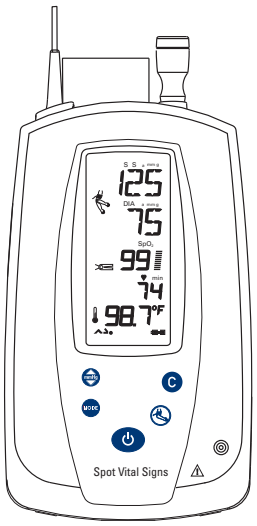
Welch Allyn Spot Vital Signs



Service Manual

Welch Allyn®

Advancing Frontline Care™

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Reorder No. 4200-89E

Manual Material No. 718448 Ver A

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Revision Information

Date	Revision	Description	Originator	Approval
3/31/01	A	Introduction of Service Manual	JDB	JDB
12/17/01	B	Correction made to Section 1 regarding temperature accuracy, Section 2 regarding part numbers, Section 3 regarding error codes, and updates to the drawings	JDB	JDB
9/12/02	C	Added New PCB layout and schematic for Spot Extensions. Added tool SRC-MAX to tool list in Section 2.3. Removed old PCB and Old SpO_2 PCB and replaced with new Main PCB and New SpO_2 PCB in section 2.4. Changed section 4.7 to cover both Spot and Spot Extensions SpO_2 PCB removal and replacement. Changed section 5.8 to cover both Spot and Spot Extension SpO_2 testing. General Spelling and grammar clean up.	JDB	JDB
02/02/03	D	Arden document release to SKF. Updated USA Service Center contact information.	JDB	DLK
05/01/03	E	Correction to tools required for service. Corrected General Information phone numbers.	DLK	DLK
09/16/03	F	Updates repair BOM. Updated Accessories. Re-formated manual to meet Welch Allyn service manual work instructions.	DLK	DLK
12/12/03	G	Correction to page numbering and to voltage calibrations. Re-formatted all systems of measurement to meet NIST Standards. Reformatted Appendix E. Corrected grammar and punctuation. Revised service and support details in Section 1. Removed schematics.	DLK	RJS
3/9/06	H	Removed references to Nellcor motion tolerance.	AMJ	JPK
3/21/07	J	SAP new version glitch	AMJ	FL
3/21/07	K	Update section on Setting the Date and Time. Include testing and disassembly/assembly for the Masimo SpO_2 feature and updated repair parts lists.	AMJ	FL
2010/11/05	L	Changed part number for SPOT Repair Tool SW CD from 130S57E to 716948 on pages 39 and 52 . Updated copyright page with latest service phone numbers and combined Title pages and Front cover pages.	KMR	NEA
2012/04/26	A	New Material Number taken out 718448. CE mark removal	KMR	GB

Drawings and/or illustrations and/or part numbers in this document are for reference only. For the most current revision call the Welch Allyn Customer Service phone number (see page ii).

Contents

1 Introduction

Welch Allyn has updated the Spot Vital Signs from its original configuration; offering a Pressure Preset option (Version 2, page 14) instead of a Print option (Version 1, page 13). In addition, some Version 2 configurations offer Masimo SpO_2 technology.

Table 1. Version comparison

Function/Appearance	Version 1 (serial number less than 200705000)	Version 2 (serial number 200705000 and above)
Available option	Print	Pressure Preset
Available SpO_2 capability	Nellcor	Masimo or Nellcor
Bezel and switch array color	Black bezel/multi-colored switch array	Blue

Warnings and cautions

Familiarize all operating personnel with the general safety information in this summary. Specific warnings and cautions are also found throughout this manual. Such specific warnings and cautions may not appear here in this summary.

General warnings

A warning statement in this manual identifies a condition or practice, which if not corrected or discontinued immediately, could lead to patient injury, illness, or death.

WARNING The Welch Allyn Spot Vital Signs is designed for use by medical clinicians. Although this manual may illustrate medical spot check techniques, only a trained clinician who knows how to take and interpret a patient's vital signs should use this system.

WARNING The information in this manual is a comprehensive guide to the operation of the Welch Allyn Spot Vital Signs. To achieve satisfactory results, you should read the manual thoroughly before attempting to use the device.

WARNING Spot Vital Signs is not intended to take measurements on neonatal patients. The AAMI SP10:1992 standard defines neonates as children 28 days or less of age if born at term (37 weeks gestation or more); otherwise up to 44 gestational weeks.

WARNING The Welch Allyn Spot Vital Signs is not defibrillator proof.

WARNING The Welch Allyn Spot Vital Signs is not intended for continuous monitoring. Do not leave the device unattended while taking measurements on a patient.

WARNING To ensure patient safety, use only accessories and supplies (i.e., blood pressure cuffs, hoses, temperature probes, SpO_2 sensors, etc.) recommended for or supplied with Spot Vital Signs. Using unapproved accessories with Spot Vital Signs can affect patient and/or operator safety.

WARNING This device is not suitable for use in the presence of a flammable anesthetic mixture with air or oxygen or nitrous oxide. An explosion may result.

WARNING Avoid compression of the blood pressure cuff tubing or pressure hose of the Welch Allyn Spot Vital Signs. Compression of the cuff tubing or pressure hose may cause system errors to occur in the device.

WARNING Care should be taken to prevent water or other fluid from entering any connectors on the device. Should this occur, the connectors should be dried with warm air. All operating functions should then be checked for proper operation.

WARNING Any Spot Vital Signs which has been dropped or damaged should be checked by qualified service personnel to ensure proper operation prior to use. Do not use the Welch Allyn Spot Vital Signs if you notice any signs of damage. Contact the Welch Allyn Customer Service Department for assistance.

WARNING Every three months, inspect the temperature probe, SpO_2 cord, and accessories for fraying or other damage. Replace as necessary.

WARNING There are no user-serviceable parts inside the device other than battery replacement. Refer Spot Vital Signs to the Authorized Service Center.

WARNING The Spot Vital Signs should not be used on patients who are linked to heart/lung machines.

WARNING The Spot Vital Signs does not operate effectively on patients who are experiencing convulsions or tremors.

WARNING This device complies with current required standards for electromagnetic interference and should not present problems to other equipment or be affected by other devices. As a precaution, avoid using this device in close proximity to other equipment.

WARNING This device is not intended for hand-held use during operation.

WARNING Welch Allyn recommends leaving the battery in the device, regardless if the device is not used for long periods of time, since there is no hazard of leaving the battery in the device.

WARNING Do not autoclave.

WARNING Welch Allyn is not responsible for the integrity of any mounting installation. Welch Allyn recommends that the customer contact their Biomedical Engineering Department or maintenance service to ensure professional installation for safety and reliability of any mounting accessory.

Blood pressure warnings

WARNING To ensure pediatric blood pressure accuracy and safety, the Welch Allyn Child Print Cuff (5200-03), the Welch Allyn Small Child Durable One-Piece Cuff (5082-203-3), and the Welch Allyn Small Child Disposable One-Piece Cuff (5082-93-3) are the smallest cuffs allowed for use with young children and infants. The circumference of the child's arm must fit within the range markings on the cuff.

WARNING You may experience inaccurate blood pressure measurements if blood pressure cuffs and/or hoses other than those provided by Welch Allyn for the Spot Vital Signs are used.

WARNING Patients who are experiencing moderate to severe arrhythmias may give inaccurate blood pressure measurements.

WARNING When several blood pressure measurements are taken on the same patient, it is recommended that the blood pressure cuff site and extremity are checked regularly for possible ischemia, purpura, and/or neuropathy.

WARNING Do not change the connector(s) on the blood pressure cuff tubing of this device to luer type. Luer type connectors are commonly used in intravenous infusion systems. Using the luer connectors on blood pressure cuff tubing creates the risk that the blood pressure tubing could be mistakenly connected to a patient's intravenous line, resulting in the introduction of air into the patient's circulatory system.

SpO_2 warnings

WARNING Only use Spot Vital Signs with Masimo or Nellcor SpO_2 option with Masimo or Nellcor brand sensors and accessories, respectively. Using the wrong or unapproved sensors or cables may cause improper performance.

WARNING The SpO_2 sensors and extension cables are intended for use only for pulse oximetry measurements. Do not attempt to connect these cables to a PC or any similar device.

WARNING Before use, carefully read the sensor's directions for use, including all warnings, cautions, and instructions.

WARNING Do not use a damaged sensor or SpO_2 cable. Do not use a sensor with exposed optical components.

WARNING Tissue damage can be caused by incorrect application or duration of use of an SpO_2 sensor. Inspect the sensor site as directed in the sensor's Directions for Use.

WARNING Do not use the sensors during magnetic resonance imaging (MRI) scanning. Induced current could potentially cause burns. The pulse oximeter may affect the MRI image, and the MRI unit may affect the accuracy of the pulse oximetry measurements.

WARNING Certain ambient environmental conditions, sensor application errors, and certain patient conditions may affect SpO_2 readings and pulse signal.

WARNING Do not immerse the sensor or patient cables in water, solvents, or cleaning solutions (the sensors and connections are not waterproof). Do not use irradiation, steam, or ethylene oxide for sterilization.

WARNING Do not use the SpO_2 cable or power cord to lift the unit because the cable or cord could disconnect from the unit, causing the unit to drop on the patient.

WARNING The SpO_2 in the Welch Allyn Spot Vital signs is not intended for use as an apnea monitor.

WARNING Consider the SpO_2 an early warning device. As a trend toward patient deoxygenation is indicated, use laboratory instruments to analyze blood samples to completely understand the patient's condition.

Temperature warnings

WARNING Single-use, disposable probe covers, available from Welch Allyn, limit patient cross-contamination. The use of any other probe cover or the failure to use a probe cover may produce temperature errors and is specifically not recommended.

WARNING Use only oral probes (blue cap) for taking oral and axillary temperatures. Use only rectal probes (red cap) for taking rectal temperatures. The use of the wrong probe may produce temperature errors.

WARNING Do not allow the tip of the temperature probe to come into contact with any heat source (e.g., hands or fingers) prior to taking a temperature measurement. If this occurs, discard the probe cover and start the temperature determination again.

WARNING Long-term continuous monitoring beyond three to five minutes is not recommended in any mode.

IR communications port warnings

WARNING The Welch Allyn Spot Vital Signs contains an infrared communications port for isolated communications with external devices. The port is located on the side of the device to preclude direct eye contact on a continual basis when viewing the display. As a precaution, do not look directly into the infrared port during operation.

General cautions

A caution statement in this manual identifies a condition or practice, which if not corrected or discontinued immediately, could lead to equipment failure, equipment damage, or data loss.

Caution If the accuracy of any measurement is in question, check the patient's vital sign(s) by an alternate method, then check to make sure the device is functioning properly.

Caution Ensure the device is placed on a secure surface or use one of the optional mounting accessories.

Caution Do not place fluids on the device.

Blood pressure cautions

Caution Extremity and blood pressure cuff motion should be minimized during blood pressure determinations.

Caution If the blood pressure cuff is not at heart level, the difference in reading due to the hydrostatic effect should be noted. The value of 1.80 mmHg must be added to the displayed reading for every inch (2.5 cm) above heart level. The value of 1.80 mmHg must be subtracted from the displayed reading for every inch (2.5 cm) below heart level.

Caution Proper blood pressure cuff size and placement is essential to the accuracy of the blood pressure determination.

Caution When measuring blood pressure on children younger than 3 years of age, it is recommended that the Pressure Preset (initial inflation pressure) be set at 160 mmHg or lower.

SpO_2 cautions

Caution The pulse oximeter is calibrated to determine the percentage of arterial oxygen saturation of functional hemoglobin. Significant levels of dysfunctional hemoglobin such as carboxyhemoglobin or methemoglobin may affect the accuracy of the measurement.

Caution Physiological conditions, medical procedures, or external agents that may interfere with the pulse oximeter's ability to detect and display measurements include dysfunctional hemoglobin, arterial dyes, low perfusion, dark pigment, and externally applied coloring agents such as nail polish, dye, or pigmented cream.

Caution Some sensors may not be appropriate for a particular patient. If at least 15 seconds of perfusion pulses cannot be observed for a given sensor, change sensor location or sensor type for perfusion to resume.

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

Temperature cautions

Caution The Welch Allyn Spot Vital Signs is FDA cleared to measure the axillary temperature in Normal Mode for children under the age of 4. Normal Mode axillary temperatures may not be accurate on older children or adults. *THE WELCH ALLYN SPOT VITAL SIGNS IS NOT INTENDED TO BE USED ON NEONATAL PATIENTS.*

Electrostatic discharge (ESD)

Electrostatic discharge is a sudden current flowing from a charged object to another object or to ground. Electrostatic charges can accomulate on common items such as foam drinking cups, cellophane tape, synthetic clothing, untreated foam packaging material, and untreated plastic bags and work folders, to name only a few.

Electronic components and assemblies, if not properly protected against ESD, can be permanently damaged or destroyed when near or in contact with electrostatically charged objects. When you handle components or assemblies that are not in protective bags and you are not sure whether they are static-sensitive, assume that they are static-sensitive and handle them accordingly.

- Perform all service procedures in a static-protected environment. Always use techniques and equipment designed to protect personnel and equipment from electrostatic discharge.
- Remove static-sensitive components and assemblies from their static-shielding bags only at static-safe workstations - a properly grounded table and grounded floor mat - and only when you are wearing a grounded wrist strap (with a resistor of at least 1 megohm in series) or other grounding device.
- Use only grounded tools when inserting, adjusting, or removing static-sensitive components and assemblies.
- Remove or insert static-sensitive components and assemblies only with monitor power turned off.
- Insert and seal static-sensitive components and assemblies into their original static-shielding bags before removing them from static-protected areas.

Always test your ground strap, bench mat, conductive work surface, and ground cord before removing components and assemblies from their protective bags and before beginning any disassembly or assembly procedures.

Symbols

The following symbols are associated with the Spot Vital Signs.

Safety symbols

Agency symbols

Identifies information within the manual to avoid injury or equipment failure.

Caution: consult accompanying documents

Type BF Equipment

Internally Powered, Lead Acid Battery

Handle with Care

Transport Temperature

Storage Humidity

Recycle

Class II Equipment

IPXØ

Equipment is not protected against the ingress of liquid.

Do not dispose of this product as unsorted municipal waste. Prepare this product for reuse or separate collection as specified by Directive 2002/96/EC of the European Parliament and the Council of the European Union on Waste Electronic and Electrical Equipment (WEEE). If this product is contaminated, this directive does not apply.

For more specific disposal information, see www.welchallyn.com/weee, or contact Welch Allyn Customer Service at +44 207 365 6780.

Mode of Operation: Continuous

166292

CERTIFIED TO:
CAN/CSA STD C22.2 NO. 601.1

CONFORMS TO:
UL STD 60601-1

IEC 60601-1

CE

0297

The CE mark on this product indicates that it has been tested to and conforms with the provisions noted within the 93/42/EEC Medical Device Directive.

EC REP

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2 Overview

Purpose and scope

The Spot Vital Signs Service Manual is intended as a reference for maintenance and repair to the field replaceable unit (FRU) level and are listed on page 55. This manual provides the technical qualified service person with troubleshooting information, repair procedures, and calibration and performance verification instructions. A technical overview of the Spot subsystems is provided as an introduction to the device's circuitry and pneumatics.

This manual is intended for the technical qualified service person. Service training classes on Welch Allyn's products are available. Contact Welch Allyn Technical Service for information.

Other applicable documents

The Spot Vital Signs Directions for Use manual is also available. Refer to this document for information other than maintenance and repair.

Welch Allyn 9600 Plus Calibration Tester Directions for Use - for all models.

Masimo Directions for Use - for models 42M0B and 42MTB

Nellcor Directions for Use - for models 42N0B and 42NTB

Contents checklist

Unpack the Welch Allyn Spot Vital Signs and applicable accessories, identify each item with the following checklist and inspect for missing items. Retain the shipping materials in the event of shipping damage or for return, if necessary, to Welch Allyn for repair or warranty service. All Spot Vital Signs include the following components:

Spot Vital Signs Device. This device automatically measures and displays blood pressure and pulse rate. Options include thermometry and pulse oximetry.

Directions for Use Manual. Read this manual thoroughly before using Spot Vital Signs. Save this manual for reference.

Warranty Card. This card validates the Spot Vital Signs warranty. Fill out the warranty card and mail it today.

Blood Pressure Cuff. Latex free blood pressure cuff with connectors. Other size cuffs are available separately.

Blood Pressure Hose. Latex-free pressure hose with connectors to attach various sizes of blood pressure cuffs to the Spot Vital Signs.

AC Power Transformer and Cord Assembly. Provides power to the Spot Vital Signs and charges the internal battery.

Quick Reference/Error Code Card. Attach this quick operating and error code guide to the device handle, mobile stand, or wall mount.

Possible attachments

Spot Vital Signs may include the following items based on the model and accessories purchased:

SureTemp Temperature Probe and Covers. One oral temperature probe (blue cap) and one box of 25 single-use, disposable probe covers.

Pulse Oximetry (SpO_2). The finger clip SpO_2 sensor and extension cable are for use with adult and pediatric patients. Other sensors are available separately.

Service

Caution Unauthorized repairs will void the warranty.

A Welch Allyn Service Center must perform all repairs on products under warranty. *Unauthorized repairs will void the warranty*. Qualified electronics personnel or a Welch Allyn Service Center should repair products out of warranty.

Technical assistance

If you have an equipment problem that you cannot resolve, call the Welch Allyn Service Center nearest you for assistance. Technical service telephone support is available on normal business days.

If you are advised to return a product to Welch Allyn for repair or routine maintenance, schedule the repair with the service center nearest you.

Before returning a product for repair, you must obtain authorization from Welch Allyn. Service personnel will give you a Service Notification number. Returns without a Service Notification number will not be accepted for delivery.

If you need to return the Spot Vital Signs for service:

- Remove all hoses, cables, sensors, power cords, and any ancillary products not associated with the problem.
- Whenever possible, use the original shipping carton and packing materials.
- Include a packing list and the Welch Allyn Service Notification number.
- Note the Service Notification number on the outside of your shipping container.

It is recommended to insure all returned goods. The sender may initiate any claims for loss or damage to the product.

Field replacement units

Included with the Service Manual is a complete list of field replacement units. Order spare parts from your local Welch Allyn Service Center.

Service loaners

Service loaners are provided, on request, if a Welch Allyn Service Center provides repair service. Loaners for products repaired while under the original warranty, or while under service contract, are provided free of charge and are shipped within 48 hours of notification of need.

For service repairs outside of warranty or contract, loaners are available for a nominal charge and shipment is subject to availability. Loaners are shipped pre-paid; however, this charge is added to the service charges.

Service intervals

Verify Spot Vital Signs annually for blood pressure calibration, temperature, and SpO_2 accuracy.

Spot Vital Signs configurations

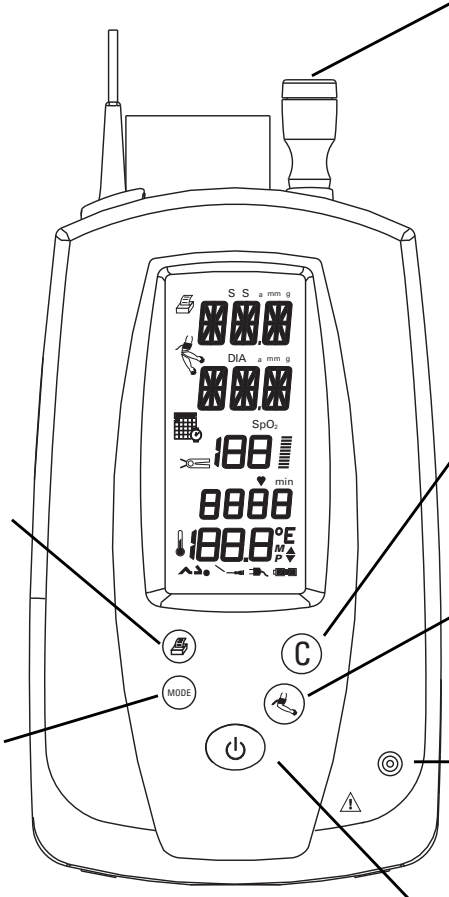
Table 2. Available Versions of Spot Vital Signs

REF	Description
4200B	Spot Vital Signs with blood pressure only
420TB	Spot Vital Signs with blood pressure and SureTemp thermometer
42MOB	Spot Vital Signs with blood pressure and Masimo SpO_2*
42NOB	Spot Vital Signs with blood pressure and Nellcor SpO_2
42MTB	Spot Vital Signs with blood pressure, SureTemp thermometer, and Masimo SpO_2 *
42NTB	Spot Vital Signs with blood pressure, SureTemp thermometer, and Nellcor SpO_2

* Version 2 configurations only.

