



**Hillrom™**

# Welch Allyn® Spot Vital Signs 4400



## Service manual

Software version 1.X

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VITAL SIGNS DEVICE.



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# Symbols and definitions

## Documentation symbols

For information on the origin of these symbols, see the Welch Allyn symbols glossary: <https://www.hillrom.com/content/dam/hillrom-aem/us/en/sap-documents/LIT/80022/80022945LITPDF.pdf>.

	<b>WARNING</b> The warning statements in this manual identify conditions or practices that could lead to illness, injury, or death. Warning statements appear with a grey background in a black and white document.
	<b>CAUTION</b> The caution statements in this manual identify conditions or practices that could result in damage to the equipment or other property, or loss of data.
	Follow instructions/directions for use (IFU) -- mandatory action. A copy of the IFU is available on this website. A printed copy of the IFU can be ordered from Welch Allyn for delivery within 7 calendar days.

## Power symbols

	Stand-By		Direct current (DC)
	Power plug		Battery absent or faulty
	Alternating Current power present, battery fully charged		Battery charge level
	Alternating Current power present, battery is charging		Battery

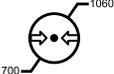
	Alternating current (AC)		Rechargeable battery
	Rated power input, DC		Rated power input, AC
<b>Li-ion</b>	Lithium-ion battery		Protective Earth (PE)

## Connectivity symbols

	USB
---	-----

## Miscellaneous symbols

	Manufacturer		Defibrillation-proof Type BF applied parts
	Reorder Number		Serial Number
	Product Identifier		Recyclable
	Do not reuse, Single use device		Separate collection of Electrical and Electronic Equipment. Do not dispose as unsorted municipal waste.
IPX2	IP = International Protection Marking X = No object ingress rating 2 = Protected against vertically falling water drops when enclosure tilted up to 15°		Call for maintenance
	This way up		Fragile

	Authorized Representative in the European Community		This device has no alarms.
	Temperature limit		Global Trade Item Number
	Stacking limit by number		Keep dry
	Humidity limitation		Atmospheric pressure limitation
	Medical Device		Prescription only or "For Use by or on the order of a licensed medical professional"
	Non-ionizing electromagnetic radiation		

## Mobile stand symbols

	Maximum safe working load limits		Mass in kilograms (kg)
	<b>CAUTION</b> The caution statements in this manual identify conditions or practices that could result in damage to the equipment or other property, or loss of data.		

## Screen symbol

	Process indicator for activities like acquiring measurements and connecting to a laptop
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## About warnings and cautions

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Warning and caution statements can appear on the device, on the packaging, on the shipping container, or in this document.

The device is safe for patients and clinicians when used in accordance with the instructions and the warning and caution statements presented in this manual.

Before using the device, familiarize yourself with the sections of this manual that pertain to your use of the device.



**WARNING** The warning statements in this manual identify conditions or practices that could lead to illness, injury, or death.



**CAUTION** The caution statements in this manual identify conditions or practices that could result in damage to the equipment or other property, or loss of patient data.

## General warnings and cautions



**WARNING** Patient injury risk. Many environmental variables, including patient physiology and clinical application, can affect the accuracy and performance of the device. Therefore, you must verify all vital signs information, especially NIBP and SpO<sub>2</sub>, before treating the patient. If there is any question about the accuracy of a measurement, verify the measurement using another clinically accepted method.



**WARNING** Personal injury risk. The power cord plug is the disconnect device used to isolate this equipment from supply mains. Position the equipment so that it is not difficult to reach or disconnect the plug.



**WARNING** Patient injury risk. Damaged cords, cables, and accessories can affect patient and operator safety. Never lift the device by the power supply cord or patient connections. Routinely inspect the AC power cord, blood pressure cuff, SpO<sub>2</sub> cable, and other accessories for strain relief wear, fraying, or other damage. Replace as necessary.



**WARNING** Patient injury risk. During defibrillation, keep discharge paddles away from device sensors and other conductive parts in contact with the patient.



**WARNING** Patient injury risk. Any external compression of the blood pressure hose or cuff or kinked tubing may cause patient injury, system errors, or inaccurate measurements.



**WARNING** Patient injury risk. Wash hands to reduce the risk of cross-contamination and nosocomial infection.



**WARNING** Patient injury risk. Do not place the device in any position that might cause it to fall on the patient.



**WARNING** Patient injury risk. Do not place the cuff on the arm on the same side of a mastectomy or lymph node clearance. If necessary, use the femoral artery in the thigh to take a measurement.



**WARNING** Patient injury risk. Inaccurate measurement risk. Do not place the cuff where it can disturb proper circulation. Do not place the cuff on any area where circulation is compromised or on any extremity used for intravenous infusions. Do not place the cuff on any limb where intravascular access or therapy, or an arterio-vascular (A-V) shunt is present. Observe the limb concerned to ensure that operation of the device does not result in prolonged impairment of circulation.



**WARNING** Patient injury risk. Inaccurate measurement risk. Do not use an SpO<sub>2</sub> finger clip sensor and a blood pressure cuff simultaneously on the same limb. Doing so may cause a temporary loss of pulsatile flow, resulting in either no reading or an inaccurate SpO<sub>2</sub> or pulse rate until the flow returns.



**WARNING** Do not apply cuff to areas on patient where skin is delicate or damaged, as this can cause further injury. Check cuff site frequently for irritation.



**WARNING** Equipment failure and patient injury risk. Do not cover the air intake or exhaust vents on the rear and base of the device. Covering these vents could cause overheating of the device.



**WARNING** This equipment is not suitable for use in the presence of electro-surgery.



**WARNING** For operator and patient safety, peripheral equipment and accessories that can come in direct patient contact must comply with all applicable safety, EMC, and regulatory requirements.



**WARNING** Equipment damage and personal injury risk. When transporting the device on a mobile stand, properly secure all patient cables and cords to keep them clear of the wheels and to minimize trip hazards.



**WARNING** Equipment damage and personal injury risk. No modifications to the device are allowed by anyone other than a qualified Welch Allyn service representative. Modification of the device could be hazardous to patients and personnel.



**WARNING** Electric shock hazard. This equipment must only be connected to a supply mains with protective earth.



**WARNING** Electric shock hazard. All signal input and output (I/O) connectors are intended for connection of only devices complying with IEC 60601-1, or other IEC standards (for example, IEC 60950), as applicable to the device. Connecting additional devices to the device may increase chassis or patient leakage currents. Measure the leakage currents to confirm that no electric shock hazard exists.



**WARNING** Explosion or contamination hazard. Improper disposal of batteries may create an explosion or contamination hazard. Never dispose of batteries in refuse containers. Always recycle batteries according to local regulations.



**WARNING** Inaccurate measurement risk. The device is not intended for use during patient transport outside of the medical facility. Do not use the device to take measurements on any patient in transit.



**WARNING** Inaccurate measurement risk. Do not connect more than one patient to a device.



**WARNING** Inaccurate measurement risk. Dust and particle ingress can affect the accuracy of blood pressure measurements. Use the device in clean environments to ensure measurement accuracy. If you notice dust or lint build-up on the device's vent openings, have the device inspected and cleaned by a qualified service technician.



**WARNING** Inaccurate measurement risk. Do not expose to temperatures higher than 122° F (50° C).



**WARNING** Inaccurate measurement risk. Do not use the device on patients who are on heart-lung machines.



**WARNING** Inaccurate measurement risk. Do not use the device on patients who are experiencing convulsions or tremors.



**WARNING** Liquids can damage electronics inside the device. Prevent liquids from spilling on the device.

If liquids are spilled on the device:

1. Power down the device.
2. Disconnect the power plug.
3. Remove battery pack from the device.
4. Dry off excess liquid from the device.



**NOTE** If liquids possibly entered the device, remove the device from use until it has been properly dried, inspected, and tested by qualified service personnel.

5. Reinstall battery pack.
6. Reconnect the power plug.
7. Power on the device and verify that the device functions normally before using it.



**WARNING** The device may not function properly if dropped or damaged. Protect it from severe impact and shock. Do not use the device if you notice any signs of damage. Qualified service personnel must check any device that is dropped or damaged for proper operation before putting the device back into use.



**WARNING** Defective batteries can damage the device. If the battery shows any signs of damage or cracking, it must be replaced immediately and only with a battery approved by Welch Allyn.



**WARNING** Personal injury risk. Improper handling of the battery can lead to heat generation, smoke, explosion or fire. Do not short-circuit, crush, incinerate, or disassemble the battery. Never dispose of batteries in refuse containers. Always recycle batteries according to national or local regulations.



**WARNING** Use only Welch Allyn approved accessories, and use them according to the manufacturer's directions for use. Using unapproved accessories with the device can affect patient and operator safety and can compromise product performance and accuracy, and void the product warranty.



**WARNING** Welch Allyn is not responsible for the integrity of a facility's power. If the integrity of a facility's power or protective earth conductor is in doubt, always operate the device on battery power alone when it is attached to a patient.



**WARNING** The use of the Spot Vital Signs 4400 device adjacent to or stacked with other equipment or medical electrical systems should be avoided because it could result in improper operation. If such use is necessary, the Spot Vital Signs 4400 and other equipment should be observed to verify that they are operating normally.



**WARNING** Use only accessories and cables Welch Allyn recommends for use with the Spot Vital Signs 4400 device. Accessories and cables not recommended by Welch Allyn may affect the EMC emissions or immunity.



**WARNING** Maintain minimum separation distance of 12 inches (30 cm) between any part of the Spot Vital Signs 4400 device and portable RF communication equipment (including peripherals such as antenna cables and external antennas). Performance of the Spot Vital Signs 4400 device might degrade if proper distance is not maintained.



**WARNING** Use of accessories, transducers, and cables other than those specified may result in degraded electromagnetic compatibility performance of this device.



**WARNING** Use of accessories, transducers, and cables other than those specified may result in increased emissions or decreased immunity of the device.



**WARNING** Patient harm and equipment damage risk. Carefully route patient cords and cables to reduce the possibility of patient entanglement. When transporting the Spot Vital Signs device on a mobile stand, properly secure all patient cords and cables to keep them clear of the wheels and to minimize trip hazards.



**WARNING** Strangulation risk. The cords and cables can wrap around the patient's neck. When used on children or vulnerable patient populations, the Spot Vital Signs 4400 device accessories must only be applied with special care and under permanent supervision. When used on adults, caution should be taken.



**WARNING** Choking risk. An oral probe cover enters the patient's mouth when taking oral temperatures. When inserting the probe tip inside the mouth of a patient, ensure that the probe cover remains on the probe tip to avoid the risk of the patient choking on the probe cover. When using on children or vulnerable patient populations, the Spot Vital Signs 4400 device must only be used with special care and under permanent supervision. When used on adults, caution should be taken.



**WARNING** Verify the patient vitals data for each entry on the Spot Vital Signs 4400 device before transferring patient records.



**CAUTION** This device is not intended for use in the home healthcare environment.



**CAUTION** Do not operate the device in the presence of magnetic resonance imaging (MRI) or hyperbaric chambers.



**CAUTION** Electric shock hazard. Do not sterilize the device. Sterilizing the device could damage the device.



**CAUTION** United States Federal law restricts this device to sale, distribution, or use by or on the order of a physician or licensed healthcare professional.



**CAUTION** Electromagnetic interference risk. The device complies with applicable domestic and international standards for electromagnetic interference. These standards are intended to minimize medical equipment electromagnetic interference. Although this device is not expected to present problems to other compliant equipment or be affected by other compliant devices, interference issues still may occur. As a precaution, avoid using the device in close proximity to other equipment. In the event that equipment interference is observed, relocate the equipment as necessary or consult manufacturer's directions for use.



**CAUTION** Do not move the stand while the power source is plugged into the mains outlet.



**CAUTION** Do not sterilize the device. Sterilizing the device could harm the device.



**CAUTION** Use only a Class I (grounded) AC power cord to charge the power source for the device.



**CAUTION** Never move the device or mobile stand by pulling on any of the cords. This may cause the device to tip over or damage the cord. Never pull on the power cord when disconnecting the cord from the mains outlet. When disconnecting the power cord, always grasp the attachment plug. Keep the cord away from liquids, heat, and sharp edges. Replace the power cord if the strain relief, cord insulation, or metal prongs are damaged or begin to separate from the attachment plug.



**CAUTION** Do not exceed the maximum weight limits for your mobile stand with basket or bins. See the "Specifications" section of the device's *Instructions for use* for the basket/bin and mobile stand maximum weight limits.



**CAUTION** Use only the Welch Allyn USB client cable to connect a laptop computer to the USB client port. Any laptop connected to the device must be running on a battery, a 60601-1 compliant power supply, or a 60601-1 compliant isolation transformer.



**CAUTION** If the touchscreen is not responding properly, refer to the troubleshooting section. If the problem cannot be resolved, discontinue use of the device and contact an authorized Welch Allyn service center or qualified service personnel.



**CAUTION** If the device stops operating within its design specifications, remove it from service and have it inspected by a qualified service person.

## Residual risk information

This product complies with relevant electro-magnetic interference, mechanical safety, performance, and biocompatibility standards. However, the product cannot completely eliminate potential patient or user harm from the following:

- Harm or device damage associated with electro-magnetic interference,
- Harm from mechanical hazards,
- Harm from device, function, or parameter unavailability,
- Harm from misuse error, such as inadequate cleaning, and/or
- Harm from device exposure to biological triggers that may result in a severe systemic allergic reaction.

## Adverse event reporting statement (notice to users and/or patients)

Notice to Users and/or Patients in EU: Any serious incident that has occurred in relation to the device, should be reported to the manufacturer and the competent authority of the Member State in which the user and/or patient is established.

## Safety

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All users of the device must read and understand all safety information presented in this manual before using or repairing the device.

United States federal law restricts this device to sale, distribution, or use by or on the order of a licensed medical practitioner.

### General safety considerations

- If the device detects an unrecoverable problem, it displays an error message. For more information, see “Troubleshooting.”
- To ensure patient safety, use only accessories recommended or supplied by Welch Allyn. (See the accessories list in the Appendix of the Instructions for use.) Always use accessories according to your facility’s standards and according to the manufacturer’s recommendations and instructions. Always follow the manufacturer’s directions for use.
- Welch Allyn recommends that only Welch Allyn service personnel or an authorized repair center perform warranty service. Performing unauthorized service on a device that is within warranty may void the warranty.

### Electrostatic discharge (ESD)



**CAUTION** Electrostatic discharge (ESD) can damage or destroy electronic components. Handle static-sensitive components only at static-safe workstation.



**CAUTION** Assume that all electrical and electronic components of the device are static-sensitive.

Electrostatic discharge is a sudden current flowing from a charged object to another object or to ground. Electrostatic charges can accumulate 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 device 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.

