SureSigns VS4
Vital Signs Monitor

INSTRUCTIONS FOR USE

Release A.04

English

PHILIPS

Notice

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Printing History

New editions of this document incorporate all material updated since the previous edition. Update packages may be issued between editions and contain replacement and additional pages to be merged by a revision date at the bottom of the page. Pages that are rearranged due to changes on a previous page are not considered revised.

The documentation printing date and part number indicate its current edition. The printing date changes when a new edition is printed. (Minor corrections and updates that are incorporated at reprint do not cause the date to change.) The document part number changes when extensive technical changes are incorporated.

First Edition. . . . . June 2012

Conventions

This section describes the conventions used in this guide.

Text Formatting

The following typographical conventions are used in this guide:

Typeface	Usage	Example
Bold	System keys	Press the **Main Screen** key.
Special bold	User interface text	Open the **System Menu**.

Typeface	Usage	Example
Italic	Variables, document titles	• *<product name>-<hardware configuration>-<software version>*.cfg • *SureSigns VM Series Instructions for Use*

Decimal Points

Because the SureSigns monitor uses a period (.) to indicate a decimal point in decimal numbers (for example, 10.0), all decimal numbers in this guide use a period as a decimal point. Commas are not used as decimal points.

Notes, Cautions, and Warnings

This guide uses the following conventions for Notes, Cautions, and Warnings.

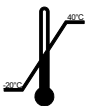
Note — A **Note** calls attention to an important point in the text.

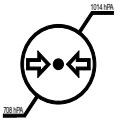
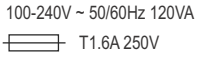
Caution **A Caution calls attention to a condition or possible situation that could damage or destroy the product or the user's work.**

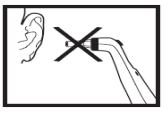
Warning **A *Warning* calls attention to a condition or possible situation that could cause injury to the user and/or patient.**

Explanation of Symbols

The following symbols appear on the SureSignsVS4 monitor and the monitor packaging.

Symbol	Description	Symbol	Description
	Alarm Silence key		NBP key
	NBP Interval key		Main Screen key
	Print key		On/Standby key
CE 0123	CE marking	SN	Serial number
Rx only	Prescription Use Only (US Federal Law)	LOT	Batch code
REF	Catalog number		Electrostatic sensitive device handling
	Fragile, handle with care		Temperature limitation

Symbol	Description	Symbol	Description
	Keep dry		Keep upright
	Atmospheric pressure limitation		Humidity limitation
SpO_2	SpO_2 connector	***ICES-001***	Canadian ISM requirement
	Caution, consult accompanying documents		Temperature connector
	Battery charging LED		AC Power LED
	NBP connector		USB port
	Nurse call connector		Option number
	Input power and fuse rating		Ethernet port

Symbol	Description	Symbol	Description
	EUFP (Environmentally friendly use period - China)		Equipotential grounding post
	Defibrillator Proof Type CF applied part		CSA mark
IPX1	Ingress protection to vertically falling water drops, except with tympanic thermometer		Compliance with WEEE standard
FCC ID	FCC label for radio	IC ID	Industry Canada label for radio
	CE marking for radio.		RF Interference
	Date of manufacture Date of first calibration		Use by
	Eject key		Probe cover installed
	Scan key		°C/°F key
	Probe cover not installed		Single Use

Symbol	Description	Symbol	Description
	Timer key		No Latex
	Choking Hazard		DEHP-free
	Consult instructions for use		Keep out of sun
	Non-Sterile		Manufacturer's Name and Address
	Sterile		

Regulatory and Safety Specifications

Declaration

CE 0123

The SureSigns VS4 vital signs monitor is a Class IIb device and complies with the requirements of the Council Directive 93/42/EEC of 14 June 1993 concerning medical devices and carries CE-marking accordingly.

CE !

The radio device used in the SureSigns VS4 vital signs monitor is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC (Radio Equipment and Telecommunications Terminal Equipment Directive).

Authorized EU Representative

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Germany

Rx Only

Caution **United States Federal Law restricts this device to sale by or on the order of a physician.**

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1
Overview

This guide describes how to operate the SureSigns VS4® vital signs monitor. For information about setting up the monitor, see the *SureSigns VS4 Installation and Configuration Guide* which describes how to install the battery, power up the monitor, and configure some of the system settings before using the monitor.

About the SureSigns VS4 Monitor

This chapter provides a brief overview of the SureSigns VS4 monitor.

Warning **Before each use, inspect the monitor and accessories for deterioration or damage. Replace any damaged equipment or report it to your system administrator.**

Note — Your VS4 monitor may or may not contain all of the functions and features discussed in this documentation. Please contact your local Philips representative for additional information.

The SureSigns VS4 is a vital signs monitor that measures blood pressure, pulse rate, oxygen saturation (SpO_2), and temperature. Features include:

- Adult, pediatric, and neonatal capability
- Lithium ion battery
- Touch screen
- Data export via wired LAN, wireless LAN,[1] or serial connection
- Storage of up to 800 patient records
- Flexible blood pressure modes, including manual start and stop, auto intervals, and user-defined interval programs
- SpO_2 waveform
- Optional recorder
- Optional roll stand or wall mount
- Optional barcode scanner for Patient ID entry

1. The wireless option may not be available in all countries.

Indications for Use

The SureSigns VS4 vital signs monitor is for use by health care professionals whenever there is a need for monitoring the physiological parameters of patients.

Standard and optional parameters include:

- NBP
- SpO_2
- Temperature

Intended Use

The SureSigns VS4 vital signs monitor is for monitoring, recording, and alarming of multiple physiological parameters of adults, pediatrics, and neonates in healthcare environments. Additionally, the monitor is intended for use in transport situations within a healthcare facility.

SureSigns VS4 Monitor Configurations

The SureSigns VS4 monitor is available in one configuration. In the table, a solid circle indicates a standard feature and a hollow circle indicates an optional feature.

	Measurement Parameters and Features					
	NBP	**Predictive Temp**	**Tympanic Temp**	**SpO_2**	**Recorder**	**Wireless**
863283	•	o	o	•	o	o

SureSigns VS4 Documentation

SureSigns VS4 documentation includes:

- ***SureSigns VS4 Installation and Configuration Guide***: Provides instructions for unpacking, installing, and connecting all hardware. Includes initial testing and configuration procedures. Also includes instructions for returning the monitor.
- ***SureSigns VS4 Instructions for Use***: Provides information for day to day operation of the SureSigns VS4 monitor. Also includes safety information, monitor specifications, and a list of compatible accessories.
- ***SureSigns VS4 Quick Card***: Provides brief descriptions of commonly used SureSigns VS4 functions.
- ***SureSigns VS4 Service Guide***: Provides instructions for repairing and testing the monitor. Includes assembly diagrams, spare parts lists and troubleshooting information.
- ***SureSigns VS4 Data Export Guide***: Provides detailed information about the syntax and structure of the HL7 messages that are exported from the VS4 monitors.
- ***SureSigns VS4 Network Configuration Guide***: Provides instructions for configuring your VS4 monitor to connect to a network using a wired LAN connection, a wireless LAN connection, or an RS-232 serial adapter.
- ***SureSigns VS4 QuickCapture Configuration Guide***: Provides instructions for configuring the QuickCapture feature on the SureSigns VS4 monitor. Includes information about defining the set of observations and assessments, creating a file to import that information into the monitor, and mapping the exported data to an EHR.

- ***SureSigns VS4 QuickAlerts Configuration Guide***: Provides instructions for configuring the QuickAlerts feature on the SureSigns VS4 monitor. Includes information about defining the set of alert messages, creating a file to import that information into the monitor, and mapping the exported data to an EHR.

Note — For information about purchasing additional copies of the *SureSigns VS4 Instructions for Use*, contact the Philips Customer Care Center.

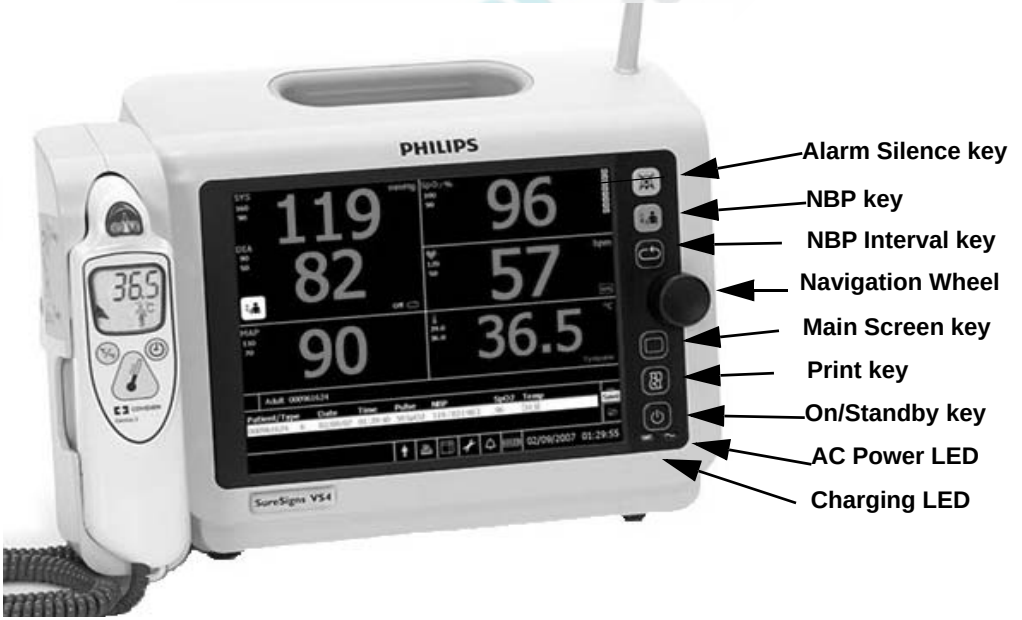
2
Basic Operation

This chapter describes how to begin using the SureSigns VS4 monitor.

For information on setting up and configuring the monitor, see the *SureSigns VS4 Installation and Configuration Guide*.

The Front Panel

All function keys and LEDs are on the monitor's front panel. The following illustration and table describe these controls.

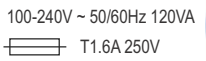


Control	Icon	Description
Alarm Silence key		Press to pause an alarm for a specified period of time.
NBP key		Press to start an NBP measurement or to start the first measurement of an NBP interval. If an NBP measurement is underway, press this key to stop the measurement.
NBP Interval key		Press to open the **NBP Interval Menu**, which is used to set an auto interval, create an interval program, or enable NBP STAT mode.
Main Screen key		Press to close a menu and return to the main screen.
Print key		Press to print patient records or SpO_2 waveforms.
On/Standby key		Press once to power up the monitor. Press again to enter Standby mode.
Navigation wheel		Use the navigation wheel to select and change various settings.
Charging LED		Changes color based on the charging status of the battery.

Control	Icon	Description
AC Power LED	~	When lit, indicates that the monitor is connected to an AC power source.

The Rear Panel

The following illustration and table describe the connectors on the back of the monitor.

Connector	Description
 Ethernet port	10/100 Base-T Ethernet port. Used for LAN data export. See your system administrator for more information.
 USB port	Standard USB 1.1, 4-pin connector used for: • The optional barcode scanner • Data export through the optional serial interface adapter • Export of patient records to a USB flash drive • Export and import of configuration settings • Software upgrades • Import of QuickCapture and QuickAlerts configuration files For more information, see your system administrator.
 Nurse call connector	3.5 mm phone jack for connection to a nurse call system.
Power connector 	Connection for the AC power cord.
 Equipotential grounding post	For facilities that require a potential equalization connection.

Setting up the Monitor

This section describes how to power up the monitor and charge the battery.

Powering Up

The monitor operates on AC power or the internal battery.

Note — Philips recommends that a battery is always installed in the monitor. If the monitor loses AC power, it resorts to battery power. If an AC power failure occurs and the monitor does not contain a battery, monitoring is interrupted and no alarms sound.

To power up the monitor:

Step	
1	Connect the power cord to the power connector on the monitor's rear panel and to an AC power source.
2	Ensure that the AC outlet is properly grounded and supplies the specified voltage and frequency (100 – 240 VAC, 50 – 60 Hz). **Note —** *Within the U.S., a hospital-grade outlet is recommended.*  AC Power LED The green AC Power LED on the front panel lights when the AC power source is connected. Also, the charging LED on the front panel indicates the current status of the battery. For more information, see "Charging the Battery" on page 2-6.

3	 On/Standby Key Press the **On/Standby** key. The monitor powers up and performs a self-test. During this self-test, the monitor also tests the speaker; listen for an audible tone to confirm that the speaker is working properly. To verify the speaker is working at any time, see “Testing Alarms” on page 4-20. You may also be prompted to change the system date the first time you power up the system. For more information, see “Changing the System Date and Time” on page 2-9.

If your facility requires a separate potential equalization connection, use the grounding post on the rear of the monitor. Connect a grounding cable from the post to the grounding system in your facility.

Charging the Battery

When the monitor is connected to AC power, the battery is being charged. When you first receive the monitor, the battery charge may be low. You should connect the monitor to an AC power source before using it on battery power alone.

If the monitor is connected to AC power, and the power cord is then disconnected, the monitor automatically resorts to battery power, if the battery is sufficiently charged. All alarm settings are preserved.

Note — To ensure that the battery is sufficiently charged, keep the monitor plugged in to AC power when it is not in use.

Three indicators show the charging status of the battery: the Charging LED, the Battery Status pane, and the large battery icon.

Charging LED

Charging LED

The Charging LED on the front panel provides the charging status of the battery. The color of the LED indicates how much charge remains in the battery:

- **Green:** The battery is at least 90% charged.
- **Flashing Green**: More than 30% charge, but less than 90%.
- **Yellow**: More than 21% charge, but less than 30%.
- **Flashing Yellow**: Less than 21% charge.

Battery Status Pane

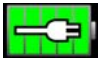
Battery Status

If the monitor is On (with battery or AC power), the Battery Status pane at the bottom of the monitoring screen indicates battery status. The number and color of bars in the pane indicates how much charge remains in the battery:

- Five **green** bars: At least 90% charge.
- Two to four **green** bars: More than 30% charge, but less than 90%.
- One **yellow** bar: More than 21% charge, but less than 30%. This charge level triggers a **Low Batt** technical alarm.
- One **red** bar: Less than 21% charge. This charge level triggers an **Extreme Low Batt** technical alarm.

If the monitor is On with battery power, you can highlight the Battery Status pane to view the estimated time remaining in the battery.

Large Battery Icon



Battery icon

If the monitor is in Standby mode and connected to AC power, a large battery icon appears in the middle of the monitor screen. The number and color of bars in the large battery icon correspond to the charge levels in the Battery Status pane, as described in “Battery Status Pane” on page 2-7. For more information about Standby mode, see “On/Standby Mode” on page 2-8.

Your system administrator can configure the monitor so the large battery icon does not appear on the monitor screen.

Note — If the battery level drops below 12%, the monitor enters Deep Sleep mode. No measurements are taken and no alarms sound. For more information, see “Deep Sleep Mode” on page 2-9.

Warning **Dispose of used batteries in an environmentally responsible manner. Do not dispose of the battery in normal waste containers. Consult your hospital administrator to find out about local arrangements.**

On/Standby Mode

If you press the **On/Standby** key while the monitor is On, the monitor goes into Standby mode and the following occurs:

- If the monitor is not connected to an AC power source, the display is blank.
- If the monitor is connected to an AC power source, a large battery icon appears in the middle of the screen, if configured to display. The number and color of bars in the icon indicate how much charge remains in the battery. If the battery requires service, a message is displayed.

Note — If the monitor is connected to an AC power source but does not contain a battery, the large battery icon contains no bars.

- Patient records remain in memory.
- Monitoring stops.

To reduce battery consumption, your system administrator can configure the monitor to automatically go into Standby mode after **5**, **10**, **15** or **30** minutes of inactivity. Only authorized personnel can change this setting (the **Auto Suspend** setting) in the password-protected **System Admin Menu**.

To resume monitoring, press the **On/Standby** key.

Deep Sleep Mode

The monitor enters Deep Sleep mode when:

- The monitor is not connected to an AC power source and it remains in Standby mode for more than 30 minutes or the battery level drops below 30%.
- The monitor is on, but not connected to an AC power source, and the battery level drops below 12%.

In Deep Sleep mode, the display is blank and the system uses minimal power to maintain the system clock.

To resume monitoring, connect the monitor to an AC power source and press the **On/Standby** key to turn the monitor back On.

Changing the System Date and Time

Use the following procedure to change the system date and time. If the **Date /Time Menu** is already open, skip to step 2.

Note — If your system administrator disables the **Date/Time Menu** in the password-protected **System Admin Menu**, you cannot change the system date and time.

The following conditions apply to the system date and time:

- If the monitor is networked and your system administrator has enabled time synchronization, the monitor date and time are automatically synchronized with the hospital EHR server or the HL7 interface server.
- The date and time cannot be changed while a patient record is open, patient records are being printed, or if a temperature or NBP measurement is in progress.
- The system clock does not adjust for daylight saving time. If time synchronization is not enabled, you must manually change the time on the monitor.

To change the system date and time:

Step	
1	Touch the date and time pane in the lower right corner of the screen display. The **Date/Time Menu** appears.
2	Touch the value you want to change. A keypad appears.
3	Enter the value in the keypad and touch **OK**.
4	Repeat step 2 through step 3 to change other values in the menu.
5	Touch the **Apply** button to save your changes and close the menu.

You can change the date format (**mm/dd/yyyy** or **dd/mm/yyyy**) and you can hide the time display using options in the **System Menu**. For details, see “Changing System Settings” on page 2-15.

Mounting the Monitor

You can mount the monitor on a roll stand or a wall mount.

Caution **If your monitor is mounted on a roll stand, use the handle on the roll stand to move the monitor. Do not use the monitor handle or the antenna to move the monitor; doing so creates stress on the mounting bracket and could cause the monitor to fall off the roll stand.**

Note — The weight of objects placed in the roll stand's basket must not exceed 3.6 kg (8 lb).

For information on mounting the monitor, see the *Instructions for Use* that came with the mounting hardware.

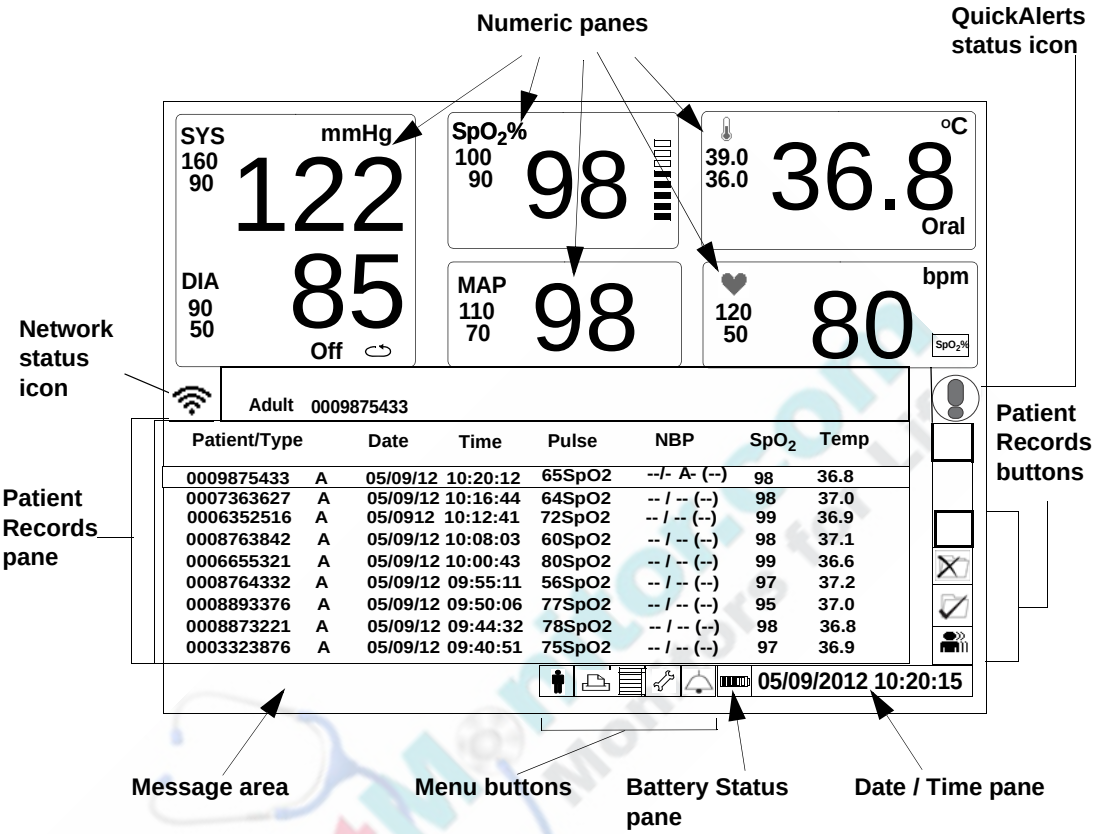
Screen Display

Note — The illustrations in this section shows the screens on a fully configured VS4 monitor.

The main screen contains the following elements:

- The **Network status** icon appears if the monitor is connected to a wired or wireless network. For more information, see "Networked Monitors" on page 2-20.
- **Numeric panes** display vital signs measurements.
- The **Patient Records pane** displays patient records that are saved on the monitor. For more information, see "The Patient Records Table" on page 3-1.

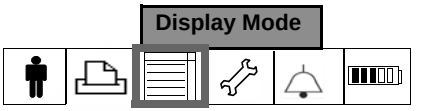
- **Patient Records buttons** are used to view, save, edit, delete, or cancel changes to patient records and to validate records before exporting them to the EHR. For more information, see “Creating a Patient Record” on page 3-11.
- The **Message area** displays short text descriptions of all active alarms. For more information, see Chapter 4, “Alarms.”
- The **QuickAlerts** status icon. For more information, see “QuickAlerts Messages” on page 4-2.
- **Menu buttons** are used to open menus to change system settings.
- The **Battery Status pane** shows the current charge of the monitor’s battery. For more information, see “Charging the Battery” on page 2-6.
- The **Date/Time** pane displays the current date and time. You can hide the time, as described in “Changing System Settings” on page 2-15.


Numeric panes
QuickAlerts status icon
SYS
160
90
122
mmHg
DIA
90
50
85
Off
SpO2%
100
90
98
MAP
110
70
98
°C
39.0
36.0
36.8
Oral
bpm
120
50
80
SpO2%
Network status icon
Adult 0009875433
Patient Records buttons
Patient Records pane
Patient/Type Date Time Pulse NBP SpO2 Temp
0009875433 A 05/09/12 10:20:12 65SpO2 --/- A- (--) 98 36.8
0007363627 A 05/09/12 10:16:44 64SpO2 -- / -- (--) 98 37.0
0006352516 A 05/0912 10:12:41 72SpO2 -- / -- (--) 99 36.9
0008763842 A 05/09/12 10:08:03 60SpO2 -- / -- (--) 98 37.1
0006655321 A 05/09/12 10:00:43 80SpO2 -- / -- (--) 99 36.6
0008764332 A 05/09/12 09:55:11 56SpO2 -- / -- (--) 97 37.2
0008893376 A 05/09/12 09:50:06 77SpO2 -- / -- (--) 95 37.0
0008873221 A 05/09/12 09:44:32 78SpO2 -- / -- (--) 98 36.8
0003323876 A 05/09/12 09:40:51 75SpO2 -- / -- (--) 97 36.9
05/09/2012 10:20:15
Message area
Menu buttons
Battery Status pane
Date / Time pane

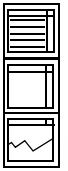
Tool Tips

When you touch a button in the main screen, a description appears.

Tool Tip for Display Mode button

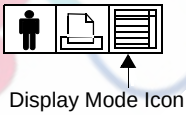


Changing the Display Mode



By default, the Patient Records pane displays all saved patient records. To hide the records or to display an SpO_2 waveform (if SpO_2 is installed on your monitor), open the **Display Mode** menu and select a different mode, as described in the following procedure.

To change the display mode:

Step	
1	 Touch the **Display Mode** button. The **Display Mode** menu appears and the currently active mode is highlighted. **Note —** *The button changes, depending on which mode is currently active.*
2	Touch a different display mode to select it. The new display mode is active.

Changing System Settings

The **System Menu** contains the following:

- System settings buttons, which allow you to change system-wide settings.
- Monitor-specific information. See “Viewing Monitor Information” on page 2-19.
- The **Save Patient Records** button, which allows you to export patient records to a USB flash drive. For more information, see “Saving Patient Records to a USB Flash Drive” on page 2-17.
- The **System Admin** button, which provides access to the password-protected **System Admin Menu**. Only qualified personnel can access the **System Admin Menu**.
- The **Shutdown** button, which allows qualified personnel to shut down the monitor for maintenance or repair.
- The **Lock Touch Screen** button temporarily locks the touch screen. To unlock the touch screen, return to the System Menu and press the **Unlock Touch Screen** button.

To change settings in the **System Menu**:

Step	
1	 System button Touch the **System** button. The **System Menu** appears.

