The names of any providers and patients used in illustrations or examples in this document are fictitious.

Every effort has been made to ensure this manual is accurate, complete, and useful. Please let us know if you have any suggestions for improvement using one of the following means of contact:

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# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preface</td>
<td>............................................................................................................................................ v</td>
<td></td>
</tr>
<tr>
<td></td>
<td>About this Document .................................................................................................................. v</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Related Documents ..................................................................................................................... v</td>
<td></td>
</tr>
<tr>
<td></td>
<td>For More Information ................................................................................................................. v</td>
<td></td>
</tr>
<tr>
<td>Section 1 – Introduction</td>
<td>................................................................................................................... 1</td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Introduction to the Vital Signs Monitor ............................................................................... 1</td>
<td></td>
</tr>
<tr>
<td>1.1.1</td>
<td>Functional Description ........................................................................................................... 1</td>
<td></td>
</tr>
<tr>
<td>1.1.1.1</td>
<td>General Characteristics ....................................................................................................... 1</td>
<td></td>
</tr>
<tr>
<td>1.1.1.2</td>
<td>VSM Data Types ................................................................................................................. 2</td>
<td></td>
</tr>
<tr>
<td>1.1.2</td>
<td>Main Components .................................................................................................................... 3</td>
<td></td>
</tr>
<tr>
<td>1.1.3</td>
<td>Hardware Controls and Indicators ........................................................................................... 8</td>
<td></td>
</tr>
<tr>
<td>1.1.3.1</td>
<td>Front-Panel Items for Blood Pressure ................................................................................. 8</td>
<td></td>
</tr>
<tr>
<td>1.1.3.2</td>
<td>Front-Panel Items for Pulse Oximetry .................................................................................... 9</td>
<td></td>
</tr>
<tr>
<td>1.1.3.3</td>
<td>Front-Panel Items for Temperature ..................................................................................... 9</td>
<td></td>
</tr>
<tr>
<td>1.1.3.4</td>
<td>Miscellaneous Front Panel Indicators .................................................................................... 10</td>
<td></td>
</tr>
<tr>
<td>1.1.3.5</td>
<td>Front Panel Controls ............................................................................................................. 10</td>
<td></td>
</tr>
<tr>
<td>1.1.3.6</td>
<td>VSM Menu System .................................................................................................................. 11</td>
<td></td>
</tr>
<tr>
<td>1.1.4</td>
<td>VSM Features in the AFHCAN Software .............................................................................. 13</td>
<td></td>
</tr>
<tr>
<td>1.1.4.1</td>
<td>Simultaneous Monitoring Capability .................................................................................... 13</td>
<td></td>
</tr>
<tr>
<td>1.1.4.2</td>
<td>VSM Status Pop-ups .............................................................................................................. 13</td>
<td></td>
</tr>
<tr>
<td>1.1.4.3</td>
<td>Workflow Flexibility .............................................................................................................. 14</td>
<td></td>
</tr>
<tr>
<td>1.1.4.4</td>
<td>VSM Screen .......................................................................................................................... 15</td>
<td></td>
</tr>
<tr>
<td>1.1.4.5</td>
<td>Clearing the VSM's Internal Memory .................................................................................... 17</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Particulars of the AFHCAN Installation ............................................................................. 18</td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Warnings and Cautions .......................................................................................................... 18</td>
<td></td>
</tr>
<tr>
<td>Section 2 – Operation</td>
<td>.................................................................................................................. 19</td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Basic Operating Procedures ................................................................................................. 19</td>
<td></td>
</tr>
<tr>
<td>2.1.1</td>
<td>Primary Measurements in a Typical Clinical Scenario ....................................................... 19</td>
<td></td>
</tr>
<tr>
<td>2.1.1.1</td>
<td>Starting the VSM .................................................................................................................. 19</td>
<td></td>
</tr>
<tr>
<td>2.1.1.2</td>
<td>SpO2 Measurement and Heart Rate ...................................................................................... 20</td>
<td></td>
</tr>
<tr>
<td>2.1.1.3</td>
<td>Temperature Measurement ..................................................................................................... 20</td>
<td></td>
</tr>
<tr>
<td>2.1.1.4</td>
<td>Blood Pressure Measurement ............................................................................................... 21</td>
<td></td>
</tr>
<tr>
<td>2.1.2</td>
<td>Special Techniques ............................................................................................................... 21</td>
<td></td>
</tr>
<tr>
<td>2.1.2.1</td>
<td>Combining All Readings into One Data Set ......................................................................... 21</td>
<td></td>
</tr>
<tr>
<td>2.1.2.2</td>
<td>Automatic Monitoring of Blood Pressure ............................................................................ 21</td>
<td></td>
</tr>
<tr>
<td>2.2</td>
<td>Supplemental Procedures ...................................................................................................... 22</td>
<td></td>
</tr>
<tr>
<td>2.2.1</td>
<td>Changing Date and Time ...................................................................................................... 22</td>
<td></td>
</tr>
<tr>
<td>2.2.2</td>
<td>Changing Volume of Pulse Tone ............................................................................................ 23</td>
<td></td>
</tr>
<tr>
<td>Section 3 – Clinical Considerations</td>
<td>.................................................................................................. 25</td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>Guidelines for Clinical Success ............................................................................................ 25</td>
<td></td>
</tr>
</tbody>
</table>
3.2 Common Mistakes ............................................................................................................. 25
3.3 Tips and Tricks .................................................................................................................. 25

Section 4 – Routine Maintenance ........................................................................................... 27

4.1 Care and Cleaning .............................................................................................................. 27
  4.1.1 General Cleaning of the VSM .................................................................................... 27
  4.1.2 Cleaning the Temperature Probe and Well ................................................................. 27
  4.1.3 Cleaning the Blood Pressure Cuff and Hose............................................................... 27
  4.1.3 Cleaning the SpO2 Sensor ........................................................................................... 27