# Overview

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## Purpose and scope

This service manual is a reference for periodic preventive maintenance and corrective service procedures for the Welch Allyn Spot Vital Signs 4400 device. It is intended for use only by trained and qualified service personnel.

Corrective service is supported to the level of field-replaceable units. These include circuit-board assemblies and some subassemblies, case parts, and other parts.



**WARNING** When performing a service procedure, follow the instructions exactly as presented in this manual. Failure to do so could damage the device, invalidate the product warranty, and lead to serious personal injury.



**CAUTION** No component-level repair of circuit boards and subassemblies is supported. Use only the repair procedures described in this manual.

Find instructions for functional testing and performance verification in the Welch Allyn Service Tool help files.

This manual applies only to this device. For servicing of any other vital signs device, see the service manual for the specific device.

Service work not described in this manual must be performed by qualified service personnel at the factory or at an authorized Welch Allyn service center.

## Related documents

When using this manual, refer to the following:

- *Welch Allyn Spot Vital Signs 4400 Instructions for use* (on the user documentation CD)
- Welch Allyn Service Tool:  
<https://www.hillrom.com/en/services/welch-allyn-service-tool/>
- *Welch Allyn Service Tool Installation and configuration guide*:  
<https://www.hillrom.com/en/services/welch-allyn-service-tool/>
- *Welch Allyn 9600 Plus Calibration Tester Directions for use*  
<https://assets.hillrom.com/is/content/hillrom/80020333LITPDFpdf>
- Hillrom website: [hillrom.com](http://hillrom.com)

## Technical support services

Welch Allyn offers the following technical support services:

- Telephone support
- Loaner equipment
- Service agreements
- Service training
- Replacement service parts
- Product service

For information on any of these services, go to this site:

<https://www.hillrom.com/en/services/>

## Service loaners

For warranty or non-warranty repairs not covered under a support agreement, loaners are available for a nominal charge, subject to availability. Payment is required prior to shipment for all loaners not covered under a support agreement. The loaner fee can be found on the Welch Allyn loaner price list.

Welch Allyn Service Centers that provide repair service for this product can, on request, loan a device for use while the device is being repaired. Loaned devices are provided free of charge for products repaired while under a support agreement that includes a free loaner provision.

## Service options

### **SmartCare™ services for maintenance and repair**

While product warranties provide basic assurance of Welch Allyn hardware quality, they may not include the full range of services and support you need. Welch Allyn offers premium service and support through our *SmartCare* program. Whether you service your own devices and require a minimum of support or rely on us to service your device, Welch Allyn provides a program that will meet your needs. For more information visit our web site at <https://www.hillrom.com/en/services/> or call your sales representative.

### **Warranty service**

All repairs on products under warranty must be performed or approved by Welch Allyn. Refer all warranty service to Welch Allyn Product Service or another authorized Welch Allyn Service Center. Obtain a Return Material Authorization (RMA) number for all returns to Welch Allyn Product Service from our website: <https://www.welchallyn.com/en/service-support/submit-a-repair.html>.



**CAUTION** Unauthorized repairs will void the product warranty.

### **Non-warranty service**

Welch Allyn Product Service Centers and Authorized Service Providers support non-warranty repairs. Contact any Welch Allyn regional service center for pricing and service options.

Welch Allyn offers modular repair parts for sale to support non-warranty service. This service must be performed only by qualified end-user biomedical/clinical engineers using this service manual.

Service training is available from Welch Allyn for biomedical/clinical engineers. For information, go to this site:

<https://www.hillrom.com/en/knowledge/technical-training/>

## Repairs

A Welch Allyn Service Center or Authorized Service Provider must perform all repairs on products under warranty unless you are a properly certified technician that has successfully completed a Welch Allyn Technical Training course. More information on Technical Training can be obtained from your sales representative or by visiting <https://www.hillrom.com/en/knowledge/technical-training/>.



**CAUTION** Unauthorized repairs will void the product warranty.

Qualified service personnel or a Welch Allyn Service Center should repair products out of warranty.

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.

### Welch Allyn Technical Support

If you have a problem with the device that you cannot resolve, call the Welch Allyn Technical Support Center nearest you for assistance. A representative will assist you in troubleshooting the problem and will make every effort to solve the problem over the phone, potentially avoiding an unnecessary return.

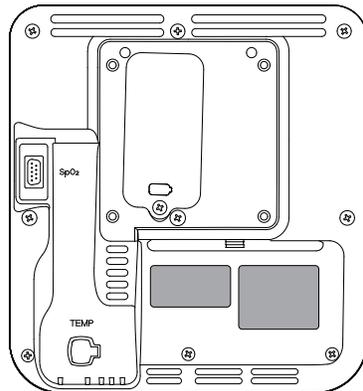
If your product requires warranty, extended warranty, or non-warranty repair service, a Welch Allyn Technical Support representative will record all necessary information to issue an RMA number. The support representative will provide you with the address of the Welch Allyn Service Center to send your device to.

Technical support is available during local business hours.

## Returning products

When returning a product to Welch Allyn for service, ensure that you have the following information:

- Product name, model number, and serial number. This information may be found on the product and serial number labels on the back housing.



- A complete return shipping address.

- A contact name and phone number.
  - Any special shipping instructions.
  - A purchase-order number or credit-card number if the product is not covered by a warranty.
  - A full description of the problem or service request.
1. Obtain an RMA number. Either contact Welch Allyn and request an RMA number or visit us on the web:

<https://www.hillrom.com/en/services/>.



**NOTE** Welch Allyn does not accept returned products without an RMA.

2. Ship the device to Welch Allyn, observing these packing guidelines:
  - a. Remove from the package the battery, all hoses, connectors, cables, sensors, power cords, and other ancillary products and equipment, except those items that might be associated with the problem.

#### **Recommendations for returning Lithium-ion batteries**

- Use ground transportation to return batteries.
- If returning multiple batteries, package each battery individually.
- Do not consolidate multiple batteries in a single package.
- Use packaging provided by Welch Allyn or the battery manufacturer.
- Do not pack a defective battery in checked or carry-on baggage if traveling by air.

#### **Packaging**

- If you return the battery with the device, remove the battery, seal the battery in an antistatic plastic bag, and place the battery in the position reserved for the battery near the device in the original shipping carton.
- If you return the battery separately, package the battery in the replacement battery's plastic bag and shipping box.

If the original shipping carton or replacement battery shipping box is unavailable, consult the manufacturer website for information about shipping Lithium-ion batteries.



**WARNING** Safety risk. Do not ship any battery that has been physically damaged or shows signs of leakage unless you receive specific instructions which meet the requirements for the shipment of Lithium-ion batteries. Dispose of damaged or leaking batteries in an environmentally safe manner consistent with local regulations.



**NOTE** In the United States, the applicable regulations can be found in the Code of Federal Regulations (CFR). Refer to 49 CFR 173.185 for shipping Lithium-ion batteries by air or ground. Use 49 CFR 172.102 sections A54 and A101 to find the special provisions for shipping Lithium-ion batteries.

- b. Clean the device.



**NOTE** To ensure safe receipt of your device by the service center and to expedite processing and return of the device to you, **thoroughly clean all residues from the device before you ship it to Welch Allyn.**

If a returned device is found to be contaminated with bodily fluids, it will be returned at the owner's expense. United States federal regulations prohibit the processing of any device contaminated with blood-borne pathogens. Welch Allyn thoroughly cleans all returned devices on receipt, but any device that cannot be adequately cleaned cannot be repaired.

- c. Put the device, enclosed in a plastic bag **with a packing list**, into the original shipping carton with the original packing materials or into another appropriate shipping carton.
- d. Write the Welch Allyn RMA number with the Welch Allyn address on the outside of the shipping carton.

## Recommended service intervals

To confirm that the device is functioning within design specifications, perform periodic service as indicated in the following table. The device has no specific use time limitation. The device may remain in service until repair is required or operation indicates that it is out of calibration.

Component	Service interval	Service procedure
NIBP module	Annually	Basic functional verification
SpO2 module	Annually	Basic functional verification
SureTemp Plus	Annually	Basic functional verification
Battery	Semi-annually <sup>1</sup>	Replace the battery

<sup>1</sup> Battery performance is a function of clinical use and charge/discharge patterns. Welch Allyn recommends replacing the battery after six months or when its remaining capacity no longer meets workflow requirements.

Customers who have the Standard unlicensed edition of the Welch Allyn Service Tool can perform the basic functional verification and calibration procedures referenced in the table by following the instructions in this manual. If you have the Gold edition of the service tool, use the tool to perform a complete functional verification and calibration of the device in lieu of performing the basic tests.

Perform a complete functional verification and calibration of the device whenever any of the following conditions exists:

- The device does not meet specifications (based on the basic functional verification)
- The device has been dropped or otherwise damaged
- The device is malfunctioning
- The case has been opened
- An internal part has been replaced (battery excluded)



**NOTE** For instructions on using the Gold edition, see the Service Tool help files.

## Maintenance

For device maintenance information, see “Maintenance and service” in the device’s *Instructions for use*. This section covers the following topics:

- Perform periodic checks
- Replace the device battery
- Cleaning requirements



**NOTE** Service-related cleaning is addressed in the service manual as well.

## The Welch Allyn Service Tool

The Welch Allyn Service Tool is available in the following editions:

- **Standard unlicensed:** Accompanies your device. Download from <https://www.hillrom.com/en/services/welch-allyn-service-tool/>.
- **Gold:** Required to perform complete functional verification and calibration. This edition requires an additional license. For more information about acquiring this license, contact Welch Allyn.



**NOTE** To qualify for the Gold license, you must attend the Welch Allyn technical training course or complete online training for the device.

Clinicians and technical service personnel can use the service tool to manage and maintain supported Welch Allyn products. You can use the service tool to do the following:

- **Review device information.** When connected to the device, the service tool lists installed modules, installed firmware and hardware versions, warranty and repair information, status, and usage history.
- **Receive notifications when periodic maintenance is needed.** The service tool can help you manage and maintain your entire inventory of supported Welch Allyn products. Through the remote service function, the service tool can connect to Welch Allyn Customer Service. With this functionality you can automatically receive firmware updates and feature upgrades for your supported products, including software upgrades for the service tool.
- **Install updates and upgrades.** The service tool can read the firmware version for each module and check for available updates or upgrades.



**NOTE** For the Welch Allyn Service Tool to support updates and upgrades, adjust your firewall settings to permit access for IP address 169.254.10.10 (the local feed server for the software upgrade process).

- **Create a work list.** The work list provides information about service actions—referred to as work orders—that are waiting for you to perform on your maintained devices. Work orders may include periodic calibrations, upgrades, or license installations.
- **Schedule periodic maintenance.** You can use the service tool to set the service interval for each maintained device.

- **View and save logs.** You can download and save log files from the device for analysis to help diagnose and identify reported issues.
- **Create user accounts.** Administrators can create user accounts and set permission levels to control access to the features, allowing one group to perform administrative tasks and another to perform service tasks. Restricting access prevents the service tool from being used to make unauthorized changes on a connected device.
- **Perform functional verification and calibration.** The service tool can check any device requiring calibration and, if necessary, calibrate the device to match the design specifications. This feature is not supported for all products and requires the service tool, Gold edition, for each supported product.
- **Recover devices.** In the rare case where a device can no longer boot because of corrupted firmware, the service tool can connect the device to Welch Allyn Technical Support to reinstall the firmware.
- **Extensible.** The service tool software accepts new plug-ins to support future Welch Allyn products.

Some of these features are enabled for any user (Standard unlicensed edition). Others require special user account privileges or a Welch Allyn service contract (Gold edition). If you require gold-level support for a Welch Allyn product, please contact Welch Allyn technical support.

## Battery performance

### About the batteries

The device uses a rechargeable, 2-cell, Lithium-ion smart battery. Internal circuitry enables the battery to report its condition to the device. The device displays the battery status via the LED power indicator, icons on the screen, and status messages appearing in the Device Status area of the display.

The battery status indicator on the device displays the remaining charge. Battery information may be collected using the service tool.

New batteries are shipped from the manufacturer with a 30 percent charge to extend shelf life. After installing a new battery in the device, you must plug the device into AC power to wake up the battery. If AC power is not applied to the device, the new battery appears discharged.

The Device Status area displays a low-battery notification when 30 minutes of power remain and again when 5 minutes of power remain. The 30-minute notification is dismissable by the user, and all functions of the device remain available. The 5-minute notification is not dismissable, and prevents acquiring vitals measurements or performing any other function until the device is plugged in to AC power.

If AC power is not applied to the device after it triggers the 5-minute notification, the device will shut down at or close to 0 minutes of remaining battery charge.

Battery charging is provided by the device's internal power supply. The power reserve threshold is determined by the device's software.

For a complete list of battery specifications, see the device's *Instructions for use*.

### Follow best practices to extend the life of the battery

The following practices help to extend the life of the battery and the device.



**WARNING** Safety risk. When handling and storing Lithium-ion batteries: Avoid mechanical or electrical abuse. Batteries may explode or cause burns if disassembled, crushed, or exposed to fire or high temperatures. Do not short or install with incorrect polarity.

- Whenever possible, keep the device plugged in to charge the battery.
- Remove the battery when storing the device for an extended amount of time.
- Replace batteries that trigger a low battery status message when fully charged.
- Do not use damaged or leaking batteries.
- Store batteries with a 30 to 50 percent charge.
- Store batteries within the temperature range indicated for each period:
  - For storage less than 30 days: Maintain temperature between –4 °F and 122 °F (–20 °C and 50 °C).
  - For storage between 30 days and 90 days: Maintain temperature between –4 °F and 104 °F (–20 °C and 40 °C).
  - For storage more than 90 days up to 2 years: Maintain temperature between –4 °F and 95 °F (–20 °C and 35 °C).
- Recycle batteries where ever possible. In the United States call 1-877-723-1297 for information about recycling your Lithium-ion battery or go to the Call2Recycle website at <https://www.call2recycle.org> for additional information.
- When recycling is not an option, dispose of batteries in an environmentally safe manner consistent with local regulations.

## Factors affecting battery operating time

The following table presents settings and conditions that affect the battery operating time and recommendations to maximize battery life.