2	Touch one of the following system settings: • **Recorder Speed** — If your monitor has a recorder, you can use this option to change the speed at which it prints. The lower the speed, the greater the resolution in the printed waveforms. Options are: **50**, **25**, **12.5**, and **6.25 mm/sec**. **Note —** *The Recorder Speed setting is independent of the Sweep Speed setting for the SpO_2 waveform.* • **Waveform Print** — Use this setting to select the length of printed waveforms. Options are **7 seconds** and **20 seconds**. For more information, see "Printing an SpO_2 Waveform" on page 10-6. • **Date Format** — You can change the monitor's date format. Options are **mm/dd/yyyy** and **dd/mm/yyyy**. • **Display Time** — Use this setting to show or hide the time in the lower right corner of the display. • **Default Patient Type** — Select a patient type. Each time you start a new patient, the default patient type is selected and the alarm settings are restored to the default values for the specified patient type. • **Monitor Name** — The default monitor name is the monitor serial number. You can use this field to change the default name to a more meaningful name. The first character must be an alphabetic character. The **Monitor Name** must be from 2 to 10 characters long. The name can contain the uppercase and lowercase letters from A to Z, the numbers 0 through 9, and the hyphen (-) character. The name cannot contain spaces. The final character must not be a hyphen. **Note —** *A message appears if you enter a monitor name that contains invalid characters or is already in use on the network.*
3	Press the **Main Screen** key on the front panel to close the menu. **Alternative:** Touch the **Main Screen** button.

Saving Patient Records to a USB Flash Drive

Warning

Exported patient records contain patient IDs and patient data. Ensure that the exported data is handled according to your facility's electronic protected health information (ePHI) guidelines.

Only authorized personnel should be allowed to view, store or transmit patient data.

Use the **Save Patient Records** button in the **System Menu** to export patient data to a USB flash drive. The exported file is a space-delimited .csv file with the name: RecordLog_*Monitor Name*.csv.

Note — Patient IDs containing non-alphanumeric characters may not display correctly if viewed in Microsoft Excel®.

Philips recommends using a SanDisk® or Kingston® USB flash drive.

To save patient records to a USB flash drive:

Step	
1	Insert a USB flash drive in the USB port on the back of the monitor.
2	Touch the **System Menu** button, and then touch the **Save Patient Records** button to start the export process. A message indicates that the patient records have been exported. **Note —** *If the USB flash drive is not detected, ensure that the flash drive is completely inserted into the USB port.*
3	Press the **Main Screen** key to close the menu. **Alternative:** Touch the **Main Screen** button.

Viewing Monitor Information

The **System Menu** displays the following read-only information about the monitor:

- **Serial Number** — The monitor's serial number, which also appears on the back of the monitor. The serial number is configured in the factory.
- **Hardware ID** — The version for each of the following hardware components:

  <*Main Board*> - <*Front End Board*> - <*FPGA*>
- **Software Version** — The software version installed on the monitor.
- **LAN MAC Address** — The unique MAC address assigned to the monitor. The MAC address is configured in the factory.
- **LAN IP Address** — The IP address currently assigned to the monitor.
- **WLAN MAC Address** — The unique wireless MAC address assigned to the monitor. The MAC address is configured in the factory.
- **WLAN IP Address** — The wireless IP address currently assigned to the monitor.
- **Language** — The language currently configured on the monitor.
- **Configuration** — The monitor type and the parameters installed in the monitor.

Note — The IP address is 0.0.0.0 until a network connection is established.

Networked Monitors

You can connect the VS4 monitor to a network using a standard wired LAN connection, a wireless LAN interface, or a serial interface adapter. A networked monitor can export patient records from the monitor to an access point or router, and then forward the data to an HL7 interface server or EHR system.

If your monitor is networked, the records in the Patient Records table change from white to green after they have been exported successfully. See “Patient Record Colors” on page 3-10.

Caution **If you are using the optional serial interface adapter to export data and you disconnect the adapter to move the monitor to a different location, make sure the black sheath completely covers the RS-232 connector after you reconnect the cable.**

Verifying the Network Connection

The network status icon, which appears on the main screen, indicates the status of the monitor’s network connection. If the monitor detects a LAN IP address and a WLAN IP address, the monitor first selects LAN for network communication.

Icon	Connection Status
	The monitor is currently connected to a wireless network. The number of bars displayed indicates the signal strength. Four bars indicates the strongest signal and no bars indicates a very weak signal.
	The monitor is currently connected to a wired network.
No icon	If the pane is empty, the monitor is not connected to a wired or wireless network.

Synchronizing the Date and Time

Your system administrator can configure the VS4 monitor to automatically synchronize the clock on the monitor to the clock on the EHR server or HL7 interface server.

If the clock on the monitor differs by more than 5 seconds from the clock on the server, the monitor will immediately adjust the date and time, unless:

- A patient record is open; the time change will occur after the record is closed.
- An NBP or temperature measurement is in progress; the time change will occur when the measurement is complete.
- A patient record is being printed; the time change will occur after printing is complete.

If the time difference is greater than 30 seconds, the following occurs:

- A low priority technical alarm message, **Date/Time Adjusted**, appears and flashes in the monitor's message area.

Note — No audible alarm is associated with a **Date/Time Adjusted** alarm message. To clear the message, press the **Alarm Silence** key.

- A horizontal blue line appears in the Patient Records table to indicate when the date/time adjustment occurred.
- In NBP Interval mode, the monitor starts a new NBP measurement.

Using the Monitor Safely

All of the patient applied parts on the SureSigns VS4 vital signs monitor are classified as type CF, which specifies their degree of protection against electrical shock. All are rated as defibrillator proof, as indicated by the heart symbol on the side panel.

This monitor is suitable for use in the presence of electrosurgery.

Ensure that the monitor is in working condition before clinical use. If the accuracy of any measurement does not seem reasonable, first check the patient's vital signs by alternative means and then with the monitor to make sure it is working properly. Always verify that the monitor's settings match your intended selections.

If you connect the monitor to any instrument, verify proper operation before clinical use. Refer to the instrument's Instructions for Use for full instructions.

Accessory equipment connected to the monitor's data interface must be certified according to EN/IEC Standard 60950 for data-processing equipment or EN/IEC Standard 60601-1 for electromedical equipment. All combinations of equipment must be in compliance with EN/IEC Standard 60601-1-1 systems requirements.

Anyone who connects additional equipment to the signal input port or signal output port configures a medical system and is therefore responsible to ensure that the system complies with the requirements of system standard EN/IEC Standard 60601-1-1. If in doubt, contact the Philips Customer Care Center or your local Philips representative.

The monitor and its accessories must be tested by qualified service personnel at regular intervals to ensure that performance has not been degraded by aging or environmental conditions. Periodic performance verification tests can be performed, as described in the *SureSigns VS4 Service Guide*.

Warning

The wireless radio complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the monitor and any person.

Explosion Hazard. Equipment not suitable for use in the presence of a flammable anaesthetic mixture with air or oxygen or nitrous oxide. Oxygen concentrations must be <25% and partial pressure <27.5 kPa when no other oxidants are present.

Electric shock hazard. Covers should be removed only by qualified service personnel. There are no user-serviceable parts inside.

Do not touch the patient, or table, or instruments during defibrillation.

Measurement accuracy may decrease temporarily while performing electro-surgery or defibrillation. This does not affect patient or equipment safety.

Do not open the monitor or attempt to change the battery. If you suspect a problem with parts within the monitor, contact your biomedical engineer or local Philips Representative.

Route patient cabling to reduce the possibility of patient entanglement or strangulation. To reduce this risk, Philips recommends the use of the cable management kit. For more information, see “Miscellaneous Accessories” on page 12-10.

Do not place the monitor in any position that might cause it to fall on the patient. Do not lift the monitor by the power supply cord or patient connections.

Do not use the monitor on more than one patient at a time.

To ensure patient electrical isolation, connect only to other equipment that provides patient electrical isolation.

Do not use extension cords to connect the monitor to electrical outlets.

LAN cables must meet all local electrical requirements.

Do not use the monitor or SpO_2 sensors during magnetic resonance imaging (MRI) scanning. Induced current could potentially cause burns. The monitor may affect the MRI image, and the MRI unit may affect the accuracy of the monitor’s measurements.

If multiple instruments are interconnected or if multiple instruments are connected to a patient, the sum of the leakage currents may exceed the limits given in IEC/EN60601-1-1. Consult your service personnel.

Do not connect this monitor to any equipment or device, other than those specified in this guide.

Sterilization is not recommended for this monitor, accessories or supplies, unless otherwise indicated in the Instructions for Use that accompany the accessories and supplies.

Use only approved accessories with the monitor. The use of unapproved accessories can diminish monitor performance or safety. Consult the Instructions for Use that accompany the accessories.

Electromagnetic interference may cause disruption of performance. Protect the monitor from sources of intense electromagnetic radiation. This device is designed to provide resistance to electromagnetic interference; however, because of the proliferation of radio-frequency transmitting equipment and other sources of electrical noise (such as cellular phones, mobile two-way radios, and electrical appliances) in the healthcare and home environments, it is possible that high levels of such interference due to close proximity or strength of a source, may result in disruption of performance of this device. Disruption may be evidenced by erratic readings, cessation of operation or other incorrect functioning. If this occurs, the site of use should be surveyed to determine the source of this disruption, and actions taken to eliminate the source. If you need assistance, contact the Philips Customer Care Center or your local Philips Representative.

Consult the Instructions for Use that accompany the accessories.

Disposing of the monitor: To avoid contaminating or infecting personnel, the environment or other equipment, make sure you disinfect and decontaminate the monitor appropriately before disposing of it in accordance with your country's laws for equipment containing electrical and electronic parts. For disposal of parts and accessories such as thermometers, where not otherwise specified, follow local regulations regarding disposal of hospital waste.

Before disposing of a SureSigns VS4 monitor, delete all patient information. For instructions on deleting patient data, see the *SureSigns VS4 Service Guide.*

To protect confidential patient information follow these guidelines:

- **Do not leave the monitor unattended.**

- **Ask your system administrator to activate the Auto Suspend option, which causes the display to go blank if there is no user interaction with the monitor. Your system administrator can also select the Large Battery Icon check box, which displays the large battery icon when the monitor goes into Standby mode.**

- **Use the Hide Patient Records option, which allows you to hide all saved records. For more information, see “Changing the Display Mode” on page 2-14.**

Access to the System Admin Menu is restricted. It is password-protected to ensure that only system administrators, biomedical engineers, or other qualified service personnel can change the system-wide settings on the monitor.

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3
Creating and Managing Patient Records

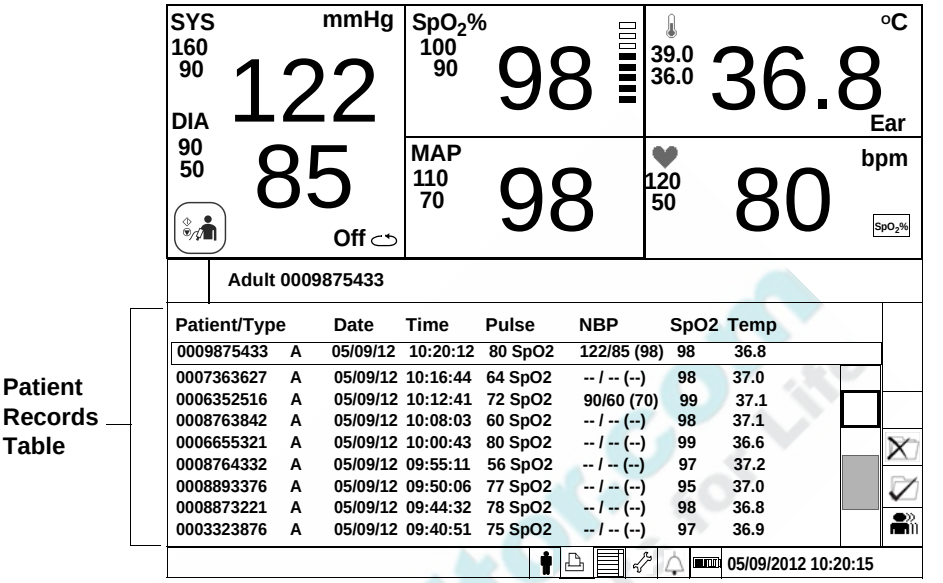
This chapter describes how to save vital signs measurements to a patient record and how to manage records in the Patient Records table.

This chapter also describes:

- Editing patient records before reviewing and exporting
- Deleting patient records
- Entering patient observations and assessments in a patient record during interval mode
- Reviewing and validating patient records using the Review menu (if the QuickCheck feature is enabled)

The Patient Records Table

The Patient Records table can store and display up to 800 records in chronological order. The newest record appears at the top of the list and the oldest one at the bottom of the list. If you try to enter more than 800 records, the oldest entry is deleted from the database, and the new one is added.



Each entry contains a patient ID (or **ID Unknown** if you do not enter an ID), the patient type, date and time, and up to four measurements. The **Time** column shows the time at which the last measurement completed. A question mark (**-?-**) in the record indicates an invalid measurement and dashes (**--**) indicate that the parameter was not measured.

Caution **If your patient records are exported over a wired or wireless network, you must enter a patient ID and any additional information required by your facility.**

Patient Records Buttons

The following table describes the buttons that appear to the right of the Patient Records table.

Button	Button Name	Description
	**QuickCapture**	If the QuickCapture feature is enabled on your monitor, and the monitor is in NBP Interval mode or Continuous SpO_2 mode, select the **QuickCapture** button to enter observations and assessments between NBP intervals or continuous SpO_2 measurements. For more information, see “Entering Observations and Assessments in Interval Mode” on page 3-14.
	**Review**	If the QuickCheck feature is enabled on your monitor, touch the **Review** button to review and validate the record before exporting it to the EHR. If you are authorized to review and validate patient records, see “Reviewing and Validating Patient Records” on page 3-27.
	**Delete**	If the record is closed, touch the **Delete** button to delete the saved record.
	**Edit**	If the record is closed, touch the **Edit** button to edit the record.
	**Cancel**	If the record is open, touch the **Cancel** button to discard the record before it is saved to the database.
	**Save**	If the record is open, touch the **Save** button to save the record.

Button	Button Name	Description
	**View Records**	Touch the **View Records** button to toggle between **View Patient** mode and **View All** mode. Select **View Patient** mode to view all records for a specific patient. Select **View All** mode to view all records in the Patient Records table.

See the procedures later in this chapter for detailed information on using these buttons.

Patient Observations and Assessments

If the QuickCapture feature is enabled on your monitor, you can enter patient observations and assessments when a record is open to take vital signs measurements. A pane containing the patient observation and assessment fields configured for your facility is displayed below the open record.

If the monitor is in NBP Interval mode or Continuous SpO_2 mode, you can select the **QuickCapture** button to open a record and enter observations and assessments. For more information, see “Entering Observations and Assessments in Interval Mode” on page 3-14.

Observations and assessments that appear in red are recommended by your facility. If more than 10 observations and assessments are defined on the monitor, you can select the **More** button to view additional observation and assessment input fields.

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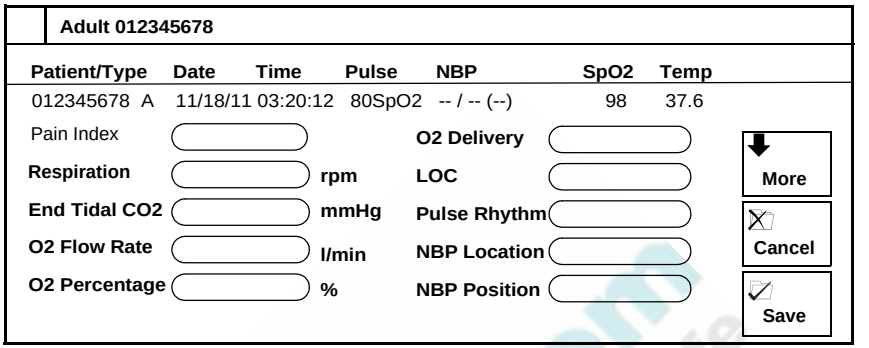

Patient ID Overview

Your system administrator configures your monitor to display any or all of the following patient ID input fields in the **New Patient Menu:**

- **MRN** (Medical Record Number): A unique number used to track and identify a patient. Maximum length is 20 characters.
- **Transaction ID**: Also known as a visit ID, the transaction ID is a unique number used to track a single patient visit. Maximum length is 20 characters.
- **First Name**, **Middle Name**, **Last Name**: The patient's name. Maximum length is 15 characters for each name field.
- **Location ID**: Typically, a description of the physical location of the monitor, for example a room number. Maximum length is 12 characters.

Note — If the monitor remains in one location, your system administrator can configure a default Location ID so that you do not have to manually enter a Location ID each time you create a new patient.

- **Operator ID**: The ID of the person using the monitor to measure a patient's vital signs. Maximum length is 12 characters.

Note — Your system administrator can configure the monitor to retain the operator ID for up to 30 minutes so that you do not have to manually enter your operator ID each time you create a new patient.

- **DOB**: The patient's Date of Birth. The format is **dd/mm/yyyy** or **mm/dd/yyyy**.
- **Gender**: The patient's gender. Valid selections are: blank, **Male**, and **Female**.

The available patient ID input fields can only be changed by your system administrator in the password-protected **System Admin Menu**. In this guide, the term *patient ID* refers to any of the patient ID types listed above.

Your system administrator also specifies whether an ID field is required. An asterisk appears next to all required patient IDs in the **New Patient Menu**. You cannot save the patient record until all required input fields are complete.

When you scroll through the Patient Records table, the display splits into two panes. The top pane displays the patient records stored on the monitor, and the bottom pane displays all of the patient IDs for the highlighted record.

Primary Patient ID

Your system administrator configures a primary ID, which can be the MRN, Transaction ID, or Location ID. On the **New Patient Menu** and the **Edit Patient Menu**, the primary ID field is enclosed in brackets (for example, **[MRN]**).

To save a record with an ID, you must enter information in the selected primary ID field. If you do not enter information in the primary ID field, the record will be saved as **ID Unknown**.

The selected primary ID appears in each patient record in the Patient Records table.

Your system administrator can configure the monitor to validate the primary ID that you enter at the monitor against patient IDs stored on the Intellibridge Enterprise (IBE) server. The monitor uses the primary ID to locate and retrieve the remaining patient ID information. When the primary ID is validated, the IBE

server returns the patient ID information and populates the corresponding fields on the monitor.

Methods for Entering and Editing Patient IDs

Your system administrator configures the method for entering patient IDs. You can enter patient IDs by using one of the following methods:

- A standard barcode scanner that reads each patient ID one at a time
- A programmed barcode scanner
- The on-screen keyboard

Using a Barcode Scanner

Before you begin scanning, make sure that you are familiar with the barcodes used at your facility.

If your barcode scanner reads individual barcodes one at a time, the monitor prompts you to scan each patient ID. The scanned information is transferred to the highlighted patient ID field on the monitor. When the monitor prompts you to scan a patient ID, you need to know which barcode corresponds with the highlighted patient ID field.

If your barcode scanner is programmed, the scanned information is automatically transferred to the corresponding patient ID fields on the monitor.

To get a proper read with the scanner:

- Hold the scanner closer to small barcodes and farther away from large barcodes.
- Ensure that the patient’s wrist band is lying flat and the barcode is visible.
- Ensure that the barcode is not damaged.
- Pause for at least one second between scans.

Note — If the barcode scanner cannot read the barcode, you can unplug the scanner and use the on-screen keyboard to enter patient IDs.

Using the On-screen Keyboard

You can use the on-screen keyboard to enter alphanumeric characters and special characters

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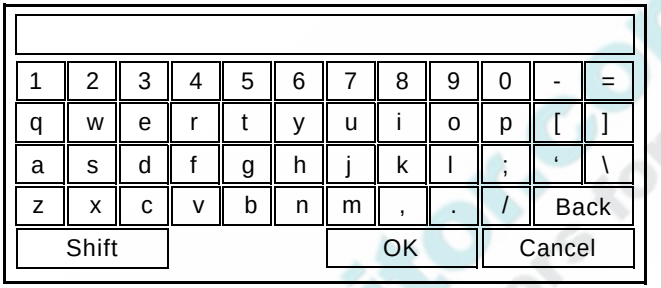


Use the on-screen keyboard as you would use a conventional keyboard:

- Enter information by selecting one character at a time.
- Use the **Shift** button to access uppercase letters and other special characters.
- Use the **Back** button to erase an incorrect character.
- Select **OK** to confirm what you have entered and close the keyboard.
- Select **Cancel** to close the keyboard.

User Authentication

Your system administrator can configure the monitor so that you are required to enter an operator ID and password before you create a patient record. Your system administrator provides you with the required password.

You can select the **Skip** button and continue creating a new patient record without entering your operator ID and password. However, you will be required to enter your operator ID and password before you can access the **Review** menu.

For information about reviewing patient records before exporting them to an EHR server, see “Reviewing and Validating Patient Records” on page 3-27.

Your system administrator can configure the monitor to retain the operator ID for up to 30 minutes so that you do not have to manually enter your operator ID each time you create a new patient. If the QuickCheck feature is enabled, and the configured time period has expired, you may be prompted to enter your operator ID and password when you create a new patient.

Caution If the monitor is left unattended during the specified timeout period, any operator can access patient data. To reset the operator ID and password, press the **On/Standby** key.

Patient Record Colors

The color of each record in the Patient Records table indicates its status, as described in the following table.

Color	Description
Red	The record is open.
White	The record has been saved. If the monitor is networked, a white record is ready to export to the EHR server. The monitor checks for new records every 60 seconds.
Green	The record has been exported successfully. A green record can no longer be edited.
Purple	If the QuickCheck feature is enabled, the record may have to be reviewed before it can be exported to the EHR server.
Blue	The record was not exported successfully and must be corrected. A message indicating the reason the record was rejected may appear on the monitor screen. If the QuickCheck feature is enabled and you correct the record, the color changes from blue to purple. The record may have to be reviewed again before it can be exported to the EHR server.

Creating a Patient Record

This section describes how to enter a patient ID, take a set of vital signs measurements, and save the measurements to the Patient Records table.

Warning

The procedures in this section instruct you to enter patient IDs in the New Patient Menu *before* taking the patient's vital signs measurements. Follow the steps in the order they are written. Taking measurements before entering patient IDs may result in sending a patient record with the wrong patient ID to the EHR.

Caution

Before you begin monitoring, make sure that the correct patient type is selected. The default alarm limits and initial cuff inflation pressures are based on the selected patient type.

Once the patient record has been saved, you cannot change the patient type.

Notes

- You do not have to enter a patient ID to take a set of measurements. However, only records that have a patient ID can be exported over a LAN or WLAN network. If you are unsure if a patient ID is required, see your system administrator.
- Depending on the workflow that your system administrator configures, you may be prompted to enter your operator ID and password to review patient records. For more information, see "Reviewing and Validating Patient Records" on page 3-27.

To create a new patient record

Step	
1	 New Patient button Scan a barcode, or touch the **New Patient** button. The **New Patient Menu** appears.
2	If you are prompted, enter your operator ID and password, and then select the **OK** button. **Notes** • *If you select the* **Skip** *button, you may be prompted to enter an operator ID and password when you review the record. For more information about reviewing records, see "Reviewing and Validating Patient Records" on page 3-27.* • *If you receive an error message after entering your operator ID and password, see Chapter 14, "Troubleshooting."*
3	If the patient type is correct, go to step 4. To change the patient type, touch the **Patient Type** field and then select a patient type. The choices are: • **Adult** • **Pediatric** • **Neonatal**
4	Enter one or more patient IDs. An asterisk appears next to every required field. **Note —** *The* **OK** *button only becomes active when all required patient ID fields are complete.*
5	When you are done entering IDs, touch the **OK** button to return to the main screen. A new row appears at the top of the Patient Records table. The new row contains the patient ID and the patient type. The text in the new row is red.

6	Begin taking vital signs measurements.
7	Optionally, enter observations and assessments in the QuickCapture pane. If your monitor is configured to display more than 10 observations and assessments, select the **More** button to display additional observation and assessment input fields.
8	When all measurements appear in the open record, do one of the following: • **To save the record,** touch the **Save** button. The text in the record changes color. For a description of the record colors, see “Patient Record Colors” on page 3-10. • **To discard the record,** touch the **Cancel** button. The record is not saved to the Patient Records table. **Note —** *If you do not touch the* **Save** *button or* **Cancel** *button, the record remains open for a time interval configured by your system administrator. After the specified time elapses, the monitor automatically saves the measurements and closes the record. If QuickCapture is enabled, the time interval is 5 minutes after the last interaction.*

Entering Observations and Assessments in Interval Mode

If the QuickCapture feature is enabled and the monitor is in NBP Interval mode or Continuous SpO_2 mode, you can enter patient observations and assessments during the interval period. The monitor saves these observations and assessments in a new record.

To enter patient observations and assessments in interval mode:

Step	
1	 QuickCapture button Touch the **QuickCapture** button. The QuickCapture pane appears below an open record.
2	Touch an observation or assessment field. If your monitor is configured to display more than 10 observations and assessments, select the **More** button to display additional observation and assessment input fields.
3	Touch the desired option.
4	When you are done entering observations and assessments, do one of the following: • To save the new record, touch the **Save** button. • To discard the record, touch the **Cancel** button.

Saving Records Without a Patient ID

Caution **Before you begin monitoring, make sure that the correct patient type is selected. The monitor's default alarm limits and initial cuff inflation pressures are based on the selected patient type. Once the record is saved, you cannot change the patient type.**

This section describes how to save vital signs measurements in a record without entering a patient ID. If you save a record with an unknown ID and then decide to assign an ID, you can edit it as described in "Editing a Patient Record" on page 3-23.

Note — You do not have to enter a patient ID to take a set of measurements. However, only records that have a primary patient ID can be exported over a LAN or WLAN network. If you are unsure if a patient ID is required, see your system administrator.