Controls

Figure 1. Spot Vital Signs with SureTemp Plus Thermometer (Version 1)



Thermometer Eject Button: push to remove used temperature probe cover.

Next Patient/Clear/Cancel Button:
- active display: clears the display.
- in Standby Mode: recalls the last patient information. Pressing a second time clears the screen.
- cancels an active blood pressure measurement and deflates the cuff.

Printer: press to print the measurements (Version 1 only).

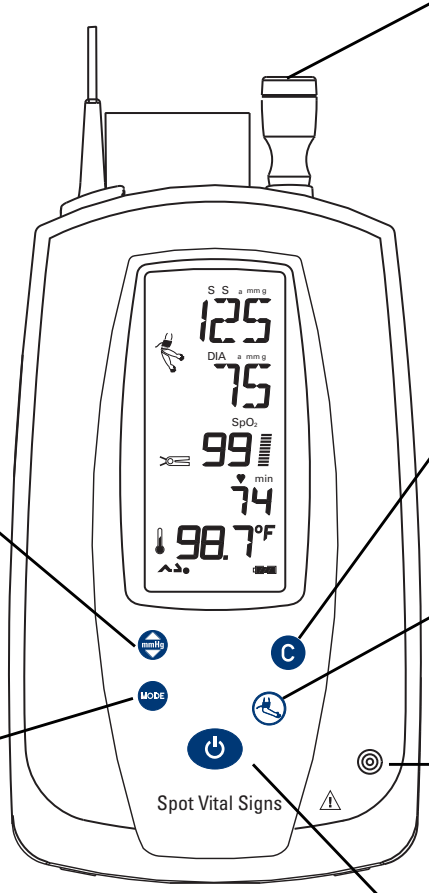
Blood Pressure Start/Stop Button: initiates a new blood pressure cycle. Pressing again cancels an active blood pressure measurement and deflates the cuff.

Mode Button:
- holding for 2 seconds while the display is active turns off/on the backlight.
- in Standby Mode, recalls the last patient information.
- with the temperature probe removed from the probe holder, switches the temperature from Oral to Axillary Mode.

Pressure Hose Connector: port for blood pressure hose.

Power Button: controls power to the device.

Figure 2. Spot Vital Signs with SureTemp Plus Thermometer (Version 2)



Thermometer Eject Button: push to remove used temperature probe cover.

Next Patient/Clear/Cancel Button:
- active display: clears the display.
- in Standby Mode: recalls the last patient information. Pressing a second time clears the screen.
- cancels an active blood pressure measurement and deflates the cuff.

Pressure Preset Button: press to change the factory inflation default for one reading (Version 2 only).

Blood Pressure Start/Stop Button: initiates a new blood pressure cycle. Pressing again cancels an active blood pressure measurement and deflates the cuff.

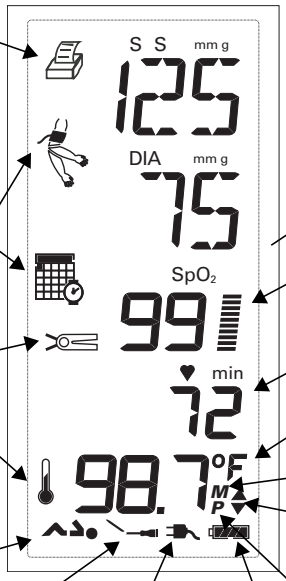
Mode Button:
- holding for 2 seconds while the display is active turns off/on the backlight.
- in Standby Mode, recalls the last patient information.
- with the temperature probe removed from the probe holder, switches the temperature from Oral to Axillary Mode.

Pressure Hose Connector: port for blood pressure hose.

Power Button: controls power to the device.

LCD (liquid crystal display)

The LCD may indicate any of the following: systolic blood pressure (mmHg or kPa), diastolic blood pressure (mmHg or kPa), temperature (°F or °C), thermometer mode, pulse rate, pulse signal level, SpO_2, MAP (mmHg or kPa), and battery charge level.



Option no longer available.

Systolic and Diastolic display: if MAP is turned on, the screen toggles between the systolic and diastolic values, and the word "MAP" and the MAP value.

Date/Time: indicates that the user must set/re-set the current date and time.

SpO_2 Display: shows the percent saturation of arterial hemoglobin (for devices with SpO_2 only).

Pulse Display: shows the pulse rate.

Measurement Indicator: displays the blood pressure, SpO2, or temperature icon as Spot Vital Signs is taking the respective measurement.

Temperature Display and Indicator: shows the temperature in Fahrenheit or Celsius (for devices with SureTemp only).

Monitor Mode Temperature: indicates the thermometer is in Monitor Mode (for devices with SureTemp only).

Out-of-range indicator: shows the patient's temperature reading above or below the measurement range limits (for devices with SureTemp only).

Icon not used.

Thermometer Mode icon: shows temperature mode (for devices with SureTemp only).

Temperature Probe Problem: indicates a temperature probe problem (for devices with SureTemp only).

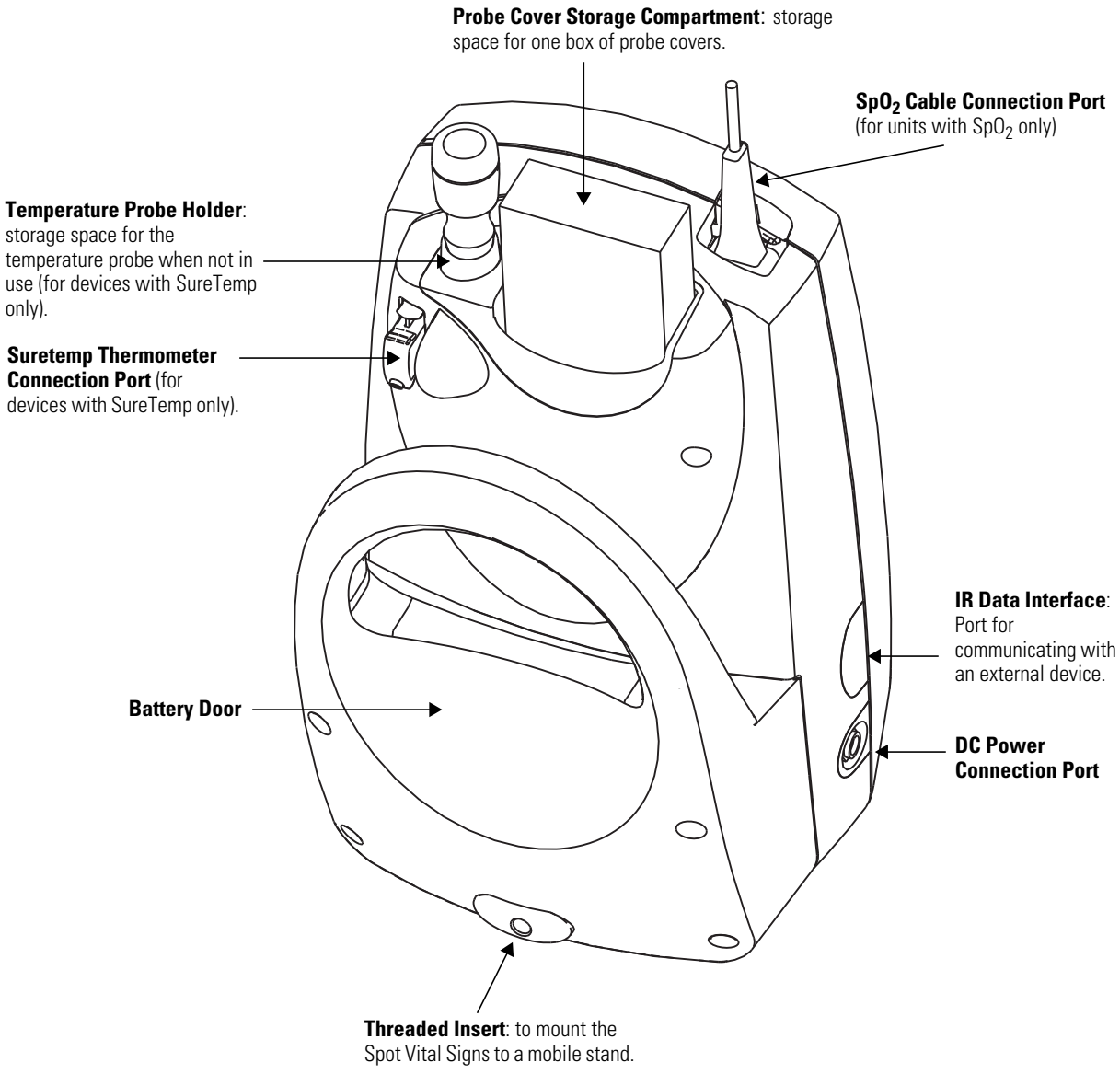
Battery Level indicator: displays the battery charge level.

Battery Charging: indicates the device is powered through the AC power transformer.

Connections

Use the following instructions to connect the blood pressure hose, thermometer probe, and optional attachments to the Spot Vital Signs.

Figure 3. Spot Side and Rear Panel Connections



Blood pressure hose and cuff connections

Have available the Spot Vital Signs, blood pressure cuff, and blood pressure hose.

1. Inspect the pressure hose; note that one end has a connector fitting and the other end does not. Attach the end without the connector fitting to the pressure hose connector (see page 14). Verify that the pressure hose is completely inserted over the connector and that the fit is snug.
2. Join the other end of the pressure hose to the blood pressure cuff pneumatic tubing. Twist the connectors together until finger-tight. ***DO NOT OVERTIGHTEN***.

Temperature probe connection

The Welch Allyn Spot Vital Signs is available with two probes — one for oral/axillary temperatures (blue cap), and one for rectal temperatures (red cap). The rectal probe is an accessory item that is ordered separately.

Press down on the tab on top of the connector and insert the connector into the temperature probe connector port on the back of the Spot Vital Signs. The probe connector only fits into Spot Vital Signs one way. Verify the connector clicks into place. Insert the temperature probe into the probe holder on the top of the Spot Vital Signs.

To remove the temperature probe, press down on the connector tab and lift out.

SpO_2 sensor

Spot Vital Signs is available with a wide variety of SpO_2 sensors and ships with a reusable finger sensor and extension cable. All other sensors are accessory items that are sold separately.

1. Align the shape and pin configuration of the extension cable connector to the SpO_2 cable connection port on the top side of the Spot Vital Signs device.
2. Push the connector firmly into the SpO_2 cable connection port.
3. Align the opposite end of the extension cable to the sensor cable connector and firmly push them together.

Note Use only Masimo or Nellcor SpO_2 sensors and accessories with the Spot Vital Signs with Masimo or Nellcor configurations, respectively.

Quick reference card

Attach the Quick Reference Card to the Spot handle, mobile stand, or wall mount using the supplied plastic cable tie.

DCpower connection

Note To assure proper electrical isolation, replace the AC power transformer/charger using only the Welch Allyn specified part (REF 5200-101A, 5200-103A, 5200-103Z).

Use the Spot Vital Signs with battery power (after charging the battery) or battery and DC power supply.

1. Insert the round transformer connector into the DC power connection port on the left of the Spot Vital Signs (see page 16).
2. Insert the line cord into the line connector on the transformer then plug the power cord on the transformer into the AC main power source to charge the battery.

Charging the battery

CHARGE THE BATTERY FOR SIXTEEN (16) HOURS PRIOR TO INITIAL USE.

Attach the DC power transformer to the Spot Vital Signs then plug the transformer into the AC main power source.

While charging, the charger icon remains on and the battery icon segments continuously sequence. When the battery is fully charged, all battery icon segments display.

As the battery voltage level drops the segments turn off from left to right. If the Spot Vital Signs is not plugged in to charge when the second last segment is turned off the Spot Vital Signs issues a warning beep. As the voltage level drops to compromise measurements an error beep is heard and all other display fields turn off. Spot Vital Signs beeps at increasingly frequent intervals until it finally powers itself off.

If not used for extended periods of time then recharge the battery.

Standby mode

Standby Mode conserves battery power. When the device is powered up, but has not been used for 2 minutes, it goes into Standby Mode. "Z Z Z" shows across the top of the display with no backlight.

To bring the Spot Vital Signs out of Standby Mode, press the **Mode** or **Pressure Preset** button or begin a patient measurement.

3 Functional overview

This functional verification procedure helps to confirm the proper operation of the Spot Vital Signs and options. This procedure supports the requirements of routine preventative maintenance. It is not necessary to disassemble the Spot Vital Signs to perform this procedure.

For the calibration procedures, see "Calibration" on page 25. If the Spot Vital Signs fails certain functional tests or a circuit board is replaced, the device may require calibration. It is necessary to disassemble the Spot Vital Signs for calibration.

Always perform this functional verification procedure after performing any calibration. This procedure contains additional tests that are not included in calibration procedures.

Power on/off and system check procedure

Press the **Power** button to turn the device on or off. Upon each power up, all the LCD segments in each display turn on briefly and two beeps sound. If the internal self-check is successful, the display shows its normal functions (see page 15) and the device is ready for operation. If the self-check fails, an error code is shown in the on the display.

To turn the unit off, press the **Power** button.

Note Turning the unit off erases measurement data.

Internal configuration mode

You can change several device operating parameters in the Internal Configuration Mode. When changed, these settings become the default power-up settings. You will also see non-changeable device configurations for technical service purposes.

To enter the Configuration Mode:

1. Turn the Spot Vital Signs off.
2. Press and hold the **Power** - **Blood Pressure Start/Stop** buttons. The device enters the Internal Configuration Mode and displays the software version.
3. Press the **Mode** button to cycle through the Internal Configuration menu until you see the menu option displayed on the screen.
4. Use the **Next Patient/Clear/Cancel** or **Blood Pressure Start/Stop** button to change the default setting.
5. Press the **Mode** button once to save the change and press the **Power** button to exit the Internal Configuration Mode.

Table 3. Configuration Menu Options

Setting	Description
Blood Pressure Calibration Displays “Cal”	Prepares the Spot Vital Signs for calibration. Only qualified personnel should verify the Spot Vital Signs blood pressure calibration. For more details, see “Blood pressure calibration” on page 27.
Inflation Pressure Preset Level Displays “PrP”	120, 140, 160, 180, 200, 240, 280 mmHg. Factory default is 160 mmHg.
Pressure Preset Level Displays “PrP”	On or off. Disables or enables the front panel Pressure Preset button.
Backlight Displays “BLT”	On or off.
Mean Arterial Pressure Displays “MAP”	On or off.
Date/Time	Changes or updates the actual date and time.
Temperature Scale Displays “TMP MOD”	Fahrenheit (°F) or Celsius (°C) Normal Mode / Fahrenheit (°F) or Celsius (°C) Monitor Mode
Blood Pressure Units Displays “BP”	mmHg or kPa.
Battery Readings Displays “BAT”	Displays the total battery voltage.
Battery Life Displays “LFE”	Total number unit measurements. Displayed information only; operator cannot change.

Functional verification

Complete all steps in this section before returning a Spot Vital Signs for service.

Verify that the pressure meter used (if not specified by this service manual) is calibrated and the calibration certificate of the meter is traceable to NIST. The pressure meter testing the Spot Vital Signs must have an accuracy of better than ″3 mmHg.

Subtract the rated accuracy of the pressure measurement standard from the ″3 mmHg rated accuracy of Spot Vital Signs. This is the **pass/fail criteria** to determine if the device is within calibration. If the differences between Spot Vital Signs and the pressure measurement standard are within the **pass/fail criteria** at all specified pressures, then the device is within calibration.

All test specifications are found in **Appendix A**.

1. Use the pneumatic tubing to connect the Spot Vital Signs to the test station (page 26). Disconnect the battery and connect the power supply. Verify the IR Data Interface is free from obstacles.
2. Open the Spot Vital Signs repair software and verify the computer is communicating with the Spot Vital Signs.
3. Hold down the **Blood Pressure Start/Stop** button while powering on the Spot Vital Signs. The Spot Vital Signs enters the **configuration test mode**. After the LCD displays the software versions press the **Mode** button to display **CAL**. Spot Vital Signs automatically performs an auto zero.
4. Attach a pneumatic clamp to the 100 cc and the 250 cc cylinder and then remove the clamp from the 500 cc cylinder.
5. Select **Test/Calibration** on the computer screen. The dialog box displays the Spot Vital Signs manometer and battery readings and the valve and pump status.

To verify the blood pressure calibration:

1. Push the Spot Vital Signs **Blood Pressure Start/Stop** button to close the valve.
2. Pump the hand bulb to the set the pressures: 0 mmHg, 50 "5 mmHg, 150 "5 mmHg, 250 "5 mmHg. Verify each pressure is within "3 mmHg of the target pressure (except for 0 mmHg which should be within "1.0 mmHg).
3. Press the **Mode** button until the LCD window reads ″bat.″

To verify the voltage reading:

1. Set the power supply to 5.6 (+0.3 / -0.0 Vdc).
2. Verify that the voltage reading meets the test specification.
3. Return the power supply to 6.5 Vdc (+0/- 0.25 Vdc) upon completion of this test.
4. Select **OK** to exit the Test Calibration dialog box.

NOTE: The pass/fail criteria for the blood pressure calibration check depends upon the accuracy of the pressure measurement standard used.

- If the pressure measurement standard used is rated with an accuracy of ±0.1 mmHg, the pass/fail criteria is ±2.9 mmHg in order to guarantee that the instrument under test is within ±3 mmHg of NIST.
- If the pressure measurement standard used is rated with an accuracy of ±1.0 mmHg, the pass/fail criteria is ±2.0 mmHg in order to guarantee that the instrument under test is within ±3 mmHg of NIST

Temperature functional check

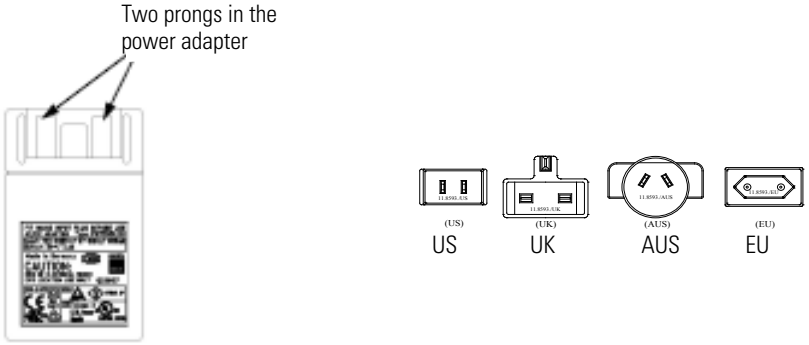
The 9600 Plus Calibration Tester takes approximately 20 minutes to heat to the lowest setting. When testing several thermometers at all three temperatures, it is recommended to test all probes at one Calibration Set Point Temperature before proceeding to the next Calibration Set Point Temperature.

To further expedite testing start at the lowest Calibration Set Point Temperature. The 9600 Plus Calibration Tester does not have an internal fan, this causes a longer cool down time than warm up time.

Refer to the 9600 Plus Calibration Tester Directions for Use manual for specific information regarding the LCD window or the control buttons.

1. Choose the proper mains plug insert and slide it over the two prongs in the power converter.

Figure 4. Power Adapter and Mains Plug Inserts

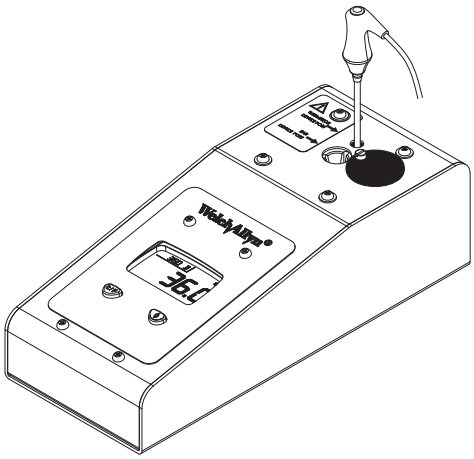


2. Plug the power adapter into the 9600 Plus Calibration Tester (Figure 4) and the opposite end into a wall outlet.
3. Place the 9600 Plus Calibration Tester on a level surface away from sunlight, drafts, and other sources of heat or cold.
4. Observe the Set Point Mode in the upper left hand corner of the LCD display. If the unit displays a "D", it is in Default Mode and will heat to the lowest Set Point Temperature. If you do not want to conduct testing at this Set Point Temperature, press and hold the Temperature Selection button to select the desired setting. The temperature display will flash before staying on continuously to indicate the 9600 Plus Calibration Tester has stabilized and is ready for use.