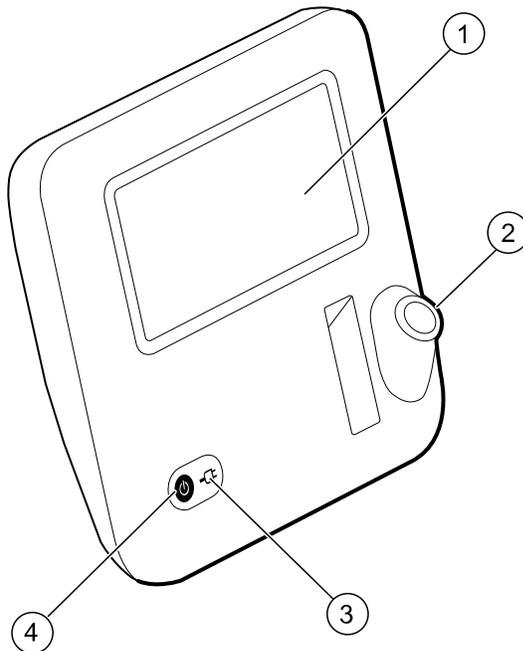
Setting / Condition	Recommended setting
Display brightness setting	5
Sleep mode setting	1 minute
Automatic power-down setting	15 minutes

## Controls, indicators, and connectors



**NOTE** Your model might not contain all of these features.

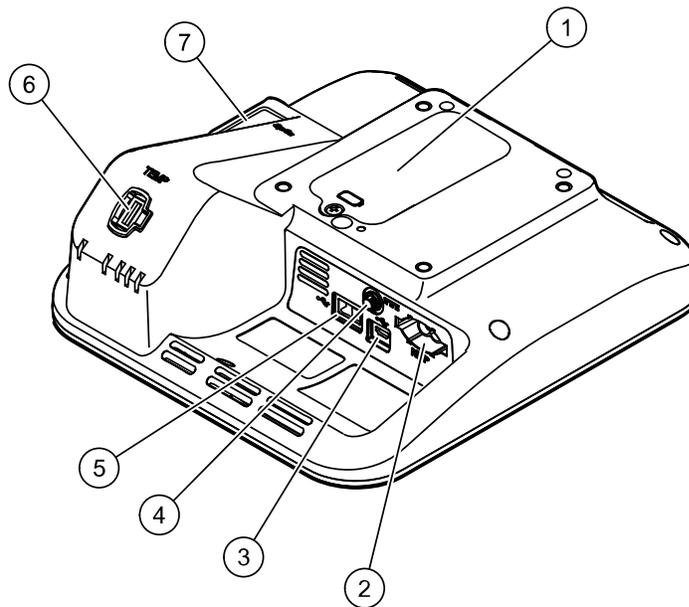
### Front-Left view



No.	Feature	Description
1	LCD screen	7" color touchscreen provides a graphical user interface
2	Thermometry probe well	Houses the SureTemp probe on the device
3	Battery charge and power-up status indicator	<p>The LED indicates the charging and power-up status when connected to AC power:</p> <ul style="list-style-type: none"> <li>• Green: The battery is charged</li> <li>• Amber: The battery is charging</li> <li>• Flashing: The device is powering up</li> </ul>

No.	Feature	Description
4	Power button	Blue button on lower-left corner of the device: <ul style="list-style-type: none"> <li>• Powers on the device</li> <li>• Provides power options for the device</li> <li>• Wakes up the device from Sleep mode</li> </ul>

### Back-Bottom-Left view



No.	Feature	Description
1	Battery compartment (behind cover)	Houses the battery (captive screw secures cover to device)
2	NIBP	Connects the NIBP hose to the device
3	USB client port	Provides a connection to an external computer for testing, software upgrades, and connectivity
4	Power connection	Connects the power adapter to the device
5	USB port	Connects a USB drive to the device for saving log files
6	Thermometry	Connects the SureTemp probe to the device
7	SpO2	Connects the SpO2 sensor to the device

## Advanced settings

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Advanced settings provide access to device preferences and service options. The following primary tabs are accessible in Advanced settings:

- General. Settings for system language as well as date and time, plus open source software disclosure.
- Parameters. Settings for physiological parameters, additional patient data, and averaging.
- Service. Settings and features that support installation and on-device troubleshooting.

## Access Advanced settings



**NOTE** You cannot access Advanced settings if sensors or error conditions are active or if vital sign measurements are displayed.

1. From the Home tab, touch the **Settings** tab.
2. Touch the **Advanced** vertical tab.
3. Touch **Advanced settings**.  
The device sounds two beeps and the General tab appears.
4. Configure device settings, physiological parameters, and perform service tasks as needed.



**NOTE** Service tasks and how to do them are detailed in this section.

5. When you are finished, touch **Exit**.  
The Home tab appears.

## General tab

### Specify the language

1. From the Home tab, touch **Settings > Advanced > Advanced settings**.  
The General tab appears.
2. Select the preferred language.
3. Optionally, configure other advanced settings.
4. When you are finished configuring advanced settings, touch **Exit** to return to the Home tab.

## Specify date and time settings

1. In Advanced settings, touch the **General** > **Date / Time** tabs.

2. Specify settings.

Setting	Action/Description
Time zone	Select the appropriate UTC time zone from the drop-down.
Date format	Select a format for displaying the date.
Enable daylight saving time	Check this box to automatically update the device time when Daylight Saving Time starts and ends.

3. Optionally, configure other advanced settings.
4. When you are finished configuring advanced settings, touch **Exit** to return to the Home tab.

## Specify power management settings

1. In Advanced settings, touch the **General** > **Power management** tabs.

2. Specify settings.

Setting	Action/Description
Allow sleep mode	Check this box to enable the device to automatically enter sleep mode after a period of inactivity. Then, set the Automatic sleep timeout period (1-30 minutes).
Allow automatic shutdown	Check this box to enable the device to automatically shut down after a period of inactivity. Then, specify the Automatic shutdown timeout (1-30 minutes).

3. Optionally, configure other advanced settings.
4. When you are finished configuring advanced settings, touch **Exit** to return to the Home tab.

## Review the open source software disclosure

1. In Advanced settings, touch the **General** > **Open Source** tabs.
2. Read Welch Allyn's disclosure about its use of "free" or "open source" software.
3. Optionally, configure other advanced settings.
4. When you are finished configuring advanced settings, touch **Exit** to return to the Home tab.

## Parameters tab

### Specify advanced NIBP settings

1. In Advanced settings, touch the **Parameters** > **NIBP** tabs.

2. Specify settings.

Setting	Action/Description
Default view	Select default primary and secondary views.
Unit of measure	Select the NIBP unit of measure for display.

- |                       |  |
|-----------------------|--|
| Algorithm default     | Select the default algorithm used to determine NIBP measurements.  |
| Cuff inflation target | If the default algorithm is set to Step, enter a default cuff inflation pressure for each type of patient. |
3. Optionally, configure other advanced settings.
  4. When you are finished configuring advanced settings, touch **Exit** to return to the Home tab.

## Specify advanced temperature settings

1. In Advanced settings, touch the **Parameters** > **Temperature** tabs.
2. Specify settings.

### Setting

### Action/Description

#### Default temperature site

Select a location for the default temperature site.

#### Unit of measure

Select primary units of measure for the temperature display on the Home tab.

#### Display temperature conversion

Enable to display primary units of measure and secondary units of measure for the temperature display on the Home tab.

3. Optionally, configure other advanced settings.
4. When you are finished configuring advanced settings, touch **Exit** to return to the Home tab.

## Specify additional parameters

1. In Advanced settings, touch the **Parameters** > **Additional parameters** tabs.
2. Select the additional parameters you wish to display on the Home tab.



**NOTE** BMI will be automatically calculated based on the patient's height and weight.

3. If you selected the options **Display height** and **Display weight**, then select the preferred unit of measurement for each parameter.
4. Optionally, configure other advanced settings.
5. When you are finished configuring advanced settings, touch **Exit** to return to the Home tab.

## Specify advanced program interval settings

1. In Advanced settings, touch the **Parameters** > **Averaging** tabs.
2. Specify settings.

### Setting

### Action/Description

Readings to average

The averaging program supports up to 6 readings. Select which readings in the series to use for the averaged measurement (and, as a result, the number of readings to average).

Delay to start

Specify the amount of time to wait after the clinician touches START AVERAGE and before the first reading starts.

Time between

Specify the amount of time to wait between each reading.

Keep if + or -

Specify the range that the program uses as criteria to accept or reject readings and establish the baseline reading.

The configured settings are displayed in the Summary section.

3. Optionally, configure other advanced settings.
4. When you are finished configuring advanced settings, touch **Exit** to return to the Home tab.

## Service tab

### Perform general device service

You can calibrate the touchscreen and check the functionality of NIBP accuracy on the device without use of the Welch Allyn Service Tool.

1. In Advanced settings, touch the **Service > General** tabs.
2. To verify the NIBP pressure valve accuracy, touch **Close Valve**.  
The pressure displays in the NIBP Pressure Verification field.  
To stop the accuracy test, touch **Open Valve** or navigate away from the screen.
3. To calibrate your touchscreen, touch **Start** in the right pane and follow the onscreen prompts.  
The Home tab appears when calibration is complete.

### Save service logs to a USB flash drive

This procedure enables you to save the last 14 active log files to a USB flash drive.

1. In Advanced settings, touch the **Service > Log file** tabs.
2. Connect a flash drive to the USB port.
3. Touch **Save to USB**.

Copies of the service log files are saved to the drive. You may remove the flash drive from the device.

### Restore factory default settings



**NOTE** This process does not restore the device to a custom configuration provided at delivery. Instead, it deletes all custom configuration data and restores factory default settings.

1. In Advanced settings, touch the **Service > System** tabs.
2. Touch **Reset**.
3. Click **OK** to confirm.

The device reboots and the default factory settings are restored.

## Power-up sequence

---

### Overview

The system performs a power-on self test (POST) of the software and internal hardware each time the device is powered on. Specific tests performed include the following:

- CVC-PIC tests
- LED power tests
- eMMC (memory) tests
- EEPROM tests

If all tests are successful, the system completes power up, the Home tab appears, and the system is ready for operation.

If the self-check fails, an error message and an error code appear in the system status area at the top of the screen to aid service personnel and engineers in diagnosing the problem. If a fault that could adversely affect the product is detected, the system enters a safe mode and stops all vitals functions. The system remains in safe mode until it is turned off by pressing  or until the device shuts down automatically after a period of inactivity.

### To perform the POST:

1. Disconnect any patient cables connected to the system.
2. Insert a fully charged battery into the system.
3. Power up the device and confirm the following:
  - a. The buzzer generates a sound.
  - b. A startup screen appears briefly and then disappears.
  - c. The power button flashes until the UI is ready.
  - d. The Home tab appears.

## Power

The Power button, located on the lower-left corner of the device, performs multiple functions:

- Powers up the device
- Wakes the device from Sleep mode
- Opens a pop-up dialog with controls to power down, enter Sleep mode, or cancel



**CAUTION** Do not use a long press of the Power button to power down the device when it is functioning normally. You will lose patient data and configuration settings. Touch the **Settings > Device** tab to power down the device.

The LED in the center of the power plug symbol indicates the battery charging status.

- Green indicates that AC power is present and that the battery is fully charged.
- Amber indicates that AC power is present and that the battery is charging.

## Power up the device

The device runs a brief diagnostic self-test each time it powers up. If an issue occurs, the error appears in the Status area.



**WARNING** To ensure patient safety, listen for an audible indicator and watch for visual messages at power-up at least once daily. Correct any system errors before using the device. In addition to the audible indicator, the screen Status area displays icons and messages that help you to distinguish any actions, if needed.



**WARNING** Always observe the device during power-up. If any display fails to illuminate properly, or if a system fault code or message displays, inform qualified service personnel immediately, or call your nearest Welch Allyn Customer Service or Technical Support facility. Do not use the device until the problem is corrected.



**CAUTION** Always use the device with an adequately charged and properly functioning battery.



**CAUTION** Use only a Class I (grounded) AC power cord to charge the battery for this device.

Press  to power up the device.

The power LED flashes until the device displays the Hillrom logo and a power-up tone sounds. On initial power-up, the device prompts you to set the language, date, and time.

## Power down the device

When the device is functioning normally, use this method to power down. This method retains patient measurements in the device memory for a maximum of 24 hours. Saved measurements are available for recall or electronic transmission to the network. This method also ensures that any configuration settings you have changed and saved will be maintained at the next startup.

1. Do one of the following to access the power menu:

- Briefly press .
- Touch **Settings > Device > Power down**.

If there is no system message, a dialog box appears with options to Power down, Sleep, and Cancel.

2. Touch **Power down**.

The device clears all data onscreen and performs a complete software shutdown.

## Reset the device

Reset the device only when the device becomes unresponsive. Patient data and configuration settings will be cleared from device memory.

1. Press and hold , located on the lower-left corner of the device.
2. If there is a prompt with options to Power down, Sleep, or Cancel, continue to press  for several seconds.

The device powers down. Patient data and configuration settings are cleared from device memory.

3. Press  to power up the device.



## Disassembly and repair

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These procedures provide instructions for device disassembly and board removal, as well as component replacement and reassembly.

Each part's disassembly instructions might include one or both of the following:

- **Reassembly notes:** This subsection contains information specific to reassembly. At a minimum, these notes indicate whether or not reassembly is the reverse of disassembly. The notes also list service kits of replacement parts where applicable.
- **When replacing the component:** This subsection contains additional instructions related to installing a new option or replacement part.

Each disassembly step includes drawings that illustrate the components to be removed. The reassembly notes could be as short as one or two lines when reassembly is the reverse of disassembly. When reassembly is more complicated, these notes alert you to any special care required to complete the repair or installation and sometimes introduce separate reassembly instructions. Line drawings appear in the reassembly notes only when they differ from the drawings in the disassembly instructions.



**WARNING** Electrical shock hazard. Disconnect AC power before opening the device. Disconnect and remove the battery before proceeding with disassembly. Failure to do this can cause serious personal injury and damage to the device.



**WARNING** Risk of fire, explosion and burns. Do not short-circuit, crush, incinerate, or disassemble the battery pack.



**WARNING** Safety risk. Do not attempt to service the device when the device is connected to a patient.



**CAUTION** Before disassembling the device or installing options, disconnect the patient from the device, power down the device, disconnect the AC power cord and any attached accessories (for example, SpO2 sensors, blood pressure hoses and cuffs, and temperature probes) from the device.



**CAUTION** If your device is configured with a SureTemp module, remove the probe well before disassembly.



**CAUTION** Perform all repair procedures at a static-protected station.



**CAUTION** When the device case is opened, regard all parts as extremely fragile. Execute all procedure steps with care and precision.



**CAUTION** Observe screw torque specifications, especially with screws that secure directly into plastic standoffs.



**CAUTION** To avoid mismatching screws and holes, keep the screws for each piece with that piece as you remove modules and circuit assemblies. It is possible to mistakenly install machine screws in locations intended for plastite screws. Plastite screws have a Torx-pan head.