To save a record without a patient ID:

Step	
1	On the main screen, verify that the correct patient type (**Adult**, **Pediatric**, or **Neonatal**) is selected. The current patient type appears in the top of the Patient Records pane. If the patient type is correct, go to step 6.
2	 New Patient button To change the patient type, touch the **New Patient** button. The **New Patient Menu** appears.

3	If you are prompted, enter your operator ID and password. **Notes** • *If you select the* **Skip** *button, you may be prompted to enter an operator ID and password when you review the record. For more information about reviewing records, see"Reviewing and Validating Patient Records" on page 3-27.* • *If you receive an error message after entering your operator ID and password, see Chapter 14, "Troubleshooting."*
4	Touch the **Patient Type** field, and then touch the desired patient type.
5	Touch the **OK** button to close the **New Patient Menu**. **Note —** *The* **OK** *button is unavailable until all required patient ID fields are complete.* A new row appears at the top of the Patient Records table. The text in the new row is red.

6	Begin taking vital signs measurements.
7	Optionally, enter observations and assessments in the QuickCapture pane. If your monitor is configured to display more than 10 observations and assessments, select the **More** button to display additional observation and assessment input fields.
8	When all measurements appear, do one of the following: • **To save the record,** touch the **Save** button. After the information is saved, the text changes color. For more information about record colors, see "Patient Record Colors" on page 3-10. • **To discard the record,** touch the **Cancel** button. The record is not saved to the Patient Records table. **Note —** *If you do not touch the* **Save** *button or* **Cancel** *button, the record remains open for a time interval configured by your system administrator. After the specified time elapses, the monitor automatically saves the measurements and closes the record. If QuickCapture is enabled, the time interval is 5 minutes after the last interaction.*

Viewing Records in the Patient Records Table

The Patient Records table displays up to nine records at one time. You can use the scroll bar to the right of the Patient Records table to scroll through all saved records. You can also view all records for a specific patient.

When you scroll through the Patient Records table, additional patient information for the highlighted record appears in a separate pane at the bottom of the screen.

The **View Records** button in the lower right corner of the Patient Records pane toggles between two modes: **View Patient** and **View All**. Use **View Patient** mode to view all records for a specific patient. Use **View All** mode to view all records in the Patient Records table.

Note — When you highlight the **View Records** button, the tool tip displays the opposite mode: if you select **View Patient**, the label changes to **View All**; if you select **View All**, the label changes to **View Patient**.

To scroll through all of the records:

Step	
1	 View Records button — Touch the **View Records** button and select **View All** mode.
2	Touch the scroll bar to highlight the Patient Records table. The scroll bar changes from gray to red to indicate that it is active.
3	Touch the up and down arrow keys in the scroll bar to scroll through all of the records.
4	Touch a record to highlight it and expand it to display additional patient ID information.

Note — If you take a new measurement while scrolling mode is active, the monitor automatically exits scrolling mode.

To view all records for a specific patient:

Step	
1	Touch the scroll bar to the right of the Patient Records table. The scroll bar changes from gray to red to indicate that it is active.
2	Touch the desired patient ID.
3	 View Records button Touch the **View Records** button and then touch **View Patient** mode. The Patient Records table displays all records for the selected patient.

Hiding the List of Patient Records

If you do not want to display patient records on the screen, enable **Hide Patient Records** mode. In this mode:

- A patient record appears while you are measuring a patient's vital signs, but disappears from the screen after the record is saved.
- The numeric panes are enlarged.

To hide patient records:

Step	
1	 Display Mode button Touch the **Display Mode** button. The **Display Mode Menu** appears and the currently active mode is highlighted. **Note —** *The button changes, depending on which mode is currently active.*
2	 Hide Patient Records button Touch the **Hide Patient Records** button. The new display mode is active.

To redisplay the patient records, select the **Display Patient Records** button from the **Display Mode Menu**.

Selecting an Existing Patient ID

After a patient ID has been saved to the Patient Records database, you can find and retrieve the ID if you want to take another set of measurements for the same patient. You do not have to re-enter the ID.

Notes

- If you are using the barcode scanner to enter patient IDs, you cannot select an existing patient from the patient ID list. This option is only available if you are using the on-screen keyboard to enter patient data.
- To save a new patient ID, you must take an associated set of vital signs measurements and save them. If you enter a new ID but do not save measurements for the new ID, the ID is not saved to the database.

To add a new set of measurements to an existing patient ID:

Step	
1	 New Patient button Touch the **New Patient** button. The **New Patient Menu** appears.
2	If you are prompted, enter your operator ID and password. **Notes** • *If you select the* **Skip** *button, you may be prompted to enter an operator ID and password when you review the record. For more information about reviewing records, see "Reviewing and Validating Patient Records" on page 3-27.* • *If you receive an error message after entering your operator ID and password, see Chapter 14, "Troubleshooting."*

3	Touch the **Select Patient ID from List** table. **Note —** *The patient list is sorted by primary ID. If you entered a patient ID and a patient name, the patient name also appears in the list.*
4	Touch a patient ID on the list.
5	Touch the **OK** button to return to the main screen.
6	Begin taking vital signs measurements.
7	Optionally, enter observations and assessments in the QuickCapture pane. If your monitor is configured to display more than 10 observations and assessments, select the **More** button to display additional observation and assessment input fields.
8	Touch the **Save** button.

Editing a Patient Record


Edit button

If you saved a patient record with an incorrect patient ID or you want to change **ID Unknown** to an actual patient ID, you can edit the patient ID as described in the following procedure.

Notes

- After you enter a patient ID and then exit the **New Patient Menu**, you can no longer change the **Patient Type**. This is because the default alarm values are based on the selected patient type.
- After a record has been exported successfully, it can no longer be edited.
- If the barcode scanner cannot read a barcode or does not function correctly, you can unplug the scanner and use the on-screen keyboard to edit patient IDs.

The method for editing patient IDs depends on the method used to enter patient IDs. You can edit a patient ID by using a barcode scanner or the on-screen keyboard. For more information, see “Methods for Entering and Editing Patient IDs” on page 3-7.

To edit a patient record:

Step	
1	Touch the Patient Records table.
2	Touch the desired patient ID.
3	 Edit button Touch the **Edit** button. The **Edit Patient Menu** appears.

4	Do one of the following: • To edit the selected patient ID, continue with step 5. • If you are using the on-screen keyboard to enter and edit patient IDs, you can replace the patient ID with one from a list of saved patient IDs: – Touch the **Select Patient ID from List** button. – Touch the patient ID in the list. The selected patient ID appears in the primary patient ID field.
5	To edit the selected patient ID: • Touch the patient ID field to be edited, and touch the characters in the on-screen keyboard, or scan the barcode. • When you are done entering the new ID, touch the **OK** button.
6	Optionally, edit observations and assessments in the QuickCapture pane.
7	Touch the **OK** button to close the **Edit Patient Menu**.
8	Touch the **Yes** button to save the changes.

Deleting Patient Records

Delete button

Use the **Delete** button to delete:

- One patient record
- All records for a specific patient
- All records in the Patient Records database

Note — If you delete all records for a specific patient, the patient ID for the deleted patient is also removed from the Patient Records database.

The options that appear in the **Delete Records Menu** depend on which View mode is active.

- If **View Patient** mode is enabled, you can delete a specific patient record or all records for the selected patient.
- If **View All** mode is enabled, you can delete a specific patient record, all records for a specific patient, or all records in the Patient Records database.

Note — When you highlight the **View Records** button, the tool tip displays the opposite mode: if you select **View Patient**, the label changes to **View All**; if you select **View All**, the label changes to **View Patient**.

Deleting Specific Patient Records

To delete one patient record or all records for a specific patient:

Step	
1	Touch the scroll bar to highlight the Patient Records table.
2	Touch the desired patient ID.

3	Touch the **View Patient** button to display all saved records for the selected patient.
4	 Delete button Touch the **Delete** button. The **Delete Records Menu** appears. The patient ID and patient type for the selected patient record appear in the top of the menu.
5	Touch one of the following options to select the check box: • **Delete the selected patient record** • **Delete all records for selected patient**
6	Touch the **OK** button. A confirmation window opens.
7	Touch the **Yes** button. The patient records are deleted.

Deleting All Patient Records

To delete all records in the Patient Records database:

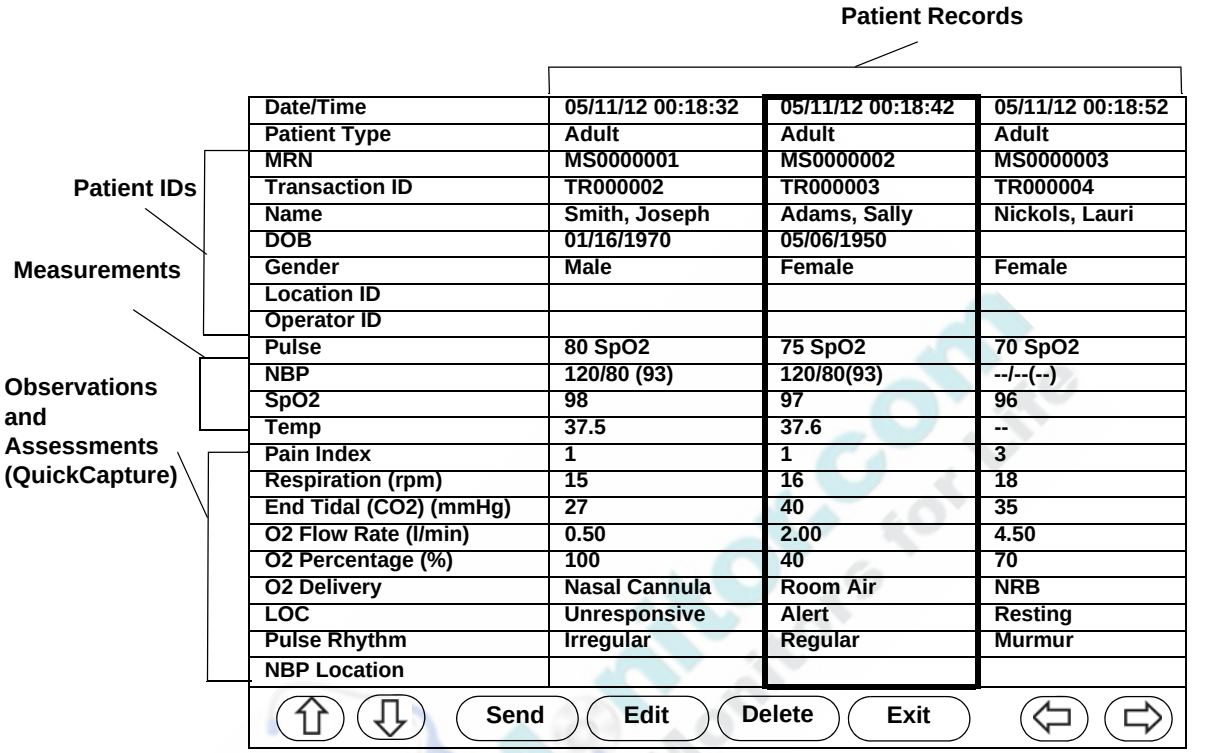
Step	
1	Make sure **View All** mode is enabled.
2	 Delete button Touch the **Delete** button. The **Delete Records Menu** appears.

3	Touch the **Delete all records** option and select the check box.
4	Touch the **OK** button. A confirmation window opens.
5	Touch the **Yes** button. All patient records are deleted.

Reviewing and Validating Patient Records

If the QuickCheck feature is enabled on your monitor, you may be authorized to review and validate patient records at the patient bedside before the records are exported to an EHR server. Depending on the workflow that your system administrator configures, you may be prompted to enter your operator ID and password to review patient records. Your system administrator provides you with the required password.

Use the Review menu to validate patient records before sending them to the EHR system.


Patient Records
Patient IDs
Measurements
Observations and Assessments (QuickCapture)
Date/Time
Patient Type
MRN
Transaction ID
Name
DOB
Gender
Location ID
Operator ID
Pulse
NBP
SpO2
Temp
Pain Index
Respiration (rpm)
End Tidal (CO2) (mmHg)
O2 Flow Rate (l/min)
O2 Percentage (%)
O2 Delivery
LOC
Pulse Rhythm
NBP Location
05/11/12 00:18:32
Adult
MS0000001
TR000002
Smith, Joseph
01/16/1970
Male
80 SpO2
120/80 (93)
98
37.5
1
15
27
0.50
100
Nasal Cannula
Unresponsive
Irregular
05/11/12 00:18:42
Adult
MS0000002
TR000003
Adams, Sally
05/06/1950
Female
75 SpO2
120/80(93)
97
37.6
1
16
40
2.00
40
Room Air
Alert
Regular
05/11/12 00:18:52
Adult
MS0000003
TR000004
Nickols, Lauri
Female
70 SpO2
--/--(--)
96
--
3
18
35
4.50
70
NRB
Resting
Murmur
Send
Edit
Delete
Exit

A box surrounds the record that is currently selected. Select the right and left arrow buttons to browse through the records. If your monitor is configured to display observations and assessments, select the up and down arrow buttons to display additional observation and assessment fields.

To validate a patient record in the **Review** menu:

Step	
1	In the Patient Records table on the main screen, select the patient record to review.
2	 Review button Touch the **Review** button.
3	If you are prompted, enter your operator ID and password. **Note —** *If you receive an error message after entering your operator ID and password, see Chapter 14, "Troubleshooting."* The Review menu appears.
4	Review the information in the record. If your monitor is configured to display observations and assessments, select the ⇧ and ⇩ buttons to display additional observation and assessment fields.

5	Do one of the following: • To edit the record, touch the **Edit** button. The **Edit Patient Menu** appears. After you edit and save the record, the Review menu appears. • To delete the selected record, touch the **Delete** button. • To accept the record and send it to the EHR server, touch the **Send** button. The selected record exports and the text in the record changes color. For a description of record colors, see “Patient Record Colors” on page 3-10. • To close the Review menu and return to the main screen, touch the **Exit** button.

4
Alarms

Alarms alert you to conditions that need immediate attention. Alarms are divided into three levels of severity:

- **High** — Indicates a potentially life-threatening situation. A high-priority alarm requires an immediate response from the clinician.
- **Medium** — Also indicates a physiological condition that requires prompt attention. Medium alarms are most often triggered by an alarm limit violation.
- **Low** — Most low-priority alarms indicate a problem with the monitor that needs to be corrected; for example, an alarm indicating that the recorder is out of paper.

When an alarm event occurs, the monitor issues both a visual and audible alarm.

If the QuickAlerts feature is enabled, the monitor displays alert messages that require an immediate response. See “QuickAlerts Messages” on page 4-2.

Visual Alarms

The VS4 monitor uses the following visual alarm indicators: flashing numeric values, alarm messages, alarm icons, and the QuickAlerts message box.

Also, in the Patient Records table, a measurement that exceeds alarm limits is enclosed in a box.

Flashing Numeric Values

When a physiological alarm occurs, the text and the background of the pane change colors and start flashing, as described in the following table.

Alarm Priority	Background Colors
High	Flashing red and white
Medium	Flashing yellow and white
Low	Blue, no flashing

If a measurement exceeds the monitor's measurement range, a question mark **(- ? -)** replaces the value in the numeric pane and an **Out of Range** message appears in the message area.

QuickAlerts Messages

In addition to the low, medium, and high level alarm messages that can occur on the monitor, your system administrator can define a set of alert messages that require an immediate response.

Note — QuickAlerts are for adult patients only.

Your system administrator can define these alert messages to display if:

- The standard vital signs measurements (Pulse Rate, SpO_2, NBP, and temperature) are out of range.
- A patient observation or assessment value is out of range.

For example, your administrator can define an alert message to display when a patient's temperature exceeds the alarm limit, or when the Pain Index assessment exceeds 7.

Each alert message notifies you of the reason for the message and the actions to perform in response. When the monitor is in NBP Interval mode or Continuous SpO_2 mode, QuickAlert messages do not appear when a vital signs measurement

is out of range. However, a QuickAlert message may appear if an observation or assessment is out of range.

QuickAlerts Icon	Description
	When QuickAlerts is enabled for an adult patient, this icon appears on the main screen.
	If QuickAlerts is enabled, and the current patient type is not an adult, this icon appears on the main screen.

When a QuickAlerts message appears:

Step	
1	Read and respond to the instructions that appear in the box.
2	Touch **OK** to acknowledge and close the message box.

Alarm Messages

Alarm messages appear in the message pane in the bottom left side of the screen. Alarm messages use the same colors as the flashing numeric panes described above. For a complete list of alarm messages and descriptions of each message, see "Appendix A, Alarm Specifications."

High-priority alarm messages pre-empt lower priority alarm messages. After the high-priority alarm has been resolved, the low-priority alarm message appears. If multiple alarms of the same priority occur at the same time, the alarm messages rotate every 1.5 seconds.

Alarm Icons

Alarm icons represent the current alarm status. The following table describes these icons.

Alarm Icon	Description
	The alarm icon with dashed lines indicates that an alarm has been temporarily silenced, or *paused*. This icon appears when you press the **Alarm Silence** key once to pause all active alarms. It also appears in all numeric panes when you activate the Audio Pause mode to indicate that all alarms have been temporarily silenced for the specified pause period.
	The alarm icon with solid lines indicates that you have explicitly turned off the alarms and the alarms will not sound again until you explicitly turn them on again. This icon appears when you disable one or more alarms in the parameter menus or the **Alarm Menu**. It also appears in all numeric panes when you activate the Audio Off mode.

For more information, see “Silencing Alarms” on page 4-16.

Audible Alarms

The alarm sound and interval depend on the alarm priority. High-priority alarms beep at a faster rate and sound different than medium and low priority alarms.

You can change the following audible alarm settings:

- **Alarm volume** — You can increase or decrease the alarm volume. See “Adjusting the Alarm Volume” on page 4-12.
- **Alarm tones** — The SureSigns VS4 monitor offers two sets of alarm tones. Only authorized personnel can change the alarm tone in the password-protected **System Admin Menu**.
- **Silence alarms** — You can pause alarms or silence alarms indefinitely. See “Silencing Alarms” on page 4-16.

To verify that the speaker is working at any time, perform the procedure in “Testing Alarms” on page 4-20.

Warning

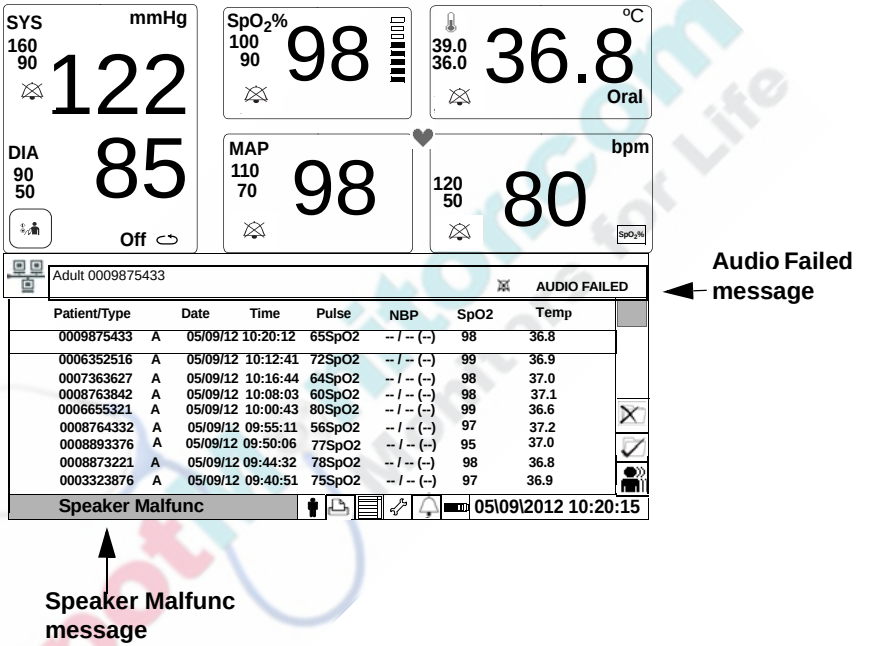
Never pause an audible alarm or decrease the alarm volume if this could compromise patient safety.

Do not rely exclusively on the audible alarm system for patient monitoring. The most reliable method of patient monitoring requires correct operation of the monitor *and* close observation of the patient.

Speaker Malfunction Notification

If the speaker malfunctions, a flashing red and white box with the **AUDIO FAILED** message appears in the top section of the patient records pane and the **Speaker Malfunc** message appears in the message pane.

For more information on manually testing the speaker, see “Testing Alarms” on page 4-20.



Warning

Audible alarms do not occur when the **AUDIO FAILED** message is displayed. If this message appears, do not use the monitor and contact your system administrator for repair.

Latched and Non-Latched Alarms

When a *non-latched alarm* occurs, the alarm stops when the condition that triggered the alarm ends. For example, if a cable becomes disconnected, the alarm ends when the cable is reconnected. The majority of alarms are non-latched.

A *latched alarm* continues even after the condition that caused the alarm has resolved itself. An **SpO_2 Desat** alarm is an example of a latched alarm. If an **SpO_2 Desat** alarm occurs and the SpO_2 value returns to normal, the alarm will continue to sound to notify the clinician of the event.

The following alarms are always latched:

- **SpO_2 Desat**
- **NBP Overpressure**
- **Loss of Monitoring**

By default, the alarms listed above are latched and all other alarms are non-latched. However, if your system administrator has enabled the **Latch Physiological Alarms** option, *all* physiological alarms are latched and will continue to sound until you acknowledge the alarms by pressing the **Alarm Silence** key.

Changing Alarm Limits

Warning

Be aware that the monitors in your care area may each have different alarm settings, to suit different patients.

Always check that the alarm settings are appropriate for your patient before you start monitoring.

When changing alarm limits, do not use extreme alarm limit values, which will render the alarm system useless.

Notes

- Default values can be either factory-set default values or values set by your system administrator.
- You may not be able to change alarm limits if your system administrator has enabled the **Lock Alarm Limits** option.

You can change the alarm limits for the current monitoring session by:

- Changing alarm limits for an individual parameter, using the parameter's numeric pane menu. See "Changing Individual Alarm Limits" on page 4-9.
- Opening the **Alarm Menu** to change some or all of the alarm limits in one place. See "Changing Alarm Limits in the Alarm Menu" on page 4-10.

The new alarm limits remain in effect for the current monitoring session. The alarm limits are reset to default values when you start a new patient or change the patient type.

Note — During the time that you are changing alarm limits, the alarm system will continue to operate normally.

Changing Individual Alarm Limits

To change the alarm limits or disable the alarm for one parameter:

Step	
1	Touch the desired numeric pane.
2	Touch the current values for the selected parameter.
3	Touch the high or low alarm limit to increase or decrease the value.
4	To disable an audible high or low limit alarm, touch the alarm icon.  Alarm Disabled Icon After an alarm has been disabled, an X appears across the alarm icon and an alarm icon appears in the numeric pane where the alarm was disabled. **Notes** • *If your system administrator has changed the alarm disable setting in the password-protected* **System Admin Menu**, *you cannot disable audible alarms (the option is unavailable).* • *The alarm disable setting applies to high and low alarm limits only. If you disable audible alarms and a measurement exceeds the selected high or low alarm limits, the monitor displays a visual alarm, but no audible alarm sounds. All other alarms will still produce an audible and visual alarm.*
5	Press the **Main Screen** key on the front panel to close the menu. **Alternative:** Touch the **Main Screen** button.

Changing Alarm Limits in the Alarm Menu

To change alarm limits for one or more parameters:

Step	
1	 Alarms button Touch the **Alarms** button on the bottom of the screen. The **Alarm Menu** appears. Current alarm settings are displayed.
2	Touch the high or low alarm limit to increase or decrease the value for each parameter that you want to change.
3	To disable an alarm, touch the alarm button to highlight it.  Alarm Disabled Icon After an alarm has been disabled, an X appears across the alarm icon and an alarm icon appears in the numeric pane where the alarm was disabled. **Notes** • *If your system administrator has changed the alarm disable setting in the password-protected* **System Admin Menu**, *you cannot disable audible alarms (the option is unavailable).* • *The alarm disable setting applies to high and low alarm limits only. If you disable audible alarms and a measurement exceeds the selected high or low alarm limits, the monitor displays a visual alarm, but no audible alarm sounds. All other alarms will still produce an audible and visual alarm.*
4	Press the **Main Screen** key on the front panel to close the menu. **Alternative:** Touch the **Main Screen** button.

Setting System Alarm Options

Use the **Alarms Menu** to:

- Change alarm limit settings (see “Changing Alarm Limits in the Alarm Menu” on page 4-10)
- Enable print on alarm
- Show or hide alarm limits
- Adjust the alarm volume
- Set alarm limits automatically
- Restore default alarm settings

Enabling Print on Alarm

If a recorder is installed in the monitor, you can configure the monitor to automatically generate a printout when a physiological alarm occurs.

To enable the print on alarm feature:

Step	
1	Open the **Alarm Menu** and touch the **Print on Alarm** check box to select the desired setting. ✓ = Print on Alarm is enabled No ✓ = Print on Alarm is disabled
2	Press the **Main Screen** key on the front panel to close the menu. Alternative: Touch the **Main Screen** button.

Showing or Hiding Current Alarm Limits

Current high and low alarm limits are displayed in each numeric pane by default.

To change the alarm limit display:

Step	
1	Open the **Alarm Menu** and touch the **Display Alarm Limits** check box to select the desired setting: ✓ = Alarm limits display in all numeric panes No ✓ = Alarm limits do not display in the numeric panes
2	Press the **Main Screen** key on the front panel to close the menu. **Alternative:** Touch the **Main Screen** button.