To begin functional verification of the SureTemp thermometer:

Caution Store thermometers for testing in the same room as the 9600 Plus Calibration Tester for approximately 30 minutes prior to testing to allow for thermal accommodation.

1. Remove the probe from the probe well and clean it with either a 70% isopropyl alcohol solution, a 10% chlorine bleach solution, or a non-staining disinfectant. Let the probe air dry. Do not apply a probe cover.
2. Place the thermometer in Monitor Mode, refer to the thermometer's Operator's Manual.
3. Insert the probe into the Thermistor Device Port.



4. Wait for approximately one minute or until temperature on the thermometer is stable for ten seconds. Compare the thermometer's temperature reading to the 9600 Plus Calibration Set Point Temperature. If the temperatures are within ±0.1° C (±0.2° F), the thermometer is within calibration.
5. Test all available thermometers for calibration verification at the current Calibration Set Point Temperature. Proceed to the next Calibration Set Point Temperature, see "Changing the calibration set point temperature" on page 23.

Changing the calibration set point temperature

To scroll from one set point to the next, press and hold the Temperature Selection button until a beep is heard. The newly selected set point appears in the upper left corner of the LCD display. The device's current temperature is displayed, starts to flash, and continues flashing until the cavity reaches the equilibrium at the new set point.

SpO2 functional check

There is no way to change the functionality of the SpO_2 module. If the SpO_2 is not functioning properly, contact Technical Service.

Masimo

This section applies to Version 2 only. Use the Masimo Tester to perform to functionally check the Masimo sensors.

1. Orient the Masimo extension cable such that the DB-9 connector connects to the SpO_2 connector on Spot Vital Signs. Connect the opposite end of the extension cord to the Masimo Tester (part number 11593).
2. Power on Spot Vital Signs and confirm the SpO_2 reading in the Display Window is 81%± 3% and the pulse reading is 61 bpm ± 1 bpm.

   If the reading is outside the range, contact Welch Allyn Technical Service.
3. Place the thumb and index finger on the gray buttons on either side of the Masimo Tester connector, press the buttons firmly, and gently pull to remove the tester.

Nellcor

Nellcor MP205 SpO_2 module

This section applies to Version 1 only. Use a Nellcor-approved SpO_2 simulator (SRC-2) to check the SpO_2 functionality.

1. Confirm the settings of the simulator:
   - Rate: 112
   - Light: High 1
   - Modulation: High
   - RCAL Mode: RCAL63/local
2. Connect the Nellcor SpO_2 simulator test cable to the Spot Vital Signs.
3. Verify the Spot Vital Signs reading meets the requirements of the Repair Test Specification in Appendix C.
4. Reconnect the SpO_2 sensor. Place the sensor onto your finger and check Spot vital Signs for a reading.

Nellcor MP506 and Nell-3 SpO_2 modules

Use a Nellcor-approved SpO_2 simulator (SRC-MAX) to check the SpO_2 functionality.

1. Confirm the settings of the simulator:
   - HR: 60 and 200
   - SpO_2%: 75 and 90
2. Connect the Nellcor SpO_2 simulator test cable to the Spot Vital Signs.
3. Verify the Spot Vital Signs reading meets the requirements of the Repair Test Specification in Appendix A.
4. Reconnect the SpO_2 sensor. Place the sensor onto your finger and check Spot Vital Signs for a reading.

4 Calibration

This chapter provides procedures to perform all adjustments required to calibrate the Spot Vital Signs to conform to Welch Allyn specifications. Calibration requires qualified personnel to open the device housing.

WARNING Electric shock hazard. There are no user-serviceable parts inside Spot Vital Signs other than battery replacement (see "Battery removal and replacement" on page 70). An operator may only perform maintenance procedures specifically described in this manual. For service, refer the device to an Authorized Service Center.

Note Always disconnect the sealed lead-acid battery in the Spot Vital Signs before performing any calibration function.

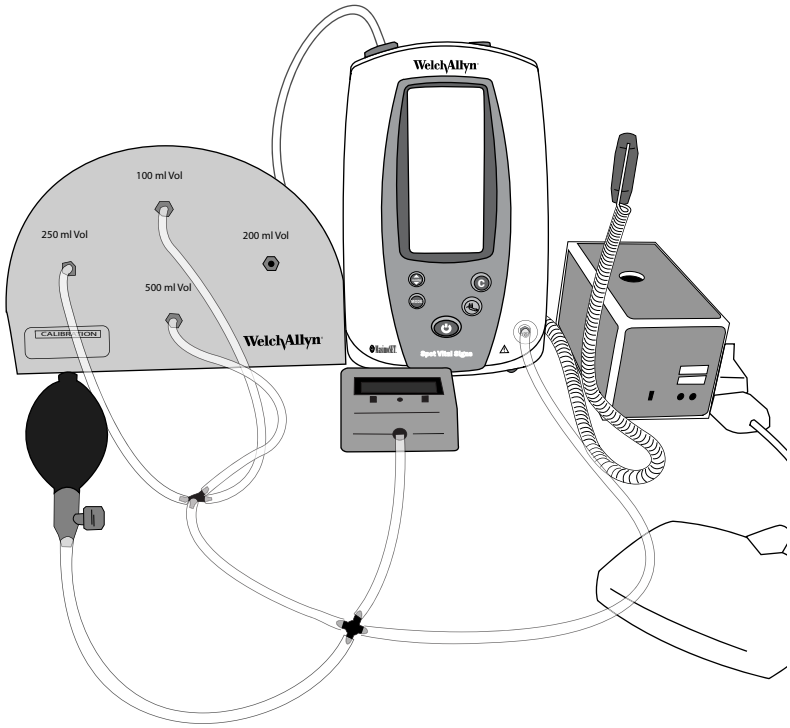
Gather the tools listed on page 39 to have available during the procedures.

Connections

1. Connect the blood pressure pneumatic tubing to the Spot Vital Signs and to the test station (part number 401028).
2. Connect the IR Data Interface cable to the computer.
3. Start the Spot Vital Signs repair software on the computer.
4. Remove the battery and connect the power supply to the Spot Vital Signs.
5. Confirm the IR Data Interface is not obstructed.

Figure 5. Connect Diagram

Part Number
401028



Voltage calibration

1. Follow the steps in "Connections".
2. Adjust the power supply to 5.6 Vdc ±0.1 Vdc (+0.3/-0.0 Vdc).
3. Hold down the **Blood Pressure Start/Stop** button while powering up to enter the "configuration test mode". After the software versions are displayed, press the **Mode** button until the Spot Vital Signs displays "**BAT**" in the LCD window.
4. Select **Calibrate > Voltage** in the repair software. The Spot Vital Signs display window goes blank.
5. Read the voltage on the digital multi-meter (DMM) connected to the power supply.
6. Type the voltage reading in the Calibrated Voltage box and select **Update**.
7. Enter your initials in the Calibration Signature field to complete the voltage calibration. and select **OK**. The voltage on the LCD display matches that of the DMM.

Blood pressure calibration

1. Follow the steps in "Connections" on page 25.
2. Adjust the power supply to 6.5 Vdc (+0/- 0.25 Vdc).
3. Hold down the **Blood Pressure Start/Stop** button while powering up to enter the "configuration test mode". After the software versions are displayed, press the **Mode** button until the Spot Vital Signs displays "**CAL**" in the LCD window.
4. Select the **Calibrate > Manometer** on the computer.
5. Verify the valve is "open" and select **Calibrate 0**.
6. Press the **Blood Pressure Start/Stop** button to close the valve and verify the 500 cc cylinder is the only volume in the system.
7. Increase the pressure to 250 mmHg ±5 mmHg using the bulb and valve.
8. Use the bulb and the calibrated digital pressure meter to manually inflate the device to 200 mmHg and enter the pressure meter reading from Spot Vital Signs in the **Calibration Gain** text field.
9. Place the cursor into the box below the **Calibrate 0** button and type in the value of the pressure reading seen on the pressure meter. Select **Calibrate 250**.

Date/time set

After recharging a dead battery or after disconnecting the battery for a few minutes, you must program the date and time screen.

To set the date/time after after a power loss (Version 1 only):

1. Press and hold the **Blood Pressure Start/Stop + Power** buttons to enter the Internal Configuration mode. The Spot Vital Signs displays an E38 error. Press the **C** button to cancel the error, and the revision level of the internal software displays.
2. Press the **Mode** button to advance to the Date Set Screen. The day, month, and year show in the systolic, diastolic, and heart rate displays, respectively.
3. Use the **Mode** button to select the date item for change. When a date option is selected, the respective display flashes.
4. Use the **Next Patient/Clear** or **Blood Pressure Start/Stop** buttons (arrow up or arrow down) to change the selected date option. After making all the desired date changes, press the **Mode** button once to save the change and advance to the Time Set Screen.

   When in the Time Set Screen the hour (in 24-hour format) and minutes appear in the systolic and diastolic displays, respectively. Use the **Mode** button to select the time item for change. When selected, the time option flashes. Use the **Next Patient/Clear** or **Blood Pressure Start/Stop** buttons to set the time (in the same manner as described previously).
5. Press the **Mode** button to save the time and advance to the next screen.
6. Press the **Power** button to turn off the Spot Vital Signs.

To update the displayed date and time:

1. Press and hold the **Blood Pressure Start/Stop + Power** buttons to enter the Internal Configuration Menu. Spot Vital signs displays the revision level of the internal software.
2. Press the **Mode** button to advance to the Date Set Screen. The day, month, and year appear in the systolic, diastolic, and heart rate displays, respectively.
3. Use the **Mode** button to select the date option for change. When a date item is selected, the respective display flashes.
4. Use the **Next Patient/Clear** or **Blood Pressure Start/Stop** buttons (arrow up or arrow down) to change the selected date option. After making all the desired date changes, press the **Mode** button once to save the change and advance to the Time Set Screen.

   When in the Time Set Screen the hour (in 24-hour format) and minutes appear in the systolic and diastolic displays, respectively. Use the **Mode** button to select the time item for change. When selected, the time option flashes. Use the **Next Patient/Clear** or **Blood Pressure Start/Stop** buttons to set the time (in the same manner as described previously).
5. Press the **Mode** button to save the time and advance to the next screen.
6. Press the **Power** button to turn off the Spot Vital Signs.

5 Troubleshooting

When the main printed circuit board (PCB) is replaced on a Spot Vital Signs version 1, the print function is no longer available. The new function, Pressure Preset, raises or lowers the blood pressure maximum inflation level for one measurement only. When replacing the main PCB, replace the switch array as well.

The following table of conditions and error codes provides a quick reference of the descriptions and probable causes of error codes.

To clear the error code:

Power the Spot Vital Signs off, wait five seconds, and power on. If the error code reappears then power the Spot Vital Signs off and disconnect the battery for five minutes. Reconnect the battery and power on. If the error code continues to reappear, call Welch Allyn for a Service Notification Number (see "Technical assistance" on page 11).

Press the Blood Pressure Start/Stop button to reset flashing patient alarm conditions.

Error codes

Table 4. General

Code	Description	Corrective Action
E11	Internal safety violation	Check patient, contact Technical Service.
C12	Ambient temperature out of range	Adjust ambient temperature or device location.
C13	Battery failure	Use wall transformer.
E0.0 - E9.9	Temperature module malfunction	Contact Technical Service.
E42	Internal communications error	Disconnect the battery and wait 5 minutes. Reconnect the battery and then set the date and time.
E20 - E50	General internal malfunction	Contact Technical Service.

Table 5. Blood Pressure

Code	Description	Corrective Action
C02	Auto-zero failure	Check for air obstruction, limit patient movement.
C03	Inflation too rapid	Check for kinked blood pressure cuff tubing, pressure hose, or other air obstruction.
C04	Excessive inflation time	Check for air leaks.
C05	Excessive noise	Check patient condition, blood pressure cuff placement, limit patient movement.

Table 5. Blood Pressure

Code	Description	Corrective Action
C06	Measurement was outside of device's measurement range	Check patient condition.
E10	Blood pressure cuff overpressure condition	Check patient condition.

Table 6. Temperature

Code	Description	Corrective Action
C20	Broken/missing probe	Replace probe.
P	Loss of tissue contact	Ensure proper probe positioning.
E0.2, E0.3	Ambient temperature out of range	Adjust ambient temperature or device location.
C22	10-minute diagnostic time exceeded	Remove probe, discard probe cover, retake temperature.

Table 7. SpO_2

Code	Description	Corrective Action
E7	Internal SpO_2 error.	Retake reading.
C6	SpO_2 pulse rate out of range	Check patient condition.
C8	Faulty SpO_2 sensor.	Replace sensor.
C9	SpO_2 time limit exceeded.	Remove sensor from patient. Reapply sensor and retake reading.

Causes and corrective action

Table 8. Inaccurate Blood Pressure Readings

Possible Cause	Explanation and Corrective Action
Incorrect blood pressure cuff size. Use Welch Allyn approved blood pressure cuffs only.	Determine correct blood pressure cuff size. • Use reference markings on blood pressure cuff. • Measure patient's arm circumference midway between elbow and shoulder to select correct blood pressure cuff size).
Patient's arm position	Ensure patient's arm is at heart level.
Arm movement during blood pressure cycle	Keep arm still during blood pressure cycle. • Movement may cause inaccuracies from artifact.
Blood pressure taken over clothing	Take blood pressure on a bare arm.
Arrhythmia	Check for regularity of heart rate (palpate pulse or check device). • Moderate to severe heart rate irregularities may make blood pressure difficult to measure.

Table 8. Inaccurate Blood Pressure Readings

Possible Cause	Explanation and Corrective Action
Incorrect reference	Use the correct Korotkoff sound to determine diastolic blood pressure. • Many listeners incorrectly equate diastolic blood pressure with the disappearance of sound only (phase 5). The Welch Allyn Spot Vital Signs was developed using the American Heart Association recommendations, which state that phase 5 be used unless sound continues to 0 mmHg, in which case the change in the quality of sound (phase 4) is to be used. Deflate blood pressure cuff no faster than 3 mmHg per second. • One of the major sources of error in auscultatory blood pressure measurement is deflating the blood pressure cuff too quickly. The American Heart Association recommends deflation no faster than 3 mmHg per second. Only use a sphygmomanometer that is calibrated. • An uncalibrated sphygmomanometer may take inaccurate blood pressure measurements.
Change in blood pressure between auscultatory reading and Welch Allyn Spot Vital Signs reading	Check blood pressure immediately prior to Welch Allyn Spot Vital Signs reading.
Poor auscultatory sound recognition by observer	Use higher quality stethoscope. Have a different observer check patient's blood pressure.
Note: Differences of up to 10 mmHg are considered normal and occur for a number of reasons including intra-patient blood pressure variability, observer hearing differences, and auscultatory deflation rate.	

Table 9. Cuff Inflation and Deflation with No Blood Pressure Reading Displayed (or Error Code in Display)

Possible Cause	Explanation and Corrective Action
Leak in pneumatic system	Ensure all blood pressure cuff attachments are tight. Carefully check for leaks in the blood pressure cuff, tubing, and pressure hose attached to the device.
Arm movement during cycle	Keep arm still during blood pressure cycle. Movement may cause inaccuracies from artifact.
Blood pressure cuff tubing or pressure hose movement artifact	Do not contact blood pressure cuff tubing or pressure hose during blood pressure cycle. Movement may cause inaccuracies from artifact.

Table 10. No Blood Pressure Cuff Inflation

Possible Cause	Explanation and Corrective Action
Connections between device and blood pressure cuff loose	Check all connections (do not overtighten).

Table 11. Temperature Malfunction

Possible Cause	Explanation	Corrective Action
Error code displayed	Broken probe	Replace probe. Consult Service Manual. Notify biomedical department or Welch Allyn Technical Support.
Low temperature readings	Improper probe placement	Place probe in most posterior sublingual pocket when in Oral Mode. Verify patient has had nothing to eat or drink for 20 minutes.

Table 11. Temperature Malfunction

Possible Cause	Explanation	Corrective Action
No temperature displayed	Probe not replaced	Replace probe in holder prior to taking another temperature.

Table 12. SpO_2 Malfunction

Possible Cause	Corrective Action
Sensor in place but no SpO_2 on display	Insert the patient's finger completely into sensor. Verify blood pressure and SpO_2 measurements are not taken on the same extremity. Verify the sensor cable is correctly plugged into device. Verify you are using the correct sensor. Use only Masimo or Nellcor SpO_2 sensors and accessories with the Welch Allyn Spot Vital Signs with Masimo or Nellcor configurations, respectively.

Table 13. Device Does Not Turn On

Possible Cause	Explanation and Corrective Action
Low battery	Check connections between device and transformer, and transformer and wall receptacle.
Device not powering up	Unplug unit from wall receptacle and check for breaks in cord. If connections are secure, check electrical outlet. Charging indicator is on if connections are good and the device is plugged into a working outlet. Notify biomedical department or Welch Allyn Technical Support.

Table 14. Blood Pressure Cuff Too Tight (Over Inflation)

Possible Cause	Explanation and Corrective Action
Pressure preset too high	Check default Pressure Preset setting in internal configuration mode. Unless patient has underlying systolic hypertension, set pressure preset at 160 mmHg. (If systolic blood pressure greater than pressure preset, the device automatically increases an additional 40 mmHg.)

Table 15. Blood Pressure Cuff Pops Off

Possible Cause	Explanation and Corrective Action
Inappropriate blood pressure cuff size	Determine blood pressure cuff size with the blood pressure cuff markings. If blood pressure cuff continues to pop off, notify biomedical department or Welch Allyn Technical Support.
Blood pressure cuff applied inside out	Re-apply blood pressure cuff. Make sure Welch Allyn label is facing away from arm.

Table 16. Blood Pressure Cuff Deflating Too Slowly

Possible Cause	Explanation and Corrective Action
Normal operation	Typical time to take a reading is 20 to 45 seconds; 165 seconds is the maximum.
Pressure preset too high	Check default pressure preset setting in internal configuration mode.
Patient movement	Have patient sit still. Do not have arm tight against chest wall, as respiration may affect speed and accuracy of blood pressure measurement.

Table 16. Blood Pressure Cuff Deflating Too Slowly

Possible Cause	Explanation and Corrective Action
Small leak in pneumatic system	Check blood pressure cuff tubing and pressure hose for leaks.

Battery voltage check

1. Follow the steps in "Connections" on page 25.
2. Set the power supply to 6.5 Vdc (+0/-0.25 Vdc).
3. Use a DMM to check the battery voltage. If the voltage is less than 6.0 Vdc, charge the battery.

   If an E38 error is present on Version 1, the battery does not charge correctly. Clear the error and then proceed.

   To charge the battery, place the battery back into the Spot Vital Signs and connect the charger for 8 hours. Let the device sit idle for one day and recheck the battery voltage. If the voltage is below 6.0 Vdc, replace the battery (see "Battery removal and replacement" on page 70).
4. Power on Spot Vital Signs. If the device does not power on:
   a. Verify the power supply is connected to the device and turned on.
   b. Change the main PCB (see "Main printed circuit board assembly" on page 44).
   c. Change the display PCB (see "LCD disassembly" on page 42).

Window display check

1. Press the **Power** button to start the Spot Vital Signs.
2. Observe the Spot Vital Signs window display and verify the LED segments light up for one to two seconds before the device enters the normal operating mode.

   If there any segments that do not light, change the window display (see "LCD disassembly" on page 42).

Blood pressure calibration check

Perform two or three blood pressure cycles to verify proper cuff inflation/deflation and the readings. If Spot Vital Signs does not inflate or deflate properly perform the following procedure.

1. Open the Spot Vital Signs housing (see "Front housing and key pad disassembly" on page 42).
2. Check Spot Vital Signs for pinched tubing and reroute if necessary. Re-run the blood pressure cycle to confirm the problem is fixed.

   If there are no pinched tubes, change the valve (page 48).

3. Power off Spot Vital signs and enter the Configuration Mode (see "Internal configuration mode" on page 20).
4. Press the **Mode** button until Cal displays in the LCD window.
5. Press the **Start** button to close the valve and use the bulb to manually inflate the device to 250 mmHg and confirm Spot Vital Signs meets the leak test specification (see "Leak test" on page 73).

Temperature functional check

Use the 9600 Plus Caligration Tester to check the thermometer accuracy (see "Temperature functional check" on page 22).

