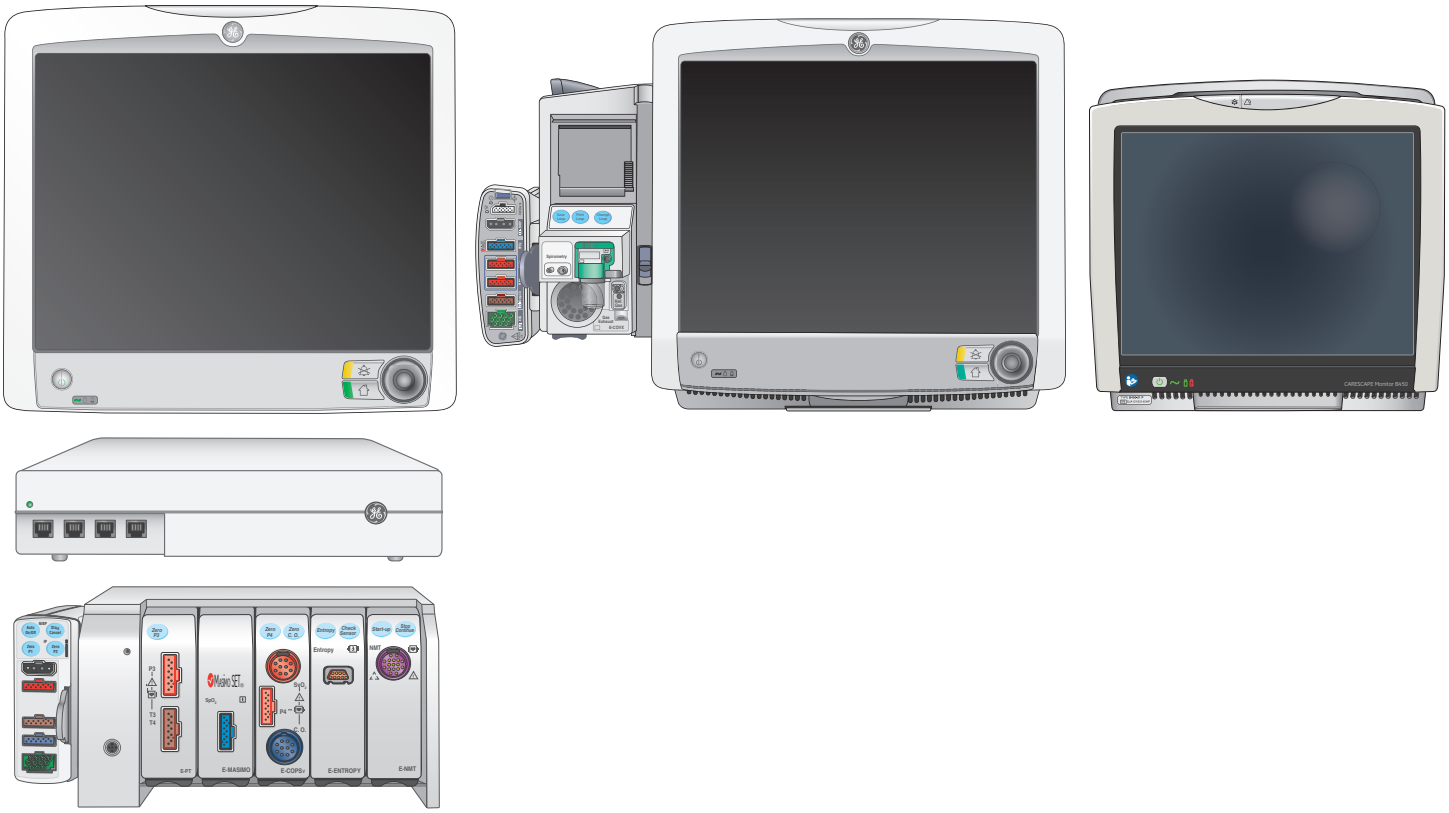
GE Healthcare

CARESCAPE™ Modular Monitors

Participant Guide



Education Services
Clinical Development

CARESCAPE™ Modular Monitors

Participant Guide

Education Services
Clinical Development

Customer Support Center: 800-558-7044

Notice

Configurations available for this product depend on local market and standards requirements. Illustrations in this course may not represent all configurations of the product. This course does not cover the operation of every accessory.

The materials contained in this document are intended for educational purposes only. This document does not establish specifications, operating procedures or maintenance methods for any of the products referenced. Always refer to the official written materials (labeling) provided with the product for specifications, operating procedures and maintenance requirements.

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Note! This guide is not intended to replace the User's Reference Manuals that you received with the machine. Please refer to the disclaimer notice at the end of this participant guide for more information.

This course is intended for CARESCAPE Modular Monitors. The material contained in this course is intended for educational purposes only. Always refer to the official written materials provided with the CARESCAPE Modular Monitors for specifications, operating procedures, and maintenance requirements.

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1 Welcome

Welcome to the Participant Guide for the CARESCAPE Modular Monitors. The purpose of this Guide is to give you, the information and product knowledge needed to understand the operation of the CARESCAPE Modular Monitors.

This Participant Guide is not intended to replace the CARESCAPE Modular Monitors User's Manual. It is intended for use as an educational tool only. Always refer to the User's Manual for detailed warnings and instructions.

Using this guide will ensure that all the essential objectives will be discussed during the training session. Combined with the use of hands-on exercises, this Participant Guide will also help ensure that the end-user has the sufficient knowledge and skills to proficiently operate the CARESCAPE Modular Monitors.

Training Session Overview

The CARESCAPE Modular Monitors training session is designed to give participants the information and product knowledge needed to proficiently operate the CARESCAPE Modular Monitors System. The training session will use discussion, as well as extensive hands-on practice to teach the course objectives as they apply to the specific care area.

Training Session Objectives

At the end of this course, the learner will be able to:

- Identify the main components of the CARESCAPE Modular Monitors
- Navigate through multiple menus and return to the normal display
- Identify the waveform and parameter areas of the display
- Setup and initiate patient monitoring, including placing the monitor in standby, resuming monitoring and starting/ending monitoring
- Modify the screen setup, including selecting a profile and a page, manually assigning waveforms and parameter windows and setting up a split screen
- Manage alarms, including identifying alarm types, changing alarm limits, pausing alarms and turning alarms on and off
- Setup, initiate and manage parameter monitoring for the following parameters:
    - ECG,
    - NIBP,
    - Pulse Oximetry
- If applicable, setup, initiate and manage parameter monitoring for the following parameters:
    - 12-lead ECG,
    - Impedance Respiration,
    - Temperature,
    - Invasive Pressure,
    - Cardiac Output,
    - Airway Gases,

- Access numerical and graphic trends, access events and create and view a snapshot.
- If applicable, access and manipulate the Drug Calculations menu, including the Calculator and the Titration Table.
- If applicable, access and manipulate the Calculations menu, including the Hemodynamic, Oxygenation and Ventilation calculations.
- If applicable, view a remote bed and setup viewing of remote beds in alarm
- If applicable, setup and print to a recorder and/or a laser printer. Printouts may include waveforms, reports and various parameters.
- If applicable, connect and view peripheral devices such as pulse oximeters and continuous cardiac output monitors

Icons Used in This Manual



Objectives: Appears at the beginning of each chapter, and includes a list of the overall objectives to cover for the chapter.



Terms You Should Know: A list of terms the participant should understand in the chapter.



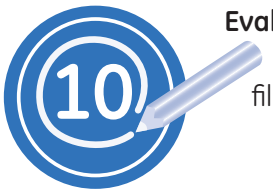
Check Your Knowledge: Appears at the end of each chapter, and includes a list of questions regarding the chapter subject matter.



Hands on Activity: Appears at the end of each chapter. Asks the participant to perform specific tasks that pertain to the subject matter of the chapter.



Clinical Training: Includes the clinical training test, and is located in the last chapter of the book.



Evaluation: Appears on the last page of the book, and must be filled out be each participant.



Note! Represents information which is additive in terms of helping the participant better understand specific tasks, activities and processes.

2 Hardware

Objectives: Hardware

By the end of this chapter, you should be able to:

- Identify components of the system used in your care area
- Name the main acquisition module that you are using and list the parameters that are being measured from that module
- Insert and remove the acquisition modules that you will be using

Terms You Should Know: Hardware

Acquisition Modules: Hardware that can measure multiple parameters, connect to the patient, process patient data signals and send signals to the monitor for display.

CARESCAPE Network: Establishes communication and allows patient data to be sent to another monitor or Central Station.

S/5 Network: Establishes communication and allows patient data to be sent to an optional iCentral.

Unity Network ID Connectivity Device: Hardware that acquires digital data from eight individually isolated serial ports. Data is collected from up to eight peripheral devices (not necessarily manufactured by GE), then the device transmits the formatted data to the monitor.

Note! *Use only approved accessories, including mounts, defibrillator-proof cables and invasive pressure transducers. For a list of approved accessories, see the CARESCAPE Modular Monitors Supplemental Information Manual.*

Overview: CARESCAPE Monitor B850 Basic Components

The CARESCAPE B850 Patient Monitoring system is a multi-parameter patient monitor that is modular and configurable. You can choose Tram-Rac Frame (module frame is shown) different components and acquisition module combinations to get the desired monitoring features and parameters.

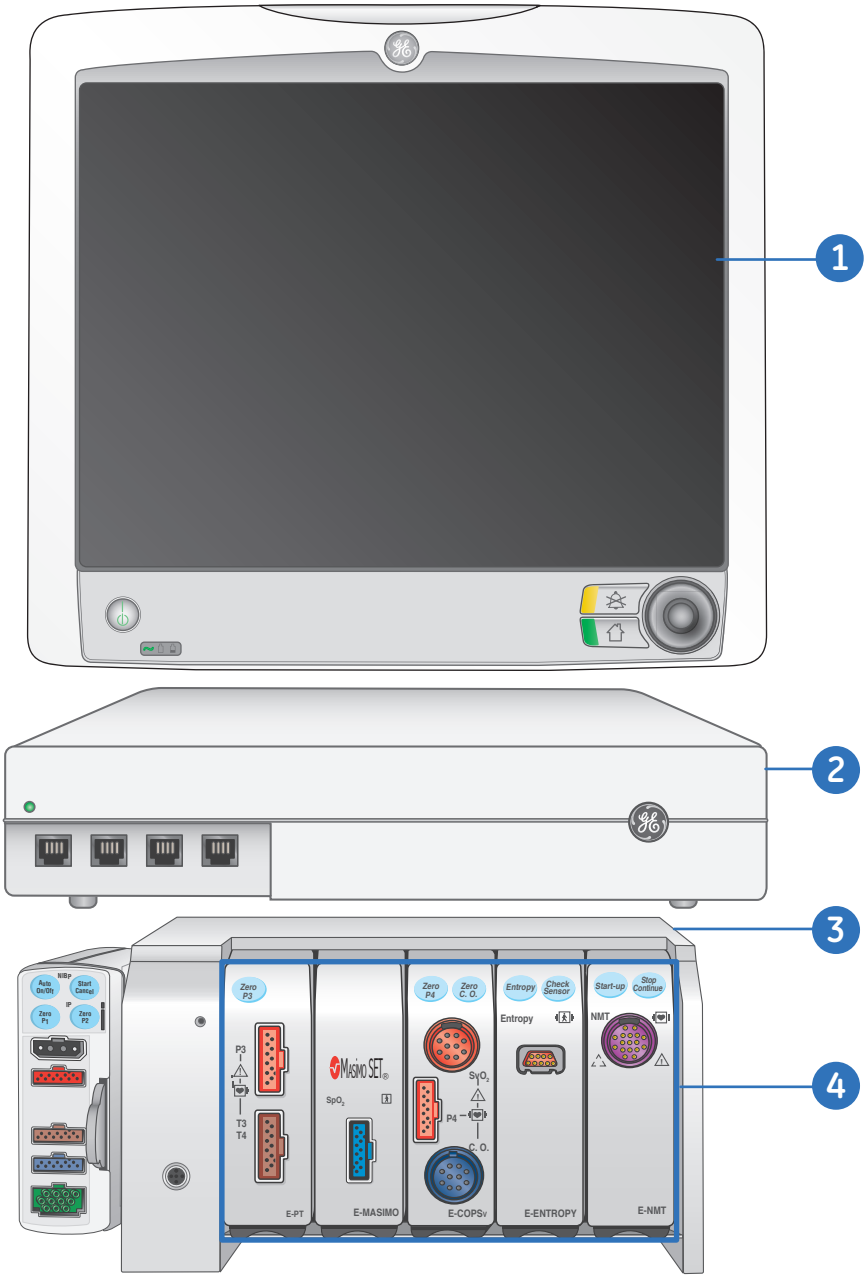


Figure 2.1 CARESCAPE B850 basic components

The CARESCAPE B850 Patient Monitoring system consists of the following basic components:

1. 19-inch Display
2. Processing Unit
3. Module Frame
4. Acquisition Modules

We will discuss each of these components in further detail throughout this section.

Processing Unit

Front view

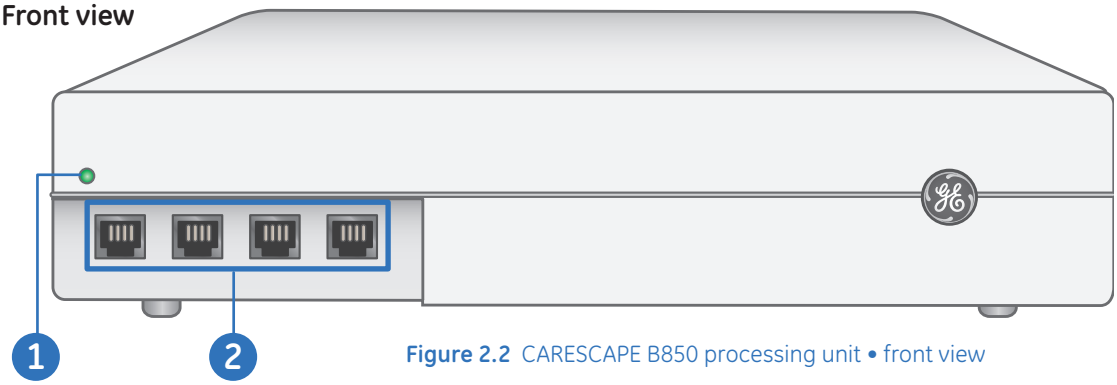


Figure 2.2 CARESCAPE B850 processing unit • front view

1. **Power Indicator:** Illuminates green when power is turned on.
2. **Four M-port connectors:** Used to connect peripheral devices to the monitor. Peripheral devices include:
   - Remote control
   - PRN 50-M recorder
   - Remote alarm box (remote nurse call)
   - Unity Network ID connectivity device

Back view

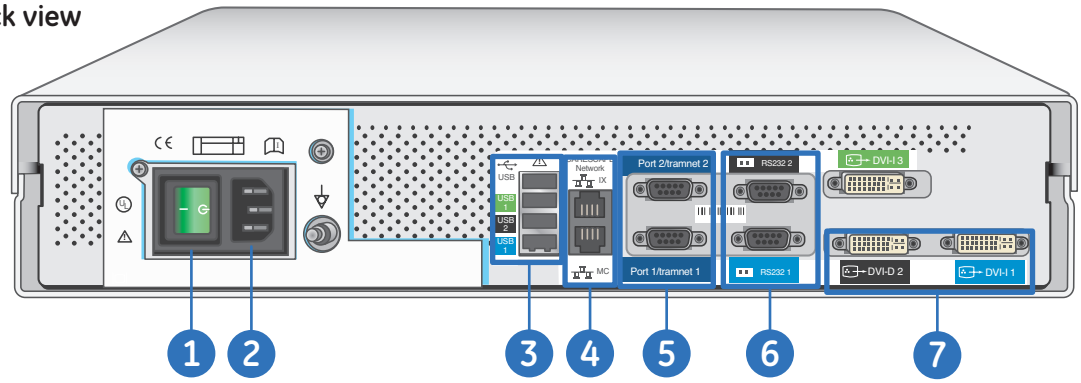


Figure 2.3 CARESCAPE B850 processing unit • back view

1. **Power on/off:** Powers the Processing unit on and off.
2. **Power Inlet Connector:** Main power connection.
3. **USB Ports:** Connects devices such as keyboard, mouse, barcode scanner and touchscreen display. There are four USB ports.
4. **Ethernet Network Ports:** Connects the MC and IX networks. The IX Network provides access to devices such as the MUSE server, Citrix server, and IX printers.
5. **TRAM-NET and ePort**: Connects the PDM module, E-module frame, and Tram-Rac.
6. **RS232 Ports:** Provides communication with a serial touchscreen.
7. **DVI Connectors:** Displays are connected. DVI-1 supports a digital display and cloned analog display. DVI-2 supports only one digital display. DVI-3 (optional third video) supports a digital display and a cloned analog display (iPanel application only).

Display

1. **Alarm Light:** The alarm light provides a visual alarm when an alarm condition is present. It indicates the highest priority alarm. The alarm light also provides a visual indicator when the audio alarms are paused or when they are off.
2. **Trim Knob Control**: Turn the trim knob control to scroll through the menu options and press to confirm them.
3. **Pause Audio Alarm and Home Keypads:** Pause Audio Alarm keypad pauses active audio alarms or pre-pauses audio for incoming active alarms. Home keypad closes all menus/ applications displayed on the screen.
4. **On/Standby:** Powers the unit on and off.

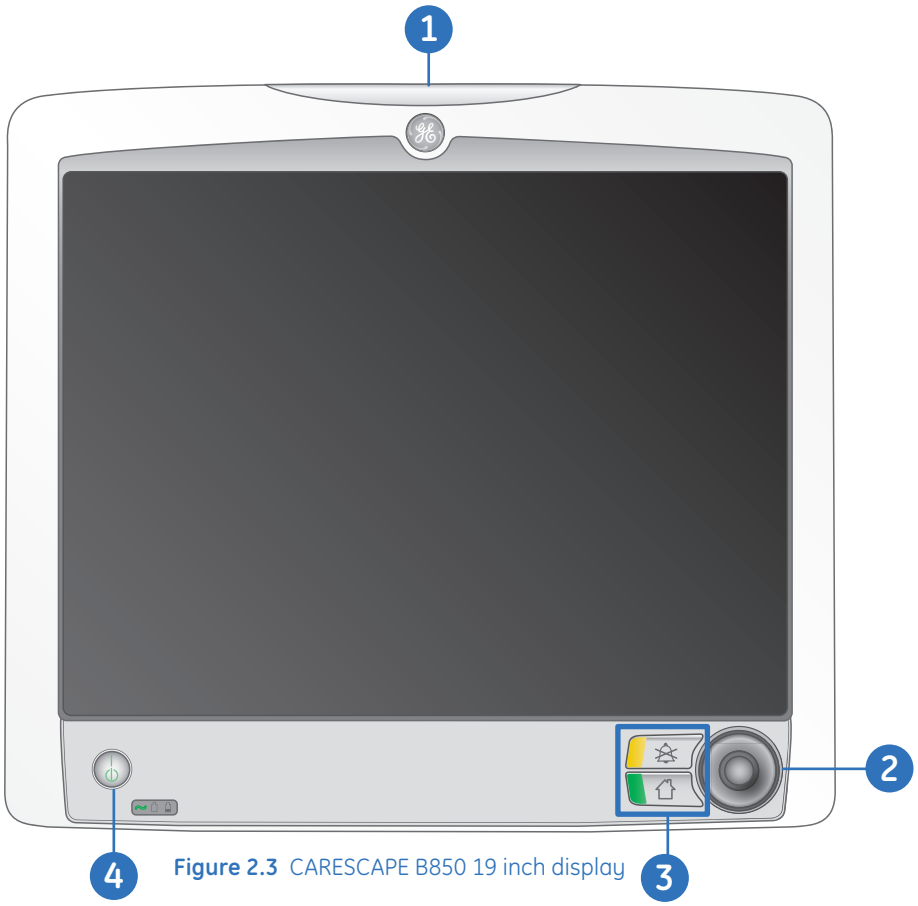


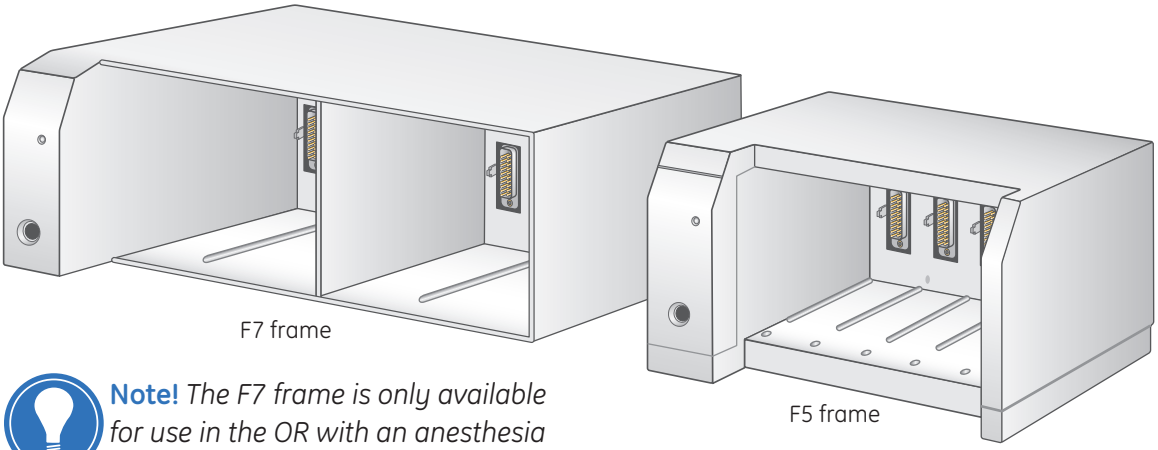
Figure 2.3 CARESCAPE B850 19 inch display

Module Frames and Racs

Frames

The frames provide the following functions for the CARESCAPE Monitor B850.

- Provide Ethernet connectivity to the patient monitor
- Provide an interface between the monitor and E-modules allowing additional parameters to be monitored
- F5 frame supports both the PDM and PSM with an optional slide mount



Note! *The F7 frame is only available for use in the OR with an anesthesia machine.*

Figure 2.4 F5 and F7 frames

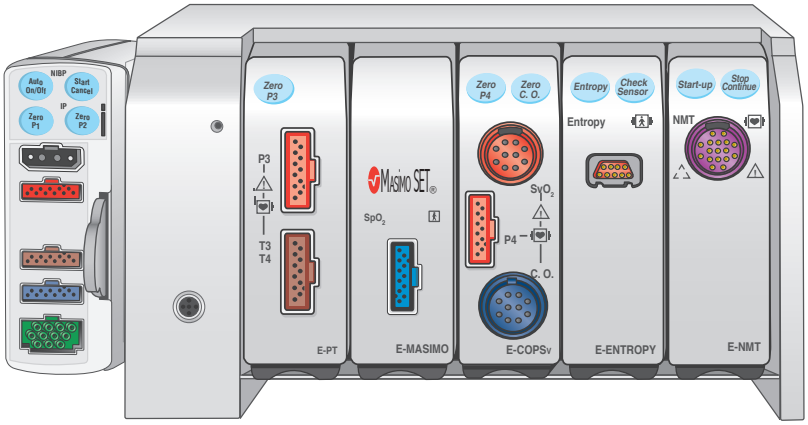


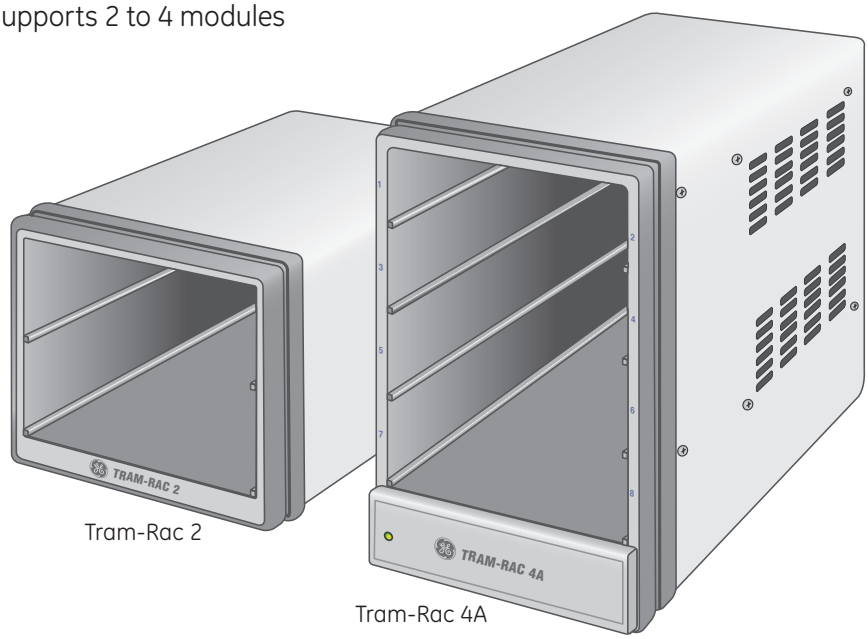
Figure 2.5 F5 frame with modules

Tram-Rac

The size of the Tram-Rac determines the extent of monitoring capabilities. The Tram-Rac housing holds one multi-parameter TRAM module or 2 single parameter modules. The Tram-Rac 4A housing holds one multi-parameter TRAM module plus two single parameter modules.

The Tram-Rac provide the following functions for the CARESCAPE B850:

- Provides interface between the monitor and a TRAM module and/or a single parameter Tram-Rac module
- Supports 2 to 4 modules



Tram-Rac 2

Tram-Rac 4A

Figure 2.6 Tram-Rac 2 and 4A

Note! *A multi-parameter TRAM module must be placed in the top 2 slots of a Tram-Rac 4A.*



Figure 2.7 Tram-Rac 4A with modules

Overview: CARESCAPE Monitor B650 Basic Components

The CARESCAPE B650 Patient Monitoring system is a multi-parameter patient monitor that is modular and configurable. You can choose different components and acquisition module combinations to get the desired monitoring features and parameters.

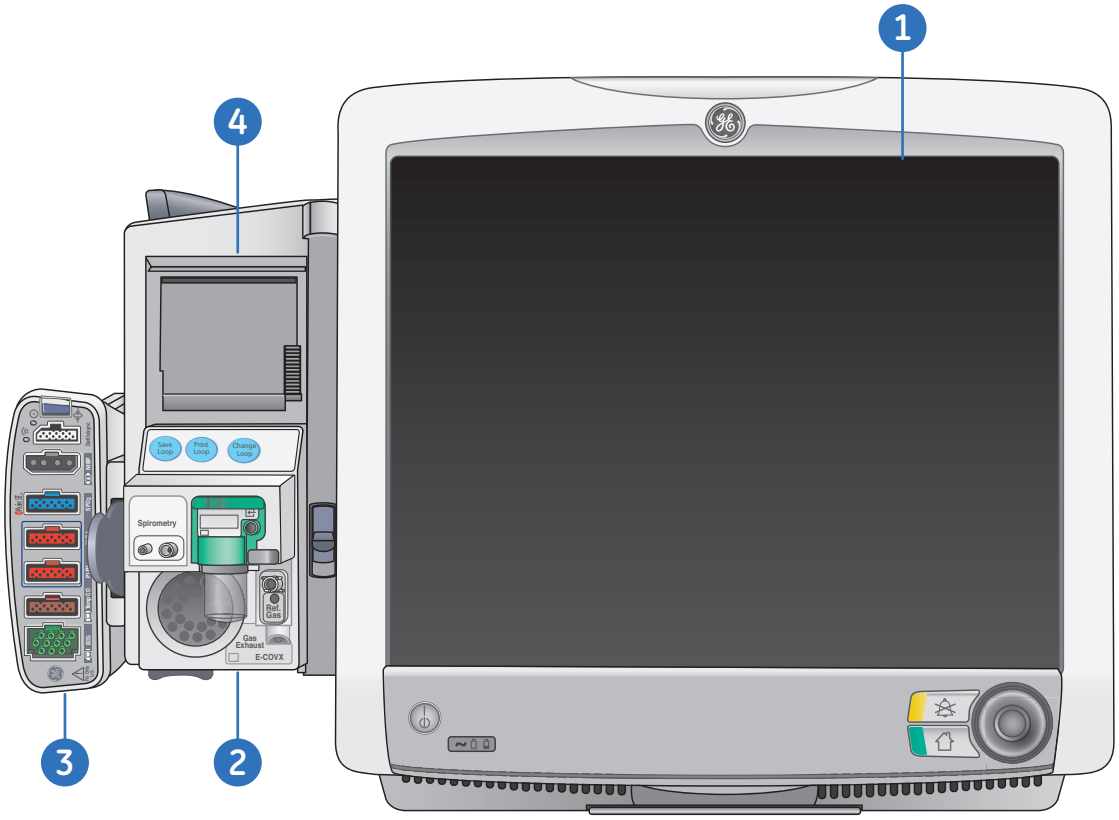


Figure 2.8 CARESCAPE Modular Monitors basic components

The CARESCAPE Modular Patient Monitoring system consists of the following basic components:

1. Display
2. Optional additional module slot (shown with E-COVX module inserted)
3. Acquisition module (PDM shown)
4. Optional recorder

Monitor Front View

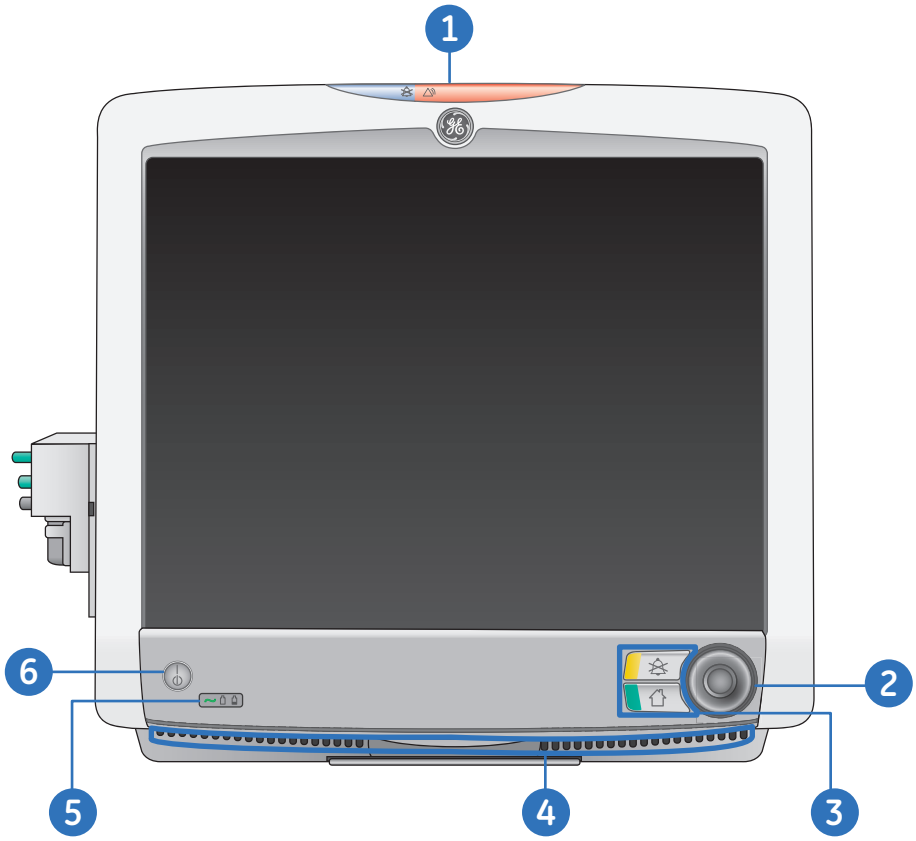


Figure 2.9 CARESCAPE Modular Monitors - front

1. **Alarm Light:** The alarm light provides a visual alarm when an alarm condition is present. It indicates the highest priority alarm. The alarm light also provides a visual indicator when the audio alarms are paused or when they are off
2. **Trim Knob Control:** Turn the trim knob control to scroll through the menu options and press to confirm them.
3. **Pause Audio Alarm and Home Keypads:** Pause Audio Alarm keypad pauses active audio alarms or pre-pauses audio for incoming active alarms. Home keypad closes all menus/ applications displayed on the screen.
4. **Ventilation Holes:** System does not have an internal fan so it cools by convection.
5. **Battery Power/Mains Power Indicators:** Indicates whether the monitor is being used on battery or mains power, and also whether the battery is charging, full or missing. See table 2.1 for indicator symbol purpose.
6. **On/Standby:** Powers the unit on and off.

Table 2.1 Battery Indicator

Indicator	Purpose
green - on	Monitor is operated on mains power.
green - on	Monitor is operated on battery power.
orange - flashing	Battery failure, or no battery.
orange - on	Battery is charging. The indicator goes off when the battery is fully charged.

Alarm Light

The integrated alarm light provides a visual alarm when an alarm condition is present. The alarm light also provides a visual indicator when the audio alarms are paused or when the audio alarms are off.

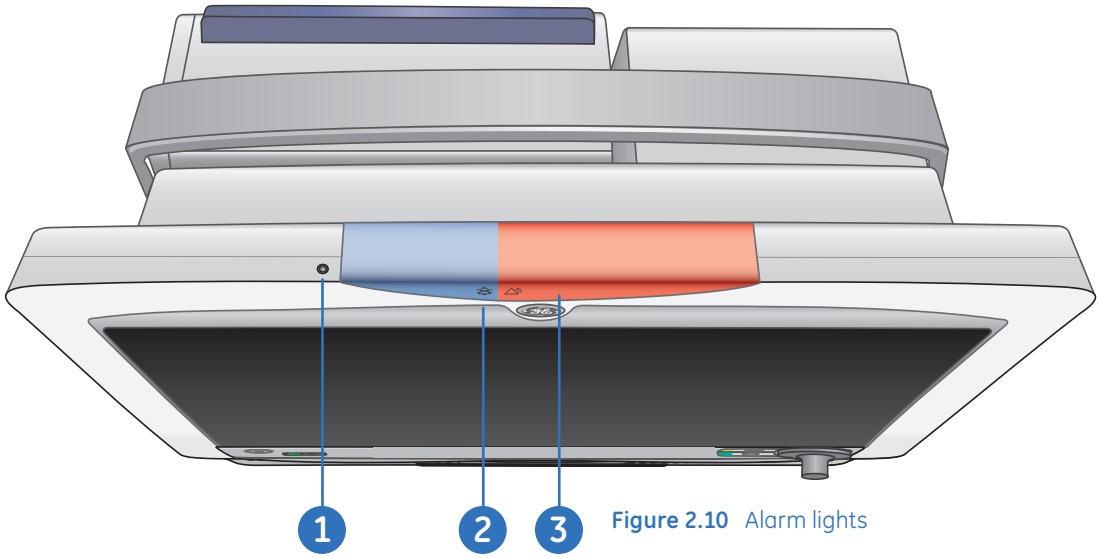


Figure 2.10 Alarm lights

1. Ambient Light Sensor: This sensor can be used to automatically adjust the display and keypad brightness (see the Brightness menu under Monitor Setup).
2. Alarm light area (blue, yellow or red).
3. Audio alarm paused /off area.

Monitor Back View

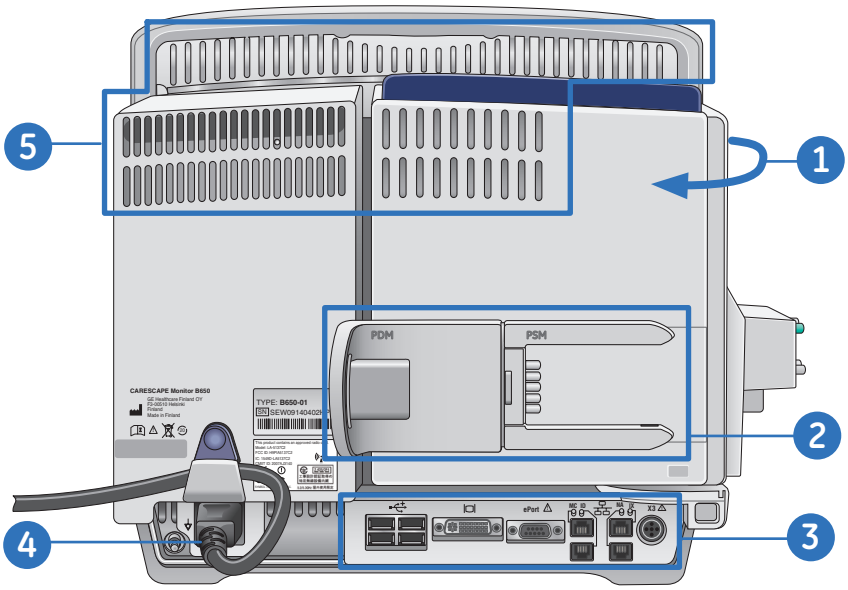


Figure 2.11 CARESCAPE Monitor B650 back view

1. Pivoting module frame.
2. Slide mount for PDM or PSM.
3. User interface board (Advanced board shown).

Note! *There are two versions of the interface boards:* ***Standard*** *has the following (Standard board is not an option in the US):*

- *USB Ports (2 USB 2.0 Type A connectors)*
- *DVI-I connector for a secondary display*
- *Network connector for the CARESCAPE Network MC network & S/5 Network*

Advanced *has the following:*

- *USB Ports (2 or 4 pcs USB 2.0 Type A connectors)*
- *DVI-I connector for a secondary display*
- *ePort connector for PDM module*
- *Network connector for the CARESCAPE Network MC network & S/5 Network*
- *Network connector for the Unity Network Interface Device (ID) Connectivity Device*
- *Network connector for the CARESCAPE Network IX network*
- *Remote-on connector*

4. Power and ground.
5. Ventilation holes

Monitor Side Views

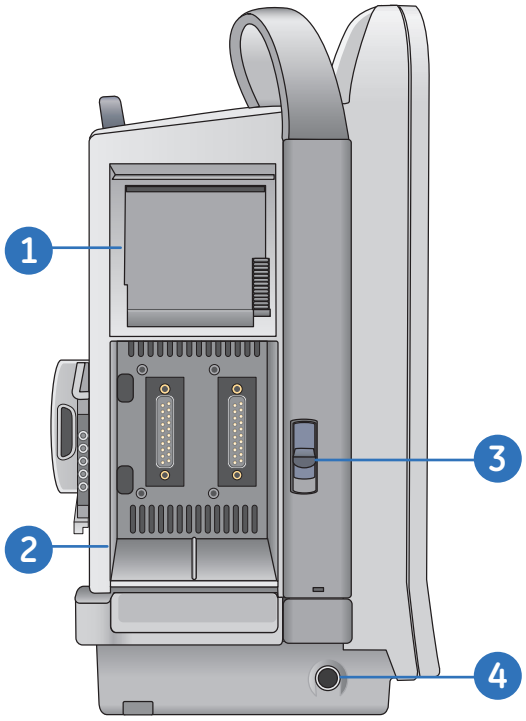


Figure 2.12 CARESCAPE Monitor B650 - left side

1. Recorder (printer)
2. Module slot: for one double width or two single width modules
3. Release switch for the pivoting module frame
4. Defib/Sync connector
5. Lock for battery cover
6. Battery compartment

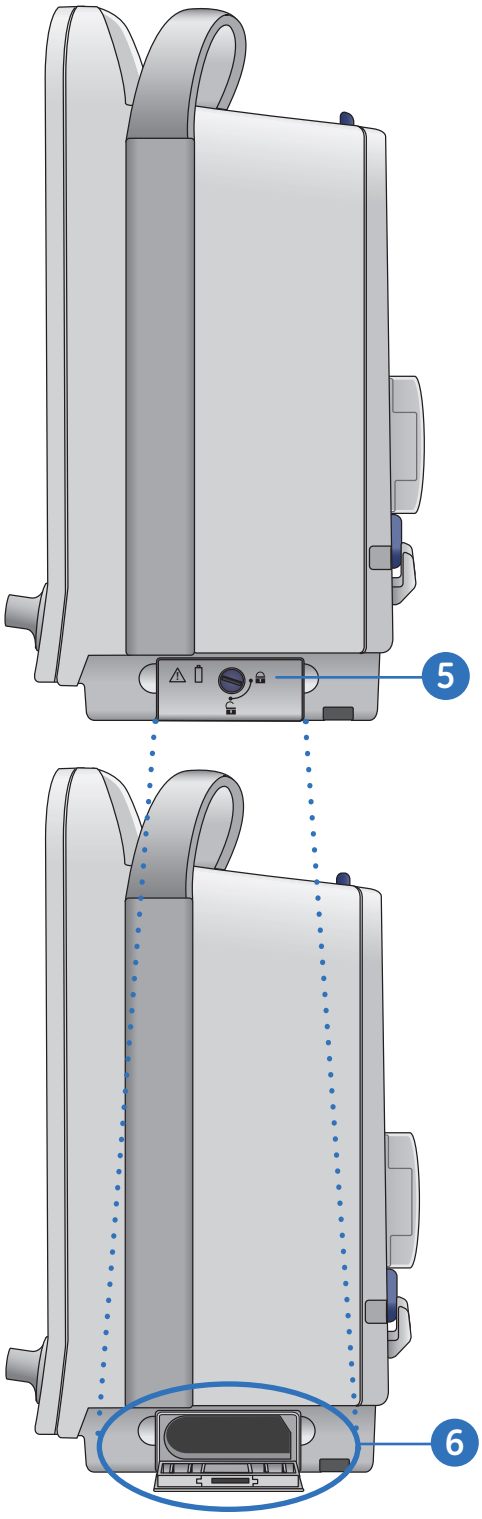


Figure 2.13 CARESCAPE Monitor B650 - right side

Inserting and Removing the Battery

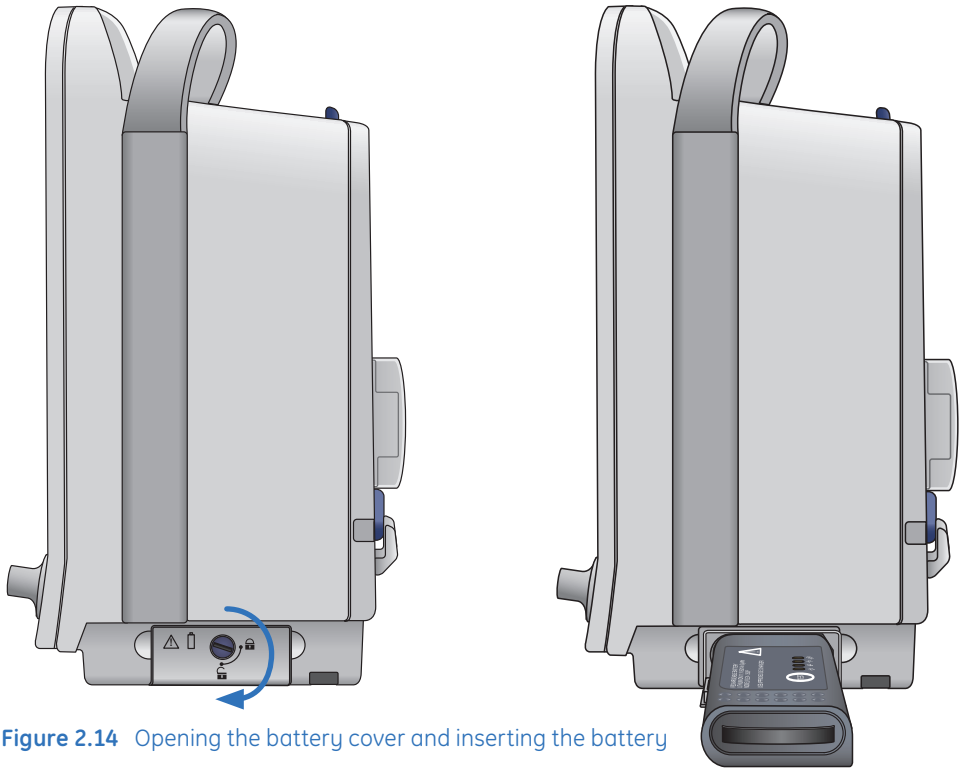


Figure 2.14 Opening the battery cover and inserting the battery

1. Open the battery slot by turning the lock 90 degrees clockwise.
2. Insert the battery with the test indicator side up and the connector end first all the way into the battery slot. To remove the battery, pull it out from the cord.
3. Push the cover back up and lock it in place by turning the lock 90 degrees counter-clockwise.

Checking the Charge Level of Battery



Figure 2.15 Battery with test indicator facing up

There are three ways to check the charge level of the battery:

1. **Using the monitor software:** This method is found under the ***Monitor Setup*** > ***Battery Status*** menu.
2. **Checking the monitor battery symbol on the Screen:** The symbol is found in the upper right corner of the display.
3. **Using the test button on the battery:** Press the ***TEST*** button on the battery itself.

Secondary Display

The monitor supports one secondary (clone) display. The displays integrate visual alarms and provide USB connectivity. The GE 19-inch touchscreen display provides an integrated abbreviated keypad and a Trim Knob control.



Figure 2.16 CARESCAPE Monitor B650 19 inch display

Pivoting Module Frame

The pivoting module frame provides an interface between the monitor and acquisition modules. There are four pivoting module frame options available:

- Frame with PSM and PDM support
- Frame with PSM, PDM and E-module support
- Frame with PSM, PDM and recorder support
- Frame with PSM, PDM, E-module and recorder support

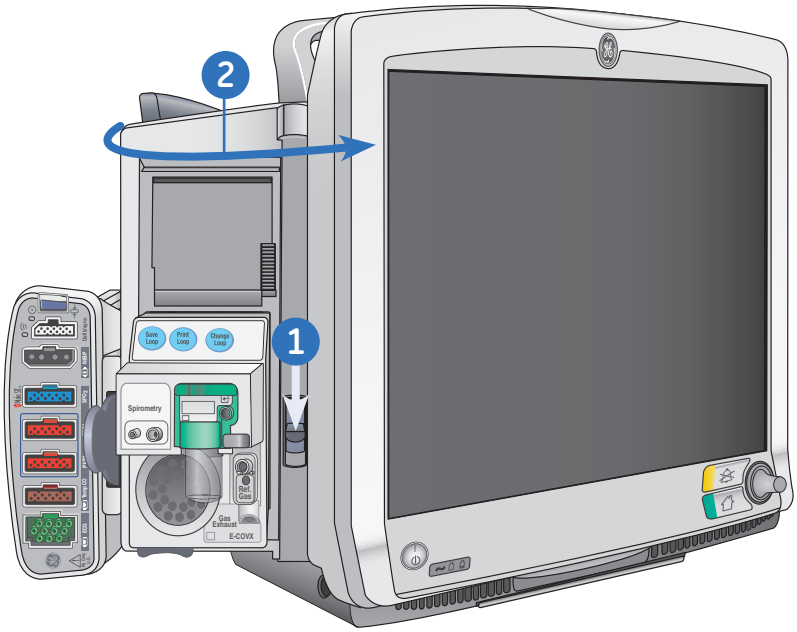


Figure 2.17 Module in the 45° position

Turning the pivoting module frame

1. Press the pivoting module frame's release switch.
2. Keep the release switch pressed and turn the module frame to the position you prefer (45 or 90 degrees). The module frame clicks when locked in position. In this picture, the module frame has been turned to the position of 45 degrees.

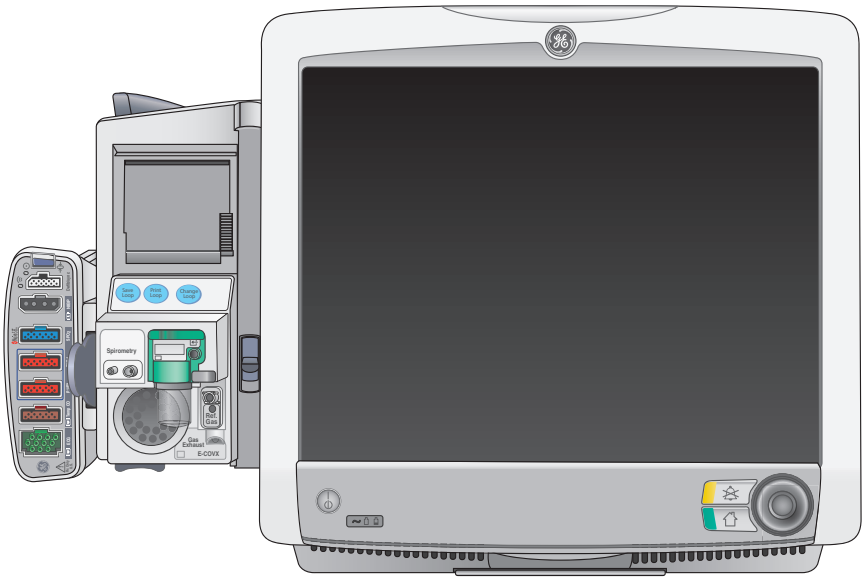


Figure 2.18 Module in the 90° position

3. The module frame is in the position of 90 degrees.

To return the pivoting module frame to its original position, press the release switch and turn the frame.

Note! *Make sure that the frame locks in place and that the red color in the upper part of the switch is no longer visible.*

Overview: CARESCAPE Monitor B450 Basic Components

The CARESCAPE B450 Patient Monitoring system is a multi-parameter patient monitor that is modular and configurable. You can choose different components and acquisition module combinations to get the desired monitoring features and parameters.

Front View

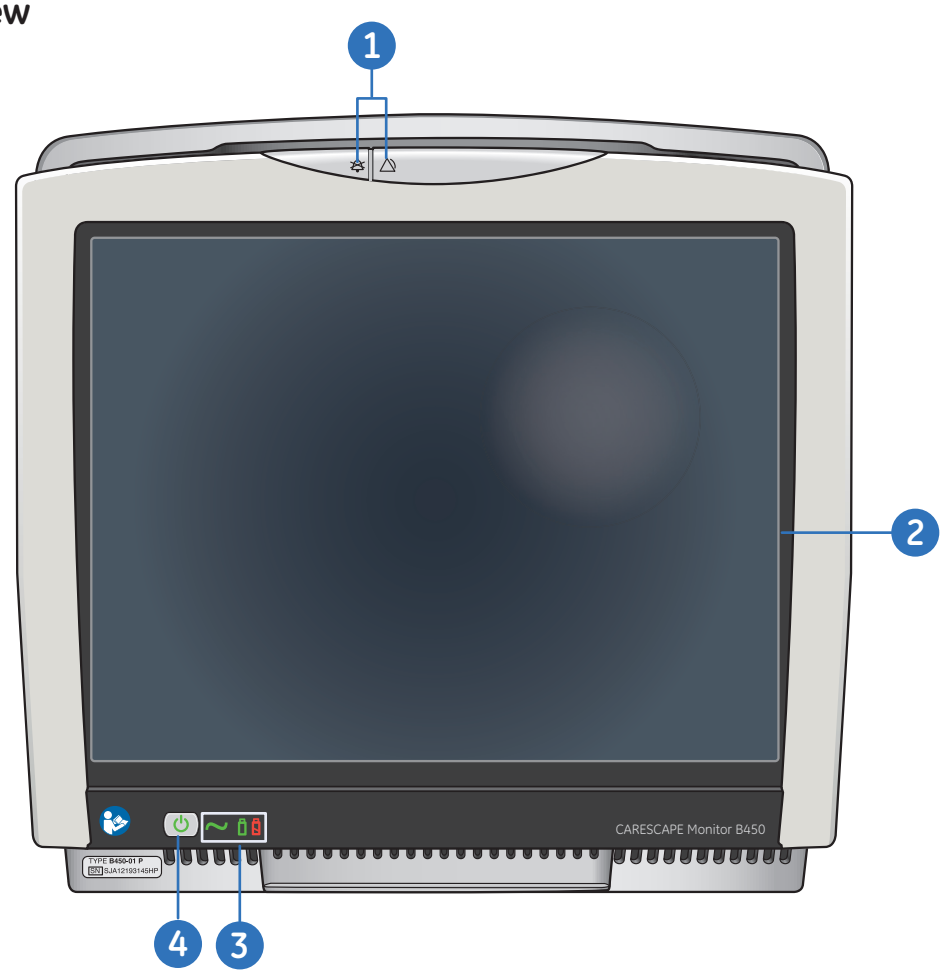


Figure 2.19 CARESCAPE Monitor B450 basic components

1. Alarm lights
2. Display screen with touch screen ability
3. Battery power/mains power indicators
4. On/Standby

Back View

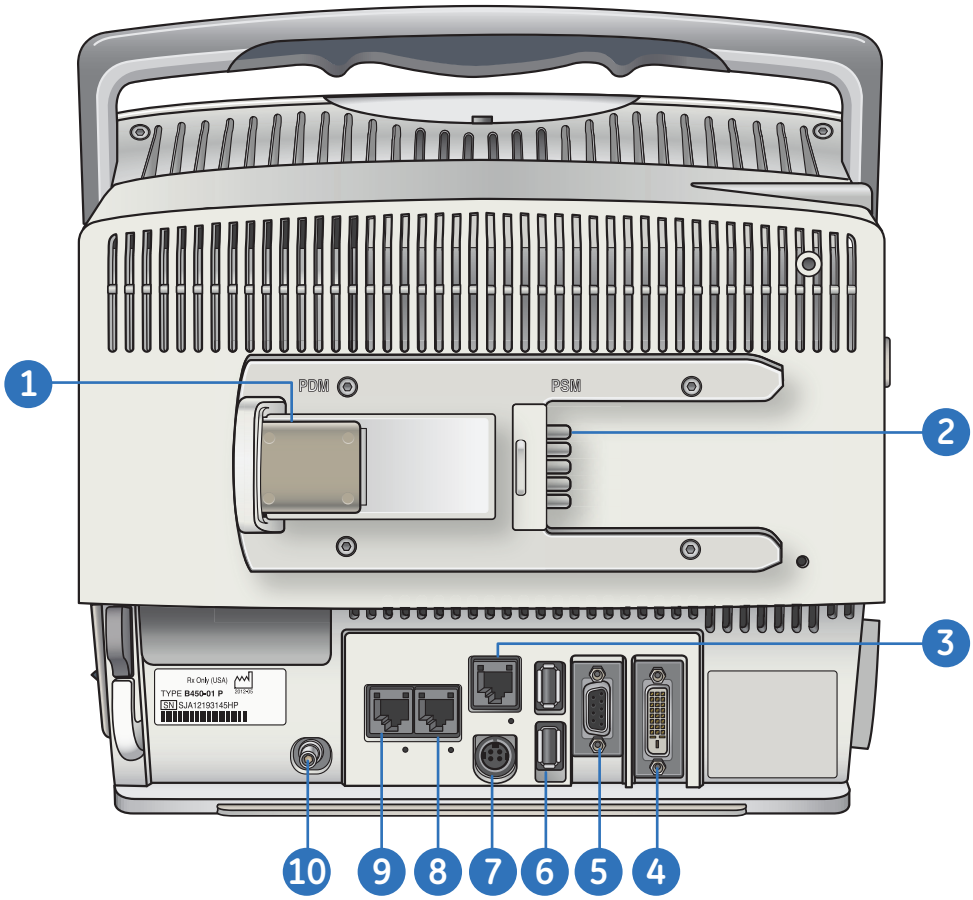


Figure 2.20 CARESCAPE Monitor B450 back view

1. Slide mount, connector for PDM
2. Slide mount, connector for PSM
3. Connector for Unity Network Interface Device (ID)
4. Connector for secondary display
5. Connector for ePort (PDM cable)
6. USB ports
7. Connector for remote on/off
8. Connector for IX Network. The IX Network provides access for example to the MUSE server, Citrix server, and IX printers.
9. Connector for MC Network. The MC Network establishes communication and allows patient data to be sent to an optional CIC Pro Clinical Information Center or CARESCAPE Central Station.
10. Power and ground

Monitor Side Views

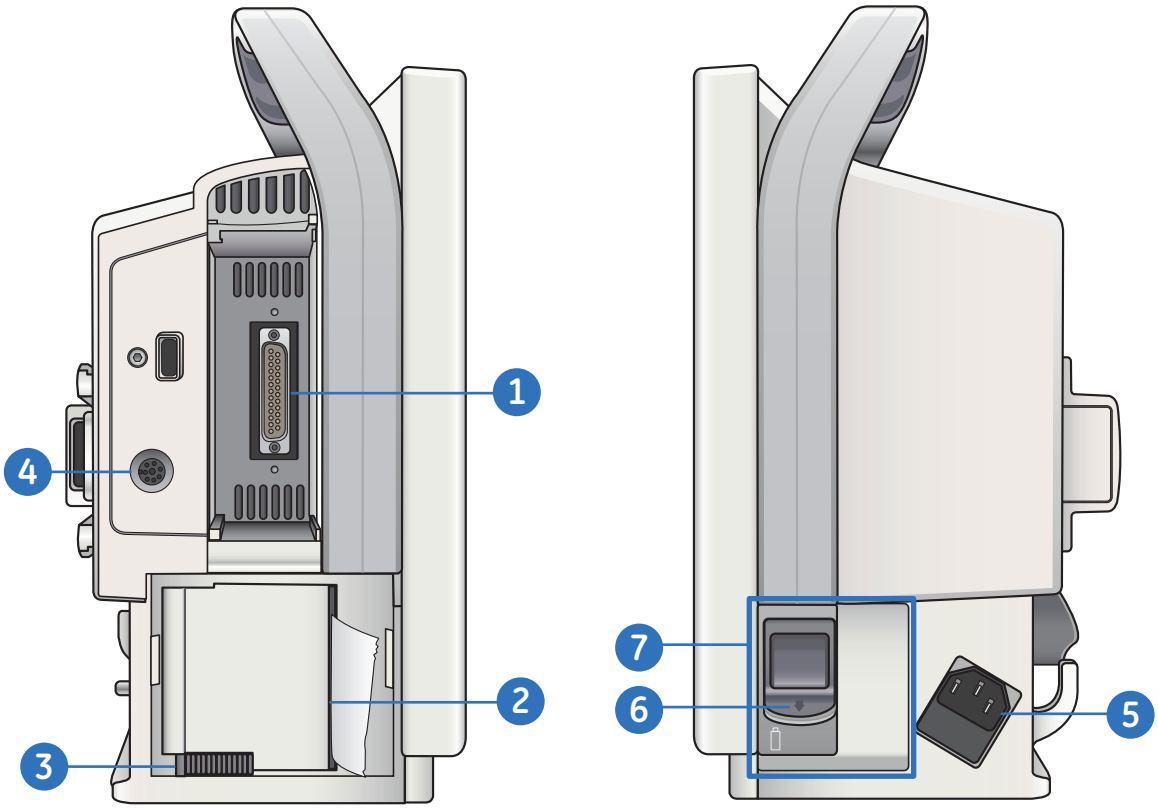


Figure 2.21 CARESCAPE Monitor B450 side views

Left Side

1. Module Slot: For one single-width module
2. Optional recorder
3. Release latch for recorder
4. Defibrillator (ECG) and IABP synchronization (E-modules only)

Right Side

5. Power cord receptacle
6. Release latch for battery door
7. Battery compartment

Inserting and removing the B450 monitor battery

1. Open the battery cover by pressing the battery cover release latch down and pulling the battery door open: The yellow warning symbol inside the battery slot door:

   WARNING! The B450 must always be used with a battery inserted. This will ensure the functioning of the monitor and prevent data loss during possible supply mains interruptions.

2. Insert the batteries, one at a time, with the test indicator facing front and the connector end first all the way into the battery slot.
3. Close the battery door carefully.
4. To remove a battery, open the battery cover and pull the battery out from the cord.

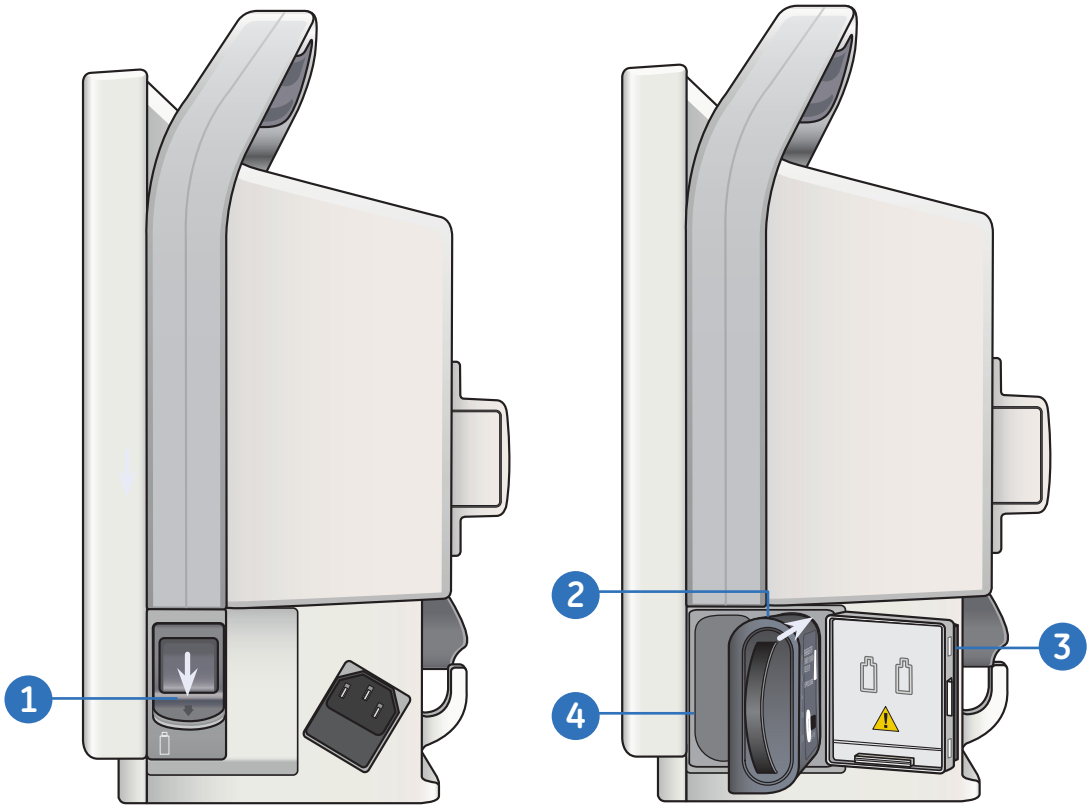


Figure 2.26 CARESCAPE Monitor B450 battery insertion and removal

Checking the battery charge with monitor software



Figure 2.27 Battery

You can check the monitor battery status using the monitor software:

1. Select the battery status area in the upper right corner of the screen, or select ***Monitor Setup*** > ***Battery Status***.
2. Check the Monitor battery status that appears. If the B450 has two batteries inserted, there are two columns, A and B, that show information for each battery.
3. If you wish to see more detailed battery information, select the ***Advanced*** tab.

Acquisition Modules

Acquisition modules connect to the patient, process patient data signals, and send patient data signals to the monitor.

Multi-parameter Hemodynamic Modules

Multi-parameter modules are capable of monitoring more than one parameter simultaneously, e.g., ECG, SpO_2, and NBP. Only one of these modules can be used at the same time. The four main multi-parameter hemodynamic modules include; PRESTN, PSM, PDM and TRAM.

Other Modules

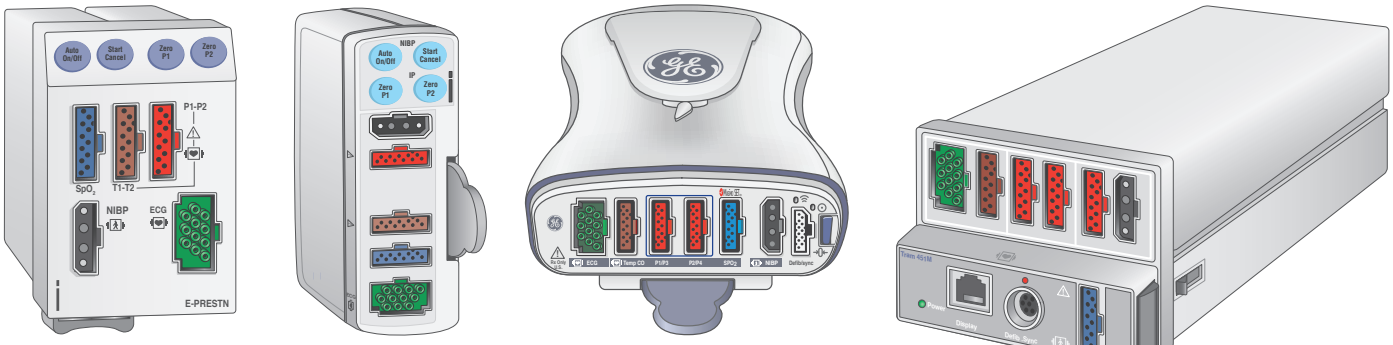
There are many other parameter acquisition modules that can interface to the CARESCAPE Monitor B850.

E-modules: Insert into the Frame and offer a wide variety of parameter acquisition capability.

Tram-Rac modules: Insert into the Tram-Rac and are limited in parameter capability. Most are single-parameter.

Note! *Note! The TRAM acquisition module is used only with the CARESCAPE Monitor B850 and a Tram-Rac. The PDM acquisition module and E-modules are used with the CARESCAPE Monitor B850 (with a F5 or F7 Frame), B650, and B450.*

With ESP V2 the E-NSATx and E-MASIMO modules will function when the NICU software package is running. ALL other E-modules WILL NOT function when the NICU software package is running.



PRESTN
Pressure, Respiration, ECG, SpO_2, Temperature, NIBP

PSMP
Patient Side Module

PDM
Patient Data Module

TRAM
Module

Figure 2.28 Multi-parameter hemodynamic modules



Figure 2.29 E-modules



Figure 2.30 Tram-Rac modules

PDM (Patient Data Module)

The PDM processes the patient data signals and sends them to the monitor for display. It stores 24 hours of patient data at 1-minute resolution.

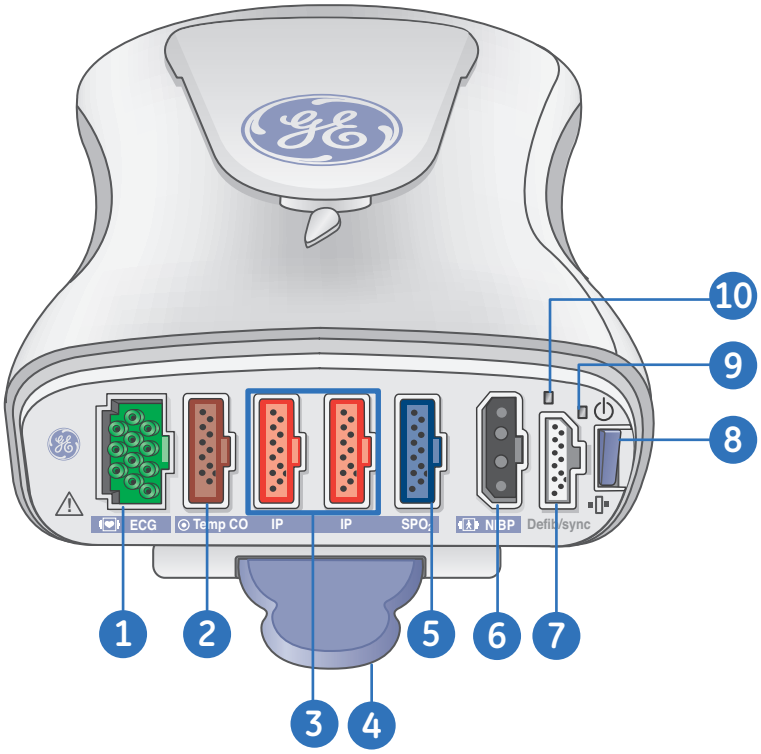


Figure 2.31 PDM components

1. ECG / Imp. Respiration
2. T1-T2/CO
3. P1-P4
4. Tab for removing the module
5. SpO_2
6. NIBP
7. Defib/Sync
8. Dual function Power On and Zero All button
9. Power indicator
10. Communication indicator

The PDM supports:

- 3,5,6 or 10 lead ECG cables.
- SpO_2 - Nellcor or Masimo
- NBP- DINAMAP SuperSTAT technology
- Two Temps
- Cardiac Output
- Up to 4 invasive pressures
- Respiration - I, II, and Abdominal RL-LL
- EK-Pro arrhythmia detection algorithm for arrhythmia processing.