4.2 Elementary Troubleshooting .............................................................................................. 27
  4.2.1 Battery Charging and Care ......................................................................................... 27
  4.2.2 Responding to Error Codes ......................................................................................... 28

Appendix A - Client Software Setup ...................................................................................... A-29

List of Illustrations

<table>
<thead>
<tr>
<th>Figure</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VSM monitor unit - front</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>VSM – various views</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Blood pressure cuffs and hose</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>SpO2 sensor items</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Temperature probe items</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>Miscellaneous cables</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>Front panel diagram</td>
<td>8</td>
</tr>
<tr>
<td>8</td>
<td>Blood pressure items on front panel of VSM</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>Pulse oximetry items on front panel of VSM</td>
<td>9</td>
</tr>
<tr>
<td>10</td>
<td>Temperature items on the front panel of VSM</td>
<td>9</td>
</tr>
<tr>
<td>11</td>
<td>Front panel indicators for patient type and general status</td>
<td>10</td>
</tr>
<tr>
<td>12</td>
<td>VSM pop-up status messages</td>
<td>13</td>
</tr>
<tr>
<td>13</td>
<td>One example of a possible work flow using VSM</td>
<td>14</td>
</tr>
<tr>
<td>14</td>
<td>Basic VSM screen</td>
<td>15</td>
</tr>
<tr>
<td>15</td>
<td>VSM data as shown on the Case screen</td>
<td>16</td>
</tr>
<tr>
<td>16</td>
<td>Display elements associated with VSM</td>
<td>16</td>
</tr>
<tr>
<td>17</td>
<td>Example of a disparity in reported time of a measurement</td>
<td>22</td>
</tr>
</tbody>
</table>

List of Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Functions of VSM front panel controls</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Menu sequence 1 (quick press of Menu button)</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>Menu sequence 2 (press and hold Menu button)</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>Functions of VSM-related screen buttons</td>
<td>17</td>
</tr>
</tbody>
</table>
Preface

About this Document

This document is part of the set of user manuals provided with the AFHCAN Cart. These user manuals, covering various topics, are normally assembled into a binder delivered with each Cart. This modular design has the following advantages:

- the set of manuals provided with your cart includes documents for the specific peripheral devices installed
- each document is a stand-alone publication, so as new devices or features are added to the Cart, new manuals can be added to the existing binder
- user information that is common to all items of equipment does not need to be repeated in each module, but can be covered in separate modules and referenced as needed

Related Documents

This document assumes you have read the introductory hardware and software manuals included in this binder.

The original manuals provided with the equipment were included in a set of materials delivered with the AFHCAN Cart. Those manuals can be used to supplement the information provided in this document. Be aware, however, that items installed on an AFHCAN Cart may have been modified slightly, so the features as described in the original product manuals may not apply.

For More Information

This document describes the equipment to a level of detail that will meet most user's needs in the context of clinical use of the AFHCAN Cart. For more information, contact AFHCAN Customer Support:

AFHCAN Customer Support
Phone: 888 449-4435
Fax: 907 729-2269
email: customersupport@afhcan.org

Additional information about the Vital Signs Monitor can be found on the manufacturer's website:

http://www.welchallyn.com/medical/
Section 1 – Introduction

1.1 Introduction to the Vital Signs Monitor

This manual describes the principal features and operation of the Vital Signs Monitor (VSM), Welch Allyn Model 53NT0, as installed on an AFHCAN Cart.

1.1.1 Functional Description

1.1.1.1 General Characteristics

The VSM can automatically measure and display four major vital signs:

- temperature
- blood pressure
- heart rate
- oxygen saturation (SpO₂)

These four items of data are displayed on the front panel of the VSM. They can be read into an AFHCAN case as single measurements or as a series of observations over time. The accumulated information is initially displayed in a table on the VSM page. Additionally, there is an option for displaying the data as graphs.

Although the VSM has been installed on an AFHCAN Cart for telemedical applications, there is nothing to stop providers from using the VSM as a stand-alone instrument in the clinic. As long as the AFHCAN Cart is powered up during use, the VSM’s internal, backup battery will remain charged, and the device can be used as described in the Welch Allyn instruction manual.

If used as a stand-alone device, there are two additional vital sign measurements which can be selected and displayed, if desired, but which are not brought into a case: mean arterial pressure (MAP), and monitored temperature. These two features are not normally used in the clinical settings for which the AFHCAN Cart was designed.

Monitored temperature is a continuous reading of the actual temperature, whereas the single reading of temperature is the predicted value of where the temperature measurement would stabilize. The predicted value can be determined very quickly based on the initial rate of change detected by the probe. The predicted value is likely to be a little higher than the monitored value and closer to true body temperature. The VSM allows the user to select between degrees Fahrenheit and degrees Celsius.

Heart rate can be detected by the pulse oximeter (SpO₂ sensor) or can be detected in conjunction with obtaining blood pressure. If both blood pressure and pulse oximeter readings are being taken at the same time, heart rate will be based on the pulse oximeter. The pulse oximeter also generates an input to a pulse strength indicator (a bar-type display) on the front panel of the VSM. The pulse strength indicator is a general indicator and not a measured value.
The message window will display error messages, menu items and options, and the MAP reading, if selected. Each numerical display can also display error messages particular to the associated sensor or reading.

The VSM includes default, high and low alarm levels for each of the measured items. Alarm levels can be adjusted by the user, if desired, as described in the Welch Allyn instructions. Other user-controlled functions include setting the VSM's time, adjusting the volume of the pulse tone, and selecting the type of patient (adult, pediatric, or neonate1).

The VSM can store up to 99 sets of readings in its internal memory (numbered from 1 to 99). If the AFHCAN software discovers that there are some existing measurements in the VSM's memory when a case is opened up (and in particular, when the VSM screen is accessed), the software will ask the user if this existing data should be included in the case. This applies only to the most recent set of readings in the VSM's memory. The VSM's memory can be cleared in a number of ways, the most common being turning the VSM off and/or closing and sending a case.