Masimo SpO_2 functional check

Use the Masimo Tester to check the functionality of the SpO_2 module of Spot Vital Signs (see "Masimo" on page 24).

Nellcor SpO_2 functional check

Use a Nellcor approved simulator to check the functionality of the SpO_2 module of Spot Vital Signs (see "Nellcor" on page 24).

Communication option check

1. Select **Tools > Options** and confirm that communication port and the cable are selected.
2. Select **Test** and confirm that the Spot Vital Signs responds accordingly.

   If an error is present then confirm that there are no obstacles in the way of the IR Data Interface. Re-try the test.

   If the error is still prsent then change the Main PCB (page 44).

Functional testing procedures

Perform the functional testing procedures in this section before returning Spot Vital Signs into service.

Verify you are using a calibrated pressure meter with an accuracy of better than ±3 mmHg and that the calibration certificate is traceable to NIST.

Subtract the rated accuracy of the pressure measurement standard from the ±3 mmHg rated accuracy of Spot Vital Signs. This is the pass/fail criteria to determine if the device is within calibration. If the differences between Spot Vital Signs and the pressure measurement standard are within the pass/fail criteria at all specified pressures then the device is within calibration.

1. Follow the steps in "Connections" on page 25.
2. Enter the "Internal configuration mode" on page 20. Aftering viewing the software versions, press the **Mode** button until CAL displays in the LCD window. Spot Vital Signs automatically performs an auto zero once the LCD window displays CAL.

3. Connect to the 500 cc cylinder.
4. Select **Test > Calibration** in the repair software. The dialog box displays the Spot Vital signs manometer reading, battery reading, and valve and pump status.
5. Push the **Blood Pressure Start/Stop** button to close the valve.
6. Use the hand bulb to verify Spot Vital Signs is within calibration specification at the target pressures of 250±5 mmHg, 150 ±5 mmHg, 50 ±5 mmHg, and 0 mmHg with each reading within ±3 mmHg of the target pressure except for the 0 mmHg reading which is within ±1.0 mmHg.
7. Press the **Mode** button until the LCD window displays bat.
8. Set the power supply to 5.6 Vdc (+0.3/-0.0 Vdc). Verify the voltage reading meets the specification (see "Voltage calibration" on page 74).

   After completing this test, return the power suppy to 6.5 Vdc (+0/-0.25 Vdc).
9. Select **OK** in the Test Calibration dialog box.

Current test

1. Follow the steps in "Connections" on page 25.
2. Power off Spot Vital signs and then power on in normal mode.
3. Select **Test > Current Levels** in the Spot Vital Signs Repair Software. Use the reading from the current meter and check the following current levels:
   a. Blank
   b. Back Light (Idle)
   c. Valve/Pump
   d. SpO_2 Mode

   The test result is a pass or fail result.
4. Select **Ok** to exit the dialog box.

Noise levels

1. Follow the steps in "Connections" on page 25.
2. Select **Test > Noise Levels** in the Spot Vital Signs Repair Software and press the **Test** button to retrieve Spot Vital Signs internal pressure channel noise level. The test result is a pass or fail result (page 73).
3. Select **Ok** to exit the dialog box.

Button test

1. Follow the steps in "Connections" on page 25.

2. Select **Test > Button Test** in the Spot Vital Signs Repair Software and press each button on Spot Vital Signs while verifying that the computer acknowledges each button in the Button Pressed display.
3. Select **Ok** to exit the dialog box.

Interface test

1. Follow the steps in "Connections" on page 25.
2. Select **Test > Display** in the Spot Vital Signs Repair Software to confirm the Window Display shows all of the segments.
3. Select **all on** in the Spot Vital Signs Repair Software to confirm the Window Display shows all of the segments.
4. Select **all off** in the Spot Vital Signs Repair Software to confirm the Window Display clears all of the segments.
5. Select **Normal** in the Spot Vital Signs Repair Software to confirm the Window Display returns to the normal display.
6. Select **Segment** in the Spot Vital Signs Repair Software to confirm the Window Display shows each number is correct as the test progresses one cycle.
7. Select **on** in the backlight Spot Vital Signs Repair Software to confirm the Window Display backlight comes on.
8. Select **off** in the backlight Spot Vital Signs Repair Software to confirm the Window Display backlight goes out.
9. Select **buzzer test** to confirm the buzzer of Spot Vital Signs is on. Select **Ok** to exit the test and turn the buzzer off.
10. Select **Ok** to exit the dialog box.

Print quality

This section affects Spot Vital Signs Version 1 only.

This test requires the use of the TTL service port. You cannot complete the test using IR for communication.

1. Follow the steps in "Connections" on page 25.
2. Verify the printer is the HP IR printer that works with Spot Vital Signs.
3. Select **Test > Print Quality**. Select **test pattern 1**. The printer prints out a pattern of large and small ASCII characters.
4. Verify the quality of the printer output.
5. Select **test pattern 2**. The printer prints out a solid gray field.
6. Verify the quality of the printer output.
7. Select **Ok** to exit the dialog box.

If the print quality is poor for either test then replace the printer batteries and re-test.

Pneumatic tests

1. Follow the steps in "Connections" on page 25.
2. Attach the test system to the 100 cc cylinder. Select **Test > Pneumatic > Leak Test**. The software tests for leaks and provides a Pass or Fail indication.
3. Attach the test system to the 500 cc cylinder. Select **Dump Test** . The software tests for the dump speed and provides a Pass or Fail indication.
4. Attach the test system to the 250 cc cylinder. Select **Inflation Test**. The software tests for the inflation time and provides a Pass or Fail indication.
5. Attach the test system to the 100 cc cylinder. Select **Valve Control Test**. The software tests for valve control and provides a Pass or Fail indication.
6. Select **Ok** to exit the dialog box.

Fail safe (over pressure) test

1. Follow the steps in "Connections" on page 25.
2. Enter the "Internal configuration mode" on page 20. Aftering viewing the software versions, press the **Mode** button until CAL displays in the LCD window. Spot Vital Signs automatically performs an auto zero once the LCD window displays CAL.
3. Connect the Spot Vital Signs to the 500 cc cylinder and press the **Blood Pressure Start/Stop** button to close the valve.
4. Pump the hand bulb until an E10 error occurs and record the highest pressure observed on the pressure meter.
5. Press the **Cancel** button to return to CAL mode.
6. Press the **Blood Pressure Start/Stop** button to close the valve.
7. Apply 70 mmHg and start a timer. When an E11 error code is triggered, stop the timer and record the time.

Service work checklist

Spot Vital Signs

Model Number	Serial Number	BP Cycle Count	Technician	Date

Test	Test Data	Pass/Fail	Test Specification
Unit SW Version			
SPO2 SW Version			
Thermometry SW Version			
Unit Pressure @ 0 mmHg			+/- 1 mmHg
Unit Pressure @ 50 mmHg			+/- 1 mmHg
Unit Pressure @ 150 mmHg			+/- 1.5 mmHg
Unit Pressure @ 250 mmHg			+/- 2.0 mmHg
Test Voltage @ 5.5 V			+/- 0.1 VDC
Current Test – Sleep State			< 0.5 A
Current Test – Valve Pump			< 2.0 A
Noise Level			< 0.05 mmHg
Button Test			Pass/Fail
Interface Test			Pass/Fail
Leak Test			<= 6 mmhg in 15 seconds
Dump Test			< 10 Seconds
Inflation Test			< 7 Seconds
Valve Control Test			Pass/Fail
Over Pressure Test			296 to 329 mmHg
SPO2 Sensor - Masimo			81% +/- 3% 61bpm +/- 1bpm
SPO2 Sensor - Nellcor			90% +/- 1% 60bpm +/- 1bpm
Temperature Calibration			96.8 +/- 0.2F 105.8 +/- 0.2F
Temperature Cal Key Suretemp			97.3 +/- 0.2 F

6 Disassembly and repair

This chapter provides the instructions for removing and replacing serviceable modules in the Spot Vital Signs.

Unless otherwise noted, re-assembly procedures are the reverse order of the disassembly procedures.

WARNING Electric shock hazard. There are no user-serviceable parts inside Spot Vital Signs other than battery replacement (see "Battery removal and replacement" on page 70). An operator may only perform maintenance procedures specifically described in this manual. For service, refer the device to an Authorized Service Center.

WARNING Follow the ESD procedures on see "Electrostatic discharge (ESD)" on page 7.

Note Always disconnect the sealed lead-acid battery in the Spot Vital Signs before performing any repair function.

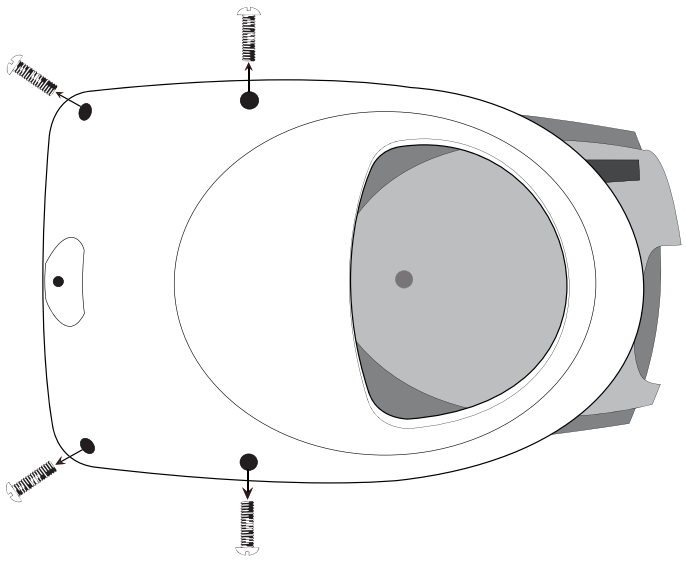
Have the following tools available during the procedures.

Description	Part Number	Source
Bulb and valve	5088-01	Welch Allyn
Pneumatic tubing (3 ea.)	5089-12	Welch Allyn
Test Cable (IR)	66P824	Welch Allyn
Test Cable (Service Cable Kit)	130S60	Welch Allyn
Repair Software	716948	Welch Allyn
Welch Allyn 9600+ Calibrator	01800-210	Welch Allyn
Welch Allyn Calibration Key	06137-000	Welch Allyn
Spot Vital Signs Service Manual	4200-145E	Welch Allyn
Pneumatic clamps (3)	21730-001	VWR Scientific 800-932-5000
Pliers		Tool/Supply Store
Wire Cutter		Tool/Supply Store
Tweezers		Tool/Supply Store
Torque Bit (T8)		Tool/Supply Store
phillips screw driver		Tool/Supply Store
T10 Torx Bit		Tool/Supply Store
3/8 Hex Socket		Tool/Supply Store

Description	Part Number	Source
Cable Tie Tool		Tool/Supply Store
Setra Pressure Meter (1-10 PSIG)	2270-01	Setra +1 800 257 3872
Netech Pressure Meter	20-200IN	Netech +1 800 547 6557
Masimo SpO_2 Tester	11593	Masimo +1 800 326 4890
Masimo Extension Cable - 4 ft	PC-04-WA	Masimo +1 800 326 4890
Nellcor Patient Simulator	SRC-2 for MP205	Nellcor +1 800 6355267
Nellcor Patient Simulator	SRC-MAX for MP506/NELL-3	Nellcor +1 800 635 5267
Nellcor Test Cable	8-Dec	Nellcor +1 800 635 5267
Calibration Volumes	401028	Welch Allyn
IBM compatible computer 486 133 MHz computer or better.		
Digital Multi-Meter (qty 2) with 4.5 digit displays for accuracy.		
Power Supply: 0-20 Vdc adjustable with 0-3A output.		

Battery disassembly

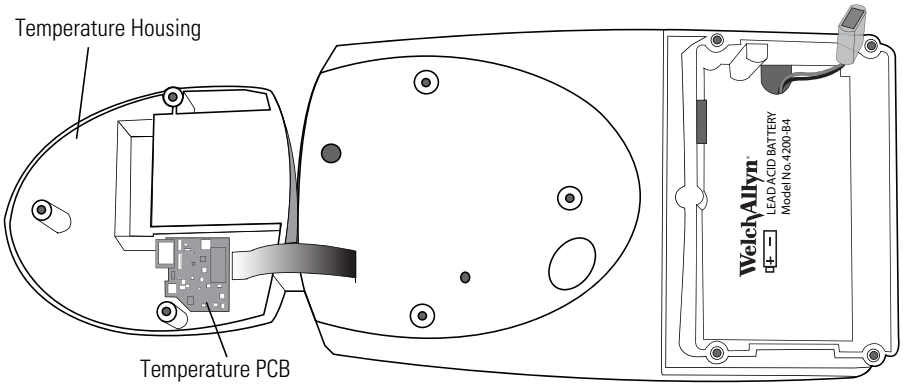
1. Disconnect the power and all accessories from the Spot Vital Signs.
2. Remove the four screws holding the battery door using a phillips-head screwdriver.
3. Remove the battery door to expose the battery and lift it out. Disconnect the one-way connector.



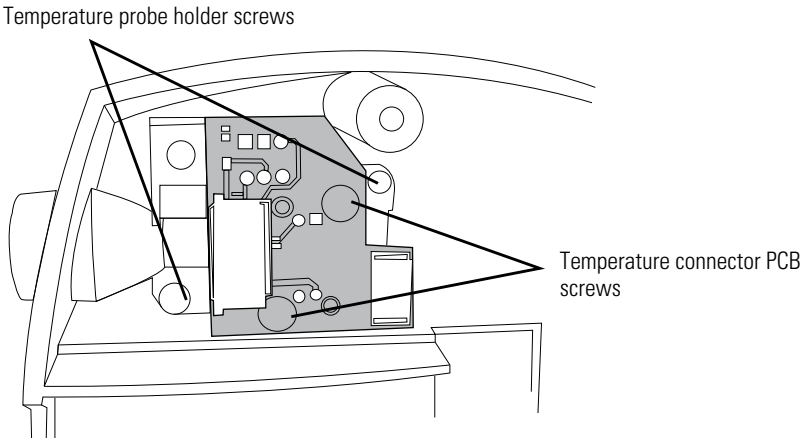
Temperature disassembly

Follow the previous steps and then:

1. Remove the three #10 Torx screws from the temperature housing.
2. Roll the temperature housing toward the top of the Spot Vital Signs and carefully lay it on the bench.



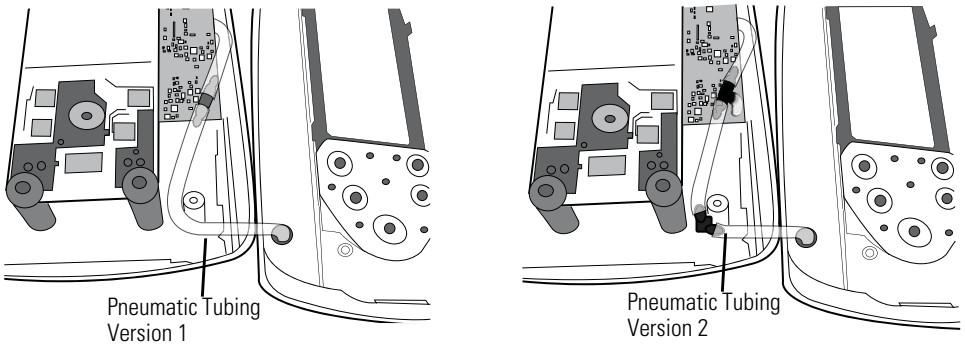
3. Unplug the flex cable from the connector on the temperature PCB.
4. Remove the two #10 Torx screws from the temperature PCB from the temperature housing.
5. Remove the two #10 Torx screws on the temperature probe holder and gently pull out.



Front housing and key pad disassembly

Follow all the previous steps and then:

1. Remove the two screws inside the battery housing that are identified with arrows molded into the housing and the two screws underneath the temeprature housing.
2. Hold the device together and lay the back housing on the bench.
3. Carefully roll the front housing to the right.
4. Disconnect the tubing from the front housing.

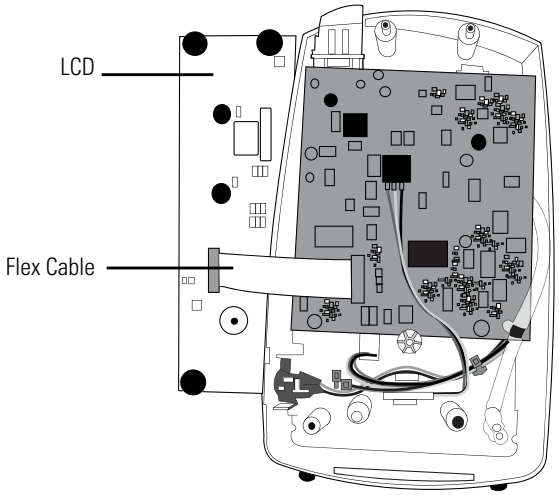


5. Gently pull the button switch array out of the cover.
6. Align and push the new button switch array into place.

LCD disassembly

Follow all the previous steps and then:

1. Gently lift the LCD module from the posts.
2. Roll the LCD to the left of the Spot Vital Signs and lay it on the bench.

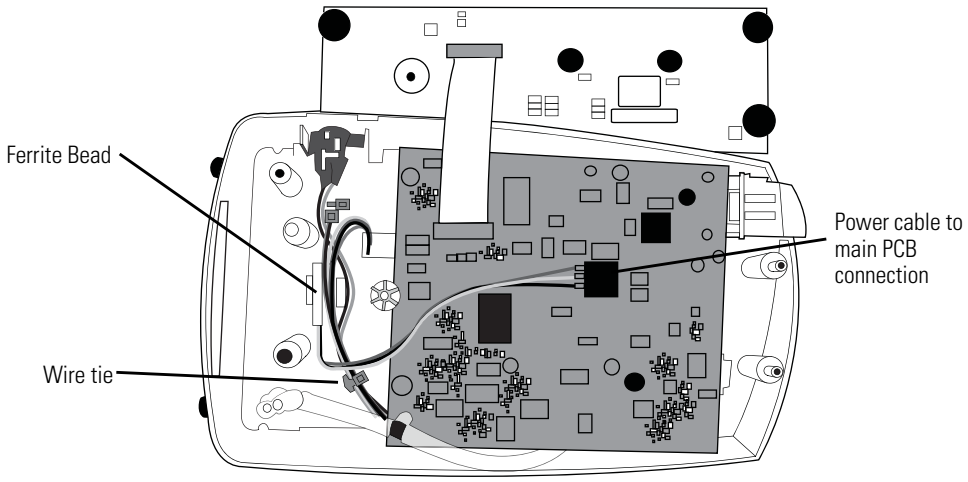


3. Remove the flex cable from the LCD and set the LCD aside.

Power and battery cable disassembly

Follow all the previous steps and then:

1. Push down on the tab that connects the power cable to the main PCB and pull it toward the bottom of the Spot Vital Signs.

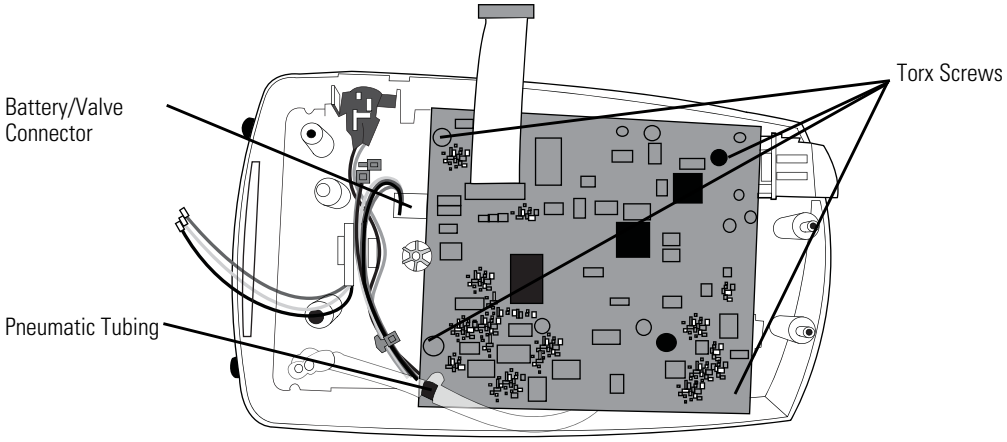


2. Lift the ferrite from its holder.
3. Use a 3/8" Hex socket to remove the nut from the outside of the transformer connector. Slide the cable through the rear housing opening.
4. Cut the wire tie and slide the battery connector out of the rear housing to remove the cable assembly.