The PDM Battery



Figure 2.32 Inserting a battery into the PDM

The PDM can be used with or without a battery. The PDM battery features include:

- Uses one rechargeable lithium-ion battery.
- The PDM will shut down if there is not a battery in place and is removed from either the PDM dock or frame. Data is not lost.
- The PDM battery, when fully charged, can provide one additional hour of battery time to the Transport Pro.
- The PDM will take longer to display data in the absence of a battery when re-connected to the monitor or Transport Pro.
- A PDM battery gauge indicator displays in the information area when a battery-powered PDM module is connected. If the PDM module is connected without a battery installed, PDM battery failure indicator is displayed.



Figure 2.33 Battery capacity gauge icon

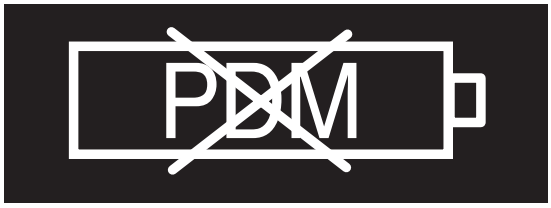


Figure 2.34 Battery failure indicator icon

PSM (Patient Side Module)

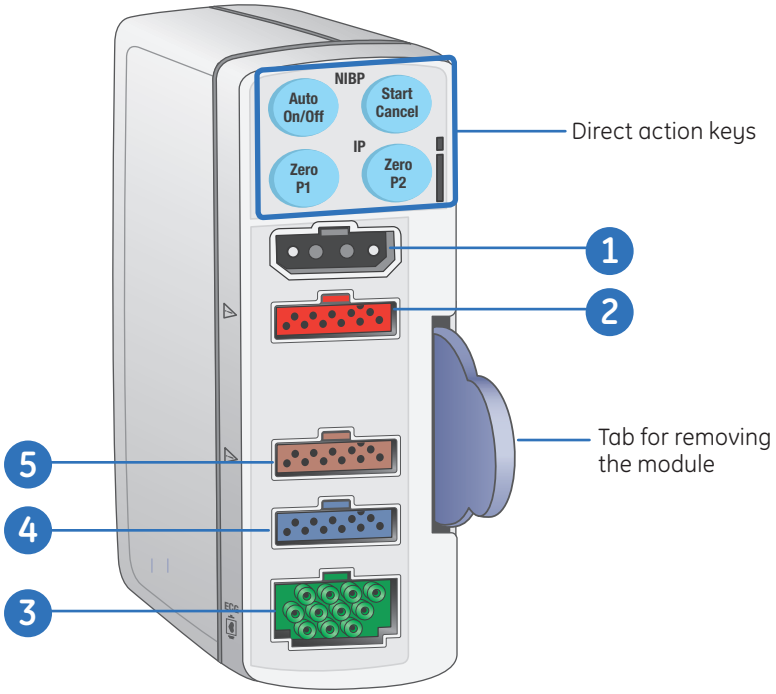


Figure 2.35 PSMP

1. NIBP
2. P1-P2
3. ECG /Imp. Respiration
4. SpO_2
5. T1-T2

The PSM also has a variation called the PSMP that supports invasive blood pressure measurement. There are direct action keys on the module for starting or stopping a blood pressure, starting or stopping an automatic NIBP cycle and zeroing invasive pressures.

The PSMP supports:

- 3, 5, 6, or 10 lead ECG cables
- SPO_2 - Ohmeda
- NIBP
- Two invasive blood pressures (with the PSMP)
- Two temperatures
- EK-Pro arrhythmia detection algorithm - processing done in the Processing unit

PRESTN

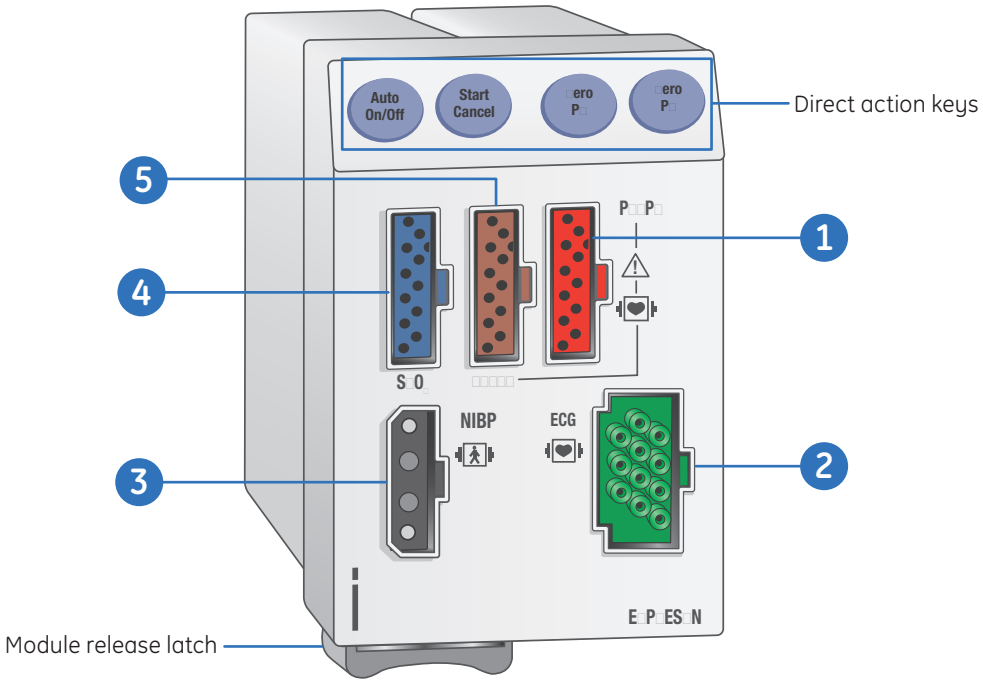


Figure 2.36 PRESTN module

1. P1-P2
2. ECG
3. NIBP
4. SpO_2
5. T1-T2

The PRESTN must be inserted into the E-frame for connectivity to the monitor. There are direct action keys on the module for starting or stopping a blood pressure, starting or stopping an automatic NIBP cycle, and zeroing invasive pressures. The PRESTN module family uses the EK-Pro arrhythmia detection algorithm. The processing is done in the Processing unit.

There are variations of PRESTN. They are PRESTN and RESTN. Each letter stands for the parameter it measures. PRESTN supports:

- **P** -up to 2 invasive blood pressures
- **R** - Respiration
- **E** - ECG-3, 5, 6, or 10 lead cables
- **S** - Spo_2 - Ohmeda
- **T** - up to two temperatures
- **N** -Non-invasive blood pressure

Other E-Modules

There are many other hemodynamic and parameter acquisition modules that can interface to the CARESCAPE Monitor B650 and B850.



Figure 2.37 E-modules

TRAM

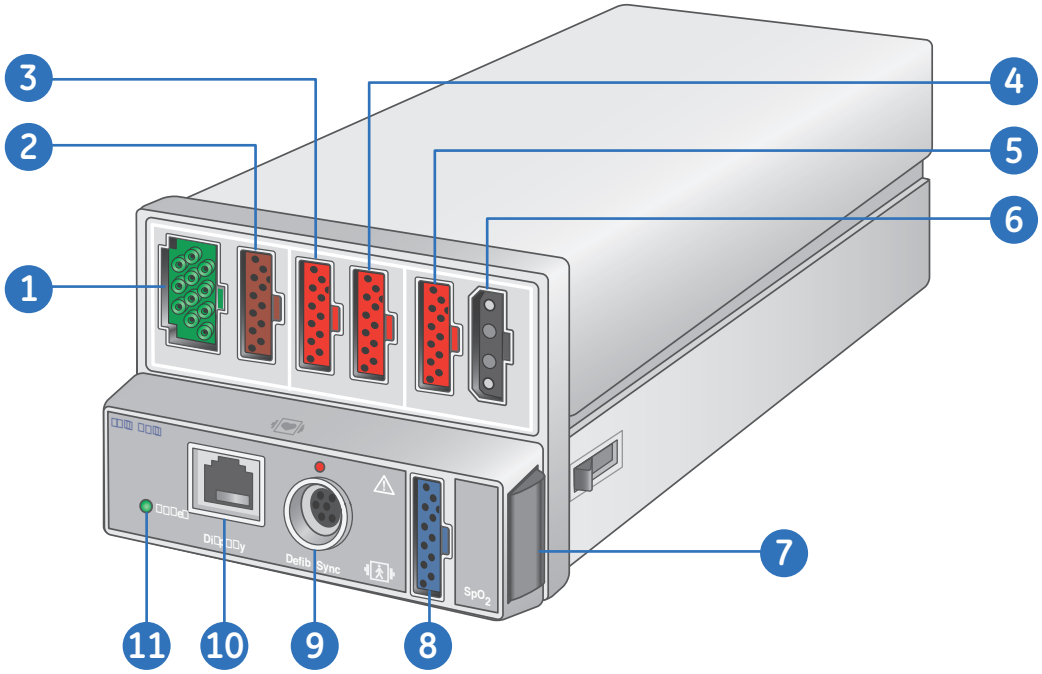


Figure 2.38 TRAM module

1. ECG/ Imp. Respiration
2. T1-T2/ CO
3. BP1
4. BP2
5. BP 3/4
6. NIBP
7. Release lever
8. SpO_2
9. Defib/Sync
10. Transport Display
11. Power indicator light

There are several variations of the Multi-parameter TRAM module. Configuration of the TRAM module determines the parameters it monitors. The TRAM processes the patient data signals and sends them to the monitor for display. It stores 24 hours of patient data at 1 minute resolution. The TRAM module is used with the CARESCAPE Monitor B850 only.

The TRAM supports:

- ECG- 3, 5 or 10 lead ECG cables.
- Respirations - Lead I or II
- Two Temps
- Cardiac Output
- Up to 4 invasive pressures (dependent on TRAM type)
- NIBP-DINAMAP Classic technology
- SpO_2 – Nellcor or Masimo
- EK- Pro arrhythmia detection algorithm for arrhythmia processing.

Monitoring Other Parameters

E-modules

The following tables show the E-modules and the listed parameter(s) that it monitors.

Table 1.1

E-Module	ECG	Invasive BP	SpO_2	Temp	NIBP	Imp Resp	CO	CCO	SvO_2	$ScvO_2$
E-P		X								
E-PP		X (2)								
E-PT		X		X (2)						
E-COP		X					X			
E-COPSv-00		X					X		X	
E-COPSv-01		X					X		X	X
E-PiCCO		X						X		
E-NSATX			X							
E-MASIMO			X							

Note! *E-PiCCO, E-COP and E-COPSv modules cannot be used at the same time in one monitor; they are categorized as identical modules in CARESCAPE Monitor software.*

NSATX = Nellcor technology with Oximax and the latest NELL line technology.
E-MASIMO = Masimo technology

Table 1.2

E-Module	Relaxation	Plexus stimul	EEG	AEP	Entropy	BIS
E-NMT	X	X				
E-EEG			X	X		
E-BIS						X
E-ENTROPY					X	

Note! *The TRAM module is used with the CARESCAPE Monitor B850 only.*

Airway Modules

Table 1.3

E-Module	CO_2	N_2O	O_2	Anesthetic agents	Agent identification	Gas Exchange	Spirometry
E-miniC	X	*	-	-	-	-	-
E-sCO	X	*	X	-	-	-	-
E-sCOV	X	*	X	-	-	-	X
E-CO	X	*	X	-	-	-	-
E-COV	X	*	X	-	-	-	X
E-COVX	X	*	X	-	-	X	X
E-sCAiO	X	X	X	X	X	-	-
E-sCAiOV	X	X	X	X	X	-	X
E-CAiO	X	X	X	X	X	-	-
E-CAiOV	X	X	X	X	X	-	X
E-CAiOVX	X	X	X	X	X	X	X

* The E-sCO, E-CO, E-sCOV, E-COV, and E-COVX modules automatically compensate for N_2O in realtime although N_2O values are not displayed on screen. The E-miniC requires manual selection from the monitor menu to compensate for N_2O.

Letters in the airway modules stand for:

C = CO_2 (and N_2O in Compact Airway Modules)

O = Patient O_2

V = Patient Spirometry

A = Anesthetic Agents

i = Agent Identification

X = Gas Exchange

s = Single width gas module

Tram-Rac Modules

The following Table shows the single-parameter modules and the parameter it measures.

Table 1.4

Tram-Rac module	Invasive BP	CO_2	SpO_2
BP/Dual Temp	X		
BP	X		
BP/CO	X		
Dual BP	X(2)		
SpO_2 GE			X
SpO_2 Masimo			X
Capnostat Mainstream Et CO_2		X	
Capnostat Dual Et CO_2		X	
CapnoFlex CO_2		X	

Installing and Removing Modules

Installing and Removing B850 Modules

WARNING When connecting PDM or TRAM, the loaded IP labels may affect the channel labeling of other already connected channels, and consequently also the alarm limits.

Installing and Removing the PSM to a Frame

To Install the PSM onto a Frame:

1. Connect a module by aligning it with the insertion guides on the outside of the frame.
2. Push the module into the frame until it clicks and stops.

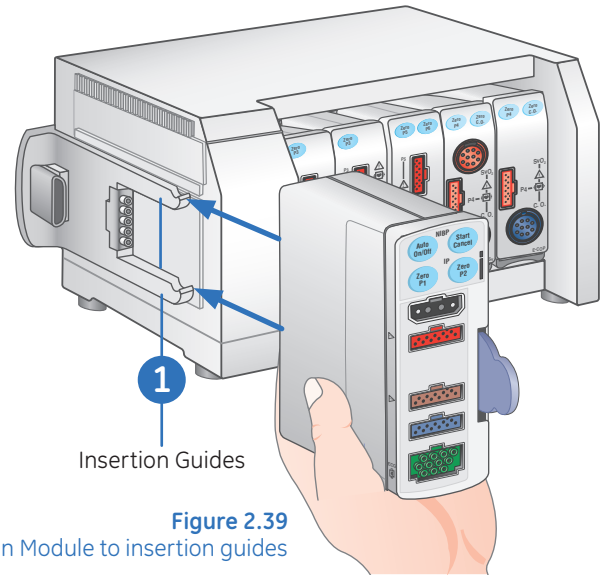


Figure 2.39
Align Module to insertion guides

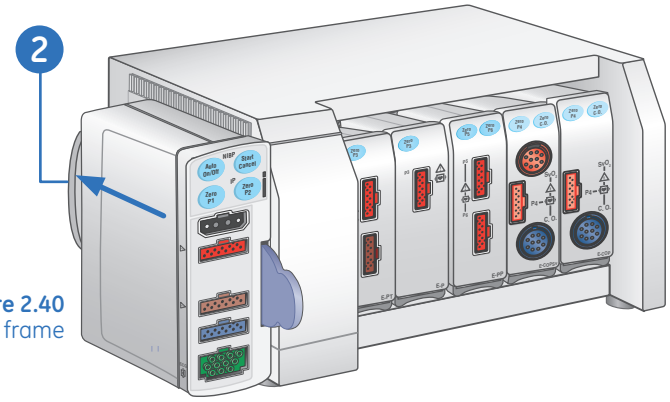


Figure 2.40
Push module into frame

To Remove the PSM From a Frame:

1. Pull the release tab to retract the locking key and release the PSM from the Frame.
2. Grasp the PSM firmly and slide it off the Frame guides.

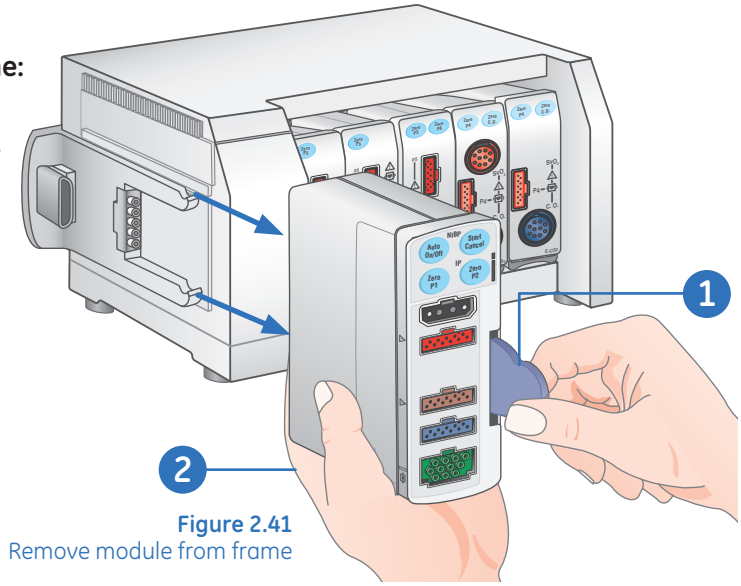


Figure 2.41
Remove module from frame

Installing and Removing the PDM to a Frame

To Install the PDM onto a Frame or Docking Station:

1. Connect a module by aligning it with the insertion guides on the outside of the frame or on the docking station rails.
2. Gently slide the PDM until the locking key clicks and stops.

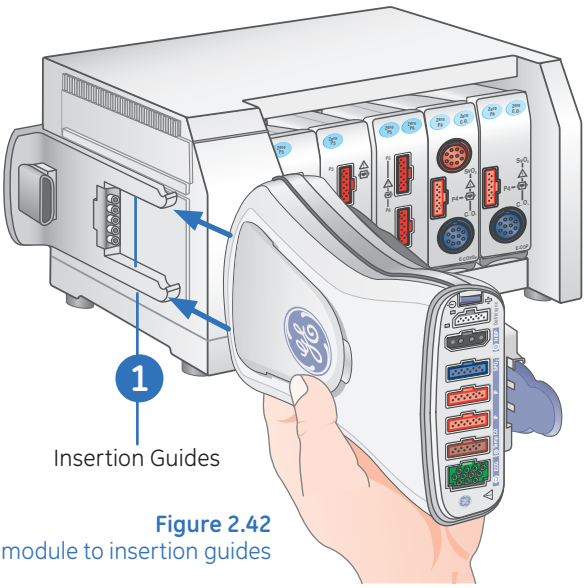


Figure 2.42
Align module to insertion guides

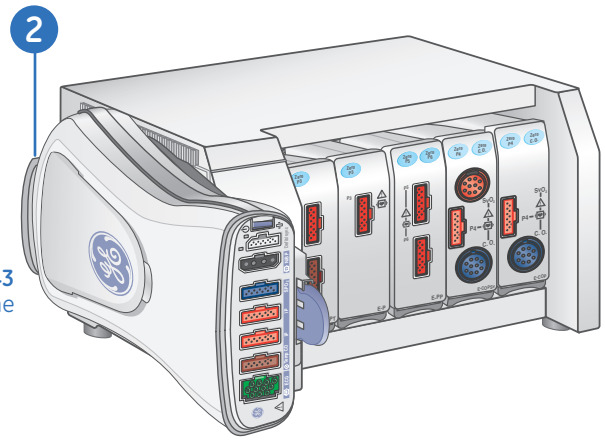


Figure 2.43
Push module into frame

To Remove the PDM Module From a Frame or Docking Station:

1. Pull the release tab to retract the locking key and release the PDM from the Frame.
2. Grasp the PDM firmly and slide it off the Frame guides or PDM docking station.

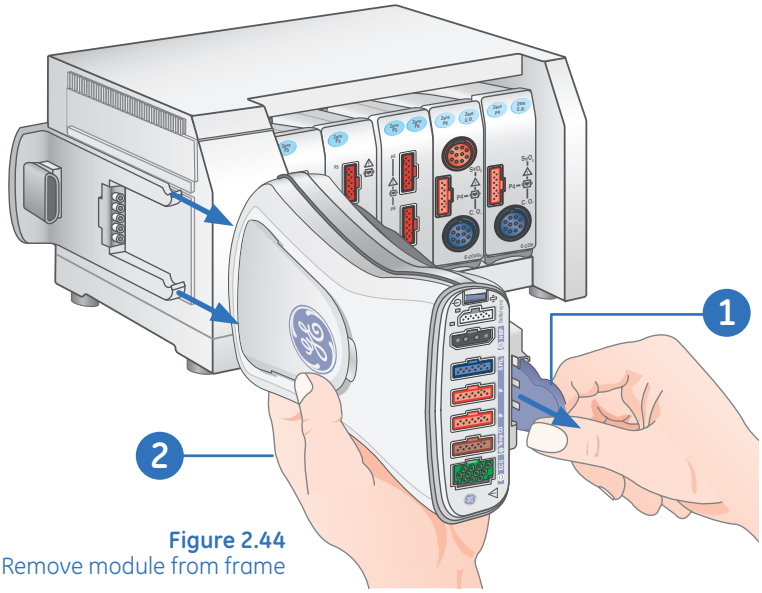


Figure 2.44
Remove module from frame

Installing and Removing Other E-modules to a Frame

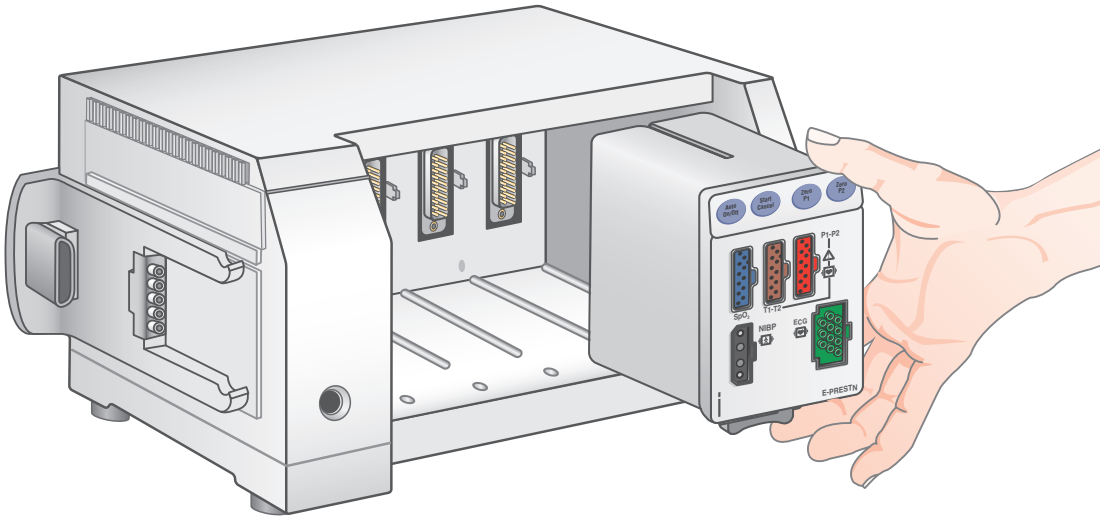


Figure 2.45 install or remove a PRESTN module

To Install the module onto a Frame:

1. With the module properly oriented, align the module insertion guide slot with the insertion guide.
2. Push the module into the frame until it clicks.

To Remove the Module From a Frame:

1. Press the release latch on the bottom left-hand side of the module.
2. Grasp the module firmly and pull out of the frame.

Installing and Removing Modules from the Tram-Rac Housing

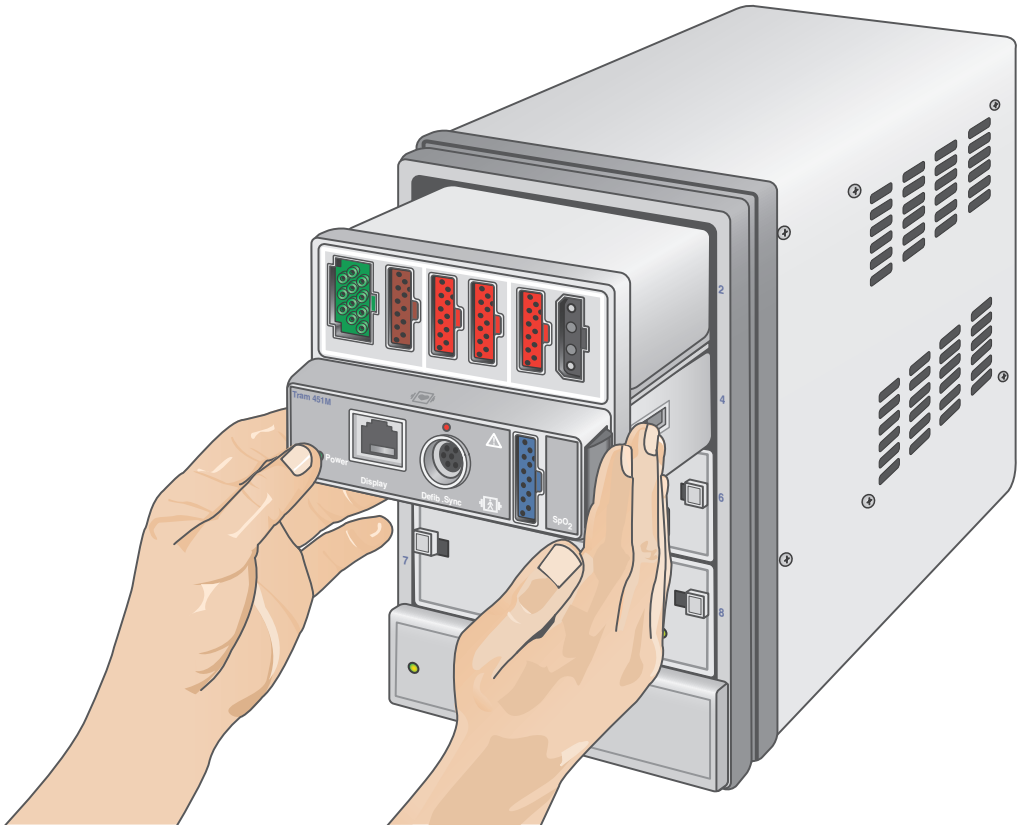


Figure 2.46 Removing a TRAM module

To install a module in the Tram-Rac Housing:

1. Facing the Tram-Rac housing, guide the back of the module into the appropriate position.
2. Gently push the module into the housing. You will hear a click when the module is fully inserted.

To remove a module from the Tram-Rac Housing:

1. Push the module into the Tram-Rac housing. This releases the module and makes it easier to remove.
2. Press and hold the release levers found on each side of the front of the module.
3. Pull the module out about 6 inches (15 cm).
4. Grasp the module firmly with both hands and remove it. Do not try to hold the module by the release levers.

Installing and Removing B650Modules

To install a PSM or PDM

1. Connect a module by aligning it with the insertion guides on the pivoting module frame.

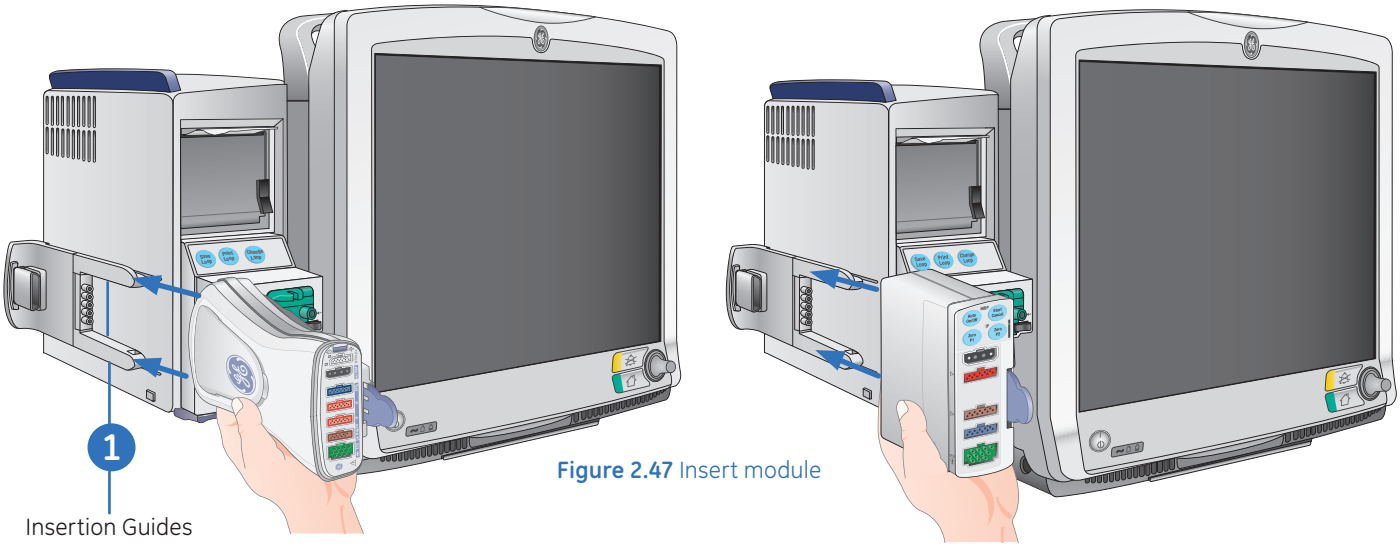


Figure 2.47 Insert module

2. Push the module into the frame until it clicks and stops.



Figure 2.48 Push module until it clicks

Note! *The PDM module requires additional time to power up when used without the PDM battery. Do not interrupt the startup sequence by unplugging the PDM module.*

To Remove a PSM or PDM

1. Pull the pull tab out and slide the module out of the guides.
2. Hold onto the module to make sure it does not drop when it comes out.

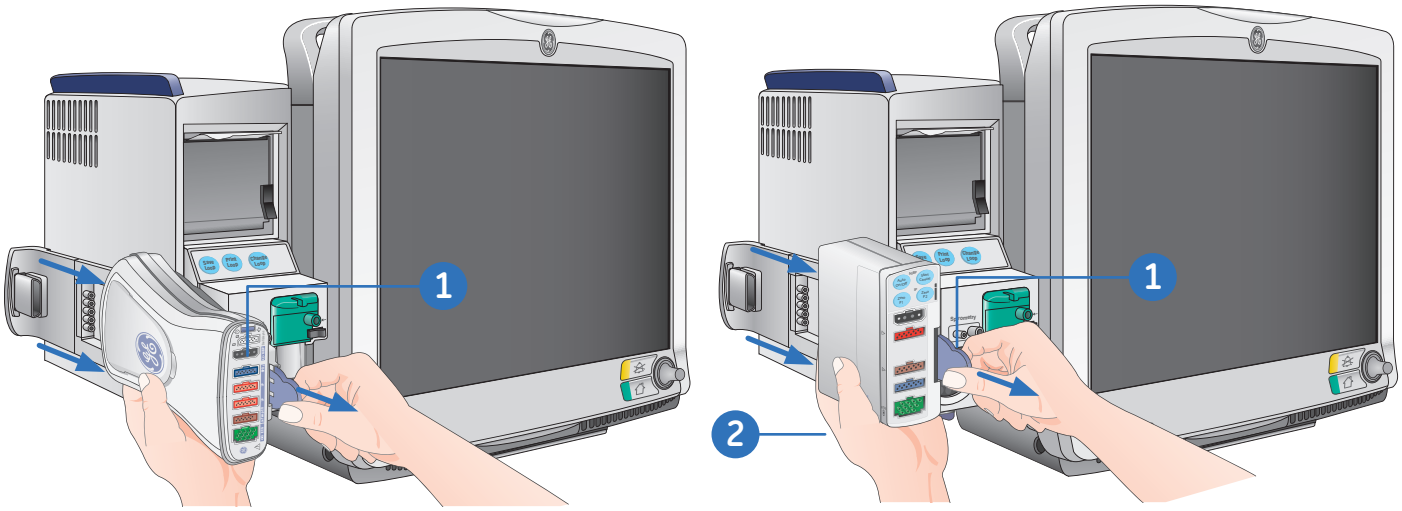


Figure 2.49 Remove PSM and PDM module

To Install Other E-modules

1. With the module properly oriented (module release latch facing down), align the insertion guide slot in the module with the insertion guide in the module frame.
2. Push the module into the module frame until it clicks.

To Remove Other E-modules

1. Press the release latch on the bottom left-hand side of the module.
2. Grasp the module firmly and pull out of the module frame.

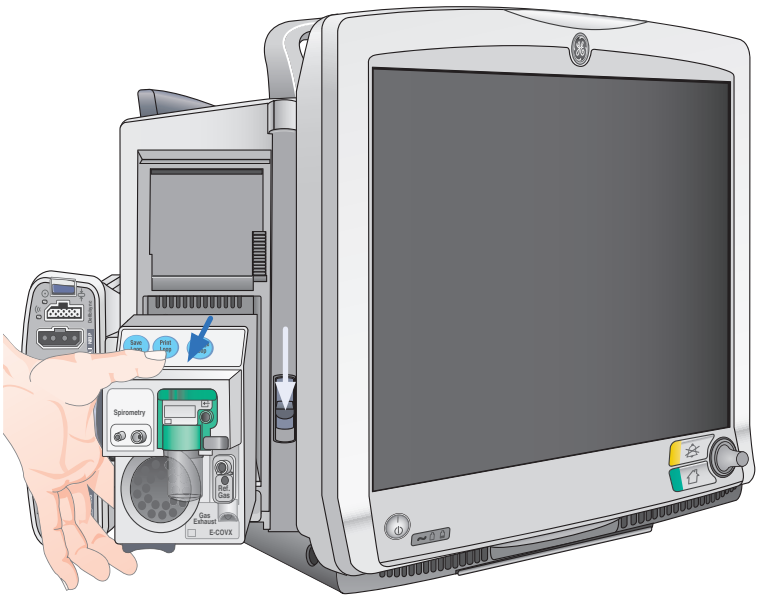


Figure 2.50 Remove module

Installing and Removing B450Modules

To install a PSM or PDM

1. Align the brackets on the back of the module with the insertion guides on the pivoting module frame.
2. Slide the module into the docking station until it clicks and stops.

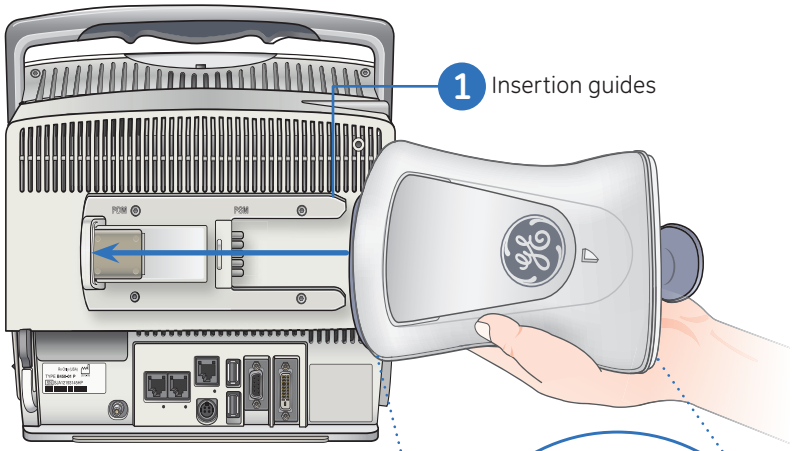


Figure 2.51 Insert PDM onto guides

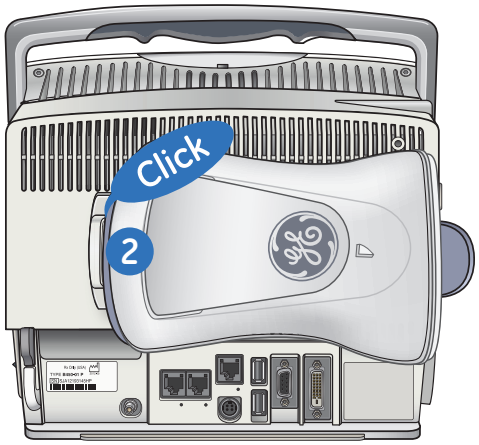
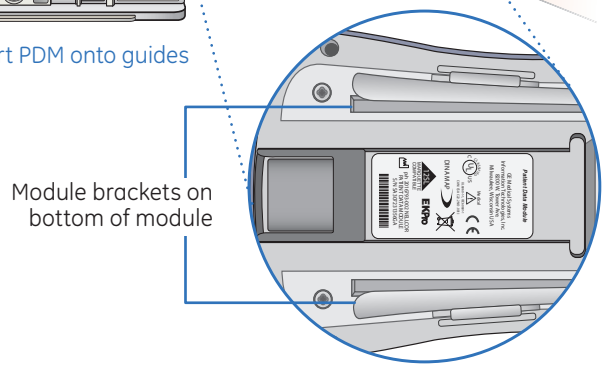


Figure 2.52 Slide PDM to stops



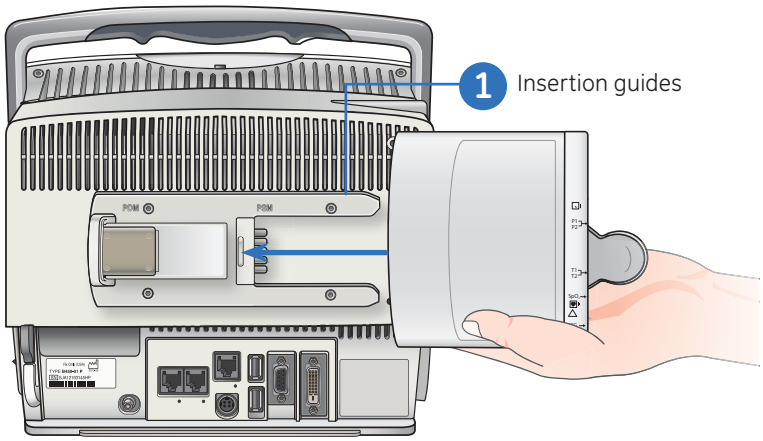


Figure 2.53 Insert PSM onto guides

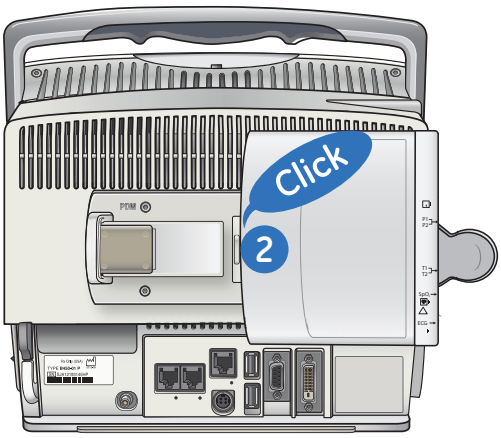


Figure 2.54 Slide PSM to stops

To remove a PSM or PDM

1. Pull the release tab out and slide the module out of the guides.
2. Hold onto the module to make sure it does not drop when it comes out.

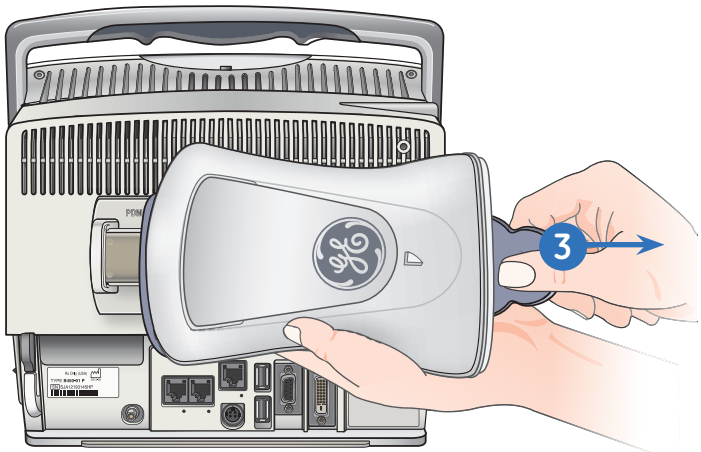


Figure 2.55 Pull PDM tab

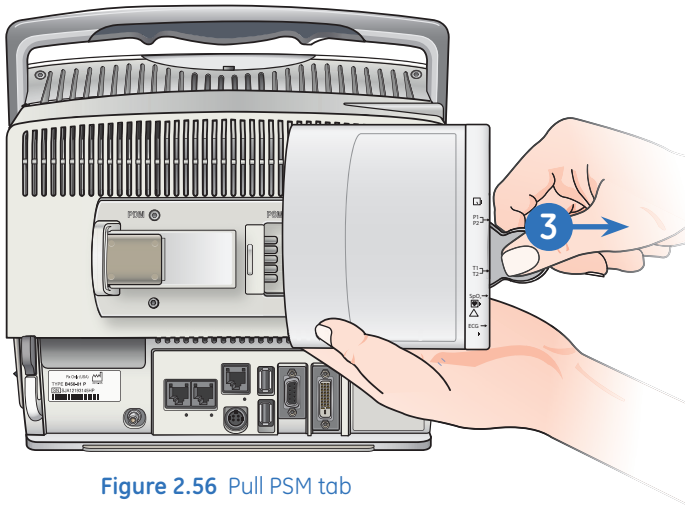


Figure 2.56 Pull PSM tab

Connecting other E-modules than PSM to the B450

1. With the module properly oriented (module release latch facing down), align the insertion guide slot in the module with the insertion guide in the module frame.
2. Push the module into the module frame until it clicks.

Removing other E-modules than PSM from the B450

1. Press the release latch at the bottom of the module.
2. While pressing the release latch, grasp the module firmly and pull out.

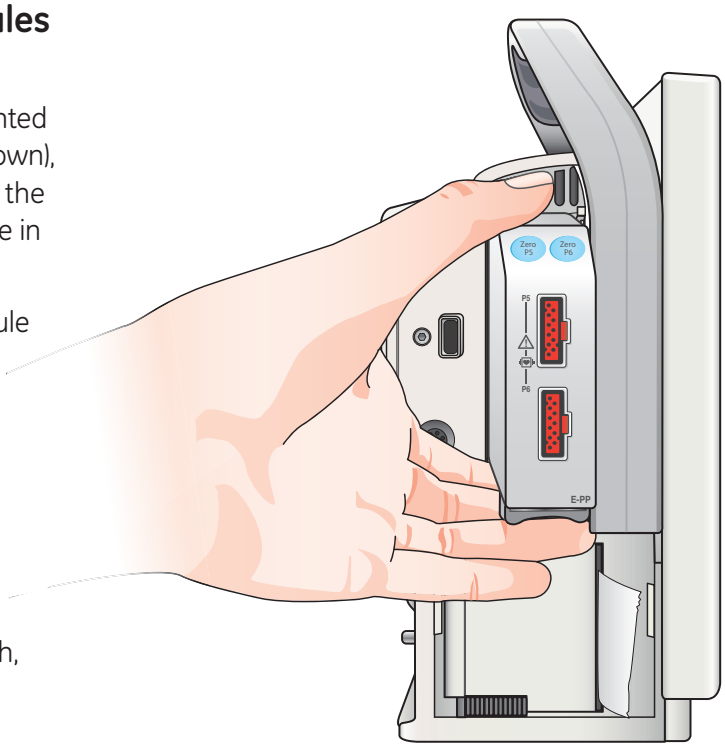


Figure 2.57 E-module tab

CARESCAPE Modular Monitor Peripheral Devices

Remote Control

The corded remote control has a trim knob and provides the same patient monitor controls as the keypad.

The remote control is connected to the patient monitor via one of the USB connectors at the back of the monitor or at the bottom of the display.

Laser Printer and Recorder Option

The monitor can print to a configured network laser printer, or to the optional recorder in the pivoting module frame, or to a remote recorder on the network.

Barcode Reader

The barcode reader can be used to scan a Technician ID and Patient Information from barcodes when admitting patients.

Keyboard and Mouse

A washable, antibacterial keyboard is specified for use with the monitor. A standard mouse may be used. These items allow you to enter data or select any on screen items without using the on-screen keyboard, Trim Knob or touchscreen display.

Unity Network ID Connectivity Device

The Unity Network ID connectivity device acquires digital data from eight individually isolated serial ports. The data is collected from up to eight peripheral devices (not necessarily manufactured by GE), then the device transmits the formatted data to the monitor.

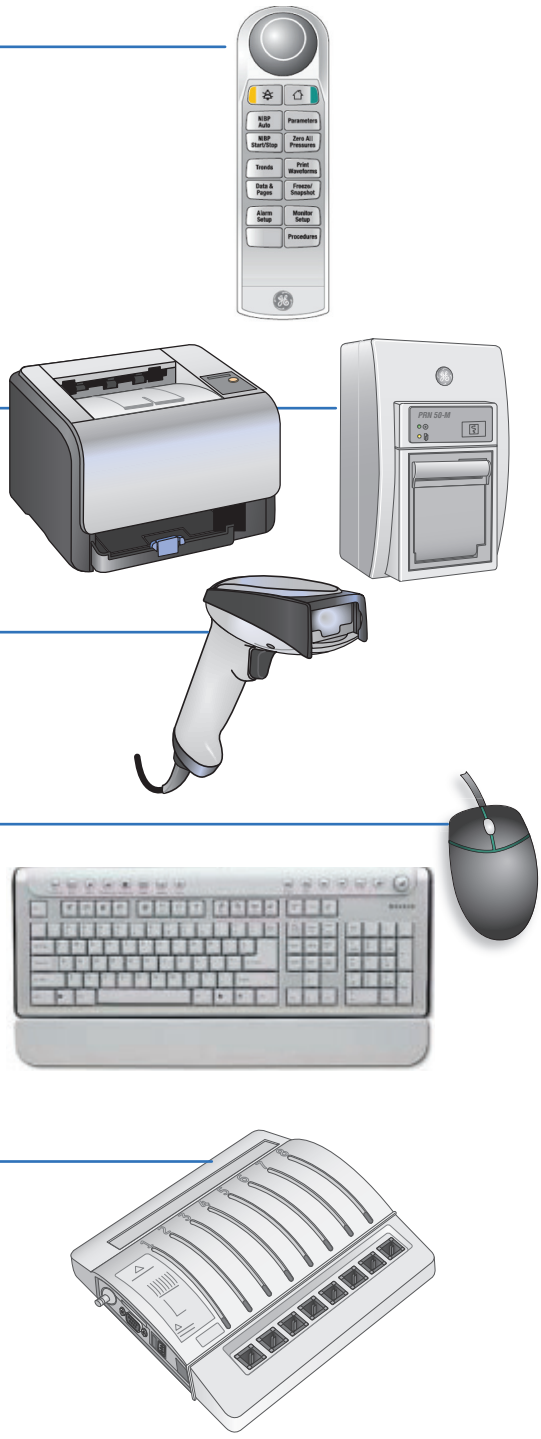


Figure 2.58 Examples of peripheral devices

Central Stations

There are two central stations that can be used to with the CARESCAPE Modular Monitors.

CIC Pro Central Station

The CARESCAPE Network MC establishes communication and allows patient data to be sent to an optional CIC Pro central station.

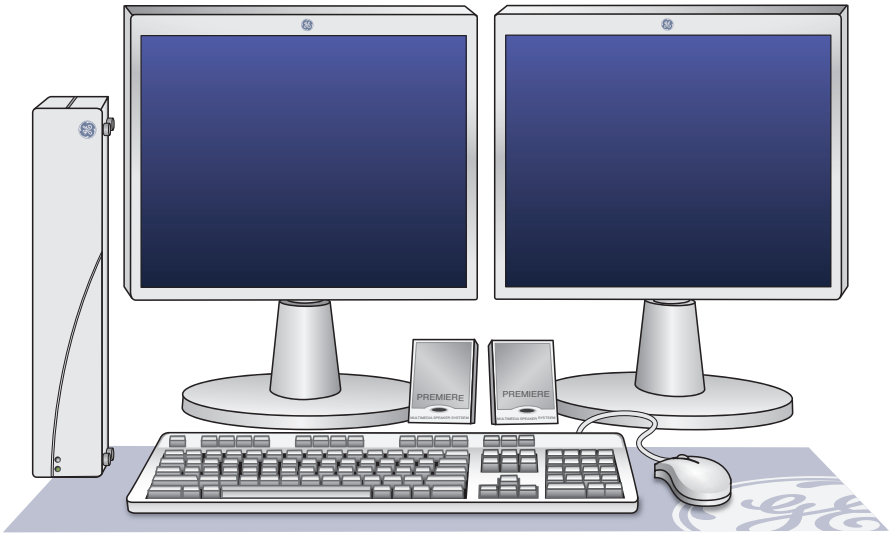


Figure 2.59 CIC Pro Central Station

iCentral

The S/5 Network (Ethernet) establishes communication and allows patient data to be sent to an optional iCentral (central station).



Figure 2.60 iCentral

Check Your Knowledge: Hardware



1. What type of module could be defined as “a module that connects to the patient, processes data signals, and sends patient data signals to the monitor”?

2. What does PDM stand for?

Hands on Activity: Hardware



Practice inserting and removing the acquisition device and/or modules you will be using in your care area.

3 Screen Navigation

Objectives: Screen Navigation



By the end of this chapter you should be able to:

- Identify the areas of the display screen
- Access the correct main menu for a specific task to be done
- Identify the parts of a menu

Terms You Should Know: Screen Navigation



Data Field: You can use the on-screen keyboard or a standard keyboard to type data into a data field. Data fields are selected with a touchscreen, Trim Knob control, or mouse.

Information Area: Displays information such as patient name, profile name and battery status.

Menu: A main component for handling the device. Each parameter has a menu to perform actions related to it, such as changing an alarm limit.

Parameter Windows: Parameter Window: A rectangular screen area that shows patient measurements using numerical values, text and graphics. It also shows additional measurement related information (e.g. units, settings, alarm limits etc.).

Split Screen: Part of waveform area reserved for showing graphical and numerical data such as a Minitrend.

Waveform: A graphical presentation of a real-time measurement signal.

Main Screen Layout

The main screen displays alarms, information, trends, snapshots, waveforms, parameter windows, and the main menu in pre-defined areas.

When the information area of the screen is selected, it opens the Admit/Discharge menu and provides access to the Patient, Load Patient, Administr. Information and Standby tabs. If the OR or PACU software packages are used, the Case Setup menu opens and the Standby tab is not available.

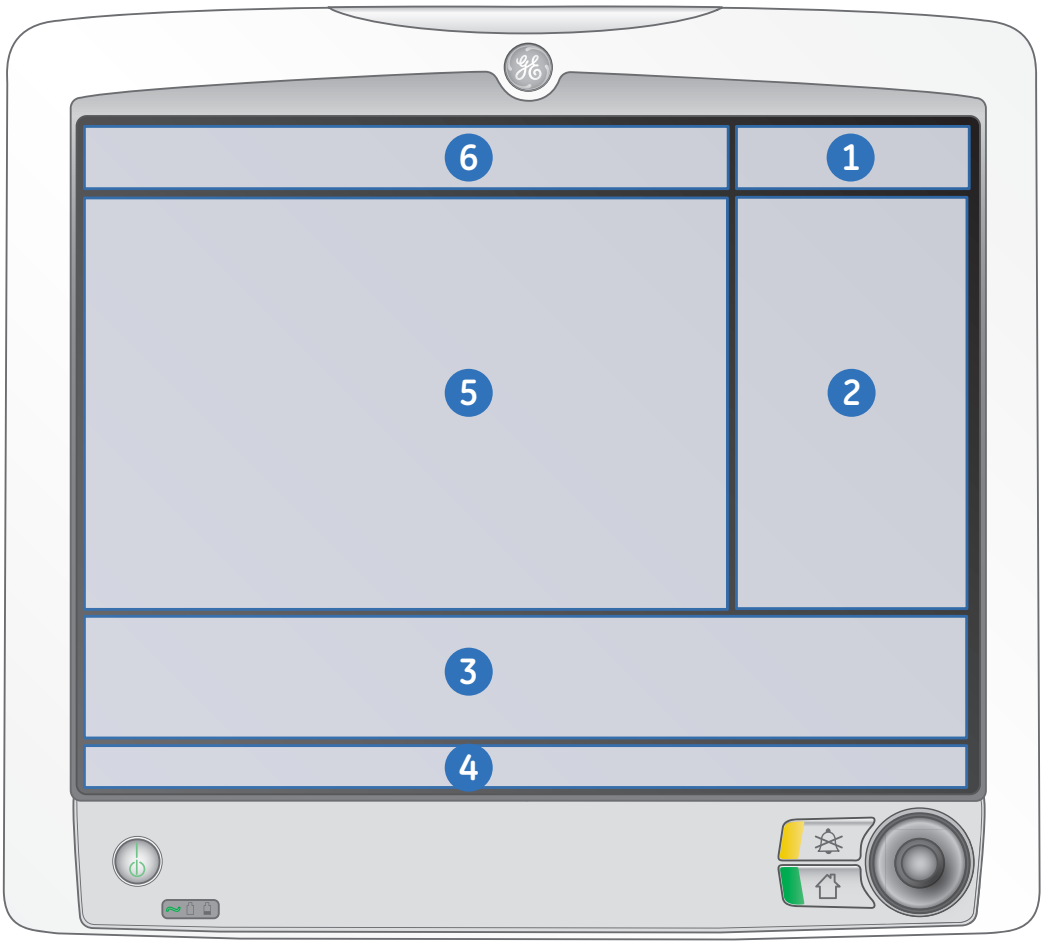


Figure 3.1 Screen layout

The main screen consists of the following components:

1. Information Area
2. Upper Parameter Windows
3. Lower Parameter Windows (option)
4. Main Menu Area
5. Waveform Area (may also consists of a split screen or Minitrend)
6. Alarm Area

In addition, the information area of the screen displays the following information:

- Patient name (if entered)
- Profile name that is being used for patient monitoring
- PDM battery gauge icon if a PDM module is connected to the monitor. You can access the Battery Status menu by clicking this icon
- B650, B450: Monitor battery gauge and battery status icons (if batteries are inserted). You can access the Battery Status menu by clicking these icons
- Bed name and care unit of the local monitor (if connected to the MC Network)
- Network symbol (if connected to the MC Network or S/5 Network)
- B650, B450: WLAN signal strength symbol (if connected to the wireless network)
- Telemetry transmitter used in combination monitoring

Menu Overview

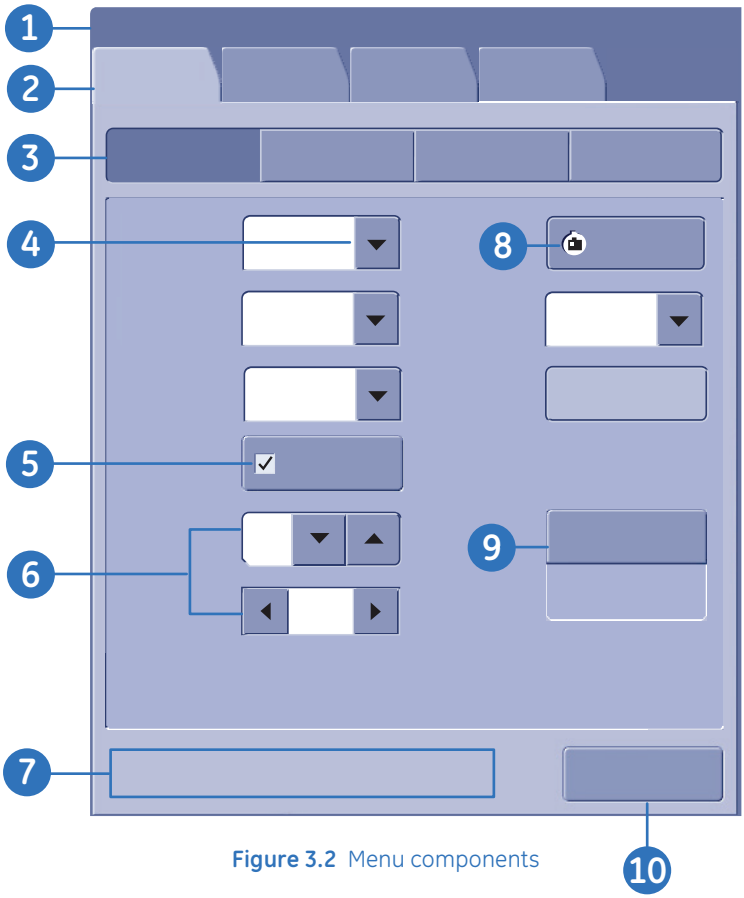


Figure 3.2 Menu components

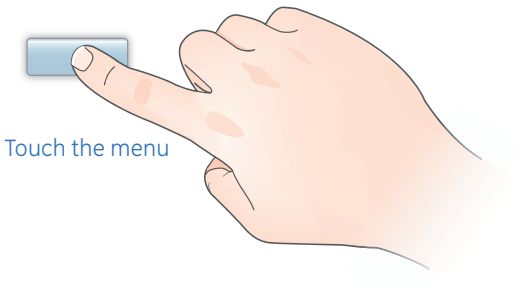
A menu may consist of the following components:

1. Menu title (for example, ***ECG***)
2. Submenu tabs (for example, ***ECG, ST, QT, Arrhythmia***)
3. Tabs (for example, ***Setup, Alarms***)
4. Selection lists: when selecting the arrow, a list of options appears
5. Check box for selecting/deselecting a feature
6. Arrow selector spinner for increasing/decreasing a value
7. Help text area
8. Radio button for selecting/ deselecting a feature
9. Selection key. The field below shows the current selection/status.
10. Exit key (for example, ***Previous Menu, Close***

Note! *Not all menus have these same components.*

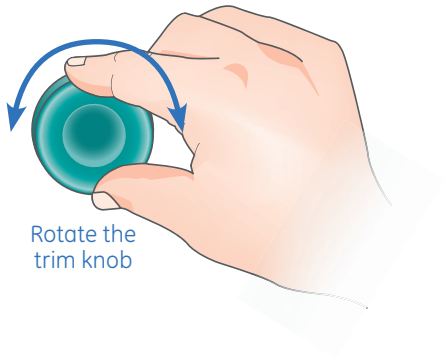
Selecting Menu Options with a Touchscreen

1. Touch the menu option with your finger.
2. The highlight on screen moves to this option.
3. Lift your finger off the screen, and the selected function is performed (e.g., a list opens).



Selecting Menu Options with a Trim Knob Control

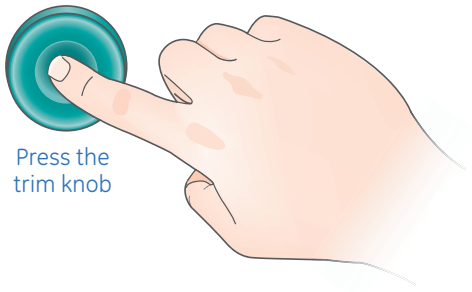
1. Rotate the Trim Knob control in either direction to move the highlighted cursor from option to option on the display.
2. Press the Trim Knob control once to select the highlighted option.



Note! *With the B450 the Trim Knob is available only on the optional remote control.*

Selecting Menu Options with Mouse

1. Move the mouse until the pointer (arrow) is on the menu option you wish to select.
2. Click the left mouse button once.



Data Field Entries

You can use the on-screen keyboard or a standard keyboard to type data into a data field. Data fields are selected with a touchscreen, Trim Knob, or mouse.

Entering Data with the on-screen keyboard

When data entry is required, the monitor automatically displays an on-screen keyboard for you to use.

1. Select the desired field. The selected field changes color into yellow, indicating that you can begin entering the text.
2. Select the characters you wish to type with the mouse, Trim Knob, or touchscreen.

Entering data with a keyboard

1. Select the desired data field. The selected field changes color into yellow, indicating that you can begin entering the text.
2. Type the desired text into the selected field with the keyboard.

Check Your Knowledge: Screen Navigation



1. How do you navigate through the display screen and menus?
2. What else does the information area of the title bar do?
3. What is the fastest way to get out of a menu?

Hands on Activity: Screen Navigation



Access multiple menus and navigate through various selections.

4 Monitoring Basics

Objectives: Monitoring Basics



By the end of this chapter you should be able to:

- Start and end Monitoring
- Add patient information
- Enable Combination Monitoring mode
- Utilize the Roving functionality
- Start and stop Standby
- Modify the screen setup

Terms You Should Know: Monitoring Basics



Admit: A patient is admitted or a case is started when the monitor detects any of the following vital signs: ECG/Impedance Respiration, Art, ABP, Fem, UAC, NIBP, SpO_2, CO_2, EEG, BIS or Entropy. Each vital sign has activation criteria that must be met before the vital sign is considered active. Can also be referred to as starting monitoring.

ADT Server: A server that collects patient demographic information from the Hospital Information System (HIS) and transfers it when requested to the bedside monitor or central station. You must use a patient identifier such as a medical record number (MRN) or last name.

Discharge: The monitor resets to the defaulted settings, including alarm limits, and also removes all patient data and trend data from the monitor and connected acquisition modules. Can also be referred to as End Case or ending monitoring.

Profile: A set of pre-defined features that are configured and stored as defaults. These have unique settings suited to a particular care unit or patient demographic within a broader care environment (software package). Each software package can have up to eight pre-defined profiles created.

Standby Mode: A function of the monitor that allows the user to temporarily take the patient off the monitor without alarming or discharging data.

Overview: Monitoring Basics

The terminology used in different software packages varies: in OR and PACU, you start or reset a case, and in other software packages you admit or discharge a patient. In addition, some other menu selections may also differ according to the licenses in use.

Starting Monitoring

A case automatically starts/a patient is admitted when the monitor detects any of the following vital signs: ECG, impedance respiration, Art, ABP, Fem, UAC, NIBP, SpO_2, CO_2, EEG, BIS, or Entropy. Each vital sign has activation criteria that must be met before the vital sign is considered active. When a case is started/a patient is admitted at the bedside monitor and the monitor is connected to the network, patient data will display at the central station.

A case manually starts/a patient is admitted when any patient data is entered or loaded. Patient data can be entered locally using the monitor, loaded from an Admit-Discharge-Transfer (ADT) server over the CARESCAPE Network, or entered remotely using a central station. If the monitor is connected to the S/5 Network, patient and trend data can be loaded to the iCentral. No trend data can be loaded from the CARESCAPE Network.

The following are generic instructions listing the basic steps for starting monitoring. Parameter-specific instructions are more detailed and should always be followed as well.

1. Connect the patient to the monitor according to the measurement setup requirements. The alarms and parameter settings become active.
2. If the startup profile is not suitable, select another profile.
3. Enter patient demographics, or load/combine the data.
4. Start the measurement.
5. Zero invasive pressure lines.
6. If required, change the parameters on screen.
7. Check alarm limits and adjust if necessary.

Adding Patient Information

Entering Patient Data With the Monitor

The Admit/Discharge menu is used to add or edit patient information. To access the Admit/Discharge menu:

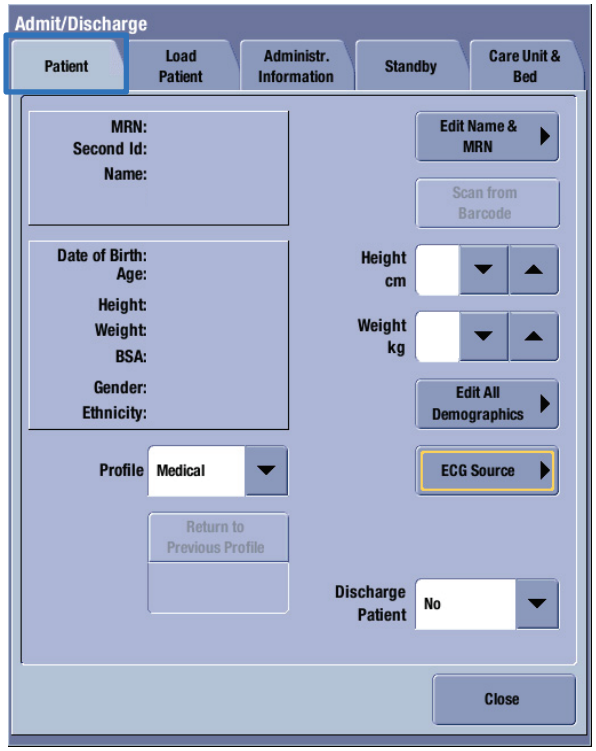


Figure 4.1 Patient information window

1. Select the patient information area on the screen, or select ***Data & Pages*** > ***Admit/Discharge*** or ***Start / Reset Case***.
2. Select the ***Patient*** tab.
3. Edit or enter patient data.
    a. **Edit Name & MRN:** Select to add or edit the patient's name and medical record number
    b. **Edit all Demographics:** Select to edit values for different types of data.

Entering Patient Data with the Barcode Reader

You can scan patient data from barcodes if this function has been enabled during configuration. For more information, see the monitor's technical manual.

1. Select the patient information area on the screen, or select ***Data & Pages*** > ***Admit/ Discharge*** or ***Start / Reset Case***.
2. Select the ***Patient*** tab.
3. Select ***Scan from Barcode.***

   Note! *Any information, including empty fields, scanned from the barcodes replaces the corresponding information previously entered from the monitor.*

4. You can cancel the scanning by selecting ***Cancel Scan***.

Loading Patient Information

Loading patient information from the CARESCAPE network (adt server):

In the CARESCAPE Network, patient information can be loaded from the ADT server. You cannot merge data between the monitor and the ADT server.

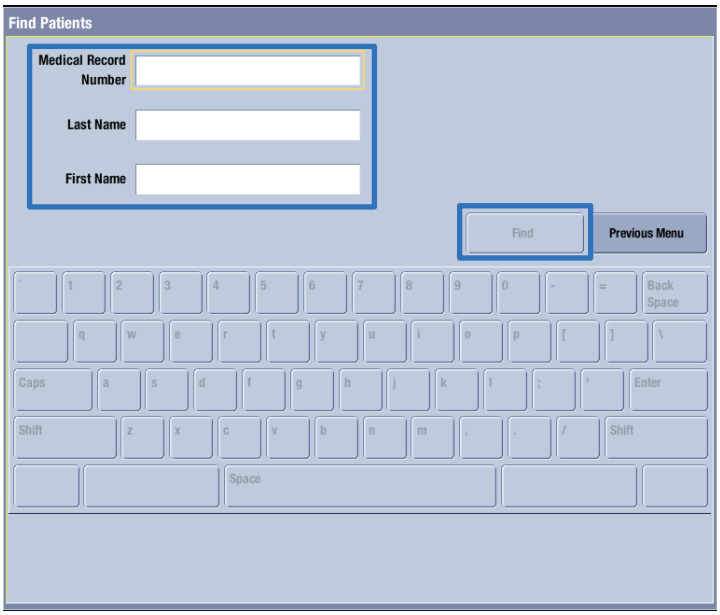


Figure 4.2 Find patient menu

1. Select the patient information area on the screen.
2. Select the ***Load Patient*** tab.
3. Select ***Find Patients***.
4. Select the ***Medical Record Number*** and/or ***Last Name*** field and enter the information you have available. You can also add the First Name information but the search does not function with this information only.
5. Select ***Find***.
6. When the patient list appears, select the patient.
7. Select ***Load Patient Information*** to load the data from the ADT server.