1.1.1.2 VSM Data Types

The data collected by the VSM can be classified into two different types, each of which behaves differently in both the VSM and the AFHCAN software:

- cycle data - which are individual readings that are stored in VSM's memory
- monitored data - which are continuous readings that are displayed but not stored in the VSM's memory

The idea of cycle data comes from blood pressure measurements. The process of obtaining blood pressure involves a cycle that begins with inflating the cuff, slowly deflating to obtain a systolic reading, continuing the deflation to obtain a diastolic readings, and finally complete deflation of the blood pressure cuff. The cycle has a beginning and end, and produces two discrete values. These values are stored in the VSM's memory. Due to the way noninvasive blood pressure is measured, it is not possible to continuously monitor blood pressure. Even if a clinician works very quickly to take a sequence of readings, each set of readings will be separated in time.

Predicted temperature readings are also handled as cycle data. Each reading is a discrete measurement that is stored in the VSM's memory. (Monitored temperature, if selected, is just a continuous readout on the front of the VSM. Monitored temperature values are not stored in the VSM's memory and are not read into a case.)

SpO2 data is continually monitored by the sensor and the VSM, so it is monitored data. The readings on the front panel of the VSM are continually updated based on inputs from the SpO2 sensor. By itself, SpO2 data is not stored in the VSM's memory because it cannot be reduced to an item of data – it is a continuous stream of measurements.

Heart rate can be cycle data or monitored data depending on its origin. If the heart rate comes from the SpO2 sensor, then it is monitored data; if it comes from the blood pressure cuff, then it is

---

1 The items included as part of the AFHCAN installation are generally geared toward adult patients. Information about using the VSM with pediatric or neonatal patients, and the required equipment, can be found in the Welch Allyn documentation.
cycle data and is stored in the VSM's memory. As mentioned previously, if both the SpO2 sensor and blood pressure cuff are both active, heart rate is based on the SpO2 monitor.

There is one overriding exception to all the situations and conditions described above: if blood pressure is measured simultaneously with any other measurement, all the measured data present at the completion of the blood pressure cycle will be stored in the VSM's memory as cycle data even if it would otherwise be considered monitored data. This includes SpO2, heart rate, and monitored temperature.

As mentioned earlier, cycle data is stored in the VSM's memory, whereas monitored data is not. There are two places in the AFHCAN software when the difference between cycle data and monitored data is important:

- when the VSM page is first accessed
- during the setup of the AFHCAN client software

**Importing Existing Data**

When the VSM page is first accessed from the Add To Case screen, the AFHCAN software checks the VSM to see if there is any cycle data stored in memory. If data is present, the user will be asked whether this existing data should be brought into the current case. The benefit of this feature is that the user can connect a patient to the monitor and begin taking vital signs before logging in to the AFHCAN software. Once the vital signs are underway, the user can log in and identify the patient. Then, on opening the VSM page, the option to incorporate the vital sign readings will be presented. The AFHCAN software can only read in the most recent item in the VSM's memory. Any other readings stored in memory can be reviewed on the VSM, but will be ignored by the AFHCAN software.

**Note:** If the VSM is used as a stand-alone device, its memory should always be cleared at the conclusion of a patient encounter. This ensures patient confidentiality and prevents data from a previous patient from being incorporated into the wrong case.

**A Word about the AFHCAN Client Setup Program**

In general, the AFHCAN software controls when the different types of data are read into a case. Basically the AFHCAN software asks the VSM if it has any new data to report, and if so, to send it in. The timing of how these requests for data are made differ depending on which type of data is involved, and are based on settings entered in the setup program.

**1.1.2 Main Components**

The VSM consists of the following components (see Figures 1 through 6):

- monitor unit
  - internal, rechargeable battery
- sensors and related items
  - blood pressure cuff (2 sizes)
  - blood pressure connector hose
- SpO₂ sensor (reusable and single-use sensors)
- sensor extension cable
- oral thermometer
  - probe (blue top) and cable
  - probe well (blue)
- cables power cords
  - RS-232 data cable
  - power cord
  - power adapter

Figure 1
VSM monitor unit - front
Figure 2
VSM – various views
Figure 3
Blood pressure cuffs and hose

Figure 4
SpO2 sensor items
Figure 5
Temperature probe items

Figure 6
Miscellaneous cables
1.1.3 Hardware Controls and Indicators

Figure 7 shows the arrangement of all controls, data displays, indicators, and markings on the front panel of the VSM.

**Figure 7**  
Front panel diagram

1.1.3.1 Front-Panel Items for Blood Pressure

Figure 8 shows the front-panel items that pertain to blood pressure.

**Figure 8**  
Blood pressure items on front panel of VSM
1.1.3.2 Front-Panel Items for Pulse Oximetry

Figure 9 shows the front-panel items that pertain to pulse oximetry (SpO₂).

![Pulse oximetry items on front panel of VSM](image)

Figure 9
Pulse oximetry items on front panel of VSM

1.1.3.3 Front-Panel Items for Temperature

Figure 10 shows the front-panel items that pertain to temperature.

![Temperature items on the front panel of VSM](image)

Figure 10
Temperature items on the front panel of VSM
1.1.3.4 Miscellaneous Front Panel Indicators

Figure 11 shows front panel indicators that apply to the entire VSM regardless of the type of data being collected.

![Diagram of front panel indicators](image)

**Indicates selected patient type**
(each having different default values for alarm levels, etc.)

**When lit, VSM is on AC and battery is charged; when flashing, battery is charging**

**When lit, indicates battery is low**

**(Function unknown)**

**Figure 11**
Front panel indicators for patient type and general status

1.1.3.5 Front Panel Controls

Table 1 describes the functions of the front panel controls on the VSM.