Main printed circuit board assembly

Follow all the previous steps and then:

1. Remove the pneumatic tubing from the transducer on the main PCB.



2. Remove the battery/valve cable connector from the bottom of the PCB.
3. Remove the 4 #10 Torx screws from the PCB.
4. Lift Main PCB from housing.

   If the Spot Vital Signs uses SpO_2 then remove the three screws on the underside of the Main PCB and lift the SpO_2 PCB off the main board (two main board connectors).

5. Attach the existing SpO_2 board to the new main board reusing all hardware.

SpO_2 circuit board disassembly

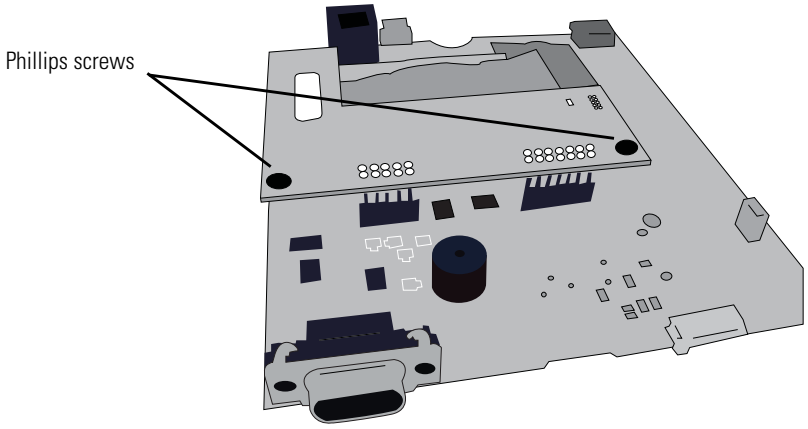
Note To assure proper SpO_2 operation, replace the SpO_2 board using only the Welch Allyn specified part.

To assure patient electrical isolation, after the main board is nearly back in position, verify that the SpO_2 flex cable is freely floating and not pressed up against the main board.

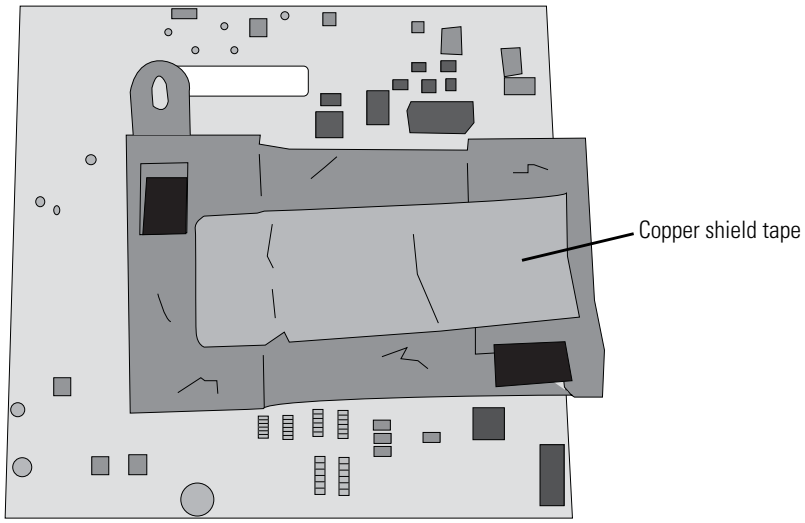
Follow all the previous steps and then:

Masimo board

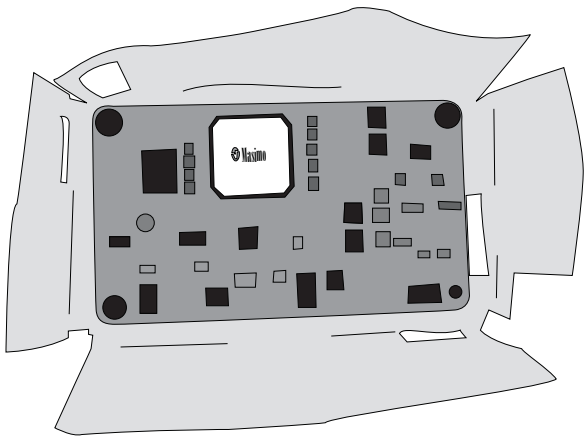
1. Remove the copper tape and unfold the shielding. This exposes the two screws that hold the PCB to the standoffs.



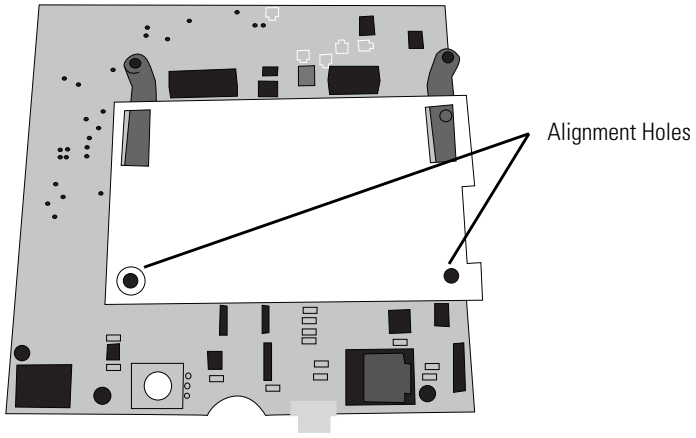
2. Remove the two phillips head screws and lift the Masimo adapter board straight up. There are four connectors on this board - two connect to the main PCB and the other two connect to the Masimo PCB.



3. Unfold the paper to expose the SpO_2 board and remove the two screws holding the board.



4. Remove the 2 screws and lift the board and shielding off the standoffs. This exposes insulating paper.
5. Verify the paper is properly aligned before re-installing the shielding and the new PCB assembly.

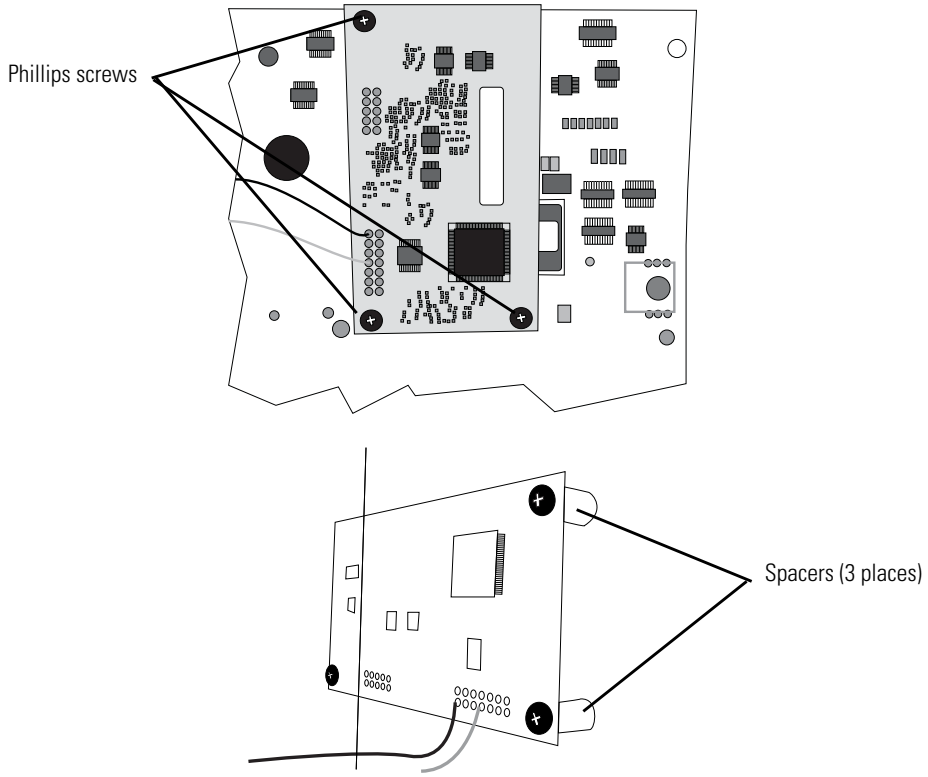


When reassembling, lay the shielding on top of the insulating paper and then replace the board. Verify shielding lays over top of standoff after folding.

Nellcor board

Follow all the previous steps and then:

1. Remove the three phillips head screws along with the nuts and spacers from the SpO_2 PCB.



2. Remove the SpO_2 module (Nellcor MP205) from the main PCB.

Note If a failure occurs in the MP205 PCB (obsolete), update to a Nell-3 PCB (704870) and update the Main PCB (403290). The new Main PCB (403290) correctly operates an MP205, an MP506, or a Nell-3 PCB. If the Nell-3 is used with the old main PCB, an E7 error occurs after connecting the power.

For MP205 PCB: Verify the following:

- There are two shunts at the top of the jumper row on the PCB before installing on the Main PCB.
- The two locking tabs on the connectors of the Nellcor MP205 PCB are broken off before installing onto the Main PCB.
- The nylon washers are located on the main PCB when reassembling the SpO_2 PCB to the Main PCB.

For MP506 or Nell-3 PCB: Verify the following:

- The DIP switch positions are (1-on, 2-on, 3-off and 4-off) on the new PCB and the two locking tabs on the connectors of the Nellcor MP506 PCB are broken off before installing onto the Main PCB.
- Verify that the nylon washers are located on the main PCB when reassembling the SpO_2 PCB to the Main PCB.

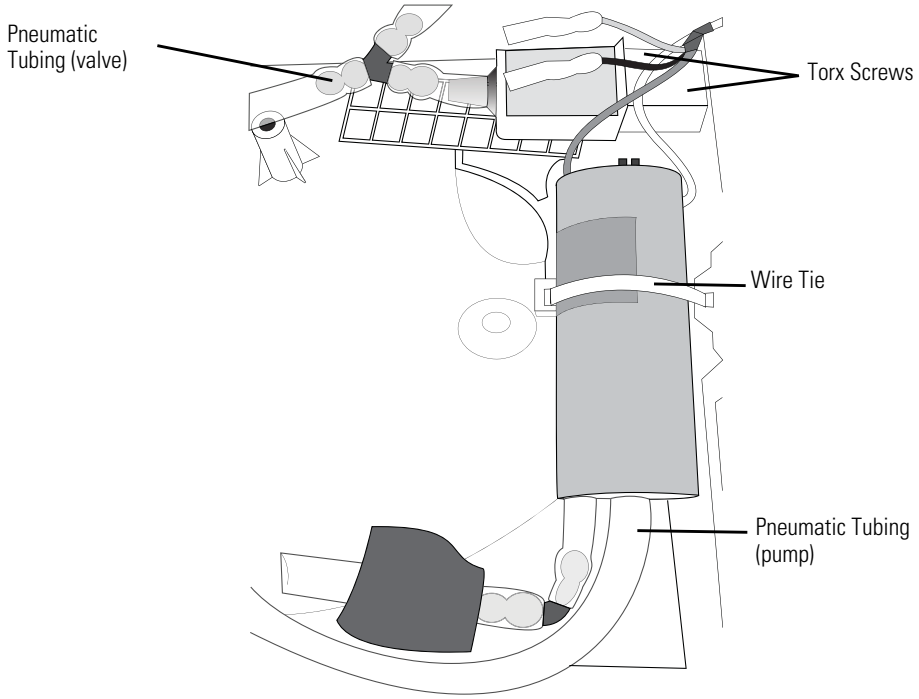
Pump and valve disassembly

Note For proper blood pressure operation, replace the pump using only the Welch Allyn specifed part.

To assure patient electrical isolation, do not modify the length of the pump wires.

Follow all the previous steps and then:

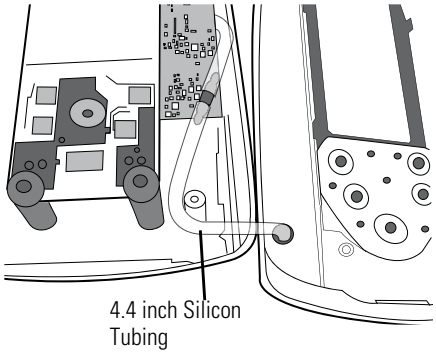
1. Disconnect the pneumatic tubing from the valve and pump.



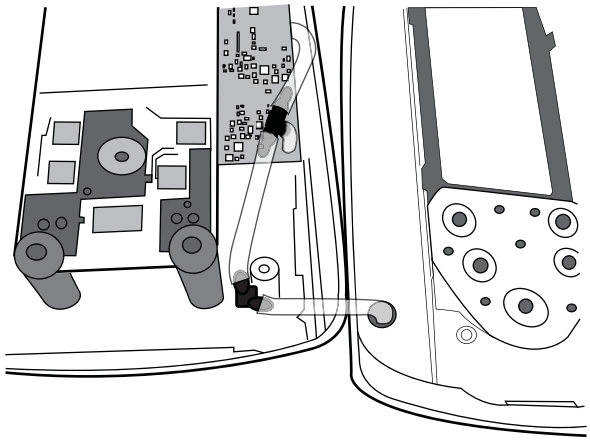
2. Cut the wire tie and remove the two Torx screws.
3. Lift the valve and the pump from their respective locations on the rear housing.

To upgrade the pneumatic tubing:

1. Verify you have two pieces of silicon tubing 1.5 inches in length (421051-11) and one elbow fitting (703843) available.
2. Remove the 4.4 inch silicon tubing from the “T” fitting.



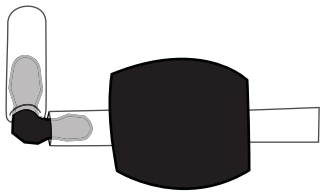
3. Insert one of the 1.5 inch silicon tubing pieces onto the “T” fitting.
4. Insert the elbow fitting into the 1.5 inch silicon tubing.
5. Insert the second 1.5 inch tubing onto the elbow fitting.
6. Connect the 1.5 inch tubing to the Spot Vital Signs.



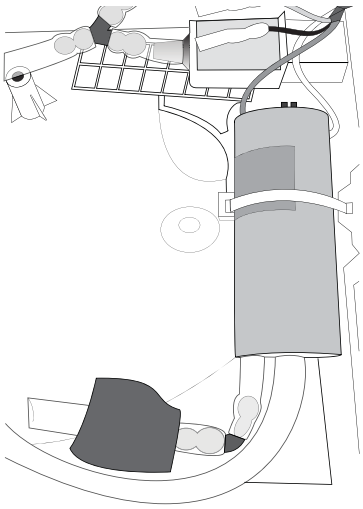
To assemble the pump filter:

1. Verify you have three pieces of silicon tubing .8 inches in length (421051-5), one elbow fitting (703843), one NIBP filter (600-0520-00), and one foam sleeve (706327) available.
2. Connect one piece of the silicon tubing at each end of the elbow fitting, and then connect the NIBP filter to one of the open ends.
3. Connect the last piece of silicon tubing to the opposite end of the NIBP filter.

4. Carefully slide and center the foam sleeve over the NIBP filter.



5. Remove the open-ended tubing from the pump and replace with the pump filter assembly. Confirm proper pump fitting.



7 Technical overview

System description

The Spot Vital Signs automatically measures systolic and diastolic blood pressure, pulse rate, pulse oximetry (SpO_2), and temperature (oral, axillary under 4 years, and rectal) for adult and pediatric patients (excluding neonates).

The device is intended to be used by clinicians and medically qualified personnel. It is available for sale only upon the order of a physician or licensed health care provider.

Refer to the Spot Vital Signs Directions for Use manual for complete information.

Battery /charge system

Spot Vital Signs includes a 6 Volt, 4.5 amp-hour sealed lead-acid battery that supplies all power to the device. A polarized connector protects against reversing the battery connection. An external power supply charges the battery and can operate Spot Vital Signs at the same time. The external power supply provides the Spot Vital Signs with up to 1000mA at 7.2VDC. As the battery charges, the energy required to charge it decreases and the external power supply voltage rises to 8 VDC while supplying 750mA. The voltage to the external power supply is approximately 12.5VDC with no load attached. The Spot Vital Signs monitors the battery voltage to control the fast and trickle charge modes. The CPU allows fast charge until the battery reaches approximately 7.0 VDC, and then the CPU switches the charger circuit to trickle charge mode. For a dead battery the external charger supplies sufficient power to allow the Spot Vital Signs to power on, but not enough energy for a blood pressure cycle. A 5 amp surface mount fuse is populated on the Spot Vital Signs main board at location F301.

Main CPU power supply

A single +5VDC linear regualtor (U319) powers the CPU and provides power to other digital circuitry on the main printed circuit board.

Clock/calendar power

The battery directly powers the internal real time clock (U309) through a voltage divider. The Spot Vital Signs always has power if a battery is connected. A 100uF capacitor (C308) delivers energy to the real time clock during a battery exchange. If the battery is disconnected for longer than 1 minute, reset the real time clock after restoring the battery power.

Mod B NIBP power

The main board contains the circuitry required for blood pressure measurement. The main CPU controls the battery power to this module through a +5V linear regulator (U6). In the event of a critical blood pressure module error, the main CPU disconnects power from the ModB module through the BPEN signal at Q11. A separate +5V linear regulator (U1) powers the ModB analog circuitry to keep digital signal noise separated from the analog components.

Thermometer power

A combination of the main CPU +5V and the ModB +5V supply the SureTemp thermometer circuitry. If the main CPU disconnects power from the ModB blood pressure circuitry then the SureTemp circuitry is also disabled.

SpO_2 power

The battery supplies power to the SpO_2 through a +5V linear regualtor (U322). If there is no SpO_2 module connected to the Spot Vital Signs main board the SpO2 power supply is disconnected.

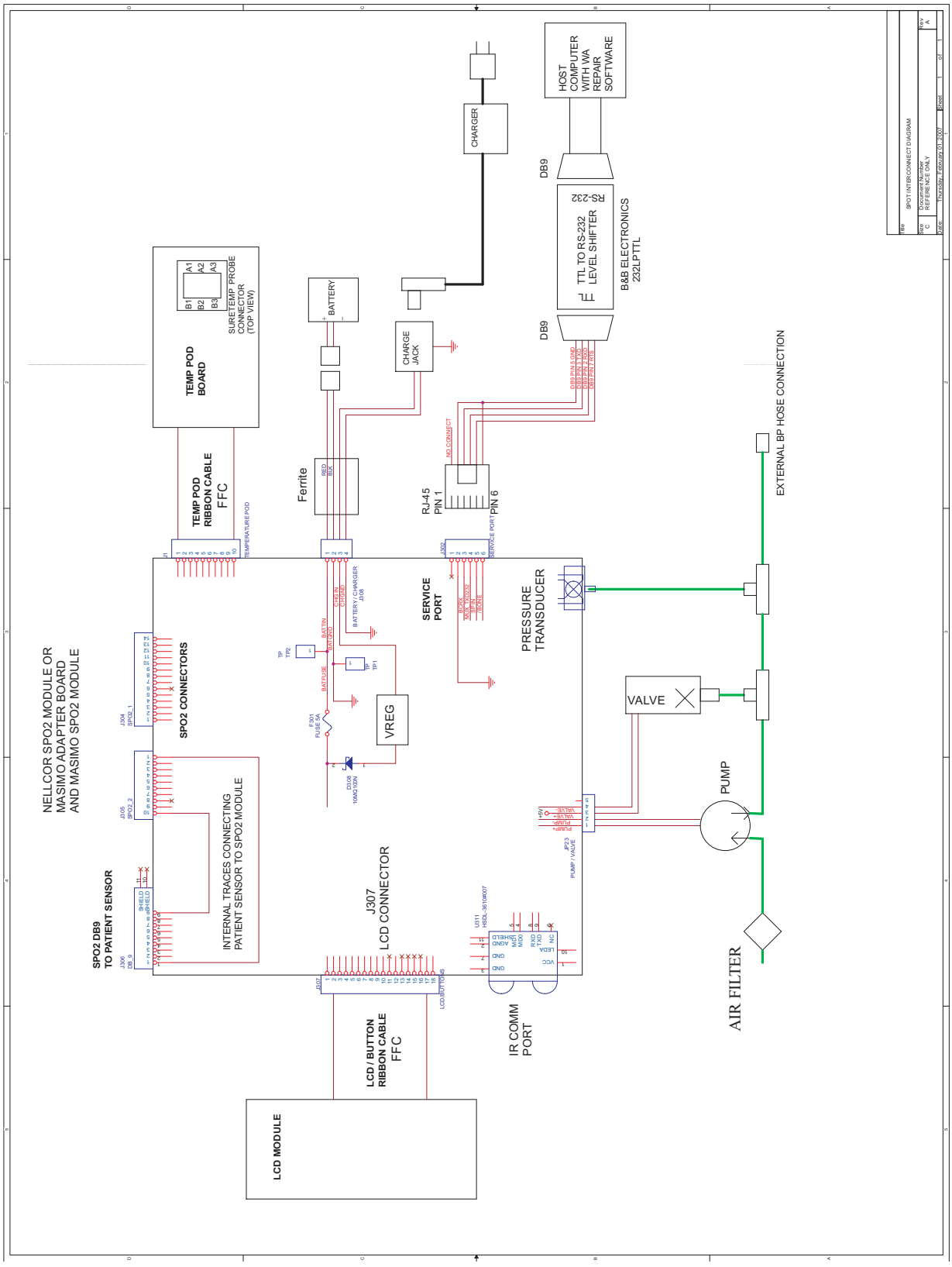
LCD power

The main CPU supplies power to the LCD module through the J307 connector, and the FET Q312 and comparator U324A control the backlight. This comparator and FET create a pulse width modulated signal that allows the backlight to maintain constant brightness during changing battery voltages. The white backlight LEDs are connected in series inside the LCD module. This configuration causes some LEDs to look brighter or dimmer than adjacent LEDs. This is normal and expected.