Adjusting the Alarm Volume

Note — Your system administrator can set a minimum alarm volume, which prevents you from setting the volume below a specific level.

To increase or decrease the alarm volume:

Step	
1	Open the **Alarm Menu** and touch the **Alarm Tone Volume** option. A keypad appears.
2	Enter the value in the numeric keypad and touch **OK.**
3	Press the **Main Screen** key on the front panel to close the menu. **Alternative:** Touch the **Main Screen** button.

Setting Automatic Alarm Limits

Note — The **Auto Set Alarm Limits** feature is only available in NBP Interval mode or Continuous SpO_2 mode. The feature is unavailable if the monitor is not in one of these modes.

You can quickly set alarm limits that are based on an individual patient's vital signs measurements. After you take an initial set of measurements, the monitor calculates an offset and applies it to each value to generate new upper and lower alarm limits.

Note — If the calculated offset value exceeds the alarm limit range, the monitor does not change the upper and lower alarm limits.

The formulas used for calculating the **Auto Set Alarm Limits** and the alarm limit ranges are listed in Appendix A, "Alarm Specifications."To set automatic alarm limits:

Step	
1	To establish a baseline, take an initial set of vital signs measurements on the patient.
2	Open the **Alarm Menu** and touch the **Auto Set Alarm Limits** button. A confirmation window opens.
3	Touch **Yes**. The monitor creates new high and low alarm limits based on the existing measurements. **Note —** *The alarm limits change for existing measurements only; the alarm limits do not change if a parameter was not measured.*
4	Press the **Main Screen** key on the front panel to close the menu. **Alternative:** Touch the **Main Screen** button.

Restoring Default Alarm Settings

Notes

- Default alarm settings can be either factory-set defaults or defaults set by your system administrator in the password-protected **System Admin Menu**. The default values set by your system administrator override the factory defaults.
- The system automatically restores default values when you start a new patient, change the patient type, or put the monitor in Standby mode.

Alarm settings include the alarm limits, as well as the enable and disable alarm settings.

To restore the factory default values or the default values set by your system administrator:

Step	
1	Open the **Alarm Menu** and touch the **Restore Default Alarm Settings** button. A confirmation window opens. **Note —** *If your system administrator enables the* **Lock Alarm Limits** *setting in the password-protected* **QuickAlerts Menu,** *you cannot change the alarm limits.*
2	Touch **Yes**. The monitor restores all alarm settings to the default values.
3	Press the **Main Screen** key on the front panel to close the menu. **Alternative:** Touch the **Main Screen** button.

For a list of factory default alarm values, see Appendix A, "Alarm Specifications."

Silencing Alarms

Alarm Silence key

The following table describes how to silence audible alarms using the **Alarm Silence** key on the front panel of the monitor.

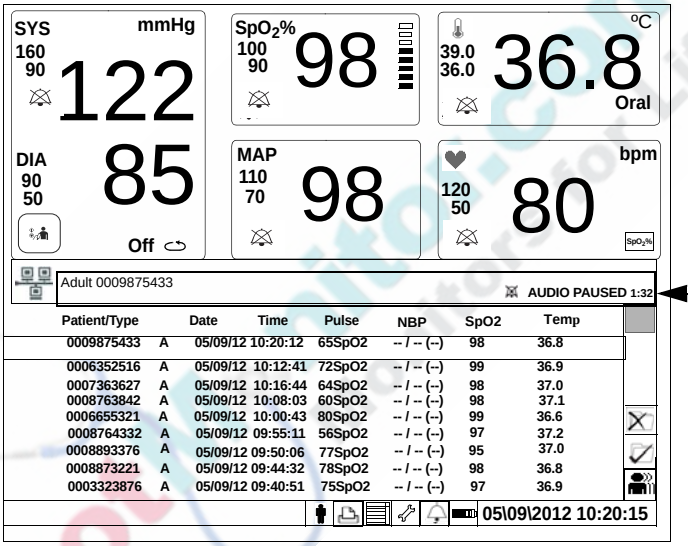
Note — Measurements can be either continuous or aperiodic. Continuous measurements include SpO_2, Pulse Rate derived from SpO_2, and Monitored Temperature. Aperiodic measurements include NBP, Pulse Rate derived from NBP, and temperature. The **Alarm Silence** key responds differently depending on which type of measurement is alarming.

To	Press	Result
Silence a continuous alarm for 60 seconds.	**Alarm Silence** key once.	The active alarm is silenced for 60 seconds. The visual indicators continue to flash.
Silence a continuous alarm.	**Alarm Silence** key once.	The audible and visual alarm indicators for the active alarm are silenced and cleared.
Pause all alarms for a predetermined time interval—Audio Pause mode.	**Alarm Silence** key twice quickly.	Audible alarms are paused for the Audio Pause period. Visual alarm indicators continue to flash. When the Audio Pause period ends, active alarms sound again.
Silence all alarms indefinitely—Audio Off mode.	**Alarm Silence** key for two seconds.	All alarms are silenced indefinitely. Visual alarm indicators continue to flash.

Audio Pause Mode

If you press the **Alarm Silence** key two times quickly, the monitor enters Audio Pause mode. All audible alarms are silenced for one of the following pre-defined time intervals: **30**, **60**, **90**, **120**, or **180** seconds. The time interval is configured by your system administrator in the password-protected **System Admin Menu**.

During Audio Pause mode, a white box with the **AUDIO PAUSED** message appears in the top section of the patient records pane and a timer shows the amount of time remaining until the Audio Pause mode ends.



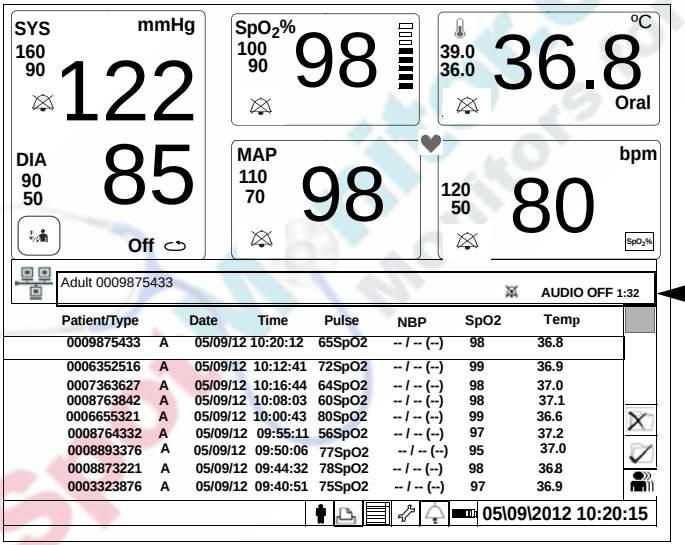
To end Audio Pause mode, press the **Alarm Silence** key.

Audio Off Mode

Note — If your system administrator has changed the **Allow Audio Off** setting in the password-protected **System Admin Menu**, Audio Off mode is disabled.

If you press and hold the **Alarm Silence** key for two seconds, the monitor enters Audio Off mode. All audible alarms are silenced until you press the **Alarm Silence** key again to end the Audio Off mode.

During Audio Off mode, a red box with the **AUDIO OFF** message appears in the top section of the patient records pane.



To end Audio Off mode, press the **Alarm Silence** key.

Acknowledging Technical Alarms

When a technical alarm occurs and you press the **Alarm Silence** key once, the monitor responds in one of the following ways:

- For SpO_2 technical alarms (such as **SpO2 No Sensor**) and a **Low Batt** alarm, the audible alarm is silenced and visual alarm indicators continue to flash until the error condition is corrected.
- For NBP technical alarms (such as **NBP Loose Cuff**) and temperature technical alarms (such as **Temp Probe Error**), the audible alarm is silenced and visual alarm indicators are cleared.
- For an **Extreme Low Batt**, the audible alarm is silenced and visual alarm indicators continue to flash. The audible alarm resumes after 60 seconds.

For a description of the technical alarm messages, see "Appendix A, Alarm Specifications."

Testing Alarms

To verify that the audible alarm system is working:

Step	
1	With the monitor turned on, make sure that all alarms are enabled (the monitor is not in Audio Pause or Audio Off mode).
2	Make sure the NBP alarm is enabled (the crossed bell icon does not appear in the NBP numeric pane).
3	Connect the NBP hose to the NBP input connector, but do not place the cuff on your arm.
4	 NBP Key Press the **NBP** key on the front panel.
5	Wait for the NBP module to cycle and check that an NBP alarm message appears and an alarm tone sounds.
6	If you do not get the results in step 5, contact your biomedical engineer or service department.

Nurse Call System Alarms

A nurse call signal reflects the audio output of the monitor: if the monitor is sounding an alarm, the nurse call system is signaling.

If your monitor is connected to a nurse call system, note the following:

- When an audible alarm is silenced (Audio Pause or Audio Off) at the bedside unit, the nurse call system will not alarm.
- If a user disables one or more alarms (through a specific parameter menu or the **Alarm Menu**) at the bedside unit, these alarms are also disabled on the nurse call system.
- Your system administrator can change the alarm priority level for the nurse call signal. For example, if the priority level is set to high in the password-protected **System Admin Menu**, only high-priority alarms will sound on the nurse call system. If it is set to medium, both high-priority and medium-priority alarms will sound on the nurse call system.

Alarms Safety Information

Caution

The monitor detects and responds almost immediately to most out-of-limits conditions, except when averaging of the physiological signal is required to reduce unwanted noise signals. Examples of averaging include SpO_2 measurements and measurements derived from SpO_2 signals.

The alarm volume should be loud enough to be heard within a room or through an open door. Set the volume based on the environment and ambient noise levels.

For visual alarms, the side-to-side viewing angle of the display is approximately ± 30 degrees relative to normal viewing.

5
Monitoring SpO_2

The SureSigns VS4 monitor uses a motion-tolerant signal processing FAST SpO_2 algorithm, which produces the following SpO_2 measurements:

- Oxygen saturation of arterial blood (SpO_2) — The percentage of oxygenated hemoglobin in relation to the sum of oxyhemoglobin and deoxyhemoglobin (functional arterial oxygen saturation)
- An SpO_2 (pleth) waveform — A visual indication of a patient's pulse
- A Pulse Rate value — The value is derived from the pleth wave
- A perfusion indicator — Indicates the quality of the SpO_2 signal

Selecting an SpO_2 Sensor

When selecting a sensor, consider the patient's weight and activity level, adequacy of perfusion, availability of sensor sites, need for sterility, and anticipated duration of monitoring.

You can use two types of SpO_2 sensors:

- **Reusable sensors** can be reused on different patients.
- **Disposable sensors** must not be reused on different patients, however, they can be reused or relocated on the same patient.

For more information on compatible SpO_2 sensors, see Chapter 12, "Accessories List."

If an SpO_2 value does not seem reasonable, use the pleth wave and perfusion indicator to assess the signal quality. If the perfusion value is low (three bars or less) try adjusting the sensor or using a different type of sensor.

Caution **Do not apply the blood pressure cuff to the same extremity as the one to which an SpO_2 sensor is attached because the cuff inflation disrupts SpO_2 monitoring and leads to nuisance alarms.**

Note — If the SpO_2 measurement is delayed for more than 30 seconds (due to an excessively noisy signal or because you are trying to measure NBP and SpO_2 on the same limb), the **SpO2 Extd Update** alarm occurs and the numeric pane display alternates between the measurement value and a question mark (**-?-**).

Connecting SpO_2 Cables

Connect the sensor cable to the SpO_2 input connector on the side panel, as seen in the illustration. If the sensor uses an adapter cable, plug the sensor into the adapter cable, and the adapter cable into the SpO_2 input connector.

SpO_2 Technical Alarms

The SureSigns VS4 monitor is designed so that you can easily move from one patient to another to take a set of vital signs measurements without sounding alarms. However, you can also use the monitor for extended SpO_2 monitoring of an individual patient by placing the monitor in Continuous SpO_2 Monitoring mode (see "Enabling Continuous SpO_2 Monitoring" on page 5-6) or NBP Interval mode (see "About NBP Intervals" on page 6-10).

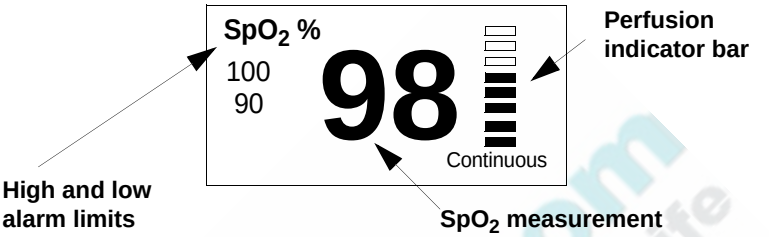
Because the **SpO_2 Non-Pulsatile** and **SpO_2 No Sensor** technical alarms are not useful if you connect and disconnect sensors between patients, these alarms are only enabled when the monitor is in Continuous SpO_2 Monitoring mode or NBP Interval mode. If the sensor falls off or becomes disconnected from the monitor, a high-priority alarm occurs.

If the monitor is *not* in Continuous SpO_2 Monitoring mode or NBP Interval mode, the **SpO_2 Non-Pulsatile** and **SpO_2 No Sensor** technical alarms are disabled, which allows you to remove the SpO_2 sensor from a patient without sounding alarms.

Warning **Do not rely exclusively on the audible alarm system for patient monitoring. The most reliable method of patient monitoring requires correct operation of the monitor *and* close observation of the patient.**

The SpO_2 Numeric Pane

The following illustration shows the components of the SpO_2 numeric pane.



Changing SpO_2 Settings

Use the **SpO_2 Menu** to:

- Change the SpO_2 response mode
- Change the SpO_2 alarm limits
- Enable Continuous SpO_2 monitoring

To open the **SpO_2 Menu**:

- Touch the SpO_2 numeric pane.

  The **SpO_2 Menu** appears and current SpO_2 settings are displayed.

Changing the SpO_2 Response Mode

The **SpO_2 Response** setting determines how quickly the monitor reports changes in SpO_2 values.

Note — If your system administrator has enabled an **SpO_2 Alarm Delay** value, consider the total possible delay time when selecting the **SpO_2 Response** setting. For more information, see “Desaturation Alarm (Desat)” on page 5-8.

To change the SpO_2 response mode:

Step	
1	Open the **SpO_2 Menu** and touch the **SpO_2 Response** menu item to select one of the following options: • **Slow** — Use this setting when motion artifact is an issue. SpO_2 changes are reported more slowly compared to the other modes. • **Normal** — Use this setting for most monitoring situations. • **Fast** — Use this setting for special applications (for example, sleep studies) when you need a fast response. Do not use the **Fast** setting if motion artifact is an issue.
2	Press the **Main Screen** key on the front panel to close the menu. **Alternative:** Touch the **Main Screen** button.

Changing the SpO_2 Alarm Limits

For information on changing the SpO_2 alarm limits, see “Changing Alarm Limits” on page 4-8.

The SpO_2 default alarm limits are:

	Adult	Pediatric	Neonatal
SpO_2 high limit	100%	100%	95%
SpO_2 low limit	90%	90%	85%

Enabling Continuous SpO_2 Monitoring

The **Continuous SpO_2 Monitoring** option allows you to continuously monitor a patient’s SpO_2 and save the SpO_2 measurements to a patient record at a specified interval.

To enable Continuous SpO_2 Monitoring:

Step	
1	Open the **SpO_2 Menu** and touch the **Continuous SpO_2 Monitoring** menu item.
2	**Note —** *To prevent the* **SpO_2 Non-Pulsatile** *alarm from sounding, place the SpO_2 sensor on the patient before you select* **On**. Select one of the following options: • **Off** — Continuous SpO_2 Monitoring is disabled. • **On** — Continuous SpO_2 Monitoring is enabled. If you select **On**, the **Save SpO_2 to Patient Record** option appears. This option allows you to specify how often the monitor will save an SpO_2 measurement to the patient’s record.

3	Select the **Save SpO_2 to Patient Record** option.
4	Select one of the following options: **1 minute**, **2 minutes**, **3 minutes**, **5 minutes**, **10 minutes**, **15 minutes**, **30 minutes**, **60 minutes**, **90 minutes**, **120 minutes**.
5	Press the **Main Screen** key on the front panel to close the menu. **Alternative**: Touch the **Main Screen** button. The word **Continuous** appears in the lower right corner of the SpO_2 numeric pane.

Your system administrator can configure the following Continuous SpO_2 options in the password-protected **System Admin Menu**:

- If the **Align Interval to Clock** option is enabled, the SpO_2 measurements are aligned with the time of day. For example, if you set the interval to 10 minutes and you begin continuous measurements at 10:17, the monitor saves the first measurement at 10:17. The next SpO_2 measurement is saved at 10:20, then 10:30, 10:40, and so on

  If the **Align Interval to Clock** option is disabled, the measurements in the example above occur at 10:17, 10:27, 10:37, and so on.

- If the **Default Continuous SpO_2** option is enabled, the monitor is placed in Continuous SpO_2 mode each time you turn the monitor on or start a new patient.

Desaturation Alarm (Desat)

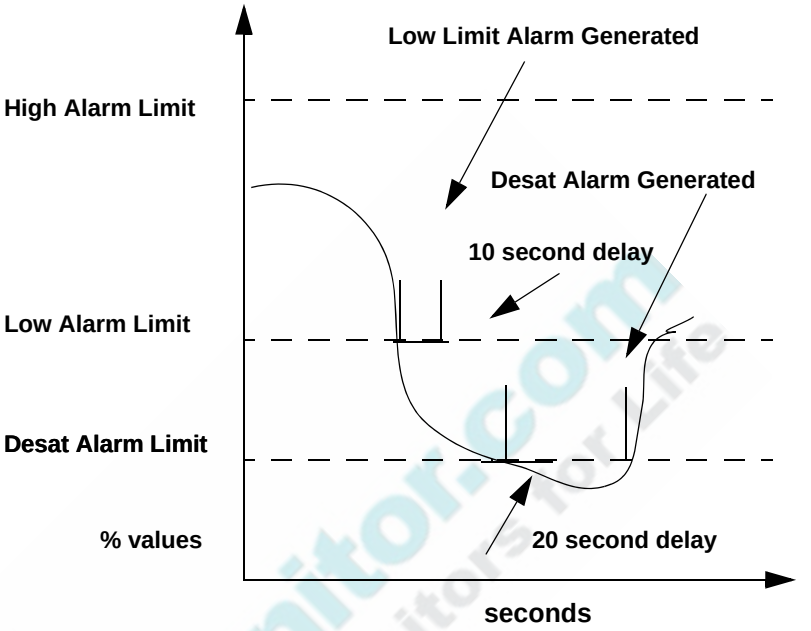
The Desaturation alarm is a high-priority alarm that alerts you to a potentially life-threatening drop in oxygen saturation. The Desat alarm is not configurable; it is based on the current SpO_2 low alarm limit. The Desat alarm limit is fixed at 10 less than the current low limit for adults and pediatric patients and 5 less for neonates.

Your system administrator can set an alarm delay for the Desat alarm, which does not sound until the alarm criteria are met.

SpO_2 Alarm Delay

If your system administrator configures an SpO_2 alarm delay time, and the SpO_2 value exceeds the current high or low alarm limits, the monitor does not issue an SpO_2 alarm until the specified alarm delay time elapses. For example, if your system administrator sets the SpO_2 alarm delay to 10 seconds, the monitor will generate an alarm if the SpO_2 value exceeds the high or low alarm limits for more than 10 seconds.

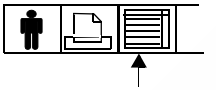
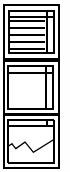
The **SpO_2 Alarm Delay** applies to SpO_2 high and low alarms and SpO_2 Desat alarms. The delay can be 0 to 30 seconds. If your system administrator has enabled the SpO_2 alarm delay option on your monitor, the current settings are displayed in the **SpO_2 Menu**. The following illustration demonstrates SpO_2 alarm delays.


Low Limit Alarm Generated
High Alarm Limit
Desat Alarm Generated
10 second delay
Low Alarm Limit
Desat Alarm Limit
% values
20 second delay
seconds

Displaying an SpO_2 Waveform

When you are currently monitoring a patient's SpO_2 values, you can display an SpO_2 waveform.

To display a waveform:

Step	
1	 Display Mode button Touch the **Display Mode** button. **Note —** *The button changes, depending on which mode is currently active.* The **Display Mode Menu** appears and the currently active mode is highlighted.
2	 Display Patient Records Hide Patient Records Display Waveform Touch the **Display Waveform** button. An SpO_2 waveform appears in the bottom of the screen.

Configuring the SpO_2 Waveform

Note — The pleth waveform is normalized to the display area on the screen. The height of the waveform has no relationship to the actual optical signal strength.

Use the **SpO_2 Waveform Menu** to change the speed of the SpO_2 waveform.

To open the **SpO_2 Waveform Menu**:

Step	
1	Touch the SpO_2 waveform. The **SpO2 Waveform Menu** appears. Current SpO_2 waveform settings are displayed.
2	Touch the Sweep Speed.

Changing the Waveform Speed

The **Sweep Speed** setting in the **SpO_2 Waveform Menu** determines the speed at which the waveform is drawn across the screen.

To change the sweep speed:

Step	
1	While in Waveform mode, touch the SpO_2 waveform screen to open the **SpO_2 Waveform Menu**.
2	Touch the **Sweep Speed** menu item to select one of the following options: • **12.5 mm/s** • **25.0 mm/s** • **50.0 mm/s**
3	Press the **Main Screen** key on the front panel to close the menu. Alternative: Touch the **Main Screen** button.

SpO_2 Safety Information

The SureSigns VS4 pulse oximeter is calibrated to indicate functional oxygen saturation.

Warning

To minimize risk of damage to the monitor during defibrillation use only approved supplies.

Never apply an SpO_2 sensor at ambient temperatures above 35°C (95°F) because this can cause severe burns after prolonged application.

Injected dyes, like methylene blue, or intravascular dyshemoglobins (methemoglobin and carboxyhemoglobin) can lead to inaccurate measurements.

Interference can be caused by:

- **High levels of ambient light. To avoid this problem, cover the application site with opaque material.**
- **Electromagnetic interference.**
- **Excessive patient movement and vibration.**

High oxygen levels can predispose a premature infant to retrolental fibroplasia. If this is a consideration, do not set the high SpO_2 alarm limit to 100%. This is equivalent to switching the alarm off. Transcutaneous O_2 monitoring is recommended for premature infants receiving supplemental oxygen.

Do not use disposable sensors on patients who have allergic reactions to the adhesive.

Do not use the monitor or SpO_2 sensors during magnetic resonance imaging (MRI) scanning. Induced current could potentially cause burns. The monitor may affect the MRI image, and the MRI unit may affect the accuracy of the monitor's measurements.

If your patient has a very low Pulse Rate or strong arrhythmia, pulse rate readings derived from SpO_2 may cause nuisance alarms. Use the pleth wave and perfusion indicator to assess signal quality. If necessary, use a different method, such as ECG, to measure the patient's Pulse Rate.

The SpO2 Non-Pulsatile and SpO_2 No Sensor technical alarms are enabled only when the monitor is in Continuous SpO_2 mode or NBP Interval mode. If the monitor is *not* in Continuous SpO_2 mode or NBP Interval mode, these SpO_2 technical alarms will not sound.

Unexpected High/Low alarms and unexpected Desat alarms may occur less when the SpO_2 High/Low alarm delay is on. Check the patient frequently.

Caution

Use only specified sensors and cables, otherwise patient injury can result. Before using a sensor verify that it is compatible with the monitor. For a complete list of compatible accessories, see Chapter 12, "Accessories List."

Skin irritations or lacerations can occur if the sensor is attached to one location for too long. Inspect the application site every two to three hours to ensure skin quality and correct optical alignment. If the skin quality changes, move the sensor to another site. Change the application site at least every four hours.

Unintended overheating of applied parts (SpO_2 sensor) can cause localized skin reddening to the patient.

Sensors are not sterile and should not be used in a sterile environment.

Do not apply the sensor too tightly as this results in venous pulsation. This can severely obstruct circulation and lead to inaccurate measurements.

Follow the sensor's Instructions for Use; adhere to all warnings and cautions.

Check that the light emitter and the photo-detector are directly opposite each other. All light from the emitter must pass through the patient's tissue.

Remove colored nail polish from the application site.

Make sure that the sensor is the appropriate size. The sensor should not fall off, nor should it be too tight.

When applying the M1193A or M1193T neonatal sensor, do not overtighten the strap.

When using the M1195A infant finger sensor, select a finger or toe with a diameter of between 7 mm and 8 mm (0.27" and 0.31").

If a sensor is too loose, it might compromise the optical alignment or fall off. If it is too tight — because the application site is too large or becomes too large due to edema — the excessive pressure may cause venous congestion distal, leading to interstitial edema, hypoxaemia and tissue malnutrition.

Do not use OxiCliq™ disposable sensors in a high humidity environment, such as in neonatal incubators or in the presence of fluids, which can contaminate sensor and electrical connections causing unreliable or intermittent measurements.

For neonatal patients, place all sensor connectors and adapter cable connectors outside the incubator. The humidity in the incubator can cause inaccurate measurements.

Do not place the sensor on extremities with an arterial catheter or intravascular venous infusion line.

Do not use more than one extension cable (M1941A). Do not use an extension cable with Philips reusable sensors or adapter cables with part numbers ending in -L (which indicates "Long" version).