### Table 1
Functions of **VSM** front panel controls

<table>
<thead>
<tr>
<th>Control</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>On/Off</strong></td>
<td>Push to turn VSM on. Push again to turn off. When the VSM is on, the vertical bar in the switch is lit (as are a few other items on the display). On power-up, VSM performs self test and sequentially illuminates all front panel indicators so user can check for any bad display segments. Turning the VSM off clears data from the VSM's memory.</td>
</tr>
<tr>
<td><strong>Menu</strong></td>
<td>When pushed, activates menu sequence 1. When pushed and held for three seconds, activates menu sequence 2. Once a menu sequence has been activated, pushing this button steps through the menu items. Once a desired menu item is located, use the up/down arrow button to change the setting of that menu item.</td>
</tr>
<tr>
<td>The up/down arrow button works in conjunction with the <strong>Menu</strong> button to sequence through the setting of a particular menu item. Works in conjunction with the <strong>Limits</strong> button to step alarm limit values up or down. Works in conjunction with the <strong>Auto</strong> button to set the interval for automatic blood pressure cycles. May be used in conjunction with the Review button to sequence through readings stored in memory. Works in conjunction with the temperature probe to sequence through the three different types of temperature readings (oral, axillary adult, axillary pediatric).</td>
<td></td>
</tr>
</tbody>
</table>
### Control Function

<table>
<thead>
<tr>
<th>Control</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Suspend</strong></td>
<td>Silences audible alarms. Provides a neutral way to exit from a menu sequence (other buttons can be used to exit from a menu sequence, but those buttons also activate their respective functions).</td>
</tr>
<tr>
<td><strong>Start/Stop</strong></td>
<td>Push to begin a manual blood pressure measurement (cycle). Push to stop either a manual or automatic blood pressure cycle.</td>
</tr>
<tr>
<td><strong>Auto</strong></td>
<td>Push to set an interval for automatic blood pressure monitoring. (Works in conjunction with the up/down arrow button to step through available intervals.) An interval of &quot;--&quot; means automatic BP monitoring is off (default).</td>
</tr>
<tr>
<td><strong>Review</strong></td>
<td>Push to display the most recent set of readings stored in memory. Push again to step down through the readings -or- use the up/down arrow button to move up or down through the readings. Push and hold three seconds to initiate the sequence for clearing all readings from memory.</td>
</tr>
<tr>
<td><strong>Limits</strong></td>
<td>Works in conjunction with various displays and the up/down arrow button to set high and low alarm levels for each measurement. Pressing the Limits button sequences through the current high-level alarm setting and the current low-level alarm setting for each individual function. Levels are displayed in the same window where the measurement is usually read. Note that there are different values for high/low alarm levels are used for each type of patient (adult, pediatric, or neonatal). Note also that default alarm levels are restored each time a different patient type is selected. For most clinical situations involving telemedicine, the default values are appropriate. Consult the Welch Allyn documentation for more information on changing values, if desired.</td>
</tr>
</tbody>
</table>

#### 1.1.3.6 VSM Menu System

The VSM has two menu sequences which allow the user to control general settings for the monitor. The first menu sequence is accessed by pressing the **Menu** button. Subsequent presses run through the sequence of menu items show in Table 2. The second menu sequence is accessed by pressing and holding the **Menu** button for three seconds. Subsequent presses run through the sequence of menu items shown in Table 3. For each item, the value displayed is changed by pressing the up/down arrow button.
Table 2
Menu sequence 1 (quick press of **Menu** button)

<table>
<thead>
<tr>
<th>Press</th>
<th>Item</th>
<th>Function</th>
<th>Range of Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Type of patient</td>
<td>Changes the operating characteristics of the VSM to match the type of patient.</td>
<td>Adult (default)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pediatric</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Neonatal</td>
</tr>
<tr>
<td>2</td>
<td>Target pressure</td>
<td>Changes the initial, target inflation pressure for the blood pressure cuff. Initial pressure must be above systolic level. (Note that VSM will automatically raise level and repeat test if too low initially).</td>
<td>100 — 270</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>default = 160 (adult)</td>
</tr>
<tr>
<td>3</td>
<td>Temp mode</td>
<td>Selects both the units and the monitoring mode (predicted or monitored).</td>
<td>°F (Fahrenheit, predicted)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(default)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>°F + M (monitored)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>°C (Celsius, predicted)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>°C + M (monitored)</td>
</tr>
<tr>
<td>4</td>
<td>Pulse tone volume</td>
<td>Adjusts the volume of the audible tone associated with monitored heart rate (SpO2 sensor).</td>
<td>0 (silent) — 5</td>
</tr>
</tbody>
</table>

Table 3
Menu sequence 2 (press and hold **Menu** button)

<table>
<thead>
<tr>
<th>Press</th>
<th>Item</th>
<th>Function</th>
<th>Range of Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Set hour</td>
<td>First value for entering time of day.</td>
<td>00 — 23</td>
</tr>
<tr>
<td>2</td>
<td>Set minute</td>
<td>Second value for entering time of day. Press and hold arrow button for faster sequencing.</td>
<td>00 — 59</td>
</tr>
<tr>
<td>3</td>
<td>Set year</td>
<td>Sets the current year.</td>
<td>00 — 99</td>
</tr>
<tr>
<td>4</td>
<td>Set month</td>
<td>Sets the current month.</td>
<td>JAN — DEC</td>
</tr>
<tr>
<td>5</td>
<td>Set day</td>
<td>Sets the current day.</td>
<td>01 — 31 (based on month)</td>
</tr>
<tr>
<td>6</td>
<td>MAP display</td>
<td>Controls whether mean arterial pressure will be displayed. (May be displayed on VSM, but is not read into an AFHCAN case.)</td>
<td>MAP ENABLED</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MAP DISABLED (default)</td>
</tr>
<tr>
<td>7</td>
<td>Blood pressure units</td>
<td>Selects whether blood pressure will be displayed in millimeters of mercury or kilopascals.</td>
<td>mmHg (default)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>kPa</td>
</tr>
</tbody>
</table>
**Note:** The units used in blood pressure measurements selected on the VSM may be different than the units selected on the AFHCAN software. If VSM and AFHCAN software are displaying different units, the AFHCAN software performs the necessary conversions. All readings displayed will be the correct values for the selected units.