Communications

A Spot Vital Signs and computer can communicate through the IR or service communication ports. IR communication is the default mode and works as a standard serial port (9600 baud, 8 data bits, no parity, 1 stop bit, no flow control) when used with Welch Allyn 716948 communications kit. The hard-wired service port is positioned behind the battery. Connect the port as described in the interconnect diagram. The hard-wired port is intended for service use only. Never use the hard-wire communications port while the device is connected to a patient because it has no patient isolation protection.

Interconnect diagram



8 Field replaceable units

If a Version 1 (serial number less than 200705000) is sent in for updates or repair to the main printed circuit board, it is necessary to upgrade the keypad and front housing/bezel assembly. The Spot Vital Signs is then referred to and functions as a Version 2. See Table 1 on page 1 for the specific version differences.

The following lists identify the available FRUs for Spot Vital Signs. To order an FRU, contact Welch Allyn Technical Support.

Table 17. Repair Replacement Table (Version 1 only)

Faulty Part	Replacement Part(s)
Main PCB assembly 421267-501 (Print option)	Main PCB assembly 403290 (Pressure Preset option) Front Housing (Version 2) 403300 Switch Array (Version 2) 706213 Directions for Use (English) 706272
LCD 421020-501	LCD 706062
Switch Array (Version 1)	Switch Array (Version 1) 703430
Front Housing (Version 1) 421049-502	Front Housing (Version 1) 421049-502

Parts listed below are used in both Version 1 and Version 2 unless otherwise indicated.

Table 18. Spot Vital Signs Repair Parts List

Description	Part Number	Source
Probe Assembly, Lathg Conn. Oral - 9 Ft	02678-100	Welch Allyn
Probe Assembly, Lathg Conn, Rectal - 9 Ft	02679-100	Welch Allyn
M031 Probe Cover Clear - 1K	05031-101	Welch Allyn
Cable Tie Mount	113P463	
Cable Tie, 6 inch	113P464	
Switch Array, Spot, Epoxy Coated, Version 1	703430	Welch Allyn
Grommet, Ribbed, Shock Isolation	421019	
Assembly, Spot Pump Repair	421023-501	Welch Allyn
Flex Cable, Main to Display	421030	Welch Allyn
S/N Tracking Label, Version 1	402427	Welch Allyn
S/N Tracking Label, Version 2	403430	
Screw, 4-20 x .31 Plastite PH Torx	421037	
Lockwasher, 5/16 Internal Tooth	421039	

Table 18. Spot Vital Signs Repair Parts List

Description	Part Number	Source
Rear Housing	421040-1	Welch Allyn
Door, Battery	421042	Welch Allyn
Pod, Temperature	421044	Welch Allyn
IR Window	421045	Welch Allyn
Cover, SpO_2	421048	Welch Allyn
Front Housing Assembly, Version 1	421049-502	Welch Allyn
Assembly, Pneumatic Tubing Only	421001-503	Welch Allyn
Assembly, Pneumatic Fittings and Tubing	421001-504	Welch Allyn
Fitting “Y” 1/8 x 1/8 x 1/8	620216	
Fitting “T” 1/8 x 1/16 x 1/8	620217	
Fitting, Elbow 1/8” *Ref L230_2)	703843	
Tubing, Silicone, 1/8 x 1/4 x .80	421051-5	
Tubing, Silicone, 1/8 x 1/4 x 3.60	421051-6	
Tubing, Silicone, 1/8 x 1/4 x 9.0	421051-8	
Tubing, Silicone 1/8 x 1/4 x 1.50	421051-11	
Tubing, Silicone 1/16 x 3/16 x .50”	421052-1	
Filter, NIBP	600-0520-00	
Foam Sleeve	706327	
Flex Cable, Main to Temperature Pod	421066	Welch Allyn
Cable Assembly - Pump/Pneutron Valve	421099	Welch Allyn
PCB Assembly, Temperature Pod	421105-501	Welch Allyn
Battery Label, Rear Housing	421219N	Welch Allyn
Cable Tie, 6” Releasable	421220	
Cable Assembly - Power Spot Ext	421273	Welch Allyn
Label, Caution/Button	421278	Welch Allyn
Packet, Desiccant, 2 Unit	618E50-1	
Pump	620156	Welch Allyn
Stepper Valve	620157	Welch Allyn
Nellcor Label (carton)	620038	Welch Allyn
“Nellcor Works Here” Label	620377-1	
Nellcor Nell3 Pulse Oximetry	704870	
Nellcor Nel-3 Patent Label	705224	
Washer, Flat, #4 Nylon	22P1451	
Standoff, #4 x .0400”	421018	
4-40 x .250 Hex Nut	790043	
Screw 4-40 .750 Pan Phillips w/Nyloc	9P2486	
Latch, SpO_2	421047	

Table 18. Spot Vital Signs Repair Parts List

Description	Part Number	Source
Label, SureTemp Technology	70999-0000	
Detachable Power Cord, Aust	400627	
Detachable Power Cord, Swiss	761076-8	
Detachable Power Cord, South America	761076-9	
Foam Strip	78P567	
1vb Label Blank 1" x 4"	900242-8	
Screw 2-28 .750 Pan Tox SS	9P2847	
Flex cable, main to display	421030	
Pump sub-assembly	421023-501	
IR window	421045	
Battery, 6 volt	4200-84	
Cable assembly - power Spot Vital Signs ext.	421273	
Rear housing	421040-1	
Front housing assembly, Version 1 only - black	421049-502	
Temperature pod housing	421044	
SpO_2 cover	421048	
Battery door	421042	
Switch array, Version 1 only - 6/W/B	703430	
PCB assy, temperature pod	421105-501	
Cable assy - pump/pneutr ON valve	421099	
Stepper valve	620157	
Flex cable, main to temp pod	421066	
Assy, pneumatic tubing	421001-504	
Assy, Masimo front housing, Version 2 only - blue	403301	
MS-11 OEM PCB, Version 2 only	031-0160-00	
Standoff set, MS-11, left and right, Verions 2 only	706070	
Shield, MS-11, Version 2 only	706053	
Masimo adapter PCA, Version 2 only	403291	
Tape, copper, Masimo shield, Version 2 only	704681	
Assy, plain front housing, blue	403304	
Main PCA, Version 2 only	403290	
Display module	706062	
Switch array, blue/white	706213	
MS-11 Nomex, Version 2 only	706055	
Assy, pump filter	403370	
Power cord - domestic	76400	
Assembly, Spot pneumatic repair	421001-503	

Table 18. Spot Vital Signs Repair Parts List

Description	Part Number	Source
Battery, sub-assembly	421002-501	
Transformer, 120VAC/60 Hz, 8 Vdc	5200-101A	
Transformer, 220VAC/50 Hz, 8 Vdc	5200-103A	
Calibration key, temperature probe calibration	5200-25	
Power cord (Europe)	76402	
Power cord (UK)	76404	
Patent label, Masimo, Version 2 only	704608	
Screw 4-20 .250 pan phillips, Version 2 only	106124-4	
DFU, English	706272	
Flex cable, main to display	421030	
Pump sub-assembly	421023-501	
IR window	421045	
Battery, 6 volt	4200-84	
Cable assembly - power Spot Vital Signs ext.	421273	
Rear housing	421040-1	
Front housing assembly, Version 1 only - black	421049-502	
Kits Available:		
Spot Temperature Upgrade	130S61	
Nellcor SpO_2 Upgrade	130S62	
Masimo SpO_2 Upgrade	130S64	
Pneumatic Assembly Upgrade:		
Fitting, Elbow 1/8" (REF L230_2)	703843	
Tubing, Silicone, 1/8 x 1/4 x .80	421051-5	
Tubing, Silicone, 1/8 x 1/4 x 1.50	421051-11	
Filter, NIBP	600-0520-00	
Foam Sleeve	706327	

9 Specifications

Consider the accessories connected to the Spot Vital Signs as Type BF applied parts.

Patient population

The Welch Allyn Spot Vital Signs is designed for use with adult and pediatric patients. Welch Allyn defines a pediatric patient as 29 days or more of age.

THE WELCH ALLYN SPOT VITAL SIGNS IS NOT INTENDED FOR USE ON NEONATES.

Welch Allyn defines neonates as children 28 days or less of age, born at term (37 weeks gestation or more), otherwise up to 44 gestational weeks.

Blood pressure

Cuff Pressure Range	0 mmHg to 300 mmHg
Cuff Inflation Factory Default	160 mmHg
Systolic Range	60 mmHg to 250 mmHg
Diastolic Range	30 mmHg to 160 mmHg
Accuracy	Blood pressure accuracy meets or exceeds SP10-1992 AAMI standards for non-invasive blood pressure accuracy (AAMI standard: ± 5 mmHg mean error, 8 mmHg standard deviation). Blood pressure accuracy is validated for pressure measurement using the upper arm only.
Determination Time	Typical: 20 to 45 seconds Maximum: 165 seconds
Pulse Rate Range	40 bpm to 200 bpm
Pulse Rate Accuracy	±5.0%
Overpressure Cutoff	305 mmHg -0/+15 mmHg

Temperature

Accuracy	Calibration accuracy: ± 0.2° F (± 0.1° C).
Range	Maximum: 109.4° F/43.0° C Minimum: 86.0° F/30.0° C
Determination Time	Oral: approximately 4 seconds Axillary: approximately 10 seconds Rectal: approximately 15 seconds

Pulse pximetry

Masimo sensor accuracy guide

Accuracy specified when used with Masimo SET pulse oximetry monitors or with licensed Masimo SET pulse oximetry modules using Masimo patient cables, during no motion. Numbers present ± 1 standard deviation. Plus or minus one standard deviation represents 68% of the population. SpO_2 accuracy from 70% to 100%. Pulse rate accuracy from 25 to 240 bpm. This accuracy guide only affects Version 2.

Performance Measurement Range	SpO_2: 70 to 100% Pulse Rate: 25 - 240 beats per minute (BPM)
Perfusion	0.02% to 20%
SpO_2 Accuracy	Saturation: 70% to 100% No Motion: Adults, Pediatrics ± 2 digits Motion: Adults, Pediatrics ± 3 digits Low Perfusion: Adults, Pediatrics ± 2 digits
Pulse Rate Accuracy	Pulse Rate: 25 to 240 bpm No Motion: Adults and Pediatrics ± 3 digits Motion: Adults and Pediatrics ± 5 digits Low Perfusion: Adults and Pediatrics ± 3 digits

Table 19. Masimo Sensor Accuracy Guide

		Saturation Accuracy		Pulse Rate Accuracy	
Sensor	**Weight Range**	**No Motion**	**Motion**	**No Motion**	**Motion**
LNCS-DCI	> 30 kg	± 2%	± 3%	± 3 bpm	± 5 bpm
LNCS-DCIP	10 to 50 kg	± 2%	± 3%	± 3 bpm	± 5 bpm
LNCS-ADTX	> 30 kg	± 2%	± 3%	± 3 bpm	± 5 bpm
LNCS-PDTX	10 to 50 kg	± 2%	± 3%	± 3 bpm	± 5 bpm
LNCS INF-L	3 to 20 kg	± 2%	± 3%	± 3 bpm	± 5 bpm
LNOP-DCI	> 30 kg	± 2%	± 3%	± 3 bpm	± 5 bpm
LNOP-DCIP	10 to 50 kg	± 2%	± 3%	± 3 bpm	± 5 bpm
LNOP-ADT	> 30 kg	± 2%	± 3%	± 3 bpm	± 5 bpm
LNOP-PDT	10 to 50 kg	± 2%	± 3%	± 3 bpm	± 5 bpm
LNOP INF-L	3 to 20 kg	± 2%	± 3%	± 3 bpm	± 5 bpm

Masimo patents

The Masimo sensors and cables are covered under one or more of the following U.S.A. patents: 5,758,644; 5,823,950; 6,011,986; 6,157,850; 6,263,222; 6,501,975; and other applicable patents listed at www.masimo.com/patents.htm.

Nellcor® sensor accuracy guide

Accuracy specifications are based on controlled hypoxia studies with healthy, non-smoking adult volunteers over the specified saturation SpO_2 range. Pulse oximeter SpO_2 readings were compared to SaO_2 values of drawn blood samples measured by hemoximetry. All accuracies are expressed as + "X" digits. This variation equals plus one standard deviation (+ 1 SD), which encompasses 68% of the population.

SpO2 Accuracy (MP205 specification - 2002 and earlier)	±3% in the range of 70-100% Oxygen saturation (1 stand deviation). <70% unspecified by the OEM.
Pulse Rate Range	25 to 240 bpm
Pulse Rate Range (using SpO_2 determination MP205 specification -2002 and earlier)	25 to 245 bpm
Pulse Rate Accuracy	±3 bpm ±3 bpm (low perfusion)
Pulse Rate Accuracy (MP205 Spec - 2002 and earlier)	SpO_2 Module Heart Rate ±3 bpm

Table 20. OxiMax Sensor Models, Single Patient Use

Sensor Models	SpO_2 Range 70% to 100%
MAX-AI	± 2
MAX-PI	± 2
MAX-II	± 2
MAX-RI[1]	± 3.5

[1] The accuracy specification has been determined between saturations of 80% to 100%.

Table 21. OxiCliq Sensor Models, Single Patient Use

Sensor Models	SpO_2 Range 70% to 100%
OXICLIQ-PI	± 2.5

Table 22. Reusable Sensor Models

Sensor Models	SpO_2 Range 70% to 100%
D-YS (Infant to Adult)	± 3
D-YS and D-YSE	± 3.5
D-YS and D-YSPD	± 3.5
DS-100A	± 3
OXI-A/N (Adult)	Adult: ± 3
OXI-P/I (Pediatric/infant)	± 3

Nellcor patents

Covered by one or more of the following US Patents: 4,802,486; 4,869,254; 4,928,692; 4,934,372; 5,078,136; 5,351,685; 5,485,847; 5,533,507; 5,577,500; 5,803,910; 5,853,364; 5,865,736; 6,083,172; 6,708,049; Re. 35,122 and foreign equivalents.

Mechanical

Dimensions	Height: 9.7 inches (24.6 cm) Length: 5.7 inches (14.5 cm) Depth: 4.7 inches (12.0 cm)
Weight	Approximately 4.6 pounds (2.2 kg)
Mounting	Self-supporting on rubber feet Custom Mobile Stand Custom Wall Mount Custom IV Pole Mount
Portability	May be hand-carried when held by the rear handle.

Electrical

Power Requirements	Patient-rated isolation transformer is connected to AC mains: North American Version:120VAC, 60Hz. 0.13A Input, 7.2VDC, 1.0A Output International Version:240VAC, 50Hz 0.065A Input, 7.2VDC, 1.0A Output Australian Version:240VAC, 50Hz, 13VA Input, 7.2VDC, 1.0A Output
Battery	Lead acid, with external charger. A fully charged battery supports 130 typical blood pressure determinations taken at 7-minute intervals. The battery is 90-100% charged after 12 hours of charging. The battery automatically charges when the Spot Vital Signs is powered through the AC power transformer. The battery charges faster when the instrument is not in operation.

Environmental

Operating Temperature	+10° to +40° C (Thermometer operating temperature 16° to 40° C) +50° to +104° F (Thermometer operating temperature 61° to 104° F)
Storage Temperature	-20° to +50° C -4° to +122° F
Transport Temperature	-20° to +49° C -4° to +122° F
Relative Humidity	15 to 90% (non-condensing)
Operating Altitude	-170 to +4877 m -557 to +16,000 ft.

Guidance and manufacturer's declaration

Emissions and immunity information

Electromagnetic Emissions

The Spot Vital Signs is intended for use in the electromagnetic environment specified below. The customer or user of the Spot Vital Signs should assure that it is used in such an environment.

Emissions Test	Compliance	Electromagnetic Environment - Guidance
RF emissions CISPR 11	Group 1	The Spot Vital Signs uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	The Spot Vital Signs is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

Electromagnetic Immunity

The Spot Vital Signs is intended for use in the electromagnetic environment specified below. The customer or user of the Spot Vital Signs should assure that it is used in such an environment.

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%.
Electrical fast transient/ burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	±1 kV differential mode ±2 kV common mode	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	>95% dip in 0.5 cycle 60% dip in 5 cycles 30% dip for 25 cycles >95% dip in 5 seconds	>95% dip in 0.5 cycle 60% dip in 5 cycles 30% dip for 25 cycles >95% dip in 5 seconds	Mains power quality should be that of a typical commercial or hospital environment. If the user of the Spot Vital Signs requires continued operation during power mains interruptions, it is recommended that the Spot Vital Signs be powered from an uninterruptible power supply or battery.
Power frequency (50/60Hz) 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.

Electromagnetic Immunity

The Spot Vital Signs is intended for use in the electromagnetic environment specified below. The customer or user of the Spot Vital Signs should assure that it is used in such an environment.

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 Spot Vital Signs including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance**
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	V1 = 3 Vrms	$d = (1.17)\sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	E1 = 3 V/m	$d = (1.17)\sqrt{P}$ 80 MHz to 800 MHz $d = (2.33)\sqrt{P}$ 800 MHz to 2.5 GHz where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in metres (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,[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: 

Note 1: At 80 MHz and 800 MHz, the higher frequency range applies.

Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

[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 Spot Vital Signs is used exceeds the applicable RF compliance level above, the Spot Vital Signs should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the Spot Vital Signs.

[b] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

Recommended Separation Distances Between Portable and Mobile RF Communications Equipment and the Spot Vital Signs

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

	Separation Distance According to Frequency of Transmitter (m)		
Rated Max. Output Power of Transmitter (W)	**150 kHz to 80 MHz** $d = (1.17)\sqrt{P}$	**80 MHz to 800 MHz** $d = (1.17)\sqrt{P}$	**800 MHz to 2.5 GHz** $d = (2.33)\sqrt{P}$
0.01	0.11667	0.11667	0.23333
0.1	0.36894	0.36894	0.73785
1	1.1667	1.1667	2.3333
10	3.6894	3.6894	7.3785
100	11.667	11.667	23.333

For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

Note 1: At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

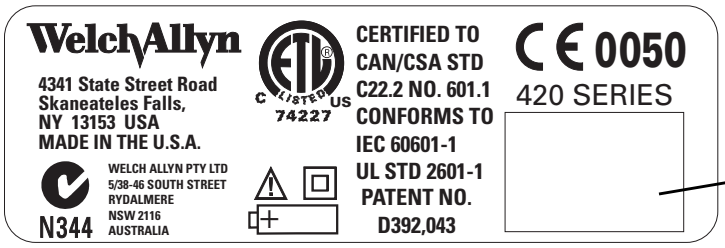
Patents

D392,043 and other patents pending.

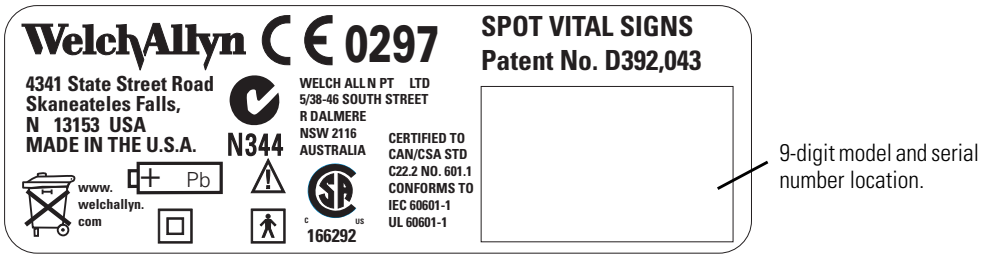
Identification label and serial numbering system

The identification label for the Spot Vital Signs is located on the bottom of the device. The serial number format has 9-digits. The first 4 numbers state the year of manufacture and the last 5 numbers state the Spot Vital Signs manufacturing number. Therefore, 200608000 means the 8000th Spot Vital Signs manufactured in the year 2006.