## Required tools and equipment

- Phillips #0 screwdriver
- Phillips #1 screwdriver
- T-10 Torx screwdriver
- 3/8" socket

## Torque value table

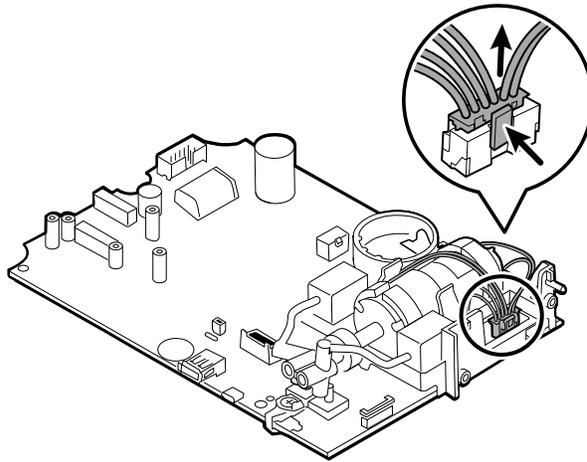
Use this table to determine how much torque to apply to screws by type and location when reassembling the device.

Description	Torque specification	Bit type	Where used
NUT, 5/16-32. THIN PROFILE	3.0 +/-0.5 in-lbs	3/8" hex	Power harness
SCR,4-20X.31 PLASTITE PH TORX	4.5 +/-0.5 in-lbs	T-10 Torx	SpO2 insert - Rear housing
SCR,4-20X.31 PLASTITE PH TORX	4.5 +/-0.5 in-lbs	T-10 Torx	Pneumatic & Sensor assy
SCREW 4-40 .250 PAN PHILLIPS STEEL ZINC	4.5 +/-0.5 in-lbs	#0 Phillips	SpO2 sensor & SpO2 adapter PCBA
SCREW, M4 X 10 PAN HEAD W NYLOC	7.5 +/-0.5 in-lbs	#1 Phillips	Rear - Front housings
SCR, M4 PAN HD, PHD, SHOULDER	4.5 +/-0.5 in-lbs	#1 Phillips	Battery Door
SCR, 4-20X.31 PLASTITE PH TORX	4.5 +/-0.5 in-lbs	T-10 Torx	Pneumatic & Sensor assy
SCREW, M4 X 10 PAN HEAD W NYLOC	7.5 +/-0.5 in-lbs	#1 Phillips	Rear and Front housings

## Connector types

Disassembly and repair procedures require that you disconnect and reconnect the following connector types inside the device:

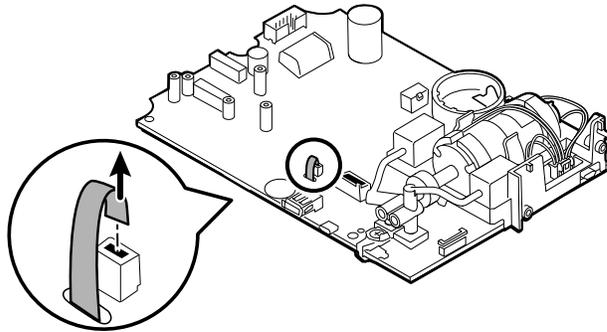
- **Locking (squeeze-release):** Locking connectors use a latching mechanism to prevent accidental disconnection during assembly and use. The latch is located on one end of a tab so it may flex and lock into place when coupled with its matching connector. The tab provides a lever to release the latch. Some connectors have multiple latches that require you to press multiple tabs to release.



To remove a locking connector, squeeze the tab(s) to release the latch(es) and remove the cable.

To connect a locking connector, push the mating pieces together until the latch(es) lock in place.

- **Friction:** Friction connectors use a spring mechanism to create friction between the contacts.



To remove a pressure connector, grasp each connector mating half and pull the halves apart.

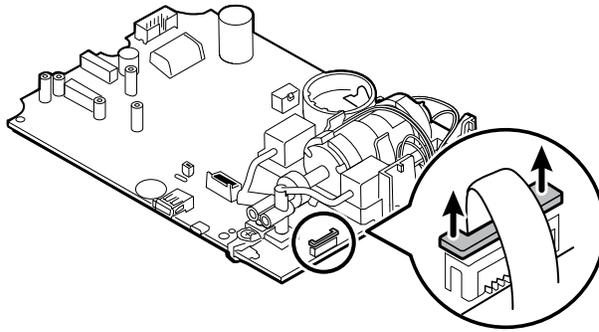


**CAUTION** Do not use excessive force to disconnect the connector. Excessive force may result in pulling the mounted connector off the circuit board.

To connect a friction connector, grasp each connector mating half and insert one half into the other.

- **ZIF (zero insertion force):** The device uses flex cables and ZIF flex cable connectors. Flex cables and ZIF connectors require special care when handling.

ZIF connectors use a sliding outer piece that latches and unlatches to secure and release the flex cable. ZIF cables cannot be successfully connected or disconnected without properly unlatching and latching the sliding outer piece.



**CAUTION** Do not use excessive force when releasing pressure on the connector. Excessive force may result in breaking the sliding outer piece.

#### To remove a ZIF connector



**CAUTION** Remove a flex cable only *after* the ZIF latch is open.

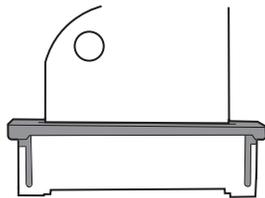
1. Using a suitable tool (for example, a paper clip, small flat-head screwdriver, or needle-nose pliers), slide the latching piece of the connector away from the connector body.



2. Remove the cable.

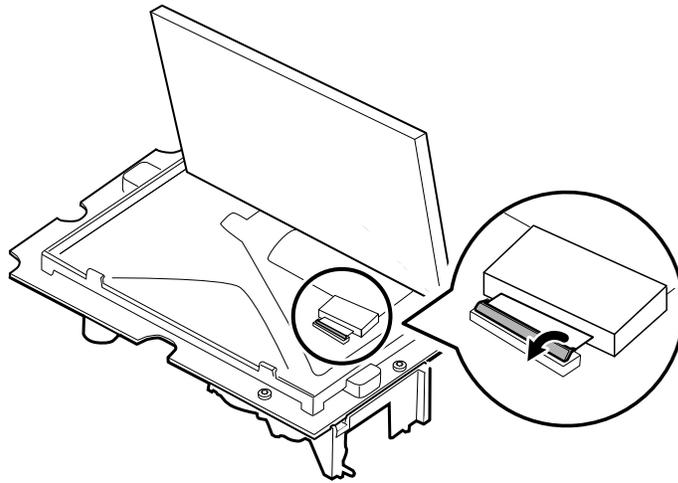
#### To connect a ZIF connector

1. Slide the latching piece of the connector away from the connector body.
2. Insert the flex cable into the connector. This may require using a suitable tool to keep the latching piece elevated.
3. Slide the latching piece toward the connector body until it locks into place.



- **FHY connector (Self-Lock mechanism):** The device uses Self-Lock mechanism cable connectors.

A Self-Lock mechanism enables the cover to close by one-touch operation.



**CAUTION** Do not use excessive force when releasing pressure on the connector. Excessive force may result in breaking the locking mechanism.

#### To remove a Self-Lock mechanism



**CAUTION** Remove a flex cable only *after* the FHY connector latch is open.

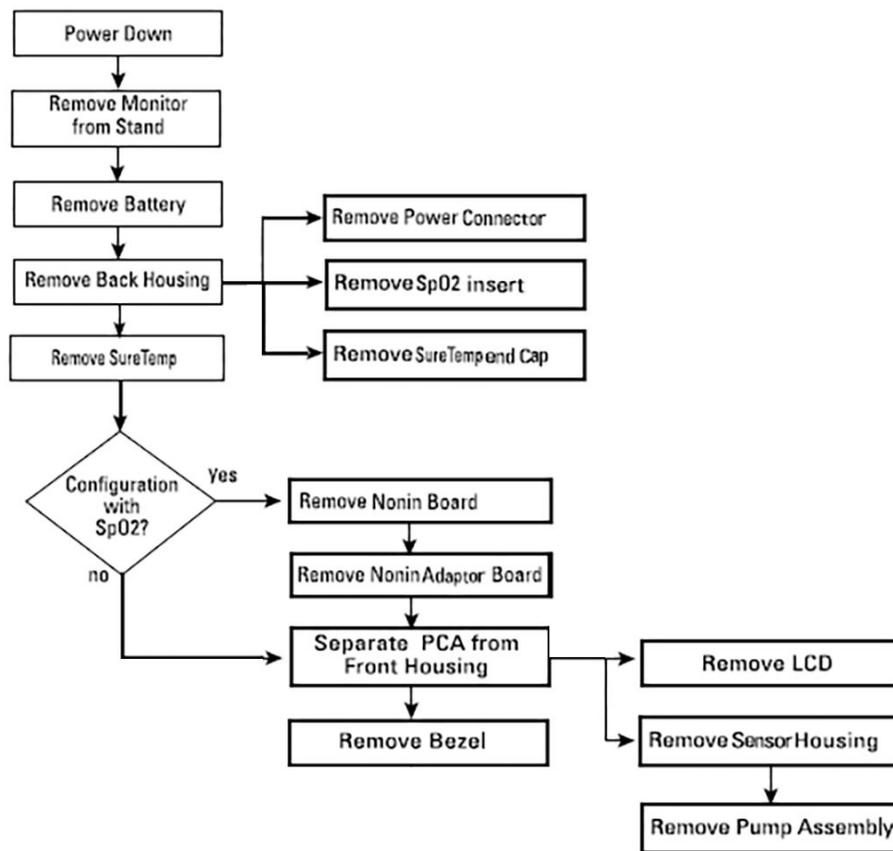
1. Lift the latching piece of the connector up off the the connector body.
2. Remove the cable.

#### To connect a Self-Lock mechanism

1. Lift the latching piece of the connector up off from the connector body.
2. Insert the flex cable into the connector.
3. Push down on the latching piece connector until it locks into place.

## Disassembly overview

The following flow chart provides an overview of the complete disassembly of the device. Most disassembly activities require that you complete a subset of the steps detailed here. The flow chart indicates the steps which must be completed in sequence to remove a particular component. Because a different sequence of preliminary steps is required to remove certain components, you should use this flow chart as a reference at the start of every disassembly and component replacement procedure.



**NOTE** After performing any of these procedures and before returning the device to service, you must use the service tool, Gold edition, to complete the full suite of functional tests to ensure that all systems are operating within the design specifications. For more information about these tests and the service tool, see “Functional verification and calibration.” If you do not have the service tool, you can download it from <https://www.hillrom.com/en/services/welch-allyn-service-tool/>.

## Power down the device

When the device is functioning normally, use this method to power down. This method retains patient measurements in the device memory for a maximum of 24 hours. Saved measurements are available for recall or electronic transmission to the network. This method also ensures that any configuration settings you have changed and saved will be maintained at the next startup.

- Do one of the following to access the power menu:
  - Briefly press .
  - Touch **Settings** > **Device** > **Power down**.

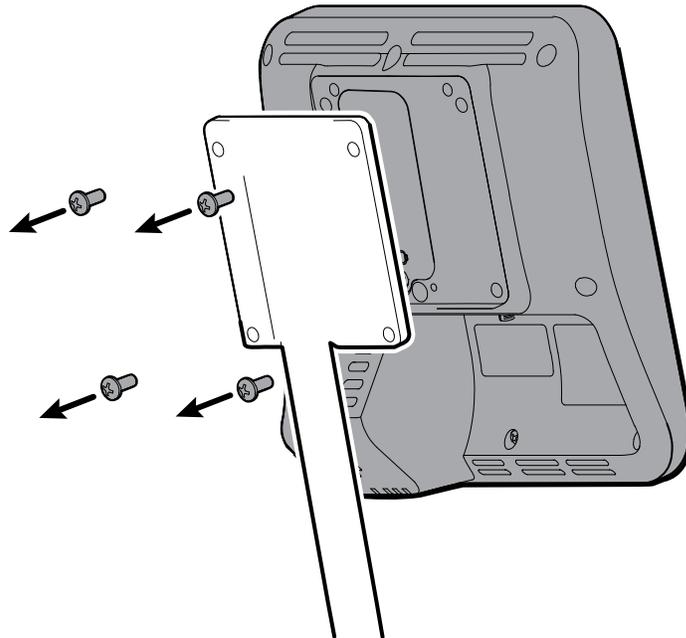
If there is no system message, a dialog box appears with options to Power down, Sleep, and Cancel.

- Touch **Power down**.

The device clears all data onscreen and performs a complete software shutdown.

## Remove the device from the Mobile stand

1. Disconnect the power cord from the wall.
2. Disconnect the power supply and communication cables from the device.
3. Remove the 4 Phillips screws from the back of the mount.



4. Grasp the device securely and remove the device from the mount.

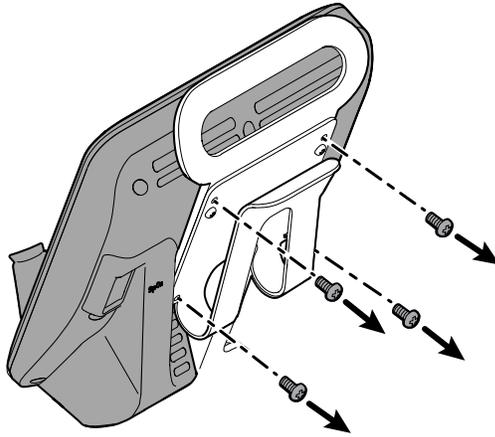
## Reassembly notes



**NOTE** Remounting the device is the reverse of removal.

## Remove the device from the 4400-DST Desk stand

1. Disconnect the power cord from the wall.
2. Disconnect the power supply and communication cables from the device.
3. Remove the 4 Phillips screws from the back of the mount.