Loading patient and trend data from the S/5 network:

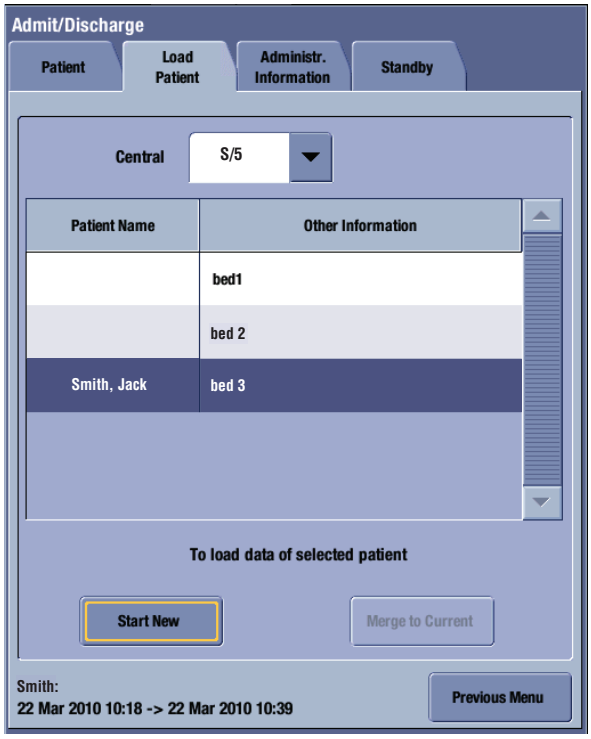


Figure 4.3 S/5 menu

1. Select the patient information area on the screen.
2. Select the ***Load Patient*** tab.
3. Select a central station from the ***Central*** list. A patient table appears, showing all the patient cases saved on the selected central station.
4. Select a patient from the table.
5. One of the following selections is available:
    - ***Start New*** is available when there is no active patient case/admitted patient on the monitor. Select this to load patient data from the network.
    - ***Reset Current*** or ***Discharge Current*** is available when there is an active case/admitted patient on the monitor. Select this to end the case/discharge the patient on the monitor and to erase all patient data. The selected patient case is loaded from the network.
    - ***Merge to Current*** when there is an active patient case/admitted patient on the monitor and the same patient can be found at the central station. Select this to combine their patient data.

The message ***Loading from network*** is displayed until all data has been loaded. The monitor will send all updated patient data except trends to a connected PDM or TRAM.

Entering Administrative Information

Administrative information can be transferred from the monitor to the PDM only.

1. Select the patient information area on screen.
2. Select the ***Administr. Information*** tab.
3. Select ***Edit***.
4. Select the field to be edited and enter the data as required:
    - Visit Number
    - Primary Physician
    - Referring Physician

Combination Monitoring Mode

The combination monitoring is a licensed feature where ECG is acquired from a telemetry receiver system. This ECG data acquisition capability enhances basic telemetry monitoring by providing access to all of the available parameters from bedside monitors, while acquiring the ECG data from telemetry. In this monitoring mode, all data — local and telemetry — is viewed at the central station and the bedside monitor. However, any historical data stored at the central station will be unavailable. Any new alarm history samples created on the telemetry transmitter cannot be viewed on the monitor if they are created after the combination monitoring has been started. Only the snapshots created on the monitor and the samples of the telemetry transmitter created prior to starting the combination monitoring can be viewed.



Note! *This option cannot be used in the NICU software package.*

The Combo mode uses a monitor mounted in a room, but the ECG data can be acquired from either the monitor or from a telemetry transmitter/transceiver.

To admit a patient to combination monitoring:

1. Select the ECG parameter window or select ***Data and Pages***.
2. Select ***Admit/Discharge*** (only if ***Data and Pages*** was selected).
3. Select ***ECG Source.***
4. Select the Telemetry TTX number from the ***ECG Source*** list.
5. Verify the desired TTX number is visible in the upper right corner of the display.

In case the telemetry patient has been admitted when the device is connected to the monitor, the arrhythmia alarm priorities and limit alarm priorities (except in case the monitor alarm is set to escalating) and the following ECG settings of the telemetry will be used:

- HR, ST, and PVC alarm limits
- PVC alarm status (on/off)
- Pacemaker detection
- Lead analysis
- Va lead position
- Primary lead
- ECG waveform size
- Arrhythmia detection level
- ST analysis status (on/off)

When combination monitoring is started with a non-admitted telemetry patient, these same settings from the monitor will be sent to telemetry. Additionally, the Telemetry Waveforms printing location is sent to telemetry. If the telemetry alarm priority is such that it is not supported by the monitor, it will be mapped to the next higher priority available.

When combination monitoring is started with a non-admitted telemetry patient, the printout type selection will be sent to the telemetry transmitter.

To discharge a patient from combination monitoring:

1. Select the ***ECG*** parameter window or select ***Data and Pages***.
2. Select the ***Admit/Discharge*** (only if ***Data and Pages*** was selected).
3. Select the ***Discharge Patient*** tab
4. Select the appropriate tab:
    - **Monitor Only:** discharges bedside, telemetry remains admitted
    - **Telemetry Only:** discharges telemetry, bedside remains admitted
    - **Monitor & Telemetry:** discharges both bedside and telemetry monitoring



Note! *If discharging both the monitor and telemetry you need to remove all ECG leads and patient cables from the patient*

Roving Functionality

Roving functionality allows you to move, or rove, the monitor to fit the patient's acuity needs, rather than moving the patient to a monitored room. When you move the monitor to a new location in the CARESCAPE Network, you can update the unit and/or bed names from drop-down lists, or add new names manually. Available selections depend on what has been allowed in configuration.

This functionality is also available in the combination monitoring mode for roving between beds. In other words, you can move the monitor or a patient wearing a telemetry transmitter from one location to another and update the information accordingly.

To admit a rover patient:

1. Connect the AC Power source and Network cable.
2. Push the power button to activate the display.



Note! *The display must be turned on and the network cable plugged in for at least two minutes for the monitor to acquire Unit/Bed information*

Roving between bed and care units:

If roving between units is allowed, you can update the unit name when moving the monitor to a new location:

1. Select the patient information area in the top right corner of the screen or select ***Data and Pages.***
2. Select the ***Admit/Discharge*** tab (only if ***Data and Pages*** was selected).
3. Select the ***Care Unit and Bed*** tab.
4. Select the appropriate Care Unit Name from the drop down list. (only required if roving to different care units)

   Select ***Bed Name*** from the drop down list. The new name appears in the upper right corner of the display. The unit name is given first, then a dash and the bed name (for instance, UNIT1–BED1).



Note! *Changing the Care Unit Name will also update the contents of the Bed Name list.*

The unit name and bed number should appear automatically in the drop down box. If not, be sure the network cable in connected and that at least two minutes has passed for the network to collect information.

You can also change the name manually through ***New Unit & Bed****, or through* ***New Bed****. These selections are available in the* ***Care Unit & Bed*** *menu according to what has been allowed in the Roving settings.*

If roving between units is allowed and the 12SL ECG with ACI TIPI is enabled, you can enter the Location ID that will be used in the 12SL reports:

1. Select the patient information area on screen.
2. Select the ***Care Unit & Bed*** tab.
3. Select the ***Location ID*** field and enter the ID with the on-screen numeric keypad. You can enter any number from 0 to 599.

Adding new units and beds (manual roving)

If manual roving between beds and/or units is allowed, you can also enter their names manually:

1. Select the patient information area.
2. Select the ***Care Unit & Bed*** tab.
3. Select ***New Unit & Bed***. If the Roving settings do not allow roving between units, the New Unit & Bed is not available. In this case, select ***New Bed*** to enter a new bed name.
4. Select the ***Care Unit Name*** or the ***Bed Name*** field and type the new name with the on-screen keyboard. The maximum number of characters for the Care Unit Name is seven, and for the Bed Name it is five.
5. Select ***Confirm*** to ensure that the names you entered are valid.

To discharge a rover patient:

1. Select the patient information area in the top right corner of the screen or select ***Data and Pages.***
2. Select the ***Admit/Discharge*** tab (only if ***Data and Pages*** was selected)
3. Remove all ECG leads and patient cables from the patient.
4. Select the ***Discharge Patient*** tab.
5. Select ***Yes***. The message ***Patient Discharged*** will appear at the top of the screen.

Rover/Combination Monitoring

The Rover/Combo mode combines the mobility feature of Rover monitoring with the telemetry capabilities of Combo monitoring.

To admit a patient to rover and combination monitoring:

1. Connect the AC Power source and Network cable.
2. Push the power button to activate the display.

Note! *The display must be turned on and the network cable plugged in for at least two minutes for the monitor to acquire Unit/Bed information.*

Roving between units:

1. Select the patient information area in the top right corner of the screen or select ***Data and Pages.***
2. Select the ***Admit/Discharge*** tab (only if ***Data and Pages*** was selected).
3. Select the ***Care Unit and Bed*** tab.
4. Select the appropriate Care Unit Name from the drop down list.
5. Select ***Bed Name*** from the drop down list.

Note! *The unit name and bed number should appear automatically in the drop down box. If not, be sure the network cable in connected and that at least two minutes has passed for the network to collect information.*

To discharge a patient from combination monitoring:

1. Select the ECG parameter window or select ***Data and Pages.***
2. Select the ***Admit/Discharge*** (only if ***Data and Pages*** was selected)
3. Select the ***Discharge Patient*** tab
4. Select the appropriate tab:
    - **Monitor Only:** discharges bedside, telemetry remains admitted
    - **Telemetry Only:** discharges telemetry, bedside remains admitted
    - **Monitor & Telemetry:** discharges both bedside and telemetry monitoring

Note! *If discharging both the monitor and telemetry you need to remove all ECG leads and patient cables from the patient.*

Ending Monitoring

Overview

Resetting a case/discharging a patient deletes all patient information from an attached PDM or TRAM. If this is not desired, disconnect the PDM or TRAM from the monitor before resetting a case/discharging the patient.

The monitor may be configured with an automatic case reset/patient discharge timer. If this is configured and vital signs are no longer detected, monitoring will end automatically after the configured time has elapsed. The patient can be discharged remotely using a central station provided that this option has been enabled. This option is not available in OR and PACU software packages.

Removing Patient Data from the PDM and Bedside Monitor

To ensure that no physiological data remains in the acquisition module or in the bedside monitor after resetting a case/discharging the patient, do the following:

- **PDM:** Do not disconnect the acquisition module from the bedside monitor before ending a case or discharging a patient. You must also disconnect all the patient cables from the patient. The PDM can continue to measure patient data with battery power even when the module is not connected to the patient monitor.
- **Bedside monitor:** Remove the acquisition modules from the monitor or disconnect all the patient cables from the patient.

Resetting a Case/Discharging A Patient

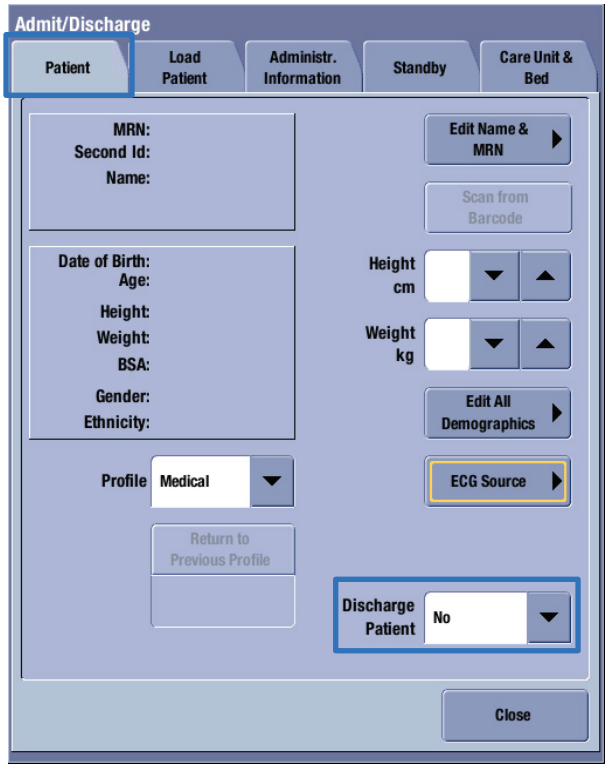


Figure 4.4 Admit discharge – patient menu

1. Disconnect patient cables.
2. Print necessary data and wait until the printing is completed.
3. Select the patient information field on the screen.
4. Select the ***Patient*** tab.
5. Select ***Reset Case*** or ***Discharge Patient*** (selection with vary depending on software license).

Monitor settings, including alarm limits, return to their default settings. All patient data and trend data is removed from both the monitor and a connected PDM or TRAM.

Resetting a Case/Discharging a Patient in Combination Monitoring Mode

Note! *Not applicable with NICU software packages.*

1. Disconnect patient cables.
2. Print necessary data and wait until the printing is completed.
3. Select the patient information field.
4. Select the ***Patient*** tab.
5. Select ***Reset Case*** or ***Discharge Patient*** and one of the following:
    - **No:** No discharge actions take place.
    - **Telemetry:** The patient is discharged from the telemetry transmitter but not from the monitor.
    - **Monitor:** The patient is discharged from the monitor but not from the telemetry transmitter.
    - **Both:** The patient is discharged from the monitor and the telemetry transmitter.

Standby

Starting Standby

When you remove the patient temporarily from the monitor, you can use the standby option.

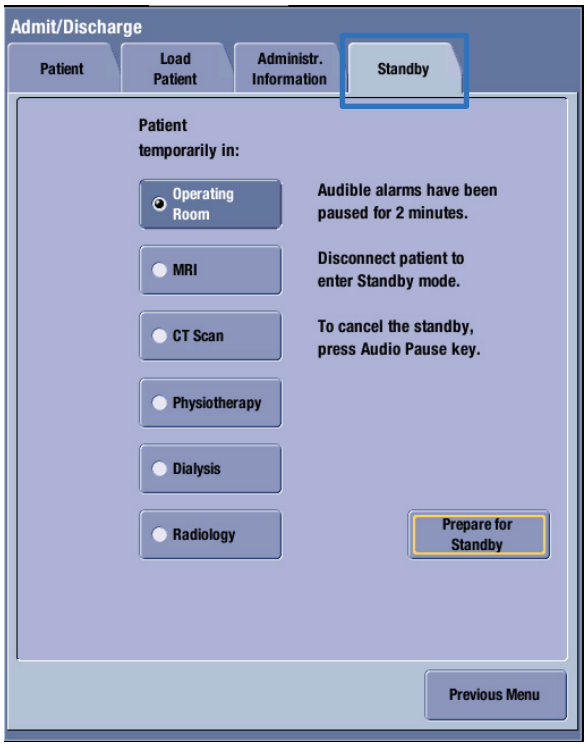


Figure 4.5 Standby menu

1. Select the patient information area on the screen.
2. Select the ***Standby*** tab.
3. Select the radio button for an appropriate standby location.
4. Select ***Prepare for Standby***. If patient cables are still connected and the monitor receives vital signs, a text indicating that audio alarms have been paused appears.
5. Disconnect patient cables to start the standby. If you do not disconnect the cables and vital signs are still present after the audio pause time expires, the standby is canceled.
6. Check that the ***NIBP Auto*** is turned off.

The screen goes blank and the GE logo along with a message such as ***Patient temporarily in MRI*** (according to the location selected) appears.

Ending Standby

The monitor ends the standby automatically when any of the following conditions occur:

- Vital signs are still present after ***Prepare for Standby*** has been selected and the audio pause time expires
- Any vital signs are detected as active
- User input is received: a keyboard key is pressed, Trim Knob control is pressed or rotated, primary mouse button is pressed, touchscreen is pressed
- A PDM or TRAM is connected

Continuing Monitoring

Patient information and data is stored in the PDM and TRAM. The ***Connecting Measurement*** message appears on the monitor when the PDM or TRAM is first connected. Vital sign monitoring is not available during this initialization time. At the conclusion of the initialization, the stored patient information and data can be transferred to the monitor from the acquisition module. While patient information and data is being transferred, the ***Loading from PDM*** or ***Loading from Tram*** message appears on the monitor. The type of patient information and data that can be transferred includes the following:

- Patient demographic data
- Patient trends and alarm histories; alarm histories are converted to snapshots during the transfer
- All zeroed invasive pressure site labels
- All invasive pressure transducer zero values for channels 1 to 4
- Latest values and timestamps for C.O., PCWP, and NIBP measurements
- NIBP cuff size
- NIBP auto cycle on/off information
- NIBP cycle time information if the NIBP auto cycle is on

The actions taken by the monitor and the menus that appear depend on whether the monitor has an active patient case/admitted patient or not.

Continuing monitoring when a case is not active/patient is discharged

When you connect a PDM or TRAM that is actively measuring vital signs from ECG, invasive pressures or SpO_2, the patient information and data is automatically loaded from the PDM or TRAM to the monitor and a case is automatically started/patient is admitted.

When you connect a PDM or TRAM that is not actively measuring vital signs from ECG, invasive pressure or SpO_2 but contains patient information, the ***Continue*** menu appears. The Continue menu has two informative fields on the top: the ***Patient in the monitor*** and the ***Patient in the PDM*** or ***Patient in the Tram***. These fields show the text ***No patient identification data available*** if there is no active case/admitted patient.

Select one of the following to continue monitoring:

- ***Load PDM Data / Load Tram Data:*** This selection loads patient information and data from the module
- ***Erase PDM Data / Erase Tram Data:*** This selection erases the patient information and data from the module

Continuing monitoring when a case is active/patient is admitted

When you connect a PDM or TRAM that contains an MRN that matches the MRN entered on the monitor, the patient information and data is automatically loaded from the PDM or TRAM to the monitor and a case is automatically started/patient is admitted.

When you connect a PDM or TRAM that contains patient information but the MRN does not match the MRN entered on the monitor, the ***Continue*** menu appears.

The ***Continue*** menu has two informative fields on the top: the ***Patient in the monitor*** and the ***Patient in the PDM*** or ***Patient in the Tram***. These fields show the MRN and Name of the Patient information if there is an active case/admitted patient. Select one of the following to continue monitoring:

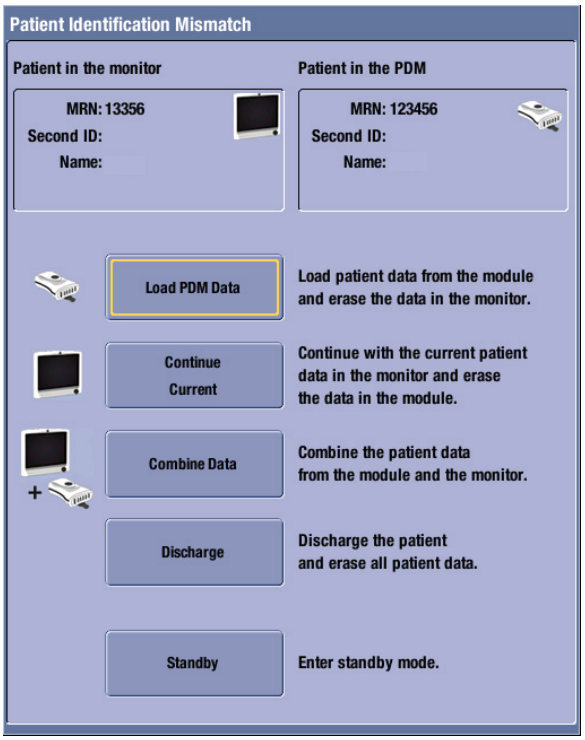
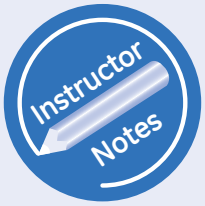


Figure 4.6 Continue menu

- **Load PDM Data / Load Tram Data:** This selection erases the patient data from the monitor and loads the data from the module.
- **Continue Current:** Monitoring will continue with the patient data from the monitor. If the patient identification is not the same on the acquisition module and the monitor, this selection erases the patient data from the monitor and continues with the patient currently on the module.
- **Erase PDM Data / Erase Tram Data:** This selection erases the patient data from the module.
- **Combine Data:** This selection combines the patient data from the module with that of the monitor even if the patient identification is different or it has not been entered. Use this selection if no MRN has been entered or you know for certain that you will continue monitoring the same patient. This selection may also be useful if there has been a typing mistake or some other minor error when entering the patient identification. Any information available in one device and not in the other will overwrite the missing information.

  Note! *Be careful when using this selection. If you are not absolutely certain that it is the same patient on the monitor and module, do not combine the data.*

- **Discharge:** This selection deletes the patient data from the module and from the monitor.



Continue Monitoring:
When data is combined either automatically or manually, only the data after the last module disconnection is loaded. To load all trends, discharge the patient from the monitor and make sure that the PDM/TRAM is not connected to the monitor. Then reconnect the module.

If you connect a PDM or TRAM module and there is no patient information or data in the module or in the monitor, the monitoring does not start and the ***Continue*** menu does not appear.

When you select to erase data or discharge a patient in the ***Continue*** menu, the patient's vital signs cannot be observed during the erase/discharge cycle time.

If the ***Continue*** menu is open when a request for time adjustment is received, the adjustment will be delayed until the menu is closed and data has been loaded.

If a PDM or TRAM is connected to the monitor when the time is adjusted, the monitor sends the new time to the module.

Modifying the Screen Setup

Pages

A page defines monitor screen formats such as parameter window areas, split screen settings and combined invasive pressure waveform settings. The contents are preconfigured but can be changed. Page configuration is password protected, but once the pages are configured they can be selected to screen by all users. There may be pages designed, for instance, for physicians, surgeons, or nurses.

When monitoring begins, the main page appears automatically. This preconfigured page is called the normal screen. Any changes you make to the screen setup during monitoring are changes to this normal screen. These changes are not permanent and are valid until the case is reset/the patient is discharged from the monitor. They are also kept in the monitor memory for 15 minutes after the power is turned off.

Profiles

A profile is a group of unique settings suited to a particular care unit or patient demographic and can be customized. Settings for a profile could include alarm limits, screen layouts, trends and snapshot settings. When you start monitoring a patient, you can use the startup profile or select another profile. According to the configuration, your monitor software may have up to eight profiles to choose from.

In addition to the normal screen, each profile can have up to five additional pages and some of these may be preconfigured. These additional pages are needed for instance when all the measured parameters do not fit on the normal screen page. These pages can also include information that is needed only during a specific phase of care. The name of the page currently in use is always displayed in the upper part of the screen.

Selecting the Normal Screen (Main Page)

You can return to the normal screen (main page) any time during monitoring by either selecting the Home icon or key or selecting ***Data & Pages*** > ***Normal Screen***.

Selecting Pages

You can select different pages to the screen during monitoring to view their information.

1. Select ***Data & Pages***.
2. Select the radio button of the page you want to see.
3. You can return to the normal screen by selecting the home icon or key, or through ***Data & Pages*** > ***Normal Screen***.

Selecting a Profile

You can select another profile while monitoring a patient without losing any patient data.

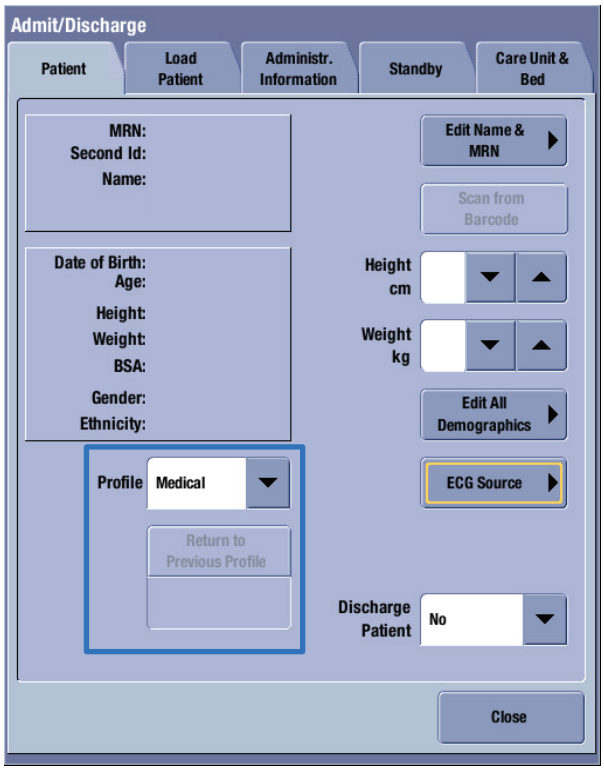


Figure 4.7 Admit discharge – patient menu

1. Select the patient information area on the screen.
2. Select the ***Patient*** tab.
3. Select a profile from the ***Profile*** list.
4. You can return to the previous profile by selecting ***Return to Previous Profile***.

Note! *If you make changes to a profile while using it, you can only return to its previously saved settings by selecting another profile and then returning to the one you were using.*

Manually Modifying the Screen

Parameter windows

The parameter windows show numeric or graphic presentation of the measurement data. Each window can contain one or several parameters according to what you have chosen.



Figure 4.8 Parameter window sizes

The parameter windows can be of four different sizes according to the number of selected and active parameters on screen. The sizes can be described as ***big*** (full width, full height), ***small*** (half width, half height), ***tall*** (half width, full height), and ***wide*** (full width, half height):

You can configure parameters to the lower parameter area (horizontal, lower part of the screen) and/or to the upper parameter area (vertical, on the right).

Upper parameter area

You can configure individual waveforms and parameter windows in the Upper Parameter Area. One parameter window can show more than one parameter when parameter combinations (such as SpO_2 & SvO_2) are used.

You can also combine invasive pressure waveforms. ECG or ST monitoring reduces the number of upper parameter windows by one, and monitoring both of them reduces the number by two.

Lower parameter area

Any numeric parameter window in the lower parameter area having an empty field (OFF) above or below it is automatically enlarged.

You can configure a maximum of eight lower parameter windows. When the lower parameter windows are on, they reduce the space used for waveforms and upper parameter windows. You can then choose up to six waveforms and 12 parameter windows to display in the upper parameter area of the screen.

Selecting parameters to the screen

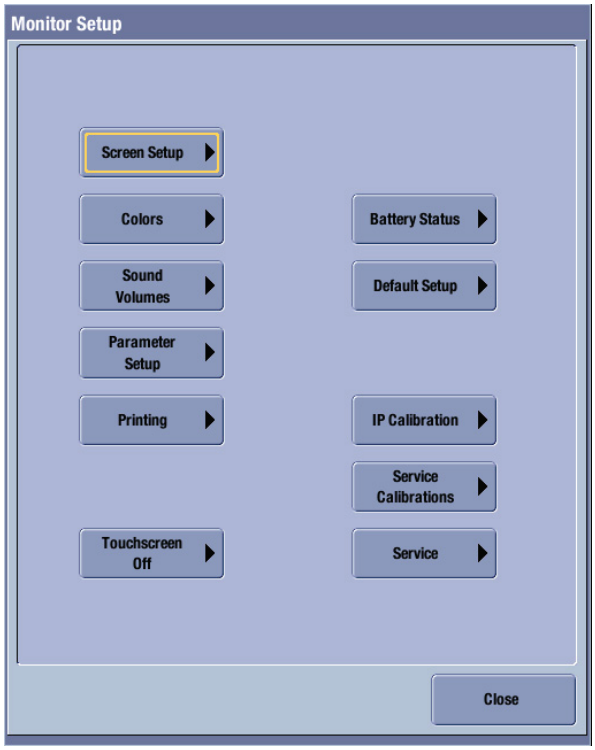


Figure 4.9 Monitor setup menu

1. Select ***Monitor Setup*** > ***Screen Setup***.
2. B850 and B450 with the Double Video license: Select ***Screen 1*** or ***Screen 2*** tab.
3. Select the parameter to the upper or lower parameter area:
    a. Select ***Upper Parameter Area*** > ***Show Parameter***. If a parameter is still not visible in the upper parameter area after you have selected it to the screen, raise its priority with the arrow keys in the ***Change Order*** column. If you want to hide the waveform of a parameter, deselect ***Show with Waveform***.
    b. Select ***Lower Parameter Area*** and activate it by selecting the radio button ***Double Height*** or ***Single Height***. Then select the parameter from the dropdown lists. To hide the Lower Parameter Area from the screen, select ***Off***. Selecting ***Double Height*** allows eight different parameter combinations in the selection lists in addition to the individual parameters, and selecting ***Single Height*** allows four combinations.

Selecting the display mode for invasive pressure waveforms

You can select the invasive pressure waveforms to be shown as individual waveforms, or in a combined view.

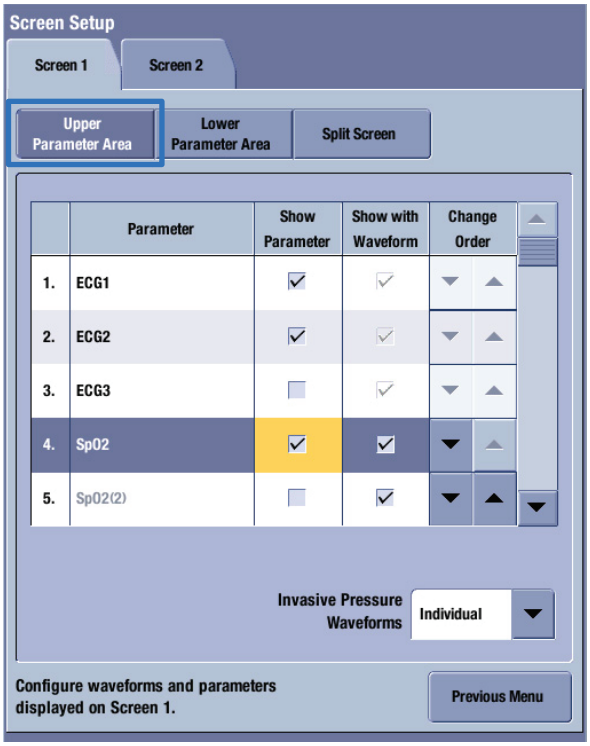


Figure 4.10 Screen setup menu

1. Select ***Monitor Setup > Screen Setup***.
2. B850 and B450 with the Double Video license: ***Select Screen 1*** or ***Screen 2*** tab.
3. Select ***Upper Parameter Area***.
4. Select an option from the Invasive Pressure Waveforms list:
   - To view individual waveforms, select ***Individual***
   - To combine the currently displayed adjacent waveforms (2 to 4), select ***Combined***. The new waveform field will use the combined height of the original fields.
   - To combine up to four waveforms in one field, select ***4invP.*** The new waveform field will use the height of two upper parameter windows.

Setting up a split screen

You can split the waveform area into two parts. The split screen option divides the screen so that you can view graphic and/or numeric data of the chosen measurement on the left while still having waveforms and parameter windows visible at the same time.

1. Select ***Monitor Setup*** > ***Screen Setup***.
2. B850 and B450 with the Double Video license: ***Select Screen 1*** or ***Screen 2*** tab.
3. Select ***Split Screen***.
4. Select the type of split screen you need from the dropdown list:
    - **Off:** no split screen
    - **ST:** shows current and reference QRS complexes and ST trends
    - **Spiro 1:** is a basic view of Patient Spirometry data
    - **Spiro 2:** is an enhanced view of Patient Spirometry data
    - **EEG:** shows the EEG compressed spectral array (CSA)
    - **AEP:** shows the current auditory evoked potentials (AEP) waveforms
    - **Minitrend:** shows a Minitrend beside the waveforms

Check Your Knowledge: Monitoring Basics



1. What does placing the monitor in standby do?
2. What is a profile?
3. When changing profiles after the patient is admitted/case started, will you lose patient information if that profile does not have a parameter on the screen that is being monitored?
4. What menu do I access to change a profile?

Hands on Activity: Monitoring Basics



1. Practice changing profiles to see what each profile looks like.
2. Manually change the screen setup by turning on and off upper area parameters, changing the order and hiding waveforms as well as turning on and off lower parameter area and assigning parameters to some windows for the lower area.
3. Enable or disable mintrends to see what the screen differences look like.
4. Place monitor in standby.
5. Discharge/end case the monitor.

5 Alarms

Objectives: Alarms



By the end of this chapter you should be able to:

- Adjust the alarm volume
- Turn an audible alarm on and off
- Pause an audio alarm
- Change a parameter alarm limit
- Set an arrhythmia alarm
- Set a parameter alarm priority level
- Set Auto Limits
- Return to default alarm limits
- Activate sleep mode, if applicable

Terms You Should Know: Alarms



Breakthrough alarm: Allows pre-defined and user-selectable alarms to "break through" (interrupt) an All Alarms Audio Off or a 2 or 5 minute audible alarm pause condition.

Escalating alarm: Starts at a designated priority level and will escalate to the next higher priority level of alarm if the alarm condition has not been resolved.

Latched alarm: The audible alarm and visual message remains after the alarm condition no longer exists.

Patient-specific alarm: Alarms that are individualized and based on a patient's current condition.

Physiological alarm: Triggered by a patient measurement being outside the parameter limits, by apnea, or by an arrhythmia condition.

Technical alarm: Triggered by an electrical, mechanical, or other failure of the equipment, or by failure of a sensor or component.

Overview: Alarms

Types of Alarms

The monitor provides two types of alarm settings, system and patient-specific. System alarm settings are set globally across an entire care environment. They are configured at the time of installation and are password protected. Examples of configurable system alarm settings are:

- Minimum alarm volume allowed
- Audio and alarm light off allowed
- Absolute (Guard) limit setting

Patient-specific alarm settings are individualized based on a patient's current condition. Examples of bedside alarm settings are:

- Parameter alarm limits
- Arrhythmia alarm priority settings

Alarm Conditions

Physiological alarm conditions are triggered by a patient measurement being outside the parameter limits, by apnea, or by an arrhythmia condition.

Technical alarm conditions are triggered by an electrical, mechanical, or other failure of the equipment, or by failure of a sensor or component. Technical alarm conditions may also be caused when an algorithm cannot classify or interpret the available data.

Alarm Priority Levels

Physiological and technical alarms are categorized by priority level:



Figure 5.1 Examples of alarm priorities

1. **High priority** alarms require an immediate response.
2. **Medium priority** alarms require a prompt response.
3. **Low priority** alarms require you to be aware of this condition.
4. **Informational priority** messages provide information you should know.

Alarm priority escalation

An escalating alarm starts at a designated priority level (low or medium) and will escalate to the next higher priority level of alarm (after a set number of seconds) if the alarm condition has not been resolved. It is important to note that these escalate up to the next level but will not reset until the condition has been resolved.

Note! *Alarm priority escalation affects the currently ongoing alarm condition, not any future alarms of the same type. Any new alarms will alarm at their designated priority level, not at the escalated level.*

Physiological Alarm's Activation Criteria

Physiological alarms have individual activation criteria as shown in the table. Alarm annunciation does not depend on case activity.

Table 5.1 Alarm activation criteria

Parameter	Alarm activation criteria
ECG	Active measurement for 30 seconds.
Impedance Respiration	Active measurement for 30 seconds.
SpO_2	Active measurement for 60 seconds.
NIBP	Manual, Automatic, or Stat mode started.
IP	Active measurement for 30 seconds
Temperature	Active as soon as measurement readings are available.
C.O.	Active as soon as continuous measurement readings are available from the Unity Network ID connectivity device.
SvO_2	Active as soon as measurement readings are available.
Gases	Active measurement for 60s without apnea.
Patient Spirometry	Active if the module is connected and communicating with the monitor.
Entropy	Measurement readings within the preset alarm limits for 30 seconds.
EEG	When EEG is present and active for 15 seconds.
BIS	Active measurement for 30 seconds.
TC	Active measurement for 60 seconds.

Alarm Area

Alarm and information messages can be displayed in three areas:

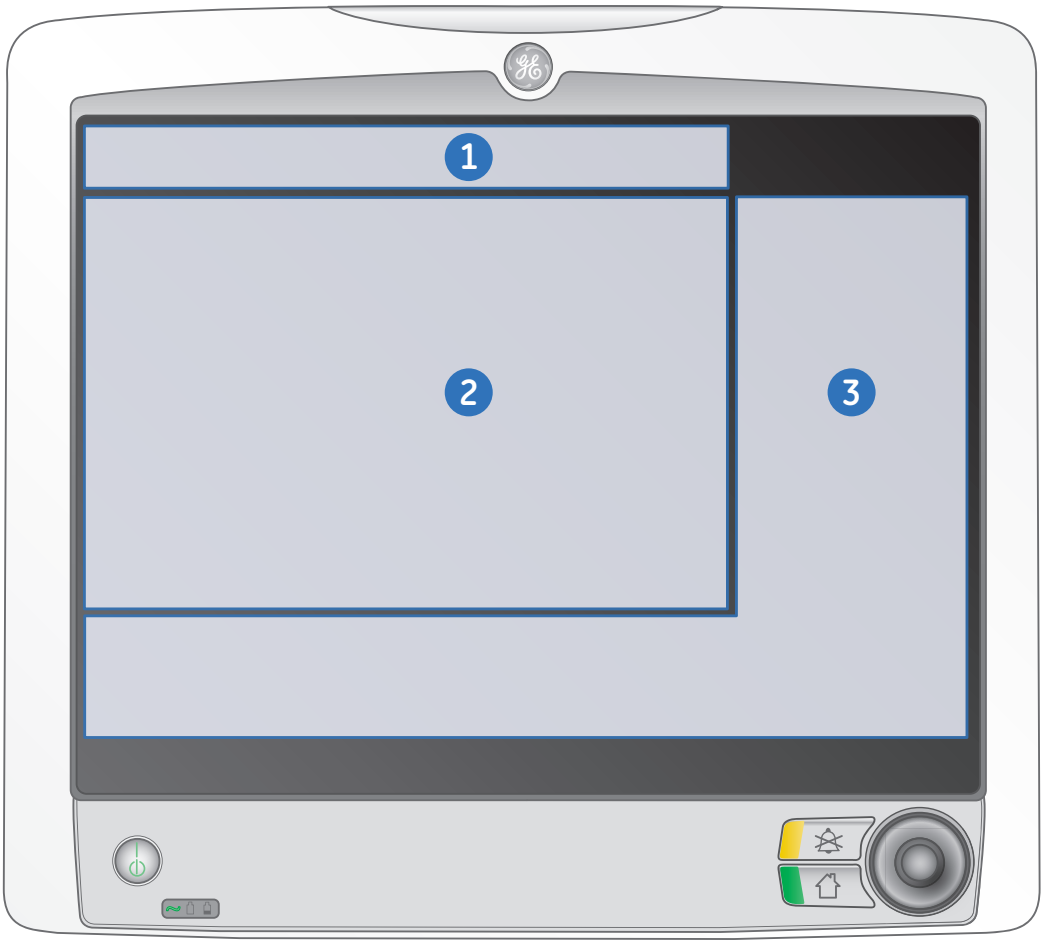


Figure 5.2 Alarm areas

1. Alarm area
2. Waveform area
3. Parameter area

In the alarm area, up to five alarm or information messages may be displayed from left to right, from the newest highest priority alarm to the oldest lowest priority alarm. Up to four of the newest highest priority remote alarm messages display first, followed by the newest highest priority local alarm messages.

Audible Alarms

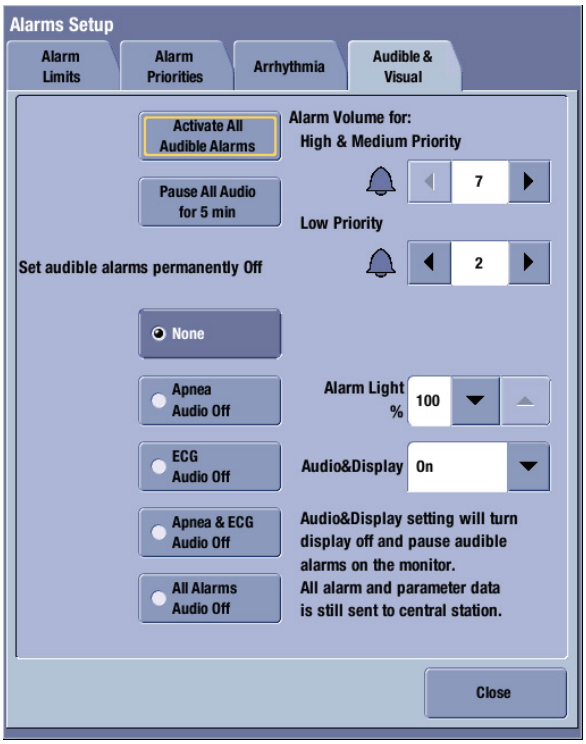


Figure 5.3 Alarm setup - audible & visual menu

When more than one alarm occurs at the same time, the monitor will sound an alarm tone for the highest priority alarm. Any lower priority audible alarm tones are suppressed by the higher priority alarm tone.

The most recent of the alarms that has the highest priority level at this moment is the alarm that is broadcast on the network. For example, if there is one medium-priority alarm and a low-priority alarm appears, the medium-priority alarm is broadcast, not the most recent (low-priority) alarm. If there is one medium-priority alarm and another medium-priority alarm appears, the latest alarm that appeared is broadcast.

Adjusting the Alarm Volume

Lowering the number will lower the volume, raising the number will increase the volume:

1. Select ***Alarm Setup*** from the monitor's main menu.
2. Select the ***Audible & Visual*** tab.
3. Adjust the volume according to what is available in the menu:
    - Adjust the ***Alarm Volume*** value. This is the volume for all alarms
    - Adjust the ***Alarm Volume*** for: separately for ***High & Medium Priority*** and ***Low Priority***

Note! *The selections in the Alarms Setup menu vary according to how the monitor has been configured.*

Turning Audible Alarms On/OFF

Note! *The ability to turn off certain audible alarms will vary according to how the monitor has been configured.*

You can turn on/off the audible physiological alarm tones for an alarm group or for all alarms.

1. Select ***Alarm Setup*** from the monitor's main menu.
2. Select the ***Audible & Visual*** tab.
3. Select an alarm group. Choices are:
    - **None:** No audible alarms are turned off
    - **Apnea Audio Off:** Turns off audible alarms for apnea, $EtCO_2$, $FiCO_2$, respiration rate, Ppeak low, PEEPe, PEEPtot, PEEPi, and MVexp limit alarms
    - **ECG Audio Off:** Turns off audible alarms for all HR and PR source limit and arrhythmia alarms
    - **Apnea & ECG Audio Off:** Turns off audio alarms for all HR and PR source limit, arrhythmia, apnea, $EtCO_2$, $FiCO_2$, respiration rate, Ppeak low, PEEPe, PEEPtot, PEEPi, and MVexp limit alarms
    - **All Alarms Audio Off:** Turns off all audible alarms except some high priority alarms defined as breakthrough alarms
4. To turn on all audible alarms again, select ***Activate All Audible Alarms***, or select ***None*** as instructed above.

When audible alarms are turned off:

- All audible alarms are turned off except for any high priority alarms configured to break through the audio off setting
- The audio off bell icon displays in the upper left corner of the display screen
- The alarm audio pause/off area of the alarm light is solid blue when audible alarms are paused or when audio off is selected for an alarm group.

Pausing Audio Alarms

Selecting the pause audio key results in different alarm behaviors depending on whether the alarms are active and/or latched or not. Acknowledging or pausing audio alarms does not affect other alarm indicators. They will still continue indicating alarms.

When the monitor is on the network, alarms can also be paused and acknowledged at the central station.

Table 5.2 Active and/or latched alarms

Selection	Result
Active and/or latched alarms	
Select once	• Pauses all active audio alarms for 2 minutes. • Removes all latched alarms. • Deactivates some technical alarms.
Second selection of during the 2 minute pause	• Starts a 2 or 5 minute audio pause period for all alarms except the specified breakthrough alarms. The 2 or 5 minute duration is a care unit setting and password protected. • Removes all new latched alarms. • Some technical alarms may also be deactivated with this selection.
Select once during audio pause	• Ends the audio pause period. • Restores all acknowledged and silenced alarms if the alarm condition still exists.
No active or latched alarms	
Select once	• Starts a 2 or 5 minute audio pause period for all alarms except the specified breakthrough alarms.
Select once during audio pause	• Ends the audio pause period. • Restores all acknowledged and silenced alarms if the alarm condition still exists.

Pausing Alarms for 5 Minutes

You can pause audible alarms with the pause audio key for 2 or 5 minutes according to the care unit settings. You can also pause all alarms for 5 minutes through the ***Alarms Setup*** menu.

1. Select ***Alarm Setup*** from the monitor's main menu.
2. Select the ***Audible & Visual*** tab.
3. Select ***Pause All Audio for 5 min.*** This will pause all alarms, including the breakthrough alarms, except FiO_2 low, EtO_2 low<18%, FiN_2O low>82%, and Ppeak high. It also removes latched alarms.

Activating All Paused Audible Alarms

If necessary, you can activate all paused audible alarms before the 2 or 5 minute pause expires.

1. Select ***Alarm Setup*** from the monitor's main menu.
2. Select the ***Audible & Visual*** tab.
3. Select ***Activate All Audible Alarms***.

Audio Pause with Combination Monitoring

When using combination monitoring, the pause audio behavior is the following:

- If the telemetry transmitter is in pause audio state, the monitor will also be in the same state. You can cancel the pause audio at the bedside monitor by selecting the pause audio key. This will not affect the telemetry device.
- If the monitor's own pause audio state ends before the telemetry transmitter's audio pause, the monitor will re-enter pause audio.
- The pause audio started by the telemetry transmitter at the monitor will also end when the transmitter's pause audio ends.

Breakthrough Alarms

The breakthrough alarms feature allows pre-defined and user-selectable alarms to "break through" (interrupt) an ***All Alarms Audio Off*** or a 2 or 5 minute audible alarm pause condition.

The FiO_2 low, EtO_2 low, FiN_2O high, and Ppeak high alarms will always break through when escalated to or activated at high priority alarm condition regardless of the ***All Alarms Audio Off*** selection or any alarm pausing.

The following alarms will break through when activated at high priority alarm condition regardless of the 2 to 5 minute audible alarm pause: Asystole, V Fib/V Tach, V Tach, and Brady (in the NICU software package only).

Latched Alarms

When alarms are latched, the audible alarm and visual message remains after the alarm condition no longer exists. The audible alarm can be paused with the pause audio key, and this also clears the alarm message from the screen. Alarms can be configured to latch for high priority alarms only, all alarm priorities, or none. The Latching Alarms setting is configured in the Care Unit Settings and it is password protected.

Setting Parameter Alarm Limits

Parameter alarm limits may be set in the ***Alarms Setup*** menu, or in the parameter menus' own Alarms tab. Alarm limits should not be set beyond reasonable physiological boundaries in order to maintain patient safety. Setting outside of reasonable boundaries would cause the alarms to be ineffective.

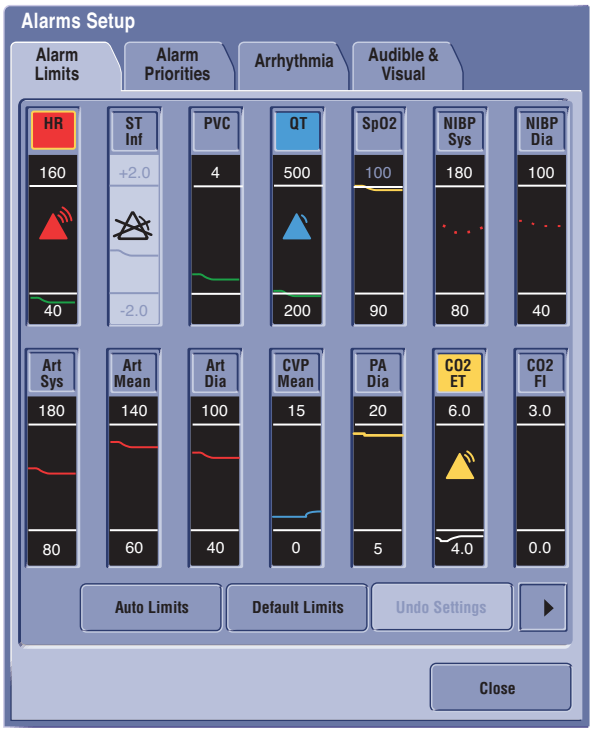


Figure 5.4 Alarms setup – alarm limits menu

1. Select ***Alarm Setup*** from the monitor's main menu.
2. Select the ***Alarm Limits*** tab.
3. Select a parameter label.
    - If you are unable to find a specific parameter, select the right arrow to display additional labels. If the parameter limit has been turned off, the alarm limit will be greyed out.
    - Selecting a parameter label takes you to that parameter menu's Alarms tab where you can select alarms on or off, and set their limits.

Setting Alarm Limits Automatically

When selected, the Auto Limits feature automatically sets new high limit and low limit values, based upon the current physiological value. The Auto Limits should only be used for patients whose currently measured values are considered safe.

1. Select ***Alarm Setup*** from the monitor's main menu.
2. Select the ***Alarm Limits*** tab.
3. Select ***Auto Limits***.

If you need to undo these changes and return to the previous alarm limit settings, select ***Undo Settings*** before closing the menu.

Returning the Default Alarm Limits

1. Select ***Alarm Setup*** from the monitor's main menu.
2. Select the ***Alarm Limits*** tab.
3. Select ***Default Limits***.

If you need to undo these changes, select ***Undo Settings*** before closing the menu.

Alarm Locks

Alarm locks prevent parameter alarm limits from being turned off. When an alarm is locked, a lock icon appears next to the ***Alarm On/Alarm Off*** setting. Parameter alarm locks are set in the Care Unit Settings and they are password protected.

Alarm Guard Limits

Alarm guard limits prevent parameter alarm limits from being adjusted above (high) or below (low) these values. When an alarm has a guard limit, there is a gray guard indicator in the alarm adjustment dialog. Alarm guard limits are set in the ***Care Unit Settings*** and they are password protected.

Setting Arrhythmia Alarms

Note! *For more information on arrhythmia detection, see the ECG chapter of this guide.*

You can set the arrhythmia alarms in the ***Alarms Setup*** menu, or in the ***ECG*** menu.

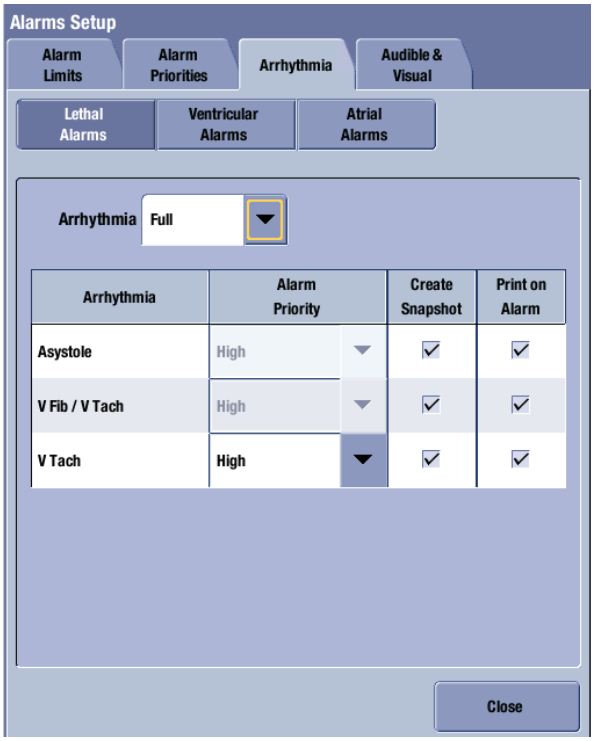


Figure 5.5 Alarms setup – lethal alarms menu

1. Select ***Alarm Setup*** from the monitor's main menu.
2. Select the ***Arrhythmia*** tab.
3. Select ***Lethal Alarms.***
4. You can now select the ***Alarm Priority, Create Snapshot,*** and ***Print on Alarm*** options per arrhythmia.
5. If ***Full Arrhythmia*** license is enabled, you can also select options for the ***Atrial Alarms*** and ***Ventricular Alarms***.
    - **Ventricular Alarms:** You can select the ***Alarm Priority, Create Snapshot***, and ***Print on Alarm*** options.
    - **Atrial Alarms:** You can select the ***Alarm Priority, Create Snapshot***, and ***Print on Alarm*** options. In addition, you can set the detection criteria for ***SV Tachy: SVT Length, HR for SVT /min***, and ***Pause Interval.***

Setting Parameter Alarm Priority Levels

Escalating an alarm priority increases the priority of the alarm condition or increases the sense of urgency of an alarm signal. The alarm priority is based on clinical considerations.

The allowed priorities for different alarm groups are defined in the ***Care Unit Settings*** and they are password protected.

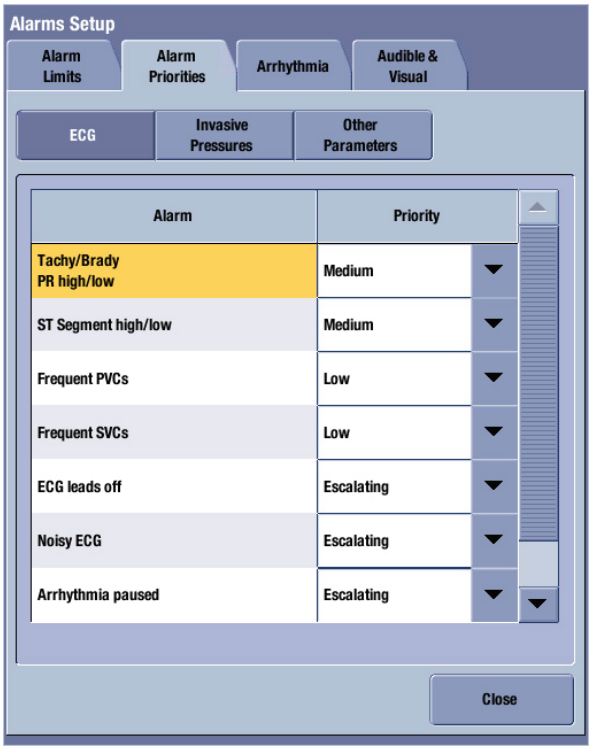


Figure 5.6 Alarms setup – alarm priorities menu

1. Select ***Alarm Setup*** from the monitor's main menu.
2. Select the ***Alarm Priorities*** tab.
3. Select the alarm group: ***ECG, Invasive Pressures***, or ***Other Parameters***.
4. Select the alarm and its priority from the list.

Sleep Mode

Note! *This feature is not available with OR and PACU software packages.*

The sleep mode turns off all local alarm indicators (if it has been enabled in the ***Care Unit settings***) until you turn them back on again. Patient monitoring is occurring; however, the monitor is not displaying patient data or indicating patient alarms locally. Local printing is also inactive. Alarms are logged and trended. If the monitor is connected to the network, alarms and alarm printouts, and parameter data (and nurse call signals with B850) will continue to be sent over the network during sleep mode.

1. Select ***Alarm Setup*** from the monitor's main menu.
2. Select the ***Audible & Visual*** tab.
3. Select ***Audio&Display > Off***.

A screen saver replaces the display of patient data. Any user input (touchscreen, button, Trim Knob, keyboard key, mouse click) reactivates the alarms and the monitoring screen.

Check Your Knowledge: Alarms

1. What are the 4 levels of alarms and what are their colors?
2. What does latching alarm mean?
3. Do you have to admit the patient on the monitor in order for alarms to be active?
4. What is an escalating alarm?
5. What does “sleep mode” mean?
6. What are the ways in which you can access and adjust the alarm settings?

Hands on Activity: Alarms



1. Initiate different alarms on the simulator: Identify the different levels of alarms that are simulated. Identify by color and sound.
2. Choose one of the alarms initiated and adjust the limit so the alarm does not continue.
3. Choose one of the alarms initiated, acknowledge the alarm, then pause all alarms. Verbalize which bell icons are when the alarm is acknowledged and when all alarms are paused.

6 ECG

Objectives: Alarms



By the end of this chapter you should be able to:

- Prepare and apply electrodes to the patient for 3-lead, 6-lead and 10-lead analysis
- Describe the use of the combination monitoring mode
- Select an ECG source
- Change a selection from the ECG setup menu
- Change a selection from the ECG advanced menu
- Change a selection from the HR/PR alarms menu
- Change a selection from the PVC/SVC alarms menu
- Utilize the ST analysis menu
- Utilize the QT menu
- Change an alarm setting from the Lethal, Ventricular and Atrial alarms menu

Terms You Should Know: Alarms



Combination mode: A licensed mode in which ECG is acquired from a telemetry receiver system.

Ischemic burden: Provides additional information about the degree of ST changes during a certain time period. It is a visualization of ischemia.

QT: QT interval, measured from start of the QRS to the end of the T-wave.

QTc: Corrected value of the QT interval, QT/square root of R-to-R interval.

ST: ST measurement, amplitude difference between ST point and ISO point.

ISO point: Point in the isoelectric level between P and Q waves, used as reference for ST measurement.

J point: End of S wave.

ST point: Point defined to be a certain distance after J point, e.g. J+60ms. ST value is measured at ST point.

Skin Preparation and Lead Placement

Preparing the Patient's Electrode Sites

Excessive body hair or skin oil reduces electrode contact with the skin and decreases the quality of electrode signal. When preparing the electrode sites, avoid bones close to skin, obvious layers of fat and major muscles.

1. Shave any hair from the electrode site.
2. Gently rub the surface of the skin to increase capillary blood flow.
3. Clean the skin with alcohol or a mild soap and water solution to remove skin oil and dead or abraded skin cells.
4. Dry the skin completely before applying the electrodes.

Applying the Electrodes to the Patient

1. Place the electrodes on the prepared sites.
2. Stabilize the electrode and leadwire with a leadwire stress loop near the electrode.
3. Tape the stress loop to the patient (excluding neonates).

Note! *A secured stress loop prevents leadwire rotation about the electrode snap, leadwire tugging at the electrode, and ECG artifact.*

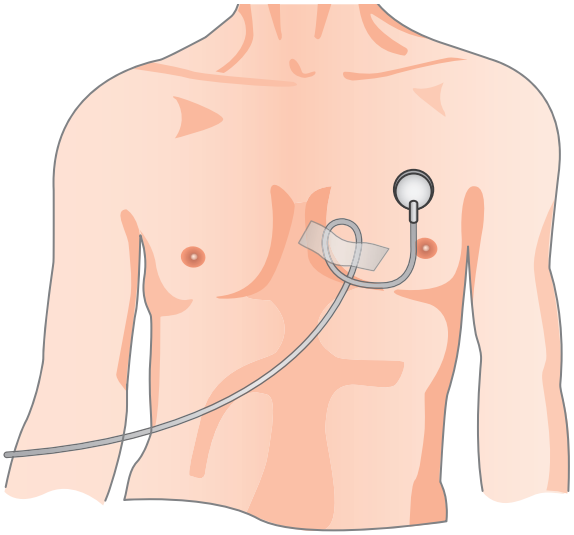


Figure 6.1 Secured stress loop

3-lead or 5-lead ECG Electrode Placement

For a 3-leadwire electrode placement, the R/RA, L/LA, and F/LL electrodes should be used.

Key: IEC Lead - AAMI/AHA Lead

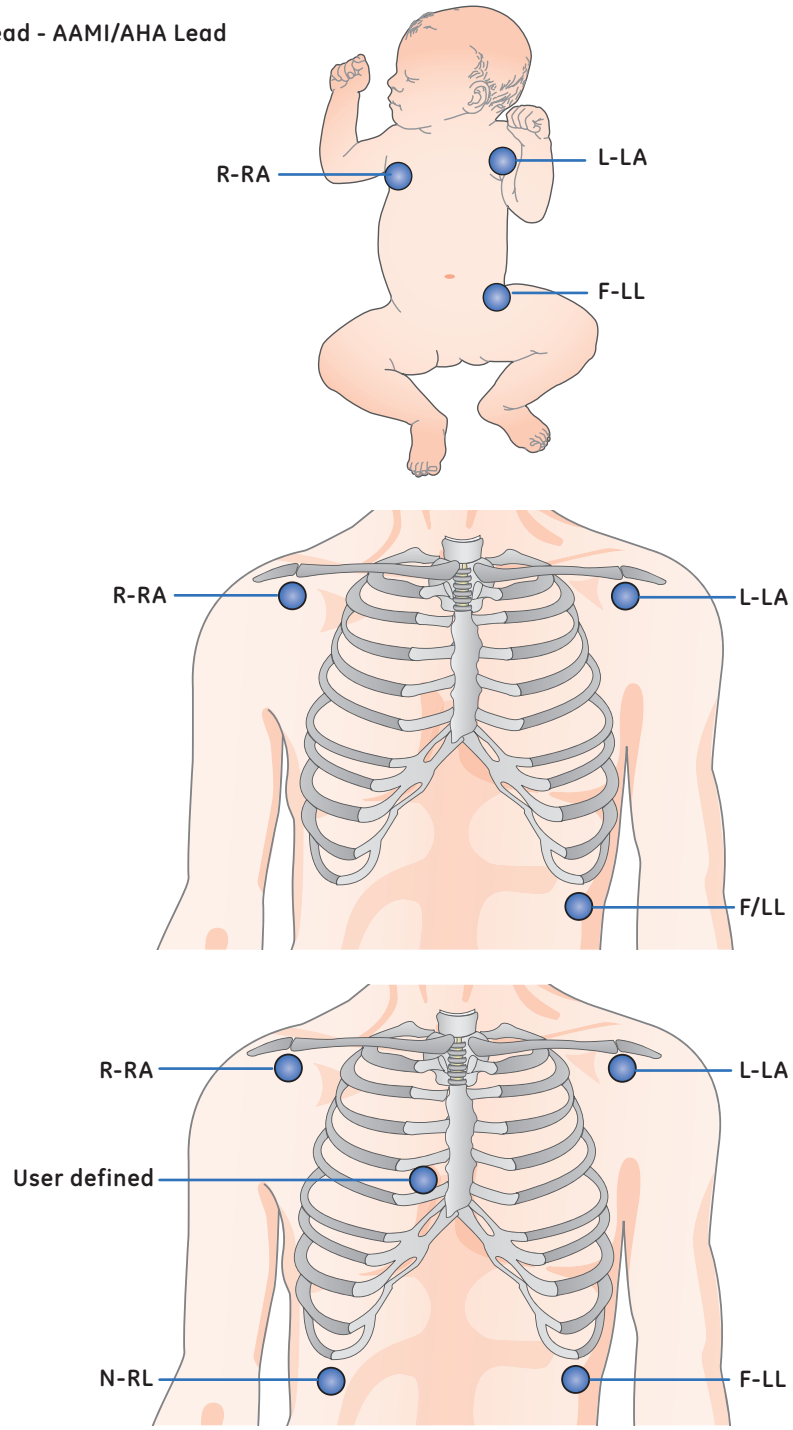


Figure 6.2 3 and 5 lead electrode placement

IEC Lead	AAMI/AHA Lead	Electrode Placement
R -Red	RA - White	Just below the right clavicle
L - Yellow	LA - Black	Just below the left clavicle
User defined	User defined	For the 5-lead placement, place the precordial electrode according to the physician's preference.
N - Black	RL - Green	Lower right edge of the rib cage
F -Green	LL - Red	Lower left edge of the rib cage

6-lead ECG Electrode Placement

Note! *PDM and PSM only. For 12RL monitoring, a 12RL 12 lead ECG license is required.*

If you are using the 6–leadwire cables for a 12 lead ECG connection, note that the 12RL can be used for adult patients only.