For Spot Vital Signs, Version 1, the serial number is any year prior to 2007 and a manufacturing number 04999 or less. These serial number labels require the CE0050 mark.



For Spot Vital Signs, Version 2, the year is 2007 and the manufacture number is 05000. These serial number labels require the CE0297 mark.



Firmware identification

To confirm the software levels of the Spot vital signs, enter the Configuration Mode (page 20).

The main software versions display as follows:

In the SW1 screen the top two numbers are the software version of the Spot Module and the remaining numbers are for the SpO_2 module (if available). Press the **Start** or **Clear** button to cycle through the SpO_2 software number.

In the SW2 screen the two numbers represent the NIBP module software and the temperature algorithm version (if temperature is active).

Note Review the Repair Test Specifications document located in Appendix C to verify the firmware levels.

10 Maintenance

Cleaning

Spot Vital Signs

Caution Do not use ethyl alcohol to clean the Spot Vital Signs device.

Caution Do not sterilize or autoclave the Spot Vital Signs.

Occasionally wipe the Spot Vital Signs, as necessary, with a cloth slightly dampened with appropriately diluted, non-staining disinfectant solution. Use either 70% isopropyl alcohol, 10% chlorine bleach solution, or mild detergent in warm water. Never immerse the Spot Vital Signs in any type of fluid.

Note Prevent water or other fluids from entering any connectors. Should this occur, dry the connectors with warm air. Check all measurement functions for proper operation.

Blood pressure cuff

Caution Do not press with a hot iron.

Clean the blood pressure cuff with a damp cloth, or wash in water with soap or detergent. Before washing the blood pressure cuff, remove the tube fitting(s), close off tubes with plugs (available as accessory 5082-163) and place the hook and loop fasteners in the closed position. After washing, allow the blood pressure cuff to air dry. Re-assemble the tube fitting(s).

Disinfection: You may use glutaraldehyde-type liquid disinfectants on the durable blood pressure cuff. Prolonged use of these disinfectants at full strength may cause discoloration of the white blood pressure cuff markings.

Sterilization: Do not use steam or heat to sterilize the blood pressure cuff or pressure hose. If necessary, use gas sterilization.

Cables and pressure hose

Wipe the cabling and pressure hose with a damp cloth moistened in a mild detergent solution. Do not immerse.

Temperature probe

Periodically wipe the temperature probe clean with an alcohol-dampened cloth, warm water, or properly diluted, non-staining disinfectant. Do not immerse the probe.

SpO_2 sensor

WARNING Do not immerse the sensor in water, solvents, or cleaning solutions (the sensors and connections are not waterproof). Do not use irradiation, steam, or ethylene oxide for sterilization.

Clean the reusable SpO_2 sensor with a 70% isopropyl alcohol solution and allow to air dry. Do not immerse the sensor or cable.

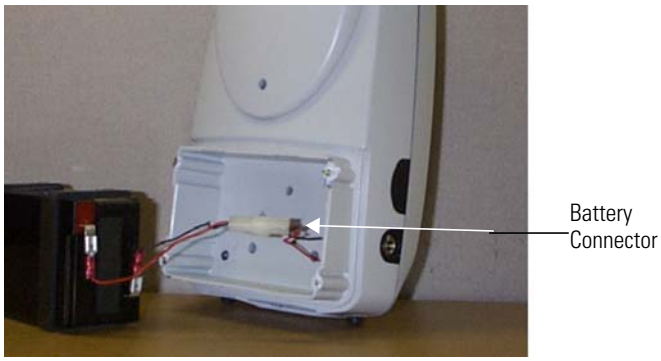
Every 3 months, inspect the temperature probe, SpO_2 cord, and accessories for fraying or other damage. Replace as necessary.

Battery removal and replacement

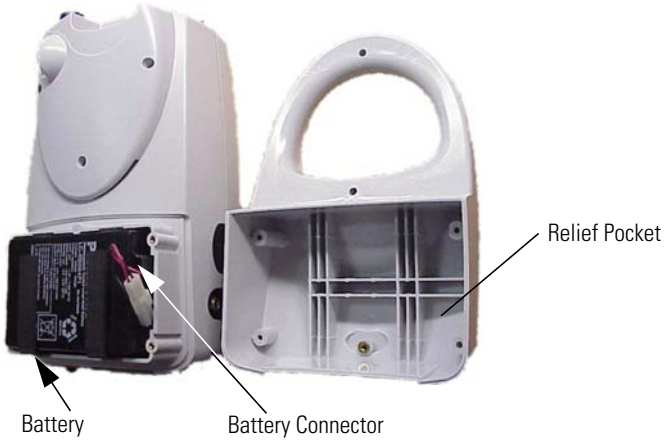
Caution Only use the Welch Allyn 4200-84 lead acid battery. Using the incorrect battery will cause damage to the Spot Vital Signs and void the warranty.

As necessary, replace the internal battery after heavy use or the battery no longer charges. Use a battery with the same part number.

1. Turn the Spot Vital Signs off and disconnect the DC power transformer cord.
2. Remove the 4 screws holding the battery door using a phillips-head screwdriver. Remove the battery door to expose the battery.
3. Tip the Spot Vital Signs to slide the battery out. Disconnect and discard the old battery per local regulations. Reconnect the new battery as shown as quickly as possible to prevent loss of power to the unit and subsequent loss of clock time.



4. Slide the new battery completely into the compartment. Lay the connector on the battery. The relief pocket in the battery door purposely provides sufficient clearance for the battery connector.



5. Replace the battery door and tighten each of the 4 screws.
6. Connect the AC power transformer to the Spot Vital Signs and charge the new battery for 16 hours. It is possible to use the Spot Vital Signs during this charging period.

The battery is a lead-acid battery. In the USA, call 1-800-SAV-LEAD for instructions on how to recycle. For users outside the US please contact your local authorities on recycling.

Masimo SpO_2 calibration check

Use a Masimo-approved SpO_2 simulator (Fluke Biotek Index 2 or Clinical Dynamics SmartSat) to check the SpO_2 accuracy. There is no way to change the calibration of the SpO_2 module. If the SpO_2 is out of calibration, contact Technical Service.

Nellcor SpO_2 functional check

Use a Nellcor SpO_2 simulator (SRC-MAX) to check the SpO_2 functionality. There is no way to change the functionality of the SpO_2 module. If the SpO_2 is not functioning properly, contact Technical Service.

SpO_2 accessory disposal

Dispose of all finger sensors and cables in accordance with facility, local, and goverment regulations.

Temperature calibration check

Use the 9600 Plus Calibration Tester to check the SureTemp thermometer accuracy. If the thermometer is out of calibration, contact Technical Service.

A Repair test specifications

This appendix refers to the Spot Vital Signs without pneumatics (tubing and cuff), temperature probe, SpO_2 probe, or main battery attached, unless otherwise noted.

Use the Repair Software for the performing the tests on the Spot Vital Signs. The standard test voltage, unless otherwise stated is 6.5 Vdc (+0/-0.25 Vdc). Unless otherwise stated, all calibrated volumes are ±10cc of the stated volume.

Unit software for the Spot Vital Signs is equal to or greater than "1.07" for "Spot" software (SW 1) and equal to or greater than "1.01" for ModB software (SW2). If the Unit has Nellcor SpO_2 (MP205 PCB), the SpO_2 software is equal to or greater than "1.2.0.0". If the Unit has Nellcor SpO_2 (MP506 PCB), the SpO_2 software is equal to or greater than "1.7.2.0". If the Unit has the temperature option, the temperature software is equal to or greater than "2.1".

General unit test

A-D noise test

The A-D Noise Test is defined as the amount of noise on the Spot Vital Signs A-D pressure channel; over a 1 second sample time while 0.0 mmHg is applied to the device pressure port. The maximum limit is 0.050 mmHg.

Leak test

The Leak Test is defined as the amount of pressure drop that is recorded over a 15-second interval with a 100cc cylinder attached to the Spot Vital Signs pressure port and that volume having a stabilized pressure of 250 mmHg. The limit is 5 mmHg maximum.

Inflation test

The Inflation Test is defined as the amount of time the Spot Vital Signs pump can inflate a 250 cc cylinder from 5 mmHg to 210 mHg. The limit is 7 seconds, maximum.

Dump test

The Dump Test is defined as the amount of time it takes Spot Vital Signs to deflate a 500 cc cylinder from 260 mmHg to less than 15 mmHg. The limit is 10 seconds.

Pneumatic calibration

Note Do not calibrate the Spot Vital signs if the internal temperature is greater than 89.9° F (32° C).

Calibrate the Spot Vital Signs with 0 and 250 mmHg applied to the pressure port with the following algorithm:

Adjust the pressure calibration **offset** value with the following formula. ((Last auto zero pressure value + current Unit pressure) **(** 16384) **/** (pressure offset correction value + pressure gain correction value). The pressure-offset value must be -15384 to 15384.

Verify that Spot Vital Signs successfully performs an auto zero.

Adjust the pressure gain value until the pressure deviation from the applied pressure is less than 0.1 mmHg. Continue to utilize the following formula until the pressure is less than 0.1 mmHg. (Applied pressure / Unit pressure) **(** pressure gain value. The pressure gain value must be 1000 to 31767.

When the pressure transducer calibration is performed (only when successful), a calibration signature (four printable characters) and the calibration date/time is stored in the Spot Vital Signs memory - any of four printable characters.

Pneumatic accuracy test

Enter the Internal Configuration Mode to perform this test (see "Internal configuration mode" on page 20).

Perform an Auto-zero before starting this test ("To verify the blood pressure calibration:", Step 1 on page 27 through Step 4 on page 27). The Pneumatic Accuracy test is defined as the comparison of Spot Vital Signs pressure measurement and applied pressure at 0, 50, 150, and 250 mmHg. The specification for each reading is within ±3 mmHg of the target pressure except for the 0 mmHg reading which is within ±1.0 mmHg.

Valve control test

Connect a 100 cc cylinder to the Spot Vital Signs pressure port and pressurize to 160 mmHg. Give Spot Vital Signs the commands to open the valve for 10 mmHg/s, 15 mmHg/s, and 25 mmHg/s. Record each pressure drop: 4 to 12 mmHg, 4 to 15 mmHg, and 4 to 25mmHg, respectively.

Voltage calibration

Calibrate the Spot Vital Signs battery voltage measurement circuit at 5.5 Vdc (+0.1/-0.0 Vdc). Verify the battery calibration factor is 14,384 to 18,384. (?)

After performing a successful battery measurement circuit calibration, Spot Vital Signs memory will store a calibration signature of up to four printable characters.

Blank mode current test

The Blank Mode Current Test is defined as the amount of current drawn through the battery terminals. All LCD segments, the back light, and the SpO_2 mode are all turned off. The limit is 200 mA maximum.

Back light (Idle) current test

The Back Light Current Test is defined as the amount of current drawn through the battery. All LCD segments and the back light are turned on while the SpO_2 mode is turned off. The limit is 400 mA maximum.

Valve/pump mode current test

The Valve/Pump Mode Current Test is defined as the amount of current that is drawn through the battery terminals; Spot Vital Signs is in the Blank Mode while the valve and pump are actuated to on. The limit is 700 mA maximum.

Interface test

When given the proper commands, the Display Window will turn on or off all segments and turn on or off the back light. When given the proper command, the buzzer sounds to verify operation. The user determines the pass/fail criteria.

Temperature option requirements

Accuracy test

Verify the accuracy of the temperature module is within ±0.2° F for readings with a nomal temperature of 97.3° F (36.3° C) using a Cal Key (5200-25). Verify Spot Vital Signs can read a temperature of 96.4° F (35.8° C) and 106° F (41.1° C) within ±0.3° F/±0.2° C using a Welch Allyn 9600 Plus Calibrator.

If using a water bath to take temperatures, verify the bath themperature is between 84° F and 106°F/28.8°C and 41.1°C. The reading must agree within (±1.0° F/0.8° C) measuring against a temperature stated that is accurate to within (±1.0° F/0.8° C).

Temperature probe test

Spot Vital Signs displays “188.8” and then “ORL” after you remove the oral probe from the probe housing.

SpO_2 option requirements

These tests are only valid on Spot Vital Signs models with the Masimo or Nellcor SpO_2 option.

SpO_2 functional test

See “Masimo” or “Nellcor” starting on page 24 for the functional test.

SpO_2 mode current test

The SpO_2 Mode Current Test is defined as the amount of current, less the Blank Mode Current, that is drawn through the battery terminals, placing Spot Vital Signs in the Blank

Mode, actuating the SpO_2 mode and applying any SpO_2 signal to the device. The maximum limit is 120 mA maximum.

Fail safe test

Over pressure test

Verify that Spot Vital Signs can detect over pressure on the pneumatic system between 296.0 mmHg and 329 mmHg.

Over 15 mmHg

Verify that Spot Vital Signs can detect static pressure over 15 mmHg for 180 seconds.

B Supplies and Accessories

Latex-free blood pressure

Table 1. Cuff and Bag Combination

Catalog #	Description	Catalog #	Description
5200-01	Cuff and bladder, adult, one tube	5200-10	Cuff and bladder, thigh, one tube
5200-02	Cuff and bladder, large adult, one tube	5200-03	Cuff and bladder, child, one tube

Table 2. One-Piece Cuff

Durable Cuff		Disposable Cuff	
Catalog #	**Description**	**Catalog #**	**Description**
5082-203-3	One-piece cuff, small child, one tube	5082-93-3	One-piece cuff, small child, one tube (box of 5)
5082-204-3	One-piece cuff, child, one tube	5082-94-3	One-piece cuff, child, one tube (box of 5)
5082-205-3	One-piece cuff, small adult, one tube	5082-95-3	One-piece cuff, small adult, one tube (box of 5)
5082-206-3	One-piece cuff, adult, one tube	5082-96-3	One-piece cuff, adult, one tube (box of 5)
5082-207-3	One-piece cuff, large adult, one tube	5082-97-3	One-piece cuff, large adult, one tube (box of 5)
5082-208-3	One-piece cuff, thigh adult, one tube	5082-98-3	One-piece cuff, thigh, one tube (box of 5)

Table 3. Replacement Cuffs and Bladders

Catalog #	Description	Catalog #	Description
5200-04	Adult Bladder, one tube	5082-01	Adult cuff (sleeve)
5200-05	Large Adult Bladder, one tube	5082-16	Large adult cuff (sleeve)
5200-06	Child Bladder, one tube	5082-18	Child cuff (sleeve)
5200-11	Thigh Bladder, one tube	5082-64	Thigh cuff (sleeve)

Table 4. Miscellaneous Blood Pressure Accessories

Catalog #	Description	Catalog #	Description
5200-12	Straight Pressure Hose (8ft./2.4M)	5200-08	Calibration T-Connector
5200-19	Straight Pressure Hose (5ft./1.5M)		

Pulse oximetry accessories and supplies

Masimo

Table 5. Adhesive Sensors: Single-Patient Use

Catalog #	Description	Weight Range
LNCS-ADTX	Adhesive Finger Sensor - Adult (20 per case)	>30 kg
LNCS-PDTX	Adhesive Finger Sensor - Pediatric (20 per case)	10 to 50 kg
LNCS INF-L	Adhesive Finger Sensor - Infant (20 per case)	3 to 20 kg
LNOP-ADT	Adhesive Adult sensor (20 per case)	>66 lbs (30 kg)
LNOP-PDT	Adhesive Pediatric sensor (20 per case)	22 to 110 lbs (10 to 50 kg)
LNOP INF-L	Adhesive Infant sensor (20 per case)	3 to 20 kg

Table 6. Reusable Sensor

Catalog #	Description	Weight Range	Quantity
LNCS-DCI	Finger sensor - adult	>66 lbs (30 kg)	1
LNCS-DCIP	Finger sensor - pediatric	10 to 50 kg	1
LNOP-DCI	Finger sensor - adult	>66 lbs (30 kg)	1
LNOP-DCIP	Finger sensor - pediatric	10 to 50 kg	1

Table 7. Sensor Cables

Catalog #	Description	Weight Range	Quantity
LNC-4-WA	4-foot cable with DB-9 connector for LNCS	NA	1
LNC-10-WA	10-foot cable with DB-9 connector for LNCS	NA	1
PC-04-WA	4-foot cable with DB-9 connector for LNOP	NA	1
PC-08-WA	8-foot cable with DB-9 connector for LNOP	NA	1

Nellcor

Table 8. OxiMax Adhesive Sensors: Single-patient use

Catalog #	Description	Weight Range	Quantity
MAX-AI	Adult sensor	>30 kg	24
MAX-PI	Pediatric sensor	10 - 50 kg	24
MAX-II	Infant sensor	3-20 kg	24
MAX-RI	Adult nasal sensor	>50 kg	24
SRC-MAX	Portable oximetry tester		

Table 9. OxiMax OxiCliq® Sensors: Reusable cable

Catalog #	Description	Weight Range	Quantity
OC-3	OxiCliq sensor cable (3 ft)		1
OXICLIQ PI	Pediatric oxygen transducer, user with OC-3 cable	10 - 50 kg	Case of 24

Table 10. OxiMax Reusable Sensors

Catalog #	Description	Weight Range	Quantity
DS-100A	Durasensor® adult oxygen transducer	>40 kg	1
OXI-A/N	Oxiband® OXI-A/N, adult/neonatal* transducer	<3 kg or >40 kg	1 sensor/50 wraps
OXI-P/I	Oxiband OXI-P/I, pediatric/infant transducer	3 - 40 kg	1 sensor/50 wraps
D-YS	Dura-Y® oxygen transducer	>1 kg	1 sensor/40 wraps
D-YSE	Ear clip (use with Dura-Y sensor)	>30 kg	1
D-YSPD	PediCheck™ pediatric spot-check sensor (use with Dura-Y sensor)	3 - 40 kg	1

Table 11. OxiMax Sensor Cables

Catalog #	Description	Quantity
DEC-4	SpO_2 extension cable, 4 ft.	1
DEC-8	SpO_2 extension cable, 8 ft.	1

* The Welch Allyn Spot Vital Signs is not intended for use on neonatal patients.

Temperature

Table 12. Accessories and Supplies

Catalog #	Description	Catalog #	Description
02678-100	Oral/axillary probe (9ft./2.7M)	05031-110	Disposable probe covers (10,000 covers, 25/box)
02679-100	Rectal probe (9ft./2.7M)	06137-000	Temperature Calibration Key
05031-101	Disposable probe covers (1,000 covers, 25/box)	01802-110	Model 9600 Plus Calibration Tester

Mounting

Table 13. Accessories and Supplies

Catalog #	Description	Catalog #	Description
4200-60	Mobile Stand	4200-64	IV Pole Mount
4200-62	Wall Mount	4200-70	Anti-Theft Kit

Extended warranty

Table 14. One-year extended warranty

Catalog #	Description	Catalog #	Description
4200-00B	Model 4200B	4200-M0B	Model 42M0B
4200-OTB	Model 420TB	4200-NTB	Model 42NTB
4200-N0B	Model 42N0B	4200-MTB	Model 42MTB

Miscellaneous

Table 15. Accessories and Supplies

Catalog #	Description	Catalog #	Description
4200-84	Lead Acid Battery	5200-101A	AC Power Transformer (US/Canada/Japan)-120V, 60Hz
4200-87X*	Directions for Use	5200-103A	AC Power Transformer (Europe/UK) -240V, 50Hz
4200-88X*	Quick Reference/Error Code Card	5200-103Z	AC Power Transformer (Australia) - 240V, 50Hz
4200-155	Inservice CD (English only)	76400	Line Cord (US/Canada/Japan)
4200-89E	Service Manual (English only)	76402	Line Cord (Europe)
4200-100	Carrying Case	76404	Line Cord (UK)
4200-170	Connectivity Accessory Kit	76406	Line Cord (Australia)
53600	Printer paper (24 rolls)	4200-250	Pediatric accessory kit (small child, child, small adult cuffs and Nellcor SpO_2 sensor)
53600B	Printer paper (4 rolls)	4200-350	Pediatric accessory kit (small child, child, small adult cuffs and Masimo SpO_2 sensor)

* Replace the "X" with the following letter abbreviation to order the appropriate language manual.