To avoid electrical interference, position the sensor cable and connector away from power cables.

To dispose of pulse oximeter equipment or components, follow local regulations regarding disposal of hospital waste.

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6
Monitoring NBP

The SureSigns VS4 monitor measures Systolic, Diastolic, and Mean Arterial Pressure (MAP) by acquiring pressure pulses through a series of controlled deflation steps of an inflated cuff.

NBP key

NBP Interval Key

The VS4 provides two ways to monitor blood pressure:

•**Manual measurements** — Press the **NBP** key on the front panel to start a single NBP measurement. You can also touch the **NBP** button in the NBP numeric pane to start a single NBP measurement.

•**Interval measurements** — Press the **NBP Interval** key on the front panel to open the **NBP Interval Menu**, where you can select a specific interval, create an interval program, or enable STAT measurements.

Measurement Limitations

You cannot take an NBP measurement on patients with heart rate extremes of less than 40 bpm or greater than 300 bpm, or if the patient is on a heart-lung machine.

For pregnant patients, including preclamptic patients, the effectiveness of a sphygmomanometer has not been established.

NBP measurements may be inaccurate or impossible on patients with the following conditions:

- An irregular arterial pressure pulse
- Cardiac arrhythmias
- Excessive and continuous movement, such as shivering or convulsions
- Rapid blood pressure changes
- Severe shock or hypothermia that reduces blood flow to the peripheries
- Obesity, where a thick layer of fat surrounding a limb dampens the oscillations coming from the artery
- An edematous extremity

Selecting an NBP Cuff

Select an NBP cuff based on the patient's arm size. After wrapping the cuff around the patient's arm, the index line should fall between the two range lines and the arterial marking should be over the patient's brachial artery.

A cuff that is too loose or too tight can cause inaccurate measurements. Also, if the cuff is too loose, it may not deflate properly.

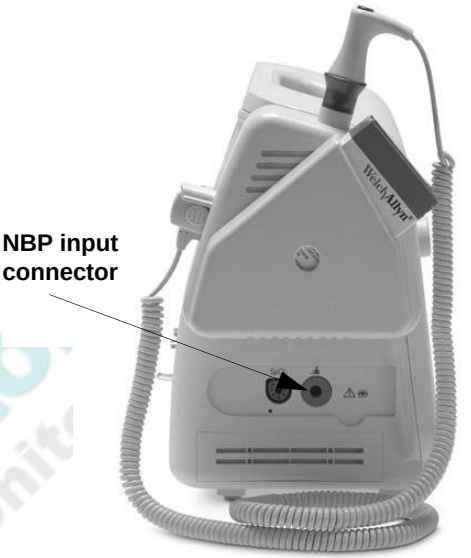
You can use two types of NBP cuffs:

- **Reusable cuffs** can be reused on different patients.
- **Disposable cuffs** must not be reused on different patients; however, they can be reused or relocated on the same patient.

For information on compatible NBP cuffs, see Chapter 12, “Accessories List.”

Connecting the Cuff and Hose

Connect the selected cuff to the hose and the hose to the NBP input connector, as shown. in the illustration.



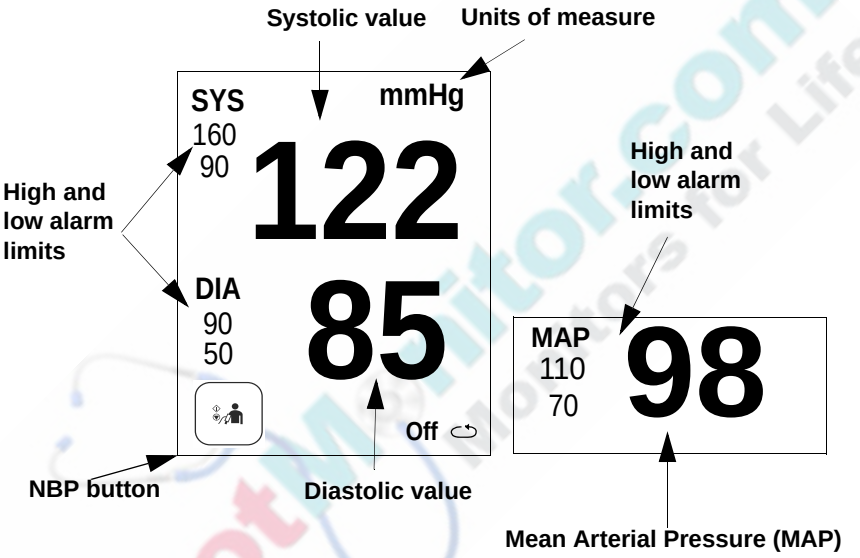
Warning **Never connect intra-arterial or intra-venous, or any other Luer connectors, to the NBP tubing. This could cause serious injury and death.**

Caution **Do not compress the hose or restrict the pressure.**

NBP Numeric Panes

Two panes are used to display NBP values. One pane displays the Systolic and Diastolic values. The other pane displays the current inflation pressure while the cuff is inflating, then displays the NBP MAP value when the measurement completes.

The following illustration shows the components of the two NBP numeric panes.



Changing NBP Settings

Use the **Blood Pressure Menu** to:

- Enable or disable the **Auto Print NBP** feature
- Change the NBP alarm limits
- Configure the initial inflation pressure
- Change the units of measurement

To open the **Blood Pressure Menu**:

- Touch the NBP numeric pane.

  The **Blood Pressure Menu** appears, and current settings are displayed.

Enabling Automatic NBP Printouts

If your monitor has a recorder, you can use the **Auto Print NBP** feature to generate a printout each time an NBP measurement is taken. This may be useful when you are taking NBP interval measurements.

To enable auto print:

Step	
1	Open the **Blood Pressure Menu** and touch the **Auto Print NBP** check box to select the desired setting: ✓ = Auto print is enabled No ✓ = Auto print is disabled
2	Press the **Main Screen** key on the front panel to close the menu. **Alternative:** Touch the **Main Screen** button.

For more information on the monitor's printing capabilities, see Chapter 10, "Printing."

Changing the NBP Alarm Limits

For information on changing NBP alarm limits, see “Changing Alarm Limits” on page 4-8.

The NBP default alarm limits are:

	Adult	Pediatric	Neonatal
Systolic			
High limit	160 mmHg (21.3 kPa)	120 mmHg (16.0 kPa)	90 mmHg (12.0 kPa)
Low limit	90 mmHg (12.0 kPa)	70 mmHg (9.3 kPa)	40 mmHg (5.3 kPa)
Diastolic			
High limit	90 mmHg (12.0 kPa)	70 mmHg (9.3 kPa)	60 mmHg (8.0 kPa)
Low limit	50 mmHg (6.7 kPa)	40 mmHg (5.3 kPa)	20 mmHg (2.7 kPa)
Mean			
High limit	110 mmHg (14.7 kPa)	90 mmHg (12.0 kPa)	70 mmHg (9.3 kPa)
Low limit	70 mmHg (9.3 kPa)	50 mmHg (6.7 kPa)	24 mmHg (3.2 kPa)

Configuring the Initial Inflation Pressure

The **Initial Inflation Pressure** setting specifies the maximum amount that the cuff will inflate when you start a new patient. In Interval mode, the cuff inflates to the **Initial Inflation Pressure** setting for the first NBP measurement, and then the monitor adjusts the inflation value based on the patient's Systolic measurement.

The factory default value for **Initial Inflation Pressure** is based on the patient type:

- Adult — 160 mmHg (21.3 kPa)
- Pediatric — 140 mmHg (18.7 kPa)
- Neonatal — 100 mmHg (13.3 kPa)

As the cuff inflates, the current inflation pressure appears in the NBP MAP pane. After the measurement is complete, the inflation pressure value disappears and the final MAP value appears in the pane.

To change the initial inflation pressure:

Step	
1	Open the **Blood Pressure Menu** and touch the **Initial Inflation Pressure** menu item.
2	Enter the value in the numeric keypad and touch **OK.** **Note —** *When using the touch screen to enter the initial NBP cuff inflation pressure, make sure you enter a value that is a multiple of 10. For example, enter 120, 130, 140, and so on. If you enter a value that is not a multiple of 10, the monitor rounds up or down to the nearest 10 and resets the value. For example, if you enter 124, the monitor resets the pressure to 120. If you enter 136, the monitor resets the pressure to 140.*
3	Press the **Main Screen** key on the front panel to close the menu. **Alternative:** Touch the **Main Screen** button.

If you start a new patient, change the patient type, or put the monitor in Standby mode, the Initial Inflation Pressure reverts to the factory default value or the default value set by your system administrator. Default values can be changed in the **System Admin Menu**, which is password-protected.

Note — For safety reasons, the cuff automatically deflates if:

- The measurement time exceeds 120 seconds (90 seconds in Neonatal mode)
- The microprocessor fails
- The overpressure limit is exceeded
- Power is lost

Changing the NBP Units of Measurement

To change the blood pressure units of measurement:

Step	
1	Open the **Blood Pressure Menu** and touch the **Blood Pressure Units** menu item to select one of the following options: • **mmHg** • **kPa**
2	Press the **Main Screen** key on the front panel to close the menu. **Alternative**: Touch the **Main Screen** button.

About NBP Intervals

For continuous NBP monitoring, the SureSigns VS4 monitor offers three types of interval measurements:

- Auto intervals
- Interval programs
- STAT measurements

For information about adding observations and assessments between intervals, see “Entering Observations and Assessments in Interval Mode” on page 3-14.

If your system administrator enables the **Align Interval to Clock** option, the NBP interval measurements are aligned with the time of day. This means that if you set the interval to 10 minutes, and you press the **NBP** key at 10:17 to start the auto interval or interval program, the monitor records the first measurement at 10:17. The next NBP measurement will begin at 10:20, then 10:30, 10:40, and so on.

If the **Align Interval to Clock** option is disabled, the measurements in the previous example will occur at 10:17, 10:27, 10:37, and so on.

If your monitor is networked and a time sychronization occurs in which the time difference is greater than 30 seconds, the monitor starts a new NBP measurement.

Opening the NBP Interval Menu

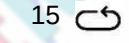
NBP Interval Key

To open the **NBP Interval Menu** from the **Blood Pressure Menu**: Press the **NBP Interval** key on the front panel to open the **NBP Interval Menu**. You can also access the NBP Interval Menu by selecting the NBP Interval button in the Blood Pressure Menu.

Starting NBP Interval Measurements

Note — If your system administrator enables the **Default NBP Interval** option in the password-protected **System Admin Menu**, the monitor is placed in NBP Auto Interval mode each time you turn the monitor on or start a new patient. You must press the **NBP** key to begin interval measurements.

To start NBP interval measurements:

Step	
1	Open the **NBP Interval Menu** and touch the **NBP Auto Interval** menu item.
2	Touch one of the following options: **Off**, **1**, **2,** **3**, **5**, **10**, **15**, **30**, **60**, **90,** or **120** minutes.
3	Press the **Main Screen** key on the front panel to close the menu. **Alternative:** Touch the **Main Screen** button. The **Press**  message flashes in the NBP numeric pane.
4	Press the **NBP** key on the front panel to begin the first interval measurement.  The selected interval value and the Interval icon appear in the NBP numeric pane.

Stopping NBP Interval Measurements

To stop interval measurements, do one of the following:

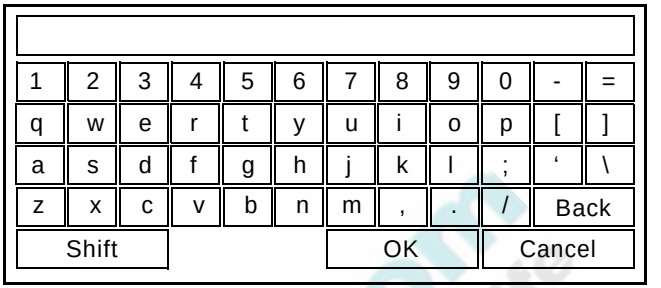
- Open the **NBP Interval Menu** andselect the **Off** option in the **NBP Auto Interval** menu item.
- Start a new patient.
- Press the **On/Standby** key.

Creating or Starting an NBP Interval Program

You can create up to five different interval programs to measure blood pressure at intervals based on your unit-specific protocols. For example, in a Post Operative setting, you may want to configure the monitor to take a blood pressure measurement every 15 minutes for the first hour, then every 30 minutes for the second hour.

To create an NBP Interval program:

Step	
1	Open the **NBP Interval Menu** and touch the **NBP Interval Program** menu item.
2	Touch an undefined program (**Program 1**, **Program 2**, and so on). The **NBP Interval Program Menu** appears.

3	Touch the **Name** menu item. A keyboard appears. 
4	Enter up to 10 characters by touching each character. If you enter an incorrect character, touch the **Back** button to erase the character or touch the **Cancel** button to start over. When you are done entering the program name, touch the **OK** button.
5	Touch the **Duration** option for Period 1.
6	Touch a duration value from the list, then touch **OK**.
7	Touch the **Interval** option for Period 1.
8	Touch an interval value from the list and touch **OK**. **Note —** *The interval value cannot be larger than the duration value. The system prevents you from selecting an incorrect interval value.*

9	Repeat step step 5 through step 8 to define up to five periods for the interval program.
10	Press the **Main Screen** key on the front panel to close the menu. **Alternative:** Touch the **Main Screen** button. The **Press** message flashes in the lower corner of the NBP numeric pane.
11	Press the **NBP** key on the front panel to begin the first interval measurement. **POST - OP** **15** The program name, the current interval value, and the Interval icon appear in the lower right corner of the NBP numeric pane.

To start an NBP Interval program:

Step	
1	Open the **NBP Interval Menu** and select the **NBP Interval Program** menu item.
2	Touch a program. The **NBP Interval Program Menu** appears.
3	Touch the **OK** button.
4	Press the **Main Screen** key on the front panel to close the menu. **Alternative:** Touch the **Main Screen** button. The **Press** message flashes in the NBP numeric pane.
5	Press the **NBP** key on the front panel to begin the first interval measurement. **POST - OP** **15** The program name, the current interval value, and the Interval icon appear in the lower corner of the NBP numeric pane.

Clearing All Interval Programs

Use the **Clear All Programs** option to clear all saved NBP Interval programs. When you select the **Clear All Programs** button, all settings are cleared and the program names return to their default values.

To clear all NBP interval programs:

1	Open the **NBP Interval Menu** and touch the **Clear All Programs** button.
2	A confirmation window opens.
3	Touch **Yes** to confirm that you want to clear all NBP interval programs.

Enabling NBP STAT Mode

In STAT mode, the monitor takes as many measurements as possible within a 5-minute period, pausing between each measurement. At the end of the 5-minute period, the interval setting returns to **Off,** or to the default NBP Interval value, if your system administrator set a default interval value.

Note — The pause time between measurements varies with each patient, but the pressure in the cuff is reduced to less than 15 mmHg for adults and 5 mmHg for neonates.

In STAT mode, the monitor does not measure Pulse Rate derived from NBP. A question mark (-?-) appears in the numeric pane.

To enable STAT mode:

Step	
1	Open the **NBP Interval Menu** and touch the **STAT** menu item.
2	**STAT**  STAT measurements begin immediately. The word **STAT** and the Interval icon appear in the NBP numeric pane.

Stopping an NBP Measurement

To stop a manual or interval measurement in progress, press the **NBP** key on the front panel. If the monitor is in interval mode when you press the **NBP** key, the current measurement is stopped, but the next scheduled interval measurement will occur.

Recalculating the NBP Value if the Limb is not at Heart Level

If the limb is not at heart level while an NBP measurement is in progress, recalculate the displayed NBP value as follows:

If the limb is	Then
Higher than heart level	For each centimeter higher, add 0.75 mmHg (0.10 kPa) or For each inch higher, add 1.9 mmHg (0.25 kPa)
Lower than heart level	For each centimeter lower, deduct 0.75 mmHg (0.10 kPa) or For each inch lower, deduct 1.9 mmHg (0.25 kPa)

NBP Safety Information

Caution **Do not reuse disposable NBP cuffs.**

Warning **Select the correct patient category setting for your patient. Do not apply the higher adult inflation, overpressure limits and measurement duration to neonatal patients.**

Do not measure NBP on patients with sickle-cell disease or any condition where skin damage has occurred or is expected.

Continual NBP measurements can cause injury to the patient being monitored. Weigh the advantages of frequent measurement and use of STAT mode against the risk of injury. Use clinical judgement to decide whether to perform frequent unattended blood pressure measurements on patients with severe blood clotting disorders because of the risk of hematoma in the limb fitted with the cuff.

In some cases, rapid, prolonged cycling of an NBP cuff has been associated with any or all of the following: ischemia, purpura, or neuropathy. Apply the cuff according to the directions and check the cuff site and cuffed extremity regularly when blood pressure is measured at frequent intervals or over extended periods of time.

Check the patient's limb to assure that circulation is not constricted. Constriction of circulation is indicated by discoloration of the extremity. Check the limb at regular intervals based on the circumstances of the specific situation.

Do not place the cuff on an extremity being used for intravenous infusion, with an arterial catheter in place, or on any area where circulation is compromised or has the potential to be compromised.

Do not apply the blood pressure cuff to the same extremity as the one to which an SpO_2 sensor is attached because the cuff inflation disrupts SpO_2 monitoring and leads to nuisance alarms.

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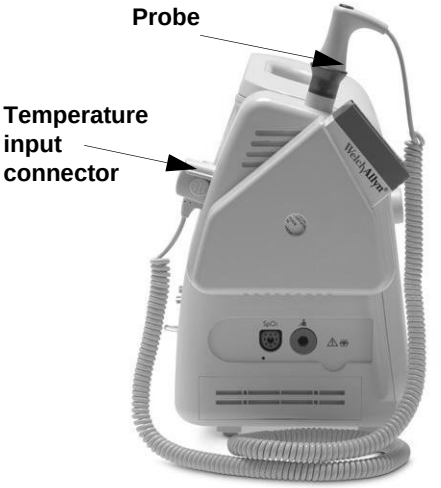
7
Monitoring Temperature — Predictive

This chapter describes how to take a predictive temperature measurement with the SureSigns VS4 monitor and how to change the temperature settings.

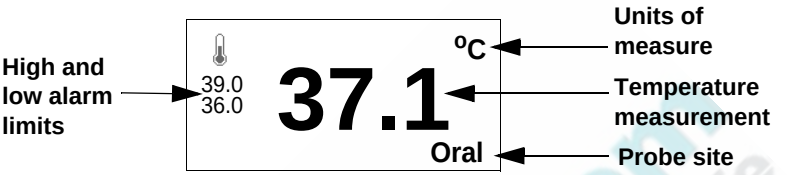
Connecting the Temperature Probe

Insert the temperature probe in the probe well. Connect the probe cable to the temperature input connector on the temperature module, as shown in the illustration.



The Temperature Pane

The following illustration shows the components of the Temperature numeric pane.



Taking a Temperature Measurement

This section provides instructions on how to take a predictive temperature measurement.

Read the warnings below before taking a temperature measurement:

Warning

Use only approved, disposable probe covers. Probe covers are for single use only. The use of unapproved probe covers or not using a probe cover can result in the following:

- **Discomfort to the patient**
- **Patient cross-contamination**
- **Erroneous temperature measurements**
- **Damage to the probe**

If the patient temperature is lower than the temperature of the probe, measurement errors may result.

When you take rectal temperature measurements, insert the probe slowly and carefully to avoid tissue damage.

To take a temperature measurement:

Step	
1	Remove the temperature probe from the probe well and firmly push the probe into a probe cover.  Ready icon A chime sounds and the Ready icon appears, indicating that you can now take a temperature measurement.
2	Verify that the correct probe site (**Oral**, **Axillary**, or **Rectal**) is selected. The probe site appears in the lower right corner of the Temperature pane. To change the probe site, see “Changing the Probe Site” on page 7-8.
3	Place the probe in the appropriate site on the patient. An hourglass appears in the numeric pane while the monitor is calculating the temperature value. A chime sounds when the temperature measurement is complete.
4	Eject the probe cover and dispose of it in accordance with your facility’s policies.
5	Replace the probe in the probe well.

Note — If the monitor is in Standby mode and you press the **On/Standby** key to turn the monitor on, the temperature module takes several seconds to reset. Do not remove the temperature probe from the well while the module resets.

Changing Temperature Settings

Use the **Temperature Menu** to:

- Change the temperature mode
- Change the probe type
- Change the temperature alarm limits
- Change the units of measurement

To open the **Temperature Menu**:

- Touch the Temperature numeric pane.

  The **Temperature Menu** appears and current temperature settings are displayed.

Changing the Temperature Mode

The following two temperature modes are available:

- **Predictive mode**. Use Predictive mode for most monitoring situations. In Predictive mode, the monitor measures the patient's temperature for approximately 4 seconds for oral measurements and approximately 16 seconds for axillary and rectal measurements.

  If the probe loses contact with the patient's tissue at any time during the measurement, the Ready icon will reappear and the pane will not display a value until contact has been reestablished.

  If the monitor cannot get a reading after 1 minute, it automatically switches to Monitored mode.

- **Monitored mode**. In Monitored mode, the monitor measures the patient's temperature continuously and displays the temperature in the numeric pane as long as the probe is in contact with the patient.

  Use Monitored mode only when the situation prevents accurate predictive measurement. The monitor automatically switches to Monitored mode when measurement quality is poor or the probe has been withdrawn from the well and no measurement taken within 60 seconds. Once the probe is returned to the probe well, the monitor cancels Monitored mode and automatically switches back to Predictive mode.

Note — Temperature measurements taken in Monitored mode are not saved to a patient record.

Caution **Do not exceed the recommended measurement periods of three minutes for oral and rectal measurements and five minutes for axillary measurements.**

To change the temperature mode:

Step	
1	Open the **Temperature Menu** and touch one of the following options: • **Predictive** • **Monitored**  Monitored Mode Icon If you select **Monitored** mode, the Monitored Mode icon appears in the Temperature numeric pane when you remove the probe from the well.
2	Press the **Main Screen** key on the front panel to close the menu. **Alternative:** Touch the **Main Screen** button.

Note — In Predictive and Monitored modes, the monitor can sometimes complete a temperature reading even though the quality of the measurement is marginal. When this occurs, the Temperature numeric pane display alternates between the measurement value and a question mark (**-?-**). The measurement is not saved to the patient record.

Changing the Probe Site

The SureSigns VS4 uses blue temperature probes for oral and axillary temperature measurements and red probes for rectal measurements.

Note — The currently selected probe site appears in the Temperature numeric pane when you remove the probe from the probe well.

To select the measurement site:

Step	
1	Open the **Temperature Menu** and touch one of the following choices: • **Blue Probe Site: Oral or Axillary** • **Red Probe Site: Rectal**
2	Press the **Main Screen** key on the front panel to close the menu. **Alternative:** Touch the **Main Screen** button.

Changing the Temperature Alarm Limits

For information on changing the Temperature alarm limits, see “Changing Alarm Limits” on page 4-8.

The Temperature default alarm limits are:

	Adult	Pediatric	Neonatal
Temperature high limit	39°C (102.2°F)	39°C (102.2°F)	39°C (102.2°F)
Temperature low limit	36°C (96.8°F)	36°C (96.8°F)	36°C (96.8°F)

If a High or Low temperature alarm occurs in Monitored mode, the alarm message and the blue background in the Temperature pane remain on the screen after you press the **Alarm Silence** key.

The alarm is cleared only when the patient’s temperature returns to normal or you place the temperature probe back in the probe well.

Changing the Temperature Units of Measurement

To change the temperature units of measurement:

Step	
1	Open the **Temperature Menu** and touch one of the following options: • **°C** (Celsius) • **°F** (Fahrenheit)
2	Press the **Main Screen** key on the front panel to close the menu. **Alternative:** Touch the **Main Screen** button.

Verifying the Temperature Accuracy

To understand the method for verifying the accuracy of your thermometer, it is important to understand how the thermometer works. Taking repeat temperatures in quick succession on the same patient or comparing the readings to another thermometer will not work for the following reasons:

- The thermometer is a “predictive” thermometer, which means that it uses an algorithm to predict what a patient’s temperature would be in three to five minutes.
- When the thermometer is placed in the patient site, the probe is generally cooler than the patient temperature site and the patient is generally warmer. Heat is then transferred to the probe, causing the patient’s body site to be cooled. The body site then takes approximately 20 minutes to return to the original temperature. If you repeat the temperature measurement or use a different thermometer prior to the 20-minute recovery time, the reading will likely be different.
- Different thermometers use different predictive algorithms. These algorithms are based on a sampling of patients’ temperatures at the desired quick predict time versus their three to five minute temperature. Therefore, comparing a SureSigns temperature reading to a reading from a different thermometer is not an effective method for testing accuracy.

After you take a predictive temperature measurement on a patient, you can verify the value by following these steps:

Step	
1	Replace the temperature probe in the probe well.
2	Open the **Temperature Menu** and touch the **Mode** menu.
3	Touch **Monitored**. Monitored Mode Icon The Monitored Mode icon appears in the Temperature numeric pane when you remove the probe from the well.

4	Remove the temperature probe from the probe well and firmly push the probe into a probe cover.
5	Place the probe in the appropriate site on the patient. **Note —** *The* **Temp Low** *alarm may sound for several seconds while the temperature stabilizes.*
6	Hold the probe in position for the following durations: • 3 minutes for oral and rectal temperatures • 5 minutes for axillary temperatures This is the amount of time it takes for the probe and the patient's body site to come to thermal equilibrium (or the same temperature).
7	Before removing the probe, note the temperature value. (Monitored temperature values are not saved to a patient record.)