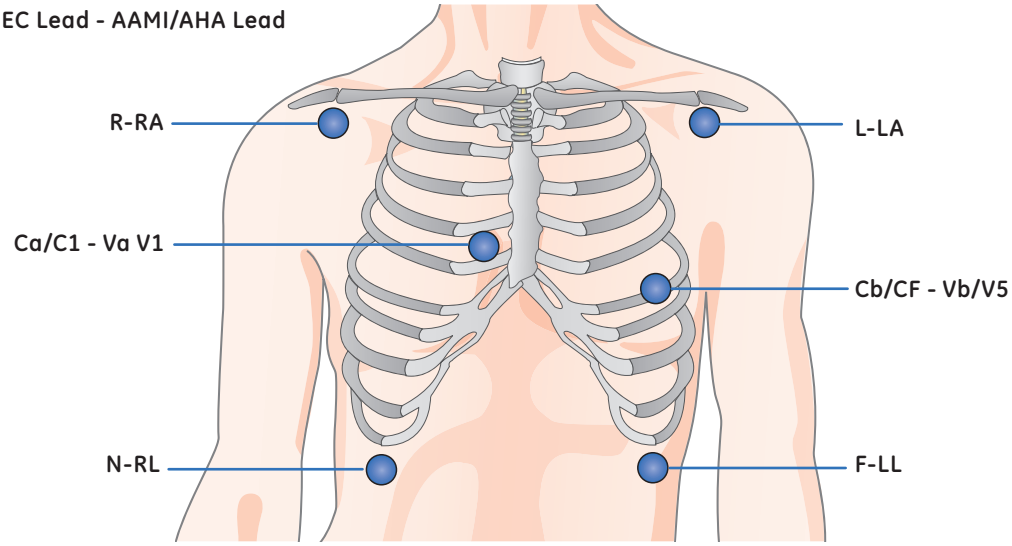


Figure 6.3 6-lead electrode placement

IEC Lead	AAMI/AHA Lead	Electrode Placement
R -Red	RA - White	Just below the right clavicle
L - Yellow	LA - Black	Just below the left clavicle
Ca/C1 - white	Va/V1 - brown	4th intercostal space, right sternal border
Cb/C5 - white	Vb/V5 - brown	Left anterior axillary line at C4/V4 level
N - Black	RL - Green	Lower right edge of the rib cage
F -Green	LL - Red	Lower left edge of the rib cage

10-lead ECG Electrode Placement for Cardiac Monitoring

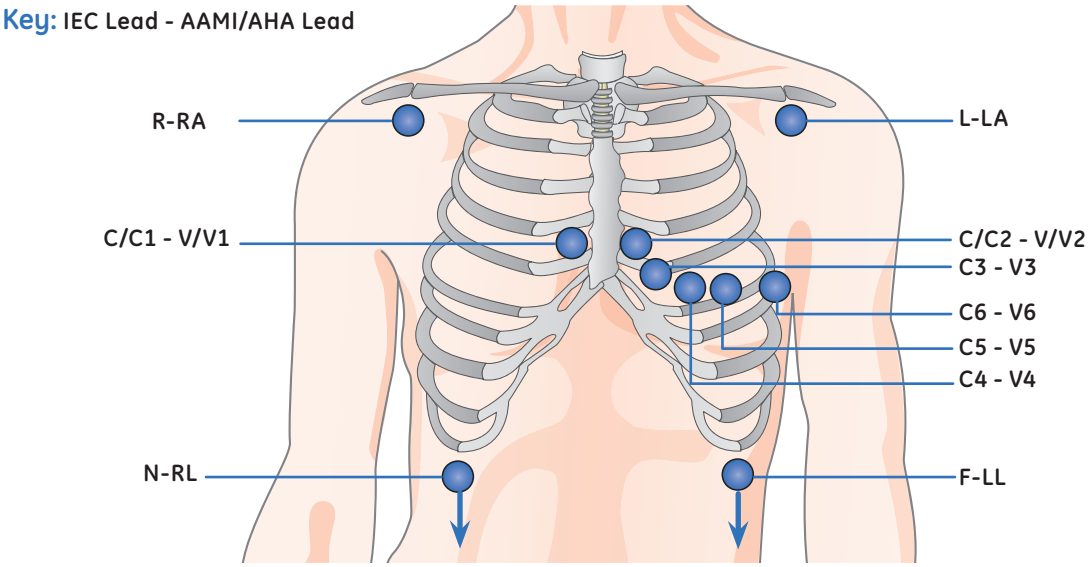


Figure 6.4 Standard resting 10-lead ECG electrode placement

IEC Lead	AAMI/AHA Lead	Electrode Placement
R -Red	RA - White	Just below the right clavicle
L - Yellow	LA - Black	Just below the left clavicle
N - Black	RL - Green	Lower right dege of the rib cage
F -Green	LL - Red	Lower left of the rib cage
C/C1 - white/yellow	V/V1 - brown	4th intercostal space, right sternal border
C2 - white/yellow	V2 - brown/yellow	4th intercostal space, left sternal border
C3 - white/green	V3 - brown/green	Midway between C2/V2 and C4 /4
C4 - white/brown	V4 - Brown/blue	5th intercostal space, mid-clavicular line
C5 - white	V5 - brown/orange	Left anterior axillary line at C4/V4 level
C6 - white/purple	V6 - brown/purple	Mid axillary line at C4/V4 and C5/V5 levels

Standard Resting 10-lead ECG Electrode Placement

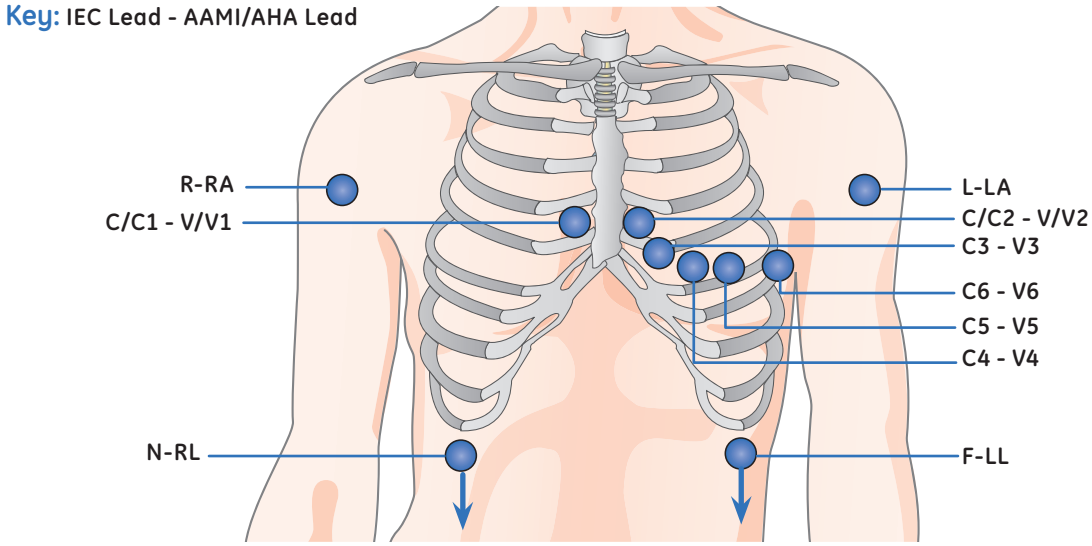


Figure 6.5 Standard resting 10-lead ECG electrode placement

IEC Lead	AAMI/AHA Lead	Electrode Placement
R -Red	RA - White	Right deltoid or wrist
L - Yellow	LA - Black	Left deltoid or wrist
N - Black	RL - Green	Right thigh or ankle
F - Green	LL - Red	Left thigh or ankle
C/C1 - white	V/V1 - brown	4th intercostal space, right border of sternum
C2 - white/yellow	V2 - brown/yellow	4th intercostal space, left border of sternum
C3 - white/green	V3 - brown/green	Midway between C2/V2 and C4 /4
C4 - white/brown	V4 - Brown/blue	5th intercostal space, mid-clavicular line
C5 - white/black	V5 - brown/orange	Left anterior axillary line at C4/V4 level.
C6 - white/purple	V6 - brown/purple	Mid axillary line at C4/V4 and C5/V5 levels

Combination Monitoring Mode

Overview

Note! *This option cannot be used in the NICU software package.*

The combination monitoring is a licensed feature. In combination monitoring mode ECG is acquired from a telemetry receiver system. This ECG data acquisition capability enhances basic telemetry monitoring by providing access to all of the available parameters from bedside monitors, while acquiring the ECG data from telemetry. In this monitoring mode, all data — local and telemetry — is viewed at the central station and the bedside monitor. However, any historical data stored at the central station will be unavailable. Any new alarm history samples created on the telemetry transmitter cannot be viewed on the monitor if they are created after the combination monitoring has been started. Only the snapshots created on the monitor and the samples of the telemetry transmitter created prior to starting the combination monitoring can be viewed.

If the telemetry patient has been admitted when the device is connected to the monitor, the arrhythmia alarm priorities and limit alarm priorities (except when the monitor alarm is set to escalating) and the following ECG settings of the telemetry will be used:

- HR, ST, and PVC alarm limits
- PVC alarm status (on/off)
- Pacemaker detection
- Lead analysis
- Va lead position
- Primary lead
- ECG waveform size
- Arrhythmia detection level
- ST analysis status (on/off)

When combination monitoring is started with a non-admitted telemetry patient, these same settings from the monitor will be sent to telemetry. Additionally, the ***Telemetry Waveforms*** printing location is sent to telemetry.

If the telemetry alarm priority is such that it is not supported by the monitor, it will be mapped to the next higher priority available.

Note! *Refer to the Combination Monitoring Mode section in the Monitoring Basics chapter for details about combination monitoring.*

Selecting the ECG Source

This setting is available if the telemetry license is enabled and the combination monitoring mode ***Monitor or Telemetry*** has been enabled during configuration. The monitor needs to be in the CARESCAPE Network.

1. Select the ***HR*** parameter window.
2. Select a source from the ***ECG Source*** list.

This list contains the monitor and available telemetry transmitter(s). When you confirm the source selection with Confirm, the connection between the selected transmitter and monitor will be established (telemetry transmitter selected), or the patient is discharged from the telemetry transmitter (monitor selected).

Using the ECG Setup Menu

The following tasks are all initiated from the ECG Setup menu. You can access the ECG Setup menu by selecting the ***HR*** parameter window.

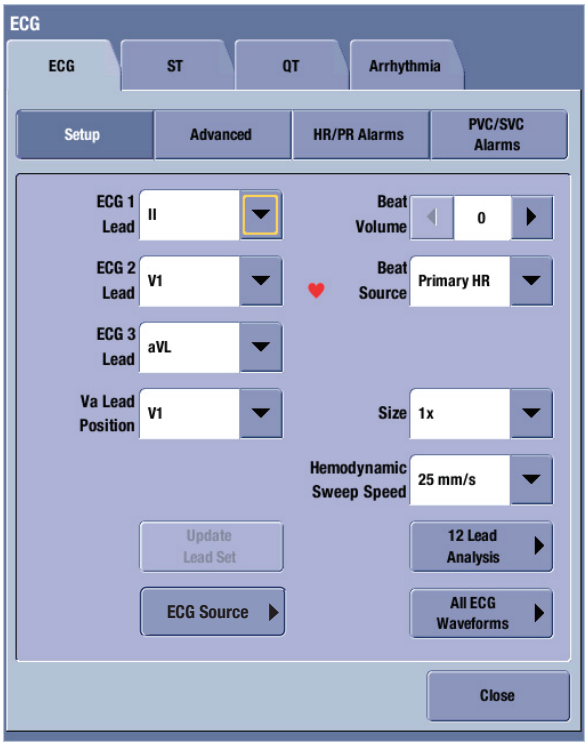


Figure 6.6 ECG setup menu

Selecting the First, Second and Third Displayed ECG Lead

From the ECG Setup menu, select a lead from the ***ECG 1 Lead***, ***ECG 2 Lead*** and ***ECG 3*** Lead list.

Selecting the Va ECG Lead

Note! *12RL monitoring - The Va lead is the first V-lead label used with a 6-leadwire ECG cable for 12RL monitoring. 12RL is possible only if the Va is set to V1.*

- The Va Lead Position selection affects the ST numeric trends.
- When using a 6-leadwire ECG cable, the factory default for the Va lead is V1, however you may choose a different lead.
- The Va lead is the only V-lead used with a 5-leadwire ECG cable.
- The Va lead is the V-lead data that is sent to all remote devices like the central station.

1. Select the ***HR*** parameter window.
2. Select a lead from the ***Va Lead Position*** list.

Selecting the Vb ECG Lead

Note! *PDM and E-modules only. 12RL monitoring - The Vb lead is the second V-lead label used with a 6-leadwire ECG cable for 12RL monitoring and must be set to V5.*

This selection is not available with combination monitoring.

When using a 6-leadwire ECG cable, the factory default for the Vb lead is V5, however you may choose a different lead.

1. Select the ***HR*** parameter window.
2. Select a lead from the ***Vb Lead Position*** list.

Changing to an ECG Cable With Fewer Leadwires

This selection will update the measurement mode between 3–, 5–, 6–, 12RL and 10–lead mode when changing to a smaller amount of leadwires with PDM, TRAM, and E-modules. Transition from the 12RL mode to the 6–lead mode is detected automatically.

This selection is not available with combination monitoring.

1. Select the ***HR*** parameter window.
2. Select ***Update Lead Set***.

Deactivating the ECG Leads Off Alarm

The selection is available when there are not enough leads connected for arrhythmia detection. This selection will acknowledge the ***ECG Leads Off*** alarm, but it will not change the measurement mode to fewer leads.

This selection is not available with combination monitoring.

1. Select the ***HR*** parameter window.
2. Select ***Deactivate ECG Leads Off***.

Selecting the Beat Source

Not all sources (like telemetry ECG, TRAM IP) provide the necessary status information for a beat source. To change the source:

1. Select the ***HR*** parameter window.
2. Select the beat source from the ***Beat Source*** list:
    - Primary HR
    - ECG
    - Art
    - ABP
    - Fem
    - UAC (NICU software package only)
    - Pleth

The beat source indicator will appear beside the chosen beat source on the screen, and the beat sound will reflect the beat of that source.

Setting the Beat Volume

1. Select the ***HR*** parameter window.
2. Set the beat tone volume with the ***Beat Volume*** arrows. The range is 0 (volume off) to 10. The louder the volume, the more bars in the indicator.

Setting the Beep Tone During Bradycardia and HR Low Alarms

Note! *PDM and TRAM only. NICU software package only.*

- This selection is not available with combination monitoring.
- This selection is available if the Beat Volume for QRS is set to 0 (off).
- If the alarm for bradycardia has been set to off or silenced, or the ECG alarms are silenced permanently, then the QRS tone does not sound either.

1. Select the ***HR*** parameter window.
2. Set the beep tone: ***Beat Tone on Brady Only*** > ***On*** or ***Off***.

When the beep tone is selected ***On***, the QRS tones will sound only with ***Brady*** alarm conditions.

- If the alarm volume has been set to below 8, the QRS tones will sound at the selected alarm volume level +2.
- If the alarm volume has been set to 8 or more, the QRS tones will sound at alarm volume level 10.

Selecting the ECG Waveform Size

1. Select the ***HR*** parameter window.
2. Select a value from the ***ECG Size*** list. The selections are ***0.5x***, ***1x***, ***2x*** and ***4x***. The smaller the value, the smaller the waveform.

Setting the Sweep Speed

Note! *This setting adjusts the waveform speed for all of the hemodynamic parameters.*

1. Select the ***HR*** parameter window.
2. Select a numeric value from the ***Hemodynamic Sweep Speed*** list. The smaller the value, the slower the sweep speed.

Printing All ECG Waveforms

Note! Pressing Graph in the telemetry transmitter will start the telemetry waveform printing.

1. Select the ***HR*** parameter window.
2. Select ***All ECG Waveforms***.
3. Select ***Print Page***.
4. You can stop printing by selecting ***Stop Printing*** or ***Cancel Printing***.

Using the ECG Advanced Menu

The following tasks are all initiated from the ECG Advanced menu. You can access the ECG Advanced menu by selecting the HR parameter window and then selecting the ***Advanced*** tab.

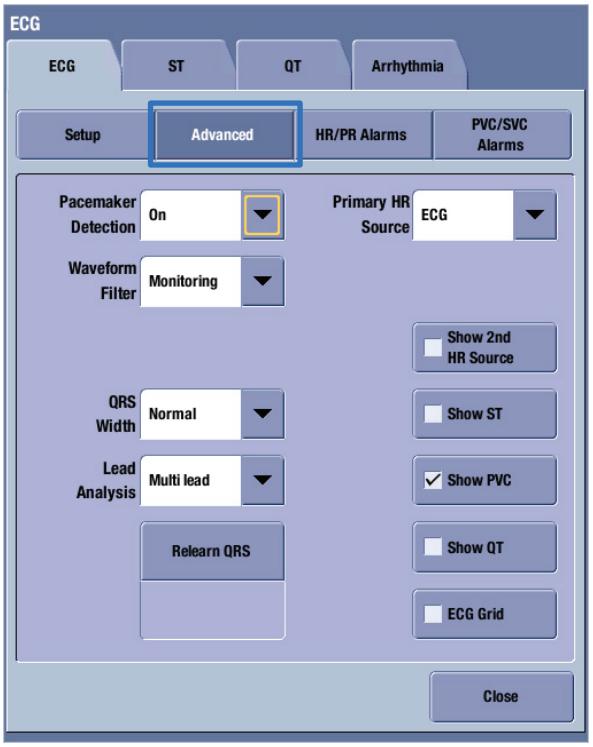


Figure 6.7 ECG advanced menu

Selecting the Pacemaker Detection

With PDM, TRAM, and combination monitoring the pacemaker detection must be turned on at the monitor. It must be used whenever the monitored patient has a pacemaker. However, you may disable pacemaker event processing by turning off pacemaker detection. When pacemaker detection is turned off, the monitoring device ignores pacemaker pulse detections which may adversely affect the heart rate accuracy of the monitoring device.

1. Select the ***HR*** parameter window.
2. Select the ***Advanced*** tab.
3. Select a value from the ***Pacemaker Detection*** list. List options are acquisition module dependent:

    a. E-modules:

    - **Show:** Displays pacemaker spikes on the ECG waveform.
    - **Hide:** Hides the pacemaker spikes on the ECG waveform.
    - **Sensitive:** Increases pacemaker detection sensitivity and displays the pacemaker spikes on the ECG waveform. By selecting this option you can improve the detection of small amplitude pacemakers. However, this mode is also more sensitive to false pacemaker detections.

b. PDM:

- **On:** Turns on pacemaker detection.
- **Off:** Turns off pacemaker detection.

c. TRAM, combination monitoring:

- **Off:** Turns off pacemaker detection.
- **Pace 2**: Minimizes the possibility of counting pacemaker artifact as QRS complexes during asystole.
- **Pace 1:** Does not minimize the possibility of counting artifact as a QRS complex during asystole. If the monitor resets or is discharged, or the profile is changed, and the monitor is set to Pace 1, the monitor automatically changes to the Pace 2 setting.

Selecting the ECG Waveform Filter

You can select how the waveform appears on the display and on the printout.

1. Select the ***HR*** parameter window.
2. Select the ***Advanced*** tab.
3. Select a filter from the ***Waveform Filter*** list. Choices are:

a. Diagnostic:

- TRAM: 0.05 to 100 Hz.

  Note! TRAM with a 10-leadwire cable: The waveform filter is automatically set to ***Diagnostic*** and cannot be changed.

- E-modules and PDM: 0.05 Hz to 150 Hz.

b. Monitoring:

- PDM, E-modules, TRAM: 0.05 Hz to 32 Hz (with 50 Hz powerline frequency).
- PDM, E-modules, TRAM: 0.05 Hz to 40 Hz (with 60 Hz powerline frequency).
- Telemetry transmitters: 0.05 Hz to 40 Hz. The waveform filter is automatically set to Monitoring and cannot be changed.

c. Moderate:

- PDM, E-modules, TRAM: 0.05 Hz to 25 Hz.

d. Maximum:

- PDM, E-modules, TRAM: 5 Hz to 25 Hz.

Setting the QRS Width

Note! *This setting affects the arrhythmia detection sensitivity.*

This selection is not available with combination monitoring.

If the ***QRS Width*** is locked in the ***Care Unit Settings***, the option is not selectable.

1. Select the ***HR*** parameter window.
2. Select the ***Advanced*** tab.
3. Select a setting from the ***QRS Width*** list. Choices are:
    a. **Narrow:** Intended for use with all neonates and the pediatric patient with a QRS complex width of 100 ms or less. This is the default setting for the Infant and Pediatric profiles.
    b. **Normal:** Intended for ECG rhythms that have QRS complex widths of approximately 70 ms or wider (for example, almost all adult patients and any patient with electronic ventricular pacing).

Selecting the Leads for ECG Analysis

You can choose whether the monitor performs an ECG analysis using single lead ECG data or data from multiple ECG leads. Multiple ECG leads will typically reduce false alarms and improve the detection sensitivity. However, if most leads are noisy or low amplitude, the ***Single lead*** mode using the best available ECG lead will help.

With a 3-leadwire cable the setting is ***Single lead*** and cannot be changed. If the measurement mode is changed from the 3–leadwire mode to 5–, 6–, 10–lead or 12RL mode, the setting changes to ***Multi lead***.

1. Select the ***HR*** parameter window.
2. Select the ***Advanced*** tab.
3. Select an option from the ***Lead Analysis*** list. The choices are:
    a. **Single lead:** EkPro algorithm uses one of the leads I, II, III, or V1 for the analysis. ***ECG 1 Lead*** is used for the analysis if it is I, II, III, or V1. If it is anything else, then the following mapping is used: V2 to V6 = V1, aVR = II, aVL = I, aVF = III. Also note that the ST values are only calculated for the single lead.
    b. **Multi lead:** EkPro algorithm uses the following leads:
        - **3–lead mode:** the only measured lead (I, II, or III)
        - **5-lead and 6-lead mode:** I, II, III and the V lead assigned to Va.
        - **12RL mode:** I, II, III, and V1.
        - **12–lead mode:** I, II, III, and V1.

Relearning the Patient's QRS Pattern

During ECG monitoring, you may need to use the Relearn QRS feature when a dramatic change in the patient's ECG pattern has occurred. Allowing the monitor to learn the new ECG pattern corrects false arrhythmia alarms and heart rate values, and restores the ST measurements. Relearning takes typically 30 seconds or less. The message ***Relearning...*** displays while the monitor relearns the QRS pattern. During this time, arrhythmia detection may not be available. If the monitor is not able to relearn due to a low amplitude QRS, for example, the Arrhythmia paused alarm is triggered.

1. Select the ***HR*** parameter window.
2. Select the ***Advanced*** tab.
3. Select ***Relearn QRS***.
4. Automatic relearning takes place when:
    - The measurement mode changes between the 3–lead mode and any other lead mode.
    - The ***ECG 1 Lead*** selection is changed in the 3–lead mode.
    - The Va lead selection is changed in the 5– and 6–lead modes.
    - The ECG cable is connected (PSM, PDM).
    - The ***Lead Analysis*** setting is changed from ***Multi lead*** to ***Single lead***.

Setting the Primary HR Source

The primary heart rate can be calculated from the ECG leads, SpO2 measurement, or invasive pressure waveform.

Note! This setting adjusts the primary heart rate source for all of the hemodynamic parameters.

1. Select the ***HR*** parameter window.
2. Select the ***Advanced*** tab.
3. Select a parameter from the ***Primary HR Source*** list. The selection list will only show active measurements and ***AUTO*** or ***IntelliRate***. Choices are (***UAC*** with the NICU software package only):
    - **PDM with single HR:** IntelliRate, ECG, Art, ABP, Fem, UAC, Pleth.
    - **PDM with multiple HR**: IntelliRate, ECG.
    - **E-modules, TRAM, telemetry transmitters with single HR:** AUTO, ECG, Art, ABP, Fem, UAC, Pleth.
    - **E-modules, TRAM, telemetry transmitters with multiple HR:** AUTO, ECG.

Showing a Second HR Value in the HR Parameter Window

You can display a second heart rate source in the HR parameter window.

1. Select the ***HR*** parameter window.
2. Select the ***Advanced*** tab.
3. Select the ***Show 2nd HR Source*** check box to display the second HR source.
    - If the primary HR source for E-modules is ***ECG*** or ***AUTO*** (ECG), the secondary HR source is displayed in this order: ***Art, ABP, Fem, SpO_2***.
    - If the primary HR source for PDM is ***ECG*** or ***IntelliRate*** (ECG), or ***AUTO*** (ECG) for TRAM, the secondary HR source displayed in this order: ***UAC, Art, ABP, Fem, SpO_2***. UAC is available in the NICU software package only.
    - If the primary HR source is anything else than mentioned above, the secondary HR source is always ***ECG***.

Showing HR, PVC, QT and ECG Grid in the HR Parameter Window

Note! *Depending on your monitor configuration, these options may not all be available.*

1. Select the ***HR*** parameter window.
2. Select the ***Advanced*** tab.
3. Select the appropriate check box.

Using the HR/PR Alarms Menu

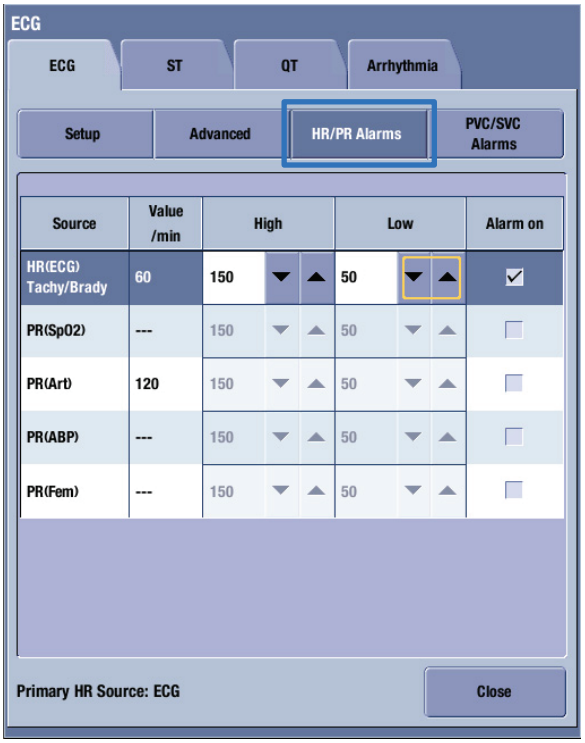


Figure 6.8 ECG - HR/PR alarms menu

The ***HR Alarms*** can be configured for ***Single*** or ***Multiple*** heart rate settings through a password protected menu.

The ***Single*** heart rate setting allows you to set one common HR limit for multiple sources (e.g., ECG, SpO_2, Art) and the PVC and SVC alarm limits for ECG from the ***Alarms*** tab. With this setting activated, turning off the SpO_2 HR alarm limits also turns off the primary HR alarm and adjusting the SpO_2 HR limit values also adjusts the primary HR limit value.

The ***Multiple*** heart rate setting allows you to set a primary heart rate/pulse rate source and up to six individual heart rate/pulse rate alarms and limits from the ***HR/PR Alarms*** tab. It also allows you to set PVC and SVC alarm limits for ECG from the ***PVC/SVC Alarms*** tab. (The tab is called ***PVC Alarms*** with TRAM or telemetry transmitters). With the Multiple heart rate setting activated, turning off the SpO_2 HR alarm limits does not turn off the primary HR alarm.

Setting HR Alarm Limits for a Single HR Source

1. Select the ***HR*** parameter window.
2. Select the ***Alarms*** tab.
3. Check that the required alarm, ***HR, PVC***, or S***VC,*** is turned on. If a feature is not active, the alarm limits are greyed out.
4. Select ***Alarm On*** to set the alarms.
5. Adjust the alarm limits with the arrows.

Setting HR/PR Alarm Limits for Multiple HR Sources

1. Select the ***HR*** parameter window.
2. Select the ***HR/PR Alarms*** tab.
3. Check that the required alarm is turned on. If a feature is not active, the alarm limits are greyed out and the ***Alarm On*** check box is not selected.
4. Select the ***Alarm On*** check box for those alarms you wish to set.
5. Adjust the alarm limits with the arrows.

Using the PVC/SVC Alarms Menu

Setting PVC Alarm Limits

Available with the full arrhythmia license only.

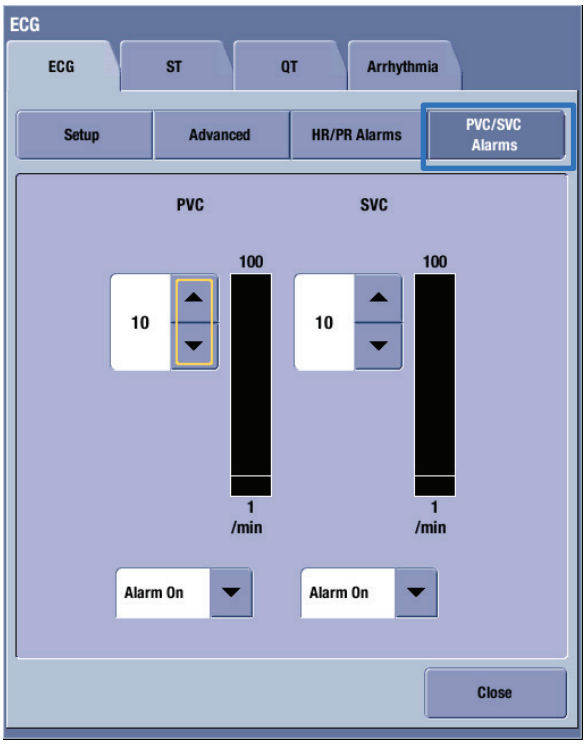


Figure 6.9 PVC/SVC menu

1. Select the ***HR*** parameter window.
2. Select the ***PVC/SVC Alarms*** or ***PVC Alarms*** (TRAM or telemetry transmitters) tab. If the heart rate setting is ***Single***, select the ***Alarms*** tab.
3. Check that the PVC alarm is turned on. If a feature is not active, the alarm limits are greyed out.
4. Select ***Alarm On*** to set the alarms.
5. Adjust the alarm limits with the arrows.

Setting SVC Alarm Limits

Available with the full arrhythmia license only. Not available with combination monitoring or TRAM.

1. Select the HR parameter window.
2. Select the ***PVC/SVC Alarms*** tab. If the heart rate setting is ***Single***, select the ***Alarms*** tab.
3. Check that the ***SVC*** alarm is turned on. If a feature is not active, the alarm limits are greyed out.
4. Select ***Alarm On*** to set the alarms.
5. Adjust the alarm limits with the arrows.

Selecting the HR Alarm Range

Available with the Single heart rate setting only.

1. Select the ***HR*** parameter window.
2. Select the heart rate alarm range from the ***HR Alarm Range*** list:
    - **30–240** (set and disabled if the ***Primary HR*** Source is ***IntelliRate, AUTO***, or ***SpO_2***).
    - **20–300**

ST Analysis

Using the ST Setup Menu

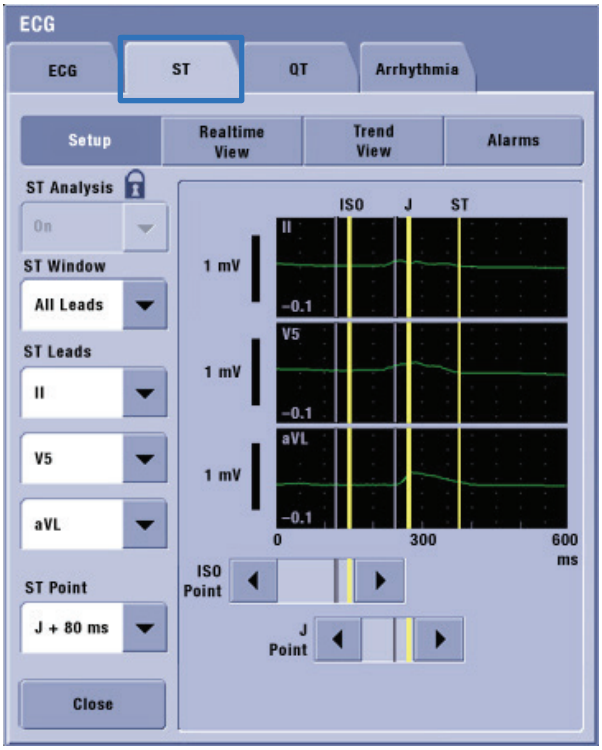


Figure 6.10 ST setup menu

Starting ST detection

1. Select the ***ST*** parameter window or select the HR parameter window and the ***ST*** tab.
2. Select ***Setup***.
3. Select ***On*** from the ST Analysis list.

Selecting leads to the ST window

1. Select the ***ST*** parameter window.
2. Select ***Setup***.
3. Select the leads for display from the ***ST Window*** list. Choices are:
    - **ST Leads:** Displays the first three ST leads. The ST lead with the greatest deviation is also displayed in the parameter window to the right of the ST leads.
    - **All Leads:** Displays anterior, inferior, and lateral lead groups.
    - **Off:** No ST parameter window is displayed. Instead, two ECG waveforms are displayed beside the HR field (if ECG2 has been selected to the screen).

Changing the displayed ST leads

You can select the display order of the first, second, and third displayed ST lead.

1. Select the ***ST*** parameter window.
2. Select ***Setup***.
3. Select a lead from the ***ST Leads*** list.

Adjusting the ST point manually

This selection is not available with combination monitoring.

- E-modules and PDM automatically set the ST point according to the heart rate. Manual adjustments may be required if the following automatic settings are not adequate (for example when QT time is short).
    - If the heart rate is greater than or equal to 120 bpm, then the ST point is set to J + 60 ms.
    - If the heart rate is less than 120 bpm, then the ST point is set to J + 80 ms.
- TRAM modules set the ST point automatically according to the profile default.

Manual adjustments may be required if the default is not adequate.

Manually adjusting the ***ST Point***, ***ISO Point***, or ***J Point*** overrides the automatic detection of the ST point. As a result, you are responsible for monitoring the patient ST levels with new adjustments and required to make further setting adjustments as necessary according to changes in the patient's rhythm.

1. Select the ***ST*** parameter window.
2. Select ***Setup***.
3. Select a value from the ***ST Point*** list.

Adjusting the isoelectric measurement (ISO) point:

This selection is not available with TRAM or combination monitoring.

E-modules and PDM automatically set the isoelectric point. Manual adjustments may be required if, for example, a P-wave is attached to the QRS-wave.

1. Select the ***ST*** parameter window.
2. Select ***Setup***.
3. Adjust the ***ISO Point*** with the arrows. When the ***ISO Point*** is adjusted, the ***ST*** point also changes accordingly and its automatic setting is stopped.

Adjusting the J point:

This selection is not available with TRAM or combination monitoring.

1. Select the ***ST*** parameter window.
2. Select ***Setup***.
3. Adjust the ***J Point*** with the arrows. When the J Point is adjusted, the ST point changes accordingly.

Using the Realtime View Menu

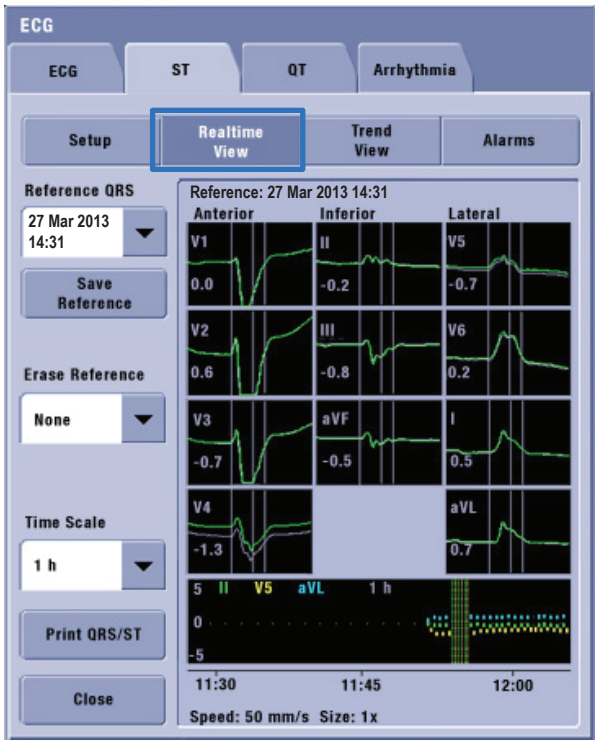


Figure 6.11 ST Realtime view menu

Saving a reference QRS manually:

This selection is not available with combination monitoring.

You cannot save a reference QRS manually until an initial reference QRS complex has been saved, or if ST Analysis is disabled.

1. Select the ***ST*** parameter window.
2. Select ***Realtime View***.
3. Select ***Save Reference***.

The current QRS becomes the new reference QRS

Automatic saving of reference QRS complexes:

The QRS reference is not saved during an ST alarm condition, only the ST snapshot is saved.

If a new reference QRS complex is saved and there is no room for another complex, then the oldest manual or automatic complex is erased. You may want to manually erase QRS complexes to avoid automated erasing.

A reference QRS complex is saved automatically whenever you do one of the following:

- Change the Va or Vb lead
- Change the ST point manually

Selecting a saved reference QRS complex for display:

This selection is not available with combination monitoring or TRAM.

You can select and display a saved reference QRS for ST analysis.

1. Select the ***ST*** parameter window.
2. Select ***Realtime View***.
3. Select a saved reference from the ***Reference QRS*** list.

Erasing a reference QRS:

This selection is not available with combination monitoring or TRAM.

You cannot erase the initial reference QRS.

1. Select the ***ST*** parameter window.
2. Select ***Realtime View.***
3. Select a reference QRS from the ***Erase Reference*** list.

If you delete the reference QRS currently displayed, then the next, newer reference QRS is displayed as the reference QRS.

Printing a realtime QRS/ST report:

This selection is not available with combination monitoring.

The QRS/ST report displays the current ST leads and the trends at 10 minute intervals.

1. Select the ***ST*** parameter window.
2. Select ***Realtime View***.
3. Select ***Print QRS/ST.***
4. To stop printing, select ***Cancel Printing***.

Selecting the ST time scale:

This selection is not available with combination monitoring.

This setting also determines the length of the ST trend report, and you can select it from the Realtime View or the Trend View.

1. Select the ***ST*** parameter window.
2. Select ***Realtime View*** or T***rend View***.
3. Select a value from the ***Time Scale*** list.

Using the Trend View Menu

This feature is not available with combination monitoring.

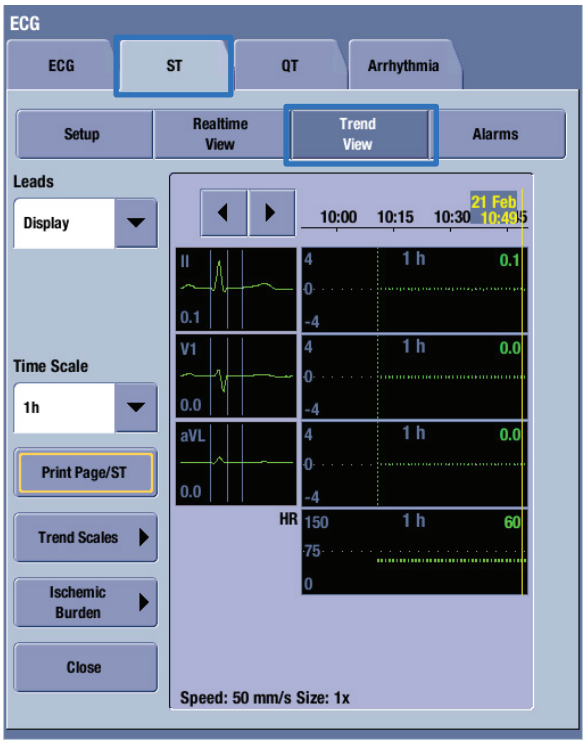


Figure 6.12 ST trend view

Displaying QRS complexes and ST trends for other leads:

This selection is not available with combination monitoring.

1. Select the ***ST*** parameter window.
2. Select ***Trend View***.
3. Select a lead group from the ***Leads*** list. Choices are:
   - **ST:** The leads displayed in the ST window.
   - **Anterior:** The leads belonging to this lead group.
   - **Inferior:** The leads belonging to this lead group.
   - **Lateral:** The leads belonging to this lead group.
   - **Display:** The leads associated with the waveforms selected for display.

Reviewing ST trends:

This selection is not available with combination monitoring.

1. Select the ***ST*** parameter window.
2. Select ***Trend View***.
3. Select the right or left arrow above the QRS view to move the ST cursor.

Printing an ST trend report:

This selection is not available with combination monitoring.

The length of the ST trend report is the same as the Trend Scales setting for ST trends.

1. Select the ***ST*** parameter window.
2. Select ***Trend View.***
3. Select ***Print Page.***
4. To stop printing, select ***Cancel Printing.***

Enabling ischemic burden:

This selection is not available with combination monitoring.

1. Select the ***ST*** parameter window.
2. Select ***Trend View***.
3. Select ***Ischemic Burden***.
4. Select the check box for ***Ischemic Burden***.

Setting the ischemic burden limits:

This selection is not available with combination monitoring.

You can set the lower and upper threshold values.

1. Select the ***ST*** parameter window.
2. Select ***Trend View***.
3. Select ***Ischemic Burden***.
4. Set the lower threshold value with the ***Depression Limit (mm)*** arrows.
5. Set the upper threshold value with the ***Elevation Limit (mm)*** arrows.

Using the ST Alarm Menu

Depending on what has been selected in the Care Unit Settings for ST alarms, you may set the ST alarm limits for a lead group, for individual leads, or for all leads relative to the patient's current measurements.

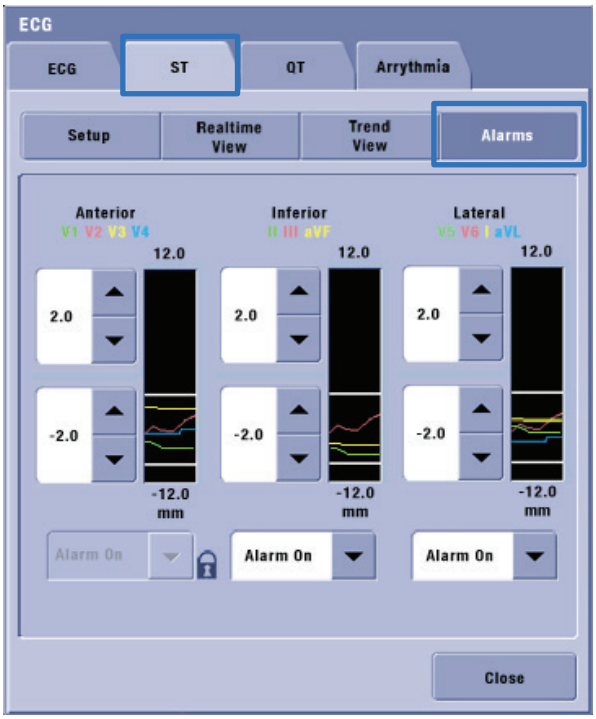


Figure 6.13 ST alarm menu – lead groups

Setting alarm limits for lead groups:

1. Select the ***ST*** parameter window.
2. Select ***Alarms.***
3. Select ***Alarm On*** for an ECG lead group: ***Anterior, Inferior,*** or ***Lateral***. If the alarm is locked, there is a lock symbol beside the selection and the selection is not available.
4. Set upper and lower alarm limits with the arrows.

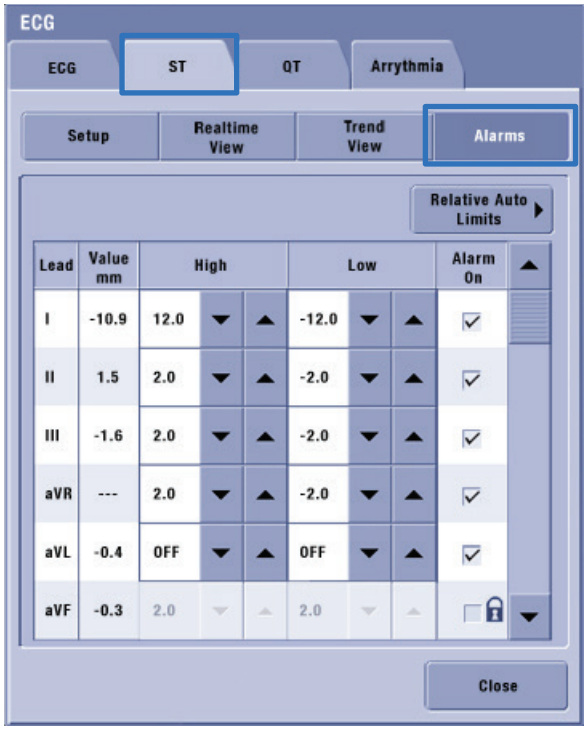


Figure 6.14 ST alarm limits – individual leads

Setting alarm limits for individual leads:

1. Select the ***ST*** parameter window.
2. Select ***Alarms***.
3. Select ***Alarm On*** for an ECG lead to adjust its alarm limits. If the alarm is locked, there is a lock symbol beside the check box and the selection is not available.
4. Set ***High*** and ***Low*** alarm limits with the arrows.

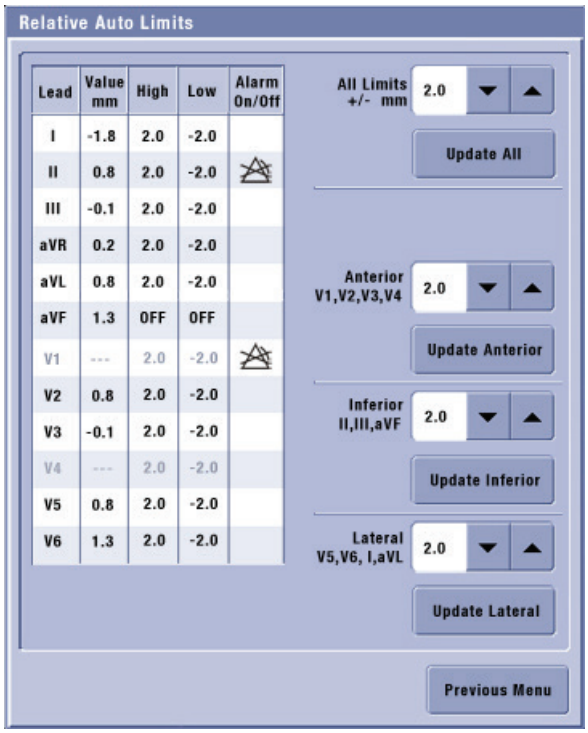


Figure 6.15 ST alarm menu – relative alarm limits

Setting relative alarm limits:

You can adjust the high/low alarm limits set around the current ST value for all of the individual ST leads or for the leads in a selected lead group. For example, when you select a Relative Auto Limits value of 2 mm, the high limit is set at the current ST value +2 mm, and the low limit is set at the current ST value -2 mm.

1. Select the ***ST*** parameter window.
2. Select ***Alarms.***
3. Select ***Relative Auto Limits***.
4. Set the relative limits as needed:
   - Set ***All Limits*** with the arrows and select ***Update All***.
   - Set limits for ***Anterior*** leads with the arrows and select ***Update Anterior***.
   - Set limits for ***Inferior*** leads with the arrows and select ***Update Inferior.***
   - Set limits for ***Lateral*** leads with the arrows and select ***Update Lateral.***

Using the QT Menu

Note! *This selection is not available with combination monitoring or TRAM.*

This selection is available with Multi-lead QT/QTc Analysis license only.

The administration of some drug types can prolong the QT segment. Monitoring QT segment changes can help identify how these drugs are affecting the QT segment.

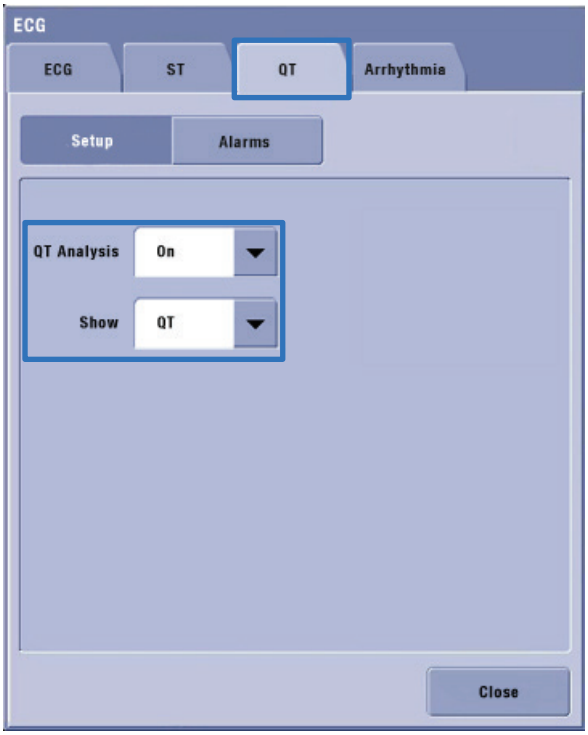


Figure 6.16 QT setup menu

Starting the QT/QTc measurement:

1. Select the ***HR*** parameter window.
2. Select the ***QT*** tab.
3. Select ***On*** from the ***QT Analysis*** list.

Selecting QT or QTc for analysis:

1. Select the ***HR*** parameter window.
2. Select the ***QT*** tab.
3. Select ***QT*** or ***QTc*** from the ***Show*** list.

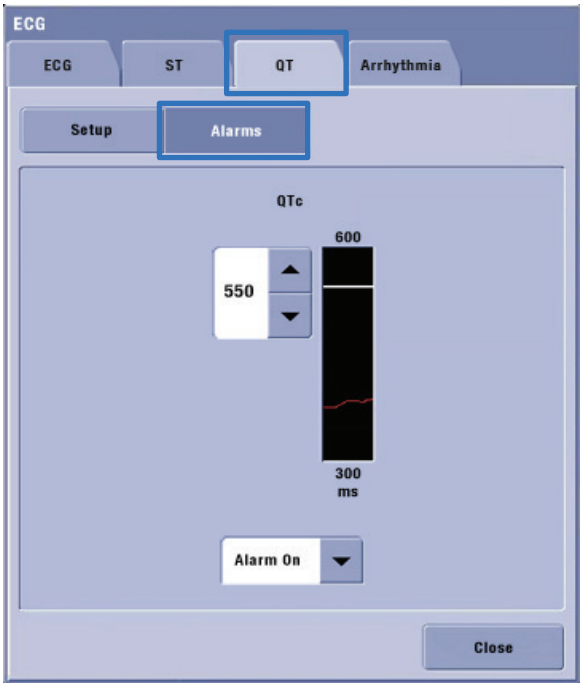


Figure 6.17 QT alarms menu

Setting QT/QTc alarms:

1. Select the ***HR*** parameter window.
2. Select the ***QT*** tab.
3. Select ***Alarms***.
4. Select ***Alarm On***.
5. Adjust the alarm limits with the arrows.

Arrhythmia Detection

Note! *This section is just a guide for various Arrhythmia settings. Please refer to the ECG chapter of the user's manual for more information on Arrhythmia Detection.*

Setting the Arrhythmia Category to Alarm

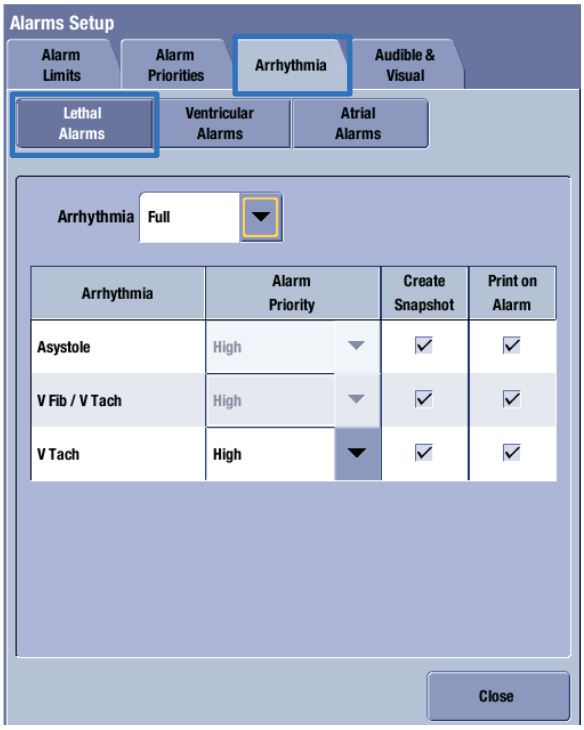


Figure 6.18 Arrhythmia – lethal alarms menu

Note! Depending on your monitor configuration, the ability to set the arrhythmia category may not be available.

1. Select the ***HR*** parameter window.
2. Select the ***Arrhythmia*** tab.
3. Select ***Lethal Alarms***.
4. Select the arrhythmia category you want to alarm:
   - **Full:** All arrhythmias alarm
   - **Lethal:** Only lethal arrhythmias alarm
   - **Off:** No arrhythmia alarms are generated

Setting Arrhythmia Alarms

While monitoring ECG, you can adjust the settings for arrhythmia alarm conditions.

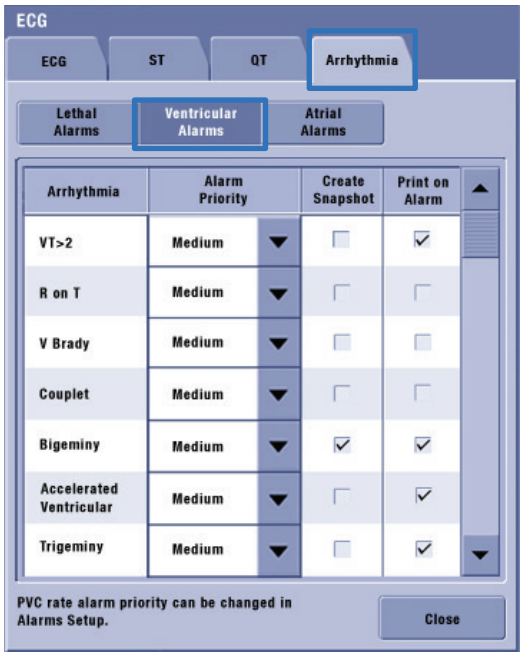


Figure 6.19 Ventricular alarms menu

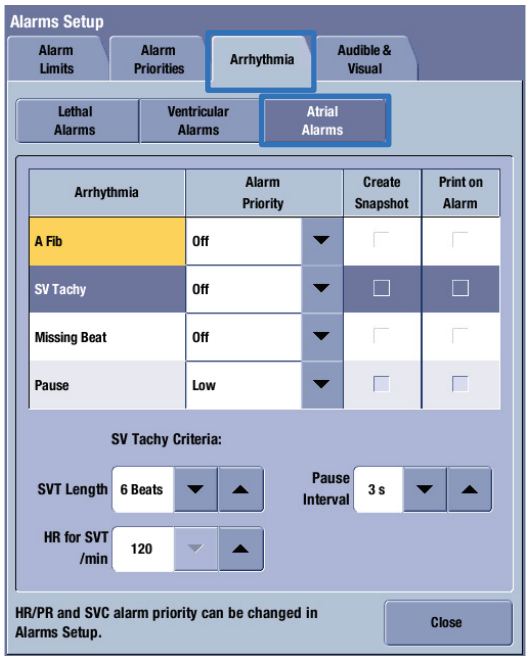


Figure 6.20 Atrial alarms menu

1. Select the ***HR*** parameter window.
2. Select the ***Arrhythmia*** tab.
3. Select ***Lethal Alarms***, ***Ventricular Alarms***, or ***Atrial Alarms***. Ventricular Alarms and Atrial Alarms are only adjustable with the full arrhythmia license.
4. Select an arrhythmia from the list.
5. Select the arrhythmia alarm's ***Alarm Priority*** with the arrows.
6. Select the check box for ***Create Snapshot*** if you wish to activate an arrhythmia snapshot creation.
7. Select the check box for ***Print on Alarm*** if you wish to activate printing during arrhythmia alarm.

For arrhythmia alarm waveform printing, the printing will continue until 20 seconds has passed from the clearance of the last active arrhythmia alarm (e.g., 10 seconds saved data, arrhythmia alarm duration + 20 seconds data).

Setting the Alarm Pause Interval

With TRAM or combination monitoring this setting is always 3 seconds and cannot be edited.

You can set the time interval between the two adjacent beats before the pause alarm condition is annunciated.

1. Select the ***HR*** parameter window.
2. Select the ***Arrhythmia*** tab.
3. Select ***Atrial Alarms***.
4. Select a value from the ***Pause Interval*** list.

Setting the SVT Length

E-modules and PDM only.

This setting determines how many consecutive SVCs are needed to trigger the SV Tachy alarm.

1. Select the ***HR*** parameter window.
2. Select the ***Arrhythmia*** tab.
3. Select ***Atrial Alarms***.
4. Select a value from the ***SVT Length*** list.

Setting HR for SVT

E-modules and PDM only.

This setting determines the minimum value for the HR to trigger the SV Tachy alarm.

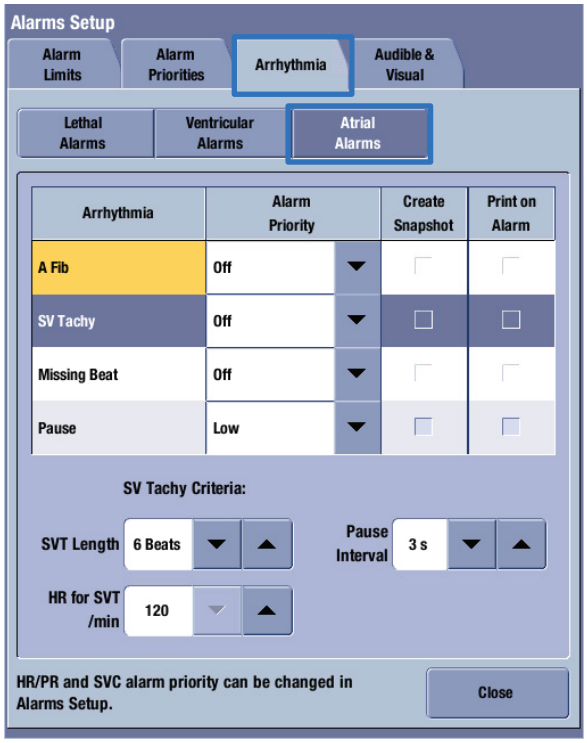


Figure 6.21 Arrhythmia – atrial alarms menu

1. Select the ***HR*** parameter window.
2. Select the ***Arrhythmia*** tab.
3. Select ***Atrial Alarms.***
4. Select a value from the ***HR for SVT /min*** list.

Alternate Pulse Rate Source and Algorithms

Alternate Pulse Rate Source

The alternate pulse rate source allows clinicians to acquire a pulse rate from a source other than ECG (Art, Fem, ABP, UAC, or SpO_2). The following circumstances may warrant the use of an alternate pulse rate source:

- Excessive artifact due to an electrical interference from equipment (e.g., electrosurgical device).
- Excessive patient movement causing significant artifact (e.g., seizure activity).
- Inability to use standard lead placement (e.g., burns).

PDM IntelliRate algorithm

The PDM uses the ***IntelliRate*** algorithm. ***IntelliRate*** extracts information from multiple physiological signals (ECG, SpO_2, Art) and applies rule-based logic to determine which heart rate source has the highest likelihood of being accurate. By reporting the most accurate rate, the trended pulse rate is more accurate, and occurrences of false pulse rate limit violation alarms are greatly reduced. The alternate pulse rate source value replaces the standard heart rate value in the HR parameter window.

TRAM, E-modules, and Telemetry Transmitters Auto Algorithm

TRAM, E-modules, and telemetry transmitters use the AUTO algorithm. AUTO selects the first available heart rate source based on a pre-defined parameter priority:

1. ECG
2. UAC (TRAM and NICU software package only)
3. Art
4. ABP
5. Fem
6. SpO_2

Check Your Knowledge: ECG Exercises



1. What is the easiest way to access the ECG menu?
2. How do you change the lead for the ECG 1 Lead selection?
3. How do you update the measurement mode when changing to an ECG cable with fewer leadwires?
4. How do you change the Beat Source?
5. How do you change the Pacemaker Detection setting?
6. Why would you want the monitor to relearn the patient's QRS pattern?

Hands on Activity: ECG



1. Have the participants change leads from the ECG menu.
2. Change the ECG waveform size and volume.
3. Show a Second HR Value in the HR Parameter Window.
4. Adjust the pacemaker detection setting and describe each option.
5. Relearn the ECG QRS pattern using the ECG Advanced menu.
6. Adjust the alarm limits heart rate.
7. Adjust the PVC and SVC alarm limits using the PVC/SVC Alarms menu.
8. Change a lead in the ST window using the ECG Setup menu.
9. Access the ST Realtime View and Trend View.
10. Access the Lethal Alarms, Ventricular Alarms and Atrial Alarms menus and change a setting.

7 12 Lead Analysis

Objectives: 12 Lead Analysis



By the end of this chapter you should be able to:

- Access the 12 lead analysis menu
- Access the 12 lead analysis settings menu and change a setting
- Perform a 12 lead ECG analysis
- Generate a 12 lead ECG report

Terms You Should Know: 12 Lead Analysis



12RL: The GE 12RL program generates a 12 lead ECG report from a subset of the electrodes used to acquire a standard 12 lead ECG. Four of the precordial channels of the 12 lead ECG (V2, V3, V4, V6) are not acquired from the patient; rather, they are reconstructed from information that is directly recorded in the other channels of the 12 lead ECG.

12SL: The 12SL Analysis Program assists the physician in measuring and interpreting resting 12 lead ECGs for rhythm and contour information by providing an initial automated interpretation. Interpretation by the product is then confirmed, edited, or deleted by the physician.

ACI-TIPI: Acute Cardiac Ischemia–Time Insensitive Predictive Instrument. TIPI utilizes recorded ECG data along with patient demographic and chest pain status to produce a numerical score which is the predicted probability of acute cardiac ischemia. Like any computer-assisted ECG interpretation program, the GE Marquette ACI-TIPI evaluation and probability score is intended to supplement, not substitute for the physician's decision process. It should be used in conjunction with knowledge of the patient's history, the results of a physical examination, the ECG tracing, and other clinical findings.

Overview

- To access the ***12 Lead Analysis*** menu, select the HR parameter window and then select ***12 Lead Analysis***
- For a 12 lead ECG analysis, a 12SL ECG with ACI-TIPI license, 10-leadwire cable, and 10–lead electrode placement are required.
- To obtain the most accurate 12 lead ECG analysis, you should enter accurate patient demographics. This is especially important when storing and comparing 12 lead reports in the MUSE database.
- For a 12 lead ECG analysis with the 12RL feature, a 12RL 12 lead ECG license and a 6–leadwire cable (or a 10-leadwire cable with the C2/V2, C3/V3, C4/V4, and C6/V6 leads disconnected) is required.
- For a 12 lead ECG analysis with the 12RL feature, confirm that the Va and Vb lead positions are set correctly for a 12RL measurement.
- For the most accurate serial comparisons, use the same electrode configuration as used on the prior analysis for the patient.

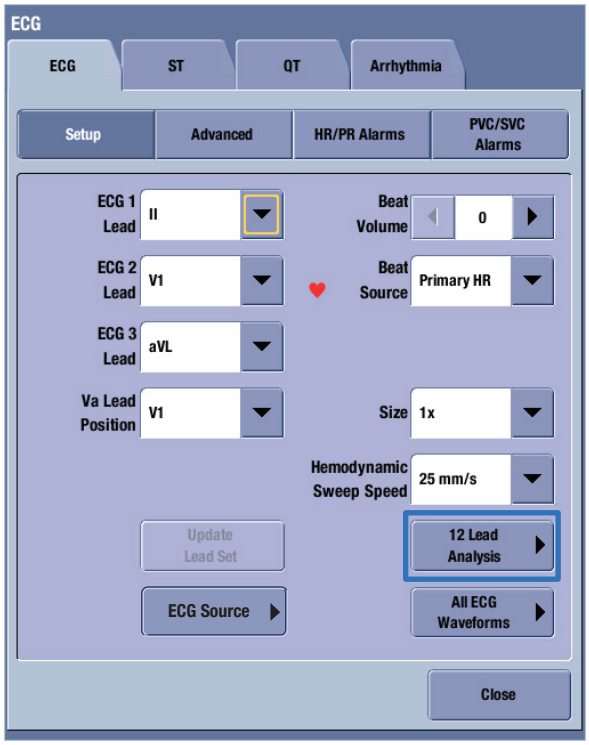


Figure 7.1 Accessing 12 lead analysis

12RL Interpolated 12 Lead ECG Analysis

The GE 12RL program generates a 12 lead ECG report from a subset of the electrodes used to acquire a standard 12 lead ECG. Four of the precordial channels of the 12 lead ECG (V2, V3, V4, V6) are not acquired from the patient; rather, they are reconstructed from information that is directly recorded in the other channels of the 12 lead ECG.

The four signals generated by the GE 12RL program are similar but not identical to the standard 12 lead ECG. All ECG data generated via 12RL are clearly identified as to which channels have been synthesized.

12SL ECG Analysis

The 12SL Analysis Program assists the physician in measuring and interpreting resting 12 lead ECGs for rhythm and contour information by providing an initial automated interpretation. Interpretation by the product is then confirmed, edited, or deleted by the physician. The 12SL analysis program is also referred to as the 12 lead ECG analysis program.

ACI-TIPI

Acute Cardiac Ischemia–Time Insensitive Predictive Instrument (ACI-TIPI) utilizes recorded ECG data along with patient demographic and chest pain status to produce a numerical score which is the predicted probability of acute cardiac ischemia. Like any computer-assisted ECG interpretation program, the GE Marquette ACI-TIPI evaluation and probability score is intended to supplement, not substitute for the physician's decision process. It should be used in conjunction with knowledge of the patient's history, the results of a physical examination, the ECG tracing, and other clinical findings.

Note! *ACI-TIPI is intended for adult patient populations.*

Using the 12 Lead Analysis Settings Menu

The following menu will be used for entering data and setting up for 12 lead analysis.

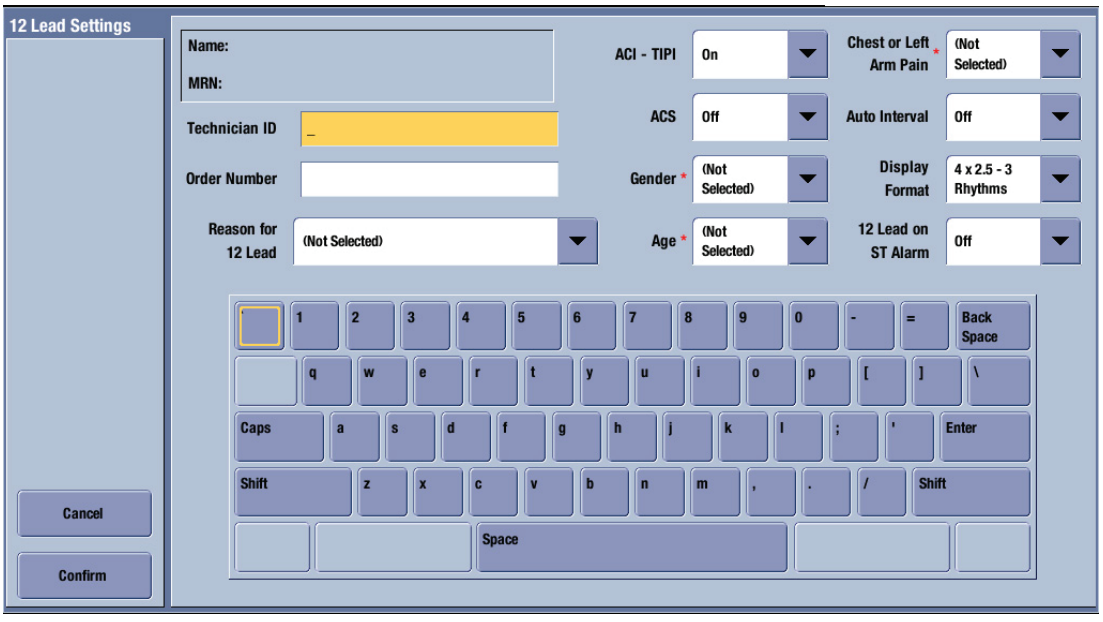


Figure 7.2 12 lead analysis settings menu

Entering data for a 12 lead ECG analysis

When the ***Tech ID Required*** setting is set to mandatory in the ***Care Unit Settings***, you must enter the Technician ID before you can confirm the 12 lead settings. All Care Unit Settings are password protected.

1. Select the ***HR*** parameter window.
2. Select ***12 Lead Analysis***.
3. Select ***Settings***.
4. Enter the ***Technician ID*** if required.
5. Enter the ***Order Number***.
6. Select an option from the ***Reasons for 12 Lead*** list.
7. You can also add your own password protected list of pre-defined reasons for recording a 12 lead ECG through the ***Care Unit Settings***.
8. Select ***Cancel*** or ***Confirm***.

Entering data for an ACI-TIPI 12 lead ECG analysis

Note! *The patient must be at least 16 years old for an ACI-TIPI 12 lead ECG analysis.*

1. Select the ***HR*** parameter window.
2. Select 1***2 Lead Analysis***.
3. Select ***Settings***.
4. Select ***On*** from the ***ACI - TIPI*** list.
5. Select the patient's gender from the ***Gender*** list. This selection will also be updated to the patient demographics.
6. If the patient's age has not been entered previously, select it now from the ***Age*** list.
7. Select the symptoms present from the ***Chest*** or ***Left Arm Pain*** list.
8. Select ***Cancel*** or ***Confirm***. Selecting ***Confirm*** is required before you can complete an ACI-TIPI 12 lead ECG analysis.

Enabling and disabling the 12SL ACS

Note! *Acute Coronary Syndrome (ACS) feature must be used only with patients to whom this measurement is suitable.*

12SL-ACS is an optional higher-sensitivity analysis for the detection of acute ischemia and acute infarction designed for a higher risk population with a higher prior probability of having these conditions. When this setting is enabled, you will get ACS-specific statements in addition to the diagnostic statements.

1. Select the ***HR*** parameter window.
2. Select ***12 Lead*** Analysis.
3. Select ***Settings.***
4. Select ***On*** or ***Off*** from the ***ACS*** list.
5. Select ***Cancel*** or ***Confirm***.

Entering the Location ID for 12SL

If roving between units is allowed and the 12SL ECG with ACI TIPI is enabled, you can enter the Location ID that will be used in the 12SL reports.

1. Select the patient information area on screen.
2. Select the ***Care Unit & Bed*** tab.
3. Select the ***Location ID*** field and enter the ID with the on-screen numeric keypad. You can enter any number from 0 to 599.

Setting Automatic 12 lead ECG Analysis Measurements

1. Select the ***HR*** parameter window.
2. Select ***12 Lead Analysis***.
3. Select ***Settings***.
4. Select a time interval from the ***Auto Interval*** list.
5. Select ***Cancel*** or ***Confirm.***

Setting the 12 lead ECG Analysis Display Format

This setting will change the 12 lead ECG waveform display format and the printed 12 lead ECG report waveform format.

1. Select the HR parameter window.
2. Select ***12 Lead Analysis***.
3. Select ***Settings.***
4. Select a format from the ***Display Format*** list:
    - ***4 x 2.5 - 1 Rhythm***
    - ***4 x 2.5 - 3 Rhythms***
    - ***12 Rhythms***
    - ***Cabrera***
5. Select ***Cancel*** or ***Confirm.***

Generating a 12 lead ECG Analysis Report During an ST Alarm Condition

You can have a 12 lead ECG report automatically generated when an ST alarm condition occurs. Automatically generated reports are viewable through ***12 Lead Analysis*** > ***Saved Reports***.