4. Grasp the device securely and remove the device from the mount.

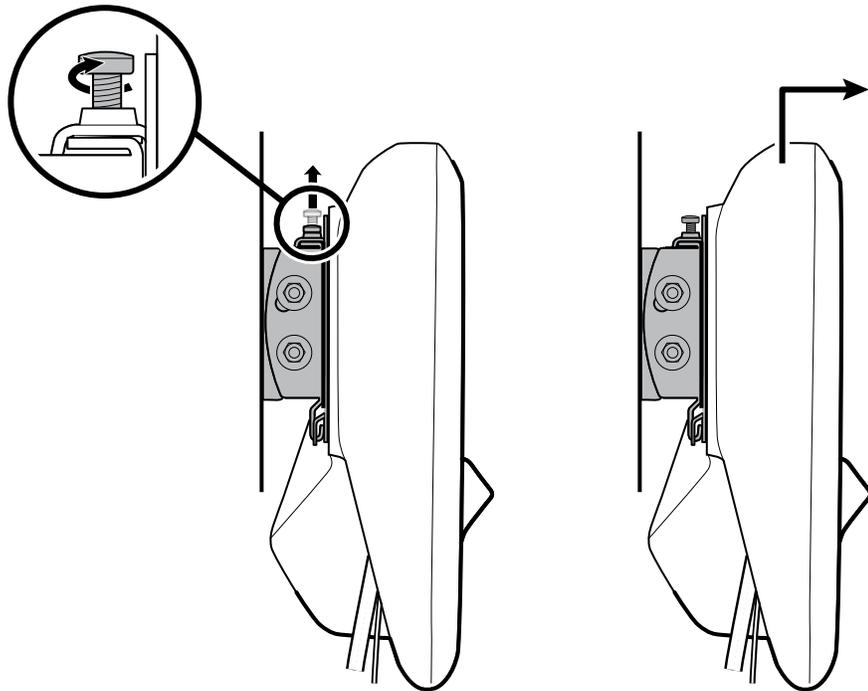
## Reassembly notes



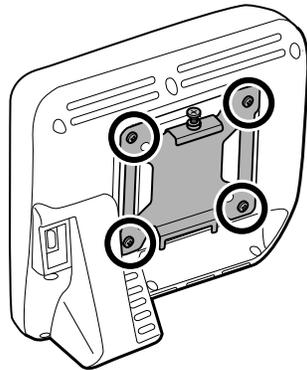
**NOTE** Remounting the device is the reverse of removal.

## Remove the device from the 77794-M4400 or 77794-2M4400 Integrated Wall Panel

1. Disconnect the power cord from the wall.
2. Disconnect the power supply and communication cables from the device.
3. Detach the device from tilt tensioner of the wall board.
  - a. Loosen the screw that secures the device to the tilt tensioner.
  - b. Firmly grasp the device with both hands and pull up to remove the device from the bottom and top mounting hooks of the wall-mount bracket.



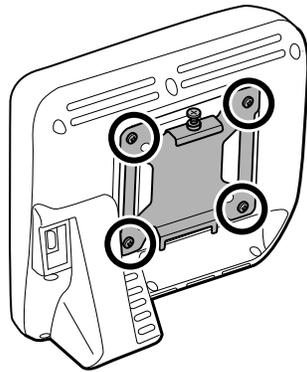
4. Grasp the device securely and remove the 4 Phillips screws from the back of the device and set the bracket aside for remounting.



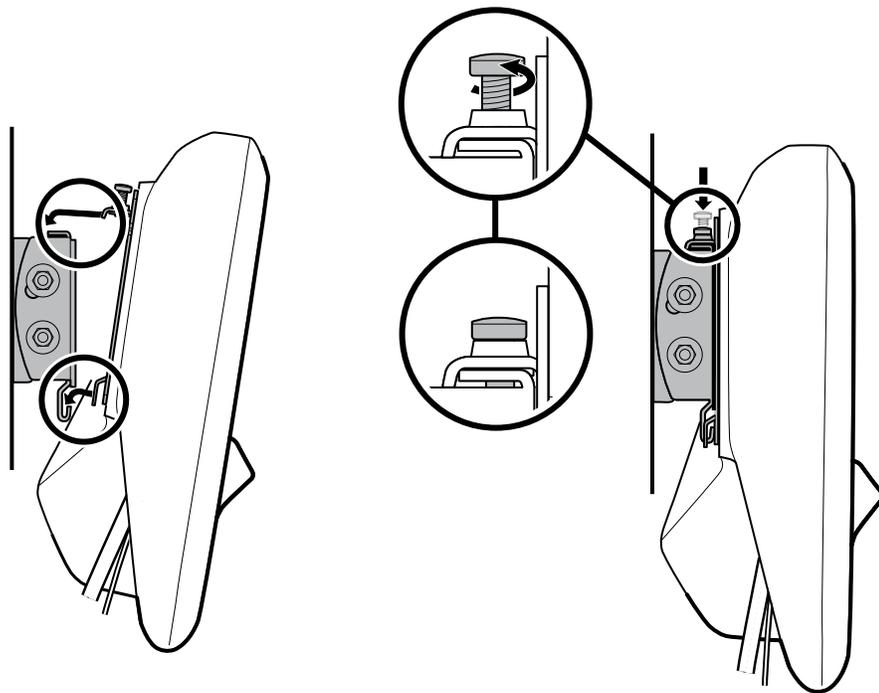
## Reassembly notes

### To remount the device:

1. Attach the device bracket to the device with the 4 Phillips screws.

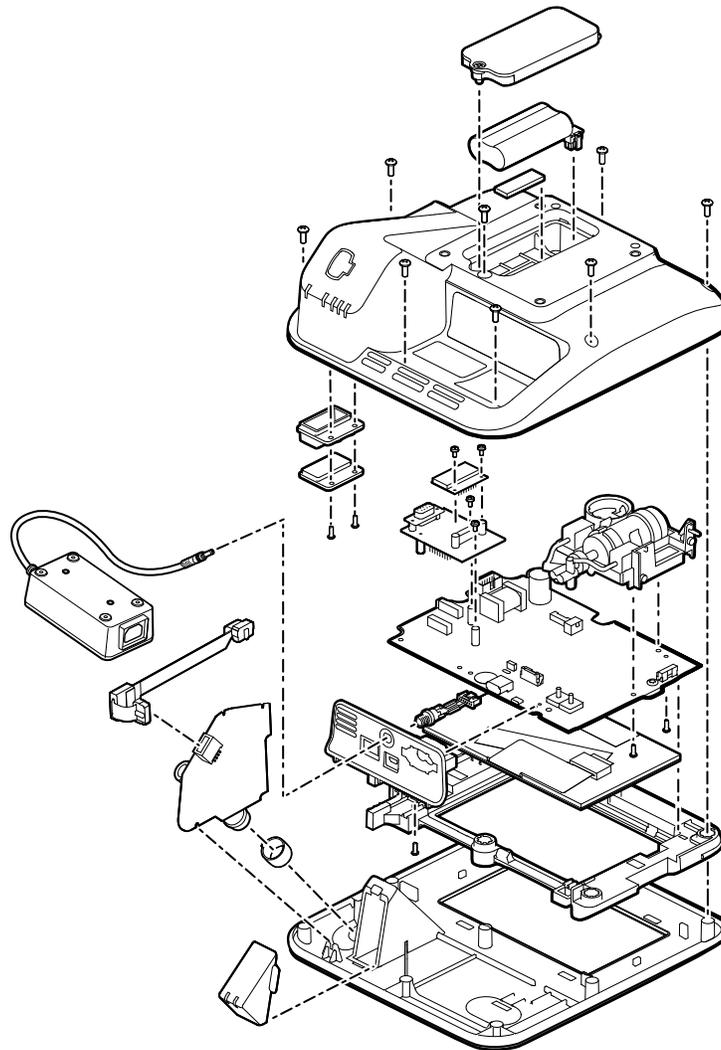


2. Mount the device onto the tilt tensioner of the wall board.
  - a. Attach the bottom of the device bracket onto the tilt tensioner so that the device hooks into place as shown in the illustration.
  - b. Attach the top of the device bracket onto the tilt tensioner so that the device hooks into place as shown in the illustration. Apply some pressure to the top of the device and push down until the device slides down into the hook of the top tilt tensioner.
  - c. Tighten the screw to secure the device bracket to the tilt tensioner.



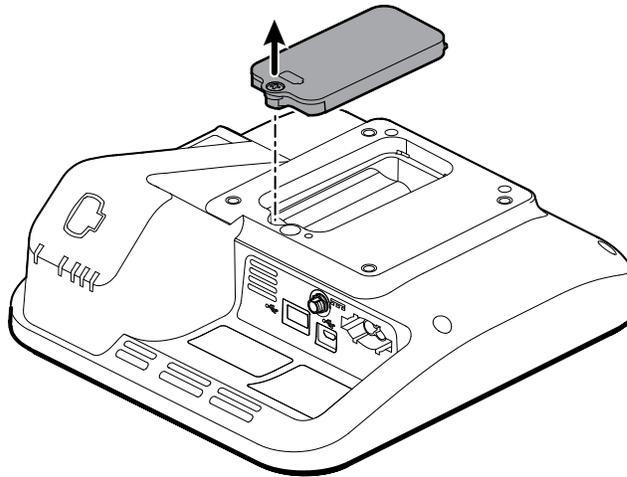
## Exploded view diagram

The drawing below shows individual components of the device and their relationships to one another.

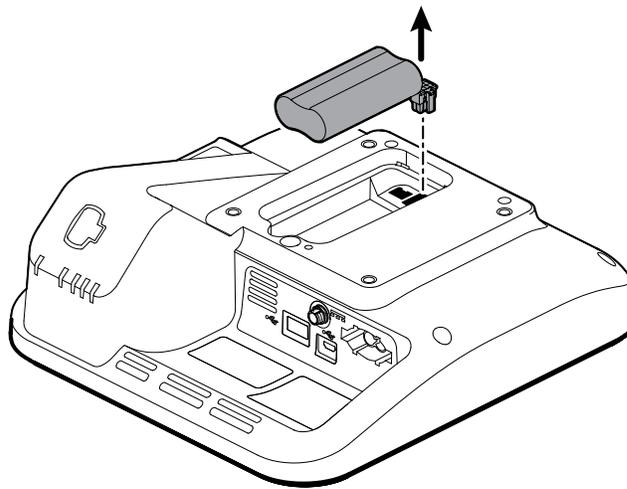


## Remove the battery

1. Place the unit face down on the table as shown.
2. Loosen the captive Phillips screw to remove the battery door.



3. Squeeze the locking tab to disconnect the battery and remove the battery.



## Reassembly notes



**WARNING** Defective batteries can damage the device. If the battery shows any signs of damage or cracking, it must be replaced immediately and only with a battery provided by Welch Allyn.

Kit items:

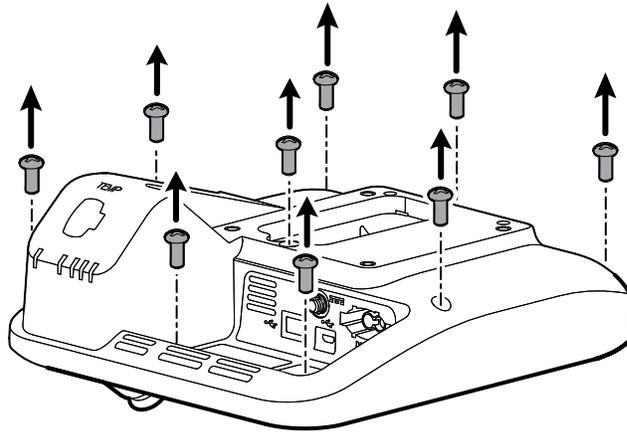
- BATT22, BATTERY PACK
- 107212, SRV KIT, BATTERY FOAM



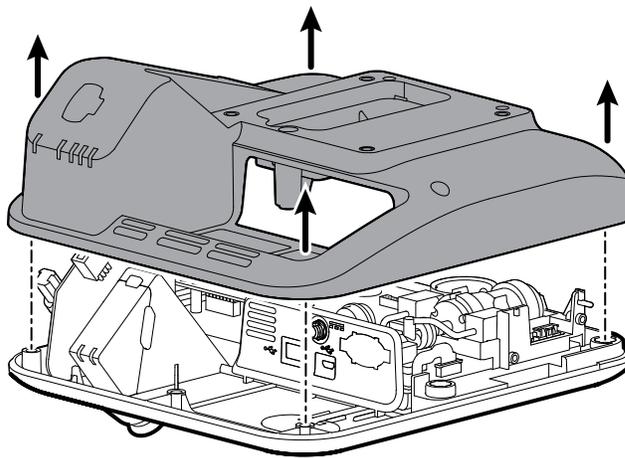
**NOTE** Reassembly is the reverse of disassembly.

## Remove the back housing

1. Remove the 9 Phillips screws on the back of the device.



2. Lift the back housing straight up.



**WARNING** The main PCA board is not secured to the front housing. Ensure that you hold the main PCA board in place if you need to carry the device or tip the device onto its end.

## Reassembly notes

Kit item:

- 107214, SRV KIT, REAR HOUSING WITH LABELS



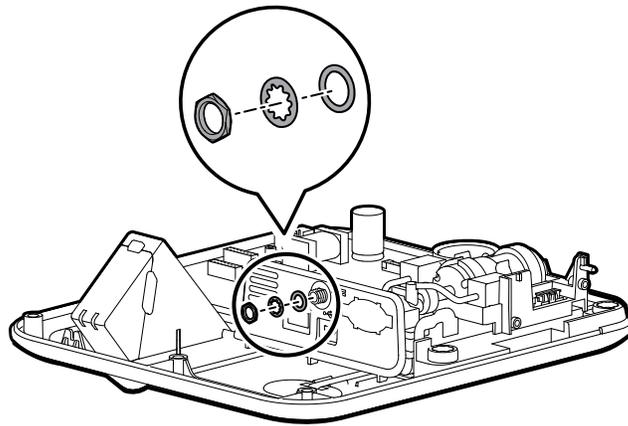
**NOTE** The back housing is not available for direct purchase. Welch Allyn limits availability of certain parts to Authorized Service Personnel only. These limitations are required to maintain product safety or maintain current regulations.



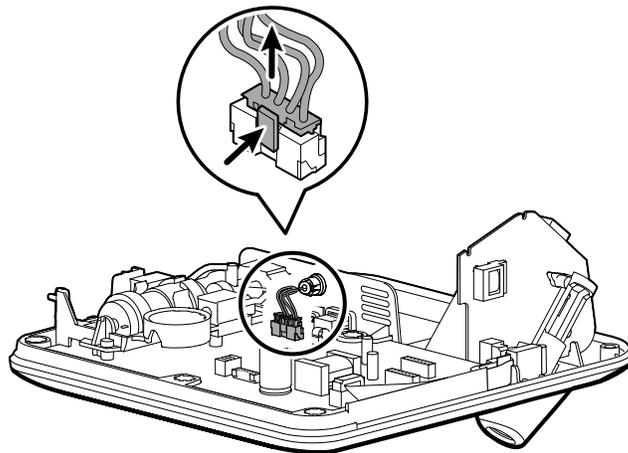
**NOTE** Reassembly is the reverse of disassembly.

## Remove the power harness

1. Using a 3/8" socket, loosen the nut from the power harness barrel, and then remove the nut and two washers. Set aside to use during reassembly.