### 1.1.4 VSM Features in the AFHCAN Software

#### 1.1.4.1 Simultaneous Monitoring Capability

One unique feature of the VSM is that it can be used simultaneously with other devices on the AFHCAN Cart. Once the *VSM* screen has been accessed and saved, any new VSM data will be read and stored into the case – even when viewing another screen. This allows you to monitor vital signs while using other devices such as the ECG. Data from the VSM will continue to be collected and saved in the case until the case is sent, placed on hold, archived, or discarded.

Simultaneous monitoring is one approach to using the VSM. Data will be read into the case as long as the case is open and VSM sensors are obtaining new data. If single measurements of vital signs are all that is needed, simply disconnect the sensors from the patient.

#### 1.1.4.2 VSM Status Pop-ups

Another unique feature of the VSM is that small display windows will pop up reporting on any change of status or activity of the VSM. These windows appear in the lower right corner of the screen, and will appear regardless of what other AFHCAN screen is displayed. Figure 12 shows a selection of VSM pop-up messages.

**Figure 12**

VSM pop-up status messages
1.1.4.3 Workflow Flexibility

Figure 13 shows just one of many possible work sequences for using the VSM. The purpose of this illustration is to emphasize the versatility of this device on the AFHCAN Cart.

Figure 13
One example of a possible work flow using VSM
1.1.4.4 VSM Screen

Figure 14 shows the VSM screen. Initially the data area shows a single blank row at the top. Each set of new readings is added at the top of the list.

The VSM screen is primary - data is active and VSM edit function (row delete) is available

Brings up graphic displays of data

Readings from VSM are added to this list; most recent is on top

Click here to see list of error messages

VSM tech info

Rows of data can be deleted (another indication this data is active)

Figure 14
Basic VSM screen

The VSM screen may be regarded as the primary screen for VSM data. The fact that you can access the VSM screen proves that the VSM is connected and ready to supply data to the case. Furthermore, the VSM screen is the only screen that allows you to edit the data (limited to deleting rows of data). Finally, the VSM screen allows you to look at the error codes that may appear on the VSM monitor and their meanings.

Note: The error codes are also printed on the side of the VSM housing, and they are covered in the Welch Allyn manual.

There are two situations where pushing the VSM button on the Add To Case screen will not bring up the VSM screen:

- if the VSM is turned off or otherwise not communicating with the AFHCAN software via the data cable, a message will appear saying "The Vital Signs Monitor is not connected," with an OK button to acknowledge the message
- on the initial attempt to open the VSM window, if the VSM has data stored in memory, the data will be displayed and the user will be invited to include the data into the case (see Figure 13 above for graphic of message window)

When VSM data is displayed from the Case screen, the overall appearance of the screen is similar to the VSM screen. If a thumbnail for a VSM report from a previous encounter with this patient is included on the Case screen, then it may be difficult to tell the active VSM report from the
The primary distinguishing feature is the presence of the **Edit** button, as shown in Figure 15. Pressing the **Edit** button takes you to the active VSM page.

**Figure 15**
VSM data as shown on the **Case** screen

**Figure 16** shows the two elements that can be brought up on the **VSM** screen:

- the graphics display
- the list of error codes

Graphical displays can be turned on and off by pressing the appropriate button. The list of error codes can be cleared by leaving the VSM screen and returning to it.

If error codes appear on VSM display, consult Welch Allyn manual for details.
Table 4 describes the functions of the buttons in the various screens and windows associated with the *VSM* screen.

### Table 4
Functions of *VSM*-related screen buttons

<table>
<thead>
<tr>
<th>Button</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Save</td>
<td>Saves VSM report to case and returns to the <em>Case</em> screen. Once the report is saved, it remains open and receives new data until the case is closed (sent, placed on hold, archived, or changes discarded).</td>
</tr>
<tr>
<td>Back</td>
<td>Before the VSM report has been saved, the Back button allows you to exit from the VSM screen without creating a VSM report. A message will come up asking you to confirm your decision. If confirmed, the software returns to the <em>Add To Case</em> screen.</td>
</tr>
<tr>
<td>Delete</td>
<td>Deletes a row of readings from the report. (This may be handy in situations, for example, where the SpO2 sensor was left on for an extended period, generating a number of readings that are essentially the same.) On pressing Delete, a message window will come up asking you to confirm your decision.</td>
</tr>
<tr>
<td>Display Graphs</td>
<td>Generates graphs of all the data in a VSM report and displays those graphs at the top of the report. The scales of graphs will adjust automatically to accommodate all the data.</td>
</tr>
<tr>
<td>Hide Graphs</td>
<td>Removes graphs from the display of the VSM report.</td>
</tr>
<tr>
<td>Include Data</td>
<td>If the VSM has data in memory, a message window will appear the first time you access the VSM function from the <em>Add To Case</em> screen. The message window will list the data as well as the date and time it was obtained. Pressing the Include Data button will add the data shown in the window as the first row of data in the VSM report.</td>
</tr>
<tr>
<td>Clear Data</td>
<td>Declines the offer to include the data from the VSM's memory in the current report, and clears the VSM's internal memory.</td>
</tr>
</tbody>
</table>

### 1.1.4.5 Clearing the VSM's Internal Memory

The VSM's internal memory will be cleared by any of the following:

- turning the VSM off
- pressing and holding the **Review** button on the VSM for three seconds, and confirming deletion
- changing the date or time on the VSM
- on declining to accept existing information in VSM's memory into case
- on completing work on a case (send, hold, archive, discard)
1.2 Particulars of the AFHCAN Installation

The AFHCAN installation places no restrictions on the functionality of the VSM as a stand-alone device. Once the VSM function has been accessed, the AFHCAN software reads in the key data and stores it in a case. At the point where active monitoring stops, the AFHCAN software will clear the VSM's internal memory.