1. Select the ***HR*** parameter window.
2. Select ***12 Lead Analysis***.
3. Select ***Settings.***
4. Select ***On*** from the ***12 Lead on ST Alarm*** list.
5. Select ***Cancel*** or ***Confirm***.

Using the 12 Lead Analysis Menu

The following tasks are all initiated from the 12 lead analysis menu. You can access the 12 lead Analysis menu by selecting the ***HR*** parameter window > ***12 Lead Analysis***.

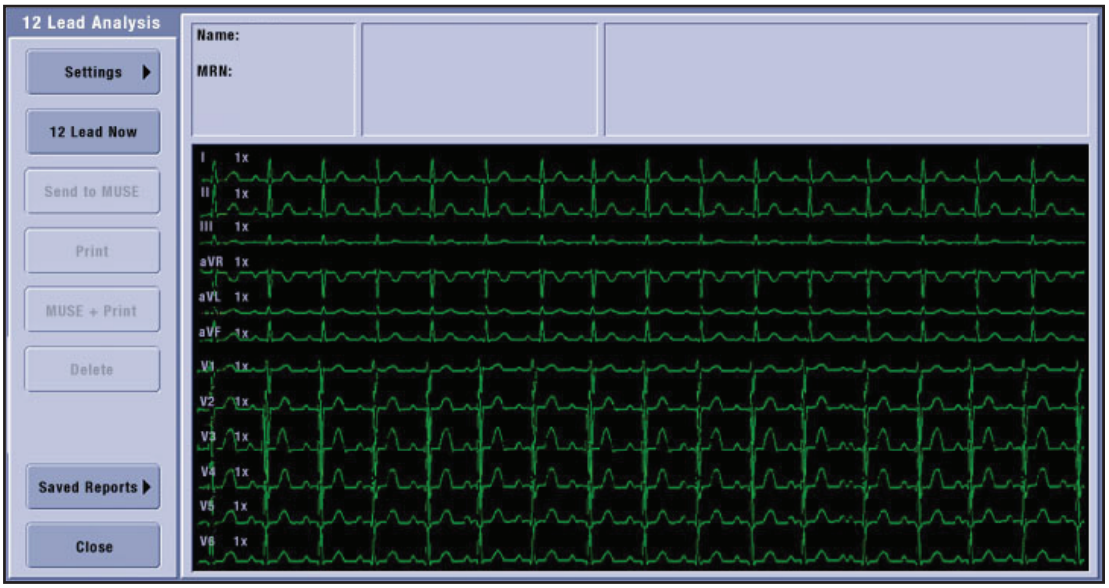


Figure 7.3 12 lead analysis menu

Performing a 12 lead ECG Analysis

1. Select the ***HR*** parameter window.
2. Select ***12 Lead*** Analysis.
3. Select ***12 Lead Now***.

All the waveforms in the ***12 Lead Analysis*** view freeze during the analysis except for the ECG I waveform. Analysis takes less than one second to complete. At that time, the monitor generates a 12 lead report, saves the report locally, and displays the report on the screen. The monitor can store up to fifteen 12 lead reports locally.

Sending a 12 lead ECG Report to the MUSE Database

1. Select the ***HR*** parameter window.
2. Select ***12 Lead Analysis***.
3. Select ***Send to MUSE***. The local 12 lead ECG report is now sent to the MUSE database.
4. Select ***Print*** to print the 12 lead report. You can also select ***MUSE + Print*** instead of the two separate steps 3 and 4 above.
5. Select ***Delete*** to delete the report and return to the real-time view.
6. To generate a new 12 lead ECG analysis report, select ***Real-time View*** and repeat the procedure for performing a 12 lead ECG analysis.

Viewing or Printing Saved 12 lead ECG Reports

You can view and print 12 lead reports that are stored at the monitor (local), or if available, stored at a MUSE database. The newest reports are displayed first.

To open a report that is stored at the MUSE database, a connection to the CARESCAPE Network is required.

1. Select the ***HR*** parameter window.
2. Select ***12 lead Analysis***.
3. Select ***Saved Reports***.
4. Select the desired 12 lead report from the list.
5. To view this report, select ***View***.

   A report that is stored locally at the monitor opens and displays in the 12 Lead Analysis view. A report that is stored at the MUSE database opens and displays in the MUSE Report view.
6. To send a locally saved 12 lead ECG report to the MUSE database, select ***Send to MUSE***. You can only send the report to the MUSE database once.
7. To re-size a report displayed in the ***MUSE Report*** view, select a value from the ***Zoom*** list. If you zoom in closer on the report, use the vertical scroll bar to view all parts of the report.
8. To print a report displayed in the ***MUSE Report*** view, select ***Print***.
9. To stop printing, select ***Stop Printing*** or ***Cancel Printing***.

The 12 lead ECG Analysis Program

The 12 lead ECG analysis program assists the physician in interpreting and measuring the resting ten seconds of ECG data. This program generates a diagnostic textual report on patient's cardiovascular condition. This report can be routed to the MUSE Cardiology Information System via the CARESCAPE Network.

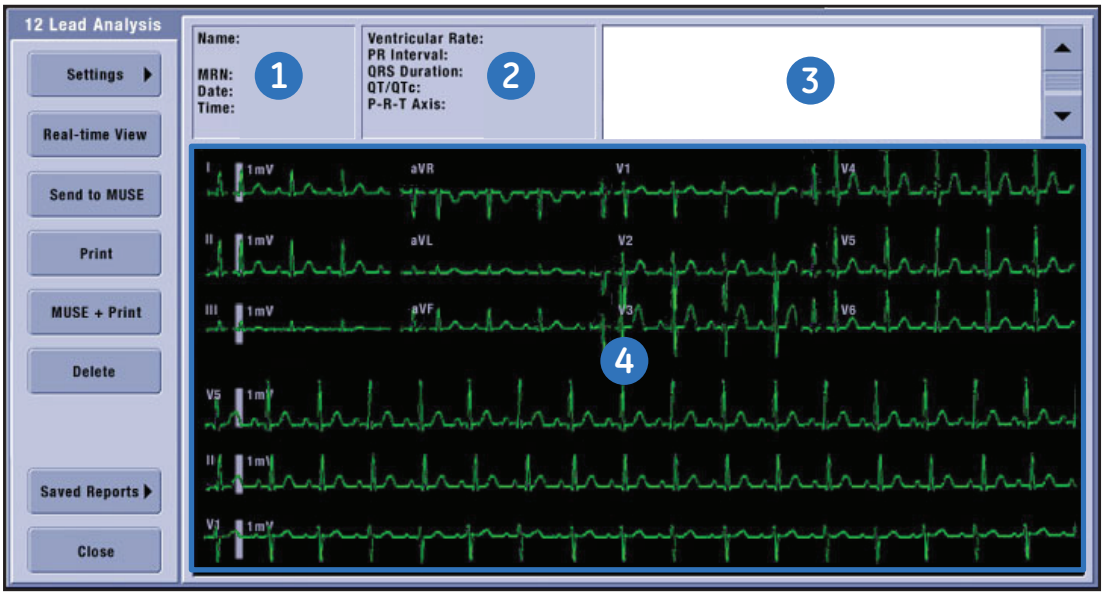


Figure 7.4 12 lead ECG report example

1. Patient information, including patient Name:, MRN:, Date: and Time: the report was generated.
2. Available values including Ventricular Rate, PR Interval, QRS Duration, QT/QTc, and P-R-T Axis.
3. Diagnostic statements and/or error messages.
4. Waveform area.

Up to 15 reports can be stored on the monitor until the patient is discharged. Also a PDF report generated by the MUSE can be viewed via the monitor.

The 12 lead ECG analysis program includes the Gender Specific Criteria and the Acute Cardiac Ischemia-Time Insensitive Predictive Instrument (ACI-TIPI). ACI-TIPI uses recorded ECG data to produce a numerical score which is the predicted probability of acute cardiac ischemia. In addition, the gender specific criteria improves the detection of acute myocardial infarctions (AMI) for adult women under the age of 60. ACI-TIPI can be enabled or disabled for the admitted patient.

Complete analysis requires a 10-leadwire cable.

The 12RL ECG Analysis Program

Note! *12RL is not available with the NICU software package.*

The 12RL analysis program generates a 12 lead ECG report from a subset of the electrodes used to acquire a standard 12 lead ECG. The 12 lead report includes the statement ***LEADS V2, V3, V4, AND V6 ARE INTERPOLATED*** to identify that the ECG measurements were analyzed using reconstructed (interpolated) leads. If the software version of the MUSE does not support this message, the message STATEMENT NOT FOUND is displayed instead. Reconstructed leads are identified on the monitor and in printouts (graphs) by the letter d (for derived) before the lead name (e.g., dV2) to ensure the clinician can identify the reconstructed waveform tracings.

12RL uses a standard 6-leadwire electrode placement to acquire leads I, II, III, AVR, AVF, V1 and V5. The four precordial leads (V2, V3, V4, V6) are not acquired from the patient. This reconstruction assumes accurate electrode placement and typical anatomy.

For 12RL monitoring, a 6- or 10-leadwire cable may be used. However, when using a 10-leadwire cable, do not prepare or connect precordial leads 2, 3, 4, or 6.

Check Your Knowledge: 12 lead



1. How do you access the 12 lead analysis menu?
2. How do you access the 12 lead analysis settings menu?
3. What is the difference between 12SL and 12RL?

Hands on Activity: 12 lead



1. Access the 12-lead analysis menu and enter various settings.
2. Perform a 12–lead ECG analysis.

8 Non-invasive Blood Pressure

Objectives: Non-invasive Blood Pressure



By the end of this chapter you should be able to:

- Setup for NIBP measurement
- Start and stop a manual NIBP measurement
- Change the NIBP cycle time
- Start and stop automatic NIBP measurement
- Activate stat mode if applicable
- Activate venous stasis if applicable
- Adjust the NIBP volume and display format
- Adjust the NIBP alarm setting

Terms You Should Know: Non-invasive Blood Pressure



DIA: Diastolic Pressure

MAP: Mean Arterial Pressure

MEAN: Mean Pressure

NIBP: Non-invasive blood pressure

Stat: Five minutes of continuous NIBP measurements

SYS: Systolic Pressure

Venous Stasis: PSM and PRESTN only. Allows you to apply continuous NIBP cuff pressure for a short period of time. The cuff inflation pressure and duration are dependent on the detected cuff or selected inflation limits.

NIBP Measurement Setup

NIBP Equipment to Patient Connection

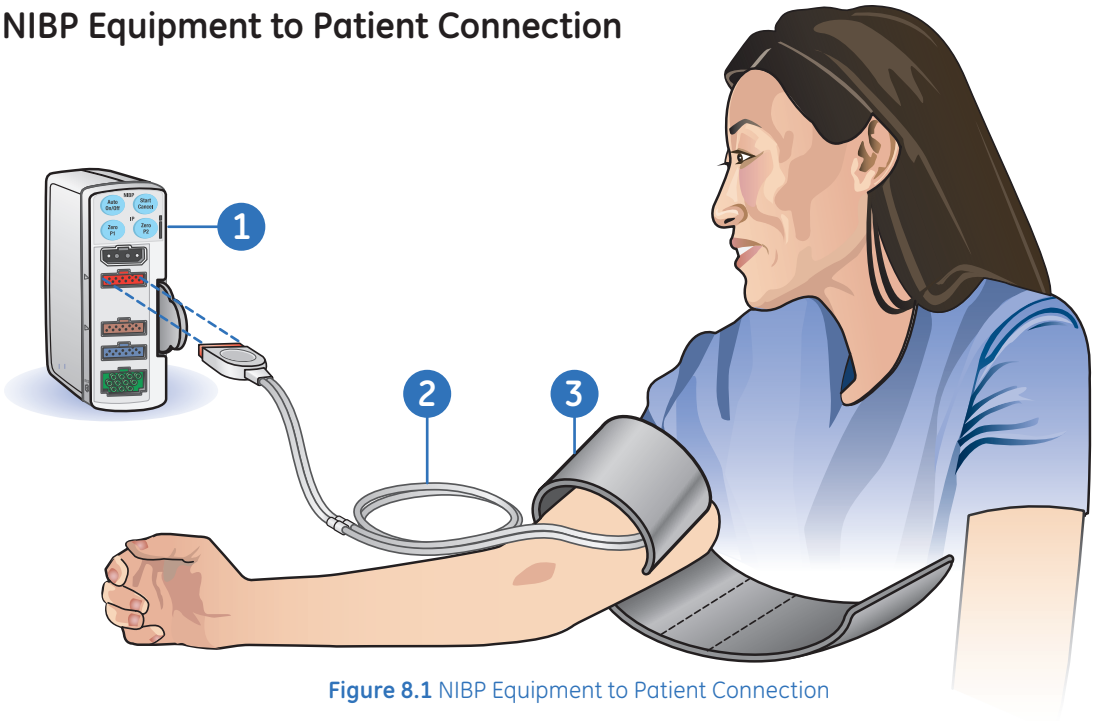


Figure 8.1 NIBP Equipment to Patient Connection

1. Module with NIBP measurement capability
2. Cuff hose
3. Cuff of correct size

Preparing the NIBP Patient Connection

4. Select an appropriate NIBP cuff size for the patient.
5. Connect the NIBP cuff hose to the module's NIBP connector.
6. Position the NIBP cuff on the patient:

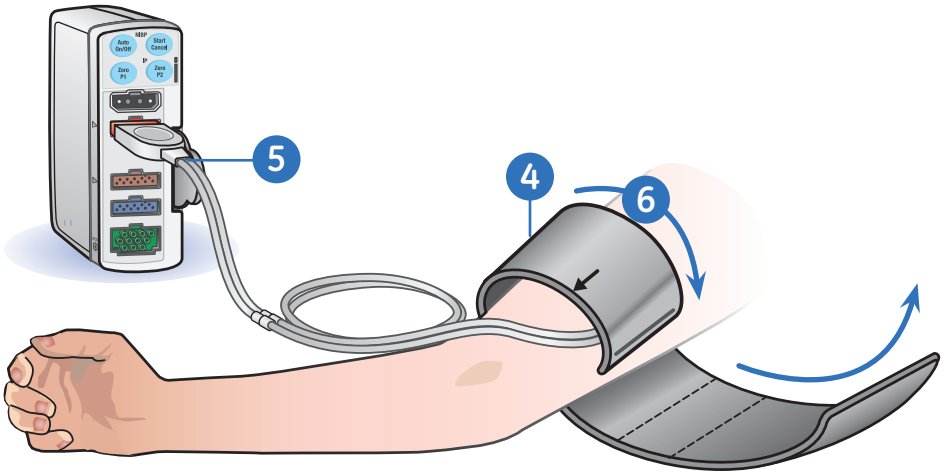


Figure 8.2 Preparing the patient for NIBP

- Place the cuff arrow over the brachial artery (or whatever artery is being used).
- Make sure that the cuff index line falls within the range markings on the cuff.
- Wrap the cuff around the limb.

7. Make sure that the NIBP cuff tubes are not kinked, compressed, or stretched.
8. Verify or select the correct ***Init. Pressure*** or ***Cuff Size*** from the ***NIBP Setup*** menu.

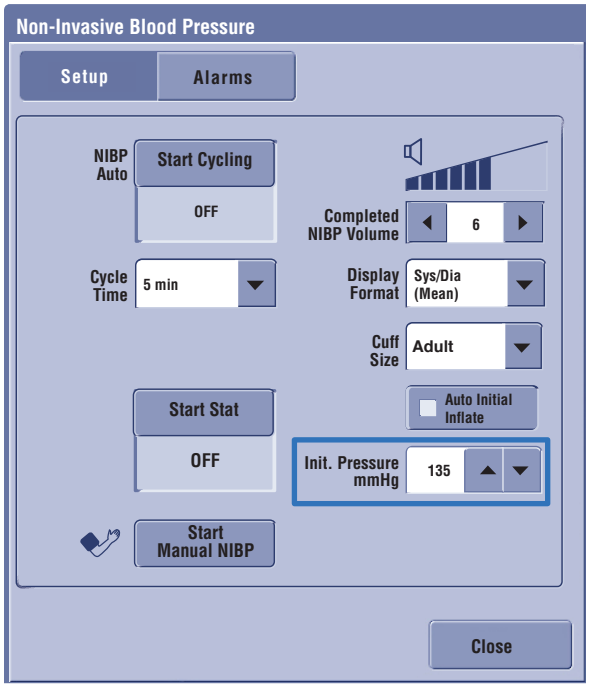


Figure 8.3 NIBP setup menu for PDM

Manual NIBP measurements

Starting or Stopping a Single NIBP Measurement

From the main menu:



Figure 8.4 Single NIBP measurement

1. Start the measurement by selecting ***NIBP Start***.
2. Stop the measurement by selecting ***NIBP Cancel***.

From the NIBP Setup menu:

1. Select the ***NIBP*** parameter window.
2. Start the measurement by selecting ***Start Manual NIBP***.
3. Stop the measurement by selecting ***Cancel NIBP.***

With the PSM module key:

1. Start the measurement by pressing the ***Start Cancel*** key.
2. Stop the measurement by pressing the ***Start Cance***l key again.

Automatic NIBP Measurements

Setting the Cycle Time Between NIBP Measurements

To automatically measure NIBP at set time intervals, you must first set the cycle time.

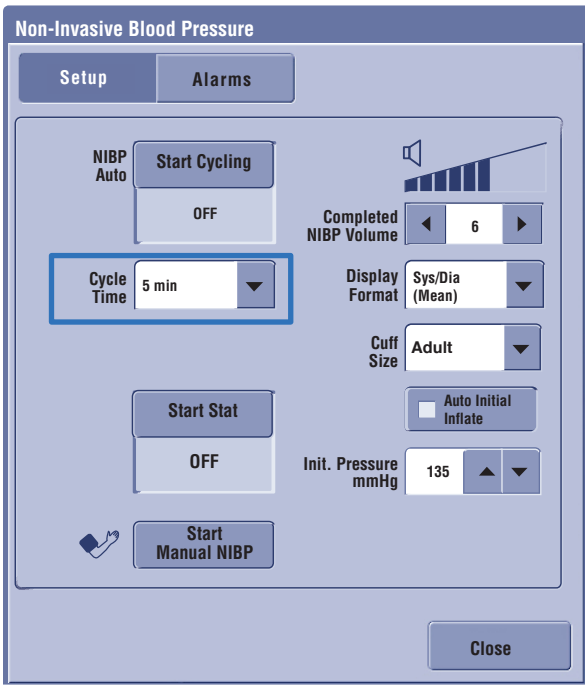


Figure 8.5 NIBP setup menu for PDM

1. Select the ***NIBP*** parameter window.
2. Select the cycle time from the ***Cycle Time*** list.

Starting or Stopping NIBP Auto

From the NIBP setup menu:

1. Select the ***NIBP*** parameter window.
2. Select ***Start Cycling*** for ***NIBP Auto***.
3. Stop the measurement by selecting ***NIBP Auto > Stop Cycling.***

From the main menu:



Figure 8.6 Single NIBP measurement

1. Select ***NIBP Auto Start***.
2. Stop the measurement by selecting ***NIBP Auto Stop***.

With the PSM module key:

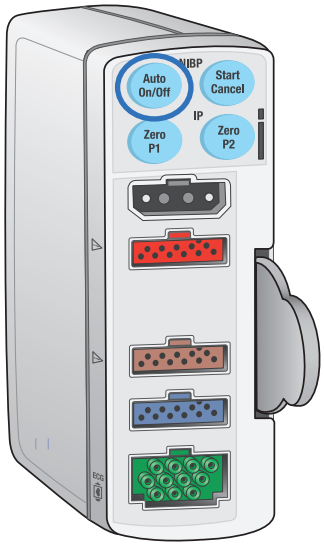


Figure 8.7 Single NIBP measurement

1. Press the ***Auto On/Off*** key.
2. Stop the measurement by pressing the ***Auto On/Off*** key again.

STAT Mode

Note! *Not available in the NICU software package.*

The STAT mode initiates a continuous cycle of measurements for five minutes. The message ***STAT*** displays in the NIBP parameter window when STAT is started. A new NIBP measurement starts after the previous measurement completes. The amount of time between measurements varies. For PDM and PSM, it is at least four seconds for adult and child and at least eight seconds for infant. For TRAM, the delay between measurements is two seconds. The early systolic value is measured and displayed until the final result is available. After five minutes, the monitor automatically returns to the previously selected cycling interval or manual mode.

Starting or stopping a Stat NIBP measurement

You can set the NIBP measurement to continue for five consecutive minutes.

1. Select the ***NIBP*** parameter window.
2. Select ***Start Stat***.
3. Stop the measurement by selecting ***Stop Stat***.

Venous stasis

Note! *PSM only.*

The venous stasis mode initiates inflation and holds a constant pressure in the cuff to help venous cannulation. The message ***Stasis*** displays in the NIBP parameter window when venous stasis mode is started. During the last 10 seconds, the ***Stasis*** message begins to flash to indicate the monitor is about to return to the previously selected cycling interval or manual mode. Stasis measurement pressure is controlled by the PSM internally.

Venous stasis allows you to apply continuous NIBP cuff pressure for a short period of time. The cuff inflation pressure and duration are dependent on the detected cuff or selected inflation limits.

Starting or stopping the venous stasis with the PSM:

1. Select the ***NIBP*** parameter window.
2. Select ***Start Venous Stasis***.
3. Stop the venous stasis by selecting ***Stop Venous Stasis***.

NIBP Cuffs

NIBP Cuff Selection and Placement

Always choose the appropriate blood pressure measurement site. In adult and child patients, the upper arm is preferred for convenience and because normative values are generally based on this site. When factors prohibit use of the upper arm, the clinician must plan patient care accordingly, taking into account the patient's cardiovascular status and the effect of an alternative site on blood pressure values, proper cuff size, and comfort.

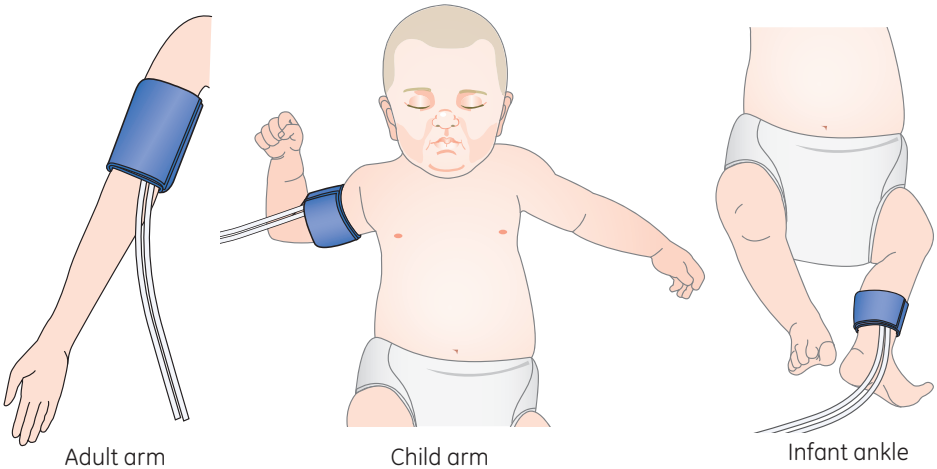


Figure 8.8 Recommended sites for placing cuffs

Always measure patient's limb and select appropriately sized cuff according to size marked on cuff or cuff packaging. When cuff sizes overlap for a specified circumference, choose the larger size cuff.

If patient is standing, sitting, or inclined, ensure that cuffed limb is supported to maintain the cuff at level of patient's heart. If the cuff is not at heart level, the difference in the measured pressure values due to hydrostatic effect must be considered.

Selecting NIBP Cuff Size

Note! *PDM and TRAM only.*

You must first select the NIBP cuff size before starting a NIBP measurement.

1. Select the ***NIBP*** parameter window.
2. Select ***Adult, Child***, or ***Infant*** from the ***Cuff Size*** list.

Note! *PDM and TRAM: When the Auto Initial Inflate setting is enabled, the initial cuff inflation pressures are dependent on the NIBP module used and selected cuff size. The initial target pressure preset can be adjusted if you desire a lower or higher initial target pressure.*

Selecting the Initial NIBP Cuff Inflation Pressure

Note! *PDM and TRAM only.* You can determine the cuff inflation pressure automatically based on the cuff size.

1. Select the ***NIBP*** parameter window.
2. Select ***Auto Initial Inflate.***

Setting the Target NIBP Inflation Pressure

Note! *PDM and TRAM only.*

You can manually change the target inflation pressure for the first NIBP measurement.

1. Select the ***NIBP*** parameter window.
2. Check that ***Auto Initial Inflate*** is not selected.
3. Select a value from the ***Init. Pressure*** list.

Selecting the Cuff Inflation Limits

Note! *PDM and TRAM only.*

Black-colored Adult/Child cuff hoses and blue-colored Infant cuff hoses are automatically detected by the monitor and inflation limits are set accordingly. However, if the cuff hoses cannot be detected automatically, you must set the inflation limits manually. You can also select the inflation limits when the automatic detection is working.

1. Select the ***NIBP*** parameter window.
2. Select the ***Setup*** tab.
3. Select ***Infant, Child,*** or ***Adult*** from the ***Inflation Limits*** list.

NIBP Volume and Display Settings

Adjusting the NIBP Measurement Completion Tone Volume

1. Select the ***NIBP*** parameter window.
2. Set the ***Completed NIBP Volume.*** The lower the value, the softer the tone.

Setting the NIBP Display Format

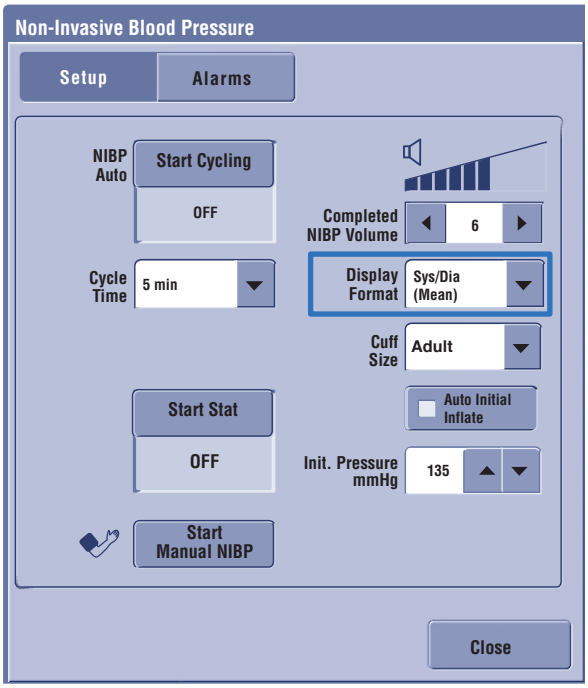


Figure 8.9 NIBP setup menu

1. Select the ***NIBP*** parameter window.
2. Select the format from the ***Display Format*** list:
3. **Sys/Dia (Mean)**: All values are shown, but the sys/dia values are shown in a bigger font.
4. **(Mean) Sys/Dia:** All values are shown, but the mean value is shown in a bigger font.

NIBP Alarms

Setting NIBP Alarms

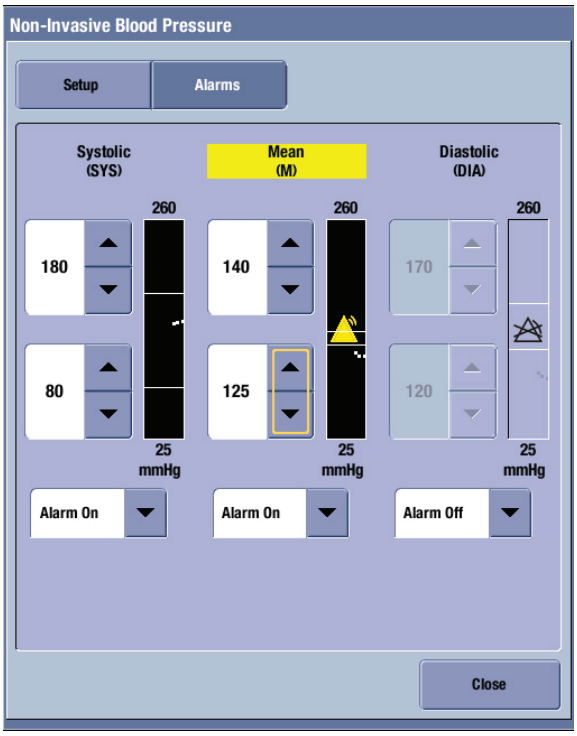


Figure 8.10 NIBP alarms menu

1. Select the ***NIBP*** parameter window.
2. Select the ***Alarms*** tab.
3. Select ***Systolic (SYS), Mean (M)***, or ***Diastolic (DIA)*** pressure. If the feature is not active, the alarm limits are greyed out. Select ***Alarm On*** to set the alarms.
4. Set the alarm limits.

Silenced NIBP Alarms

The silence alarm behavior is different for NIBP than for any other parameter. Unlike the continuously monitored parameters, NIBP is measured periodically. As a result, silencing a physiological NIBP alarm will clear that active alarm until the next NIBP measurement is taken. If the new measurement is outside the alarm limits, the alarm is activated again.

NIBP Recheck After Alarm Violation

Note! *PDM and TRAM only.*

If the NIBP value exceeds the alarm limits and the NIBP alarm priority selection is Escalating, a new measurement takes place automatically. If the NIBP measurement is taken manually, the recheck measurement is taken immediately after the first measurement. When the NIBP measurement is taken automatically, the recheck measurement is delayed by 30 seconds before the second measurement is taken.

Check Your Knowledge: Non-invasive Blood Pressure



1. Describe two ways to start a single NIBP measurement.
2. Describe two ways to start an automatic NIBP measurement.
3. How do you change the cycle time?
4. Which menu would you use to adjust the NIBP volume and the NIBP display settings?
5. Which menu would you use to change an NIBP alarm limit setting?

Hands on Activity: Non-invasive Blood Pressure



1. Start a manual and automatic blood pressure.
2. Change the cycle time.
3. Adjust the NIBP volume.
4. Adjust an NIBP alarm limit.

9 Pulse Oximetry

Objectives: Pulse Oximetry



By the end of this chapter you should be able to:

- Prepare the SpO_2 connection
- Change the sweep speed
- Change the primary heart rate source
- Show the SpO_2 pulse rate
- Adjust the SpO_2 pulse beep tone volume
- If applicable for Masimo SET, change the averaging time and sensitivity level
- If applicable for Nellcor OxiMax, change the saturation seconds and response time settings
- Change the SpO_2 alarm limits
- Describe the difference between a good quality and poor quality SpO_2 waveform

Terms You Should Know: Pulse Oximetry



SpO_2 averaging time: Average of the SpO_2 measurement over time instead of the beat to beat values.

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

SpO_2 Overview

SpO_2 Measurement Limitations

- Any E-modules other than E-MASIMO and E-NSATX used for this measurement are not suitable for use with neonatal patients.
- The pulse oximeter cannot distinguish between oxyhemoglobin and dyshemoglobins.
- Poor perfusion may affect the accuracy of measurement, especially when using an ear sensor.
- To avoid erroneous measurements, do not use a blood pressure cuff on the same limb as the SpO_2 sensor.

SpO_2 Technologies

There are three supported pulse oximetry technologies:

- GE Ohmeda
- Masimo SET
- Nellcor OxiMax

Preparing the SpO_2 Connection

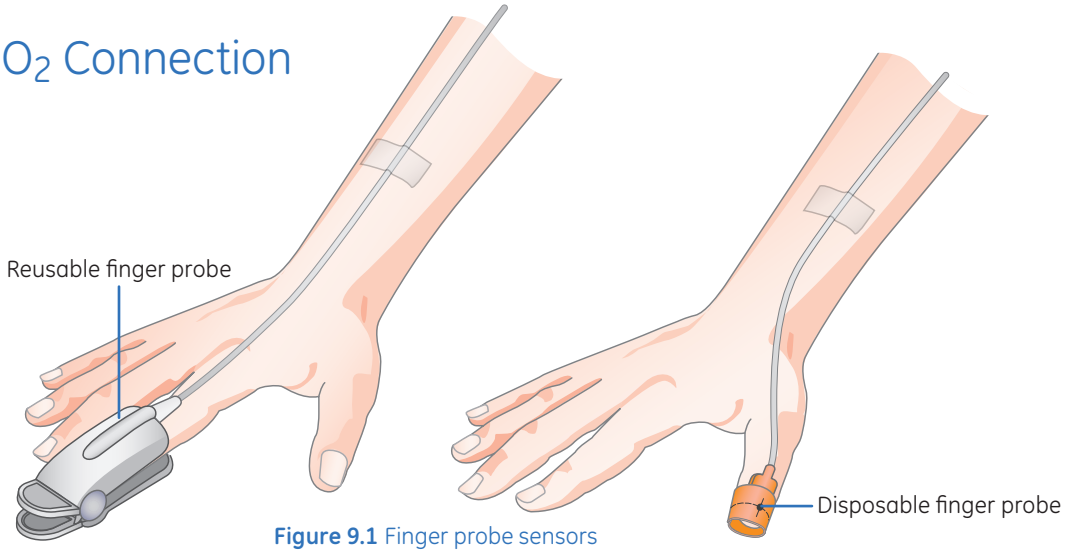


Figure 9.1 Finger probe sensors

1. Be sure the module and adapter cables are attached and connected to the monitor.
2. Clean the surface of reusable sensors.
3. Prepare the application site(s):
    - Remove nail polish
    - Remove earrings
4. Attach the sensor to the patient.
    - Be sure to follow manufacturers instructions for sensor position
5. Stabilize the sensor cable to minimize sensor movement.
6. Check that the red light is lit in the sensor.
7. Check that the waveforms and parameter values are displayed when the sensor is connected to the patient.

Using the SpO_2 Measurement

Primary and Secondary SpO_2 Measurement Sources

It is possible to measure SpO_2 from two different measurement sources simultaneously. The primary SpO_2 source is labeled SpO_2 and the secondary SpO_2 source is labeled SpO_2(2).

The following table shows the acquisition modules that may be used as primary and secondary SpO_2 measurement sources.

Primary SpO_2 source	Compatible secondary SpO_2 source(s)
PDM, TRAM, PSM	• Tram-Rac SpO_2 module • E-NSATX • E-MASIMO • Unity Network ID connectivity device
E-NSATX, E-MASIMO	• Unity Network ID connectivity device
Unity Network ID connectivity device	• Tram-Rac SpO_2 module • E-NSATX • E-MASIMO E-NSATX and E-MASIMO modules require a PDM with no SpO_2 sensor connected in order to work as a secondary SpO_2 source when the Unity Network ID connectivity device is the primary SpO_2 source.

Changing the SpO_2 Waveform Size

Note! *Applies to all other modules except the PSM.*

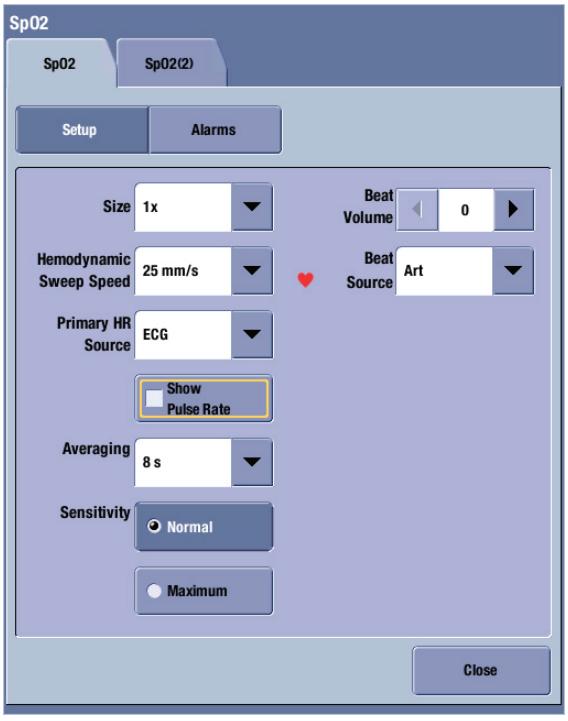


Figure 9.2
SpO_2 setup menu
Masimo Set

1. Select the **SpO_2** parameter window.

2. Select the **SpO_2** or ***SpO_2(2)*** tab.

3. Choose the size from the ***Size*** list: ***1x***, ***2x***, ***4x***, or ***8x***.

Selecting the SpO_2 Hemodynamic Sweep Speed

Note! *This setting adjusts the waveform speed for all of the hemodynamic parameters.*

1. Select the **SpO_2** parameter window.
2. Select the **SpO_2** or **SpO_2*(2)*** tab.
3. Select a numeric value from the ***Hemodynamic Sweep Speed*** list. The smaller the value, the slower the sweep speed.

Selecting the SpO_2 as the Primary Heart Rate Source

The primary heart rate can be calculated from the ECG leads, SpO_2 measurement, or invasive pressure waveform.

Note! *This setting adjusts the primary heart rate source for all of the hemodynamic parameters. HR Alarms must be configured as Single to enable the SpO_2 as the primary heart rate source.*

SpO_2 can be the Primary HR Source for all modules except the Tram-Rac single parameter modules.

1. Select the **SpO_2** parameter window.
2. Select the **SpO_2** or **SpO_2*(2)*** tab.
3. Select the heart rate source from the ***Primary HR Source*** list.

Showing the SpO_2 Pulse Rate

1. Select the **SpO_2** parameter window.
2. Select the **SpO_2** or **SpO_2*(2)*** tab.
3. Select ***Show Pulse Rate.***

Adjusting the SpO_2 Pulse Beep Tone Volume

A variable pitch beep tone rises in pitch with increasing oxygen saturation or falls in pitch with decreasing oxygen saturation.

1. Select the **SpO_2** parameter window.
2. Select the **SpO_2** or **SpO_2*(2)*** tab.
3. Adjust the volume with the ***Beat Volume*** arrows.

Changing the SpO_2 Waveform Scale

Note! *PSM only.*

1. Select the **SpO_2** parameter window.
2. Select the **SpO_2** or **SpO_2*(2)*** tab.
3. Select the scale from the ***Scale*** list:
    - **AUTO:** The scale is automatically selected according to the IrMod % (infrared modulation percentage) received from the measurement source.
    - Other scale options are ***2, 5, 10, 20***, or ***50.***

SpO_2 Settings Specific to Masimo SET

Selecting the SpO_2 averaging time:

Note! *PSM, E-MASIMO, and PDM and TRAM with Masimo technology and Masimo sensors only. Applies to the primary SpO_2 measurement only.*

You can have an average of the SpO_2 measurement on screen instead of the beat to beat values, and you can select how many seconds are used for this averaging: ***2 s, 4 s, 8 s, 10 s***, ***12 s, 14 s,*** or ***16 s.***

1. Select the ***SpO_2*** parameter window.
2. Select the ***SpO_2*** tab.
3. Select the number of seconds from the ***Averaging*** list.

Selecting the Masimo SpO_2 sensor sensitivity level:

Note! *SpO_2 modules with Masimo technology and Masimo sensors only.*

1. Select the ***SpO_2*** parameter window.
2. Select the ***SpO_2*** tab.
3. Select the appropriate ***Sensitivity*** radio button:
    - Use the ***Normal*** sensitivity setting for normal patient monitoring purposes.
    - Use the ***Maximum*** sensitivity setting for improved poor perfusion performance and for faster tracking of rapid SpO_2 saturation changes. Using the Maximum sensitivity setting delays the ***SpO_2 probe off*** detection alarm.

Nellcor OxiMax Saturation Seconds Overview

Note! *PDM and TRAM with primary SpO_2 measurement and the Nellcor option only.*

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

Saturation levels may fluctuate above and below an alarm limit, re-entering the acceptable range (non-alarm range) several times. During such fluctuation, the monitor integrates the number of SpO_2 saturation points, both positive and negative, until either the Saturation Seconds limit is reached or the saturation level returns to within the normal range and remains there.

When an SpO_2 saturation value exceeds an alarm limit, a pie chart (circular graph) in the SpO_2 parameter menu begins to fill in a clockwise direction. As seconds pass and the value is compared against the alarm limits and the Saturation Seconds setting, the chart fills proportionately. When the pie chart is completely filled, indicating that the Saturation Seconds limit has been reached, an alarm sounds. When the SpO_2 value is within the set limits, the Saturation Seconds pie chart empties in a counterclockwise direction.

For more information on Nellcor OxiMax Saturation Seconds, see the Pulse Oximetry section of the user's reference manual.

SpO_2 Settings Specific to Nellcor OxiMax

Showing the Saturation Seconds in the SpO_2 parameter window:

Note! *PDM and TRAM with primary SpO_2 measurement and the Nellcor option only.*

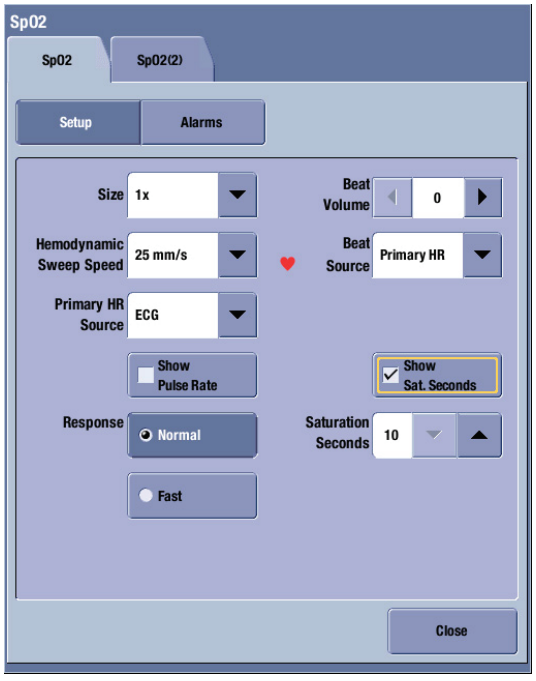


Figure 9.3
SpO_2 setup menu
Nellcor OxiMax

1. Select the ***SpO_2*** parameter window.
2. Select the ***SpO_2*** tab.
3. Select ***Show Sat. Seconds.***

Setting the Saturation Seconds threshold:

1. Select the ***SpO$_2$*** parameter window.
2. Select the ***SpO$_2$*** tab.
3. Set the threshold with the ***Saturation Seconds*** arrows.

Selecting the SpO2 response time:

Note! *PDM Nellcor only.*

You can select the response (averaging) time. Fast (default) is the recommended setting.

1. Select the ***SpO$_2$*** parameter window.
2. Select the ***SpO$_2$ SpO$_2$(2)*** tab.
3. Select the radio button for the response time: ***Normal*** or ***Fast***.

Setting the SpO$_2$ Alarms Limits

You can set the alarms and alarm limits for primary and secondary SpO$_2$ measurements separately.

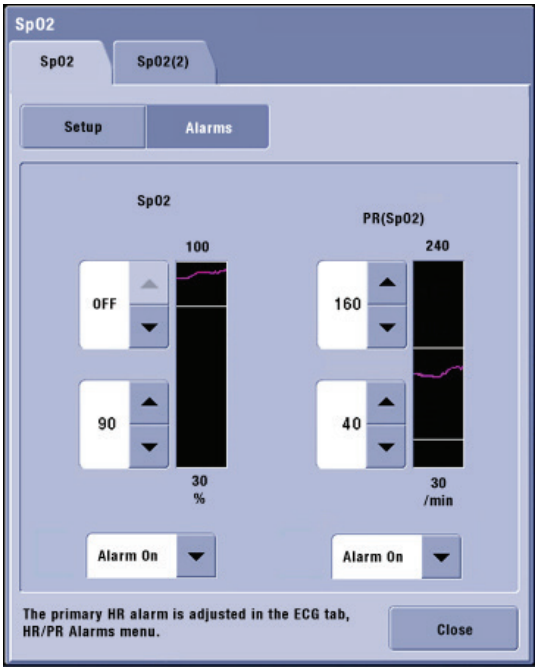


Figure 9.4
SpO$_2$ alarms menu

1. Select the ***SpO$_2$*** parameter window.
2. Select the ***SpO$_2$ SpO$_2$(2)*** tab.
3. Select the ***Alarms*** tab.
4. Set the alarm limits for the ***SpO$_2$***, ***HR***, or ***PR(SpO$_2$).***

   If a feature is not active, alarm limits are greyed out. Select ***Alarm On*** to set the alarm limits. ***HR*** appears when the ***HR Alarms*** is set to ***Single***. ***PR(SpO$_2$)*** appears when the ***HR Alarms*** is set to ***Multiple***. The ***HR*** and ***PR(SpO$_2$)*** settings are not available for the secondary SpO$_2$ measurement.
5. Set the alarm limits.

How to Interpret the SpO_2 Values

SpO_2 Signal Strength

Signal strength is indicated with asterisks in the parameter window.

For PSM with GE Ohmeda technology, the signal strength indicator is also displayed as the infrared modulation percentage in the waveform.

Unity Network Interface Device (ID) does not display signal strength indicators. Signal strength may be determined by the amplitude of the SpO_2 waveform.

SpO_2 Waveform Quality

Note! *Not for Masimo SET technology.*

Under normal conditions, the SpO_2 waveform corresponds to (but is not proportional to) the arterial pressure waveform. The typical SpO_2 waveform can help the user find a sensor location with the fewest noise spikes.



Figure 9.5 Normal waveform

If noise (artifact) is seen on the waveform because of poor sensor placement, the photodetector may not be flush with the tissue. Check that the sensor is secured and the tissue sample is not too thick. Pulse rate is determined from the SpO2 waveform, which can be disrupted by hemodynamic pressure disturbances. Motion at the sensor site is indicated by noise spikes in the normal waveform.



Figure 9.6 Abnormal waveform

SpO_2 Waveform Stability

The stability of the displayed SpO_2 values can also be used as an indication of signal validity. To aid you in successful SpO_2 monitoring, messages are provided in the SpO_2 parameter window.

Check Your Knowledge: Pulse Oximetry



1. What are the 3 supported pulse oximetry technologies?
2. Which menu would you access to change the waveform size, beat volume and sweep speed?
3. Which menu would you access to change an SpO_2 alarm limit?
4. What are three important indicators to consider when interpreting SpO_2 values?

Hands on Activity: Pulse Oximetry



1. Change the sweep speed, pulse rate and beep tone volume.
2. Change the SpO_2 alarm limits.

10 Impedance Respiration

Objectives: Impedance Respiration

By the end of this chapter you should be able to:

- Prepare the patient's respiration electrode sites
- Properly place the leads for respiration measurement
- Access the impedance respiration setup menu and change a setting
- Access the impedance respiration alarms menu and change a setting

Terms You Should Know: Impedance Respiration

Cardiac artifact alarm: A feature in the PDM and TRAM that will alert the user if the respiration rate is within 5% of the ECG heart rate. In some cases, the monitor may be counting heartbeat artifact as respirations.

Impedance Respiration: Measured across the thorax between ECG electrodes. The respiration signal is made by supplying current between the electrodes and by measuring the differential current from the electrodes. The signal measured is the impedance change caused by breathing.

Respiration Measurement Setup

Note! ***PSM:*** *Impedance respiration is intended for patients over three years old.*

Preparing the Patient's Respiration Electrode Sites

Excessive body hair or skin oil reduces electrode contact with the skin and decreases the quality of electrode signal.

When preparing the electrode sites, avoid obvious layers of fat and major muscles.

1. Shave any hair from the electrode site.
2. Gently rub the surface of the skin to increase capillary blood flow.
3. Clean the skin with alcohol or a mild soap and water solution to remove skin oil and dead or abraded skin cells.
4. Dry the skin completely before applying the electrodes.

Respiration Lead and Breath Detection

Respiration leads identify the ECG leads used for respiration measurement. The following table shows which leads are available for each module.

Lead	Available with modules
Lead I	**TRAM, PDM, PSM**
Lead II	**TRAM, PDM, PSM** PSM uses the ECG lead selection if the measurement mode is 3-lead and Lead II if the measurement mode is 5-, 6-, or 10-leadwire set. If any electrode is disconnected, the remaining lead (I, II or III) is used, if possible.
Lead RL-LL	**PDM** Not available for 3-lead measurement.

If you are monitoring with a fixed-lead, 3-lead cable, respiration can only be obtained from the lead for which the cable is manufactured. For example, if the cable is a fixed lead II cable, as indicated by a label on the cable itself, respiration can only be obtained from lead II.

PDM and TRAM: Even though the same electrodes are used for ECG and respiration monitoring, it is possible to get a lead fail message for respiration without one for ECG. The impedance may be too high for respiration detection, but the electrode is still good for ECG.

Respiration Lead Placement

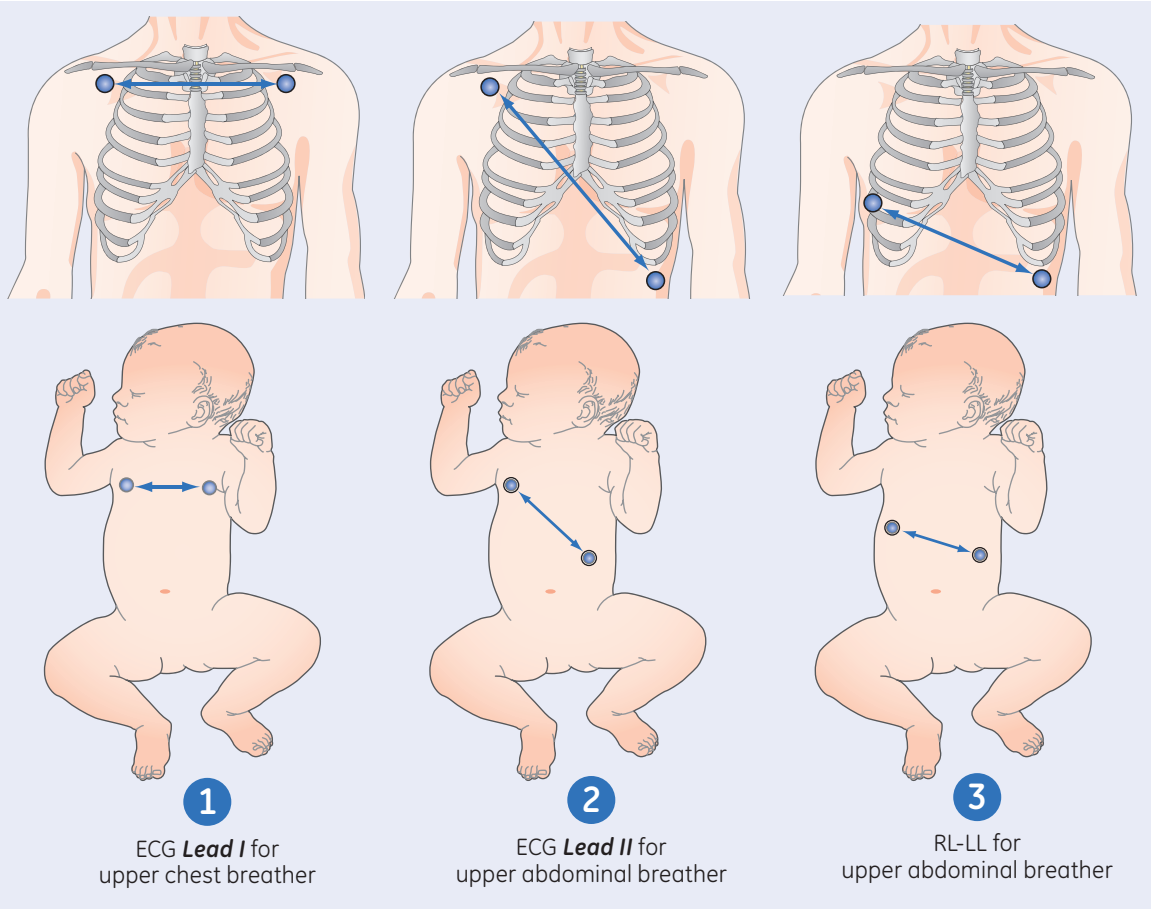


Figure 10.1 Illustrates the relationship between breathing and the ECG leads.

1. **Lead I:** Provides good thoracic (upper chest) breath detection. However, lead I is more susceptible to cardiogenic artifact than the RL-LL vector.
2. **Lead II:** Provides good thoracic breath detection and upper abdominal (lower chest) breath detection. However, lead II is more susceptible to both cardiogenic and motion (head, neck, or arm) artifact than the RL-LL vector.
3. **RL-LL:** Vector provides good abdominal breath detection and is not as susceptible to cardiogenic artifact or motion artifact. When monitoring respiration through the RL-LL vector, use a standard 5-leadwire electrode placement, except place the RL electrode on the fifth intercoastal space on the right side of the chest.

Note! *RL-LL vector only applies to PDM module.*

Using the Respiration Measurement Setup Menu

The following tasks are all initiated from the Respiration Measurement Setup menu. You can access the Respiration Measurement Setup menu by selecting the impedance respiration parameter window and then selecting the ***Setup*** tab.

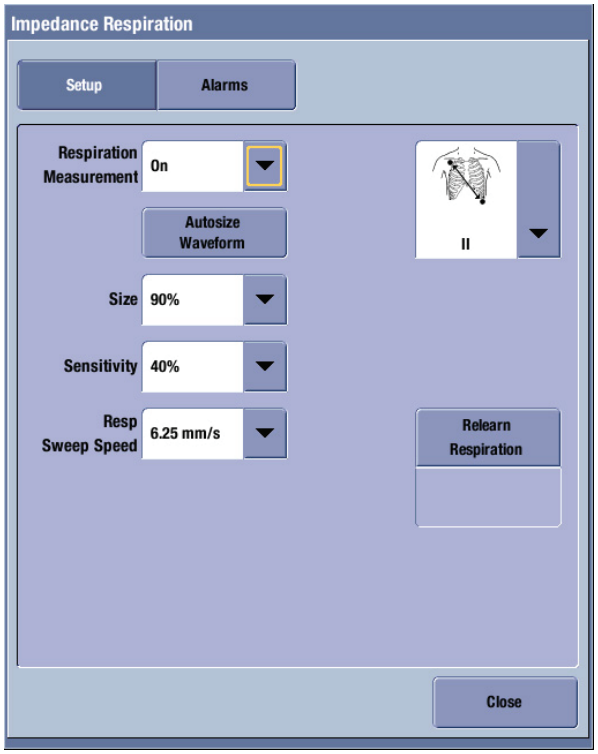


Figure 10.2 Resp rate source

Turning on the Respiration Measurement

The respiration measurement does not start automatically, so you must turn it on.

1. Select the **impedance respiration** parameter window.
2. Select the ***Setup*** tab.
3. Select ***Respiration Measurement*** > ***On***.

Selecting the Respiration Lead

Note! *TRAM and PDM only. In addition, the RL-LL respiration lead is available with PDM only.*

1. Select the ***impedance respiration*** parameter window.
2. Select the ***Setup*** tab.
3. Select lead ***I***, ***II***, or ***RL-LL*** from the selection list on the right. Lead selections are presented as graphical icons.

Selecting the Respiration Waveform Size Manually

1. Select the ***impedance respiration*** parameter window.
2. Select the ***Setup*** tab.
3. Select a value from the ***Size*** list. The greater the value, the larger the waveform size.

Selecting the Respiration Waveform Size Automatically

Note! *PDM and TRAM only.*

You can automatically size the waveform to fit the available space.

1. Select the ***impedance respiration*** parameter window.
2. Select the ***Setup*** tab.
3. Select ***Autosize Waveform***.

Selecting the Waveform Speed

1. Select the ***impedance respiration*** parameter window.
2. Select the ***Setup*** tab.
3. Select a value from the ***Resp Sweep Speed*** list. The lower the value, the slower the sweep speed.

Selecting the Waveform Sensitivity

Breath detection accuracy may be enhanced by increasing or decreasing the waveform sensitivity.

1. Select the ***impedance respiration*** parameter window.
2. Select the ***Setup*** tab.
3. Select a value from the ***Sensitivity*** list. The lower the value, the greater the sensitivity.

Relearning the Respiration Pattern

Note! *PDM and TRAM only.*

If the patient's breathing pattern changes after the initial learning process has taken place, it may be necessary to relearn. There is no respiration rate displayed during the relearning process. When relearning is complete, the ***Relearn Respiration*** message will clear and the respiration rate will be displayed. The detection threshold and the waveform size update after the new respiration pattern is learned.

1. Select the ***impedance respiration*** parameter window.
2. Select the ***Setup*** tab.
3. Select ***Relearn Respiration.***

The detection threshold (sensitivity) and the waveform size update after the new respiration pattern is learned.

Turning Off the Respiration Measurement

1. Select the ***impedance respiration*** parameter window.
2. Select the ***Setup*** tab.
3. Select ***Respiration Measurement > Off***.

Using the Respiration Measurement Alarms Menu

The following tasks are all initiated from the Respiration Measurement Alarms menu. You can access the Respiration Measurement Alarms menu by selecting the impedance respiration parameter window and then selecting the ***Alarms*** tab.

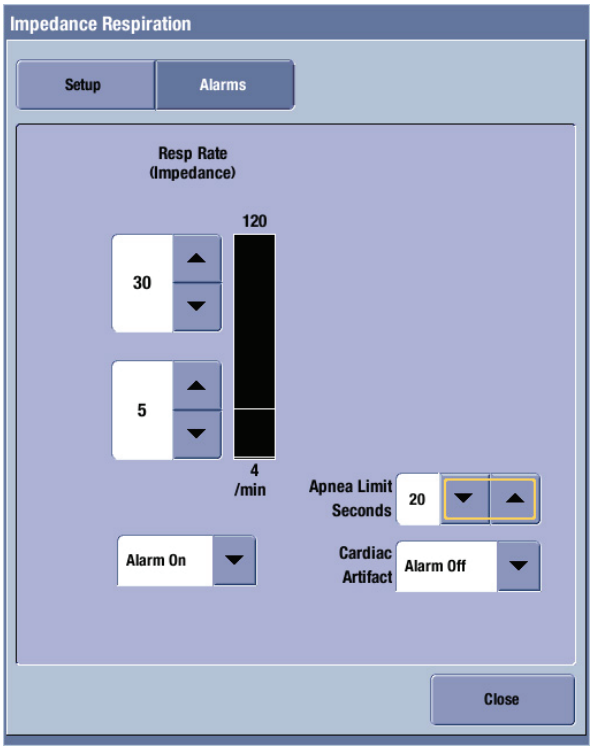


Figure 10.3 Impedance respiration alarm menu for PDM

Turning On or Off the Respiration Rate Alarm

1. Select the ***impedance respiration*** parameter window.
2. Select the ***Alarms*** tab.
3. Select ***Alarm On*** or ***Alarm Off*** for the Resp Rate (Impedance).

If you select ***Alarm Off***, you cannot adjust the alarm limits.

Setting the Respiration Alarm Limits

1. Select the ***impedance respiration*** parameter window.
2. Select the ***Alarms*** tab.
3. Set the ***Respiration Rate*** limits with the arrow selectors.

Setting the Apnea Alarm Delay



Note! *PDM and TRAM only. The delay for the PSM is always 20 seconds.*

You can select the apnea alarm delay by defining seconds in the Apnea Limit Seconds setting (3 - 30 seconds). If anything else than the default (20 seconds) is selected, the selected seconds are displayed in the parameter window.

1. Select the ***impedance respiration*** parameter window.
2. Select the ***Alarms*** tab.
3. Set the ***Apnea Limit Seconds*** with the arrow selectors.

Enabling the Respiration Cardiac Artifact Alarm



Note! *PDM and TRAM only.*

The cardiac artifact alarm can be enabled to display the Cardiac artifact message when the respiration rate is within 5% of the ECG heart rate. It takes about 30 breaths before the module detects a cardiac artifact alarm condition.

1. Select the ***impedance respiration*** parameter window.
2. Select the ***Alarms*** tab.
3. Select Cardiac ***Artifact*** > ***Alarm On.***

Check Your Knowledge: Impedance Respiration



1. Which lead is the best at detecting abdominal breathing?
2. Does the respiration measurement start automatically?
3. Which menu would you access to change the respiration lead?
4. What should you do if the patient's breathing pattern changes after starting respiration measurement?

Hands on Activity: Impedance Respiration



1. Turn on the respiration measurement.
2. Change a respiration lead.
3. Change the respiration waveform size manually.
4. Relearn the respiration pattern if applicable.
5. Change a respiration alarm limit.

11 Temperature

Objectives: Temperature



By the end of this chapter you should be able to:

- Prepare the patient for temperature measurement
- Change the temperature site label
- Display the delta value between two temperature channels
- Change the temperature alarm limits

Terms You Should Know: Temperature



Channel: Each independent temperature measurement is associated with a specific physical connection from the patient to the acquisition device. This is referred to as a channel. The monitor supports T1, T2, T3, T4 and TBlood temperature channels.

Delta: The difference between two temperature sites.

Preparing the Patient for Temperature Measurement

1. Follow the manufacturer's instructions for probe application and instructions.
2. Connect the single or dual temperature cable to the acquisition module connector.
3. Check that the temperature value is displayed when the probe is connected to a single or dual temperature cable.

Temperature Measurement on the Monitor

Up to four temperature measuring sites can be simultaneously measured and monitored (five sites when monitoring Tblood). Temperature monitoring provides numerics only. No waveform is generated or displayed.

The default temperature measuring site labels are as follows:

Label	Site
T1, T2	General label
T3, T4	General label
Eso	Esophageal
Naso	Nasal
Tymp	Tympanic
Rect	Rectal
Skin	Skin
AirW	Airway
Room	Room
Myo	Myocardial
Core	Core
Surf	Surface
Blad	Bladder

Using the Temperature Setup Menu

The following tasks are all initiated from the ***Temperature Setup*** menu. You can access the Temperature Setup menu by selecting the temperature parameter window.

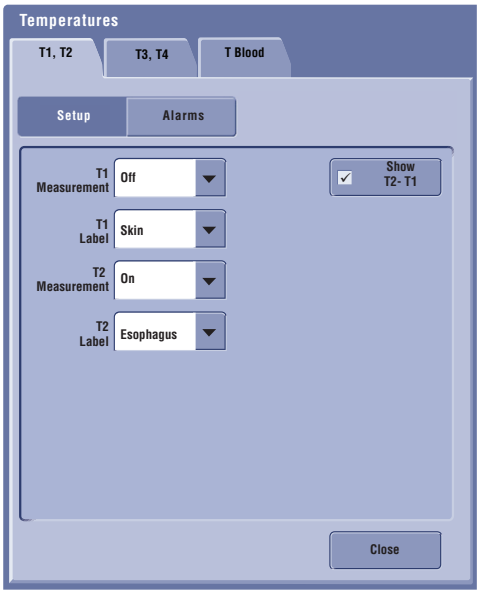


Figure 11.1 T1, T2 setup menu

Starting the Temperature Measurement

Connect the temperature probe to start the measurement. If the parameter window displays ***Off*** in the value field:

1. Select the ***temperature*** parameter window.
2. Confirm that ***Measurement*** > ***On*** is selected.

Changing the Temperature Site Label

1. Select the ***temperature*** parameter window.
2. Choose a site label from the ***Label*** list.

Displaying the Delta Value Between Two Temperature Channels

Note! *This selection is available when two temperatures are displayed in the same temperature parameter window.*

1. Select the ***temperature*** parameter window.
2. Select ***Show Tx-Ty*** (e.g., ***T2-T1***).

Stopping the Temperature Measurement

1. Select the ***temperature*** parameter window.
2. Select ***Measurement*** > ***Off***.

Setting Temperature Alarms

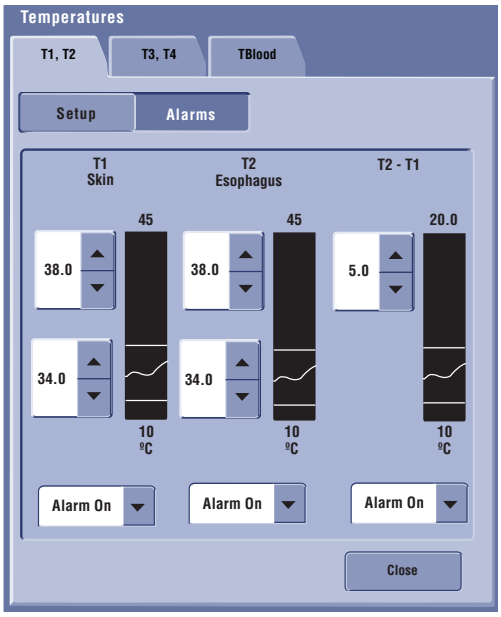


Figure 11.2 Temperature alarm

1. Select the ***temperature*** parameter window.
2. Select ***Alarms.***
3. Choose a temperature channel or temperature delta. If the feature is not active, the alarm limits are greyed out. Select ***Alarm On*** to set the alarms.
4. Set the alarm limits.

Note! *The high limit alarm setting for delta values is also adjustable. If the setting of an alarm limit has been disabled during configuration, the setting is marked with a lock symbol.*

Check Your Knowledge: Temperature



1. Is there a waveform associated with a temperature measurement?
2. What would you do if you wanted to measure temperature but the temperature parameter window displays Off in the value field.
3. How would you change the T1 measurement label?

Hands on Activity: Temperature



1. Turn the temperature measurement off and on.
2. Change a temperature site label.
3. Change a temperature alarm limit.

12 Invasive Pressure

Objectives: Invasive Pressure



By the end of this chapter you should be able to:

- Setup an invasive pressure measurement
- Zero an invasive pressure transducer
- Access the invasive pressure setup menu and change a setting
- Access the invasive pressure advanced menu and change a setting
- Change an invasive pressure alarm limit
- Utilize the PA catheter insertion menu
- Perform an automated and manual PCWP measurement

Terms You Should Know: Invasive Pressure



ABP: Arterial blood pressure

Art: Arterial. Usually refers to arterial pressure or an arterial line.

Channel: Each independent invasive pressure measurement is associated with a specific physical connection from the patient to the acquisition device. This is referred to as a channel. Each channel is associated with an invasive pressure name.

CPP: Cerebral perfusion pressure. CPP = Art (mean) - ICP (mean)

CVP: Central venous pressure.

Dia: Diastolic pressure

IABP: Intra-aortic balloon pump

ICP: Intracranial pressure

IP: Invasive Pressure

Mean: Mean pressure

MAP: Mean arterial pressure

P1-P8: Non-specific site name for the invasive pressure channels 1-8.

PA: Pulmonary artery, also called PA pressure

PCWP: Pulmonary capillary wedge pressure, also called wedge pressure.

Sys: Systolic pressure

Transducer: A device that converts the pressure signal to a voltage. The monitor interprets the voltage signal so that pressure data and pressure waveforms can be displayed.