2. Disconnect the power harness from the main PCA board and then carefully remove the power harness.



## Reassembly notes

Kit item:

- 107186, SRV KIT, POWER HARNESS



**NOTE** Reassembly is the reverse of disassembly.



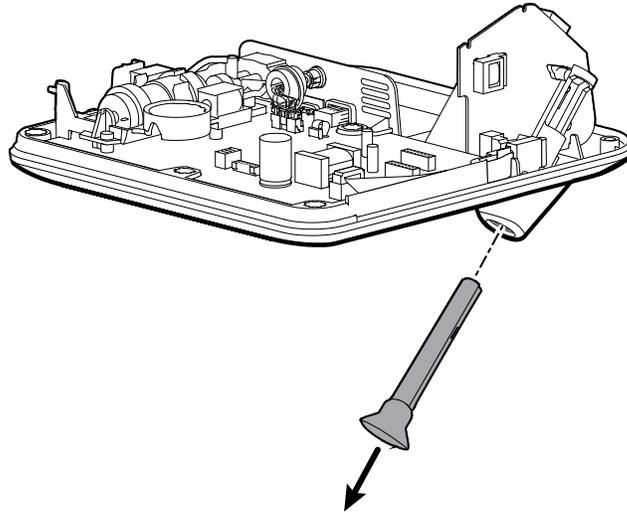
**NOTE** Ensure that you install the washers in the correct order. The flat washer slides onto the barrel first, followed by the locking washer, with the toothed side pointing toward the communications board.

## Remove the SureTemp module

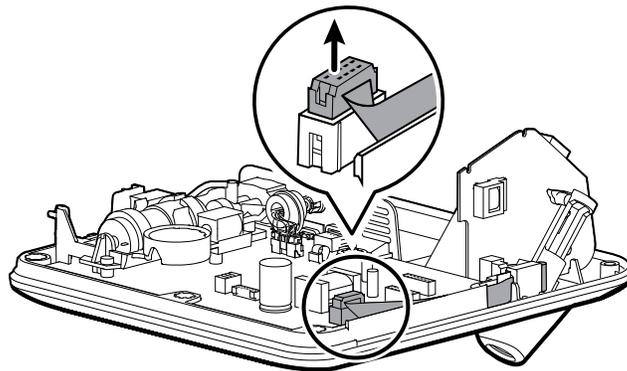


**WARNING** The main PCA board is not secured to the front housing. Ensure that you hold the main PCA board in place if you need to carry the device or tip the device onto its end.

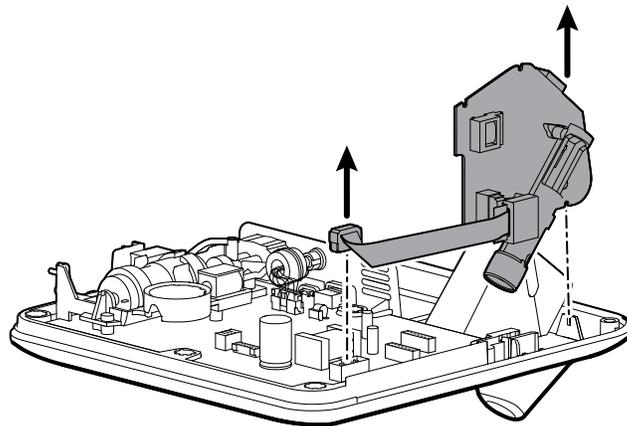
1. With the unit laying flat, reach underneath and grasp the top of the probe well with your thumb and forefinger. Firmly pull the probe well to remove it from the holder.



2. Disconnect the ribbon cable from the ZIF connector on the main PCA board.



3. Lift the module out of the housing.



4. If you are replacing only the SureTemp board or the ribbon cable, disconnect the cable from the board. Set aside the part that will be reused for reassembly.

## Reassembly notes

Kit item:

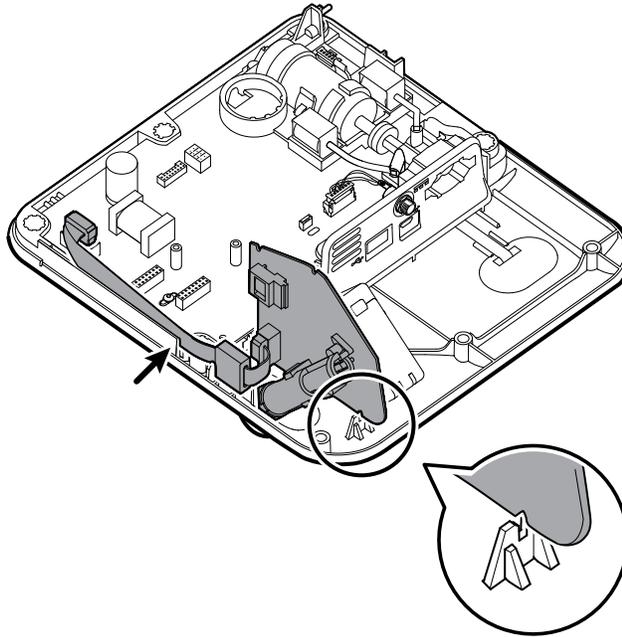
- 107187, SRV KIT, SURETEMP PLUS MODULE, w/o ring

- 107189, SRV KIT, SURETEMP CABLE



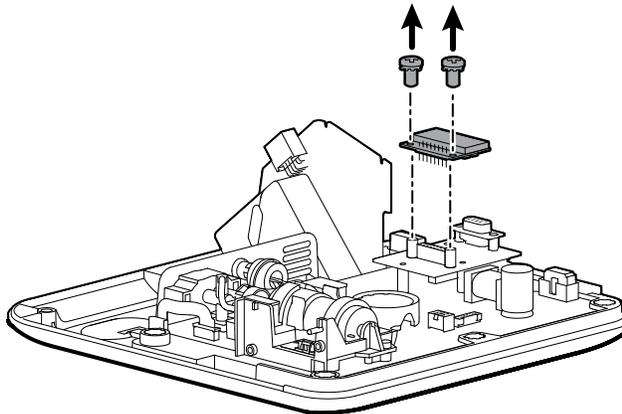
**NOTE** Reassembly is the reverse of disassembly; however, note the following:

- The SureTemp board rests in two notches on the front housing. Place the module in the notch near the bottom of the front housing, and the module will align with the notch near the main PCA board.
- Ensure that you push the cable down into the rubber gasket.
- The SureTemp module will sit loosely in place until you insert the probe well.



## Remove the Nonin SpO2 board

Remove the 2 Phillips screws (with washers) that attach the SpO2 board to the SpO2 adapter board, and then lift the board up to remove.



## Reassembly notes

Kit item:

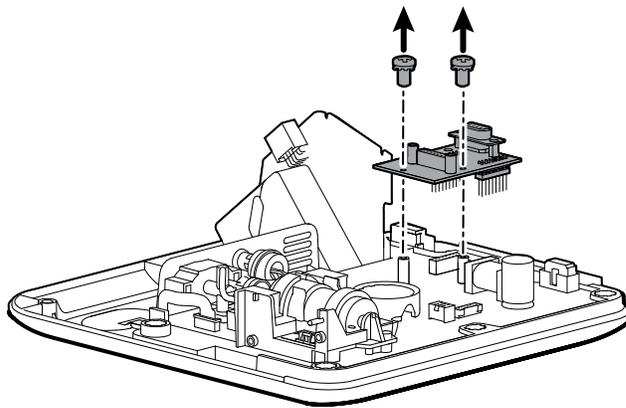
- 105933, SRV KIT, NONIN SPO2 BOARD



**NOTE** Reassembly is the reverse of disassembly.

## Remove the Nonin SpO2 adapter board

Remove the 2 Phillips screws (with washers) and then press down gently on the main PCA board while you carefully pull the SpO2 adapter board out of the connectors on the main PCA board.



## Reassembly notes

Kit item:

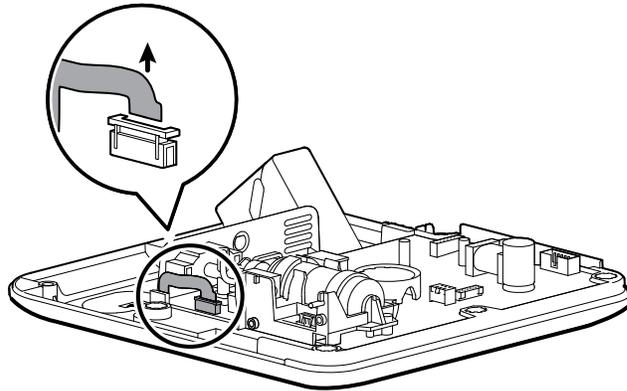
- 107185, SRV KIT, NONIN SPO2 ADAPTER BOARD



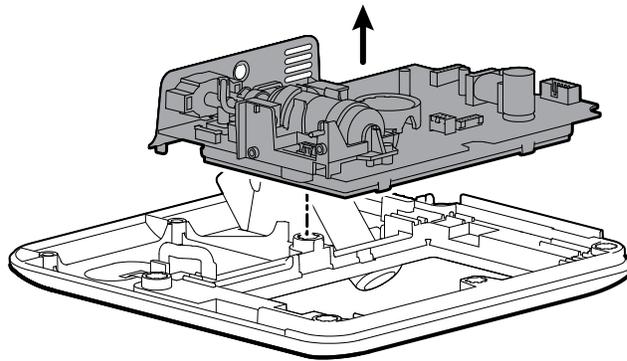
**NOTE** Reassembly is the reverse of disassembly.

## Separate the main PCA board from the front housing

1. Carefully open the latch on the ZIF connector on the main PCA board, and then remove the power switch flex cable.



2. Remove the main PCA board from the front housing.



## Reassembly notes

Kit item:

- 107184, SRV KIT, MAIN PCA, AND LCD FRAME



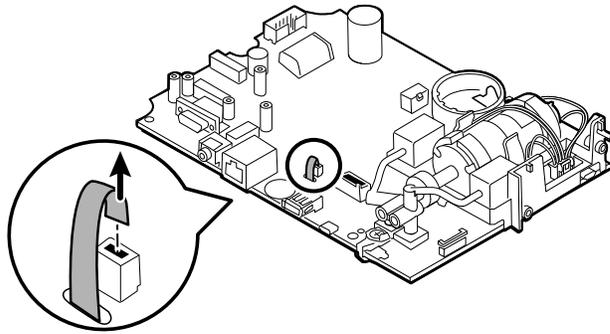
**NOTE** Reassembly is the reverse of disassembly.

## Remove the touchscreen and display ribbon cable separately from the main PCA board

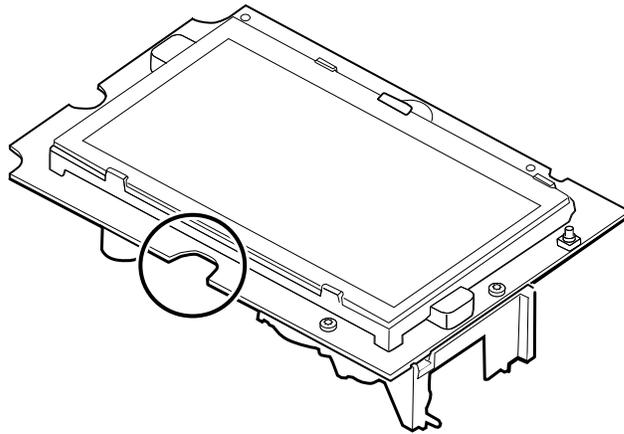


**NOTE** The touchscreen contains a serial number: TFC-K9700RTWV37TR or TFC-K9700RTWV55. Removal and Reassembly steps are the same for both serial numbers, except that the TFC-K9700RTWV37TR serial number has an integrated (soldered) LCD flex cable.

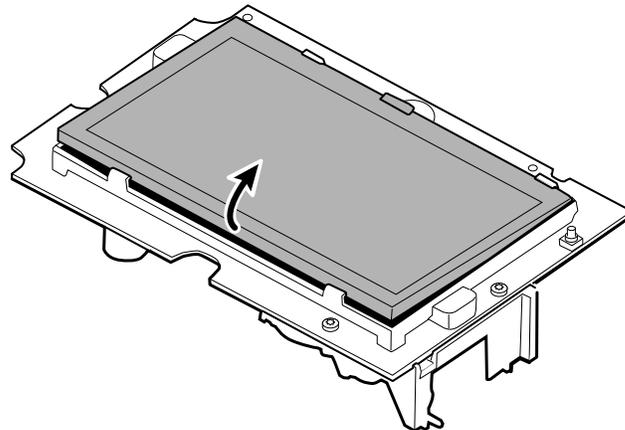
1. For the TFC-K9700RTWV55 serial number, carefully separate the LCD flex cable from its connector on the main PCA board by pulling the cable straight up.



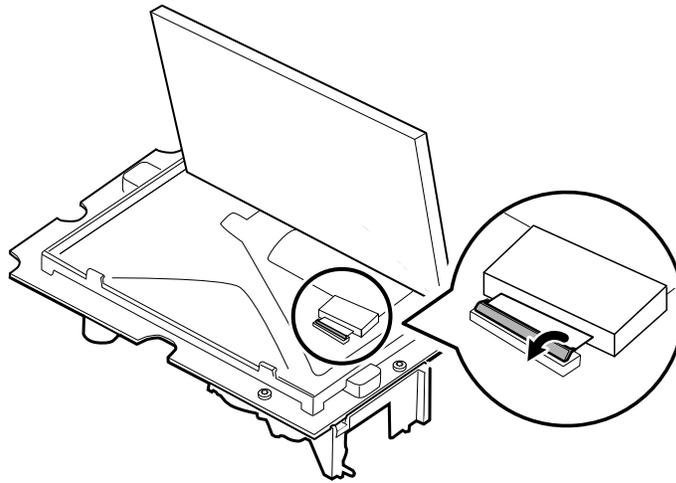
2. Turn over the main PCA board so that the notch on the board faces you.



3. On the side of the main PCA board with the notch, carefully lift the LCD past the tabs, and tilt the LCD upward.



4. Remove the Gaff tape covering the bale connector and set it aside for reassembly.
5. Carefully lift the bale (locking mechanism) of the LCD flex cable connector on the main PCA board and remove the LCD.



## Reassembly notes



**NOTE** When you return the Spot Vital Signs 4400 Extended Care device (home use model) for service to have the LCD with touchscreen replaced, the 108241 kit will be used. When you return the Spot Vital Signs 4400 device (professional model) for service to have the LCD with touchscreen replaced, the 105924 kit will be used.

### Spot Vital Signs 4400 Extended Care kit item:

- 108241, SRV KIT HW A-F, LCD WITH TOUCHSCREEN

### Spot Vital Signs 4400 kit item:

- 105924, SRV KIT, LCD WITH TOUCHSCREEN



**NOTE** Reassembly is not the reverse of disassembly.



**NOTE** Use the Gaff tape set aside during disassembly to reassemble the LCD.

## Attach the touchscreen and display ribbon cable separately to the main PCA board



**NOTE** The touchscreen contains a serial number: TFC-K9700RTWV37TR or TFC-K9700RTWV55. Reassembly steps are the same for both serial numbers, except that the TFC-K9700RTWV37TR serial number has an integrated (soldered) LCD flex cable.