1.3 Warnings and Cautions

Please observe the following points:

- Follow all warnings and cautions in the manufacturer’s literature provided with the device, as applicable.
- The Nellcor DS-100A sensor is not intended for long-term monitoring. Consult the manufacturer's literature provided with the device for further details.
- Always use a new probe cover on the temperature probe when taking a patient's temperature.
- Never reuse a probe cover.
- Never insert a probe into the probe well with the probe cover still on.
- Use only oral probes to take oral and axillary readings (blue ejection button, blue probe well).
- Use only rectal probes to take rectal temperatures (red ejection button and red probe well)\(^2\).
- Do not immerse thermometer handle in fluids.
- If using the thermometer in monitoring mode, do not exceed three minutes for oral and rectal measurements, or five minutes for axillary measurements.
  
  **Note:** The AFHCAN software will disregard temperature data when thermometer is in monitoring mode.

- Use appropriately sized blood pressure cuffs for the type of patient.
- Use the menu system to select the type of patient (adult, pediatric, neonatal) before doing any tests.
- Do not use the blood pressure cuff on an extremity already being used for intravenous infusions or SpO\(_2\) monitoring.
- SpO\(_2\) monitoring works best if finger nails are free of polish.

\(^2\) On the AFHCAN installation, the blue (oral) probe well and probe are normally the only ones used.
Section 2 – Operation

2.1 Basic Operating Procedures

2.1.1 Primary Measurements in a Typical Clinical Scenario

The operating procedures described here assume a typical clinical setting where the AFHCAN Cart is used for a telemedical consult. In this situation, vital signs are included as part of the overall patient information that is routinely developed during the encounter. Here the goal is to take single readings of the vital signs. Normally vital signs would not be monitored during the entire patient encounter (but they could be, if desired).

2.1.1.1 Starting the VSM

Proceed as follows:

1. Turn on the AFHCAN Cart and log into the software.

2. Turn on the VSM and observe the front panel for the following points:
   a. ensure all the display segments and windows illuminate in sequence
   b. the software version for the VSM is briefly displayed in the message window
   c. on conclusion of the startup sequence and self test, the time will be displayed in the message window (if it is incorrect, see 2.2.1 below to correct it)

3. If it is necessary to change the patient type, take the following steps:
   a. press the menu button once
   b. use the up/down arrow button to sequence through the available choices

   adult
   pediatric
   neonatal
   c. press the Suspend button to exit the menu system

   Note: All standard default values for alarm levels for that patient type will be set. Refer to the Welch Allyn documentation for more information on default settings.

4. Create (or open) a case for this patient.

5. From the Add To Case screen, push the VSM button.

   Note: From this point on, until the case is closed, any new data obtained by the VSM will be read into the VSM report.
2.1.1.2 SpO₂ Measurement and Heart Rate

Proceed as follows:

1. Ensure the patient's nail is free of nail polish.

2. Place the SpO₂ sensor on the patient's finger (usually the index finger) with the cable over the back of the hand.

3. In a few moments, readings will show in the $\text{SpO}_2$ % and the heart rate displays. The pulse strength display will become active. If the pulse tone volume is set above 0, an audible tone will sound with each pulse beat.

4. When the data from the SpO₂ sensor is read into a case, a pop-up window will display the values, and a new line of data will be added to the VSM report.

5. Remove the sensor. An alarm will sound. Press the Suspend button to silence the alarm.

2.1.1.3 Temperature Measurement

Proceed as follows:

1. Lift the temperature probe out of the well. The VSM will beep twice, and the type of measurement will be displayed ($\text{OrL}$ is the default).

2. In the event that it is necessary to change the type of temperature reading, press the up/down arrow button to sequence through the available options:
   - $\text{OrL}$ = oral temperature (default)
   - $\text{AA}$ = axillary adult
   - $\text{AP}$ = axillary pediatric

   Note: The VSM detects whether an oral probe well (blue) or a rectal probe well (red) is installed, and will only offer options appropriate to that well. When installed on an AFHCAN Cart, the blue probe well is standard. (Red probes may be available as an option.)

3. Place a new probe cover on the probe tip. Push cover fully into place so the end fits over a plastic bulge at the top and the ejection button comes up.

4. Place the probe under the patient's tongue in the sublingual pocket. In a few moments the VSM will beep and a reading will be displayed. This reading will be stored in the VSM's memory.

   Note: To take a subsequent temperature reading, it is necessary to eject the probe cover and return the probe to the probe well. This resets the internal circuitry and software so it is ready to take the next temperature reading.

5. Remove the probe from the patient's mouth, hold the probe over a suitable waste receptacle, and press the eject button to release the probe cover into the receptacle.

6. Place the probe back into the probe well.
2.1.1.4 Blood Pressure Measurement

Proceed as follows:

1. Select an appropriately sized blood pressure cuff for the patient. (To change cuffs, unscrew the plastic fitting that connects the hose to the cuff.)

2. Wrap the cuff around the patient's upper arm leaving enough room to fit two fingers under the cuff. (A slightly looser fit will probably work as well.)

3. Push the **Start/Stop** button on the VSM. Pressure will display in the **SYS** window. The cuff will inflate to the target pressure (default is 160 for adults).

   **Note:** If the VSM fails to obtain a systolic reading at the target pressure, it will deflate, then reinflate going to a higher starting pressure.

4. Pressure will gradually decrease, and systolic and diastolic readings will be displayed. If mean arterial pressure has been enabled, a MAP reading will be displayed in the message window. These values will be recorded in the VSM's internal memory.