UAC: Umbilical arterial catheter

UVC: Umbilical venous catheter

Invasive Pressure Measurement Setup

Invasive Pressure Equipment to Patient Connection

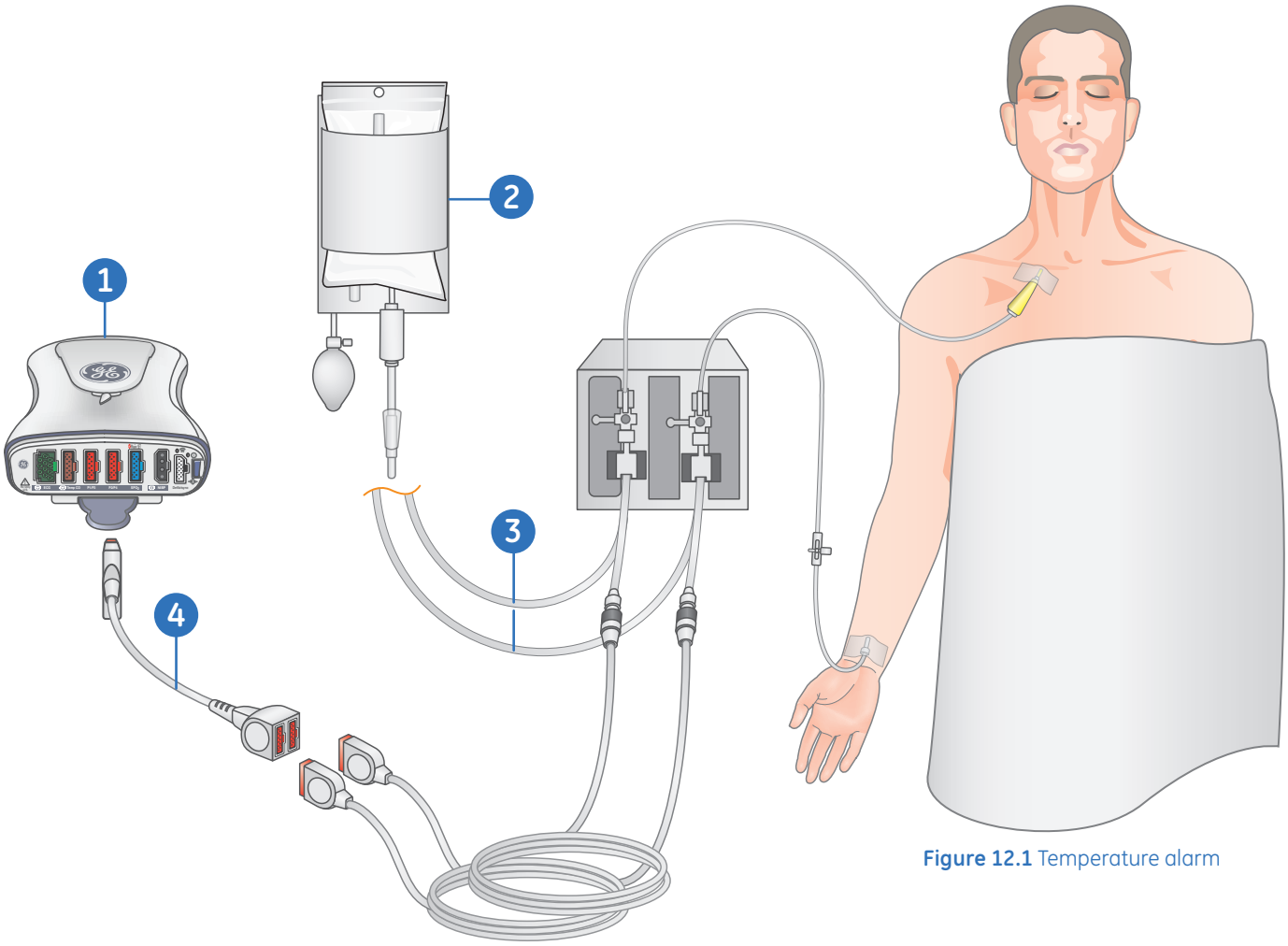


Figure 12.1 Temperature alarm

1. Module with invasive pressure measurement capability
2. Fluid bag with pressure infusor
3. Transducer setup
4. Invasive blood pressure adapter cable; single or dual cable (optional)

Invasive pressure Module Keys

There are invasive pressure keys on the following modules:

Module	Key	Functionality
E-modules	**Zero P1** to **P8**	Zeros the reference for each pressure transducer individually.
PDM		Zeros the reference for all pressure transducers connected to the PDM.

Selecting the Display Mode for Invasive Pressure Waveforms

You can select the invasive pressure waveforms to be shown as individual waveforms, or in a combined view.

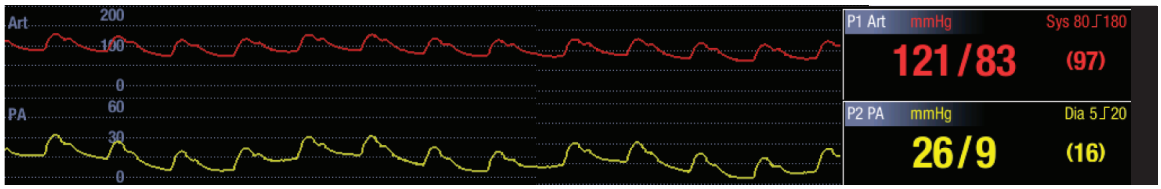


Figure 12.2 Individual waveforms

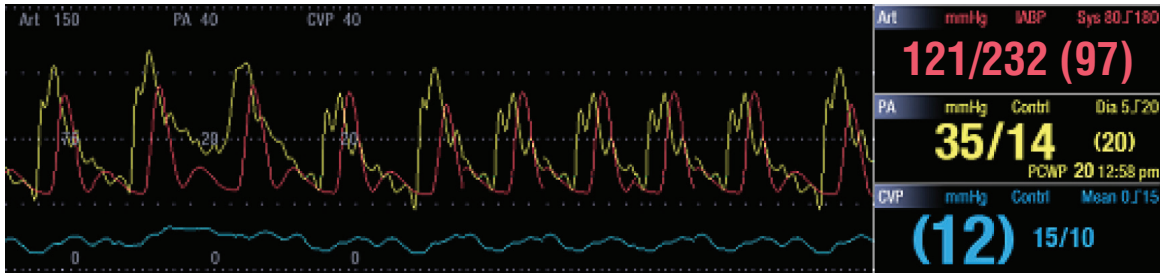


Figure 12.3 Combined waveforms

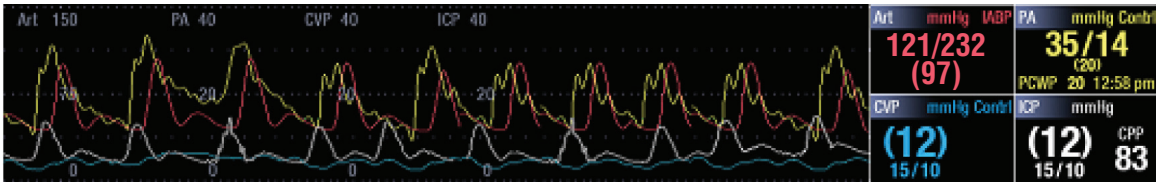


Figure 12.4 Four invasive pressure waveforms (4invP)

1. Select ***Monitor Setup > Screen Setup.***
2. B850 and B450 with the Double Video license: Select ***Screen 1*** or ***Screen 2*** tab.
3. Select ***Upper Parameter Area.***
4. Select an option from the ***Invasive Pressure Waveforms*** list:
5. To view individual waveforms, select ***Individual***.
6. To combine the currently displayed adjacent waveforms (2 to 4), select ***Combined***. The new waveform field will use the combined height of the original fields.
7. To combine up to four waveforms in one field, select ***4invP***. The new waveform field will use the height of two upper parameter windows.

Zeroing Invasive Pressure Transducers

Pressures can be zeroed individually by selecting ***Zero*** on the pressure menu or by pressing the zero key on the modules. You can zero all pressures except ICP by selecting ***Zero All Pressures*** on the main menu.



You can zero all active transducers on the E-modules by pressing each Zero P1 to P8 keys. You can zero all active transducers on the PDM module by pressing the zero all key.

To zero the invasive pressure transducers:

1. Level the transducer following your care unit's policy (usually level of the phlebostatic axis).
2. Close the transducer stopcock to the patient and open the venting stopcock to air.
3. If the pressure line you are trying to zero does not have the transducer open to air, the message ***Pressure Sensed*** displays.
4. You can zero all connected pressure transducers simultaneously by selecting ***Zero All Pressures*** from the monitor's main menu or from the remote control, or you can zero a single active pressure transducer by selecting the invasive pressure parameter window **> Setup > Zero.**
5. Check that a zero reference has been established. Watch the pressure parameter window for messages.
6. Close the venting stopcock to air and open the transducer stopcock to the patient.
7. Check that pressure numerics display on screen.

Note! ***Zero All Pressures*** *does not zero a connected ICP channel. The ICP channel must be zeroed separately. When the* ***Zero ICP separately*** *message displays, you can zero the ICP channel by pressing the* ***Zero P1*** *to* ***P8*** *or zero all module key or by selecting Zero from the ICP Setup menu.*

Using the Invasive Pressure Setup Menu

The following tasks are all initiated from the Invasive Pressure Setup menu. You can access the Invasive Pressure Setup menu by selecting the invasive pressure parameter window and then selecting the ***Setup*** tab.

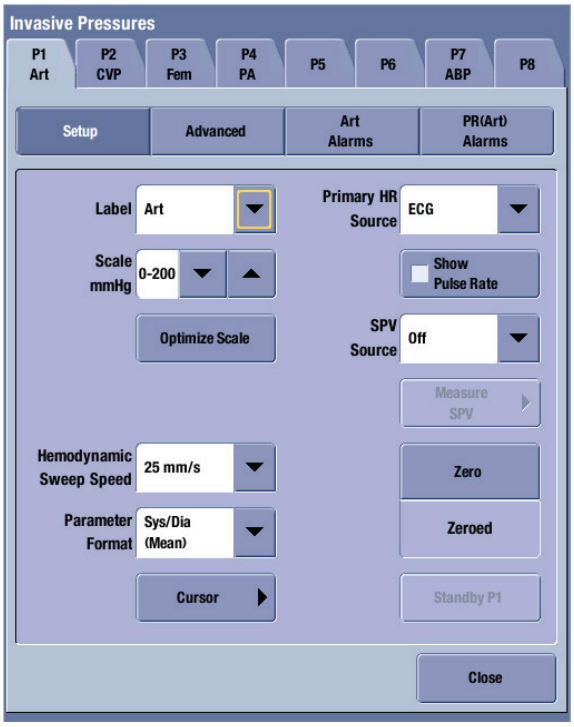


Figure 12.5 Art setup menu for PDM

Selecting an Invasive Pressure Channel Label

One channel label can only be mapped to one channel at a time. If you select a channel label that is already mapped to another channel, the other channel's label will change to the default value.

1. Select the ***Invasive Pressure*** parameter window.
2. Select the ***Setup*** tab.
3. Select a channel label from the ***Label*** list.

Selecting the Size of the Invasive Pressure Waveform

1. Select the ***Invasive Pressure*** parameter window.
2. Select the ***Setup*** tab.
3. Set the waveform scale with the ***Scale*** arrows. The larger the scale value, the smaller the waveform size.

Optimizing the Invasive Pressure Waveform Scale

You can select an automatic calculation for an optimized waveform size. This size will then be used for the local waveform, minitrend, and waveform printouts. Other instances (e.g., information sent to the network), will use the scale selection that is as close as possible to the upper limit of the optimized scale.

The algorithm uses the last four seconds of the waveform data to calculate the scale. If you notice a considerable change in the waveform during that time, wait for the waveform to stabilize and perform the operation again.

1. Select the ***Invasive Pressure*** parameter window.
2. Select the ***Setup*** tab.
3. Select ***Optimize Scale***. The ***Scale*** selection will now show the automatic limit range.



Note! *The Optimize Scale selection will not automatically change to match the waveform; you will have to select it manually every time.*

Selecting the Hemodynamic Waveform Sweep Speed



Note! *This setting adjusts the waveform speed for all of the hemodynamic parameters.*

1. Select the ***Invasive Pressure*** parameter window.
2. Select the ***Setup*** tab.
3. Select a numeric value from the ***Hemodynamic Sweep Speed*** list. The smaller the value, the slower the sweep speed.

Selecting the Displayed Invasive Pressure Format

You can choose to display systolic, diastolic or mean pressure values in different formats.

1. Select the ***Invasive Pressure*** parameter window.
2. Select the ***Setup*** tab.
3. Select the format from the ***Parameter Format*** list:
4. **Mean only:** Only the mean value is shown.
5. **Sys/Dia (Mean):** All values are shown, but the sys/dia values are shown in a bigger font.
6. **(Mean) Sys/Dia:** All values are shown, but the mean value is shown in a bigger font.
7. **Sys/Dia /Mean:** All values are shown in an equally big font.

Selecting Invasive Pressure as the Primary Heart Rate Source

The primary heart rate can be calculated from the ECG leads, SpO_2 measurement, or invasive pressure waveform.

Note! *This setting adjusts the primary heart rate source for all of the hemodynamic parameters and is available for Art, ABP, Fem, or UAC invasive pressure channels only. UAC is only available in the NICU software package. HR Alarms must be configured as Single to enable invasive pressure as the primary heart rate source.*

1. Select the ***Invasive Pressure*** parameter window.
2. Select the ***Setup*** tab.
3. Select the heart rate source from the ***Primary HR Source*** list.

Showing the Pulse Rate in the Invasive Pressure Parameter Window

Note! *This setting is available for Art, ABP, Fem, or UAC invasive pressure channels only.*

1. Select the ***Invasive Pressure*** parameter window.
2. Select the ***Setup*** tab.
3. Select ***Show Pulse Rate***.

Using the IP Channel Standby

If you wish to prepare and zero a channel beforehand, you can use the channel standby.

1. Select the ***Invasive Pressure*** parameter window.
2. Select the ***Setup*** tab.
3. Select ***Standby P1 to Standby P8*** (text changes according to the channel). Channel alarms and measurement are disabled until ***Activate P1 to Activate P8*** is selected, or pressure waveforms are detected.

Using the Invasive Pressure Waveform Cursor

You can display an invasive pressure waveform cursor for the selected invasive pressure channel. The cursor is selectable when a pressure waveform channel is active and using the selected pressure channel. Up to ten pressure points can be saved and displayed. The oldest value, displayed at the top of the list, is discarded in order to save the newest value.

1. Select the ***Invasive Pressure*** parameter window.
2. Select the ***Setup*** tab > ***Cursor.***
3. Select ***Show Cursor.***
4. You can move the cursor to specific points with the arrows.
5. To save the pressure value at the cursor point, select ***Save.***
6. To stop showing the cursor, deselect ***Show Cursor.***

Showing the CPP Value in the ICP Parameter Window

A valid mean arterial pressure is required to compute the cerebral perfusion pressure (CPP) value.

1. Select the ***Invasive Pressure*** parameter window.
2. Select the ***Setup*** tab.
3. Select ***Show CPP.***

Using the Invasive Pressure Advanced Menu

The following tasks are all initiated from the Invasive Pressure Advanced menu. You can access the Invasive Pressure Advanced menu by selecting the invasive pressure parameter window and then selecting the ***Advanced*** tab.

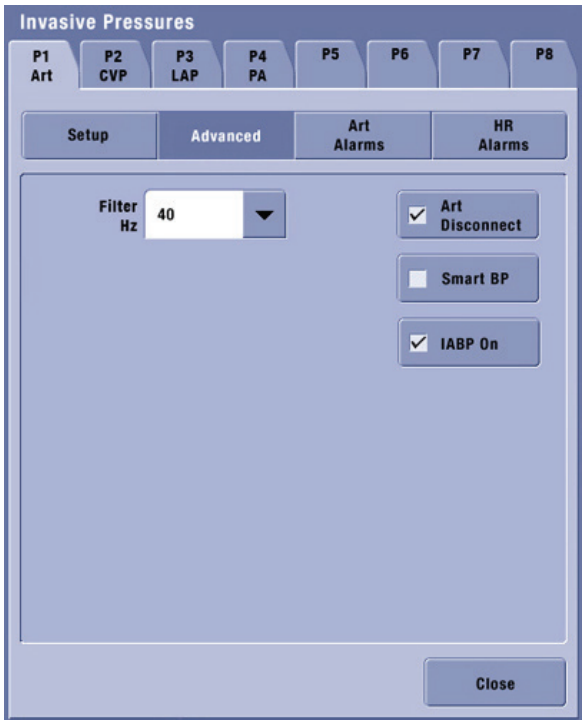


Figure 12.6 Invasive Pressure Advanced Menu

Selecting the Invasive Pressure Noise Reduction Filter

Note! *If arterial pressure is used to trigger the intra-aortic balloon pump, use the 40 Hz pressure filter.*

1. Select the ***Invasive Pressure*** parameter window.
2. Select the ***Setup*** tab.
3. Select a numeric value from the Filter Hz list. The smaller the filter value, the greater the degree of filtering that occurs.

Selecting Smart BP

Note! *PDM, TRAM and Tram-Rac modules only. Art, ABP, and Fem invasive pressure channels only.*

Smart BP is an algorithm that temporarily deactivates the arterial and femoral alarms when it detects the zeroing of a transducer, fast flushing of the system, or blood draws. The message ***Artifact*** displays during the alarm deactivation. When pulsatile pressure returns and 15-20 beats are detected, numerics are displayed and alarms are reactivated.

1. Select the ***Invasive Pressure*** parameter window.
2. Select the ***Advanced*** tab.
3. Select ***Smart BP.***

Compensating for Intra-aortic Balloon Pump (IABP) Waveform Irregularities

Note! *Be sure to turn off the IABP setting when the cardiac assist device is no longer used. Failure to do so could result in incorrect pulse rate readings.*

If you choose to trigger the balloon pump from the monitor, contact the balloon pump manufacturer directly for interface requirements, as they vary among manufacturers. Some trigger modes on certain balloon pump devices may not be compatible with the GE analog output signal, and use may contribute to patient injury or sub-optimal pumping results.

PDM, TRAM, and Tram-Rac modules only. Art, ABP, and Fem invasive pressure channels only.

Please consult the Intra-aortic balloon pump section of the user's reference manual for more information.

1. Select the ***Invasive Pressure*** parameter window.
2. Select the ***Advanced*** tab.
3. Select ***IABP On. IABP*** now displays in the invasive pressure channel parameter window.

Setting an Arterial Invasive Pressure Disconnection Alarm

You can set an additional alarm to activate if the mean pressure falls below 10 mmHg (1.33 kPa). The arterial disconnection alarm also applies to channels ABP, Fem, and UAC.

1. Select the ***Invasive Pressure*** parameter window.
2. Select the ***Advanced*** tab.
3. Select ***Arterial Disconnect***.

Setting Invasive Pressure Alarm Limits

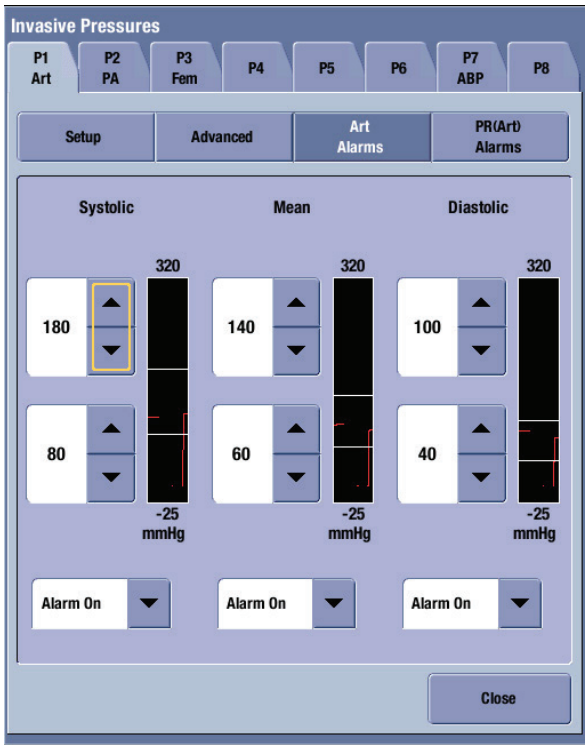


Figure 12.7 Invasive pressure arterial alarms example

1. Select the ***Invasive Pressure*** parameter window.
2. Select the desired alarms setting:
   - **x Alarms** (e.g., **Art Alarms**): Settings for the selected invasive pressure channel.
   - **HR Alarms:** Settings when the heart rate alarms are from a single source.
   - **PR(x) Alarms (e.g., PR(Art) Alarms):** Settings when the heart rate alarms are calculated from multiple sources.
3. Set the alarm limits.

Note! *If a feature is not active, the alarm limits are greyed out. You can set them on by selecting* ***Alarm On****.*

Systolic Pressure Variation and Pulse Pressure Variation

Systolic pressure variation (SPV) and pulse pressure variation (PPV) can provide useful information for example when assessing the effects of fluid therapy on the cardiac output of a patient. A parameter window with both SPV and PPV values appears on the display provided that SPV has been selected to the screen and the arterial site selected as the SPV source is active.

The SPV and PPV measurement is automatic, and SPV can also be taken manually.

With the NICU software package, no automatic SPV or PPV are available, only the manual SPV can be used.

Note! *The SPV and PPV measurements are reliable for mechanically ventilated patients with no arrhythmias, and when the arterial site selected as the SPV source is providing reliable readings.*

Changing the SPV Source

1. Select the ***Invasive Pressure*** parameter window.
2. Select ***Art, ABP, Fem*** or ***UAC.***
3. Select the ***Setup*** tab.
4. Select ***SPV Source > Art, ABP, Fem,*** or ***UAC.*** You can also turn off the measurement by selecting ***Off*** (default).

Measuring SPV Manually

The SPV can also be measured manually. In addition to ECG1 and the selected SPV source, one of the following parameters is displayed in this order: Paw, CO_2, Resp. You can set the SPV cursors to define the difference between the minimum and maximum systolic peak pressures.

1. Select the ***SPV*** and ***PPV*** parameter window.
2. Select ***Freeze Waveforms.***
3. Adjust the cursors with the arrow selectors.
4. You can save these cursors by selecting ***Save.*** This will restart the waveforms. If you do not want to save the cursors, select ***Restart Waveforms.***

Note! *You can also use the* ***Optimize Scale*** *function in the invasive pressure* ***Setup*** *menu to set the scale for manual SVP measurement.*

PA Catheter Insertion

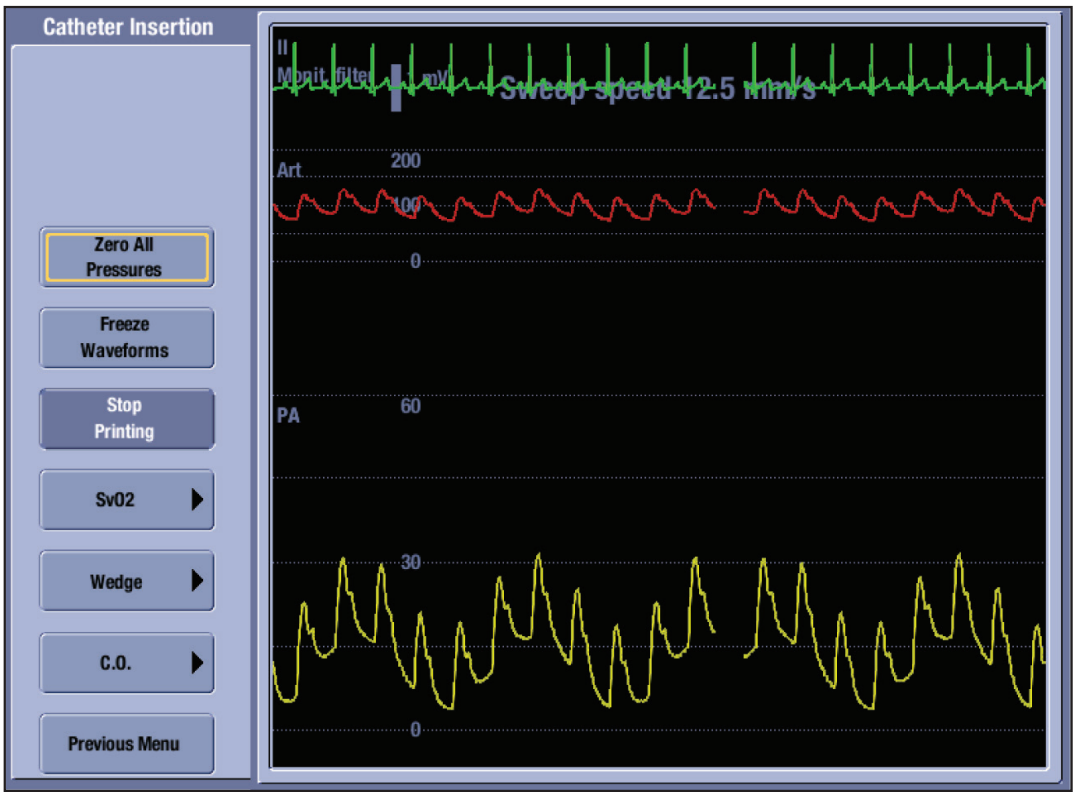


Figure 12.8 Catheter Insertion Menu

The catheter insertion mode optimizes and enlarges the PA waveform field during SWAN-GANZ thermodilution catheter insertion. Waveforms display at a rate of 12.5 mm/s and appear in the following display order: ***ECG1, Art, CVP, PA.***

The arterial priority order is: ***Art, ABP, Fem,*** or ***UAC.***

Selecting the PA Catheter Insertion Mode

1. Select the ***PA Invasive Pressure*** parameter window.
2. Select ***Zero*** to zero the invasive pressure channel.
3. Select ***Catheter Insertion.*** The pressure scale settings in the ***Catheter Insertion*** menu follow the scale settings in the ***Setup*** menu.
4. Select the procedure:
   - To start an SvO_2 procedure, select ***SvO_2.***
   - To start a pulmonary capillary wedge pressure procedure, select ***Wedge.***
   - To start a cardiac output procedure, select ***C.O.***

In the ***Catheter Insertion*** menu, you can also freeze or restart the waveforms, and print them:

- To freeze the moving waveforms, select ***Freeze Waveforms.*** At any time, select ***Restart Waveforms*** to restart the waveforms.
- To print the catheter insertion waveforms, select ***Print Waveforms.*** At any time, select ***Stop Printing*** or ***Cancel Printing*** to stop printing the waveforms.

Pulmonary Capillary Wedge Pressure (PCWP) Measurement

You can obtain a PA wedge measurement (PCWP) manually or with the automated wedge program. The manual measurement mode allows you to manually determine the PCWP value. The automated wedge program displays on-screen messages to inflate or deflate the catheter balloon. In either mode, the wedge algorithm then determines the PCWP value. You can confirm this value or adjust the measurement with the provided cursor

Showing the PCWP Value in the PA Window



Figure 12.9 Wedge menu in manual mode - ready to inflate balloon

1. Select the ***PA Invasive Pressure*** parameter window.
2. Select the ***Setup*** tab.
3. Select ***Show PCWP***.

Taking a Manual PA Wedge Measurement

Note! *PDM and TRAM only.*

1. Select the ***PA Invasive Pressure*** parameter window.
2. Select the ***Setup*** tab.
3. Select ***Wedge.***
4. Select ***Mode: Manual.***
5. To record a realtime PA wedge waveform during analysis, select ***Print PA Waveform***. To stop printing, select ***Stop Printing*** or ***Cancel Printing.***
6. Inflate the catheter balloon when the ***Manually "Freeze / Adjust" when ready*** message displays.
7. Select ***Freeze/Adjust*** once the PCWP waveform is displayed. The ***Wedge Complete*** message displays.
8. Deflate the balloon.
9. To adjust the PA wedge value, move the cursor up or down with the ***PCWP / Cursor*** arrows.
10. To save the PCWP value, select ***Confirm Wedge.*** The saved PA wedge value displays in the parameter window and is stored in trends and hemodynamic calculations.
11. To print a PCWP report, select ***Print PA Report.*** To stop printing, select ***Stop Printing*** or ***Cancel Printing.***

The PA wedge report contains 20 seconds of waveform data displayed at a waveform speed of 12.5 mm/s.

Taking an Automated PA Wedge Measurement

1. Select the ***PA Invasive Pressure*** parameter window.
2. Select the ***Setup*** tab.
3. Select ***Wedge.***
4. Select ***Mode: Auto.***
5. To record a realtime PA wedge waveform during analysis, select ***Print PA Waveform.*** To stop printing, select ***Stop Printing*** or ***Cancel Printing.***
6. Inflate the catheter balloon when the ***Inflate the Balloon*** message displays.

   Note! *PDM and TRAM only: Once the PCWP waveform is detected, the* ***Wedge processing*** *message displays.*

   After 10 seconds, the automated wedge program displays the ***Deflate the balloon***, followed by the ***Wedge Complete*** message.
7. To adjust the PA wedge value, move the cursor up or down with the ***PCWP / Cursor*** arrows.
8. To save the PCWP value, select ***Confirm Wedge.***

9. The saved PA wedge value displays in the parameter window and is stored in trends and the hemodynamic calculations.
10. To print a PCWP report, select ***Print PA Report.*** To stop printing, select ***Print Waveforms*** or ***Cancel Printing.***

The PA wedge report contains 20 seconds of waveform data displayed at a waveform speed of 12.5 mm/s.

Starting a New PA Wedge Measurement

You can clear the current wedge measurement and start a new one:

1. Select ***PA Invasive Pressure*** parameter window.
2. Select ***Setup.***
3. Select ***Wedge.***
4. Select ***Restart Wedge.***

Other Selections in the Wedge Menu

There are also two other selections in the Wedge menu:

- ***C.O.:*** This selection will open the C.O. Setup menu.
- ***Calculations:*** This selection will open the Hemo calculations menu.

Intra-aortic Balloon Pump (IABP)

Please refer to the Intra-aortic balloon pump section of the user's reference manual for more information on triggering an IABP.

Check Your Knowledge: Invasive Pressure



1. Why is it important to properly label the pressure channels?
2. Can all invasive pressures be zeroed at the same time?
3. Which menu would you access to change an invasive pressure label?
4. What is Smart BP?
5. How do you access the invasive pressure alarms menu?

Hands on Activity: Invasive Pressure



1. Demonstrate the ability to zero an invasive pressure.
2. Change an invasive pressure label.
3. Change a setting from the invasive pressure setup menu.
4. Change a setting from the invasive pressure advanced menu.
5. Change an invasive pressure alarm limit.

13 Cardiac Output

Objectives: Cardiac Output



By the end of this chapter you should be able to:

- Setup a patient connection for C.O. with an in-line probe and a bath probe
- Enter patient data for the C.I. value
- Take an automatic C.O. measurement
- Take a manual C.O. measurement
- Edit the C.O. average
- Access the C.O. setup menu and adjust a setting
- Change a setting for the Tblood alarm
- Edit a C.O. calculation
- If applicable, utilize the E-PiCCO module to measure CCO

Terms You Should Know: Cardiac Output



Cardiac Output: The volume of blood pumped by the heart per minute.

Cardiac Index: The cardiac output divided by the patient's body surface area.

Computation Constant: A set value that adjusts for catheter size, injectate volume, and injectate temperature.

Injectate: A cool solution (usually saline) that is injected into the heart to measure cardiac output using the thermodilution method.

REF: Right ventricular ejection fraction.

Thermodilution: A method of determining cardiac output by measurement of the change in temperature in the bloodstream after injecting a measured amount of cool fluid.

C.O. Measurement Setup

C.O. Equipment to Patient Connection with an In-line Probe

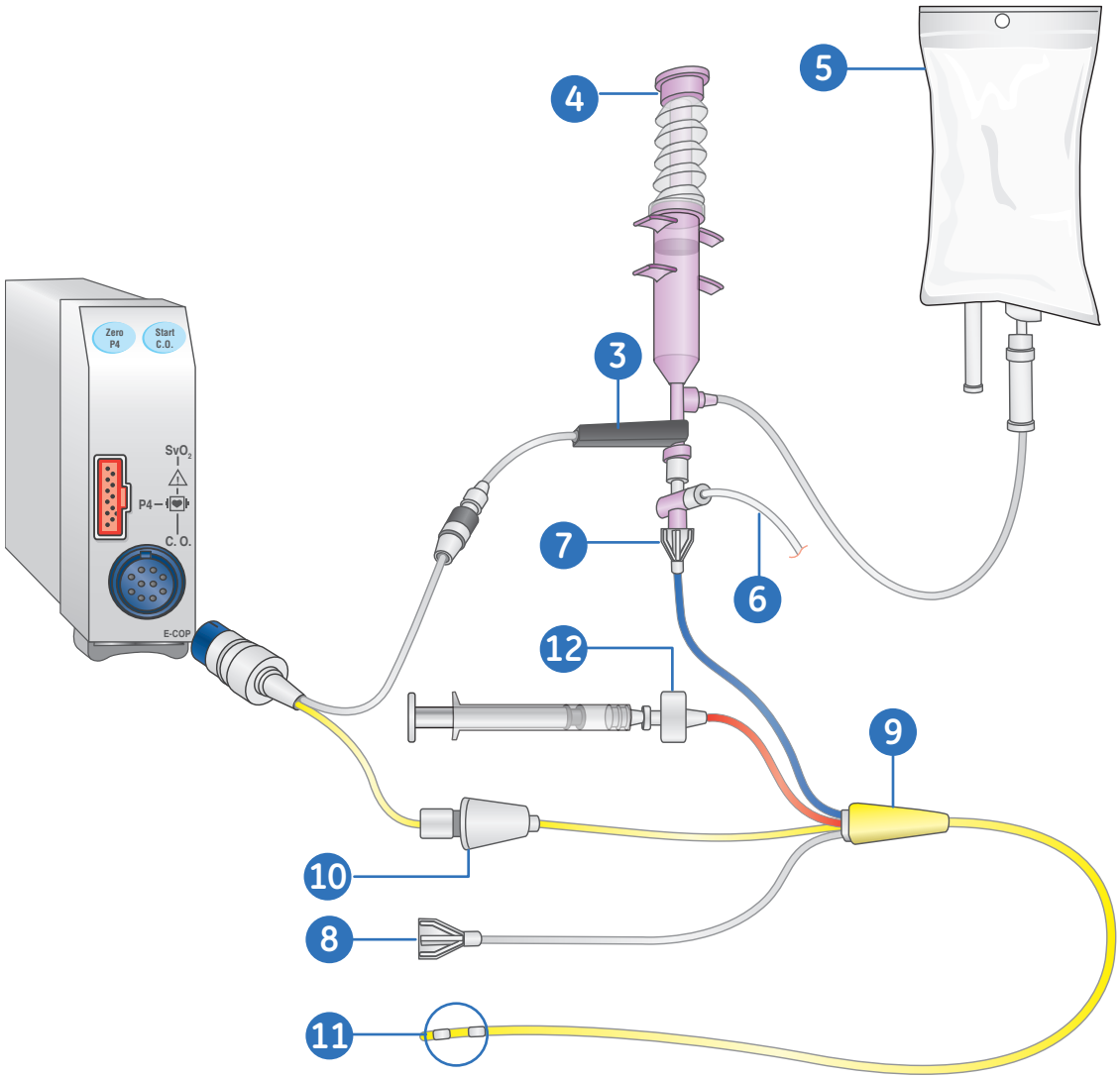


Figure 13.1 Cardiac Output Measurement with In-line Probe

1. Module with C.O. measurement capability
2. Cardiac output cable
3. In-line injectate temperature probe
4. Injectate syringe
5. Injectate solution
6. CVP line to InvBP transducer or fluid infuser
7. Proximal injectate port
8. PA distal port
9. SWAN GANZ® thermodilution catheter
10. Thermistor connector
11. Balloon
12. Balloon inflation valve

Preparing the Patient for Cardiac Output Measurement with a Bath Probe

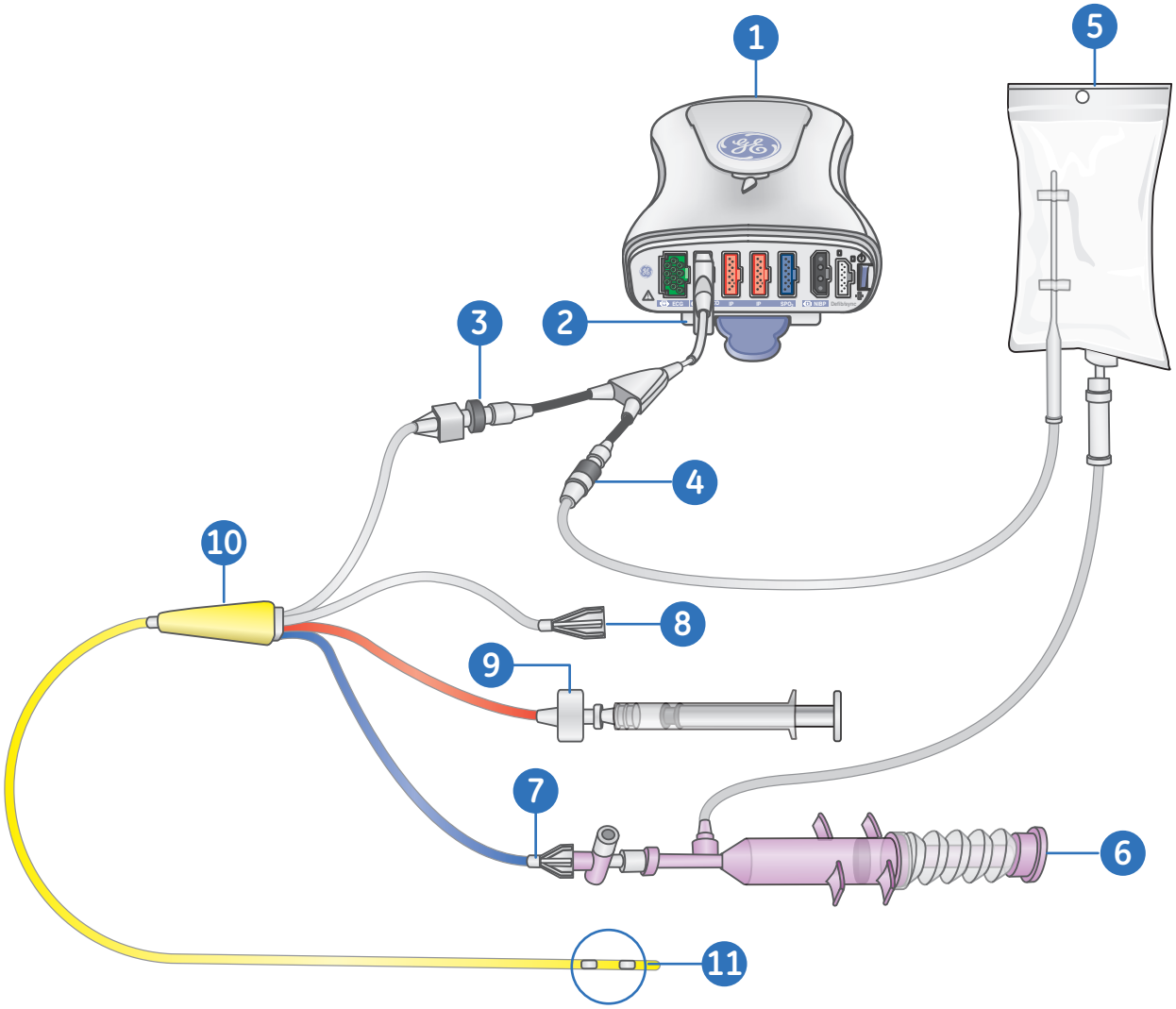


Figure 13.2 Cardiac Output Measurement with Bath Probe

1. Module with C.O. measurement capability
2. Cardiac output cable
3. Thermistor connector
4. Injectate bath probe
5. Injectate solution
6. Injectate syringe
7. Proximal injectate port
8. PA distal port
9. Balloon inflation valve
10. SWAN-GANZ® thermodilution catheter
11. Balloon

Using the C.O. Measurement

C.O. measurements can be taken using the automatic or manual measurement modes. Both measurement modes allow you to use up to six C.O. measurements for calculating a C.O. average.

You can confirm the C.O. measurements within 15 minutes from the start of the first thermodilution measurement, so even if you leave the menu the measurements will not disappear during this time.

Entering Patient Data for the C.I. Value

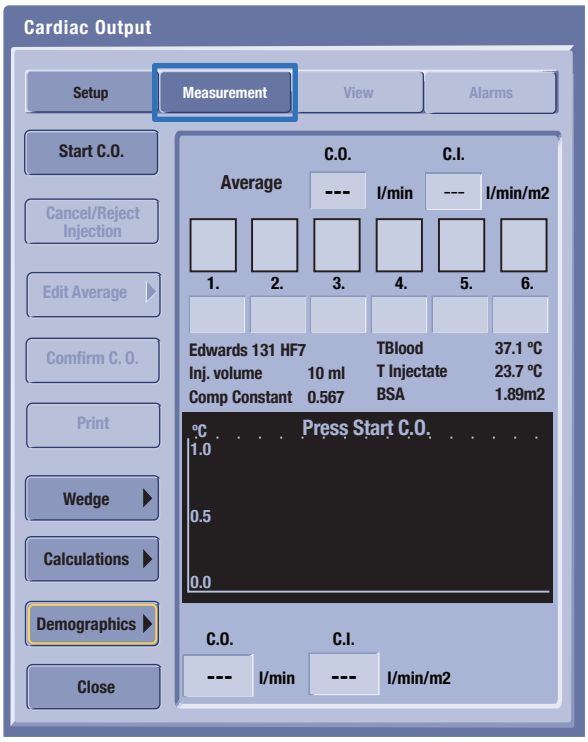


Figure 13.3 Cardiac output procedure menu

The patient's height and weight values are required for determining cardiac index (C.I.).

1. Select the ***cardiac output*** parameter window.
2. Select ***Demographics*** from the ***Measurement*** tab.
3. Set the patient's height and weight. The BSA value is calculated automatically once the height and weight have been selected.
4. You can return to the ***Cardiac Output*** menu by selecting ***Previous*** Menu.

Taking an Automatic C.O. Measurement

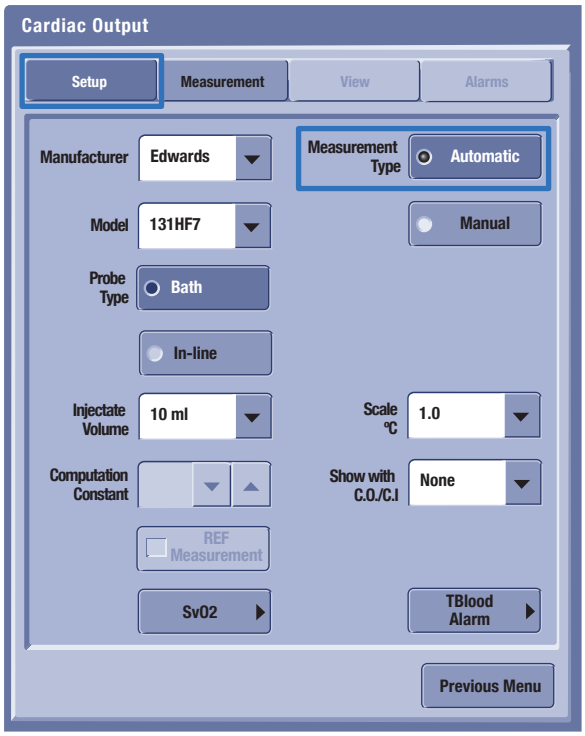


Figure 13.4 Cardiac output setup menu

1. Select the ***cardiac output*** parameter window.
2. Select the ***Setup*** tab.
3. Select the radio button for ***Automatic*** measurement type.
4. Verify that the catheter settings are correct.
5. Select the ***Measurement*** tab.
6. Complete the following:
   a. **PDM and TRAM:** Get ready to inject the injectate solution when the message ***Inject When Ready*** appears.
   b. **E-modules:** When the message ***Press Start C.O. Serial*** appears, select ***Start C.O. Serial.***
7. Inject the injectate solution smoothly within 4 to 5 seconds.
8. The message ***Measuring*** displays, followed by the message ***Please wait until the calculation is completed.***
9. Observe the washout curve displayed on the screen. The message ***C.O. Complete*** displays after the C.O. determination has been made, followed shortly by the message ***Please wait***.

   The curve disappears from the screen when the next measurement cycle can start.
10. To take another C.O. measurement, wait for this message to display before injecting the injectate:
    - **PDM and TRAM:** ***Inject When Ready***
    - **E-modules:** ***Inject now!***

Taking a Manual C.O. Measurement

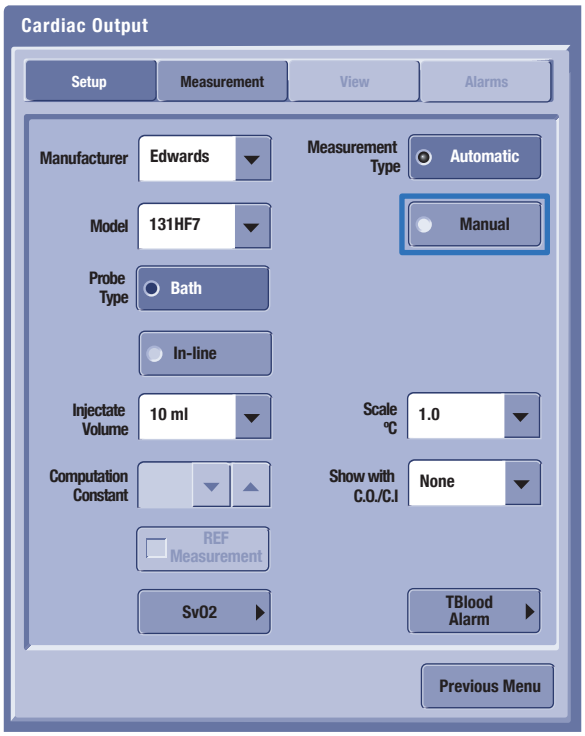


Figure 13.5 Cardiac output setup menu

Measuring C.O. using the manual mode allows you to determine when to begin the injection procedure. This mode may be preferred for patients with extreme blood temperature fluctuations, or when the automatic mode is unable to establish a stable baseline.

1. Select the ***cardiac output*** parameter window.
2. Select the ***Setup*** tab.
3. Select the radio button for ***Manual*** measurement type.
4. Select the ***Measurement*** tab and verify that the catheter settings are correct.
5. Select ***Start C.O.*** With E-modules, you can also use the ***Start C.O***. module key.
6. When the ***Inject now!*** message appears, inject the injectate solution smoothly within 4 to 5 seconds.
7. The message ***Measuring*** displays, followed by the message ***Please wait until the calculation is completed.***
8. Observe the washout curve displayed on the screen. The message ***C.O. Complete*** displays after the C.O. determination has been made, followed shortly by the message ***Please wait.*** The curve remains on the screen.
9. Allow 1 to 1.5 minutes between injections to stabilize the catheter baseline temperature.
10. To perform another C.O. measurement, wait for the ***Press Start C.O***. message to display, then select ***Start C.O***.

C.O. Trial Measurements

A real-time washout curve and numeric value are displayed with each cardiac output trial. Up to six measurements are retained. The program automatically averages each C.O. injection. When saved, the averaged value is entered into the hemodynamic calculations. The last saved average C.O. value is displayed in the parameter window with a timestamp.

Printing a report of C.O. trials:

The C.O. report must be initiated before confirming the C.O. measurements.

1. Select the ***cardiac output*** parameter window.
2. Select the ***Measurement*** tab.
3. Select ***Print.***

The selection is available only if you have not confirmed the C.O. measurements.

Editing the C.O. Average

1. Select the ***cardiac output*** parameter window.
2. Select the ***Measurement*** tab.
3. Select ***Edit Average***.
4. Check the selection boxes for those trials you wish to include in the C.O. average. If you do not wish to include a trial, ensure its selection box is not checked.
5. Select ***Confirm C.O***. to store the calculated C.O. average and display it in the cardiac output parameter window.

   If you wish to print a C.O. report, you must start printing before confirming the C.O.

Canceling a C.O. Measurement

When a C.O. measurement has just completed, you can remove this C.O. measurement trial without entering the Edit Average window.

1. In the Measurement tab, select ***Cancel/Reject Injection***.

   E-modules: In addition to removing the previous measurement, you can also cancel an in-process measurement.

C.O. Catheter Selections

You can select a cardiac output catheter from a list of default catheters and preconfigured catheters, or enter a catheter for temporary use.

Selecting a C.O. catheter from the list:

1. Select the ***cardiac output*** parameter window.
2. Select the ***Setup*** tab.
3. Select a catheter name from the ***Manufacturer*** list.
4. Select a catheter model from the ***Model*** list.

Entering a user-defined C.O. catheter:

All user-defined catheter settings are erased when the monitor is discharged.

1. Select the ***cardiac output*** parameter window.
2. Select the ***Setup*** tab.
3. Select ***User Defined*** from the ***Manufacturer*** list.
4. Set the ***Injectate Volume*** to match the value listed on the catheter packaging.
5. Set the ***Computation Constant*** to match the value listed on the catheter packaging:
    - **Ice Cold:** temperature below +6°C.
    - **Room Temp:** temperate above +18°C.
    - Any other injectate temperature value between +6°C and +18°C.

Selecting the C.O. Injectate Probe Type



Note! *PDM and TRAM only. E-modules detect the type of injectate probe automatically.*

1. Select the ***cardiac output*** parameter window.
2. Select the ***Setup*** tab.
3. Select the correct ***Probe Type: Bath*** or ***In-Line.***

Setting a C.O. Right Ventricular Ejection Fraction (REF) Measurement



Note! *E-COP and E-COPSv modules and catheters that support right ventricular ejection fraction measurement only. PDM and TRAM do not provide a REF measurement.*

A valid heart rate is required to take a REF measurement. ECG from a telemetry transmitter cannot be used.

1. Select the ***cardiac output*** parameter window.
2. Select the ***Setup*** tab.
3. Select the check box for ***REF Measurement***.

Selecting the C.O. Scale

This selection sets the upper limit of the waveform scale for the thermodilution waveform fields.

1. Select the ***cardiac output*** parameter window.
2. Select the ***Setup*** tab.
3. Select a value from the ***Scale*** list.

Selecting What to Show with C.O.

This setting affects the contents of the cardiac output parameter window.

1. Select the ***cardiac output*** parameter window.
2. Select the ***Setup*** tab.
3. Select a value from the ***Show with C.O./C.I.*** list: ***None, PCWP, Tblood. With E-COP*** and **E-COPsv** you can also select ***REF.***

   If you have an interfaced device measuring CCO, the list is called Show with CCO/CCI.

Setting the Tblood Alarm

1. Select the ***cardiac output*** parameter window.
2. Select the ***Setup*** tab.
3. Select ***Tblood Alarm.***
4. Set the Tblood alarm limits as required.
5. You can return to the cardiac output menu by selecting ***Previous Menu.***

Adjusting the SvO_2 from the Cardiac Output Menu

Note! *E-modules and catheters supporting the SvO_2 measurement only.*

1. Select the ***cardiac output*** parameter window.
2. Select the ***Setup*** tab.
3. Select ***SvO_2.***
4. Adjust the ***SvO_2*** settings as required.
5. You can return to the cardiac output menu by selecting ***Previous Menu.***

Editing Calculations

When a C.O. measurement has been confirmed, you can access the calculations menu and adjust the hemodynamic, oxygenation, or ventilation calculation values as needed.

1. Select the ***cardiac output*** parameter window.
2. Select the ***Measurement*** tab.
3. Select ***Calculations.***
4. Make necessary changes by selecting the ***Hemo, Oxy***, or ***Vent*** tab and then ***Edit Input***.
5. You can return to the ***Cardiac Output*** menu by selecting ***C.O.*** or ***Previous Menu***.

Adjusting the Wedge from the Cardiac Output Menu

The Wedge selection is available only when there is a confirmed C.O. measurement and an invasive pressure channel has been labeled as PA.

1. Select the ***cardiac output*** parameter window.
2. Select the ***Measurement*** tab.
3. Select ***Wedge***.
4. Adjust the wedge settings as required.
5. You can return to the cardiac output menu by selecting ***Previous Menu***.

Continuous Cardiac Output (CCO) with the E-PiCCO Module

Overview

The E-PiCCO is intended for determination and monitoring of cardiopulmonary and circulatory variables. Cardiac output is determined both continuously through pulse contour analysis and intermittently through thermodilution technique. In addition, the E-PiCCO measures systolic pressure, diastolic pressure and derives mean arterial pressure.

Analysis of thermodilution curve in terms of mean transit time and downslope time is used for determination of intravascular and extravascular fluid volumes. If a patient's weight and height are entered, the compatible patient monitor presents the derived parameters indexed to body surface area.

Points to note:

- Arterial pressure needed for CCO measurement must be assigned to P8
- The patient's height, weight, and gender values are required
- The measurement should be calibrated at least every 8 hours, or when the message ***Re-calibrate*** appears



Note! *The COPSv module cannot be used simultaneously with the E-PiCCO module.*

CCO Equipment to Patient Connection

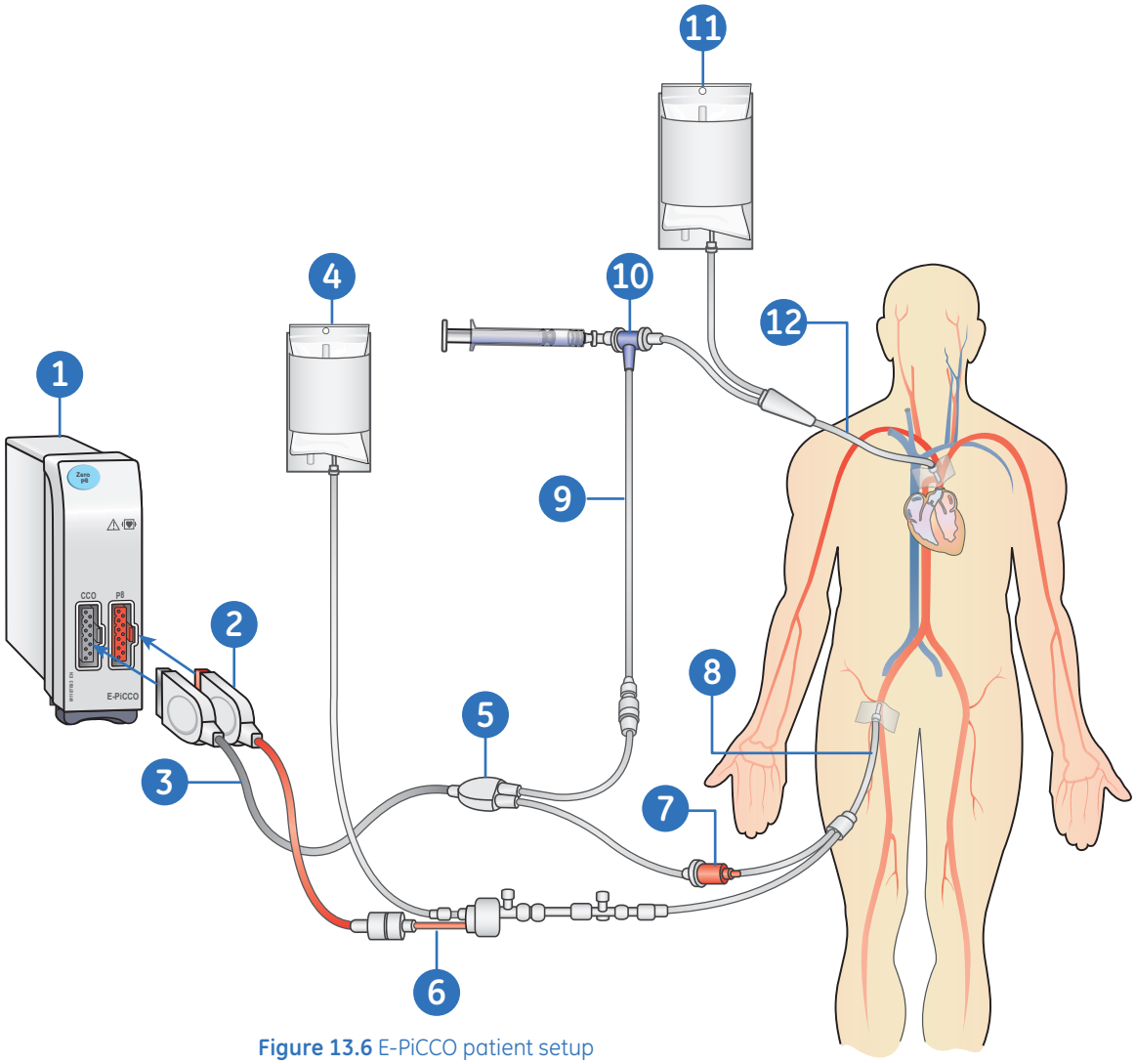


Figure 13.6 E-PiCCO patient setup

1. E-PiCCO module
2. P8 pressure connector and cable (red)
3. CCO connector and cable (gray)
4. Flush (bag of fluids)
5. PiCCO continuous cardiac output cable
6. Disposable pressure transducer
7. Catheter cable connector
8. Thermodilution catheter (PULSIOcath)
9. PiCCO injectate sensor cable
10. Injectate temperature sensor housing
11. Flush (bag of fluids)
12. Central venous catheter

Preparing the CCO Measurement

1. Select measurement accessories according to the patient type.
2. Follow your care unit's policy and procedures for positioning the patient for the CCO measurement.
3. Follow the catheter manufacturer's instructions to set up the patient cables.
4. Insert the PULSIOcath catheter into the patient according to the catheter's instructions for use, and connect the PiCCO injectate sensor cable to the CV line.
5. Connect the PULSIOcath catheter to the continuous cardiac output cable and the invasive pressure cable.
6. Connect the injectate sensor cable to the PiCCO injectate sensor cable.
7. Check that the monitor recognizes cable connections (activates the display) and all ***Cardiac Output/CCO*** menu selections are available.
8. Check that the P8 invasive pressure has been zeroed.

Using the CCO Measurement

Entering Patient Data for the C.I./CCI Value

The patient's height, weight, and gender values are required for determining cardiac index (C.I.) and continuous cardiac index (CCI), as well as other indexed values.

1. Select the ***cardiac output*** parameter window.
2. Select ***Demographics*** from the Calibrate tab.
3. Select the patient's gender from the ***Gender*** list.
4. Set the patient's height and weight. The BSA value is calculated automatically once the height and weight have been selected.
5. You can return to the ***Cardiac Output/CCO*** menu by selecting ***Previous Menu***.

C.O. Measurement Modes

C.O. measurements for calibration can be taken using the automatic or manual measurement modes. Both measurement modes allow you to use up to six C.O. measurements for calculating a C.O. average.

You can confirm the C.O. measurements within 15 minutes from the start of the first thermodilution measurement, so even if you leave the menu the measurements will not disappear during this time.

Using automatic C.O. measurement for calibration:

When measuring C.O. using the automatic mode, new measurements can be taken when the Press ***Start C.O. Serial*** message displays.

1. Select the ***cardiac output*** parameter window.
2. Select the ***Setup*** tab.
3. Select the radio button for ***Automatic*** measurement type.
4. Select the ***Calibrate*** tab.
5. When the message ***Press Start C.O. Serial*** appears, select ***Start C.O. Serial***
6. Inject the injectate solution smoothly within 4 to 5 seconds.

   If the injection does not start within one minute from the end of the previous intermediate measurement, the current intermediate measurement will stop.
7. The message ***Measuring*** displays, followed by the message ***Please wait until the calculation is completed***.
8. Observe the washout curve displayed on the screen. The message ***C.O. Complete*** displays after the C.O. determination has been made, followed shortly by the message ***Please wait.***

   The curve disappears from the screen when the next measurement cycle can start.
9. To take another C.O. measurement, wait for the ***Inject now!*** message to display before injecting the injectate.

Using manual C.O. measurement for calibration:

Measuring C.O. using the manual mode allows you to determine when to begin the injection procedure. This mode may be preferred for patients with extreme blood temperature fluctuations, or when the automatic mode is unable to establish a stable baseline.

1. Select the ***cardiac output*** parameter window.
2. Select the ***Setup*** tab.
3. Select the radio button for ***Manual*** measurement type.
4. Select the ***Calibrate*** tab.
5. Select ***Start C.O.***
6. When the ***Inject now!*** message appears, inject the injectate solution smoothly within 4 to 5 seconds.

   If the injection does not start within one minute from selecting ***Start C.O.***, the measurement will stop.
7. The message ***Measuring*** displays, followed by the message ***Please wait*** until the calculation is completed.
8. Observe the washout curve displayed on the screen. The message ***C.O. Complete*** displays after the C.O. determination has been made, followed shortly by the message ***Please wait***. The curve remains on the screen.
9. Allow 1 to 1.5 minutes between injections to stabilize the catheter baseline temperature.
10. To perform another C.O. measurement, wait for the ***Press Start C.O.*** message to display, then select ***Start C.O.***

C.O. Trial Measurements

A real-time washout curve and numeric value are displayed with each cardiac output trial. Up to six measurements are retained. The program automatically averages each C.O. injection. When saved, the averaged value is entered into the hemodynamic calculations. The last saved average C.O. value is displayed in the parameter window with a timestamp.

Printing a report of C.O. trials with E-PiCCO:

The C.O. report must be initiated before confirming the C.O. measurements.

1. Select the ***cardiac output*** parameter window.
2. Select the ***Calibrate*** tab.
3. Select ***Print.*** The selection is available only if you have not confirmed the C.O. measurements.

Canceling a C.O. Measurement with E-PiCCO

When a C.O. measurement has just completed, you can remove this C.O. measurement trial without entering the ***Edit Average*** window.

1. In the ***Calibrate*** tab, select ***Cancel/Reject Injection***.

   In addition to removing the previous measurement, you can also cancel an in-process measurement.

Editing the C.O. Average with E-PiCCO

1. Select the ***cardiac output*** parameter window.
2. Select the ***Calibrate*** tab.
3. Select ***Edit Average***.
4. Check the selection boxes for those trials you wish to include in the C.O. average. If you do not wish to include a trial, ensure its selection box is not checked.
5. Select ***Confirm C.O. & Calibrate*** to store the calculated C.O. average and display it in the cardiac output parameter window.

   This will start the continuous measurements of ***CCO, CCI, SVR, SVRI, SVV, SV, SVI,*** and ***PPV.*** It will also open the ***Numerical*** view.

   However, note that other values ***(C.O., C.I., GEDV, GEDI, ITBV, ITBI, EVLW, ELWI,*** and ***CFI***) are not measured continuously.

   If you wish to print a C.O. report, you must start printing before confirming the C.O.

Automatic Catheter Identification

With E-PiCCO, catheters are automatically identified. This is indicated on the ***Setup*** tab with the text ***Catheter*** followed by the catheter name.

If the catheter is not identified, the text ***Faulty Catheter*** is displayed. If no catheter is connected, the text ***No catheter*** is displayed.

Selecting the Measurement Site for E-PiCCO

1. Select the ***cardiac output*** parameter window.
2. Select the ***Setup*** tab.
3. Select the measurement site: ***Femoral***, ***Brachial***, or ***Axillary.***

Selecting the Patient Type

This setting is not related to other patient Demographics settings.

1. Select the ***cardiac output*** parameter window.
2. Select the ***Setup*** tab.
3. Select a value from the ***Patient Type*** list: ***Adult*** or ***Pediatric***.

Selecting the Injectate Volume

1. Select the ***cardiac output*** parameter window.
2. Select the ***Setup*** tab.
3. Select a value from the ***Injectate Volume*** list.

Selecting the CVP Source

1. Select the ***cardiac output*** parameter window.
2. Select the ***Setup*** tab.
3. Select a value from the ***CVP Source*** list: ***Manual*** or ***Auto***.

Selecting the CVP Value

The initial value will be 5 mmHg or 0.7 kPa according to what has been selected as the blood pressure unit.

1. Select the ***cardiac output*** parameter window.
2. Select the ***Setup*** tab.
3. Set the ***CVP Value*** with the arrows.

Selecting the C.O. Scale

This selection sets the upper limit of the waveform scale for the thermodilution waveform fields.

1. Select the ***cardiac output*** parameter window.
2. Select the ***Setup*** tab.
3. Select a value from the ***Scale*** list.

Selecting What to Show with C.O.

This setting affects the contents of the cardiac output parameter window.

1. Select the ***cardiac output*** parameter window.
2. Select the ***Setup*** tab.
3. Select a value from the ***Show with C.O./C.I.*** list: ***None*** or ***Tblood.***

Selecting Indexed Values

The parameters in the ***Graphical*** and ***Numerical*** views and split screen can be either indexed or non-indexed. The following parameters can be indexed: ***C.I., CCI, SVRI, SVI, ELWI, ITBI***, and ***GEDI.***

E-PiCCO indexed values are available for patients weighing over 15 kg (33 lb) only.

1. Select the cardiac output parameter window.
2. Select the ***Setup*** tab.
3. Select the ***Indexed*** check box to have indexed values.

Setting the Tblood Alarm

1. Select the ***cardiac output*** parameter window.
2. Select the ***Setup*** tab.
3. Select ***Tblood Alarm.***
4. Set the Tblood alarm limits as required.
5. You can return to the cardiac output menu by selecting ***Previous Menu.***

Selecting the Viewing Mode

Parameters measured by E-PiCCO can be displayed in ***Graphical*** or ***Numerical*** view.

1. Select the ***cardiac output*** window.
2. Select the ***View*** tab.
3. Select ***Graphical*** or ***Numerical*** from the ***View*** list.

About the Numerical View

The set of available parameters depends on the license in use. They are grouped in three groups on the screen: ***Flow, Volume,*** and ***Organ Function***. The values can be selected to be indexed or not. The displayed values are the confirmed averaged values of the last calibration measurement. There is also a timestamp beside each confirmed, not continuously measured value, indicating the time when the value was confirmed. The values that are measured continuously do not get a timestamp.

About the Graphical View

The ***Graphical*** view displays a user-selectable number (3 to 7) of parameters as a graph. It will display the label, value, and unit of the selected parameters, and each parameter corresponds to a sector in the circle.

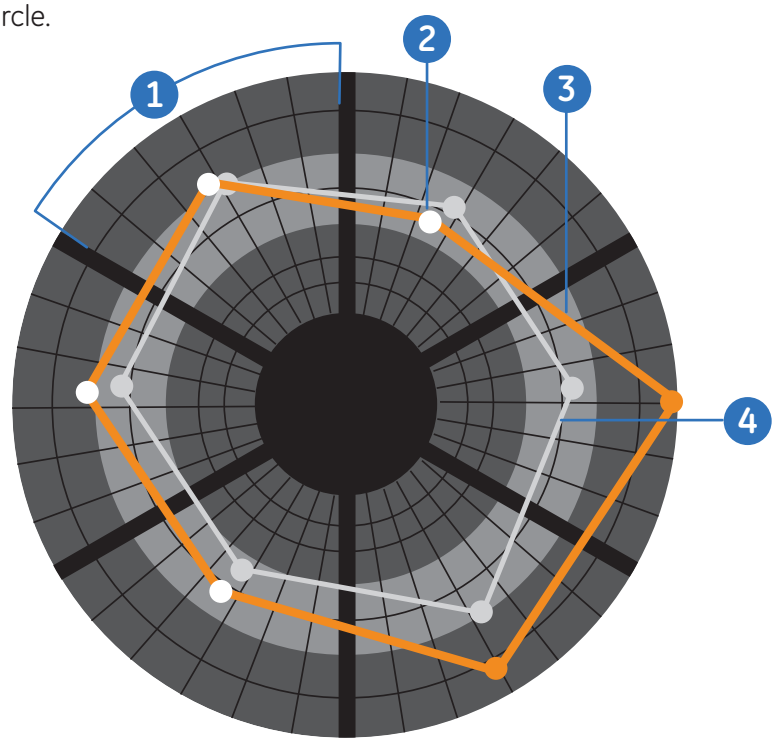


Figure 13.7 Graphical view

1. Parameter sector
2. Parameter value displayed as a white dot. If values are on the limit of or outside the target zone, the dots are orange.
3. Lines connecting the parameter value dots. If values are inside the target zone, the lines are green. If values are outside the target zone, lines are orange.
4. Target zone. Describes the normal range of the parameter values. ***HR***, ***SpO_2***, ***P8***, ***CVP***, ***CCO***, and ***CCI*** have alarm limits and their normal ranges correspond to these alarm limits. Other parameters' normal ranges are user-selectable.