Temperature Safety Information

Warning

To minimize risk of damage to the monitor during defibrillation use only approved supplies.

Use only the specified probes for your monitor.

Do not use the thermometer if you see any signs of damage to the probe.

Disposal of probe covers must be in compliance with local and facility regulations.

Caution

When replacing the temperature probe after a measurement is complete, verify that the probe is firmly seated in the well, but do not forcefully insert the probe in the well.

Biting the probe may cause damage to the probe.

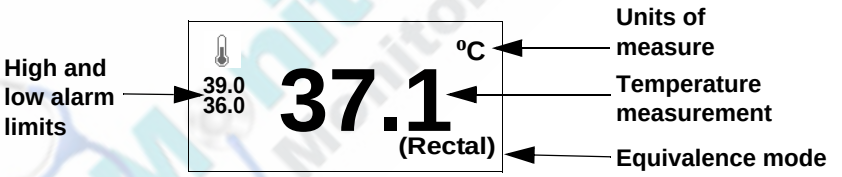
Do not take an axillary temperature through the patient's clothing. Direct probe cover-to-skin contact is required.

8
Monitoring Temperature — Tympanic

This chapter describes how to take a temperature measurement with the Genius™ 2 Tympanic Thermometer, and how to change the temperature settings.

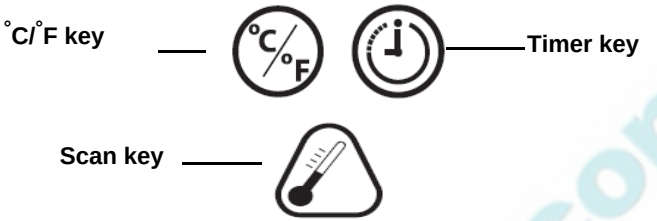
The Tympanic Temperature Pane

The following illustration shows the components of the temperature numeric pane.



Taking a Temperature Measurement

The tympanic thermometer provides the following keys to configure the settings and take a temperature measurement.



To take a temperature measurement:

Step	
1	Remove the thermometer from the thermometer base and inspect the probe lens to ensure that the probe lens is clean and clear of any material. **Notes** • *If the probe lens is soiled, gently clean it with a lens wipe or lint free swab. The lens should appear shiny and free of fingerprints and debris.* • *Probe covers must be used at all times when taking measurements.*
2	Firmly insert the probe into a probe cover and inspect it to ensure that there is no space between the cover and tip base, and that no holes, tears, or wrinkles are present in the plastic film. If not intact, use a different probe cover. The thermometer display becomes active when the probe cover is attached.
3	Insert the probe in the patient's ear, aligning the probe shaft with the ear canal.

4	 Scan key Press and release the **Scan** key. Keep the probe in the patient's ear until the thermometer beeps indicating that the measurement is complete.
5	Remove the probe from the ear. The patient temperature and equivalence mode is displayed on the thermometer, and in the Temperature numeric pane on the monitor. For more information, see "Equivalence Modes" on page 8-4. **Note —** *Do not repeat a measurement in the same ear within a 20-minute period.*
6	Press the **Eject** key to eject the probe cover. Dispose of the cover in accordance with your facility's policies. **Note —** *After 30 seconds of inactivity, the monitor returns to measurement mode.*
7	Replace the thermometer in the thermometer base.

Equivalence Modes

Depending on the equivalence mode, the thermometer adjusts the temperature measurement by a set value so that it reflects what the patient's temperature would be if measured at the actual body site.Your biomedical engineer configures the equivalence mode in the thermometer. You can view the equivalence mode in the thermometer display.

In tympanic mode (EAR) the display indicates the absolute temperature without adjustment. The following table describes the equivalence modes:

Equivalence Mode	Thermometer Display	Description
Oral		In oral mode (ORL), the tympanic temperature is adjusted to display an oral temperature equivalent. Oral Mode = Ear Mode + 0.60°C (33.08°F).
Core		In core mode (CORE), the tympanic temperature is adjusted to display a core temperature equivalent. Core Mode = Ear Mode + 1.04°C (33.87°F).
Rectal		In rectal mode (REC), the tympanic temperature is adjusted to display a rectal temperature equivalent. Rectal Mode = Ear Mode + 1.16°C (34.08°F).

Changing Temperature Settings

Use the **Temperature Menu** to:

- Change the temperature alarm limits
- Change the units of measurement

Changing the Temperature Alarm Limits

For information on changing the Temperature alarm limits, see “Changing Alarm Limits” on page 4-8.

The Temperature default alarm limits are:

	Adult	Pediatric	Neonatal
Temperature high limit	39°C (102.2°F)	39°C (102.2°F)	39°C (102.2°F)
Temperature low limit	36°C (96.8°F)	36°C (96.8°F)	36°C (96.8°F)

Changing the Temperature Units of Measurement

To change the temperature units of measurement:

Step	
1	Open the **Temperature Menu** and touch one of the following options: • **°C** (Celsius) • **°F** (Fahrenheit) **Note —** *There is also a °C/°F key on the handheld thermometer to select Celsius or Fahrenheit. However, the value entered on the thermometer does not change the setting on the monitor. The value entered at the monitor is what gets stored in the patient record.*
2	Press the **Main Screen** key on the front panel to close the menu. **Alternative:** Touch the **Main Screen** button to close the menu.

Using the Tympanic Thermometer Timer

You can use the timer on the tympanic thermometer when counting respirations. When you enable the timer feature, the timer runs from 0 to 60 seconds, at 15 second intervals.

Note — You can use the timer without removing the thermometer from the base.

To enable the timer:

Timer key

•Press and hold the **Timer** key to enter Timer mode, and then press the **Timer** key again to start the timer.

The timer runs from 0 to 60 seconds.

The thermometer issues one beep at 15 seconds, a two beeps at 30 seconds, three beeps at 45 seconds, and four beeps at 60 seconds.

At the end of 60 seconds, the thermometer waits for two seconds, and then enters sleep mode.

Note — Press the **Timer** key at any point during the timer function to stop the timer.

Temperature Safety Information

Warnings

- **The Tympanic Thermometer has an IPX code of IPX0, non-protected against ingress of water and harmful effects.**
- **The monitor displays the equivalence mode site in the Temperature numeric pane. Check the equivalence mode site before taking measurements.**
- **Storing the Genius™ 2 Tympanic Thermometer outside the specified temperature and humidity ranges could adversely affect its performance.**
- **The Genius 2 Tympanic Thermometer does not operate on battery power.**
- **Soiled or damaged infra-red optical components could adversely affect the thermometer's performance.**
- **The Genius 2 Tympanic Thermometer is designed for use with Genius 2 Thermometer probe covers. Use of any other probe cover may result in erroneous readings.**
- **The probe covers are for single use only, to prevent cross-contamination. The probe covers are a potential choking hazard. Dispose of as biological waste according to hospital policy.**
- **Check the probe cover packaging for an expiration date. Do not use expired probe covers.**
- **Ensure that the probe tip seals the ear canal prior to taking a temperature. Failure to seal the ear canal will result in a loss of accuracy.**
- **Do not use the Tympanic Thermometer on patients with ear drainage, blood, cerebrospinal fluid, vernix, ear wax plugs, or foreign bodies in the ear canal. Under normal conditions, ear wax does not affect accuracy. However, cerumen plugs or impactions containing debris can lower the temperature measurement by several tenths of a degree.**
- **Pressure equalization (PE) or tympanostomy tubes will not adversely affect accuracy. For patient comfort, wait one week after surgery before using the thermometer.**

- **When assessing patient temperatures during cold weather conditions, allow the patient to equilibrate to room temperature before use.**
- **Excessive ear drum scarring may cause lowered temperature readings.**
- **Used probe covers must be treated as infectious biological waste and disposed of in accordance with current medical practices and local regulations.**
- **Expired or old equipment must be disposed of in accordance with institutional policy.**
- **Fluid ingress may interfere with unit functionality.**
- **The Genius 2 Tympanic Thermometer LCD display is not readable if there is LCD failure. A scratched, foggy, or damaged LCD display may not be readable.**

Cautions

- **The Genius 2 Tympanic Thermometer is a precision optical instrument. For reliable and trouble-free operation, handle carefully and do not drop.**
- **When not in use, the Genius 2 Tympanic Thermometer should be placed in the thermometer base unit.**
- **Even though this device has been designed to minimize the effects of electromagnetic interference, it does generate radio frequency energy. If not used in accordance with the instructions, the device could cause interference in other equipment operating within its vicinity. If the device is causing interference, take the following actions to correct the interference:**

  – Re-orient or re-locate the receiving device
  – Increase the separation between the devices
  – Consult a biomedical engineer

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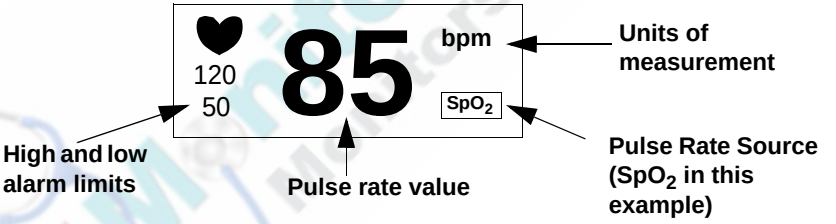
9
Monitoring Pulse Rate

The SureSigns VS4 monitor calculates and displays a pulse rate value, which can be derived from either an SpO_2 or NBP measurement.

Changing Pulse Rate Settings

The following illustration shows the components of the Pulse Rate numeric pane:



Use the **Pulse Rate Menu** to:

- Change the Pulse Rate alarm limits
- Change the Pulse Rate source
- Change the Pulse Rate volume

To open the **Pulse Rate Menu**:

- Touch the Pulse Rate numeric pane.

  The **Pulse Rate Menu** appears. Current settings are displayed.

Changing the Pulse Rate Alarm Limits

For information on changing the Pulse Rate alarm limits, see “Changing Alarm Limits” on page 4-8.

The default alarm limits are:

	Adult	Pediatric	Neonatal
Pulse Rate high limit	120 bpm	160 bpm	200 bpm
Pulse Rate low limit	50 bpm	75 bpm	100 bpm

Changing the Pulse Rate Source

The Pulse Rate value can be derived from SpO_2 or NBP. You can also select Auto as the Pulse Rate Source and the monitor will search for an available source in the following order: SpO_2 and NBP.

If the selected pulse rate source is NBP, note the following:

- The pulse rate value derived from NBP is an averaged value.
- The displayed pulse rate value is static, which means that it displays the pulse rate value at the time of the last NBP measurement. To determine the time at which the pulse rate was measured, see the time stamp in the Patient Records table.

To change the pulse rate source:

Step	
1	Open the **Pulse Rate Menu** and touch the **Pulse Source** menu item to select one of the following options: • **SpO_2** • **NBP** • **Auto**
2	Touch the desired option.
3	Press the **Main Screen** key on the front panel to close the menu. **Alternative:** Touch the **Main Screen** button.

Warning

If your patient has a very low pulse rate or strong arrhythmia, pulse rate readings derived from SpO_2 may cause nuisance alarms. Use the perfusion indicator to assess signal quality. If necessary, use a different method to measure the patient's pulse rate.

Note — If the pulse rate source is NBP, after a measurement completes, the value is removed from the monitor screen as soon as the record is closed or if the value is older than three minutes, whichever comes first.

Adjusting the Pulse Rate Volume

To increase or decrease the Pulse Rate volume:

Step	
1	Open the **Pulse Rate Menu** and touch the **Pulse Tone Volume** menu item.
2	Touch a number to increase or decrease the volume. You can turn the volume **Off**, if desired. The new volume takes effect immediately.
3	Press the **Main Screen** key on the front panel to close the menu. **Alternative:** Touch the **Main Screen** button to close the menu.

Note — The frequency of the pulse rate tone varies depending on which pulse rate source is selected. If the source is SpO_2, the frequency changes based on the SpO_2 level. If the source is NBP, there is no pulse rate tone because the NBP measurement is static[1].

[1] SpO_2 tone modulation is licensed under US patent US 4,653,498 from Nellcor Puritan Bennett Incorporated, a Tyco Healthcare company.

10
Printing

This chapter describes how to:

- Load the recorder paper
- Print one patient record
- Print multiple patient records
- Print a waveform

Warning

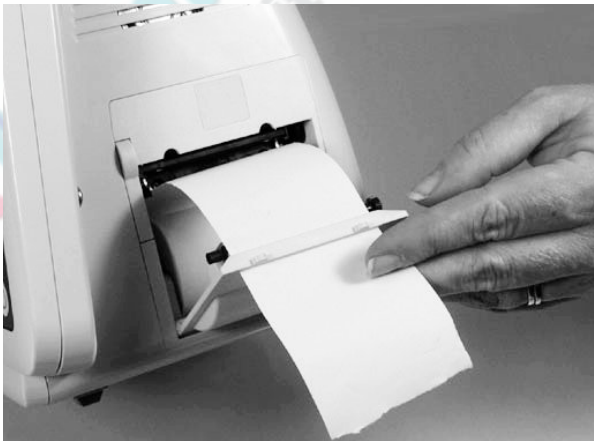
Printed and exported patient records contain patient IDs and patient data. Ensure that the printed data is handled according to your facility's electronic protected health information (ePHI) guidelines.

Only authorized personnel should be allowed to view, handle, store, or transmit patient data.

Loading the Recorder Paper

Caution **Use only Philips-supplied paper. Using the wrong paper can damage the recorder. If the paper is inserted incorrectly, no data is printed.**

To load the paper in the recorder:

Step	
1	Press the paper eject button on the left side of the recorder door to open the door. If the door does not open completely, pull it toward you.
2	Remove the empty paper core.
3	Place a new roll in the holder so that the end comes over the top of the roll and slide the paper through the slot in the door. 
4	Pull the loose edge to remove any slack and close the recorder door.
5	Press the **Print** key to verify that the paper is loaded correctly.

Printing One Patient Record


Print key

To quickly print the most recent patient record, press the **Print** key on the front panel.

The printout contains the patient ID, patient type, monitor name, date and time, and all vital signs measurements. If the QuickCapture feature is enabled on your monitor, observations and assessments appear after the measurement values. Any measurement that exceeds alarm limits is enclosed in a box.

Note — Do not press the **Print** key until a new patient record opens and the measurements appear in the new record.

To print a previously saved record, highlight the desired record and press the **Print** key on the front panel.

123456
John Jones
Adult
CN00000001

09/21/2010 10:32:51

Pulse	90 SpO2	bpm
SYS	122	mmHg
DIA	85	mmHg
MAP	98	mmHg
SpO2	98	%
Temp	99.1	°F

Printing Multiple Patient Records

Use the **Print Patient Data** menu to print multiple patient records from the patient records table or to print multiple records for a specific patient.

Note — If the QuickCapture feature is enabled on your monitor, any observations and assessments follow the vital signs measurements, as shown in the example below.

07/01/11 03:31:00	Patient	Type	Date	Time	Pulse (bpm)	NBP (mmHg)	SpO2(%)	Temp(F)	Pain Index	Resp(rpm)
US00000001	0009875433	A	07/01/11	03:20:12	65	SpO2	98	98.6		
	0007363627	A	07/01/11	03:16;44	64	Spo2	98	99.2	6	36
	0006352516	A	07/01/11	03:12:41	72	NBP	99	98.3		
_____	0008763842	P	07/01/11	03:08:03	60	SpO2	98	100.1	8	60
_____	0006655321	A	07/01/11	03:00:43	80	SpO2	99	99.1		
_____										
_____										

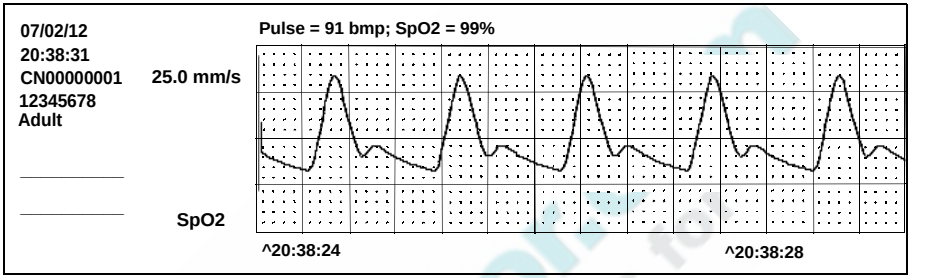
To print multiple patient records:

Step	
1	 View Records button Touch the **View Records** button and select a view mode: • Enable **View All** mode to print records from the patient record table. • Enable **View Patient** mode to print records for a specific patient.

2	 Print button Touch the **Print** button. The **Print Patient Data** menu appears.
3	Touch the number of records you want to print. • In **View Patient** mode, the choices are: **Most Recent**, **10**, **20**, **30**, **40**, **50**, or **All Records** • In **View All** mode, the choices are: **Most Recent**, **10**, **20**, **30**, **40**, **50** **Note —** *You may not be able to print all patient records at once using just one paper roll.*
4	The recorder prints the selected number of records.

Printing an SpO_2 Waveform

To print a waveform and all vital signs measurements for the current patient, place the monitor in Display Waveform mode and press the **Print** key on the front panel of the monitor. The vital signs values appear along the top of the printout and timestamps appear along the bottom.



Use the **Waveform Print** option in the **System Menu** to select the length of the printed waveform. The **Waveform Print** options are:

- **20 seconds** — The printout contains the values that occurred 7 seconds before and 13 seconds after the **Print** button was pressed.
- **7 seconds** — The printout contains the values that occurred 7 seconds after the **Print** button was pressed.

To print an SpO_2 waveform:

Step	
1	 Display Patient Records Hide Patient Records Display Waveform In the **Display Mode Menu**, select the **Display Waveform** option. The SpO_2 waveform appears in the Patient Records pane.
2	 Print key Choose one of the following options: • To print a 7-second or 20-second recording, press and release the **Print** key on the front panel. To create a continuous printout, press and hold the **Print** key on the front panel for 2 seconds.
3	To stop continuous printing, press the **Print** key.

Enabling Print on Alarm

You can configure the SureSigns VS4 vital signs monitor to automatically generate a printout when a physiological alarm occurs. After a measurement is taken, and the monitor determines that the value is outside the alarm limits, the recorder produces a printout.

The **Print On Alarm** option is available in the **Alarm Menu**. For more information, see “Enabling Print on Alarm” on page 4-11.

Enabling NBP Auto Print

To configure the monitor to initiate a printout each time an NBP measurement is taken, see “Enabling Automatic NBP Printouts” on page 6-6.

Changing the Recorder Speed

You can change the recorder speed in the **System Menu**. See “Changing System Settings” on page 2-15.

11
Care and Cleaning

To clean or disinfect your SureSigns VS4 monitor, use only the approved cleaning agents listed in this chapter.

For information on how to clean accessories, see the instructions for use provided with the accessory.

Warning

Do not use unapproved cleaning or disinfecting agents. Even small quantities of some cleaning agents will damage the monitor.

Do not use abrasive cleaners or strong solvents such as acetone or acetone-based compounds. The warranty does not cover damage caused by using unapproved substances.

General Guidelines

Keep the monitor, cables, and accessories free of dust and dirt. After cleaning and disinfecting, check the equipment carefully. Do not use the equipment if you see signs of deterioration or damage.

If you need to return any equipment to Philips, clean and disinfect it first.

Follow these general precautions:

- Always dilute cleaning agents according to the manufacturer's instructions or use the lowest possible concentration.
- Do not allow liquid to enter the case.
- Do not immerse any part of the equipment in liquid.

- Do not pour liquid onto the system.
- Never use abrasive material (such as steel wool or silver polish).
- Do not autoclave, steam sterilize, or ultrasonically clean the monitor or cables.
- Do not use bleach on electrical contacts or connectors.
- Do not use alcohol on the patient cables. Alcohol can cause the plastic to become brittle and fail prematurely.

Caution **Liquid spillage causes electrical circuit failure. If you spill liquid on the exterior of the monitor, use a clean cloth to dry the monitor. If you believe the liquid may have entered the monitor, contact your biomedical engineer, who can verify the performance and safety of the equipment.**

Cleaning and Disinfecting the Monitor

Caution

When cleaning the monitor, follow these precautions:

- **Lock the display to avoid any unintended action.**
- **Do not immerse, autoclave, steam sterilize, or ultrasonically clean the monitor.**
- **Do not use abrasive cleaners, or strong solvents such as acetone or acetone-based compounds.**
- **Do not clean electrical contacts or connectors with bleach.**
- **Use a soft cloth to clean the display window to prevent scratching.**

The tympanic temperature is rated IPXO and caution must be used to avoid liquid getting into the seams of the thermometer.

To clean the monitor:

Step	
1	Dampen a soft cloth with mild soap and water.
2	Wring any excess moisture from the cloth and gently clean the monitor.

To disinfect the monitor:

Step	
1	Dampen a soft cloth with any one of the following: • Isopropyl alcohol (70% solution in water) • Sodium hypochlorite (chlorine bleach, 5% solution in water) • Quaternary ammonium chloride compounds (<0.25%) • Hydrogen peroxide (<5%) • Peracetic acid (<1%) with Hydrogen peroxide (<1%) • Sodium dichloroisocyanurate solid (48% before dilution) • Ethylene glycol monobutyl ether (2.5%) with isopropanol (14%)
2	Wring any excess moisture from the cloth and wipe the monitor to disinfect it.

Cleaning and Disinfecting the Cables

Caution **Do not use alcohol to clean the cables. Alcohol can cause the cables to become brittle, and fail prematurely.**

To clean the cables:

Step	
1	Dampen a soft cloth with alcohol-free hand soap.
2	Wring any excess moisture from the cloth and gently clean the cables.
3	Clean the areas again with a damp cloth moistened with water only.

To disinfect the cables:

Step	
1	Dampen a soft cloth with sodium hypochlorite (chlorine bleach), 3% solution in water. **Caution: Sodium hypochlorite may discolor the cable.**
2	Wring any excess moisture from the cloth and gently clean the cables.
3	Clean the areas again with a damp cloth moistened with water only.

Cleaning and Disinfecting the Predictive Temperature Module

Caution **When cleaning the temperature module, follow these general precautions:**

- **Do not use steam, heat, or gas sterilization on the probe or probe well.**
- **Do not autoclave the probe or probe well.**

Cleaning and Disinfecting the Probe and Cord

To clean the probe and cord:

- Dampen a soft cloth with mild soap and warm water and wipe the probe and cord.

To disinfect the probe and cord:

- Dampen a soft cloth with any one of the following solutions and wipe the probe and cord:
  - Isopropyl alcohol (70% solution in water)
  - Sodium hypochlorite (chlorine bleach, 10% solution in water)
  - A nonstaining disinfectant

Cleaning and Disinfecting the Probe Well

To clean and disinfect the probe well:

Step	
1	Disconnect the probe and remove it from the well.
2	Remove the well from the monitor.
3	Dampen a soft cloth with mild soap and warm water and wipe the inner and outer surfaces.
4	If needed, disinfect the well with any one of the following: • Isopropyl alcohol (70% solution in water) • Sodium hypochlorite (chlorine bleach, 10% solution in water) • A nonstaining disinfectant
5	Thoroughly dry all of the surfaces before replacing the well in the monitor.

Cleaning and Disinfecting the Tympanic Temperature Module

Caution

When cleaning and disinfecting the tympanic temperature module, follow these general precautions:

- **Do not soak, rinse, spray, or submerge the thermometer.**
- **Do not use a cleaning agent that contains chlorine.**
- **Never spray the thermometer directly with cleaning chemicals. Spray a cloth or sponge lightly dampening it with the cleaning agent and then apply it to the thermometer.**
- **The thermometer is a non-sterile device; do not use ethylene oxide gas, heat, or any other harsh method to sterilize the thermometer.**
- **Do not immerse or autoclave the thermometer.**
- **Do not use cleaners such as Spray-Nine™, Phisohex™, Hibiclens™, Vesta-Syde™, Anios DDSH™, Sufanios Citroen™, Perasafe powder™, Sekusept Pulver, Classic™, Sekulyse™, Diesin HG™, Incides N™, or SurfaSafe™ disinfectants because they may result in damage to the thermometer case or electronics. Prolonged or repeated use of these chemicals may result in damage to the thermometer case, display, or electronics.**
- **When cleaning the thermometer with a wipe, make sure the wipe has all excess fluid squeezed from it. If the wipe is too wet, the chemical may penetrate the handset and affect the thermometer's functionality.**
- **Never use an abrasive pad or an abrasive cleaner.**

To clean and disinfect the thermometer:

Step	
1	Install a probe cover on the thermometer when cleaning to prevent harsh chemicals from damaging the tip and probe lens.
2	Dampen a clean cloth or sponge with mild detergent and water. Water temperature should not exceed 55°C (130°F). You can also clean the thermometer with isopropyl alcohol (70% solution in water).
3	If needed, disinfect the thermometer with a mild detergent or detergent wipe with any one of the following: • Damp isopropyl alcohol wipes • Cidex™ • Manuklenz™ • VIROX™ • CaviWipes™
4	After cleaning, allow the thermometer to air dry for 30 minutes before use.

To clean and disinfect the probe tip:

Step	
1	Clean the probe tip at room temperature using one of the following: • Isopropyl alcohol wipe such as Webcol™ or Curity™ • Isopropyl alcohol (70% solution in water)
2	Remove all foreign matter from the probe tip.
3	Dry the window at the end of the probe tip using a lint free swab or lens wipe. **Note —** *The thermometer lens must be free from fingerprints and smudges for proper operation.*
4	After cleaning the tip, allow the thermometer to air dry for 30 minutes before use.