2.1.2 Special Techniques

2.1.2.1 Combining All Readings into One Data Set

It is possible to handle the sensors so that a complete set of readings (blood pressure, oxygen saturation, heart rate, and temperature) are read into the case as a unit. This reduces the data display to a single line of readings. It also places a full set of readings into the VSM's internal memory. Proceed as follows:

1. Begin SpO₂ monitoring.
2. Begin taking blood pressure.
3. While blood pressure is underway, take the temperature.

At the completion of the blood pressure cycle, all available data will be captured into memory and read into the case.

2.1.2.2 Automatic Monitoring of Blood Pressure

Blood pressure can be set up for automatic monitoring. There are two basic types:

- monitoring at regular intervals
- stat monitoring

Stat monitoring takes blood pressure readings repeatedly over a span of five minutes. At the completion of each cycle, the blood pressure cuff deflates to less than safe venous return pressure and remains deflated for two seconds. It then begins a new cycle.

Interval monitoring takes place at timed intervals ranging from 1 to 240 minutes.

All blood pressure readings are retained in the VSM's internal memory, up to 99 sets of data. If the VSM function is active on the AFHCAN Cart, these readings and any additional data will be
brought into the case. The only limit to the amount of data in an AFHCAN case is the computer's storage capacity (this is more data than anyone would want).

To set up automatic monitoring of blood pressure, proceed as follows:

1. Press the **Auto** button.

2. Use the up/down arrow button to step through the available choices:

<table>
<thead>
<tr>
<th>Interval</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>--</td>
<td>automatic monitoring is off (use <strong>Start/Stop</strong> button to take manual BP)</td>
</tr>
<tr>
<td>ST</td>
<td>stat monitoring begins immediately and repeats for 5 minutes</td>
</tr>
<tr>
<td>#</td>
<td>automatic monitoring begins and repeats at the specified interval</td>
</tr>
</tbody>
</table>

   (available values include 1, 3, 4, 5, 10, 15, 30, 45, 60, 90, 120, 240)

3. Press the Suspend button to exit the interval selection sequence.

### 2.2 Supplemental Procedures

The following are procedures that are more likely to come up in the context of an AFHCAN installation. For further information on procedures not covered here, consult the Welch Allyn manual.

#### 2.2.1 Changing Date and Time

It is a good idea to verify that the VSM is displaying the correct date and time information. The reason for this is that when the AFHCAN software reads existing data from the VSM's memory into a case, the message window inviting the user to include existing data shows the time from the VSM. If the date and/or time are significantly in error, it could cause confusion as to whether the reading shown is the desired reading for this patient. Figure 17 shows an example of how this discrepancy could show up.

**Figure 17**

Example of a disparity in reported time of a measurement

To change the date and time, enter menu sequence 2, which steps through the various time and date values. Proceed as follows:

1. Press and hold the **Menu** button for three seconds. The **SET HOUR** menu item is the first to appear.
2. To set the hour, use the up/down arrow key.

3. When the hour is correct, press the Menu button to step to the next menu item, and use the up/down arrow button to adjust it, if necessary.

4. Repeat this sequence through the remaining time and date menu items.

5. When all items are correct, press the Suspend button to exit the menu sequence.

### 2.2.2 Changing Volume of Pulse Tone

The VSM can be set to produce an audible tone in conjunction with pulse and heart rate measurements from the SpO₂ sensor. The tone will beep with each heartbeat. The volume can be set from silent to fairly loud. This audible pulse tone usually applies to situations where the VSM is used for long term monitoring.

To change the volume of the pulse tone, proceed as follows:

1. Press the Menu button four times to display VOLUME in the message window.

2. Use the up/down arrow button to change the volume level. During the adjustment, the following will occur:
   - a numerical value for level will be displayed in the message window
   - a general indication will be displayed on the pulse strength indicator
   - a tone will sound at the indicated volume

3. Press the Suspend button to exit the menu sequence.
Section 3 – Clinical Considerations

These pointers are a supplement to your clinical training and experience, not a replacement for it. Emphasis here is on refining your clinical success in using the AFHCAN Cart.

3.1 Guidelines for Clinical Success

• ensure temperature probe is in continuous contact with tissue in sublingual pocket during temperature measurement
• use an appropriately sized blood pressure cuff
• keep patient still during measurement
• be sure the artery arrow on blood pressure cuff is over the artery

3.2 Common Mistakes

• blood pressure may not give accurate readings if patient has arrhythmia
• temperature probe may generate an error if probe is moved during reading
• SpO₂ sensor works incorrectly if there is polish on the patient's nail
• the standard SpO₂ sensor (Nellcor DS-100A) is for patients 88 pounds or larger
• different types of patients (adult, pediatric, or neonatal) may call for different sensors to be used (refer to vendor literature supplied with device)
• ensure the blood pressure hose is not kinked

3.3 Tips and Tricks

• use an appropriately sized cuff
Section 4 – Routine Maintenance

4.1 Care and Cleaning

4.1.1 General Cleaning of the VSM

The monitor can be wiped down with a slightly dampened cloth moistened with warm water and a mild detergent. A diluted, non-staining disinfectant solution may also be used. Observe the following points:

- never wet the monitor or immerse it in fluid
- never allow fluids to enter connector ports
- never immerse any monitor components such as hose, cuff, temperature probe, or SpO₂ sensor

4.1.2 Cleaning the Temperature Probe and Well

Wipe thermometer regularly with a cloth dampened with warm water and a mild detergent solution. Probe and handle may be cleaned with 70% isopropyl alcohol solution or a 10% chlorine bleach solution.

The probe well can be removed for cleaning. Inner and outer surfaces can be swabbed with a damp cloth or Q-tip with a 70% isopropyl alcohol or 10% chlorine bleach solution. The well can be immersed during cleaning. Please observe the following cautions:

- do not use hard, sharp, or abrasive objects to clean probe well
- do not use steam, heat, or gas sterilization
- thoroughly dry probe well before use

4.1.3 Cleaning the Blood Pressure Cuff and Hose

Wipe the cuffs and hose with a damp cloth moistened with a mild detergent solution.