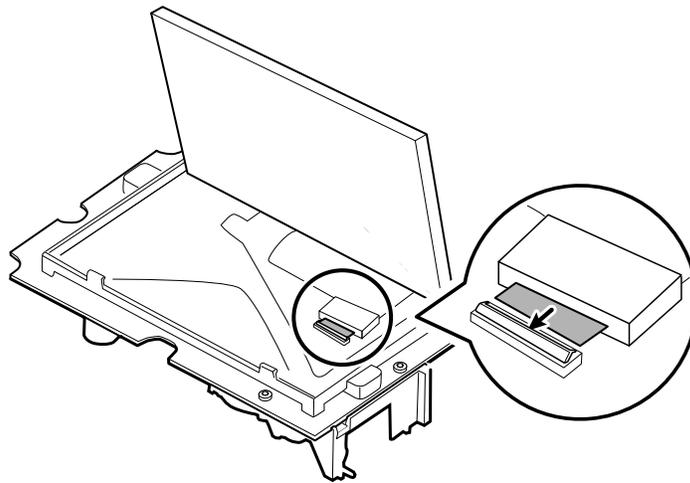
Spot Vital Signs 4400 Extended Care kit item:

- 108241, SRV KIT, HW A-F, LCD WITH TOUCHSCREEN

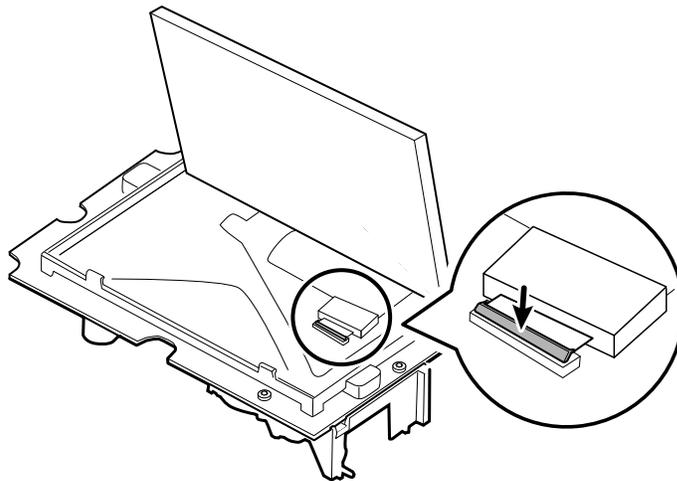
Spot Vital Signs 4400 kit item:

- 105924, SRV KIT, LCD WITH TOUCHSCREEN

1. With the LCD frame facing up, carefully insert the LCD flex cable into the connector.



2. With two fingers, press down the bale to secure the LCD flex cable.

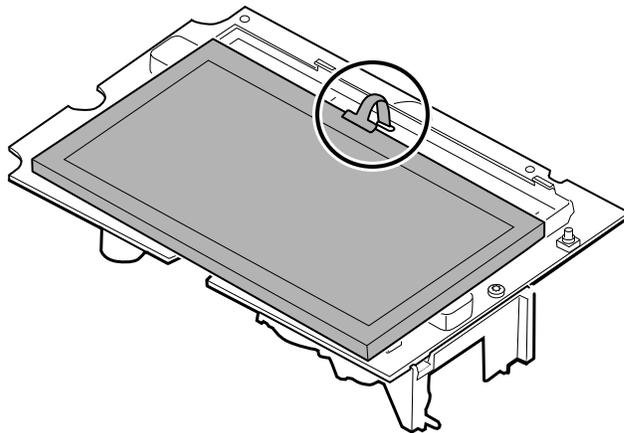


3. Apply the Gaff tape (removed during disassembly) to the connector bale and the LCD flex.



**NOTE** Do not allow the tape to touch the board or the ferrite to touch the end of the flex cable when assembled.

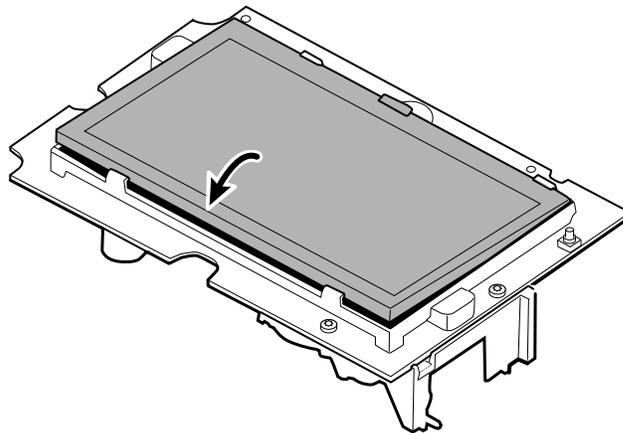
4. For the TFC-K9700RTWW55 serial number, insert the small touchscreen flex cable into the hole on the main PCA board.



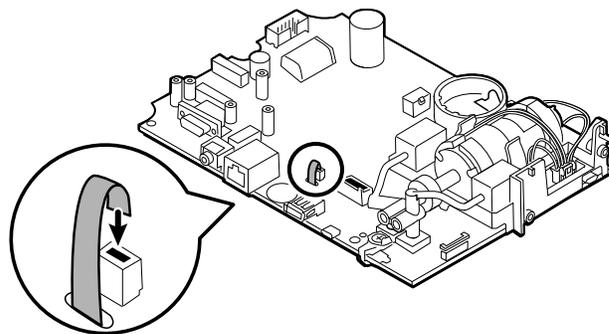
5. Place the LCD at an angle under the tabs on the flex cable side of the LCD.
6. Lower the LCD into place and carefully move the tabs on the opposite side just enough to catch and secure the LCD in the frame.



**NOTE** Ensure that the tabs hold the LCD securely.



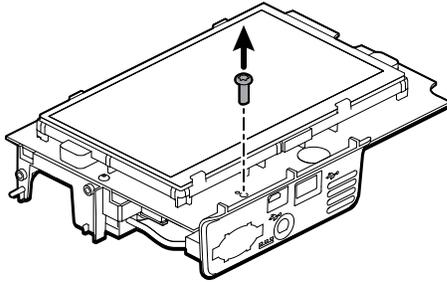
7. Turn over the main PCA board.
8. For the TFC-K9700RTWW55 serial number, insert the flex cable into its connector.



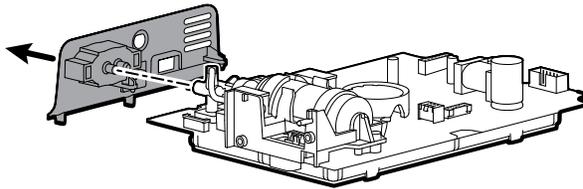
## Remove the sensor housing

Before you begin, complete the following procedures:

- Remove the power harness.
  - Remove the SureTemp module.
  - Separate the main PCA board from the front housing.
1. Turn over the main PCA board and remove the single T-10 Torx screw attaching the sensor insert to the main PCA board.



2. To disconnect the housing from the pump manifold, hold the black pump manifold with one hand and tilt the top of the insert away from the main PCA board with the other hand.



## Reassembly notes

Kit item:

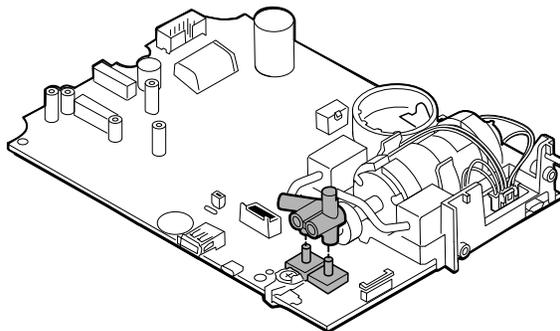
- 107215, SRV KIT, SENSOR HOUSING W/ PWR HARNESS



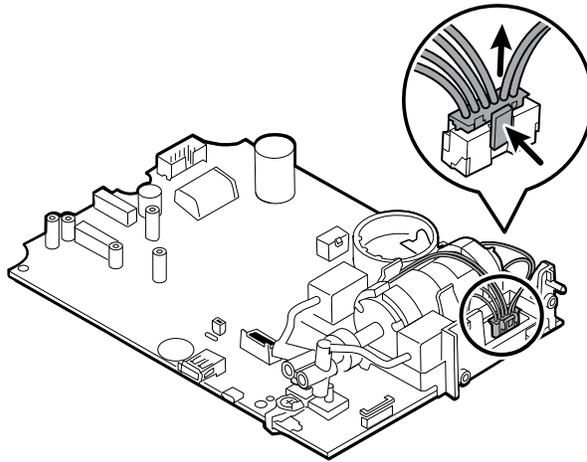
**NOTE** Reassembly is the reverse of disassembly.

## Remove the pump assembly

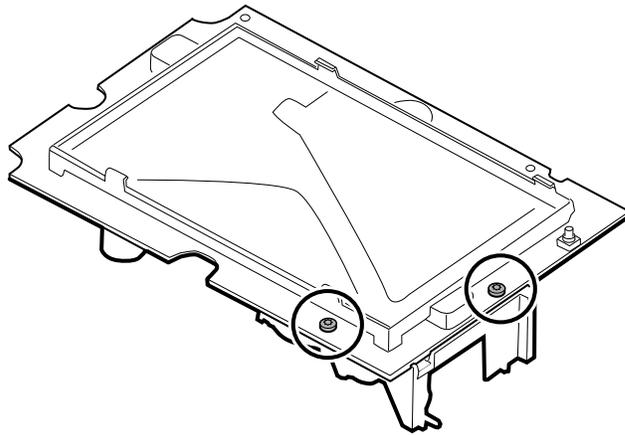
1. Remove the pump manifold from the main PCA board transducers.



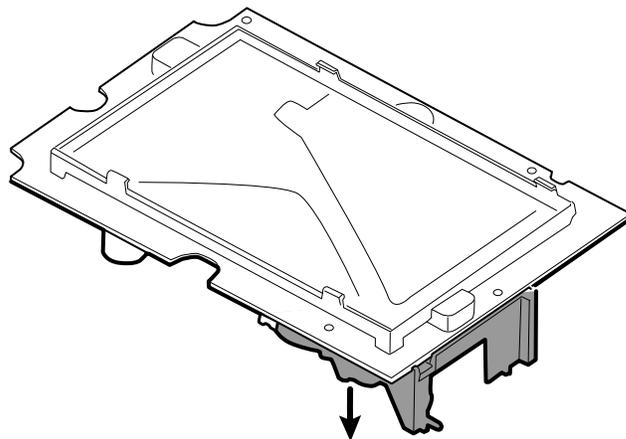
2. Pinch and remove the pump assembly connector from the main PCA board.



3. Turn over the main PCA board and remove 2 T-10 Torx screws.



4. Separate the pump assembly from the main PCA board.



**NOTE** Reassembly is different from disassembly.

## Attach the pump assembly to the main PCA board

Kit item:

- 105920, PUMP ASSEMBLY AND 2 T-10 TORX SCREWS
1. Place the pump manifold onto the main PCA board transducer. Ensure that the pump manifold is fully seated on the transducer.
  2. Connect the pump assembly connector to the main PCA board.
  3. Turn over the main PCA board.
  4. Secure the pump assembly to the main PCA board with 2 T-10 Torx screws.

## Replace the main PCA board

Replace the main PCA board as needed after removing all other components. Before you begin, ensure that you have the appropriate replacement kit items:

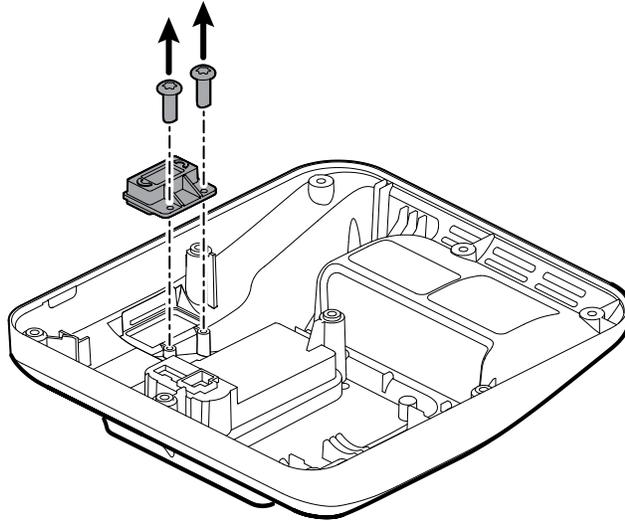
- 107184, SRV KIT, MAIN PCA, AND LCD FRAME



**NOTE** After installing a new PCA board, use the Welch Allyn Service Tool, Gold Edition, to prepare the board for first-time use. This includes programming the device serial number into the new board and performing an NIBP initialization during full device functionality. See "Program the main PCA board" and "Initialize the NIBP board" for more information. After replacing the main PCA board and completing the full functional check, set the first boot option to Production Complete using the service tool. This will set the device to prompt you to enter the language, date and time on first boot. See "Service Tool Spot 4400 Help File" for more information.

## Remove the SpO2 insert

On the inside of the back housing, remove the 2 Torx screws and then remove the insert.



## Reassembly notes

Kit items:

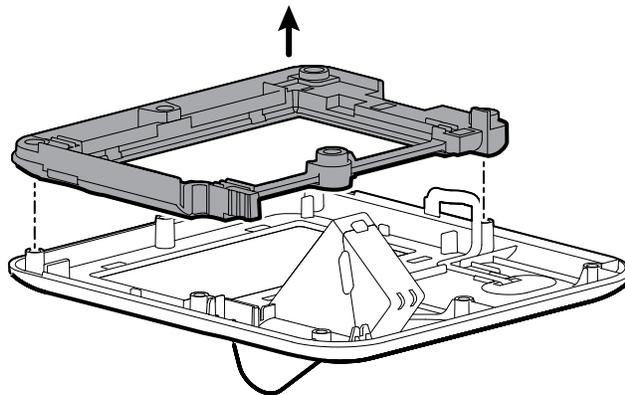
- 107350, SRV KIT, SpO2 INSERT BLANK
- 107351, SRV KIT, SpO2 INSERT Nonin



**NOTE** Reassembly is the reverse of disassembly.

## Remove the bezel from the front housing

Lift the rubber bezel up and over the power switch cable and the bosses on the front housing.