Configuring Parameters

You can configure 3 to 7 numeric parameters to appear in the Graphical view. Each parameter will correspond to one sector.

1. Select the ***cardiac output*** parameter window.
2. Select the ***View*** tab.
3. Select ***Configure.***
4. Select a value from the ***Number of Parameters*** list.
5. Select parameters from the lists ***Numeric 1*** to ***Numeric 7*** according to your needs.

   The parameters will appear in the ***Graphical*** view in the same places as you can see them when configuring: ***Numeric 1*** will be top center, and others in a clockwise sequence in the circle.

Configuring Target Zones

You can configure the upper and lower target zone limits. ***HR, P8, CVP, SpO_2***, and ***CCO/CCI*** follow the alarm limit settings and their target zones cannot be configured separately.

1. Select the ***cardiac output*** parameter window.
2. Select the ***View*** tab.
3. Select ***Configure***.
4. Select ***Target Zones.***
5. Set the ***Upper Target Zone*** and ***Lower Target Zone*** with the arrows.

   If you set either zone to ***Off***, that target zone will correspond to the parameter's maximum or minimum displayed value.

Saving a Graph

You can save the current values of all numerical parameters in the ***Graphical*** view.

You can save six reference graphs at the most. If you try to save more, the message ***Saving will erase 2nd saved graph*** appears. You can continue with the saving, but the second oldest reference graph will then be deleted.

1. Select the ***cardiac output*** window.
2. Select the ***View*** tab.
3. Select ***Graphical*** from the ***View*** list.
4. Select ***Save Graph***.

Selecting a Reference Graph

You can view a previously saved graph as a reference in the ***Graphical*** view.

1. Select the ***cardiac output*** window.
2. Select the ***View*** tab.
3. Select ***Graphical*** from the ***View*** list.
4. Select a graph from the ***Reference Graph*** list.

Erasing a Graph

You can erase unnecessary graphs.

1. Select the ***cardiac output*** window.
2. Select the ***View*** tab.
3. Select ***Graphical*** from the ***View*** list.
4. Select a graph from the ***Erase Graph*** list.

Printing a Page

You can print the currently viewed page.

1. Select the ***cardiac output*** window.
2. Select the ***View*** tab.
3. Select ***Graphical*** or ***Numerical*** from the ***View*** list.
4. Select ***Print Page***.

Selecting Split Screen

You can select the Cardiac Output / CCO split screen. It will show the same content as the ***Graphical*** view. Reference graphs are not shown and parameter units and values are shown below the graph.

1. Select ***Monitor Setup*** > ***Screen Setup.***
2. B450 and B850 with the Double Video license: ***Select Screen 1*** or ***Screen 2***.
3. Select ***Split Screen***.
4. Select ***CCO*** from the dropdown list.

Selecting Minitrend

You can select minitrends to be displayed beside the waveforms.

1. Select ***Monitor Setup*** > ***Screen Setup.***
2. B450 and B850 with the Double Video license: ***Select Screen 1*** or ***Screen 2.***
3. Select ***Split Screen.***
4. Select ***Minitrend*** from the dropdown list.

Changing the Graphic Trend Scales with E-PiCCO

1. Select ***Trends.***
2. Select ***Graphic*** from the ***View*** list.
3. Select ***Trend Scales***.
4. Select the ***Cardiac Output*** tab.
5. Set the trend scales for ***C.O., C.I., SVV, SVRI, SVI, GEDI***, and ***ELWI*** according to your needs.

Setting Alarms

You can set the high and low limit alarms for CCO and CCI. The limits cannot be outside the set Guard limits, which are set in the Care Unit Settings and are password protected.

1. Select the ***cardiac output*** window.
2. Select the ***Alarms*** tab.
3. Select the ***CCI*** and ***CCO*** alarms on or off: select ***Alarm On*** or ***Alarm Off*** according to your needs.
4. After having selected ***Alarm On***, you can adjust the high and low alarm limits with the arrows.

Check Your Knowledge: Cardiac Output



1. Which menu would you access to enter a patient's height and weight for a C.I. value?
2. How do you switch between automatic and manual C.O. measurements?
3. How do you edit the C.O. average?
4. How do you change a catheter selection?

Hands on Activity: Cardiac Output



1. Enter patient data for a C.I. value
2. Switch between automatic and manual C.O. measurement
3. Edit a C.O. average
4. Change a catheter selection
5. Change the Tblood alarm setting
6. Access the calculations menu

14 Airway Gases

Objectives: Airway Gases



By the end of this chapter you should be able to:

- Setup a gas module for gas analysis
- Describe the differences between the CARESCAPE respiratory module, the compact airway module and the E-miniC
- Access the CO_2 setup menu and change a setting
- Access the CO_2 alarms menu and adjust an alarm limit
- If applicable, adjust the FiO_2 and N_2O level
- Access the O_2 setup menu and change a setting
- Access the Agent/N_20 setup menu and change a setting
- If applicable, calibrate the airway module

Terms You Should Know: Airway Gases



End tidal (ET): The level of a gas exhaled at the end of a respiratory cycle, e.g. EtO_2 or $EtCO_2$.

Fraction of inspired (Fi): The level of a gas inspired by the patient, e.g. FiO_2 or $FiCo_2$.

Airway Gases Overview

Points to Note

- If anesthetic agents are present, use GE Healthcare anesthesia sampling lines (PE/PVC). Otherwise, you can use GE Healthcare CO_2 sampling line (PVC).
- Compact airway modules and CARESCAPE respiratory modules: Anesthetic agent identification, MAC or MACage, N_2O and EtBal are available with the anesthetic agent measurement license only. This license is available for OR, PACU, and ICU software packages.
- Make sure that you are using a water trap that is compatible with the module:
- CARESCAPE respiratory modules: D-fend Pro or D-fend Pro+
- Compact airway modules: D-fend or D-fend+
- E-miniC: Mini D-fend

Note! *E-miniC is not suitable for use with patients weighing less than 5 kg (11 lbs)*

- Empty the water trap container as soon as it is more than half full.
- Place the airway adapter between the HME and Y-piece.
- Place the airway adapter with all sampling ports upwards.
- Always check the tightness of all connections.

Make sure that the gas sampling line is properly connected to the water trap and the water trap is properly connected to the airway gas module. Gas leaks in these connections may dilute the gas sample from the patient circuit, thus resulting in erroneous gas readings

Compact airway modules: The message ***Sample line blocked*** may result if you attach the sampling line to the water trap after the monitor has completed the self-check for the module. Attach the sampling lines to the water trap before turning on the monitor.

Setup

Note! *Check that the sample line is connected to the water trap before connecting the module to the monitor or turning on the monitor.*

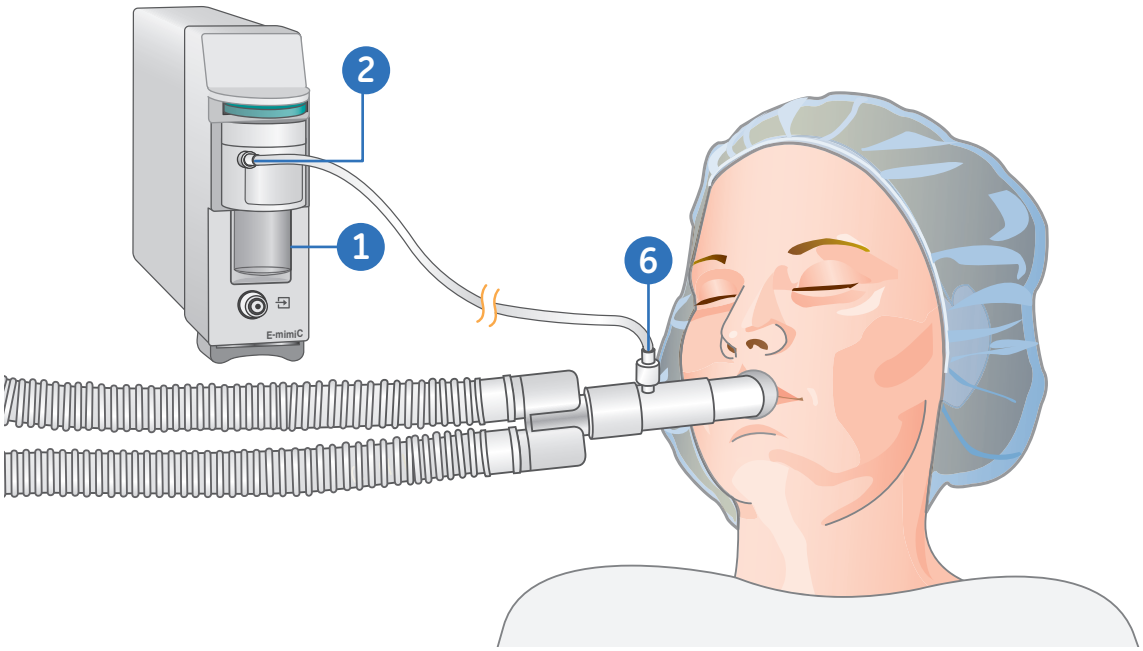


Figure 14.1 Patient connection with the E-miniC module

1. Make sure that the water trap container is empty and properly attached.
2. Connect the gas sampling line to the sampling line connector on the water trap.
3. Connect the sample gas outlet to gas scavenging if N_2O or volatile agents are used.
4. Turn on the monitor or connect the module to the monitor. The monitor performs a self-check for the module when the module is connected. Automatic agent identification is activated in those modules that have this feature.
5. Wait until the message ***Calibrating*** disappears.
6. Connect the sampling line to the airway adapter or the airway adapter to the ventilator circuit. Position the adapter with the sampling port upwards to minimize the amount of condensed water possibly entering the sampling line.
7. Check that the airway adapter connections are tight and that the adapter is operating properly.

Note! *To minimize the amount of dust drawn into the gas sampling system, always keep the water trap connected to the module. When gas measurement is not in use, you can disconnect the module from the monitor to eliminate the operating sound of the gas pump.*

Airway Gas Modules and Connectors

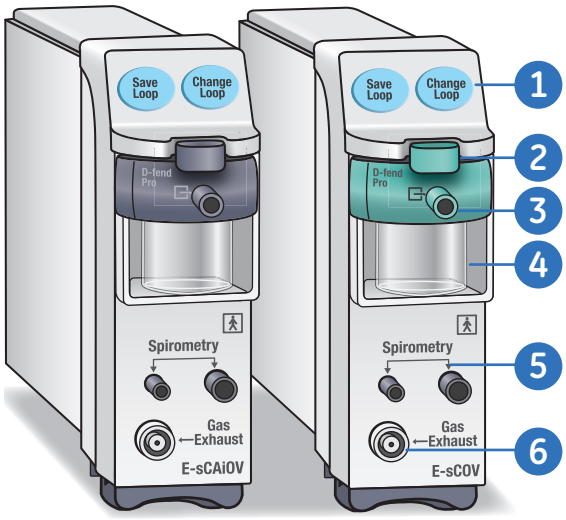


Figure 14.2 CARESCAPE respiratory modules

CARESCAPE Respiratory Module

1. Patient Spirometry keys.
2. Water trap release/locking latch.
3. Gas sample, sampling line connector on the water trap.
4. Water trap container.
5. Connectors for Patient Spirometry tubes.
6. Gas exhaust, connector for the gas exhaust line.

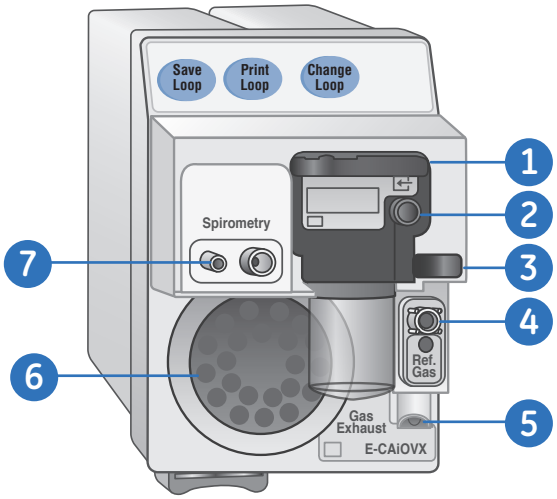


Figure 14.3 Multi-gas E-Module Connectors

Compact Airway Module

Note! *There are two types of D-Fend water traps, D-fend and D-fend+. D-fend+ is green and designed for humid conditions. The D-fend is black and is the standard water trap.*

1. D-fend water trap with washable container.
2. Sampling line connector on the D-fend water trap.
3. Water trap latch.
4. Oxygen reference gas inlet.
5. Sample gas outlet.
6. Cooling fan with dust filter.
7. Connectors for Patient Spirometry only.

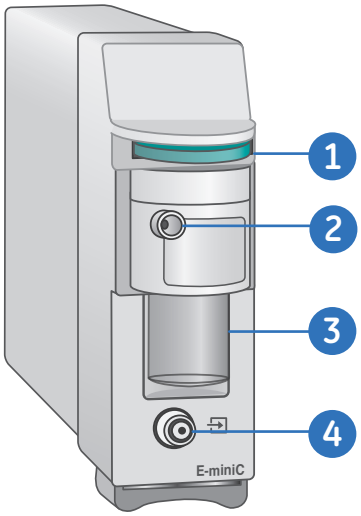


Figure 14.4 E-miniC Module

E-miniC

Note! *E-miniC is not suitable for use with patients weighing less than 5 kg (11 lbs).*

1. Water trap latch.
2. Sampling line connector.
3. Mini D-fend water trap with a washable container.
4. Sample gas outlet.

Using the E-modules for CO_2 Measurement

Available Menu Selections

Note! *Available menu selections may differ according to the modules and/or software packages.*

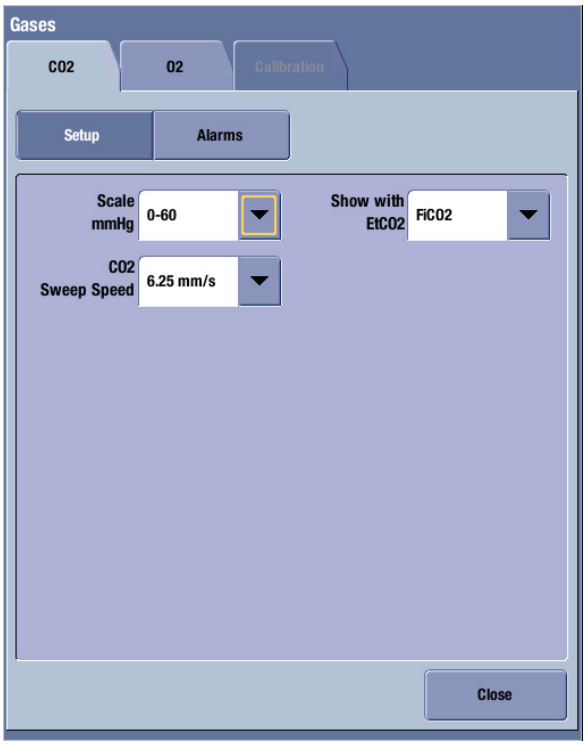


Figure 14.5 CO_2 setup menu example

Selecting the CO_2 Scale

1. Select a gas related parameter window.
2. Select the ***CO_2*** tab > ***Setup***.
3. Select an option from the ***Scale*** list.

Selecting the CO_2 Sweep Speed

1. Select a gas related parameter window.
2. Select the ***CO_2*** tab > ***Setup***.
3. Select an option from the ***CO_2 Sweep Speed*** list. The options are ***0.625 mm/s***, ***50 mm/s***, ***12.5 mm/s***, ***25 mm/s***, and ***50 mm/s***. The smaller the value, the slower the sweep speed.

Selecting What to Show with $EtCO_2$

You can select which other gas measurement value appears in the parameter window with the ***$EtCO_2$***.

1. Select a gas related parameter window.
2. Select the ***CO_2*** tab > ***Setup***.
3. Select an option from the ***Show with $EtCO_2$*** list.

Setting CO_2 Limit Alarms

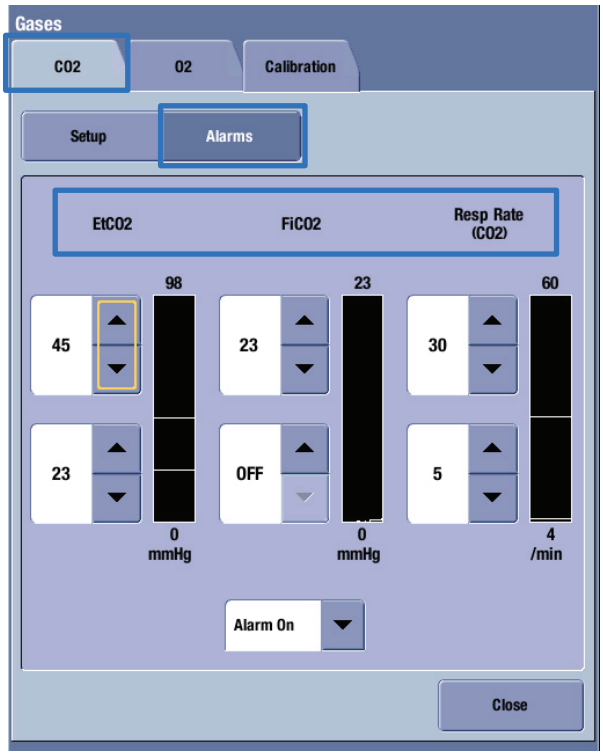


Figure 14.6 CO_2 alarms menu example

1. Select a gas related parameter window.
2. Select the ***CO_2*** tab **>** ***Alarms.***
3. Set high and/or low limit values for ***$EtCO_2$, $FiCO_2$*** and ***Respiration Rate.***

Deactivating the Apnea Alarm

Note! *This feature is meant to be used when ending CO_2 monitoring. It should not be used during active CO_2 monitoring. This setting can be enabled during configuration. If it has been enabled, there will be a selection in the CO_2 Setup menu that allows you to deactivate the alarm.*

1. Select a gas related parameter window.
2. Select the ***CO_2*** tab **>** ***Setup.***
3. Select ***Deactivate Apnea Alarm.***

Note! *When the alarm is deactivated, there will be no audible or visual Apnea alarm indications. The alarm is automatically reactivated if CO_2 vitals signs are detected and alarm condition is met again.*

Selecting the FiO2 and N2O Level

Note! *FiO_2 and N_2O compensations must be selected manually when E-miniC is used. E-miniC and the anesthetic agent measurement license only. Available for OR, PACU, or ICU software packages.*

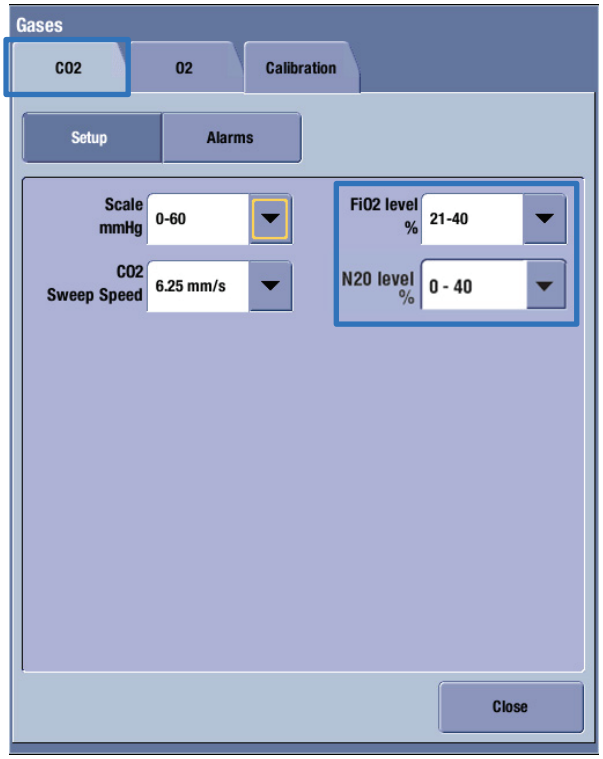


Figure 14.7 FiO_2 and N_2O level example

1. Select a gas related parameter window.
2. Select the ***CO_2*** tab **>** ***Setup.***
3. Select an option from the ***FiO_2*** or ***N_2O*** level list.

O2 Measurement

CARESCAPE Respiratory Modules and Compact Airway Modules

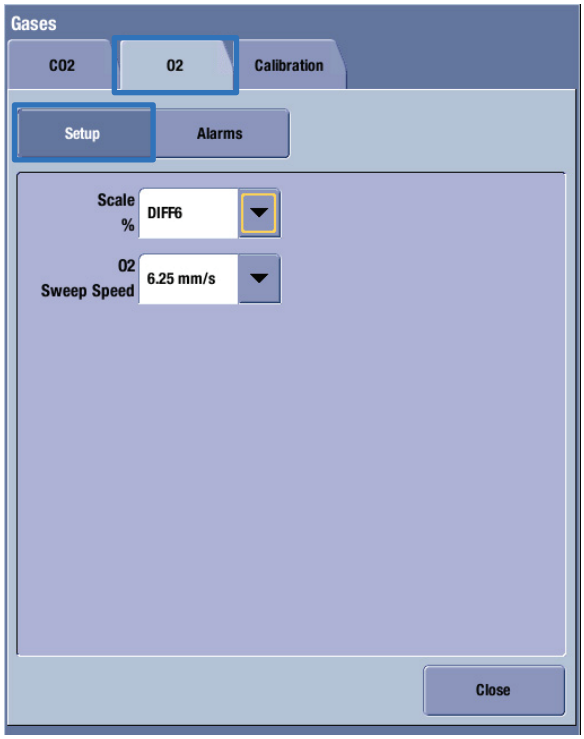


Figure 14.8 O_2 setup menu example

Selecting the O_2 scale:

1. Select a gas related parameter window.
2. Select the ***O_2*** tab **>** ***Setup.***
3. Select an option from the ***Scale*** list.

Selecting the O_2 Sweep Speed:

1. Select a gas related parameter window.
2. Select the ***O_2*** tab **>** ***Setup.***
3. Select an option from the ***O_2 Sweep Speed*** list. The options are ***0.625 mm/s***, ***6.25 mm/s***, ***12.5 mm/s***, and ***50 mm/s***.

Setting O_2 alarms:

1. Select a gas related parameter window.
2. Select the ***O_2*** tab **>** ***Alarms***.
3. Check that the required alarm (***EtO_2*** or ***FiO_2***) is on, and set its high and/or low limit values.

AA and N2O Measurement

Selecting the Agent Scale

Every anesthetic agent has its own default scale that the monitor uses when detecting the agent. You can change the scale of an agent if the amount used is higher than the default scale.

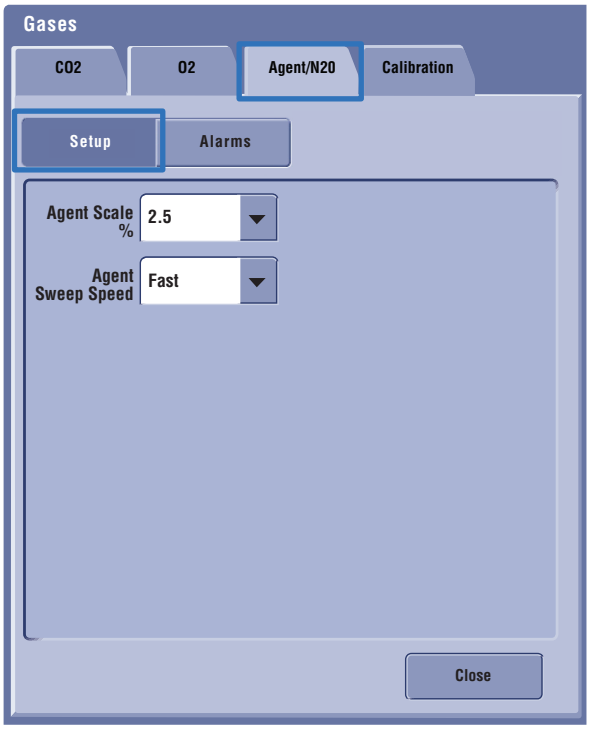


Figure 14.9 Agent/N_2O setup menu

1. Select a gas related parameter window.
2. Select the ***Agent/N_2O tab*** > ***Setup.***
3. Select an option from the ***Agent Scale*** list.

Setting Agent Limit Alarms

1. Select a gas related parameter window.
2. Select the ***Agent/N_2O tab*** > ***Alarms.***
3. Check that the required alarm (***EtAA*** or ***FiAA***) is on, and set its high and/or low limit values.

Calibrating Airway Gases

Perform calibration every six months in normal use, once every two months in continuous use, and whenever there are indications of errors in the gas readings to ensure that the measurement accuracy remains within specifications.

Note! *Make sure that you are using a correct GE Healthcare calibration gas, see the CARESCAPE Modular Monitors Supplemental Information Manual. Do not use any other calibration gases.*

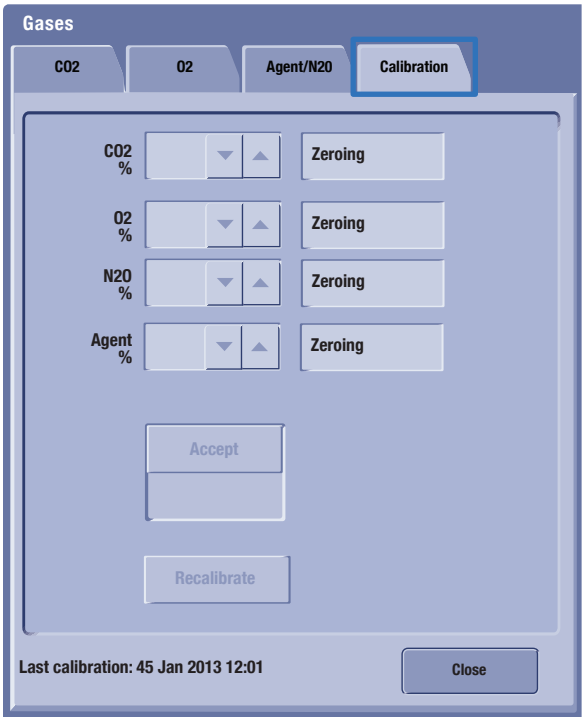


Figure 14.10 Calibration menu

1. Turn on the patient monitor. For maximum accuracy, let the monitor warm up for 30 minutes.
2. Attach a regulator to the calibration gas cylinder.
3. Attach a new sampling line to the water trap. Connect the other end of the sampling line to the regulator on the gas container.
4. Select a gas related parameter window > ***Calibration*** tab.
5. Wait until the messages ***Zero OK*** and ***Feed gas*** appear after each gas on the screen.
6. Open the regulator and feed gas until the message ***Adjust*** appears, then close the valve.
7. Check that the displayed values match the values on the calibration gas container.
8. Adjust if necessary:
   a. Select the first gas to be adjusted.
   b. Adjust the value until it matches the desired value on the gas container.
9. Confirm by selecting ***Accept***.
10. If the calibration is successful, the message ***Calibration OK*** is displayed for a few seconds. If the calibration fails, the message ***Calibration error*** appears instead. In this case, start a new calibration by selecting ***Recalibrate***.

    If the message ***Zero*** error appears, repeat the calibration procedure. If the problem persists, contact authorized service personnel.

Check Your Knowledge: Airway Gases



1. What should be connected to the water trap before connecting the module or turning on the monitor?

2. What is the main difference between the CARESCAPE respiratory module and the compact airway module?

3. What type of compensation must be selected manually with the E-miniC?

Hands on Activity: Airway Gases



1. Setup a gas module for gas analysis
2. Access the CO_2 setup menu and change a setting
3. Access the CO_2 alarms menu and adjust an alarm limit
4. If applicable, adjust the FiO_2 and N_2O level
5. Access the O_2 setup menu and change a setting
6. Access the Agent/N_20 setup menu and change a setting
7. If applicable, calibrate the airway module

15 Trends and Snapshot

Objectives: Trends and Snapshot



By the end of this chapter you should be able to:

- View graphic trends and change the time scale and trend scales
- View numeric trends and change the time interval
- Manually create a snapshot
- Select which alarms will automatically create a snapshot
- View a snapshot and change the time scale and trend scale
- Create an ST snapshot
- View an ST snapshot
- Manually create an event
- View and sort events
- Delete an event
- If applicable, view gas consumption
- Show and then remove a minitrend on the screen

Terms You Should Know: Trends and Snapshot



Event: Events are timestamps that are shown in their own list. An event is created automatically upon an alarm. An event records the time of and reason for its creation. Some events may also record a snapshot.

Graphical trend: Shows the parameter's trend data in a graphical presentation.

High-resolution trend: A licensed option that contains compressed CO_2 and impedance respiration waveforms (10Hz) as well as beat to beat heart rate and mean arterial pressure (6Hz).

Numeric trends pages: Shows the parameter trend data in a numeric format, tabulated.

Snapshot: A set of measured data stored from a certain moment of time. Snapshots can contain waveform clips and graphical trends. You can enable automatic creation of snapshots with arrhythmia alarms as well as manually create them.

ST Snapshot: A snapshot that displays QRS complexes.

Trend: Real-time measurements of a parameter over a certain period of time. If the measurements are saved with constant intervals, it is a continuous trend.

Trend cursor: Enables scrolling the trend data and viewing detailed values from a selected time. There is a trend cursor in graphical and numerical trends and in snapshots. The selected time is common for all cursors.

Trends View

There are six types of trend data to view: ***Graphic, Numeric, Snapshot, ST Snapshot, Event, ST*** and ***Gas Consumption***. The numeric trends include a predefined set of parameters. The graphic trend selections include all parameters that can be used. You can also split the normal screen page so that the left side of the screen continuously shows graphic minitrends beside waveforms.

Graphic Trends



Figure 15.1
Graphic trends view

Viewing Graphic Trends

Graphic trends contain 24 or 72 hours of trend data depending on the trend license. They contain four trend pages, each having up to six fields, with different parameters already pre-configured in the defaults. Five fields can be displayed and six fields printed. The top of each page can be configured to show the highest priority realtime waveform.

1. Select ***Trends***.
2. Select ***Graphic*** from the ***View*** list.
   - To see more parameters, select tabs 1 to 4.
   - To see numeric values of a certain time, move the cursor to that point of time.
     The numeric values are displayed next to the cursor.

Changing the Time Scale of Graphic Trends

1. Select ***Trends***.
2. Select ***Graphic*** from the ***View*** list.
3. Select a time value from the ***Time Scale*** list. The available selections depend on the license in use:
   - Basic settings for all software packages are ***20 minutes, 1 h, 2 h, 4 h, 6 h, 8 h, 10 h, 12 h,*** and ***24 h***.
   - The 72 h license provides the basic settings and additionally ***36 h, 48 h,*** and ***72 h*** selections.
   - The high-resolution license provides basic settings and additionally ***2 minute*** and ***4 minute*** selections.

Changing the Graphic Trend Scales

1. Select ***Trends***.
2. Select ***Graphic*** from the ***View*** list.
3. Select ***Trend*** Scales.
4. Select the ***General, IP/NIBP, Cardiac Output***, or ***Temp*** tab.
5. Set the trend scales for required parameters.

Printing Currently Viewed Graphic Trends

1. Select ***Trends***.
2. Select ***Graphic*** from the View list.
3. Select ***Print Page***.
4. You can stop printing by selecting ***Cancel Printing.***

Printing All Graphic Trend Data

1. Select ***Monitor Setup*** > ***Printing***.
2. Select ***Reports*** > ***Trends.***
3. Select ***Print.***
4. You can stop printing by selecting ***Cancel Printing.***

Resolution

The graphic trend resolution depends on the time scale of the trend. Graphic trends are updated once a minute, when the time scale is 1 hour and greater. For the 20 minute scale, the update rate is 10 seconds.

Note! *High-resolution trend data is not saved over power down situations. This means that data in the 2, 4 and 20 minute time scales is erased. High-resolution trend data is neither sent nor loaded to/from the network (central station) or acquisition modules (PDM and TRAM).*

Numeric Trends

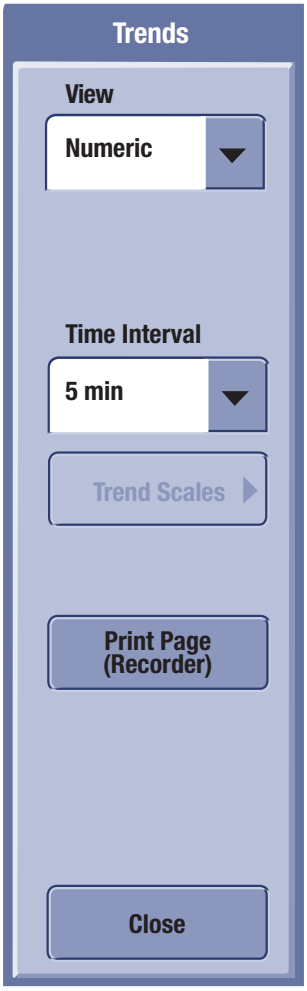


Figure 15.2
Trend menu – Numeric

Viewing Numeric Trends

Numeric trends contain nine pages with 24 or 72 hours of trend data depending on the trend license. The top of the view shows the highest priority realtime waveform. The lowest row, Mark, shows snapshot event numbers. If more than one snapshot has been created in a one-minute period, only the last snapshot event number is shown. You cannot configure the layout of the Numeric trend view.

1. Select ***Trends***.
2. Select ***Numeric*** from the ***View*** list.
    - To see other parameters, select their tabs in the ***Numeric*** trend view.
    - To see more numeric trend data, use the cursor to scroll the data in horizontal direction.

Changing the Time Interval of Numeric Trends

Numeric trends display values according to the selected time interval. Numeric trends are updated with averaged measurement data once a minute independent of the selected time scale.

1. Select ***Trends.***
2. Select ***Numeric*** from the ***View*** list.
3. Select a value from the ***Time Interval*** list.

For example, a 5 minute interval will show data for every 5 minutes, and a 30 minute interval will show data for every 30 minutes. The data is displayed in columns on the screen. NIBP, PCWP, cardiac output, NMT, and manual SPV measurements will always add one column independent of the ***Time Interval*** setting.

Printing Numeric Trends

1. Select ***Trends.***
2. Select ***Numeric*** from the ***View*** list.
3. Select ***Print Page (Recorder).***
4. You can stop printing by selecting ***Stop Printing.***

Snapshots



Figure 15.3
Trends menu – Snapshot

A snapshot is a set of measured data saved from a certain moment of time. Snapshots can contain waveform clips and graphic trends. You can take up to 400 snapshots depending on the data load.

Manually Created Snapshots

You can create a snapshot manually by selecting ***Freeze/Snapshot***. The monitor saves the image of preconfigured waveforms or trends at that moment in time.

When a snapshot is taken manually, it is automatically numbered. A Mark xxx message is shown in the message field (xxx = the sequence number of the snapshot).

This number also appears in the numeric trend view.

Creating Automatic Snapshots

You can select alarms that will automatically create a snapshot independent of their alarm priority.

1. Select ***Trends.***
2. Select ***Snapshot*** from the ***View*** list.
3. Select ***Snapshot Setup.***
4. Select which alarms will automatically create a snapshot.

Viewing Snapshots

1. Select ***Trends.***
2. Select ***Snapshot*** from the ***View*** list.

In the upper right hand corner of the Snapshot view, you can see the time the snapshot was created. Five fields can be displayed on the snapshot page, and six fields can be printed.

Changing the Snapshot Time Scale

1. Select ***Trends.***
2. Select ***Snapshot*** from the ***Trend*** list.
3. Select a time value from the ***Time Scale*** list.

Changing Snapshot Trend Scales

1. Select ***Trends.***
2. Select ***Snapshot*** from the ***View*** list.
3. Select ***Trend*** Scales.
4. Select a parameter tab: General, ***IP/NIBP, Cardiac Output***, or ***Temp.***
5. Select scales for parameters as required.

Printing Snapshot Pages

1. Select **Trends.**
2. Select ***Snapshot*** from the ***View*** list.
3. Select ***Print Page***.
4. You can stop printing by selecting ***Cancel Printing.***

Selecting Snapshots to Print Automatically

1. Select **Trends.**
2. Select ***Snapshot*** from the ***View*** list.
3. Select ***Snapshot Setup***.
4. Select the snapshots to print:
5. **No:** No snapshots print automatically.
6. **Alarms:** Snapshots created by alarms print automatically.
7. **All:** All snapshots print automatically.

ST Snapshots



Figure 15.4
Trends menu – ST Snapshot

Creating ST Snapshots Manually

An ST snapshot displays QRS complexes.

1. Select ***Monitor Setup*** > ***Parameter Setup***.
2. Select ***ECG*** > ***ST.***
3. Select ***Realtime View***.
4. Select ***Save Reference***.

The monitor saves an image of preconfigured waveforms or trends. You can take up to 10 ST snapshots depending on the data load. If there is not enough free memory in the database to create the next ST snapshot without deleting old ST snapshots, the message ***ST snapshot memory full. Oldest ST snapshot erased.*** is displayed.

Viewing ST snapshots

1. Select ***Trends.***
2. Select ***ST-Snapshot*** from the ***View*** list.

On the upper right corner of the ST-Snapshot view, you can see the time the ST snapshot was created. The ST-Snapshot view displays 11 QRS complex windows. The bottom field shows the event time scale and indication box.

Printing ST Snapshots

1. Select ***Trends.***
2. Select ***ST-Snapshot*** from the ***View*** list.
3. Select ***Print Page.***
4. You can stop printing by selecting ***Cancel Printing.***

Events



Figure 15.5
Trends menu – ST Event

Events are timestamps that are shown in their own list. An event is created automatically upon an alarm. An event records the time of and reason for its creation. Some events may also record a snapshot. Manually created events contain only the time and a manually added reason for the event. You cannot configure the Event trend pages.

Automatic Events

An event is created automatically from:

- Medium and high priority physiological or technical alarms.
- Low priority alarms that have a snapshot.
- Manually created snapshots or ST snapshots.

An event is also created automatically when alarm history is transferred from PDM, TRAM, or telemetry transmitter to the monitor and corresponding snapshots are created at the monitor.

Viewing Events

The Event trend view shows event data on horizontal axis and time on vertical axis. The top of the view shows the highest priority realtime waveform and the bottom of the view shows a sample waveform if an event has a snapshot.

1. Select ***Trends***.
2. Select ***Event*** from the ***View*** list.
    - The ***Priority*** column shows an alarm priority symbol for events created automatically from an alarm.
    - The ***Event*** column shows the reason the event was created for. If the event was created automatically, the alarm message is shown. If the event was created manually, a possible manually added text is shown. If there is a manual annotation added to the event, this text is shown in quotation marks with the prefix ***NOTE***.
    - The ***Snapshot*** column shows a snapshot symbol if there is a snapshot attached to an event.

Sorting Events

You can select how the events are sorted: by ***Time*** with the newest event on top, or by ***Priority*** with the highest priority alarm on top in chronological order. Manually created events and snapshots have the lowest priority.

1. Select ***Trends***.
2. Select ***Event*** from the ***View*** list.
3. Select ***Time*** or ***Priority*** from the ***Sort by*** list.

Creating Events Manually

The manual creation of an event enables you to add a special situation to the Event trend view and to describe its reason in the desired way.

1. Select ***Trends***.
2. Select ***Event*** from the ***View*** list.
3. Select ***Create Event***.
4. Type the text in the ***Event*** field with the on-screen keyboard. Maximum number of characters is 50.
5. Select ***Add*** to add the event to the event list. The time stamp of the event is the time you select ***Add.***

Annotating Events

You can add an annotation to an existing event to describe the event in more detail.

1. Select ***Trends***.
2. Select ***Event*** from the ***View*** list.
3. Select the desired event from the ***Event*** trend view.
4. Select ***Annotate Event***.
5. Type the text in the ***Annotation*** field with the on-screen keyboard. The maximum number of characters is 50.
6. Select ***Add*** to add the annotation text to the event.

Deleting Events

1. Select ***Trends***.
2. Select ***Event*** from the ***View*** list.
3. Select the desired event from the ***Event*** trend view.
4. Select ***Delete Event***.

Undeleting Events

1. Select ***Trends***.
2. Select ***Event*** from the ***View*** list.
3. Select the ***Show Deleted*** check box.
4. Select the deleted event you wish to undelete and select ***Undelete Event.***

Printing Events

You can print alarms and user event in event history reports. Depending on the number of saved events, one or more pages are printed.

1. Select ***Trends.***
2. Select ***Event*** from the ***View*** list.
3. Select ***Print Page.***
4. You can stop printing by selecting ***Cancel Printing.***

Gas Consumption

Viewing Gas Consumption Data

The ***Machine Gas Cons***. view shows the amount of Air, O_2, N_2O, and anesthetic agents used by an interfaced anesthesia machine during the ongoing patient case.

1. Select ***Trends***.
2. Select ***Machine Gas Cons***. from the ***View*** list.

Printing Gas Consumption Data

You must print the report before discharging the patient/ending the case.

1. Select ***Trends***.
2. Select ***Machine Gas Cons***. from the ***View*** list.
3. Select ***Print Page*** to print the currently viewed page.

Minitrend Split Screen



Figure 15.6 Minitrend

Minitrend View

You can split the normal screen page so that the left side of the screen continuously shows graphic minitrends beside waveforms. Minitrend is a license providing components for minitrend and minitrend length. The high-resolution license additionally provides compressed waveforms for CO_2 and respiration.

Minitrends follow graphic trend scale settings. Use the same scale for waveforms and trends. IP minitrends are an exception: they follow the IP waveform scales and not the IP trend scales.

Selecting the Minitrend to Screen

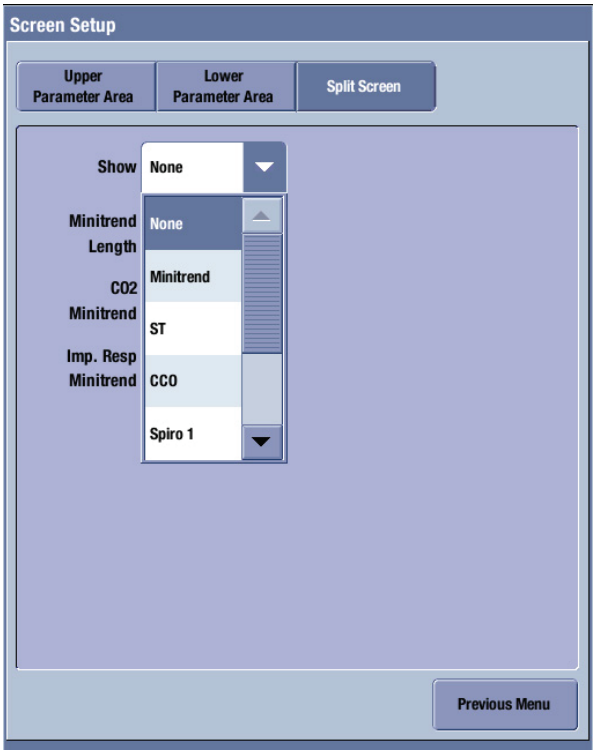


Figure 15.7 Split screen selections

1. Select ***Monitor Setup*** > ***Screen Setup***.
2. B850 and B450 with Double Video license: Select ***Screen 1*** or ***Screen 2*** tab.
3. Select the ***Split Screen*** tab.
4. Select ***Minitrend*** from the ***Show*** list.

Modifying the Minitrend Length

You can select the minitrend length from a selection varying from 1 minute to 120 minutes. The 1 minute and 2 minute selections are available with the high-resolution license only.

1. Select ***Monitor Setup*** > ***Screen Setup***.
2. B850 and B450 with Double Video license: Select ***Screen 1*** or ***Screen 2*** tab.
3. Select the ***Split Screen*** tab.
4. Select a value from the ***Minitrend Length*** list.
    - The 1 minute and 2 minute minitrends (high-resolution license) are updated every 2 seconds.
    - The 5 minute and 10 minute minitrends are updated every 10 seconds.
    - Other lengths are updated once a minute.

Selecting High-resolution Contents to Minitrend

If the high-resolution license is enabled and the ***10 min wide*** is 1 minute normal or 2 minutes wide, you can select CO_2 and impedance respiration (10Hz) ***Compressed Waveform*** minitrends or ***Resp Rate*** minitrends.

1. Select ***Monitor Setup*** > ***Screen Setup***.
2. B850 and B450 with Double Video license: Select ***Screen 1*** or ***Screen 2*** tab.
3. Select the ***Split Screen*** tab.
4. Select ***Minitrend*** from the ***Show*** list.
    - Select ***Resp Rate*** from the ***CO_2 Minitrend*** or from the ***Imp. Resp Minitrend*** list.
    - Select ***Compressed Waveform*** from the ***CO_2 Minitrend*** or from the ***Imp. Resp Minitrend*** list.

Removing Minitrend from the Screen

1. Select ***Monitor Setup*** > ***Screen Setup***..
2. B850 and B450 with the Double Video license: Select ***Screen 1*** or ***Screen 2*** tab.
3. Select the ***Split Screen*** tab.
4. Select the ***None*** from the ***Show*** list.

Check Your Knowledge: Trends and Snapshot



1. How do you change from a graphic trend view to a numeric trend view?
2. How do you change the time interval of numeric trends?
3. How do you manually create a snapshot?
4. How do you view a snapshot?
5. How do you create an Event manually?
6. How do you add the Minitrend to the screen?

Hands on Activity: Trends and Snapshot



1. View graphic trends and change the time scale and trend scales
2. View numeric trends and change the time interval
3. Manually create a snapshot
4. Select which alarms will automatically create a snapshot
5. View a snapshot and change the time scale and trend scale
6. Create and then view an ST snapshot
7. Manually create an event.
8. View and sort events.
9. Delete an event.
10. If applicable, view gas consumption.
11. Show and then remove a minitrend on the screen.

16 Calculations

Objectives: Calculations



By the end of this chapter you should be able to:

- Calculate a drug dose
- Add a new drug name
- Calculate a drug titration
- If applicable, calculate a resuscitation medication dose (NICU software only)
- View Hemo, Oxy and Vent calculations
- Select source data for Oxygen and Ventilation calculations
- Select the PCWP source for Hemodynamic calculations
- Index parameters for Hemo and Oxy calculations
- Edit calculation input values
- Save, view and print calculations
- View laboratory data
- Select the blood sample site for laboratory values
- Select the type of temperature correction for laboratory values
- Enter laboratory values
- Print laboratory values

Terms You Should Know: Calculations



Dose: A drug dose is the rate at which the drug is to be delivered.

Drug Amount: The concentration of drug diluted in solution.

Infusion Time: The amount of time it will take for a certain solution volume to infuse at a certain infusion rate.

Resuscitation Medications: Resuscitation Medications menu provides information about resuscitation medications, concentrations, routes and dosages. Available only for NICU software.

Solution Volume: The amount of dilute in which the drug is diluted. Each drug has a certain default solution volume. The unit is ml.

Titration Table: A drug dosing chart that displays a range to determine infusion rate verses dose of a medication.

Unit: The units of measure the drug is delivered in (mcg/kg/min, mcg/min, Units/h.

Drug Calculations

The drug calculator can be used many clinical situations. In addition, it also provides a titration table that can be used as the dosages are increased or decreased, based on the patient's physiologic response. The titration table displays drug dosage information that can be used to help the clinician determine the dosing effects of intravenous pump setting and infusion rate changes.

Calculations Menu Description

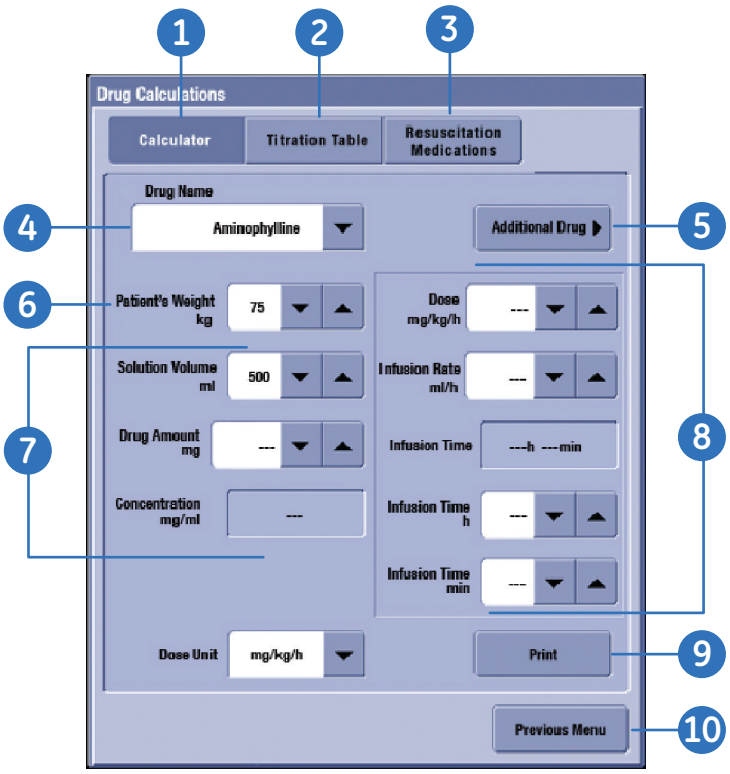


Figure 16.1 Drug calculation menu

1. **Calculator** tab: Allows you to set various drug settings like ***Drug Amount***, ***Dose***, etc.
2. **Titration Table** tab: Allows you to set the ***Dose Increment*** for a drug you select from the ***Drug Name*** list. From this tab you can also print a titration table listing the doses and infusion rates for the selected drug.
3. **Resuscitation Medications** tab: This tab is only visible in the NICU software package. It allows you to calculate, view, and print resuscitation medication information for neonates.
4. **Drug Name list:** The contents of this list are configured through the ***Care Unit*** Settings and they are password protected.
5. **Additional Drug:** Allows you to enter a new drug name to the ***Drug Name*** list temporarily. Any drugs added will only be on the list until the patient is discharged/case is ended.
6. **Patient's Weight:** Allows you to enter the patient's weight if the selected ***Dose Unit*** requires it.
7. Selections for entering drug specification information from the drug order. ***Concentration*** is automatically calculated.
8. Selections for entering drug dose administration information.

9. **Print:** Allows you to print the calculated drug dose and infusion rate.
10. **Previous Menu:** Allows you to return to the previous menu.

Calculating Drug Doses

The drug calculator allows you to calculate and print the doses and infusion rates for intravenous medications.

1. Select ***Data & Pages.***
2. Select ***Drug Calculations.***
3. Select the ***Calculator*** tab.
4. Select a drug from the ***Drug Name*** list. If necessary, you can also add a new drug to the list through selections available when selecting ***Additional Drug***.
5. If the patient's weight was not entered at the time of admission and the selected ***Dose Unit*** requires it, set the ***Patient's Weight***.

   Note! *Changing the weight in the drug calculator menu does not change the weight in the patient demographics. Changing the patient's weight in the Calculator, Titration Table, or Resuscitation Medications tab will change the displayed value in all of them.*
6. Set the ***Solution Volume.***
7. Set the ***Drug Amount***. The ***Concentration*** level is automatically calculated.
8. Set the ***Dose Unit*** if appropriate.
9. Set the ***Dose.***

The ***Infusion Rate ml/h, Infusion Time h,*** and ***Infusion Time min*** are automatically calculated.

Adding a New Drug Name

You can add a new drug name and calculate drug doses for that drug. The drug name is deleted when the patient is discharged from the monitor.

1. Select ***Data & Pages.***
2. Select ***Drug Calculations.***
3. Select the ***Calculator*** tab.
4. Select ***Additional Drug.***
5. Enter the drug name with the on-screen keyboard.

   The name can contain a maximum of 20 characters and it is case-sensitive (for example, Insulin and insulin would be two different drug names).
6. Select ***Add.***

The drug name is now added to the ***Drug Name*** list and can be selected as any other drug until the patient is discharged.

Printing Drug Dose Calculations

You can print the calculated drug dose and infusion rate.

1. Select ***Data & Pages.***
2. Select ***Drug Calculations***.
3. Select the ***Calculator*** tab.
4. Select ***Print.***
5. You can stop printing by selecting ***Stop Printing*** or ***Cancel Printing.***

Calculating Drug Titrations

The titration table calculator allows you to calculate and print titration information for a selected drug.

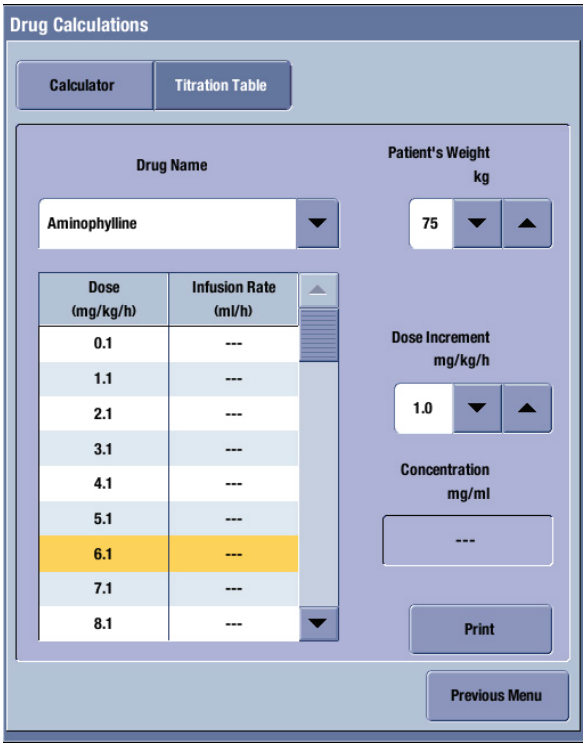


Figure 16.2 Drug calculation menu with titration table

1. Select ***Data & Pages.***
2. Select ***Drug Calculations.***
3. Select the ***Titration Table*** tab.
4. Select the ***Drug Name.***
5. If the patient weight was not entered during admission and the selected ***Dose Unit*** requires it, set the ***Patient's Weight***.

   Note! *Changing the weight in the drug calculator menu does not change the weight in the patient demographics. Changing the patient's weight in the* ***Calculator, Titration Table****, or* ***Resuscitation Medications*** *tab will change the displayed value in all of them.*

6. If needed, change the ***Dose Increment.***

The titration table now shows the doses (50 rows) in the ***Dose*** column, and corresponding infusion rates in the ***Infusion Rate (ml/h)*** column.

Printing the Titration Table

1. Select ***Data & Pages.***
2. Select ***Drug Calculations***.
3. Select the ***Titration Table*** tab.
4. Select ***Print.***
5. You can stop printing by selecting ***Stop Printing*** or ***Cancel Printing.***

Calculating Resuscitation Medication Doses

Note! *NICU software package only.*

1. Select ***Data & Pages.***
2. Select ***Drug Calculations.***
3. Select the ***Resuscitation Medications*** tab.
4. If the patient weight was not entered during admission, set the ***Patient's Weight.***

   Note! *Changing the weight in the drug calculator menu does not change the weight in the patient demographics. Changing the patient's weight in the* ***Calculator, Titration Table,*** *or* ***Resuscitation Medications*** *tab will change the displayed value in all of them.*
5. Select ***Confirm.***

The monitor will not calculate the dose values until the patient's weight value has been confirmed.

Printing Resuscitation Medication Doses

You can print a list of resuscitation medications and their concentration level, delivery method, and dose value.

1. Select ***Data & Pages.***
2. Select ***Drug Calculations.***
3. Select the ***Resuscitation Medications*** tab.
4. Select ***Print.***
5. You can stop printing by selecting ***Stop Printing*** or ***Cancel Printing.***

Hemo, Oxy and Vent Calculations Overview

Note! *Ventilation calculations are available with B850 and B650 only.*

Calculations are used to derive calculated hemodynamic, oxygenation, and ventilation values from actual measurements. Calculations also provide trending for the calculated values.

Saved laboratory data can be used as input data for oxygenation and ventilation calculations. The monitor marks the temperature corrected values in the oxygenation and ventilation calculations with the letter c.

Viewing Calculation Values

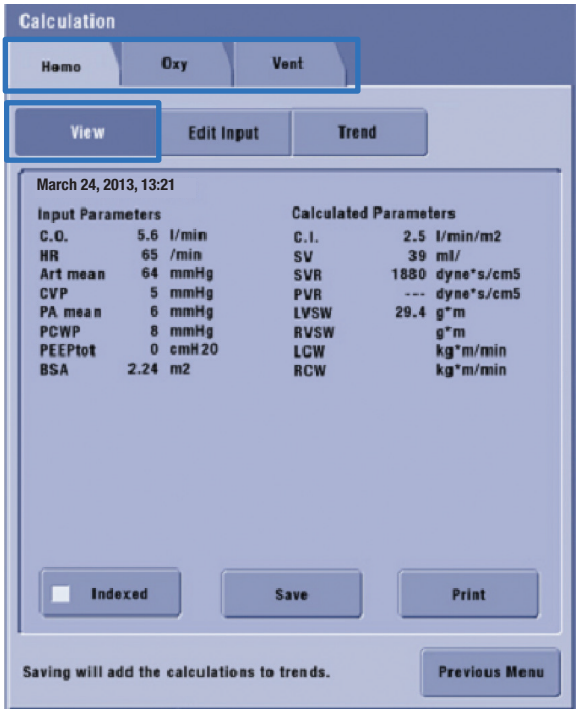


Figure 16.3 Example of Hemo calculation view

1. Select ***Data & Pages.***
2. Select ***Calculations.***
3. Select ***Hemo, Oxy,*** or ***Vent*** tab.
4. Select ***View.***

Parameter data is now displayed in two columns: Input Parameters and Calculated Parameters.

Source Data for Hemo, Oxy and Vent Calculations

Several types of data (blood gas, laboratory) are required to complete a calculation. Data can be entered automatically using a network interface, or manually by the clinician.

Source data means that the time of its collection will be used as the basis for collecting additional data from the trends. The monitor uses the C.O. measurement as source data for hemodynamic calculations. However, C.O. or CCO and/or their indexed values that are older than 15 minutes are not used as source data. Other input values (for example, HR, PA Mean, CVP, Art Mean) used in the calculation are chosen from the same time the sample is drawn or the cardiac output is measured. For oxygenation calculations the monitor uses laboratory data as source data.

In oxygenation calculations, you can select any available arterial laboratory data samples or any C.O. measurement (if no laboratory data but multiple C.O. values are available) from the current patient case to be used as source data.

In ventilation calculations, you can select any arterial laboratory data samples from the current patient case to be used as source data.

Selecting Source Data for Oxygenation Calculations

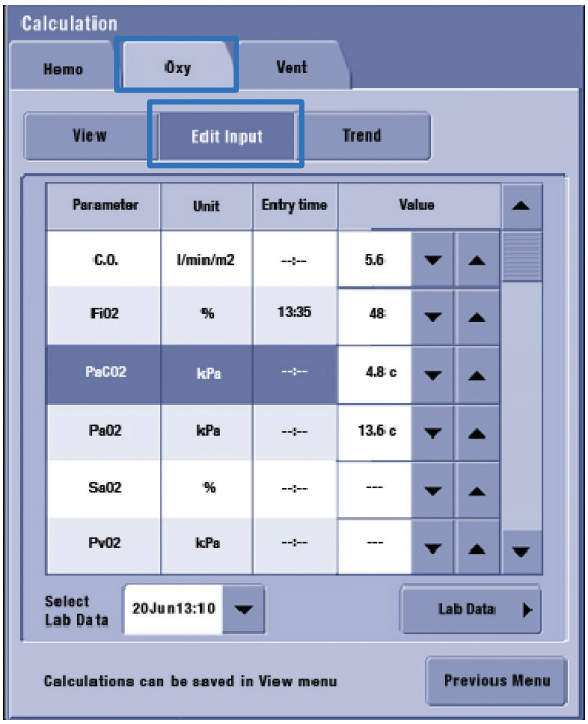


Figure 16.4 Edit input for oxygenation calculations

1. Select ***Data & Pages.***
2. Select ***Calculations.***
3. Select the ***Oxy*** tab.
4. Select ***Edit Input.***
5. Select the desired sample with corresponding time and date from the ***Select Lab Data*** list.

Estimated Values for Oxy and Hemo Calculations

Estimated Values in Oxygenation Calculations

In normal circumstances, about 3% of the total arterial oxygen content is dissolved in the blood and 97% is hemoglobin bound. When no SaO_2 laboratory result is saved in the ***Laboratory Data*** menu, the measured SpO_2 value is used to estimate the clinically relevant SaO2 value. Also, the measured $EtCO_2$ value is used to estimate the $PaCO_2$ value.

The monitor marks the estimated values by adding the letter e to the SaO_2 and $PaCO_2$ values in the ***Calculations*** > ***Oxy*** > ***Trend*** and the ***Calculations*** > ***Oxy*** > ***View***.

Estimated Values in Hemodynamic Calculations

You can select different sources for the PCWP. If you select ***LAP mean*** or ***PA***, the ***PCWP*** value in ***Hemo*** > ***Trend*** will be marked as an estimated value with the letter e. Instead, the ***Hemo*** > ***Edit Input*** and the ***Hemo*** > ***View*** show the actual selected label.

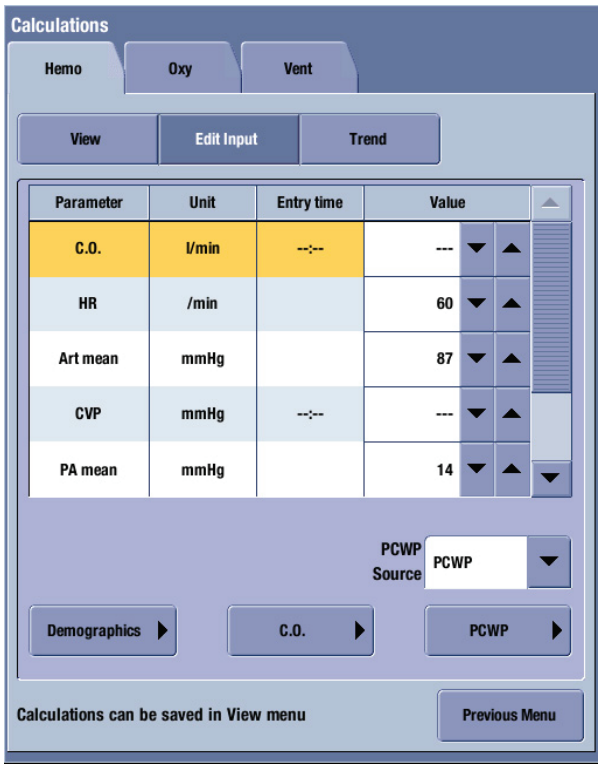


Figure 16.5 Edit input for hemodynamic calculations

Selecting the PCWP source:

1. Select ***Data & Pages***.
2. Select ***Calculations***.
3. Select the ***Hemo*** tab.
4. Select ***Edit Input***.
5. Select the source from the ***PCWP Source*** list:
   - PCWP
   - LAP mean
   - PA dia

Hemo, Oxy and Vent Calculation Functions

Indexing Parameters for Hemodynamic and Oxygenation Calculations

Indexed values are calculated only if the patient's BSA (body surface area) value is available at the time when the calculations take place.

1. Select ***Data & Pages.***
2. Select ***Hemo*** or ***Oxy*** tab.
3. Select ***View***.
4. Select the ***Indexed*** check box at the lower part of the view.

Those parameters that can be indexed are now displayed as indexed, and indexed values are calculated.

Editing Calculation Input Values

Note! *Ventilation calculations are available with B850 and B650 only.*

1. Select ***Data & Pages.***
2. Select ***Calculations***.
3. Select ***Hemo, Oxy,*** or ***Vent*** tab.
4. Select ***Edit Input.***
5. Enter or edit the parameter values with the arrows of the ***Value*** column.
6. To perform the actual calculation and save the values, select the ***View*** tab **>** ***Save.***

Note! *If you select* ***Previous Menu*** *before saving the values, they are lost.*

Saving Calculation Values

1. Select ***Data & Pages.***
2. Select ***Calculations.***
3. Select ***Hemo, Oxy,*** or ***Vent*** tab.
4. Select ***View.***
5. Select ***Save*** to save the input parameter values and calculated parameter values to the corresponding calculation trends.

   Save is disabled if neither the input parameters nor the calculated parameters have values available, or if the displayed values have already been saved.

Viewing Saved Calculations

The monitor displays indexed values if the ***Indexed*** check box has been selected in the calculations ***Trend*** menu, and ***Save*** has been selected to add the calculations to the trends. The indexed values are calculated and trended only if the patient's BSA (body surface area) value is available at the time when the calculations are performed.

1. Select ***Data & Pages.***
2. Select ***Calculations.***
3. Select ***Hemo, Oxy***, or ***Vent*** tab.
4. Select ***Trend***.

To navigate between the pages of the ***Trend*** menu, use the left or right arrow keys in the lower part of the menu.

Printing Calculations

You must save the calculations before you can print them. If they have not been saved, the ***Print*** selection is disabled.

1. Select ***Data & Pages.***
2. Select ***Calculations.***
3. Select ***Hemo, Oxy***, or ***Vent*** tab.
4. Select ***View.***
5. Select ***Print.***

Printing all Calculation Trends

1. Select ***Data & Pages.***
2. Select ***Calculations.***
3. Select ***Hemo, Oxy***, or ***Vent*** tab.
4. Select ***Trend.***
5. Select ***Print.***

Laboratory Data

Overview

The Laboratory Data menu shows various laboratory values, and you can also manually enter values needed for oxygenation and hemodynamic calculations (pH, PCO_2, PO_2, HCO_3-, BE, TCO_2, SO_2, FiO_2 and Hb). The laboratory data menu also displays a set of other laboratory data obtained through an interfaced device.

The message ***Lab data available*** is displayed when laboratory data is available from an interfaced device. The interfaced values are updated automatically to the value table. You can perform temperature correction to interfaced or obtained pH, PCO_2, or PO_2 values, but other editing is prevented.

When entering laboratory values manually, make sure that the units are the same as the units that are displayed on the screen. If they are not, convert the values before entering them.

Viewing Laboratory Data

You can view the most recently saved laboratory data.