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Accessories List

This chapter lists accessories that are compatible with the SureSigns VS4 vital signs monitor.

Note — The accessory list is subject to change. For the latest information on supported accessories, contact your authorized Philips representative or refer to www.healthcare.philips.com.

SpO_2 Accessories

Philips Reusable Sensors

Patient Category	Description	Cable Length	Part Number	Use With This Cable
Adult	Finger sensor, for patient size > 110 lb (50 kg)	2 m	M1191B	Extension Cable M1941A (2 m)
Pediatric/Small adult	Finger sensor, for patient size 33 lb – 110 lb (15 kg – 50 kg)	1.5 m	M1192A	
Neonatal	Foot/hand sensor, for patient size 2.2 lb – 8.8 lb (1 kg – 4 kg)	1.5 m	M1193A	
Adult	Ear clip sensor, for patient size > 88 lb (40 kg)	1.5 m	M1194A	
Infant	Finger sensor, for patient size 8.8 lb – 33 lb (4 kg – 15 kg)	2 m	M1195A	
Large Pediatric	Finger clip, for patient size > 88 lb (40 kg)	2 m	M1196S	
Adult	Finger sensor, for patient size > 110 lb (50 kg)	3 m	M1191BL	No extension cable
Adult	Finger clip, for patient size > 88 lb (40 kg)	3 m	M1196A	

Patient Category	Description	Cable Length	Part Number	Use With This Cable
Adult	Finger sensor, for patient size > 110 lb (50 kg)	45 cm	M1191T	Adapter Cable M1943A (1.1 m) or M1943AL (3 m)
Pediatric	Finger sensor, for patient size 33 lb – 110 lb (15 kg – 50 kg)	45 cm	M1192T	
Neonatal	Foot/hand sensor, for patient size 2.2 lb – 8.8 lb (1 kg – 4 kg)	90 cm	M1193T	
Pediatric/Adult	Finger sensor, for patient size > 88 lb (40 kg)	90 cm	M1196T	

Philips Disposable Sensors

Patient Category	Description	Part Number	Use With This Cable
Adult/Pediatric	Finger sensor, for patient size > 44 lb (20 kg)	M1131A	Adapter Cable M1943A (1.1 m) or M1943AL (3 m)
Infant	Digit sensor for patient size 7 lb – 22 lb (3 kg – 10 kg)	M1132A	
Neonatal/Infant/ Adult	Foot/hand sensor for neonate; big toe/thumb for infant; finger for adult. Neonate patient size, < 7 lb (3 kg) Infant patient size, 22 lb – 44 lb (10 kg – 20 kg) Adult patient size, > 88 lb (40 kg)	M1133A	
Neonatal/Infant/ Adult	Foot/hand sensor for neonate; big toe/thumb for infant; finger for adult. No adhesive Neonate patient size, < 7 lb (3 kg) Infant patient size, 22 lb – 44 lb (10 kg – 20 kg) Adult patient size, > 88 lb (40 kg)	M1134A	

Nellcor Disposable Sensors

Note — The Nellcor disposable sensors listed below are only available from Philips in Europe and Japan.

Patient Category	Description	Part Number	Use With This Cable
Neonate/ Adult	Sensor for neonatal foot or adult digit, for patient size < 7 lb or > 88 lb (< 3 kg or > 40 kg)	M1901B	Adapter Cable M1943A (1.1 m) or M1943AL (3 m)
Infant	Digit sensor, for patient size 7 lb – 44 lb (3 kg – 20 kg)	M1902B	
Pediatric	Digit sensor, for patient size 22 lb – 110 lb (10 kg – 50 kg)	M1903B	
Adult	Digit sensor, for patient size > 66 lb (> 30 kg)	M1904B	

NBP Accessories

Reusable Comfort Cuffs

Patient Category/ Cuff Type	Limb Circumference	Bladder Width	Part Number	Air Hose
Thigh	42 cm – 54 cm	20 cm	M1576A	M1598B (1.5 m) or M1599B (3 m)
Large Adult	34 cm – 43 cm	16 cm	M1575A	
Adult	27 cm – 35 cm	13 cm	M1574A	
Small Adult	20.5 cm – 28 cm	10.5 cm	M1573A	
Pediatric	14 cm – 21.5 cm	8 cm	M1572A	
Infant	10 cm – 15 cm	5.5 cm	M1571A	

Disposable Soft Neonatal Cuffs (Safety Connector)

Cuffs	Limb Circumference	Bladder Width	Part Number	Tubing
Size 1	3.1 cm – 5.7 cm	2.5 cm	M1866S	M1596C (1.5 m) or M1597C (3 m)
Size 2	4.3 cm – 8.0 cm	3.2 cm	M1868S	
Size 3	5.8 cm – 10.9 cm	4.2 cm	M1870S	
Size 4	7.1 cm – 13.1 cm	5.1 cm	M1872S	
Size 5 Infant	10.0 cm – 1 5.0 cm	5.5 cm	M1873S	

Reusable Easy Care Adult/Pediatric Cuffs

Patient Category/ Cuff Type	Limb Circumference	Bladder Width	Part Number	Air Hose
Thigh	44 cm – 56 cm	21 cm	M4559B	M1598B (1.5 m) or M1599B (3 m)
Large Adult X-Long	35 cm – 45 cm	17 cm	M4558B	
Large Adult	35 cm – 45 cm	17 cm	M4557B	
Adult X-Long	27.5 cm – 36 cm	13.5 cm	M4556B	
Adult	27.5 cm – 36 cm	13.5 cm	M4555B	
Small Adult	20.5 cm – 28.5 cm	10.6 cm	M4554B	
Pediatric	14 cm – 21.5 cm	8 cm	M4553B	
Infant	10 cm – 15 cm	5.5 cm	M4552B	

Disposable Soft Adult/Pediatric Cuffs

Patient Category/ Cuff Type	Limb Circumference	Bladder Width	Part Number	Air Hose
Thigh	44 cm – 56 cm	21 cm	M4579B	M1598B (1.5 m) or M1599B (3 m)
Large Adult X-Long	35 cm – 45 cm	17 cm	M4578B	
Large Adult	35 cm – 45 cm	17 cm	M4577B	
Adult X-Long	27.5 cm – 36 cm	13.5 cm	M4576B	
Adult	27.5 cm – 36 cm	13.5 cm	M4575B	
Small Adult	20.5 cm – 28.5 cm	10.6 cm	M4574B	
Pediatric	14 cm – 21.5 cm	8 cm	M4573B	
Infant	10 cm – 15 cm	5.5 cm	M4572B	

Disposable Adult/Pediatric Cuffs

Patient Category/ Cuff Type	Limb Circumference	Bladder Width	Part Number	Air Hose
Thigh	42 cm – 54 cm	20 cm	M1879A	M1598B (1.5 m) or M1599B (3 m)
Large Adult	34 cm – 43 cm	16 cm	M1878A	
Adult	27 cm – 35 cm	13 cm	M1877A	
Small Adult	20.5 cm – 28 cm	10.5 cm	M1876A	
Pediatric	14 cm – 21.5 cm	8 cm	M1875A	
Infant	10 cm – 15 cm	5.5 cm	M1874A	

Disposable Neonatal Cuffs (Luer Connector)[1]

Cuffs	Limb Circumference	Bladder Width	Part Number	Air Hose
Size 1	3.1 cm – 5.7 cm	2.5 cm	M1866A	M1596B (1.5 m) or M1597B (3 m)
Size 2	4.3 cm – 8.0 cm	3.2 cm	M1868A	
Size 3	5.8 cm – 10.9 cm	4.2 cm	M1870A	
Size 4	7.1 cm – 13.1 cm	5.1 cm	M1872A	

Disposable Neonatal Cuffs (Safety Connector)[2]

Cuffs	Limb Circumference	Bladder Width	Part Number	Air Hose
Size 1	3.1 cm – 5.7 cm	2.5 cm	M1866B	M1596C (1.5 m) or M1597C (3 m)
Size 2	4.3 cm – 8.0 cm	3.2 cm	M1868B	
Size 3	5.8 cm – 10.9 cm	4.2 cm	M1870B	
Size 4	7.1 cm – 13.1 cm	5.1 cm	M1872B	
Size 5	10 cm – 15 cm	5.5 cm	M1873B	

1. The luer connector cuffs and air hoses are not available in EEA (European Economic Area) countries.
2. The safety connector cuffs and air hoses may not be available in all countries. Check with your local sales organization.

Predictive Temperature Accessories

Patient Category	Description	Part Number
All patient types	Rectal probe and well kit	989803143391
All patient types	Oral/Axillary probe and well kit	989803143381
Disposable probe covers, 1000 per case		M4823A

Tympanic Temperature Accessories

Patient Category	Description	Part Number
All patient types	Genius 2 Tethered Tympanic Thermometer	989803180831
All patient types	Genius 2 Tympanic Thermometer Probe Covers (CE mark)	989803179611
All patient types	Genius 2 Tympanic Thermometer Probe Covers (no CE mark)[1]	989803179381
This component is licensed by one or more of the following US patents: 7,237,949; 7,354,194; 7,556,424; 7,927,012; 7,686,506; and 7,478,946, which are held by a Covidien company, the registered owner of these patents.		

1. Not available in all countries.

Miscellaneous Accessories

Description	Part Number
SureSigns value roll stand	989803175861
SureSigns premium roll stand	989803176601
Roll stand with basket	989803144001
Wall mount	989803144011
Recorder paper (5 rolls)	989803136891
Lithium Ion battery	989803144631
HS1 Barcode Scanner	453564264041
Xenon 1900 Barcode Scanner	453564273711
SureSigns HS-1 2D barcode kit	989803176611
2D barcode scanner (includes mounting arm for use with roll stand)	989803147821
Serial interface adapter	989803159601
Cable management kit	989803148841
USB hub, 4-port	453564039661

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Specifications

General Specifications

Parameter	Specification
Size	
Width	26 cm (10.2 in.)
Height	22 cm (8.6 in.)
Depth	14.5 cm (5.7 in.)
Weight (excluding optional recorder)	3.1 kg (6.9 lb)
Display	
Screen Type	8.4” SVGA TFT-AM LCD display
Resolution	800 active pixels/line, 600 active lines per frame
Refresh Frequency	60 Hz
Screen Active Area	170.4 mm x 127.8 mm (6.71 in. x 5.03 in.)
Pixel Size	0.213 mm
Viewing Angle	± 60 degrees
Alarm Audio Range	45 dB – 85 dB
System Response Time	1 second

Safety Standards

Parameter	Specification
EN/IEC 60601-1, EN/IEC 60601-1-2, EN/IEC 60601-1-1 (as applicable), EN/IEC 60601-2-30, EN/IEC 60601-2-49, ISO 9919, EN12470-5:2003, ASTM E1965-98	
Protection Class	Class I, internally powered equipment, per IEC 60601-1
Degree of Protection	Type CF defibrillator-proof: per IEC 60601-1
Mode of Operation	Continuous
Protection Against Hazards of Ignition of Flammable Anaesthetic Mixtures	Equipment is not suitable for use in the presence of a flammable anaesthetic mixture with air or oxygen or nitrous oxide, per 60601-1

Electrical Specifications

Parameter	Specification
Power Sources	
Internal Battery	Lithium ion, Smart battery 10.8 V – 11.1 V 7200 mAhr
Battery Operating Time (new, fully-charged battery)	4 hours
Battery Charge Time	< 4 hours
Power Supply	Internal, 100 VAC – 240 VAC line voltage
Power Consumption	72 Watts
Frequency	50/60 Hz

Environmental Specifications

Caution **The monitor might not meet performance specifications if stored or used outside the specified temperature and humidity ranges.**

Parameter	Specification
Mechanical Shock	Complies with the mechanical shock requirement in ISO 9919 standards for use within the healthcare facility. Test conditions include: • Peak Acceleration: 150 m/s^2 (15.3g) • Duration: 11 ms • Pulse shape: half sine • Number of shocks: 3 shocks per direction per axis (18 total)
Mechanical Vibration	Complies with the mechanical vibration requirement in ISO 9919 standards for use within the healthcare facility. Test conditions include: • Frequency range: 10 Hz – 2000 Hz • Resolution: 10 Hz • Acceleration amplitude: 10 Hz – 100 Hz: 1.0 $(m/s^2)^2/Hz$ 100 Hz – 200 Hz: -3.0 db/octave 200 Hz – 2000 Hz: 0.5 $(m/s^2)^2/Hz$ • Duration: 10 min per each perpendicular axis (3 total)

Parameter	Specification
Thermal	
Operating Temperature	10°C – 40°C (50°F – 104°F)
Storage Temperature	-20°C – 50°C (-4°F – 122°F) for the device -20°C – 40°C (-4°F – 104°F) for the device plus accessories
Humidity	
Operating	Up to 80% RH, non-condensing
Storage	Up to 90% RH, non-condensing
Altitude	Up to 3000 m (9842 ft) above sea level (701 mbar)
Electromagnetic Compatibility	Meets the EN 60601-1-2:2001 standard

The following environmental specifications refer to the Genius™ 2 Tympanic Tethered Thermometer.

Parameter	Specification
Thermal	
Operating Temperature	60.8°F – 91.4°F (16°C – 33°C) monitor with tympanic.
Storage Temperature	– 25°C to 55°C (– 13°F to 131°F) up to 95% RH non-condensing.
Altitude	Up to 3000 meters (9842 feet) above sea level

NBP Specifications

Oscillometric NBP Measurement

This monitor uses the oscillometric method for measuring NBP. In adult and pediatric mode, the blood pressure measurements determined with this device comply with the American National Standard for Electronic or Automated Sphygmomanometers (ANSI/AAMI SP10-1992) in relation to mean error and standard deviation, when compared to intra-arterial or auscultatory measurements (depending on the configuration) in a representative patient population. For the auscultatory reference, the fifth Korotkoff sound was used to determine the diastolic pressure.

In neonatal mode, the blood pressure measurements determined with this device comply with the American National Standard for Electronic or Automated Sphygmomanometers (ANSI/AAMI SP10-1992) in relation to mean error and standard deviation, when compared to intra-arterial measurements in a representative patient population. The NBP measurement is suitable for use in the presence of electrosurgery and during the discharge of a cardiac defibrillator according to IEC 601-2-30:1999/EN 60601-2-30:2000.

Oscillometric devices measure the amplitude of pressure changes in the occluding cuff as the cuff deflates from above systolic pressure. The amplitude suddenly increases as the pulse breaks through the occlusion in the artery. As the cuff pressure decreases further, the pulsations increase in amplitude, reach a maximum (which approximates to the mean pressure), and then diminish.

Studies show that, especially in critical cases (arrhythmia, vasoconstriction, hypertension, shock), oscillometric devices are more accurate and consistent than devices using other noninvasive measuring techniques.

A physician must determine the clinical significance of the NBP information.

The following table lists the specifications for the Philips NBP module.

Parameter	Specification
Technique	Oscillometric using stepwise deflation pressure
Adult Measurement Range	
Systolic	30 mmHg – 270 mmHg (4.0 kPa – 36.0 kPa)
Diastolic	10 mmHg – 245 mmHg (1.3 kPa – 32.7 kPa)
MAP	20 mmHg – 255 mmHg (2.7 kPa – 34.0 kPa)
Pulse Rate Range	40 bpm – 300 bpm

Parameter	Specification
Pediatric Measurement Range	
Systolic	30 mmHg – 180 mmHg (4.0 kPa – 24.0 kPa)
Diastolic	10 mmHg – 150 mmHg (1.3 kPa – 20.0 kPa)
MAP	20 mmHg – 160 mmHg (2.7 kPa – 21.3 kPa)
Pulse Rate Range	40 bpm – 300 bpm
Neonatal Measurement Range	
Systolic	30 mmHg – 130 mmHg (4.0 kPa – 17.0 kPa)
Diastolic	10 mmHg – 100 mmHg (1.3 kPa – 13.3 kPa)
MAP	20 mmHg – 120 mmHg (2.7 kPa – 16.0 kPa)
Pulse Rate Range	40 bpm – 300 bpm
Blood Pressure Accuracy	Maximum Standard Deviation: 8 mmHg Maximum Mean Error: ± 5 mmHg
Pulse Rate Accuracy	• 40 bpm – 100 bpm: ± 5 bpm • 101 bpm – 200 bpm: ± 5% of reading • 201 bpm – 300 bpm: ± 10% of reading
Initial Cuff Inflation	• Adult: 160 mmHg (21.3 kPa) • Pediatric: 140 mmHg (18.7 kPa) • Neonatal: 100 mmHg (13.3 kPa)
Subsequent Cuff Inflation (in NBP Interval mode only)	The subsequent inflation pressure is determined automatically, depending on the previous measurement and patient type.

Temperature Specifications

The following table contains the predictive temperature specifications.

Parameter	Specification
Monitored Mode Measurement Range	26.7°C – 43.3°C (80°F– 110°F)
Predictive Mode Measurement Range	34.4°C – 40.6°C (93.9°F – 105°F)
Accuracy	± 0.1°C (± 0.2°F)
Resolution	0.1°C (0.2°F)

The following table contains the tympanic temperature specifications.

- The software was modified during testing to increase the precision of the measurements taken from one significant digit to two significant digits.
- The increased precision umbers were then averaged to account for the known variance in measurements taken due to human factors.

The thermometer has the following US patents: 6,839,651 and 7,549,792, which are held by a Covidien company, the registered owner of these patents.

Note — *The Genius 2 Tympanic Thermometer is compatible with the SureSigns VS4 monitor.*

Parameter	Specification
Measurement Site	Ear
Equivalence Mode and Corresponding Values	Ear: absolute temperature, no adjustment Oral: Ear Mode + 0.60°C (33.08°F) Core: Ear Mode + 1.04°C (33.87°F) Rectal: Ear Mode + 1.16°C (34.08°F)
Measurement Range	33.0°C – 42.0°C (91.4°F – 107.6°F)
Accuracy (overall temperature range)	± 0.2°C (± 0.4°F)
Displayed Resolution	0.1 °C or 0.1°F
Clinical Repeatability	Meets Section A.5 of EN 12470-5: 2003 (E).
Approximate Measurement Time	≤ 2 seconds.
Pulse Timer	60 seconds.
Response Time	Less than 2 seconds
Calibration Frequency	Annually
Fluid Ingress	Fluid ingress may interfere with unit functionality. Classification of the device per clause 5.

SpO_2 Specifications

The update rate for the SpO_2 value and Pulse Rate is typically 1 second. Data averaging and other signal processing on the displayed and transmitted data values of SpO_2 and Pulse Rate is controllable by the user-selectable SpO_2 Response Mode: Slow (20 seconds), Normal (10 seconds), and Fast (5 seconds). Depending on the magnitude of difference between the alarm limit and the displayed value, the alarm signal generation delay may be from 1 second to the value of the response time (5, 10, or 20 seconds).

Because pulse oximeter equipment measurements are statistically distributed, only approximately two-thirds of pulse oximeter equipment measurements can be expected to fall within the ± Arms value measured by a CO-oximeter.

Parameter	Specification	
SpO_2 Measurement Range	0% – 100%	
Pulse Rate Measurement Range	30 bpm – 300 bpm	
SpO_2 Accuracy[1]	Range	Accuracy
Philips Reusable Sensors		
M1191B, M1191BL, M1192A	70% – 100%	± 2%
M1193A, M1194A, M1195A, M1196A, M1191T, M1192T, M1196S, M1196T	70% – 100%	± 3%
M1193T (Neonatal)	70% – 100%	± 4%
Philips Disposable Sensors		
M1131A, M1133A, M1134A (Neonatal)	70% – 100%	± 3%
M1132A, M1133A, M1134A (Adult/Infant)	70% – 100%	± 2%

Parameter	Specification	
Nellcor Disposable Sensors		
M1901B, M1902B, M1903B, M1904B	70% – 100%	± 3%
Pulse Rate Accuracy	2% or 1 bpm, whichever is greater	
Wavelength Range[2]	500 nm to 1000 nm for all specified sensors	
Maximum Optical Output Power	≤ 15mW for all specified sensors	

1. Sensor accuracy was obtained by performing controlled hypoxia studies on healthy, non-smoking adult volunteers (according to EN ISO 9919). The SpO_2 readings have been compared to CO-oximeter measurements on arterial blood samples. To represent the general population, data from at least 10 subjects (male and female) with a wide range of skin color was taken to validate SpO_2 accuracy.
2. Information about wavelength ranges can be useful for clinicians performing photodynamic therapy.

Recorder Specifications

Parameter	Specification
Type	Thermal
Paper width	58 mm
Speed	User selectable speeds of 6.25, 12.5, 25, and 50 mm/sec

Interface Specifications

Parameter	Specification
Nurse Call Alarm output	
Connector	3.5 mm phone jack, N.O and N.C contacts
Contact rating	≤ 1A, < 25VAC, < 60VDC
Isolation	1.5 kV
Delay time	< 0.5 sec
Data output	Ethernet port USB port, via the optional Serial Interface Adapter Wireless
Software upgrade	USB port
Barcode scanner connection	USB port
Wireless interface	Compliant with IEEE wireless networking standards 802.11a, 802.11b, and 802.11g Optional internal wireless module with antenna for wireless connectivity

Parameter	Specification
Antenna	The antenna in the monitor has been tested with the following specifications: • Form Factor: Whip • Type: Dipole • Maximum 2.4 GHz Gain: 2.15 dBi • Maximum 5.0 GHz Gain: 3.90 dBi

Radio Regulatory Compliance

USA — Federal Communication Commission

Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

1. Reorient or relocate the receiving antenna.
2. Increase the separation between the equipment and receiver.
3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
4. Consult the dealer or an experienced radio/TV technician for help.

Caution **FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.**

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note — FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the monitor and any person.

Industry Canada

To prevent radio interference to the licensed service, this device is intended to be operated indoors and away from windows to provide maximum shielding. Equipment (or its transmit antenna) that is installed outdoors is subject to licensing.

For the specifications for antennas that are used with the monitor, see "Interface Specifications" on page 13-13.

European Union

This device complies with the essential requirements of the R&TTE Directive 1999/5/EC. The following test methods have been applied in order to prove presumption of conformity with the essential requirements of the R&TTE Directive 1999/5/EC:

- **EN60950-1:2001 A11:2004**

  Safety of Information Technology Equipment

- **EN 300 328 V1.7.1: (2006-10)**

  Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband Transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using spread spectrum modulation techniques; Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive

- **EN 301 489-1 V1.6.1: (2005-09)**

  Electromagnetic compatibility and Radio Spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements

- **EN 301 489-17 V1.2.1: (2002-08)**

  Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for 2,4 GHz wideband transmission systems and 5 GHz high performance RLAN equipment

- **EN 301 893**

  Electromagnetic compatibility and Radio spectrum Matters (ERM); Broadband Radio Access Networks (BRAN); Specific conditions for 5 GHz high performance RLAN equipment

- **EU 2002/95/EC (RoHS)**

  Declaration of Compliance - EU Directive 2003/95/EC; Reduction of Hazardous Substances (RoHS)

This device is a 2.4 GHz wideband transmission system (transceiver), intended for use in all EU member states and EFTA countries, except in France and Italy where restrictive use applies.

In Italy the end-user should apply for a license at the national spectrum authorities in order to obtain authorization to use the device for setting up outdoor radio links or for supplying public access to telecommunications or network services.

This device may not be used for setting up outdoor radio links in France and in some areas the RF output power may be limited to 10 mW EIRP in the frequency range of 2454 MHz to 2483.5 MHz. For detailed information, the end-user should contact the national spectrum authority in France.

Hereby, Philips declares that this monitor is in compliance with the essential requirements and other relevent provisions of Directive 1999/5/EC.

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Troubleshooting

Use the information in this chapter to diagnose and correct problems with your monitor and its accessories. If you cannot resolve a problem after using the information in this chapter, contact your system administrator or biomedical engineer.

Viewing System Information

Important monitor information, such as the hardware ID and the software version, is displayed in the **System Menu**. For more information see “Viewing Monitor Information” on page 2-19.

Diagnosing a Problem

Before you begin to troubleshoot a problem, check the following basics:

1. Is the power turned on?
2. Is the battery adequately charged?
3. Is the power cord connected to the monitor and plugged into an AC power source?
4. Is the display functioning?
5. Are the LEDs on the front panel lit as you expect?

Note — It may take several seconds for the AC Power LED to light/turn off after the power cord is connected/disconnected.

When the monitor has power and a functioning display, use the information in this chapter to diagnose other monitor problems.

Troubleshooting Table

Use the following table to diagnose and fix monitor problems. The table describes a monitor problem by symptom, lists possible causes and suggested actions. If you cannot resolve a problem by using the following table, or if the table does not list the problem you are experiencing, see your system administrator.

Symptom	Possible Cause	Action
The monitor does not turn on with AC power, but turns on with battery power.	The power cord is unplugged.	Ensure that the power cord is plugged into an AC power source.
	The power cord is broken.	Replace the power cord if necessary.
The monitor turns on with AC power, but does not turn on with battery power.	The battery is not charged.	Charge the battery. For more information, see “Charging the Battery” on page 2-6.
The power is on, but the monitor screen is blank.	The monitor is in Standby mode.	Press the **On/Standby** key to end Standby mode. If the problem persists, see your system administrator.
Audible alarms do not sound.	The monitor is in Audio Pause mode or Audio Off mode.	Confirm audio alarms are enabled.
The NBP cuff does not inflate.	The tube or cuff is bent or twisted.	Straighten the tube or cuff.
	The tube or cuff is leaking air.	Replace the cuff and ensure that there is no air leakage in the tube.