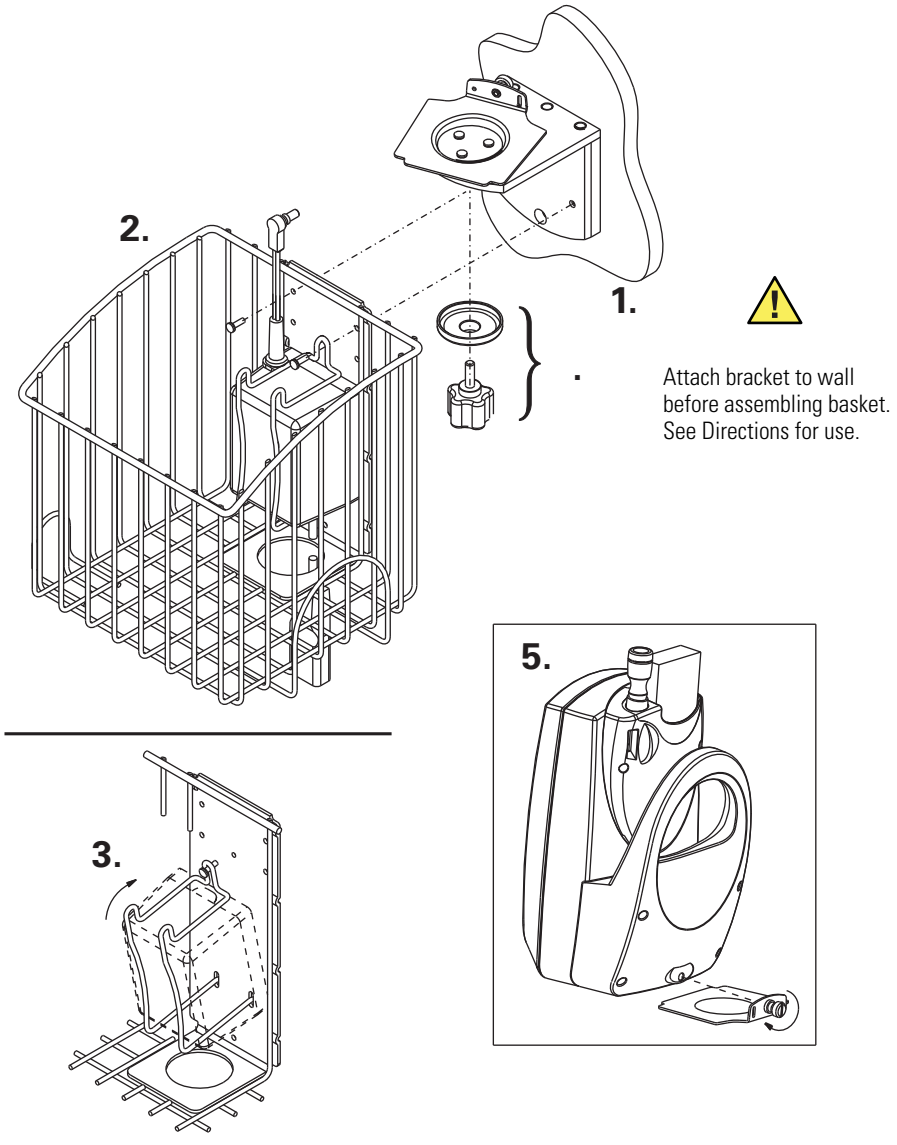
Table 16. Printed Material Language List

Language Abbreviation	Language	Language Abbreviation	Language	Language Abbreviation	Language
E	English	G	Deutsch	PO	Polish
C	Chinese	I	Italiano	P	Português
DK	Dansk	N	Norsk	S	Español
F	Français	NL	Nederlands	SW	Svensk
FI	Suomi				

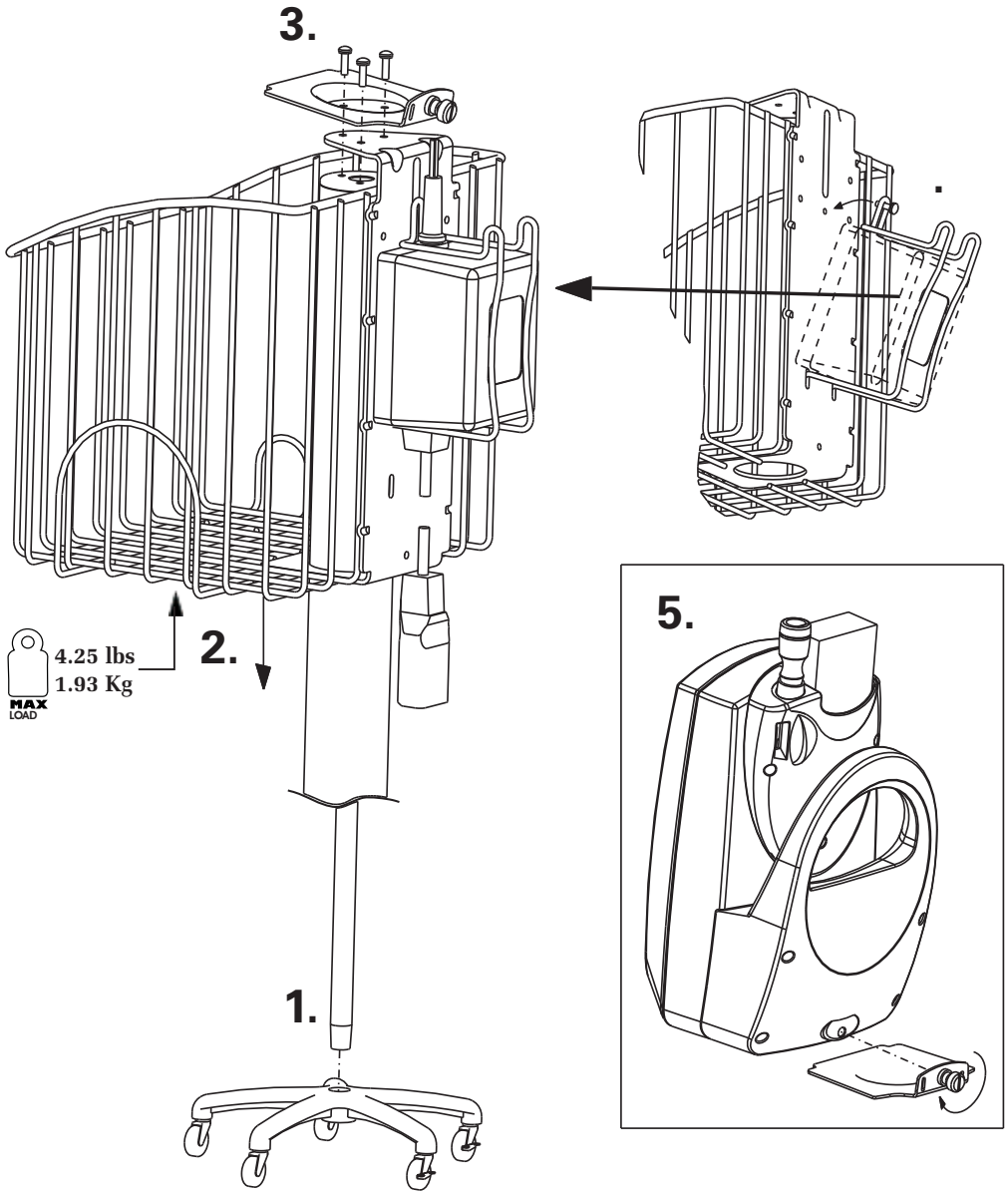
C Miscellaneous Mounting Accessories

Wall mount kit (REF 4200-62)

Caution Attach Bracket to wall before assembling basket. See Directions for Use. Welch Allyn is NOT responsible for the integrity of any Wall or IV pole mounting interface. Welch Allyn recommends that the customer contact their Biomedical Engineering department or maintenance service to ensure professional installation, safety, and reliability of any mounting accessory.

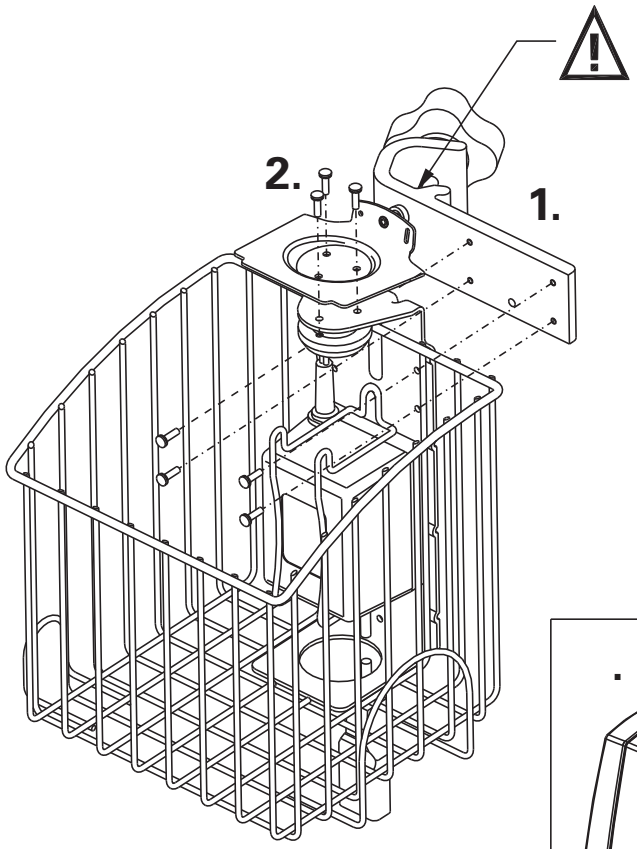


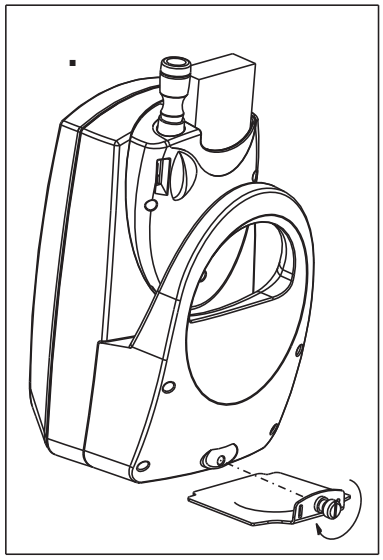
Mobile stand kit (REF 4200-60)

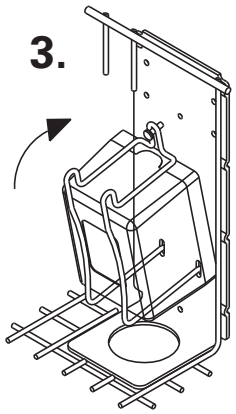


IV pole mount accessory (REF 4200-64)

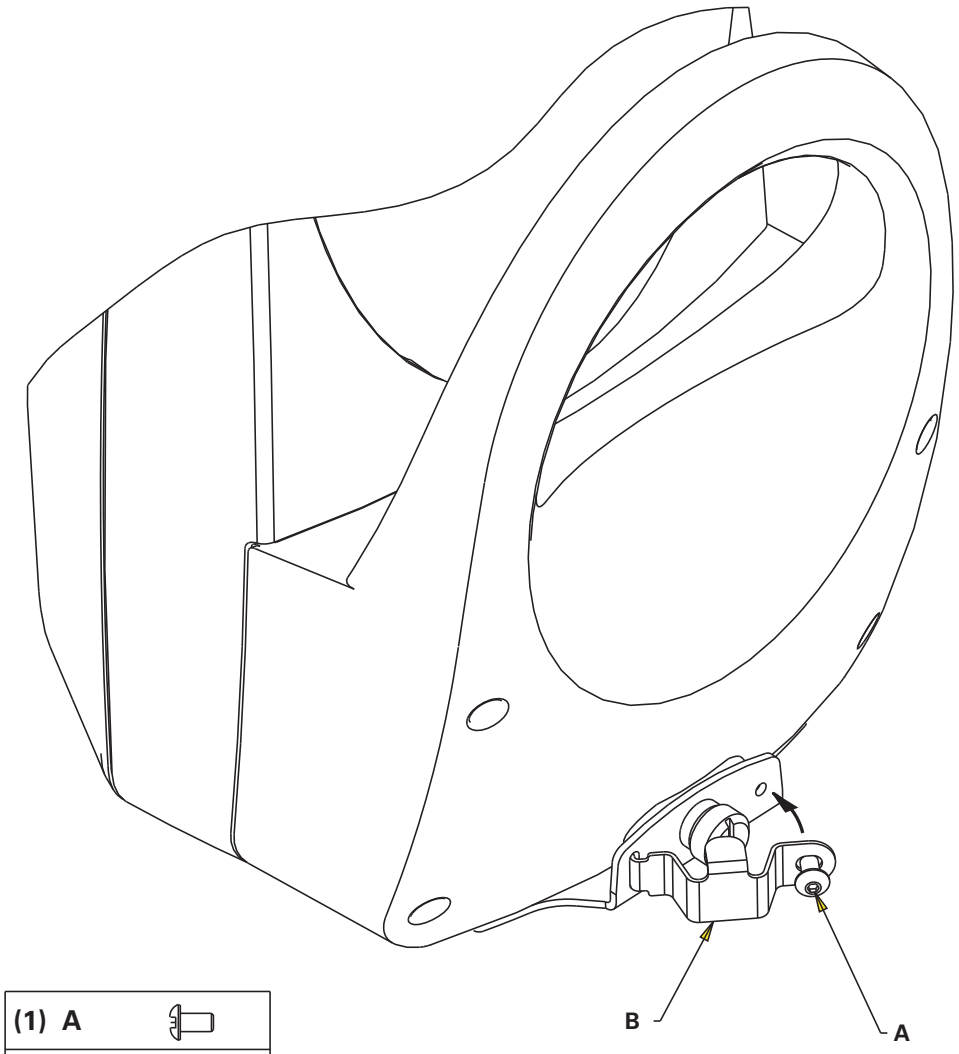
Caution Welch Allyn is NOT responsible for the integrity of any Wall or IV pole mounting interface. Welch Allyn recommends that the customer contact their Biomedical Engineering department or maintenance service to ensure professional installation, safety, and reliability of any mounting accessory

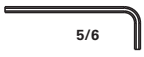






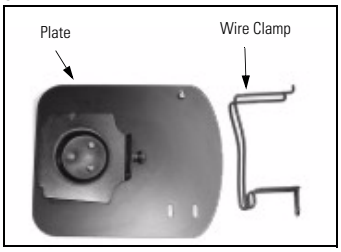
Anti-theft kit (REF 4200-70)



(1) A	
(1) B	
(1) -	

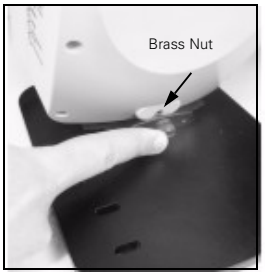
Transformer mounting plate accessory (REF 4200-75)

The Transformer Mounting Plate Kit

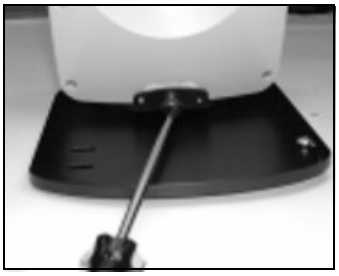


1. Align the bottom of the Spot Vital Signs with the mounting plate.

2. Slide the Spot Vital Signs onto the mounting plate and start integral screw into brass nut located on the back of the Spot unit.



3. Tighten the integral screw until snug. Do not overighten. Verify the Spot Vital is fastened securely to the transformer mounting plate.



4. Remove the wire clamp screw and save it for later use.

5. Place the transformer onto the mounting plate.

6. Place the wire clamp over the transformer and hook the two ends into the slots. The ends must slip underneath the plate.

7. Replace the screw and firmly tighten it down so that the clamp is secure.

IR dongle mounting accessory (REF 4200-170)

INSTALLATION INSTRUCTIONS:

Step 1 - Remove rubber base from IR dongle

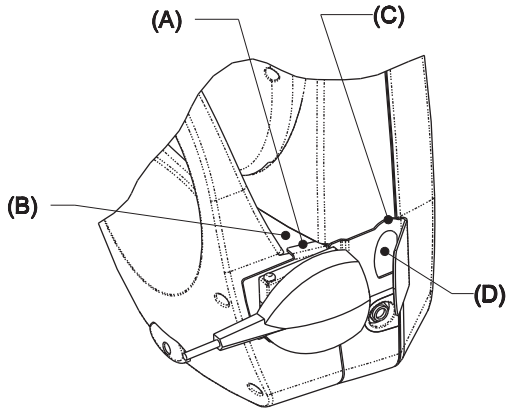
Step 2 - Place IR dongle into bracket clamps

Step 3 - Tighten screws

Step 4 - Clean side of device housing using alcohol wipe

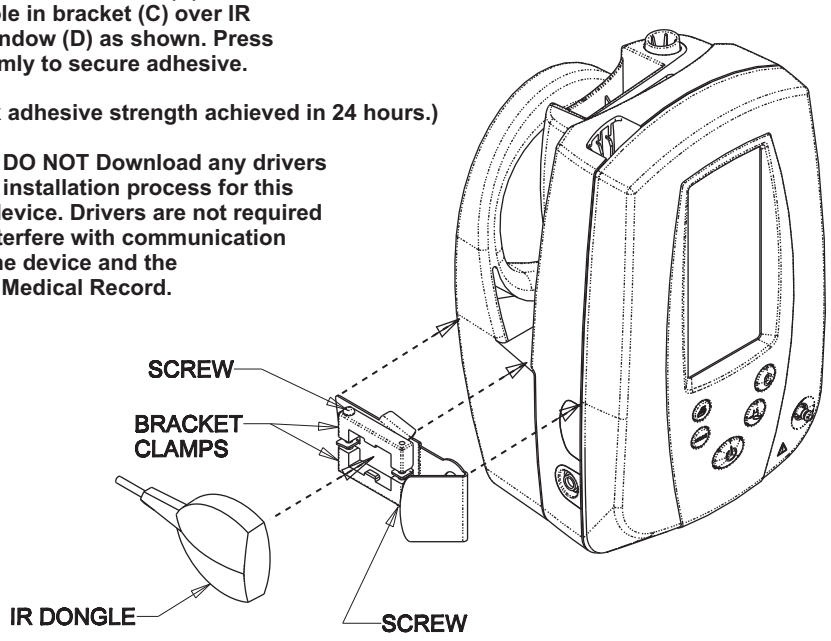
Step 5 - Remove adhesive protective paper from back of bracket

Step 6 - Place bracket flange (A) on device surface (B) and hole in bracket (C) over IR window (D) as shown. Press firmly to secure adhesive.



(Note: Max adhesive strength achieved in 24 hours.)

CAUTION: DO NOT Download any drivers during the installation process for this IR Rs232 device. Drivers are not required and will interfere with communication between the device and the Electronic Medical Record.



Warranty

Spot Vital Signs

Welch Allyn warrants Spot Vital Signs, when new, to be free of defects in material and workmanship and to perform in accordance with manufacturer's specifications for a period of two years from the date of purchase from Welch Allyn or its authorized distributors or agents. The battery is covered by a one-year warranty against original defects in material or workmanship. Welch Allyn will either repair or replace any components found to be defective or at variance from manufacturer's specifications within this time at no cost to the customer. It shall be the purchaser's responsibility to return Spot Vital Signs to Welch Allyn or an authorized distributor, agent, or service representative. This warranty does not include breakage or failure due to tampering, misuse, neglect, accidents, modification, or shipping. This warranty is also void if the instrument is not used in accordance with manufacturer's recommendations or if repaired by other than Welch Allyn or an authorized agent. Purchase date determines warranty requirements. No other express warranty is given.

Remember to submit the instrument registration/warranty card for warranty validation. Complete the information and mail the pre-addressed card to Welch Allyn.

Accessories

The Masimo finger sensor and cable are covered by a six-month warranty against original defects in material or workmanship.

The Nellcor DS-100A is covered by a one-year warranty and the Nellcor DEC-4 cable is covered by a three-month warranty against original defects in material or workmanship.

The Reusable Two-Piece Blood Pressure Cuff is covered by a two-year warranty against original defects in material or workmanship.

The SureTemp probe is covered by a one-year warranty against original defects in material and workmanship. Probe covers are intended for single-use only.

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Welch Allyn®

Advancing Frontline Care™

Reorder No. 4200-89E
Material No. 718448 Ver A