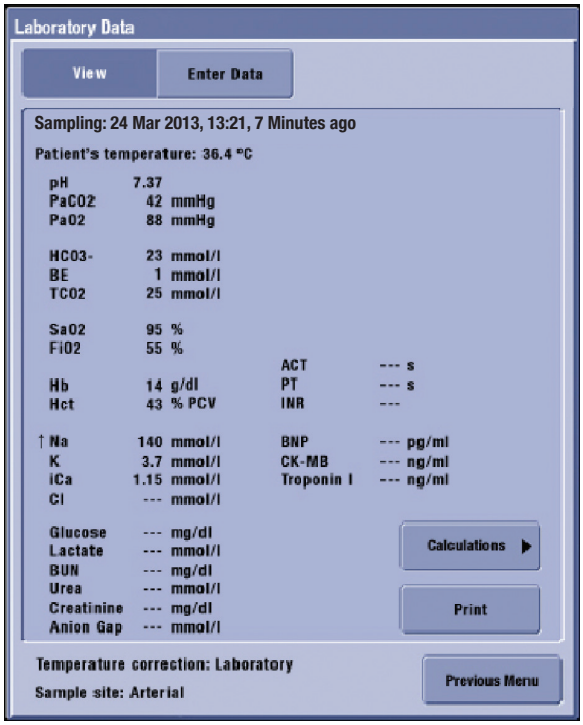


Figure 16.6 Laboratory data - view menu

1. Select ***Data & Pages.***
2. Select ***Laboratory Data.***
3. You can now see the values on the ***View*** tab.

In addition to the available laboratory values, you can see the following information:

- **Sampling:** The date and time of sampling, and how long ago the sampling took place.
- **Patient's temperature:** This is shown if it is available.
- **Temperature correction: *No, Yes***, or ***Laboratory.***
- **Sample site: *Arterial, Venous***, or ***Other.***

Selecting the Blood Sample Site for Laboratory Values

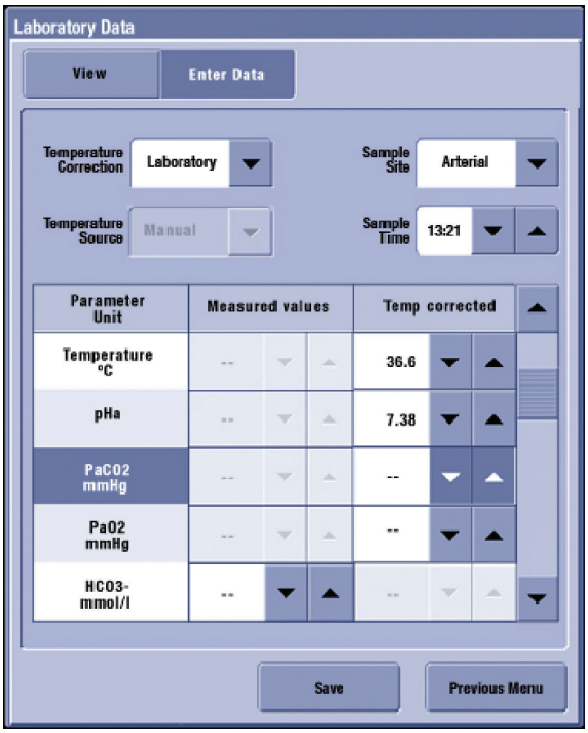


Figure 16.7 Laboratory data - enter data menu

1. Select ***Data & Pages***.
2. Select the ***Enter Data*** tab.
3. Select ***Arterial***, ***Venous***, or ***Other*** from the ***Sample Site*** list.

Note! *that selecting* ***Arterial*** *or* ***Venous*** *affects the labels of* ***pH***, ***PO_2***, ***PCO_2***, *and* ***SO_2***:

- **Arterial** *changes the labels to* ***pHa***, ***$PaCO_2$***, ***$PaCO_2$***, *and* ***SaO_2***.
- **Venous** *changes the labels to* ***pHv***, ***PvO_2***, ***$PvCO_2$***, *and* ***SvO_2***.

Temperature Correction

In the laboratory, blood gas values are measured and calibrated at +37 °C (+99 °F). The pH, PCO_2, and PO_2 values may need to be corrected to the actual patient temperature because an increase or decrease in temperature changes the amount of dissolved blood gas molecules and pH.

While the ***Enter Data*** tab of the ***Laboratory Values*** menu shows both the corrected and uncorrected values, the ***View*** tab shows either the corrected or uncorrected values depending on the ***Temperature Correction*** selection.

Selecting the type of temperature correction:

1. Select ***Data & Pages.***
2. Select ***Laboratory Data.***
3. Select the ***Enter Data*** tab.
4. Select an option from the ***Temperature Correction*** list:
   - **Laboratory:** Temperature correction has been done in the laboratory and the values have already been corrected to patient temperature. The entered ***pH***, ***PCO_2***, and ***PO_2*** values are stored without adjustment and they are shown in the ***Temp corrected*** column.
   - **Yes:** The monitor will perform correction calculations. Select a temperature source from the ***Temperature Source*** list and the monitor recalculates the entered blood gas values corrected to patient temperature. Both the corrected and uncorrected values are shown.
   - **No:** No temperature correction is needed or performed. The entered blood gas values are shown as such.

Entering or Loading Laboratory Values

1. Select ***Data & Pages.***
2. Select ***Laboratory Data.***
3. Select the ***Enter Data*** tab.
4. Adjust the values with arrow selectors.

   When you set a value, it first changes to its default value. Interfaced values are shown with gray selectors and cannot be adjusted.
5. Ensure that you have set the ***Sample Time*** or it has been sent by the interfaced device. If not, set it now.
6. Select ***Save*** to confirm the entered values.

Note! *If you do not select **Save**, new data is lost when you exit the menu.*

Printing Laboratory Values

You can print the most recently saved laboratory data.

1. Select ***Data & Pages.***
2. Select ***Laboratory Data.***
3. Select the ***View*** tab.
4. Select ***Print***.

Check Your Knowledge: Calculations



1. Is it possible to add a new drug name if it is not listed in the Drug Name list?
2. How do you access the Titration Table?
3. Which software package is needed for the Resuscitation Medication feature?
4. What are the three types of calculations available from the Calculation menu?

Hands on Activity: Calculations



1. Calculate a drug dose
2. Add a new drug name
3. Calculate a drug titration
4. If applicable, calculate a resuscitation medication dose (NICU software only)
5. View Hemo, Oxy and Vent calculations
6. Select source data for Oxygen and Ventilation calculations
7. Select the PCWP source for Hemodynamic calculations
8. Edit calculation input values
9. Save, view and print calculations
10. View laboratory data
11. Select the blood sample site for laboratory values
12. Select the type of temperature correction for laboratory values
13. Enter laboratory values

17 Bed-to-Bed Viewing

Objectives: Bed-to-Bed Viewing



By the end of this chapter you should be able to:

- Select the alarm notification type for receiving alarms from other patients
- Select the notifying alarm priority level for receiving alarms from other patients
- View a remote patient bed

Terms You Should Know: Bed-to-Bed Viewing



Alarm Notification Types

Message: Remote alarm messages display in the alarm area. At any time, you can select a remote alarm message to open a bed-to-bed window and view the remote patient's data.

Auto View: Bed-to-bed window opens immediately if no other procedure or setup window is currently open. Otherwise, a remote alarm message displays in the alarm message area. To open the bed-to-bed window and view the remote patient's data, close the currently open menu, or select the remote alarm message.

Auto View Always: Immediately closes any open procedure or setup windows and opens a bed-to-bed window with the remote patient's data

Bed to Bed Overview

When the monitor is on the network, you can open a bed-to-bed view of other remote patient beds that are on the same network. You can choose to view a remote patient bed under an alarm condition, or simply view any available bed on your network.

The numeric values, up to six waveforms, alarms, and location information are displayed inside a separate bed-to-bed window. The bed-to-bed window is located on the left side of the display screen.

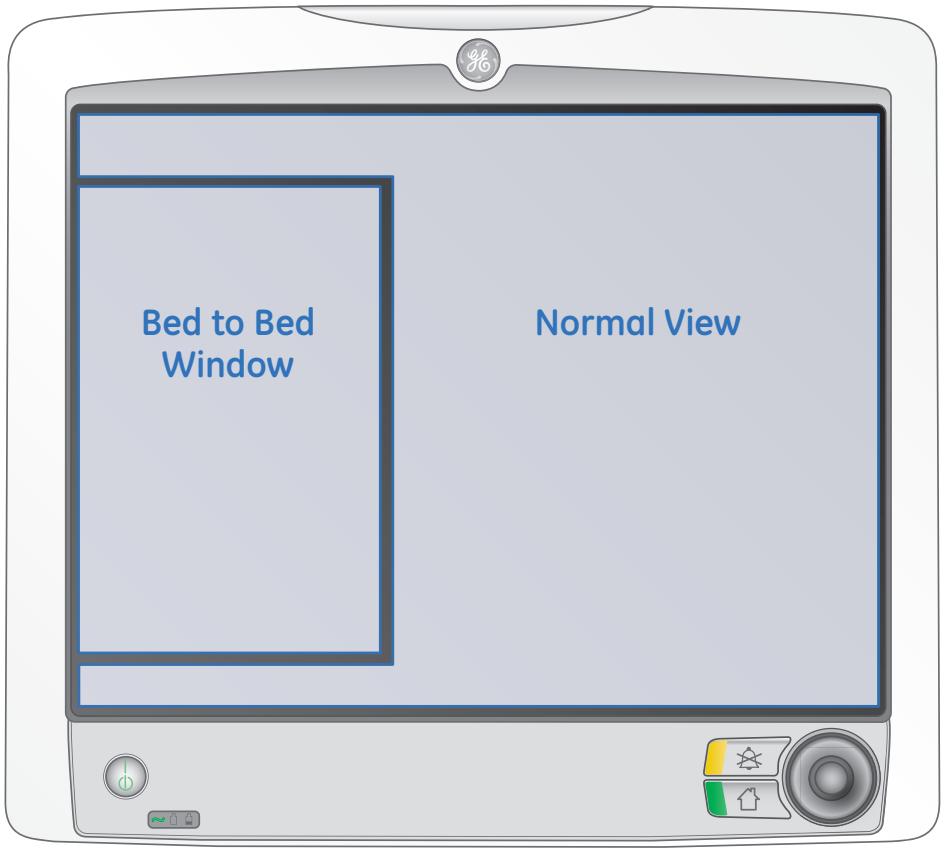


Figure 17.1 Bed-to-Bed window

Some settings related to remote alarm configuration are password protected and are set up specific to a care area.

Function	Network features
View on alarm notification	CARESCAPE Network and S/5 Network: Monitor alarms for up to 40 beds.
View remote beds	CARESCAPE Network: View one bed from up to 1023 beds. S/5 Network: View one bed from up to 128 beds.

Automatic View of Remote Beds in Alarm

Automatic viewing of remote alarms is a licensed feature.

You can set the monitor to automatically notify you with an alarm message or with a bed-to-bed window when selected remote patient beds go into an alarm condition. All automatically viewable alarming beds display in order from the highest to lowest alarm priority and from the newest to oldest alarms.

You can configure how the monitor notifies you of a remote patient bed alarm condition, and which remote patient alarm priority levels you want notification of. You can do this for individual beds, or for all remote beds of a selected care unit at once.

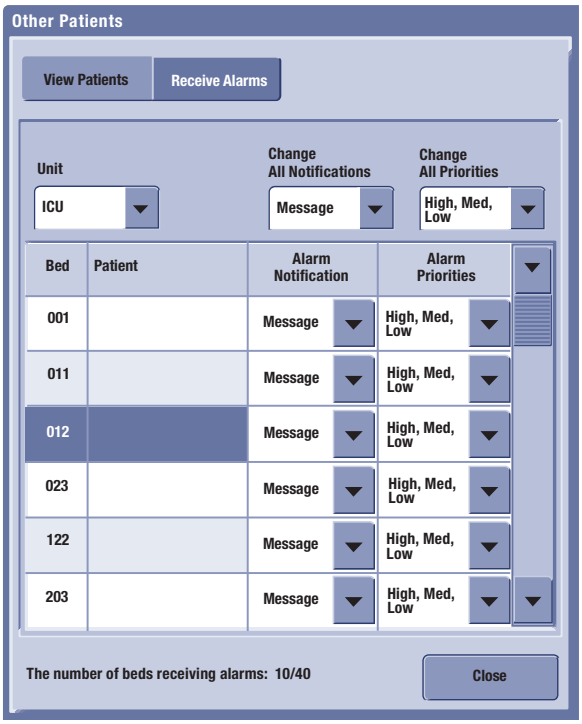


Figure 17.2 Receive alarms menu example

Selecting the Notifying Alarm Priority Level

1. Select ***Data & Pages.***
2. Select **Other Patients.**
3. Select the ***Receive Alarms*** tab.
4. Select a care unit from the ***Unit*** list.
5. Select a patient bed from the displayed list.
6. Select which alarm priority levels you want notification of:
    - **High:** Opens a bed-to-bed window for remote patients in a high alarm priority condition.
    - **High, Med:** Opens a bed-to-bed window for remote patients in a high or medium alarm priority condition.
    - **High, Med, Low:** Opens a bed-to-bed window for remote patients in a high, medium, or low alarm priority condition.

Changing the Settings for Multiple Beds

You can select a care unit and change all of the listed remote patient beds to a single notification setting and/or a single alarm priority setting. If there are more than 40 beds in the unit, the settings will be changed for the first 40 beds only.

1. Select ***Data & Pages.***
2. Select ***Other Patients.***
3. Select the ***Receive Alarms*** tab.
4. Select a care unit from the ***Unit*** list.
5. Select a setting from the ***Change All Notifications*** list:
   - **Off:** Remote alarm notification is turned off.
   - **Message:** Remote alarm messages display in the alarm area.
   - **Auto View:** Bed-to-bed window opens immediately if no other procedure or setup window is currently open. Otherwise, a remote alarm message displays in the alarm message area.
   - **Auto View Always:** Immediately closes any open procedure or setup windows and opens a bed-to-bed window.
6. Select a setting from the ***Change All Priorities*** list: ***High; High, Med; High, Med, Low.***

Note! *If you have a bed-to-bed window open and another **Auto View** or **Auto View Always** bed goes into alarm, the selection **View Next Patient** becomes selectable. It allows you to open the bed-to-bed window to view the next highest and newest alarming patient bed.*

Viewing Remote Patient Beds

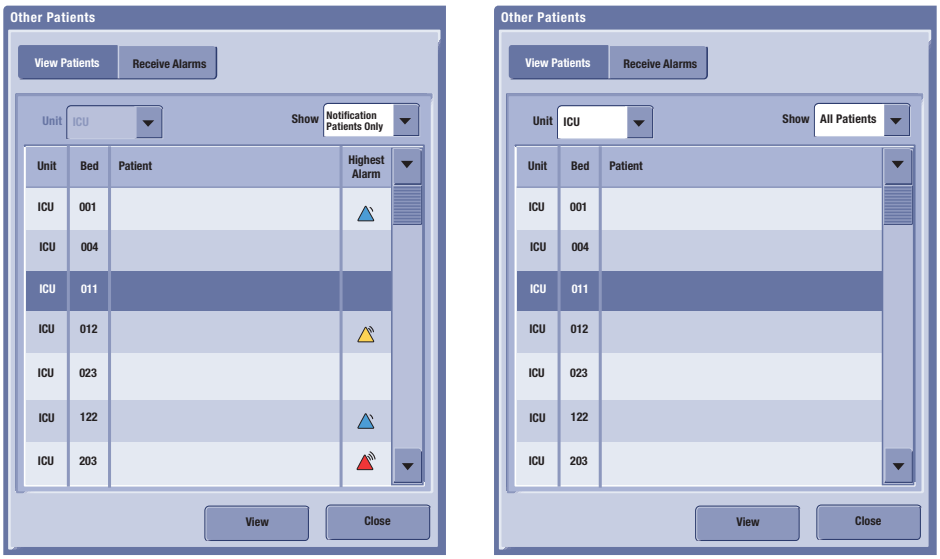


Figure 17.3 View patients menu example

You can select and view a networked alarming or non-alarming remote patient bed.

1. Select ***Data & Pages.***
2. Select ***Other Patients.***
3. Select the ***View Patients*** tab.
4. Select a care unit from the ***Unit*** list. A list of remote patient beds is displayed for the selected care unit.
5. You can select to see a list of all patient beds in the care unit or a list of remote patient beds configured for alarm notification. Select an option from the ***Show*** list:
   - To show a list of all the remote beds in the care unit, select ***All Patients.***
   - To show the list of remote patients configured for alarm notification, select ***Notification Patients Only.***
6. Select a patient bed from the displayed list.
7. Select ***View.***
8. You can stop viewing the selected patient bed and close the bed-to-bed window by selecting ***Close View.***

Note! *Selecting the home key will not close any open bed-to-bed view of an alarming or non-alarming patient bed.*

Manual Printing of Remote Bed Waveforms

Note! *CARESCAPE Network only.*

Waveform data of a remote monitor can be manually printed by selecting ***Print*** from the bed-to-bed window. With the B850, waveforms are printed using the local PRN-50 recorder if available, otherwise the printer is determined by the remote monitor's print configuration. The waveforms that appear on the printout are determined by the remote monitor's print configuration.

Check Your Knowledge: Bed-to-Bed Viewing



1. What is the difference between Auto View and Auto View Always for Alarm Notification?
2. Which menu would you access to change an alarm notification type and an alarm priority level?
3. Which menu would you access to view a remote patient bed?

Hands on Activity: Bed-to-Bed Viewing



1. Select the alarm notification type for receiving alarms from other patients.
2. Select the notifying alarm priority level for receiving alarms from other patients.
3. View a remote patient bed.

18 Printing

Objectives: Printing



By the end of this chapter you should be able to:

- Change a printer from the Devices Setup menu
- Check the print status
- Select the arrhythmias you would like to "print on alarm" from the Alarms Setup > Arrhythmia menu
- Access the Printing > Waveforms menu and change the delay, print length and paper speed.
- Select waveforms to print and then print from the Waveforms menu
- Print waveforms from the main display
- Stop waveform printing
- Configure a trend report
- Print a trend report
- Print an individual report
- Print a care report

Terms You Should Know: Printing



Local Printer: A recorder is connected directly to one of the bedside monitor's M-ports

Network Printer: A laser printer connected directly to the network

PRN 50-M Recorder: A recorder for the B850 only.

Remote Printer: A recorder is connected to another networked bedside monitor on the CARESCAPE Network or to a central station on the CARESCAPE Network

XE-50 Recorder: A recorder for the B650 and B450 only

Printing Options

Depending on the system configuration, the following printing capabilities are available:

- Printing to a recorder connected directly to one of the M-ports.
- Printing to a built-in recorder (B450 and B650).
- Printing to a remote recorder connected to another networked bedside monitor (except a B650 or a B450) or a central station in the CARESCAPE Network.
- Printing to a bedside printer connected via the IX network interface. In this case the IX Network interface cannot be used for other network purposes.
- Printing to a network printer connected to an iCentral in the S/5 Network.
- Printing to a network printer connected to the IX Network.

You can print realtime waveforms (generated by a manual request or by an arrhythmia or non-arrhythmia alarm) and numeric trends to a recorder or a printer. In addition, you can print different types of reports to a printer.

Laser Printers

A laser printer may be connected to the monitor via network, or to a central station on the network. A bedside printer may be directly connected to the monitor's network port with a crossover cable or via a network hub.

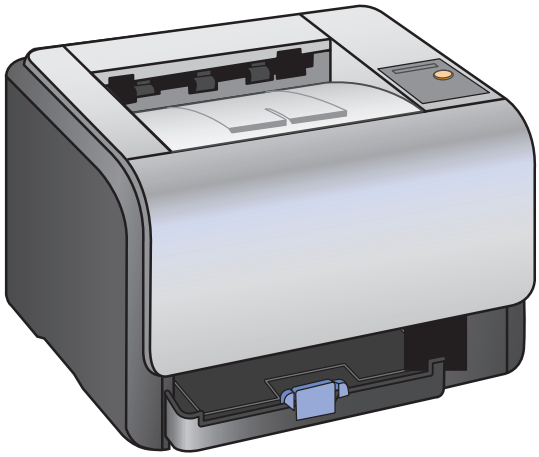


Figure 18.1 Laser printer

Recorders

Note! *Recorders print on thermal paper. The data printed on thermal paper may be destroyed by exposure to light, heat, acids, PVC, and alcohol. Make a photocopy of the printout for your archives.*

PRN 50–M Recorder (B850 only)

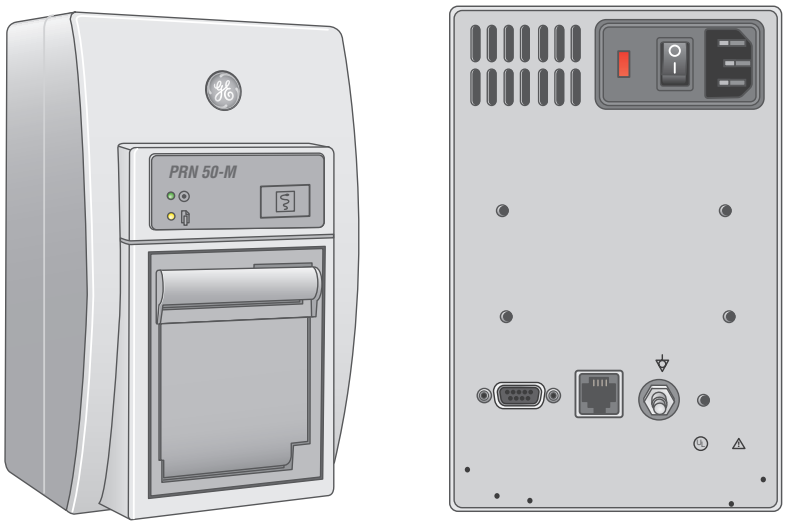


Figure 18.2 PRN 50-M recorder • front and back view

XE-50 Recorder (B650 and B450 only)

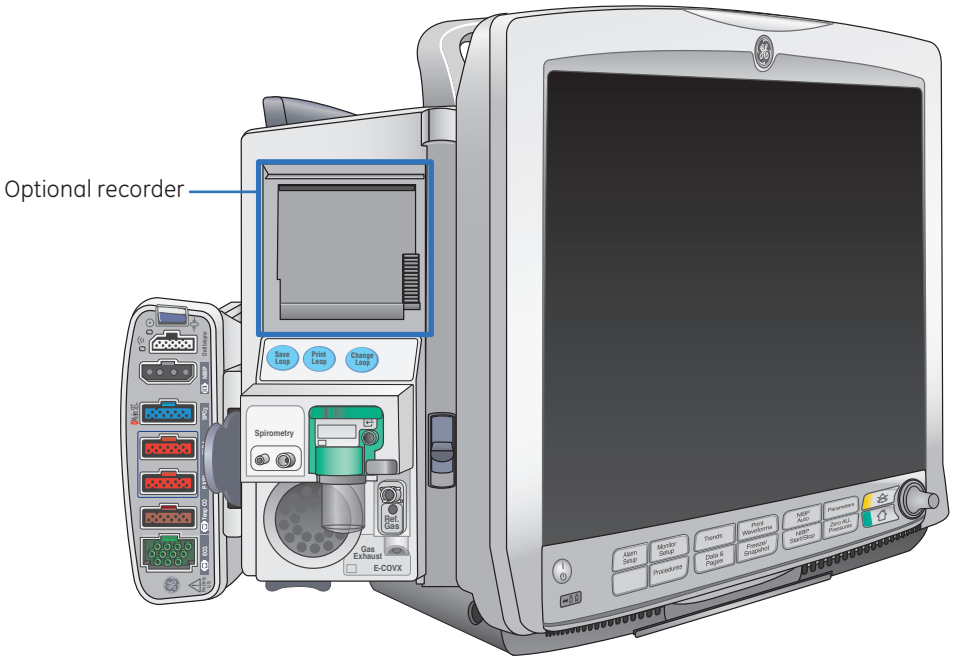


Figure 18.3 XE-50 recorder on the B650

Printing Device Selections

Changing Printer



Figure 18.4 Devices setup menu

1. Select ***Monitor Setup*** > ***Printing***.
2. Select the ***Devices*** tab.
3. Select ***Setup***.
4. Select the printout type from the ***Printout*** list.

   Note! *that the printing location (see step 5) for Telemetry Waveforms will only be sent to the telemetry when starting the combination monitoring mode with a non-admitted telemetry patient.*

5. Select the location for the printout:

If you are printing to this location	Select this option
Local recorder XE-50 or PRN 50-M (connected directly to or built in the monitor). This selection is only available for ***Telemetry Waveforms*** if the PRN 50-M recorder is connected.	***Local***
Remote recorder or printer (a recorder in another monitor in the CARESCAPE network, or a recorder or a printer connected to a central station in the network).	***Remote***
Network printer (a printer in the IX Network or connected to an iCentral). This is always the print location for reports. This is not available if the printout type is ***Telemetry Waveforms***.	***Network***

6. According to your location selection above:
   - If you selected ***Network***: Select the print device from the ***Network Device*** list.
   - If you selected ***Remote***: Choose the monitor or central station from the ***Unit*** list, and then select the print device from the ***Remote Device*** list.

Note! *You may assign one printout type to one print location only. Changing the print location does not affect printing currently in progress.*

Checking the Print Status

You can view the assigned print locations for each type of printout and check the printer status for each print device.

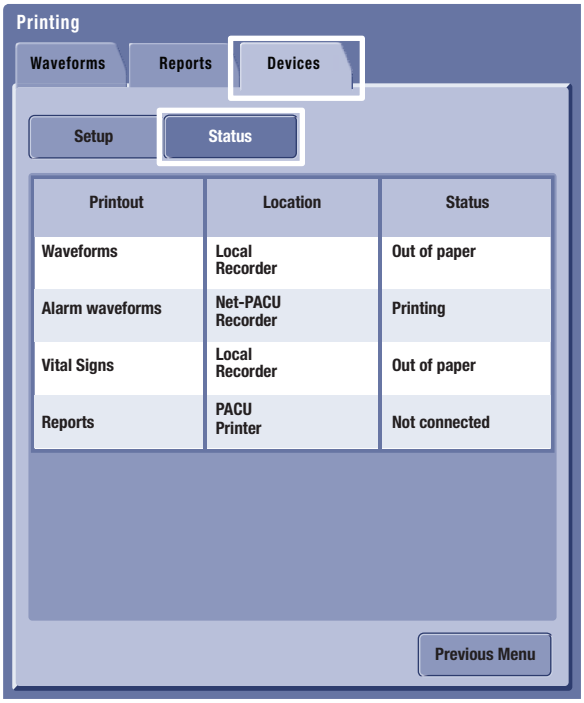


Figure 18.5 Printing status menu

1. Select ***Monitor Setup*** > ***Printing.***
2. Select the ***Devices tab*** > ***Status.***

Printing Waveforms

Printing Waveforms for an Arrhythmia Alarm

Note! *Automatic printing of waveforms is always initiated by an alarm.*

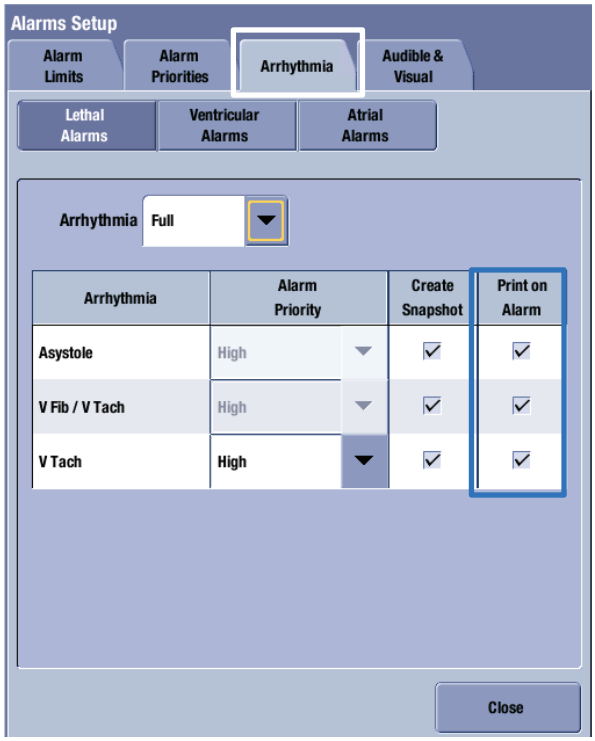


Figure 18.6 Arrhythmia print on alarm example

1. Select ***Alarm Setup*** from the main menu.
2. Select the ***Arrhythmia*** tab.
3. Select ***Print on Alarm*** for the arrhythmias you would like to print.

Note! *For arrhythmia alarm waveform printing, the printing will continue until 20 seconds has passed from the clearance of the last active arrhythmia alarm (e.g., 10 seconds saved data, arrhythmia alarm duration + 20 seconds data).*

Printing Waveforms other than Arrhythmia Alarms

Other than arrhythmia alarms that print are the high/low alarms for the following: HR, Art/ABP/Fem/UAC sys/dia/mean, SpO_2, and ST.

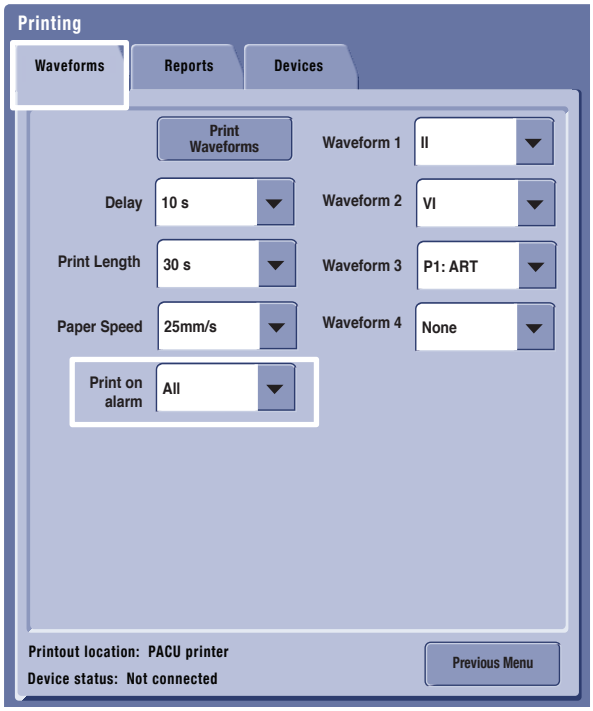


Figure 18.7 Printing – Waveforms menu

1. Select ***Monitor Setup > Printing.***
2. Select the ***Waveforms*** tab.
3. Choose a value from the ***Print on Alarm*** list:
   - **No:** No alarm waveforms print during an alarm condition.
   - **High:** Alarm waveforms print during high priority alarm conditions only.
   - **All:** Alarm waveforms print during any alarm condition.

Selecting the Waveform Delay, Print Length and Paper Speed

1. Select ***Monitor Setup > Printing.***
2. Select the ***Waveforms*** tab.
3. Select a value from the ***Delay, Print Length*** and ***Paper Speed*** selections.

Selecting Waveforms to Print

1. Select ***Monitor Setup > Printing.***
2. Select the ***Waveforms*** tab.
3. Choose the desired ECG lead/parameter for waveforms 1-4.

Printing from the Waveforms Menu

1. Select ***Monitor Setup > Printing.***
2. Select the ***Waveforms*** tab.
3. Select ***Print Waveforms***.

Printing from the Main Display



Figure 18.8 Print waveforms

1. Select ***Print Waveforms***.

Note! *If print length has been configured for **Continuous**, you will be required to stop or cancel the print request.*

Stopping the Waveform Printing

Stopping a waveform printout with PRN 50–M (B850 only):

1. Press the ***GRAPH STOP*** key on the recorder.

Stopping a waveform printout from the main display:

1. Select ***Stop Printing***.

Stopping a waveform printout from the waveforms window:

1. Select ***Monitor Setup > Printing.***
2. Select ***Waveforms*** tab.
3. Select ***Stop Printing*** or ***Cancel Printing.***

Printing Reports

Printing and Patient Discharge

Discharging a patient generates the automatic printing of care reports (ICU, ED, and NICU software packages), and cancels all other recording and laser printing.

Configuring a Trend Report

Note! *Before printing a report, ensure that you have selected the proper settings.*

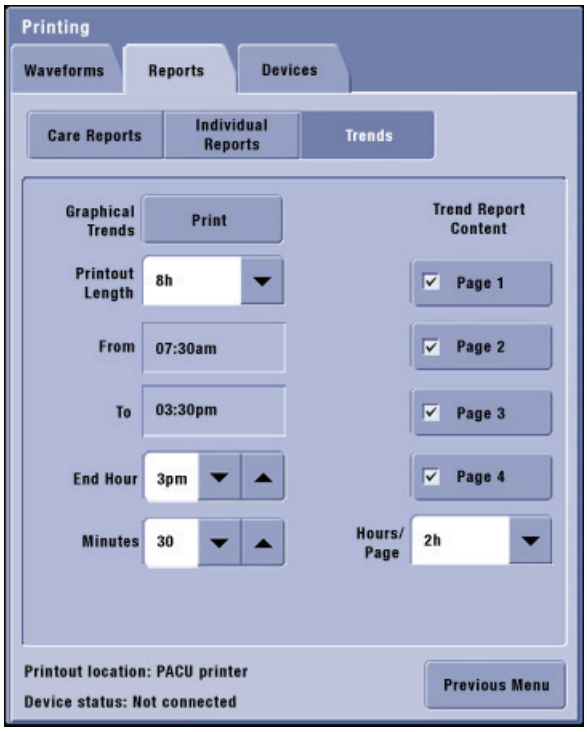


Figure 18.9 Trends report menu

1. Select ***Monitor Setup*** > ***Printing.***
2. Select the ***Reports tab*** > ***Trends.***
3. Select the desired print length.
4. Select the desired hour and minutes using the up and down arrows.
5. Select trend pages 1-4
6. Select hours per page.

Printing a Trend Report

Note! *Before printing a report, ensure that you have selected the proper settings.*

1. Select ***Monitor Setup*** > ***Printing.***
2. Select the ***Reports*** tab.
3. Select ***Trends*** > ***Print.***

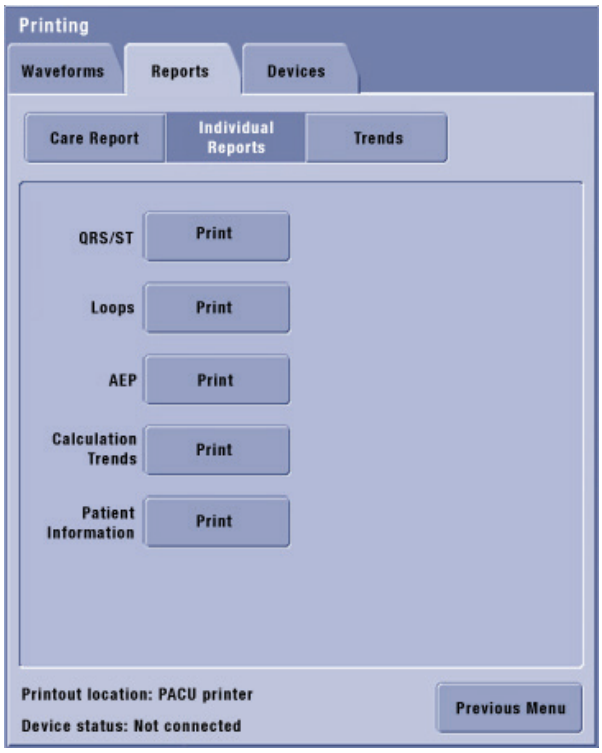


Figure 18.10 Individual reports

Printing Individual Reports

1. Select ***Monitor Setup > Printing.***
2. Select the ***Reports tab > Individual Reports.***
3. Select the report type you wish to print: ***QRS/ST, Loops, AEP, Calculation Trends,*** and ***Patient Information***.

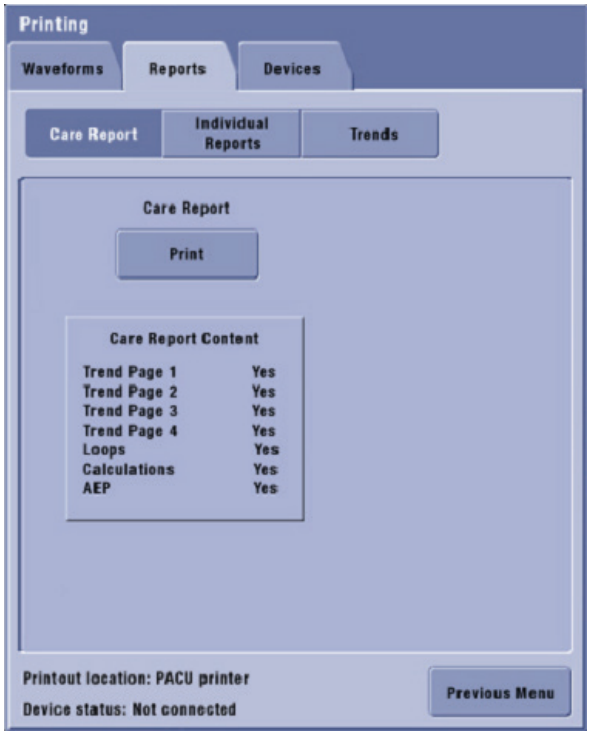


Figure 18.11 Care reports menu

Care Report Printouts

Note! *Care reports are predefined in the default setup.*

You can print care reports that include graphic trends printouts, calculation trends printouts, saved spirometry loops printouts, and/or AEP printouts.

Printing care reports manually:

1. Select ***Monitor Setup > Printing.***
2. Select the ***Reports*** tab.
3. Select ***Care Report > Print.***

Automatic Care Report Printouts

The automatic printing of care reports is possible only in the ICU, ED and NICU software packages, and it is initiated when a patient is discharged. An automatically initiated care report consists of a cover page and reports selected in the ***Profile Settings > Care Report*** menu. The care report setup allows you to select the content, duration, and resolution of the reports.

Print Header Information

Laser Printer Print Header

You can print parameter printouts from the parameters' own menus. You can get printouts of:

- Patient name (displayed if configured in the care unit default settings)
- Second ID
- Medical record number
- Bed number
- Unit name (if the monitor is on the MC Network)
- Hospital name
- Date and time of the printout
- Current page/total number of pages (e.g., 1/12)
- Printout title (e.g., alarm, waveforms, and reports)
- Identification field for a patient identification sticker
- Notes field for manually written notes

Recorder Print Header

- Patient name
- Second ID
- Medical record number
- Bed number
- Unit name
- Date and time of the printout
- Printout title

Check Your Knowledge: Printing



1. What is the quickest way to initiate a printout of waveforms?
2. How would you check the print status?
3. What are the three types of reports that can be printed?
4. How would you change the print length and paper speed for printing waveforms?

Hands on Activity: Printing



1. Change a printer from the Devices Setup menu
2. Check the print status
3. Select the arrhythmias you would like to "print on alarm" from the Alarms Setup > Arrhythmia menu
4. Access the Printing > Waveforms menu and change the delay, print length and paper speed.
5. Select waveforms to print and then print from the Waveforms menu
6. Print waveforms from the main display
7. Configure a trend report
8. Print a trend report
9. Print an individual report
10. Print a care report

19 Peripheral Devices

Objectives: Peripheral Devices



By the end of this chapter you should be able to:

- Describe the purpose of the Unity Network Interface ID
- Describe the purpose of the serial port indicator lights on the Unity Network Interface Device (ID)

Terms You Should Know: Peripheral Devices



Unity Network Interface Device (ID): A Unity Network Interface Device (ID) is used with the monitor to communicate with peripheral devices such as ventilators and gas delivery systems.

M-port: The Unity Network Interface Device (ID) connects to the B850 via one of the M-port connectors on the front of the processing unit.

Ethernet port: The Unity Network Interface Device (ID) connects to the B650 and B450 via the Ethernet port labeled ID on the back of the monitor.

Unity Network Interface Device (ID)

Note! *For a list of compatible peripheral devices, see the Unity Network Interface Device (ID) Operator's Manual. For software compatibility information, see the Unity Network Interface Device (ID) manuals.*

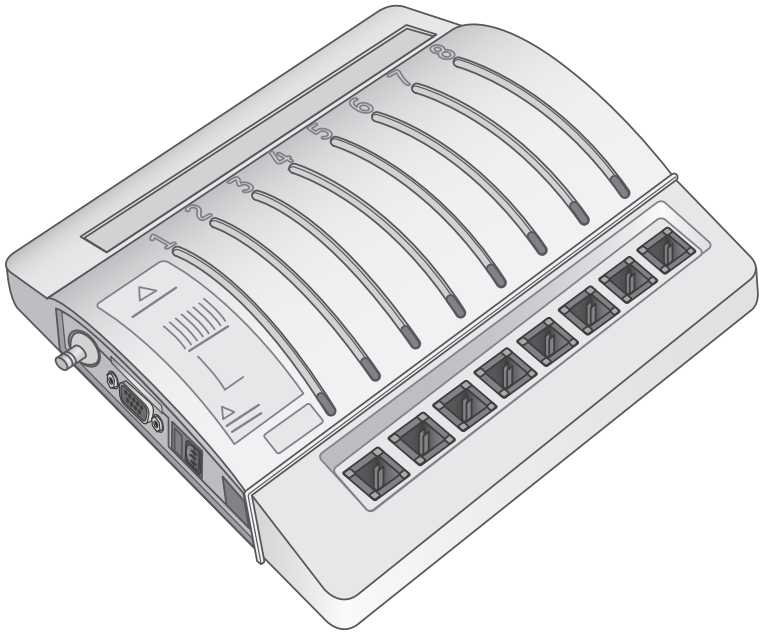


Figure 19.1 Unity ID Connectivity Device

The monitor can interface with peripheral medical devices, such as ventilators and gas delivery systems, to centralize patient data on one device. A Unity Network Interface Device (ID) is used with the monitor to communicate with peripheral devices. It acquires digital data from eight individually isolated serial ports. The data is collected from up to eight peripheral devices (not necessarily manufactured by GE), and then the interface device transmits the formatted data to the monitor.

The monitor can only display information that the peripheral device sends. The parameters sent vary with each peripheral device and are subject to change. It is also important to note that alarms vary according to the primary interfaced device.

In some cases, the peripheral device may impose alarm control parameters that you may not be able to change or silence with the monitor's controls.

Unity Network Interface Device (ID) Interconnection

The Unity Network Interface Device (ID) connects to the monitor via one of the M-port connectors on the front of the processing unit (B850), or via the Ethernet port labeled ID on the back of the monitor (B650, B450).

A factory-programmed adapter is required for each peripheral device to communicate with the connectivity device. Refer to the instructions provided with the interface adapter for adapter setup and installation instructions.

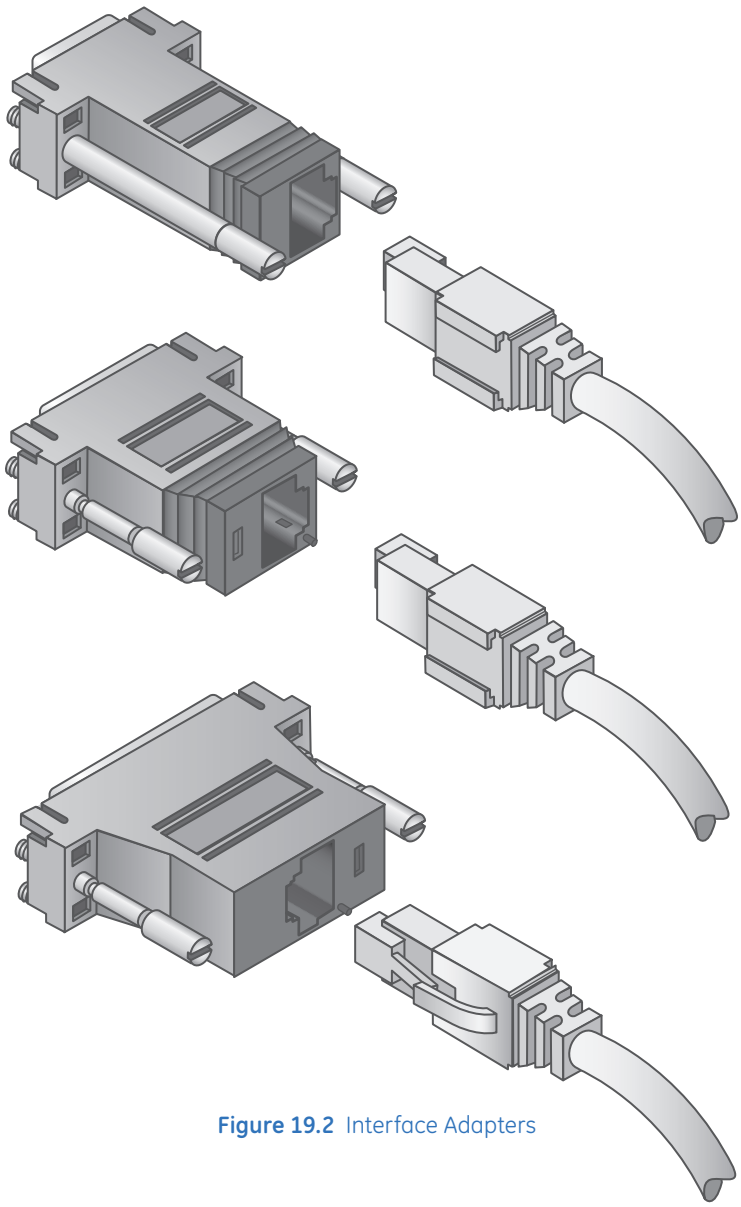


Figure 19.2 Interface Adapters

Unity Network Interface Device (ID) Serial Port Indicator Lights

Each serial port on the connectivity device has an indicator light located directly above it. The light indicates the status of the serial port.

Table 26.1 Unity Network ID Serial Port Indicator Lights

Green Indicator	Yellow Indicator	Serial port status	Description
Off	Off	No connection	Nothing is connected to the associated serial port or the interface connector is not operational.
Off	On	Communication pending	Cable and interface adapter are connected, but the supported device communication is not yet established.
Off	Slow blinking (once every 2 seconds)	Communication error	Connected, but communications error with supported device.
Off	Fast blinking (twice every second)	Other errors	Indicates: • Too many supported devices of one type are connected. • Interface adapter is malfunctioning. • Supported device software is not compatible with the monitor software. • Interface adapter is not supported by the monitor software.
On	Off	Working	Communication with the supported device is good.

Peripheral Device Limit Alarms

The limit alarms are not adjustable when the measurement source is from an external device connected to the Unity Network Interface Device (ID). Limit alarms can be turned on or off only.

Alarm limits or guard limits set for any parameter have no effect as only the limit alarms from the interfaced device are shown. In addition, they are shown only for those parameters that have their Alarm On activated.

It should also be noted that if a ventilator and a gas acquisition module are simultaneously connected to the monitor, the monitor will use the module's alarm limits and not those of the ventilator. In addition, the monitor uses the measurement data of the connected modules as the basis for its alarms.

Peripheral Device Parameter Data

The data from a peripheral device that is displayed at the monitor varies with each device. The chart below gives some general information as to what data is available to the monitoring system and how it is handled (trending, alarm broadcast, etc.).

Table 26.2 Peripheral Device Data

Peripheral device type	Waveforms a, b	Parameter windows	Trends	Alarm broadcast b	Printouts	Data to a central station c
Pulse oximeters	No	Yes	Yes	Yes	Yes	No
Transcutaneous monitors	No	Yes	Yes	Yes	Yes	No
Ventilators	Yes	Yes	Yes	Yes	Yes	Limited
Gas analyzers	No	Yes	Yes	Yes	Yes	Yes
Continuous cardiac output	No	Yes	Yes	Yes	Yes	No
Anesthesia machines	Yes	Yes	Yes	Yes	Yes	Yes
POC blood gas monitors	No	No d	Yes	No	No	No

a. Unity Network ID connectivity device supports only digital waveforms.

b. See the ***Unity Network Id Connectivity Device Operator and Service Manua***l for more details.

c. CIC version 1.0 and subsequent.

d. POC blood gas monitor data is displayed in ***Data and Pages*** > ***Laboratory Data*** window

Peripheral Device Data Presentation and Menus

For information on peripheral device data presentation and menus, see the “Interfacing with peripheral devices” section of the user’s reference manual.

Check Your Knowledge: Printing



1. Describe the purpose of the Unity Network Interface ID.

2. Describe the purpose of the serial port indicator lights on the Unity Network Interface Device (ID).

20 Clinical Training Documents

CARESCAPE Modular Monitors Training Post Test



Chapter 2: Hardware

1. What are the type(s) of CARESCAPE monitors covered in this training guide? Select all that apply.
   - A. B450
   - B. B650
   - C. B850

2. Where is the Trim Knob located on the display?
   - A. Lower left
   - B. Upper right
   - C. Lower right

Chapter 3: Screen Navigation

1. The Main Menu area of the screen is located at the top of the screen and displays alarm notification.
   - A. True
   - B. False

2. Selecting the Information area of the screen will open the Admit/Discharge menu.
   - A. True
   - B. False

Chapter 4: Monitoring Basics

1. You have to manually admit the patient to the monitor in order for alarms to be activated and patient data to be trended.
   - A. True
   - B. False

2. Which of the following criteria will automatically admit/start a case on the monitor?
   - A. When you enter patient data
   - B. When you connect patient cables and the monitor detects valid vital signs
   - C. Both A and B.

3. Which of the following is true about a profile?
    A. It does not contain alarm limits
    B. It is determined at the time of purchase
    C. It is a group of unique settings suited to a particular care unit or patient demographic

4. How do you move a parameter window to a higher priority on the screen?
    A. Select Monitor Setup > Screen Setup > Upper Parameter Area > select the parameter and use the up arrow
    B. You cannot change priority order of parameter windows
    C. This is done under password at time of set up

5. If you change profiles after the patient is "admitted", you will lose patient data.
    A. True
    B. False

6. Which tab do you access to select a profile?
    A. Load Patient
    B. Care Unit & Bed
    C. Patient

7. Which menu do you access to enable minitrends on the screen?
    A. Monitor Setup > Screen Setup > Split Screen
    B. Trends > Screen Setup
    C. Data and Pages

Chapter 5: Alarms

1. There are four types of alarms: Informational Message, Low, Medium and High, as well as a color associated with each alarm. Which is the correct list of alarms colors below, beginning with the lowest priority and ending with the highest?
    A. Yellow, Gray, Blue, Red
    B. Gray, Blue, Yellow, Red
    C. Gray, Blue, Red, Yellow

2. Identify the correct definition of a latching alarm.
    A. An alarm that remains at one level.
    B. An alarm that remains alarming even after the alarm is no longer active.
    C. An alarm that remains alarming after the user has attempted to silence it.

3. You must always turn alarms on in order for them to be active.
    A. True
    B. False

4. What is the correct way to turn off audible alarms for ECG only?
    A. Turn off the HR alarm.
    B. Pause the monitor by selecting the silence alarm icon in the main menu.
    C. By selecting Alarms Setup > Audible and Visual and select ECG Audio Off.

5. If there is an Informational Message alarm, can it be a physiological alarm?
    A. Yes
    B. No

Chapter 6: ECG

1. When preparing the patient for an ECG, what should be considered to maximize the quality of the electrode signal? Select all that apply.
    A. Avoid bones close to skin, obvious layers of fat, and major muscles
    B. Shave hair from the electrode site
    C. Make sure the skin is damp

2. What is the main reason to relearn a patient's ECG rhythm?
    A. To teach the patient about his rhythm
    B. There has been a dramatic change in the patient's rhythm
    C. You do not need to relearn a patients rhythm

3. What are the benefits of having multiple heart rate sources?
    A. You have a more accurate heart rate and occurrences of false heart rate limit alarms is greatly reduced
    B. The monitor averages them together to get a heart rate number
    C. You cannot have multiple heart rate sources

4. The ST real-time view shows the current complex superimposed over the reference complex to compare any changes.
    A. True
    B. False

5. What is the purpose of showing ischemic burden?

A. Add some color to the trend

B. Add another alarm for ST elevation or depression

C. Provide additional information about the degree of ST changes during a period of time.

6. How can you access the arrhythmia menu?

A. From the ECG menu and the Alarms setup menu

B. From any parameter menu

C. From Data and Pages menu and the Alarms menu

7. How do you disable the automatic printing of lethal alarms?

A. You cannot disable the automatic printing of alarms

B. In the lethal alarms menu, uncheck the print on alarm feature

C. This is done under password protection

8. A Brady Alarm is considered a lethal alarm in all software packages.

A. True

B. False

Chapter 7: 12-lead Analysis

1. Which program uses 10 leads to perform a 12-lead ECG?

A. 12RL

B. EK Pro

C. 12SL

2. How many reports can be saved in the monitor?

A. 8

B. 10

C. 15

D. 16

3. Which is NOT a required field when using ACI-TIPI?

A. Gender

B. Age

C. Height

D. Chest or left arm pain

Chapter 8: Non-Invasive Blood Pressure

1. What does STAT NIBP do?

A. Initiates a one time quick blood pressure measurement

B. Initiates automatic blood pressure measurements continuously for five minutes

C. Initiates automatic blood pressure measurements every 5 minutes

Chapter 9: SpO_2

1. What conditions can cause inaccurate SpO_2 readings?

A. Hypotension, excessive ambient light, severe anemia

B. Incorrect sensor placement or application

C. Sensor placement on same extremity as blood pressure cuff

D. All of the above

2. All SpO_2 devices on the monitor display a signal strength indicator.

A. True

B. False

3. The Sat-Seconds feature applies to all technologies.

A. True

B. False

Chapter 10: Impedance Respiration

1. What are the two sources of the respiration measurement?

A. Heart rate and Impedance

B. Impedance and CO_2

C. Blood pressure and CO_2

2. If the Respiration Rate Source is set to Auto, what parameter is the first priority for respiration if it is available?

A. Impedance Respiration

B. CO_2

C. Peak Pressure

3. Once the Impedance Respiration measurement is enabled, you can only turn off the respiration measurement by discharging the patient.
    A. True
    B. False

Chapter 11: Temperature

1. Which menu would you access to change a temperature label?
    A. The Temperature setup menu
    B. The Parameter setup menu
    C. There is no temperature label menu; you must plug the temperature cable into the appropriate connector.

2. Which of the following is NOT a label for temperature?
    A. Bladder
    B. Core
    C. Cardiac Output
    D. Skin

Chapter 12: Invasive Pressure

1. What is the fastest way to zero all the invasive pressures simultaneously?
    A. You must zero all pressures individually; there is no way to zero all the pressure simultaneously.
    B. Select Zero All Pressures from the main menu
    C. Select Parameters > Invasive Pressure > Zero All from the main menu

2. Which menu would you access to change an invasive pressure label and scale?
    A. The Invasive Pressure setup menu
    B. The Invasive Pressure procedures menu
    C. The Procedures menu

3. From which invasive pressure menu would you access the wedge menu?
    A. Arterial
    B. CVP
    C. PA

4. Having channel names properly labeled to reflect the site being monitored is important for proper waveform processing since different algorithms are used for processing different sites.
    A. True
    B. False

5. What does the Catheter Insertion mode do?
    A. Optimizes and enlarges the PA waveform field and is used during pulmonary artery catheter insertion.
    B. Can be accessed under the Procedures menu as well as the PA Parameter Setup Menu
    C. Displays the waveform at a rate of 12.5mm/s
    D. All of the above

Chapter 13: Cardiac Output

1. Which Cardiac Output menu would you access to select a catheter type?
    A. The Procedure menu
    B. The Setup menu
    C. The Edit Average menu

2. What values are required to calculate a cardiac index? Select all that apply.
    A. Gender
    B. Age
    C. Height
    D. Weight

Chapter 14: Airway Gases

1. Which Airway Gas menu would you select to change the CO2 scale?
    A. The CO_2 Setup menu
    B. The Calibration menu
    C. The Agent/N_2O Setup menu

2. The E-CAiO module can automatically identify anesthetic agents.
    A. True
    B. False

3. What does the E-miniC module use to remove water from the sample line?
    A. The E-miniC does not use any method to remove water from the sample line.
    B. A sidestream airway adapter
    C. A D-fend water trap

Chapter 15: Trends and Snapshots

1. What is the fastest way to access the Trends menu?
    A. Select the Trends key from the main menu.
    B. Select Monitor Setup > Trends from the main menu.
    C. Select Data and Pages > Trends from the main menu.

2. What are the types of trend data that are available?
    A. Reports, Calculations, Snapshot, Event, ST-Snapshot
    B. Graphic, Numerical, Event, Snapshot, ST-Snapshot
    C. Event, Snapshot, Alarms, Settings, Calculations

3. Snapshots are limited to numerical data and do not include waveforms.
    A. True
    B. False

4. Which of the following statements regarding Events is TRUE?
    A. You cannot manually create an event.
    B. All events record a snapshot of that event.
    C. You can annotate any event.

5. How do you create a manual snapshot?
    A. You cannot create a manual snapshot.
    B. Select the Freeze/Snapshot main menu key.
    C. Select the Snapshot button on the PDM module.

Chapter 16: Calculations

1. What can you do if a drug is not listed in the drug calculator?
    A. Nothing, drugs are limited to the list of pre-selected drugs.
    B. Contact your administrator and new drugs can be added via the Service menu.
    C. Add a new drug through the Additional Drug button from the Calculator menu.

2. What are the three types of calculations available from the Calculations menu?
    A. Hemodynamic, Oxygenation and Ventilation
    B. Respiratory, Hemodynamic and Blood Gas
    C. Cardiac, General and ICU

Chapter 17: Bed-to-Bed Viewing

1. A remote bed must be alarming before you can view the bed-to-bed window.
    A. True
    B. False

2. What are the four main features that are displayed in the bed-to-bed window?
    A. Numerical trends, Graphical Trends, Alarms and location information
    B. Numerical trends, Alarms, Lab data, Calculations
    C. Waveforms, Numerical values, alarms, location information

3. For monitors that are hardwired to the network, how many beds can you choose for automatic viewing of a remote bed in alarm?
    A. 36
    B. 40
    C. 236

Chapter 18: Printing

1. What are two printers that may be available for use?
    A. A Recorder, configured laser printer
    B. Configured laser printer, configured ink jet printer
    C. The only printing capability is a local ink jet printer

2. What is the fastest way to print waveforms?
    A. Select Data and Pages > Print > Print Waveforms
    B. Select Trends > Print > Print Waveforms
    C. Select Print Waveforms from the main menu

3. There are three types of reports that can be printed to a laser printer: Care reports, Individual reports and Trends reports.
    A. True
    B. False

4. Which Printing menu enables you to choose a different print location?
    A. Waveforms
    B. Reports
    C. Devices

5. The print length can be adjusted for an arrhythmia alarm.

A. True

B. False

Chapter 19: Peripheral Devices

1. What would you use to connect a continuous cardiac output unit to the monitor?

A. A Unity ID Connectivity Device

B. The Defib Sync connector

C. You cannot connect a continuous cardiac output unit

CARESCAPE Modular Monitor Skills Checklist



Participant Name:_____

Hospital/Facility Name:_____

City/State:_____

Date of Class/Presenter: _____

Competent in the following skills	Yes	No	NA
Chapter 2: Hardware			
Identify components of the CARESCAPE Monitor used in your care area			
Insert and remove acquisition devices			
Name the main acquisition module used in your care area, and list the parameters measured from that acquisition module			
Chapter 3: Screen Navigation			
Identify areas of the display screen			
Access the correct menus for specific tasks to be done			
Chapter 4: Monitoring Basics			
Start monitoring and end monitoring a patient			
Select a different profile			
Select a page			
Change the priority order of parameter windows displayed on the screen			
Remove a parameter window displayed on the screen			
Add patient demographics			
Place monitor in standby mode and then resume monitoring			
Load data from PDM			
Chapter 5: Alarms			
Name the four levels of alarms			
Name the color and tone associated with each level of alarm			
Pause an audio alarm			
Place the monitor in audio pause			
Adjust an alarm limit for an individual parameter			

Competent in the following skills	Yes	No	NA
Set an arrhythmia alarm			
Adjust a priority level of an alarm			
Enable printing of an atrial alarm			
Adjust the alarm volume and alarm light			
Turn off audible alarms			
Chapter 6: ECG			
ECG:			
Identify the correct lead placement on a patient			
Change the leads viewed on the screen			
View all leads of ECG			
Turn pacemaker detection off			
Relearn the QRS			
Change the primary heart rate source			
Turn on or off the secondary HR source and identify the secondary HR rate in the HR window			
ST:			
Enable or disable ST monitoring			
Change the ST leads viewed in the ST parameter window			
Create a new reference QRS complex			
Turn on ischemic burden			
QT:			
Show QTc and display QT in the HR window			
Chapter 7: 12-Lead Analysis			
Identify correct lead placement for a 12-lead ECG			
Identify the necessary information needed in the monitor to perform a 12-lead ECG			
Transmit a 12-lead ECG to the MUSE			
Print a 12-lead ECG			
Delete a 12-lead ECG			
Chapter 8: Non-Invasive Blood Pressure			
Correctly place a cuff on a patient			
Start and stop a manual blood pressure measurement			

Competent in the following skills	Yes	No	NA
Initiate an automatic blood pressure measurement			
Adjust the cycle time of an automated blood pressure			
Adjust the initial inflation pressure			
Chapter 9: Pulse Oximetry			
Change the sweep speed, pulse rate, and pulse beep tone volume			
Correctly place the sensor on a patient			
Identify at least 2 things that validate a good SPO_2 signal and data			
Chapter 10: Impedance Respiration			
Turn on the respiration measurement			
Name the two sources of respiration detection			
Change a respiration lead			
Adjust the sensitivity for detecting respiration			
Turn on or off cardiac artifact alarm			
Chapter 11: Temperature			
Turn the temperature measurement on and off			
Change a temperature site label			
Change a temperature alarm limit			
Chapter 12: Invasive Pressure			
Change an invasive alarm limit			
Zero an invasive line			
Zero all invasive lines at the same time			
Re-label a pressure channel			
Change the invasive pressure response time			
Configure the screen for pulmonary artery catheter insertion			
Perform a PA wedge measurement			
Change the waveform view to combined waveforms			
Change the waveform scale			
Chapter 13: Cardiac Output			
Access the Cardiac Output Procedures menu			
Enter a height and weight for a cardiac index measurement			

Competent in the following skills	Yes	No	NA
Select a different catheter for cardiac output			
Start an automatic cardiac output measurement			
Start a manual cardiac output measurement			
Delete a cardiac output trial			
Chapter 14: Airway Gas			
Access the CO_2 setup menu and change a setting			
E-miniC:			
Empty the Mini D-fend water trap			
Adjust the scale of the CO_2 waveform			
Multi-gas E-Module			
Empty the D-fend water trap			
Adjust the scale of the CO_2 waveform			
Chapter 15: Trends and Snapshots			
View trends in Graphic and Numeric format			
Change the time scale for viewing trends			
View additional graphic or numeric trend data not shown on the current page			
Print a trend page			
View events by time and priority			
Create an event and annotate that event			
Create a manual snapshot			
Chapter 16: Calculations			
Use the drug calculator for a common drug on the unit			
Create a titration table for the calculation			
Add a temporary drug to the calculator			
View and edit hemodynamic calculations			
View and edit Oxygenation calculations			
View and edit Ventilation calculations			
Enter laboratory data			

Competent in the following skills	Yes	No	NA
Chapter 17: Bed-to-Bed Viewing			
View a remote bed that is not alarming			
Change the alarm notification for a bed set to auto view			
Configure individual beds for automatic viewing			
Chapter 18: Printing			
Identify printers used in the care area			
Initiate a manual printout of waveforms			
Print a report			
Change the waveforms to be printed			
Change the print location for waveforms			
Adjust options for graphic trend printouts			
Check the status of printers			
Chapter 19: Peripheral devices			
Demonstrate the ability to connect a peripheral device and display the parameter window on the screen			



Note! *Skills checklist is intended for facility use only. The GE Healthcare Clinical Applications Specialist is responsible only for presenting the information. The facility utilizes the skills checklist for participants as it determines necessary.*

CARESCAPE Modular Monitors Training Post Test **ANSWERS**



Chapter 2: Hardware

1. A, B, and C
2. C

Chapter 3: Screen Navigation

1. B
2. A

Chapter 4: Monitoring Basics

1. B
2. C
3. C
4. A
5. B
6. C
7. A

Chapter 5: Alarms

1. B
2. B
3. B
4. C
5. B

Chapter 6: ECG

1. A and B
2. B
3. A
4. A
5. C
6. A
7. B
8. B

Chapter 7: 12-lead Analysis

1. C
2. C
3. C

Chapter 8: Non-Invasive Blood Pressure

1. B

Chapter 9: SpO_2

1. D
2. B
3. B

Chapter 10: Impedance Respiration

1. B
2. B
3. B

Chapter 11: Temperature

1. A
2. C

Chapter 12: Invasive Pressure

1. B
2. A
3. C
4. A
5. D

Chapter 13: Cardiac Output

1. B
2. A, C, and D

Chapter 14: Airway Gases

1. A
2. A
3. C

Chapter 15: Trends and Snapshots

1. A
2. B
3. B
4. C
5. B

Chapter 16: Calculations

1. C
2. A

Chapter 17: Bed-to-Bed Viewing

1. B
2. C
3. B

Chapter 18: Printing

1. A
2. C
3. A
4. C
5. B

Chapter 19: Peripheral Devices

1. A

Course Evaluation

CARESCAPE Modular Monitors

Course Name:_____ Date: _____

Location:_____ Instructor:_____

Please complete the following survey. The information you provide will help us to improve the course for future learners.

Rate the training by circling the appropriate number

Course Content	**4 = Strongly agree**	**3 = Agree**	**2 =Disagree**	**1 = Strongly disagree**	
The content covered the topics adequately and clearly.	4	3	2	1	NA
The activities/exercises helped me learn the content presented.	4	3	2	1	NA
The participant guide was easy to follow.	4	3	2	1	NA
The knowledge checks and/or assessments in this course were effective in helping me validate my existing and acquired knowledge.	4	3	2	1	NA
Comments:					

Instructor Delivery	**4 = Strongly agree**	**3 = Agree**	**2 =Disagree**	**1 = Strongly disagree**	
Instructor was prepared for the training session.	4	3	2	1	NA
Instructor was knowledgeable about the course content.	4	3	2	1	NA
Instructor effectively presented the course content.	4	3	2	1	NA
Instructor effectively responded to student questions.	4	3	2	1	NA
Comments:					

Course Experience	**10 = Strongly agree**								**1 = Strongly disagree**	
Rate your overall satisfaction with the course content.	10	9	8	7	6	5	4	3	2	1
Rate your overall satisfaction with the Instructor delivery.	10	9	8	7	6	5	4	3	2	1
I would recommend this training course to a friend or colleague.	10	9	8	7	6	5	4	3	2	1
Comments:										

Would you like to be contacted in the future for further inputs on our training development, delivery, and operations processes?

☐ **No** ☐ **Yes** If yes, please provide your name and email ID here:_____

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Note: The Patient Data Module (PDM) is described in promotional materials as the CARESCAPE™ Patient Data Module.
Note: A portion of the Entropy software is derived from the RSA Data Security, Inc. MD5 Message-Digest Algorithm.

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Healthcare Re-imagined

GE is dedicated to helping you transform healthcare delivery by driving critical breakthroughs in biology and technology. Our expertise in medical imaging and information technologies, medical diagnostics, patient monitoring systems, drug discovery, and biopharmaceutical manufacturing technologies is enabling healthcare professionals around the world to discover new ways to predict, diagnose and treat disease earlier. We call this model of care “Early Health.” The goal: to help clinicians detect disease earlier, access more information and intervene earlier with more targeted treatments, so they can help their patients live their lives to the fullest. Re-think, Re-discover, Re-invent, Re-imagine.

GE Healthcare Finland Oy
Kuortaneenkatu 2
FI-00510 Helsinki, Finland
Tel: +358 10 39411
Fax: +358 9 1463310

www.gehealthcare.com

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DOC1453570
Printed in U.S.A.