Symptom	Possible Cause	Action
NBP measurements are not displayed.	Wrong cuff size or incorrect cuff placement.	Use the correct cuff size and ensure proper cuff placement.
	The tube is bent or twisted or there is air leakage in the air tube or cuff.	Ensure that the tube is straight and not kinked. Replace the cuff and ensure that there is no air leakage in the tube.
	An external problem occurred.	Ensure that all external blood pressure reading requirements are met and that the patient is not moving excessively. For more information about taking NBP measurements, see Chapter 6, “Monitoring NBP.”
NBP measurements are unreliable.	Wrong cuff size or incorrect cuff placement.	Use the correct cuff size and ensure proper cuff placement.
	An external problem occurred.	Ensure that all external blood pressure reading requirements are met and that the patient is not moving excessively.
Temperature measurements are not displayed.	The probe is misplaced.	Ensure that the probe is properly placed in the measurement site.
	The probe cable is not connected.	Ensure that the temperature probe is connected.
	The temperature is over range.	Ensure that temperature readings are in the range of $15^{o}C – 45^{o}C$ ($59^{o}F – 113^{o}F$).
	The probe malfunctioned.	Replace the temperature probe.
Temperature measurements are unreliable.	The probe malfunctioned.	Replace the temperature probe.
SpO_2 measurements are not displayed.	The SpO_2 module is calculating the SpO_2 value.	Wait until the module completes the calculation.
	The SpO_2 sensor has malfunctioned.	Replace the SpO_2 sensor.

Symptom	Possible Cause	Action
SpO_2 readings are unreliable.	An external problem occurred.	Ensure that all external SpO_2 reading requirements are met and that the patient is not moving excessively. For more information about SpO_2 measurements, see Chapter 5, "Monitoring SpO_2."
The nurse call function does not signal alarm conditions.	Alarms have been silenced.	Press the Alarm Silence key to end the Audio Off mode or Audio Pause mode.
	The phone connector is loose or broken	Check the physical connection to the nurse call connector.
The USB hub does not work.	The USB hub is disconnected from the monitor.	Ensure that all USB plugs are firmly connected into their ports.
	The USB hub ports are blocked by dust or dirt.	Clean the USB hub.
	The USB hub is broken.	Replace the USB hub.
The recorder paper is jamming.	The paper is not installed correctly.	Remove paper and reinstall correctly.
	The wrong type of paper is installed.	Install the recommended recorder paper.
The recorder does not print.	An optional recorder is not installed.	Verify that a recorder is installed.

Troubleshooting the Tympanic Thermometer

If the thermometer is not functioning properly, check the following table:

Symptom	Action
Temperature reading is unusually high.	Check the probe cover for tears or gaps. If the cover is damaged, replace it.
Temperature reading is unusually low.	Remove any obstructions from the probe cover, the probe tip, and the patient's ear canal.
The thermometer does not work.	Verify that the thermometer cable is connected to the temperature input connector on the monitor. If the problem persists, contact your system administrator.
The thermometer display is blank.	Verify that the thermometer cable is connected to the temperature input connector on the monitor. If the problem persists, contact your biomedical engineer or service department.
The touch screen does not work.	In the **System Menu**, unlock the **Lock Touch Screen** if it is on. If the problem persists, see your system administrator.
System error 4 appears on the thermometer display.	Let the thermometer equilibrate in the room for 20 minutes before using. If the error persists, contact your biomedical engineer or service department.

QuickCheck Error Messages

If any of the following error messages appear, perform the actions described:

Error Message	Action
The server certificate has expired or the system date is wrong	Check the system date and time. If this is correct, ask the system administrator to update the CA certificate.
The server certificate was issued by an unknown authority	Contact your system administrator.
Validation failed	Retry the validation or contact your system administrator.
Validation failed with an unknown error	Retry or contact your system administrator.
Failed to parse IBE response	Retry or contact your system administrator.
Validation timed out	Retry or contact your system administrator.
Invalid user name or password	Check the name and re-enter the password.

A
Alarm Specifications

This appendix contains an alphabetical listing of physiological and technical alarm messages. It also contains a table of factory default alarm limits and the calculations used for the Auto Set Alarm Limits option.

Physiological Alarms

The following table contains a listing of physiological alarm messages.

Alarm Message	Priority	Cause
NBP(D) High	Medium	The Diastolic NBP value has exceeded the high alarm limit.
NBP(D) Low	Medium	The Diastolic NBP value has dropped below the low alarm limit.
NBP(M) High	Medium	The MAP NBP value has exceeded the high alarm limit.
NBP(M) Low	Medium	The MAP NBP value has dropped below the low alarm limit.
NBP(S) High	Medium	The Systolic NBP value has exceeded the high alarm limit.
NBP(S) Low	Medium	The Systolic NBP value has dropped below the low alarm limit.
Pulse High	Medium	The Pulse Rate value has exceeded the high alarm limit.
Pulse Low	Medium	The Pulse Rate value has dropped below the low alarm limit.
SpO2 Desat	High	The oxygen saturation value has dropped dangerously low. The Desat alarm sounds when the SpO_2 value is 10 less than the current low limit for adults and pediatric patients and 5 less for neonates.

Alarm Message	Priority	Cause
SpO2 High	Medium	The SpO_2 value has exceeded the high alarm limit.
SpO2 Low	Medium	The SpO_2 value has dropped below the low alarm limit.
Temp High	Low	The temperature value has exceeded the high alarm limit.
Temp Low	Low	The temperature value has dropped below the low alarm limit.

Technical Alarms

The following table contains an alphabetical listing of technical alarm messages.

Alarm Message	Priority	Cause
Date/Time Adjusted	Low	Indicates that a time change greater than 30 seconds occurred when the monitor synchronized the time to the server or EHR system. This alarm can occur only if your system administrator enables the **Synchronize Time** option on the **Date/Time Settings** menu.
Extreme Low Batt	High	This is the second low battery alarm. Remaining battery power is less than 21 percent.
Low Batt	Low	Remaining battery power is less than 30 percent.
Loss of Monitoring	Low	Indicates that the monitor has shut itself down and then rebooted, due to an internal error. The **Loss of Monitoring** message appears to inform you that some patient data may have been lost.
NBP Air Leak	Low	The monitor cannot adjust pressure. This may be due to leakage or an internal NBP module problem.

Alarm Message	Priority	Cause
NBP Artifact	Low	The monitor cannot correct the pressure to the intended value within the time limit, or the monitor requires too many pressure correction attempts to adjust the pressure to the intended value. This may be due to excessive patient movement, leakage, or a problem with extreme edematous patients.
NBP Equip Malfunc	Low	NBP equipment malfunction. See your system administrator to check the error log for details.
NBP Hose Blocked	Low	The monitor has detected a defect in the pneumatic system, such as valves, tubing, or plug.
NBP Loose Cuff	Low	The NBP cuff cannot inflate to the target value within the limits of the selected patient size. May be caused by a pump defect, leakage, or disconnected cuff.
NBP Out of Range	Low	The NBP value is outside the NBP measurement range.
NBP Overpressure	High	The NBP cuff pressure exceeds the overpressure safety limits: • 300 mmHg (40.0 kPa) for adult or pediatric patients • 150 mmHg (20.0 kPa) for neonatal patients This error is caused by a sudden rise in pressure if the cuff is squeezed or bumped. The monitor cannot take any more NBP readings until the alarm is acknowledged.
NBP Timeout	Low	The NBP cuff deflation lasts longer than the limits of the selected patient size, or the measurement time exceeded 180 seconds for adult/pediatric patients and 90 seconds for neonatal patients. This may be due to extreme bradycardia or excessive artifacts.
NBP Weak Signal	Low	The monitor could not derive a blood pressure measurement. This may be due to excessive artifacts, extremely weak pulse signal, incorrect patient size setting, or the blood pressure measurement is out of range.

Alarm Message	Priority	Cause
Recorder Door Open	Low	The recorder door is open and must be closed to work properly.
Recorder Not Installed	Low	The optional recorder is not installed in your monitor.
Recorder Out of Paper	Low	The recorder is out of paper.
Speaker Malfunc	Low	There is a speaker malfunction. This is only a visual message. See your system administrator to check the error log for details.
SpO2 Equip Malfunc	Low	SpO_2 equipment malfunction. See your system administrator to check the error log for details.
SpO2 Erratic	Low	Erratic SpO_2 measurement. Often due to a faulty sensor, incorrect application, or incorrect positioning of sensor.
SpO2 Extd Update	Low	The update period of the displayed SpO_2 value is extended because an NBP measurement is being taken on the same limb.
SpO2 Interference	Low	The level of ambient light or electrical interference is so high that it prevents SpO_2/Pulse Rate from being measured reliably.
SpO2 Low Perf	Low	SpO_2 accuracy may be compromised due to very low perfusion.
SpO2 No Sensor	High	The SpO_2 sensor cable is disconnected from the monitor. **Note —** *This alarm is only enabled when the monitor is in Continuous SpO_2 mode or NBP Interval mode; if the monitor is not in Continuous SpO_2 mode or NBP Interval mode, the alarm will not sound.*
SpO2 Noisy Signal	Low	Excessive patient movement or electrical interference is causing irregular pulse patterns.

Alarm Message	Priority	Cause
SpO2 Non-Pulsatile	High	The pulse is too weak for the algorithm to detect the physiological pulse or the sensor is no longer attached to the patient. **Note —** *This alarm is only enabled when the monitor is in Continuous SpO_2 mode or NBP Interval mode; if the monitor is not in Continuous SpO_2 mode or NBP Interval mode, the alarm will not sound.*
SpO2 Sensor Malfunc	Low	Malfunction of the SpO_2 sensor or sensor cable. See your system administrator to check the error log for details.
Temp Module Malfunc	Low	For Predictive Temperature, there is a module malfunction. If the malfunction is caused by electrostatic discharge on the temperature probe, you can reset the temperature module and clear the error by inserting the probe in the probe well and pulling it out. If the error message is not cleared after you insert the probe in the probe well and pull it out, the malfunction may be caused by one of the following: • Battery or power-supply voltage not in range • Ambient temperature too low or too high See your system administrator to check the error log for details. For Tympanic Temperature, the malfunction may be caused by one of the following: • Ambient temperature too low or too high • System error See your system administrator to check the error log for details.
Temp Out of Range	Low	For Predictive Temperature and Tympanic Temperature: The temperature value is outside the temperature measurement range.

Alarm Message	Priority	Cause
Temp Probe Error	Low	There is a probe error for Predictive Temperature. If the malfunction is caused by electrostatic discharge on the temperature probe, you can reset the temperature module and clear the error by inserting the probe in the probe well and pulling it out. If the error message is not cleared after you insert the probe in the probe well and pull it out, the malfunction may be caused by one of the following: • The probe well is missing • The probe well is not installed properly • The probe warmer has overheated See your system administrator to check the error log for details.
Touch screen Malfunc	Low	There is a touch screen malfunction. See your system administrator to check the error log for details.
Wireless Malfunc	Low	There is a wireless malfunction; cannot load wireless firmware. See your system administrator to check the error log for details.

Factory Default Alarm Limits and Alarm Ranges

This section lists the default alarm limits and the alarm limit ranges for all physiological alarms.

The following table lists the default alarm limits that are set in the factory.

Note — Your system administrator can change these factory defaults to different default values.

	Adult		Pediatric		Neonatal	
	High	Low	**High**	Low	**High**	Low
NBP Diastolic	90 mmHg (12.0 kPa)	50 mmHg (6.7 kPa)	70 mmHg (9.3 kPa)	40 mmHg (5.3 kPa)	60 mmHg (8.0 kPa)	20 mmHg (2.7 kPa)
NBP Mean	110 mmHg (14.7 kPa)	70 mmHg (9.3 kPa)	90 mmHg (12.0 kPa)	50 mmHg (6.7 kPa)	70 mmHg (9.3 kPa)	24 mmHg (3.2 kPa)
NBP Systolic	160 mmHg (21.3 kPa)	90 mmHg (12.0 kPa)	120 mmHg (16.0 kPa)	70 mmHg (9.3 kPa)	90 mmHg (12.0 kPa)	40 mmHg (5.3 kPa)
Pulse Rate	120 bpm	50 bpm	160 bpm	75 bpm	200 bpm	100 bpm
SpO_2	100%	90%	100%	90%	95%	85%
Temperature	39°C (102.2°F)	36°C (96.8°F)	39°C (102.2°F)	36°C (96.8°F)	39°C (102.2°F)	36°C (96.8°F)

The following table lists the user-adjustable ranges for all physiological alarms.

	Adult Alarm Range	Pediatric Alarm Range	Neonatal Alarm Range
NBP Diastolic High	55 mmHg – 244 mmHg (7.3 kPa – 32.5 kPa)	55 mmHg – 149 mmHg (7.3 kPa – 19.9 kPa)	22 mmHg – 99 mmHg (2.9 kPa – 13.2 kPa)
NBP Diastolic Low	11 mmHg – 85 mmHg (1.5 kPa – 11.3 kPa)	11 mmHg – 65 mmHg (1.5 kPa – 8.7 kPa)	11 mmHg – 55 mmHg (1.5 kPa – 7.3 kPa)
NBP Mean High	65 mmHg – 254 mmHg (8.7 kPa – 33.9 kPa)	55 mmHg – 159 mmHg (7.3 kPa – 21.2 kPa)	26 mmHg – 119 mmHg (3.5 kPa – 15.9 kPa)
NBP Mean Low	21 mmHg – 105 mmHg (2.8 kPa – 14.0 kPa)	21 mmHg – 85 mmHg (2.8 kPa – 11.3 kPa)	21 mmHg – 65 mmHg (2.8 kPa – 8.7 kPa)
NBP Systolic High	95 mmHg – 269 mmHg (12.7 kPa – 35.9 kPa)	75 mmHg – 179 mmHg (10.0 kPa – 23.9 kPa)	45 mmHg – 129 mmHg (6.0 kPa – 17.2 kPa)
NBP Systolic Low	31 mmHg – 155 mmHg (4.1 kPa – 20.7 kPa)	31 mmHg – 120 mmHg (4.1 kPa – 16.0 kPa)	31 mmHg – 85 mmHg (4.1 kPa – 11.3 kPa)
Predictive Temperature High	36.1°C – 43.2°C (97.0°F– 109.8°F)	36.1°C – 43.2°C (97.0°F – 109.8°F)	36.1°C – 43.2°C (97.0°F – 109.8°F)
Predictive Temperature Low	26.8°C – 38.9°C (80.2°F – 102.0°F)	26.8°C – 38.9°C (80.2°F – 102.0°F)	26.8°C – 38.9°C (80.2°F – 102.0°F)
Pulse Rate High (SpO2)	55 bpm – 299 bpm	80 bpm – 299 bpm	80 bpm – 299 bpm
Pulse Rate Low (SpO2)	31 bpm – 115 bpm	31 bpm – 155 bpm	31 bpm – 195 bpm
Pulse Rate High (NBP)	55 bpm – 239 bpm	80 bpm – 239 bpm	80 bpm – 239 bpm
Pulse Rate Low (NBP)	41 bpm – 115 bpm	41 bpm – 155 bpm	41 bpm – 195 bpm

	Adult Alarm Range	Pediatric Alarm Range	Neonatal Alarm Range
SpO2 High	50% – 100%	50% – 100%	31% – 100%
SpO2 Low	0% – 99%	0% – 99%	0% – 99%
Temperature High	36.1°C – 41.9°C (97.0°F – 107.4°F)	36.1°C – 41.9°C (97.0°F– 107.4°F)	36.1°C – 41.9°C (97.0°F – 107.4°F)
Temperature Low	33.1°C – 38.9°C (91.6°F – 102.0°F)	33.1°C – 38.9°C (91.6°F – 102.0°F)	33.1°C – 38.9°C (91.6°F – 102.0°F)

Auto Set Alarms

The following table lists the formulas used for calculating Auto Set Alarm Limits. The Auto Set Alarm Limits option is available in the **Alarm Menu.**

Parameter	Lower Limit		Upper Limit	
	Adult/Pediatric	Neonatal	Adult/ Pediatric	Neonatal
NBP Systolic	Systolic x 0.68 mmHg + 10 mmHg Systolic x 0.68 kPa + 1.3 kPa	Systolic – 15 (within 45 mmHg – 60 mmHg) Systolic – 2 within 6.0 kPa – 8.0 kPa	Systolic x 0.86 mmHg + 38 mmHg Systolic x .86 kPa + 5.1 kPa	Systolic + 15 (within 90 mmHg – 115 mmHg) Systolic +2 within 12.0 kPa – 15.3 kPa
NBP Diastolic	Diastolic x 0.68 mmHg + 6 mmHg Diastolic x .68 kPa + 0.8 kPa	Diastolic – 15 (within 20 mmHg – 40 mmHg) Diastolic – 2 within 2.7 kPa - 5.3 kPa	Diastolic x 0.86 mmHg + 32 mmHg Diastolic .86 kPa + 4.3 kPa	Diastolic + 15 (within 55 mmHg – 75 mmHg) Diastolic + 2 within 7.3 kPa -10.0 kPa

Parameter	Lower Limit		Upper Limit	
	Adult/Pediatric	**Neonatal**	**Adult/ Pediatric**	**Neonatal**
NBP Map	MAP x 0.68 mmHg + 8 mmHg MAP .68 kPa + 1.1 kPa	MAP – 15 (within 35 mmHg – 45 mmHg) MAP – 2 within 4.7 kPa – 6.0 kPa	MAP x 0.86 mmHg + 35 mmHg MAP .86 kPa + 4.7 kPa	MAP + 15 (within 65 mmHg – 75 mmHg) MAP + 2 within 8.7 kPa – 10.0 kPa
Pulse Rate (SpO2)	Pulse x 0.8 or 31/min (whichever is greater)	Pulse – 30 (within 80 – 100/min)	Pulse x 1.25 or 299/min (whichever is smaller)	Pulse + 40 (within 180 – 210/min)
Pulse Rate (NBP)	Pulse x 0.8 or 41/min (whichever is greater)	Pulse – 30 (within 80 – 100/min)	Pulse x 1.25 or 239/min (whichever is smaller)	Pulse + 40 (within 180 – 210/min)
SpO2	Same as default alarm limit	Same as default alarm limit	Same as default alarm limit	Same as default alarm limit
Temperature	Temp – 0.9°F Temp – 0.5°C	Temp – 0.9°F Temp – 0.5°C	Temp + 0.9°F Temp + 0.5°C	Temp + 0.9°F Temp + 0.5°C

B
Electromagnetic Compatibility

This appendix lists the tests and compliance levels that make the SureSigns VS4 vital signs monitor suitable for use in the specified electromagnetic environment according to IEC 60601-1-2:2001.

Instructions for Use

Medical electrical equipment can either generate or receive electromagnetic interference. This product has been evaluated for electromagnetic compatibility (EMC) with the appropriate accessories according to IEC 60601-1-2:2001, the international standard for EMC for medical electrical equipment. This IEC standard has been adopted in the European Union as the European Norm, EN 60601-1-2:2001.

Radio frequency (RF) interference from nearby transmitting devices can degrade performance of the product. Electromagnetic compatibility with surrounding devices should be assessed prior to using the product.

Fixed, portable, and mobile radio frequency communications equipment can also affect the performance of medical equipment. See your service provider for assistance with the minimum recommended separation distance between RF communications equipment and the product.

The cables, sensors/transducers, and other accessories for which compliance is claimed are listed earlier in this guide.

Warning

- **Use of accessories, transducers, and cables other than those specified may result in increased emissions and decreased immunity of the monitor.**
- **The monitor should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the monitor should be observed to verify normal operation in the configuration in which it is used.**

Reducing Electromagnetic Interference

The monitor and associated accessories can be susceptible to interference from other RF energy sources and continuous, repetitive, power line bursts. Examples of other sources of RF interference are other medical electrical devices, cellular products, information technology equipment, and radio/television transmission. If interference is encountered, as demonstrated dramatic variations in physiological parameter measurement values, attempt to locate the source. Assess the following:

- Is the interference due to misplaced or poorly applied sensors? If so, reapply sensors correctly according to directions in the product's Instructions for Use.
- Is the interference intermittent or constant?
- Does the interference occur only in certain locations?
- Does the interference occur only when in close proximity to certain medical electrical equipment?
- Do parameter measurement values change dramatically when the AC line cord is unplugged?

Once the source is located, attempt to attenuate the interference by distancing the product from the source as much as possible. If assistance is needed, contact your local service representative.

Restrictions for Use

Artifact on physiological waveforms caused by electromagnetic interference should be evaluated by a physician or physician authorized personnel to determine if it will negatively impact patient diagnosis or treatment.

Emissions and Immunity

The monitor is designed and evaluated to comply with the emissions and immunity requirements of international and national EMC standards. See Table B-1 through Table B-4 for detailed information regarding declaration and guidance.

The EMC standards state that manufacturers of patient-coupled equipment must specify immunity levels for their systems. See Table B-2 and Table B-3 for this detailed immunity information. See Table B-4 for recommended minimum separation distances between portable and mobile communications equipment and the product.

Immunity is defined in the standard as the ability of a system to perform without degradation in the presence of an electromagnetic disturbance. Degradation in system performance is a qualitative assessment which can be subjective.

Caution should, therefore, be taken in comparing immunity levels of different devices. The criteria used for degradation is not specified by the standard and can vary with the manufacturer.

Guidance and Manufacturer's Declaration

The SureSigns VS4 vital signs monitor is intended for use in the electromagnetic environment specified in the following tables. The customer or the user of the product should assure that it is used in such an environment.

Table B-1. Electromagnetic Emissions

Emissions Test	Compliance	Electromagnetic Environment Guidance
RF emissions CISPR 11	Group 1	The SureSigns VS4 vital signs monitor uses RF energy only for its internal function. Therefore, RF emissions are very low and not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	The SureSigns VS4 vital signs monitor is suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/flicker emissions IEC 61000-3-3	Complies	

Table B-2. Electromagnetic Immunity (ESD, EFT, Surge, Dips and Magnetic Field)

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment — Guidance
Electrostatic discharge (ESD) IEC 61000-4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.

Table B-2. Electromagnetic Immunity (ESD, EFT, Surge, Dips and Magnetic Field)

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment — Guidance
Electrical fast transient/burst IEC 61000-4-4	± 1 kV differential mode ± 2 kV common mode	± 1 kV ± 1 kV	In the event of reduced performance, it may be necessary to operate the patient monitor from a filtered power connection or battery powered (no electrical connection to the AC mains while monitoring).
Surge IEC 61000-4-5	± 1 kV differential mode ± 2 kV common mode	± 1 kV ± 2 kV	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions, and voltage variations on power supply input lines IEC 61000-4-11	< 5% U_T (> 95% dip in U_T) for 0,5 cycle 40% U_T (60% dip in U_T) for 5 cycles 70% U_T (30% dip in U_T) for 25 cycles < 5% U_T (> 95% dip in U_T) for 5 sec	< 5% U_T 40% U_T 70% U_T < 5% U_T	
Power frequency (50/60 Hz) Magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
Note: U_T is the AC mains voltage prior to application of the test level.			

Table B-3. Electromagnetic Immunity (RF Radiated and Conducted)

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment — Guidance
			Portable and mobile RF communications equipment should be used no closer to any part of the monitor, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.
Conducted RF IEC 61000-4-6	3 Vrms 0.15 MHz to 80 MHz Outside ISM bands	3 V rms	**Recommended Separation Distance** $d = \left[\frac{3.5}{3}\right]\sqrt{P}$; 0.150 MHz to 80 MHz

Table B-3. Electromagnetic Immunity (RF Radiated and Conducted)

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment — Guidance
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2500 MHz	3 V/m	$d = \left[\frac{3.5}{3}\right]\sqrt{P}$; 80 MHz to 800 MHz $d = \left[\frac{7}{3}\right]\sqrt{P}$; 800 MHz to 2500 MHz where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and *d* is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,[a] should be less than the compliance level in each frequency range.[b] Interference may occur in the vicinity of equipment marked with the following symbol: 

[a] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the monitor is used exceeds the applicable RF compliance level above, the monitor should be observed to verify normal operation. If abnormal performance is observed, additional measures are necessary, such as re-orienting or relocating the monitor.

[b] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m. Respiration measurement may be subject to interference at 900 - 1100 kHz and 70 - 80 MHz at less than 3 V/M field strength.

Recommended Separation Distances

The monitor is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the product can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the product as recommended below, according to the maximum output power of the communications equipment.

Table B-4. Recommended Separation Distances Between Portable and Mobile RF Communication Equipment and the Monitor

Frequency of Transmitter	**150 kHz to 80 MHz**	**80 to 800 MHz**	**800 MHz to 2.5 GHz**
Equation	$d = \left[\frac{3.5}{3}\right]\sqrt{P}$	$d = \left[\frac{3.5}{3}\right]\sqrt{P}$	$d = \left[\frac{7}{3}\right]\sqrt{P}$
Rated Maximum Output Power of Transmitter (Watts)	**Separation Distance (d) (meters)**	**Separation Distance (d) (meters)**	**Separation Distance (d) (meters)**
0.01	0.12	0.12	0.23
0.1	0.37	0.37	0.74
1	1.17	1.17	2.33
10	3.69	3.69	7.38
100	11.67	11.67	23.33

For transmitters rated at a maximum output power not listed above, the separation distance *d* can be estimated, in meters, using the equation in the corresponding column, where *P* is the maximum output power rating of the transmitter in watts according to the transmitter's manufacturer.

These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

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