4.1.3 Cleaning the SpO₂ Sensor

Clean the SpO₂ sensor with a cloth dampened with 70% alcohol or 10% bleach solution. Wipe solution off with a pad moistened with pure water. Dry with a clean, dry pad.

4.2 Elementary Troubleshooting

4.2.1 Battery Charging and Care

The VSM contains a lead-acid battery that is maintained fully charged during normal use provided the AFHCAN Cart is powered up when the VSM is used. If the VSM is used without power being applied to the AFHCAN Cart, the charge will reduce to a point where the battery low light begins to flash. If the charge goes lower yet, a LOW BATTERY message will appear in the message window, and the VSM will cease to function until the Cart is turned on and the battery is recharged.
Over the life of the battery, its capacity to hold a charge will be reduced. With repeated discharges, the battery will eventually fail and need to be replaced. Contact Welch Allyn (see Preface) for assistance in obtaining and installing a replacement battery if this situation arises.

### 4.2.2 Responding to Error Codes

For information on how to respond to error codes, refer to the Welch Allyn documentation supplied with this device.
Appendix A - Client Software Setup

When the AFHCAN client software is installed on a workstation (AFHCAN Carts or personal computers), the administrator will run a small utility program that configures the software so it is suited to that particular workstation. This is called the AFHCAN Client Setup Program. For example, if a new peripheral device is installed, the setup program allows new buttons to be added to the Add To Case screen. These settings are handled by an administrator – the user seldom has to think about them. However, there are two settings for the VSM that affect how cycle data and monitored data are handled.

Because cycle data is valid the instant it is stored in the VSM's memory, it is good for the AFHCAN software to capture it as soon as it is available. In the setup program, this is called the Polling Interval for Data. This value can be set from 1 to 60 seconds, with a default of 2 seconds. Note that a blood pressure cycle takes about 40 seconds, and a succession of temperature readings can be done in 20-second intervals (due to the need to physically replace the probe in the probe well and install a new probe cover). This means that any setting between 2 and 10 seconds ensures no cycle data will be overlooked.

Monitored data presents the opposite problem. SpO2 readings are a continuous output from the sensor. In this situation, the problem is not to capture the data as soon as it is available – the data is always available. The problem is to set a reasonable limit on the amount of data captured. Theoretically, a computer could capture thousands of individual readings per second. To avoid data overload, the setup program allows the administrator to set a reasonable interval between readings of available monitored data. This interval is called the Minimum Interval Between SpO2 Data. The interval can be set from 5 to 300 seconds, with 30 seconds as a default. The question is how many lines of data do you want to see in a case, or how many points of data do you want to see on a graph. The rate of change for SpO2 data is relatively slow. Resting heart rate can fluctuate, but tends to remain within a range. Capturing monitored data every 30 seconds provides ample amounts of data for relatively short monitoring periods. For longer term monitoring, a longer interval may be more appropriate. The shorter the interval, the greater the number of lines of data in the report.
Index

AA. See temperature, axillary adult

AFHCAN
- cart, 5, 1, 19
- client setup, 29
- client setup program, 3
- customer support, 5
- installation, 18
- software, 2, 3, 13, 18, 29

alarm
- defaults, 2, 11, 19
- high and low levels, 2, 11
- silence, 11, 20

arythmia, 25

back button, 17

battery, 1, 3, 27
- failure, 28
- recharge, 27

blood pressure, 1, 2, 11, 21, 29
- automatic monitoring, 21, 22
- cuff, 3, 21
- cuff (image), 6
- cuff, cleaning, 27
- front panel items (image), 8
- interval, 11
- stat monitoring, 21, 22
- target pressure, 12, 21
- units, 12

buttons
- images, 17

cable, 4
- (image), 7

case screen, 16

cautions, 18

cleaning, 27

clear data button, 17

clinical considerations, 25

clinical scenario, 19
combine readings, 21
confidence, 3
controls
- auto, 11
- image, 8
- limits, 11
- menu, 10
- on/off, 10
- review, 11
- start/stop, 11
- suspend, 11
- up/down arrow, 10

data
- cycle, 2, 3, 29
- erase, 11

monitored, 2, 29

date, 22

delete button, 17

display graphs button, 17
edit button, 16

error codes, 15, 16, 28

ever messages, 2

functional description. See vital signs monitor

functional description

heart rate, 1, 2, 20

hide graphs button, 17

include data button, 17

MAP. See mean arterial pressure

mean arterial pressure, 1, 12, 21

memory, 2, 3, 21, 29
- clear, 2, 3, 17

menu button, 11

menu items, 2

menu sequence
- blood pressure units, 12
- MAP display, 12
- patient type, 12
- pulse tone volume, 12
- set day, 12
- set hour, 12
- set minute, 12
- set month, 12
- set year, 12
- target pressure, 12
- temp mode, 12

menu sequences, 11

message window, 2

Orl. See temperature, oral

oxygen saturation. See SpO2

patient type, 19

power adaptor, 4

power cord, 4

pulse oximeter. See SpO2 sensor

pulse strength indicator, 1

pulse tone, 20

change volume, 23

save button, 17

simultaneous monitoring, 13

SpO2, 1, 20, 21, 29
- data, 2
- front panel items (image), 9
- minimum interval, 29
- sensor, 4
- sensor (image), 6

SpO2 sensor
- cleaning, 27

status pop-up messages, 13
status pop-ups, 13
temperature, 1, 2, 21, 25, 29
  axillary, 18
  front panel items (image), 9
  monitoring, 18
  mode, 12
  monitored, 1
  oral, 18, 20
  predicted value, 1
  probe (image), 7
  probe cover, 18
  rectal, 18
  subsequent reading, 20
  units, 12
thermometer, 4
  cleaning, 27
time, 22
time, set, 12
troubleshooting, 27
vital signs monitor. See VSM
VSM
  components, 3
  display elements (image), 16
  functional description, 1
VSM screen, 14
  image, 15
  warnings, 18
work flow, 14