**NOTE** Reassembly is not the reverse of disassembly.

## Attach the bezel to the front housing

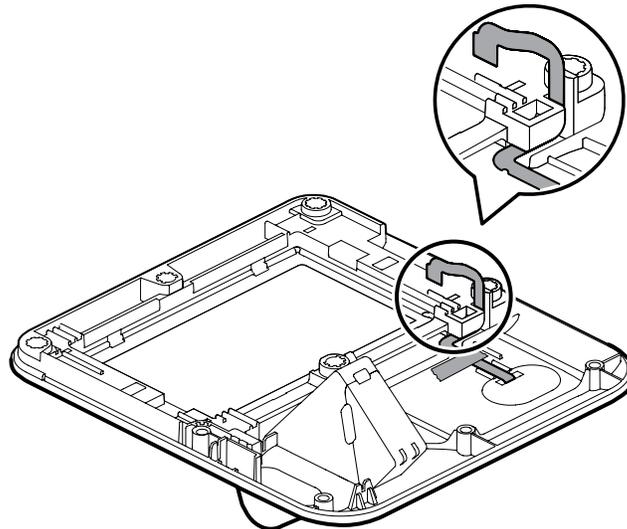
Spot Vital Signs 4400 Extended Care kit items:

- 107183, SRV KIT, LCD BEZEL
- 108202, SRV KIT, FRONT HOUSING W/ POWER SWITCH

Spot Vital Signs 4400 kit items:

- 107183, SRV KIT, LCD BEZEL
- 107213, SRV KIT, FRONT HOUSING W/ POWER SWITCH

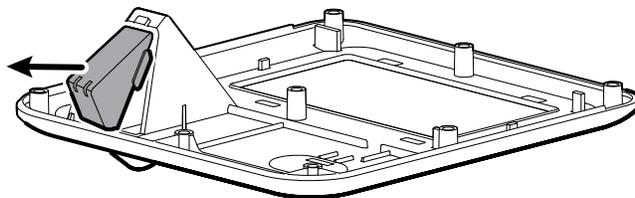
1. Lay the bezel over the 6 bosses on the front housing, and thread the power switch flex cable through the slot in the bezel.



2. Press the bezel down onto the 6 bosses on the front housing.

## Remove the SureTemp probe end cap

On the inside of the back housing, remove the end cap by gently pulling outward.



## Reassembly notes

Kit item:

- 107354, SRV KIT, PROBE BOX CAP



**NOTE** Reassembly is the reverse of disassembly.

## Disassembly and assembly notes for mobile stands and power supplies

The following table provides an at-a-glance view of the service kits that are compatible with the combination of mobile stand and power supply based on the date of manufacture. This section is divided into four major subsections, defined in the table below.

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### Section A

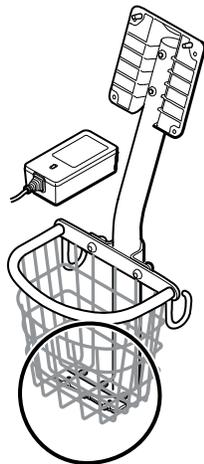


Spot 4400 devices with a 4400-MBS mobile stand meeting these criteria:

- 4400-MBS mobile stand manufactured before 02/2022\* or earlier
- 4400-PS power supply manufactured before 02/2022\* or earlier
- Power supply model: MENB1035A1500F02

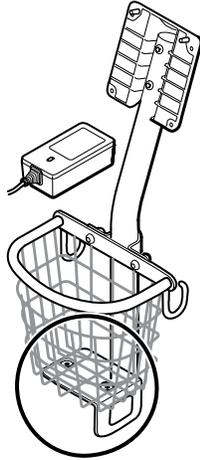
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### Section B



Spot 4400 devices with a 4400-MBS mobile stand meeting these criteria:

- 4400-MBS mobile stand manufactured after 02/2022\* or later
  - 4400-PS power supply manufactured after 02/2022\* or later
  - Power supply model: FW8031M/DT/15
-

**Section C**

Spot 4400 devices with a 4400-MBS mobile stand meeting these criteria:

- 4400-MBS mobile stand manufactured before 02/2022\* or earlier
- 4400-PS power supply manufactured after 02/2022\* or later
- Power supply model: FW8031M/DT/15
- Adapter plate kit REF 411626

**Section D**

Spot 4400 devices with a 4400-MBS mobile stand meeting these criteria:

- 4400-MBS mobile stand manufactured after 02/2022\* or later
- 4400-PS power supply manufactured before 02/2022\* or earlier
- Power supply model: MENB1035A1500F02

\* See the model number and label for further information.

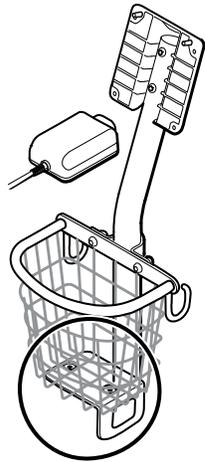
Examine your mobile stand and power supply to determine which subsection you should follow to complete disassembly and assembly procedures.

Many service kits are backward-compatible and/or interchangeable, while others are compatible with only one or two of the stand and power supply combinations.

## Section A, remove the power supply from the mobile stand

This section applies to Spot 4400 devices with a 4400-MBS mobile stand meeting these criteria:

- 4400-MBS mobile stand manufactured before 02/2022\* or earlier
- 4400-PS power supply manufactured before 02/2022\* or earlier
- Power supply model: MENB1035A1500F02

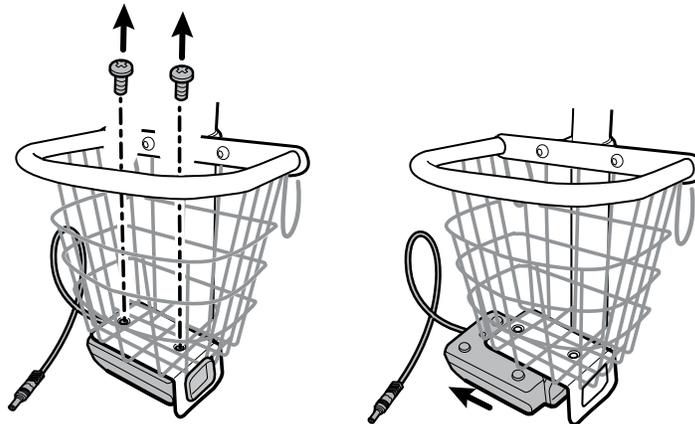


**NOTE** See the model number and label for further information.

1. Power down the device.
2. Disconnect the power cable from the device and disconnect the power cord from the wall.
3. With one hand holding the power supply, remove the 2 Phillips screws that attach the power supply to the bracket.



**NOTE** Set the screws aside for reassembly.



4. Remove the power supply unit.

Recycle or dispose of the power supply unit in an environmentally safe manner consistent with local regulations.

## Section A, attach the power supply to the stand

This section applies to Spot 4400 devices with a 4400-MBS mobile stand meeting these criteria:

- 4400-MBS mobile stand manufactured before 02/2022\* or earlier
- 4400-PS power supply manufactured before 02/2022\* or earlier
- Power supply model: MENB1035A1500F02



**NOTE** See the model number and label for further information.

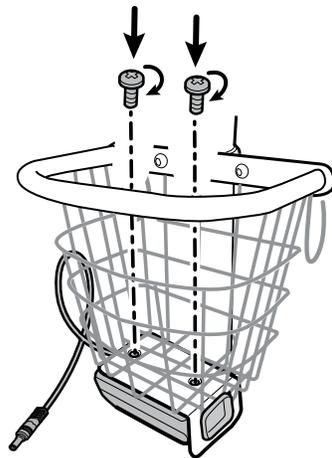
Kit item:

- 4400-PS, SRV KIT, POWER SUPPLY

1. Ensure that the side with the screw holes is facing upward, and then insert the power supply socket into the support frame.



2. Holding the power supply unit snugly to the frame, attach the power supply to the bracket using the 2 Phillips screws.

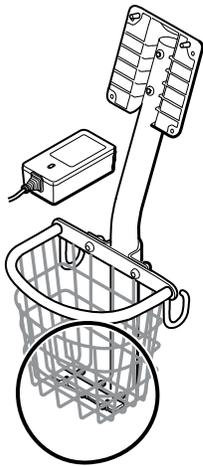


3. Thread the power cable from the power supply through one of the spaces next to the pole to reach the device, and then connect the power cable to the device.
4. Connect the power cord to the mains outlet.
5. Power up the device.

## Section B, remove the power supply from the mobile stand

This section applies to Spot 4400 devices with a 4400-MBS mobile stand meeting these criteria:

- 4400-MBS mobile stand manufactured after 02/2022\* or later
- 4400-PS power supply manufactured after 02/2022\* or later
- Power supply model: FW8031M/DT/15

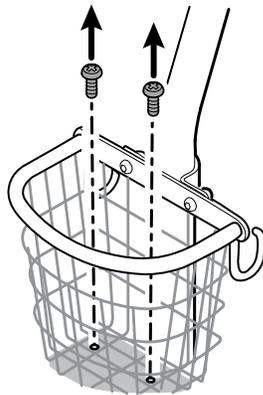


**NOTE** See the model number and label for further information.

1. Power down the device.
2. Disconnect the power cable from the device and disconnect the power cord from the wall.
3. With one hand holding the power supply, remove the 2 Phillips screws that attach the power supply to the bracket.



**NOTE** Set the screws aside for reassembly.



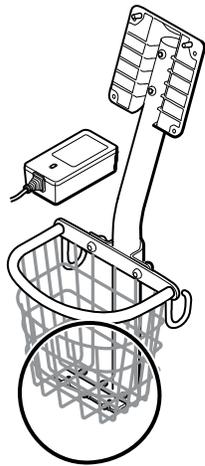
4. Remove the power supply unit.

Recycle or dispose of the power supply unit in an environmentally safe manner consistent with local regulations.

## Section B, attach the power supply to the stand

This section applies to Spot 4400 devices with a 4400-MBS mobile stand meeting these criteria:

- 4400-MBS mobile stand manufactured after 02/2022\* or later
- 4400-PS power supply manufactured after 02/2022\* or later
- Power supply model: FW8031M/DT/15

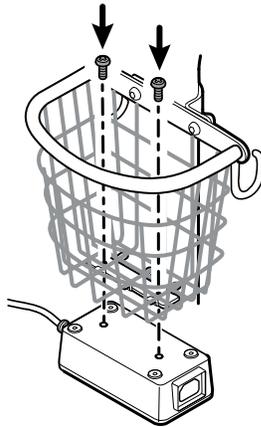


**NOTE** See the model number and label for further information.

Kit item:

- 4400-PS, SRV KIT, POWER SUPPLY

1. Holding the power supply unit snugly to the support bracket, attach the power supply to the bracket using the 2 Phillips screws.

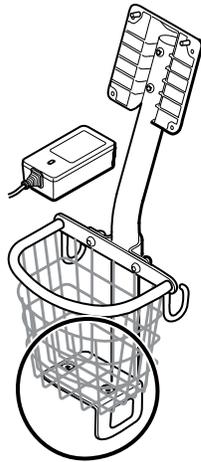


2. Thread the power cable from the power supply through one of the spaces next to the pole to reach the device, and then connect the power cable to the device.
3. Connect the power cord to the mains outlet.
4. Power up the device.

## Section C, remove the power supply from the mobile stand

This section applies to Spot 4400 devices with a 4400-MBS mobile stand meeting these criteria:

- 4400-MBS mobile stand manufactured before 02/2022\* or earlier
- 4400-PS power supply manufactured after 02/2022\* or later
- Power supply model: FW8031M/DT/15

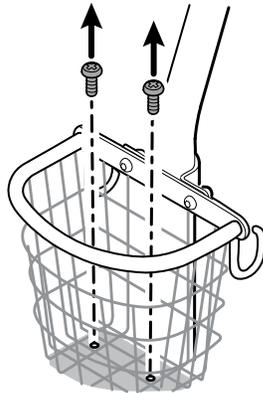


**NOTE** See the model number and label for further information.

1. Power down the device.
2. Disconnect the power cable from the device and disconnect the power cord from the wall.
3. With one hand holding the power supply, remove the 2 Phillips screws that attach the power supply to the bracket. With the other hand, hold the adapter plate and the well nuts.



**NOTE** Set the screws, adapter plate, and well nuts aside for reassembly.



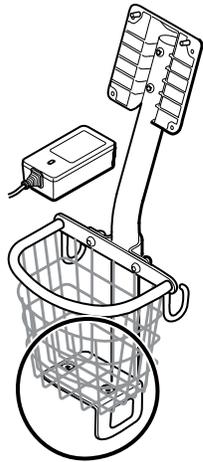
4. Remove the power supply unit.

Recycle or dispose of the power supply unit in an environmentally safe manner consistent with local regulations.

### Section C, attach the power supply to the stand

This section applies to Spot 4400 devices with a 4400-MBS mobile stand meeting these criteria:

- 4400-MBS mobile stand manufactured before 02/2022\* or sooner
- 4400-PS power supply manufactured after 02/2022\* or later
- Power supply model: FW8031M/DT/15

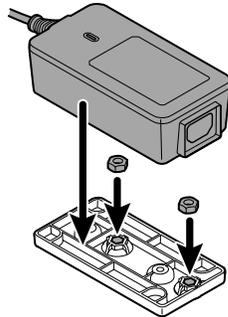


**NOTE** See the model number and label for further information. To install the new power supply onto an existing stand, you need to use the adapter plate kit REF 411626.

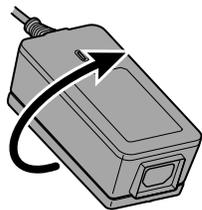
Kit item:

- 4400-PS, SRV KIT, POWER SUPPLY
- 411626, MS3 POWER SUPPLY BRACKET KIT

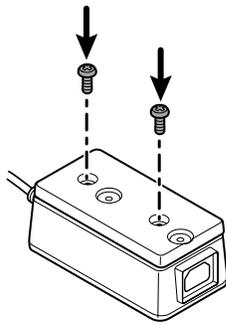
1. Install the 2 nuts by placing each nut into the adapter plate well. With one hand holding the power supply, use the other hand to close up the power supply onto the adapter plate.



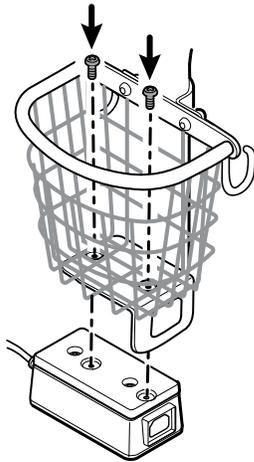
2. Flip the power supply over to ensure that the side with the screw holes is facing upward,



and then attach the power supply to the adapter plate by aligning the holes and then tighten using the 2 Phillips screws.



3. Holding the power supply unit snugly to the support bracket, tighten the 2 Phillips screws.



4. Thread the power cable from the power supply through one of the spaces next to the pole to reach the device, and then connect the power cable to the device.
5. Connect the power cord to the mains outlet.
6. Power up the device.

## Section D, remove the power supply from the mobile stand

This section applies to Spot 4400 devices with a 4400-MBS mobile stand meeting these criteria:

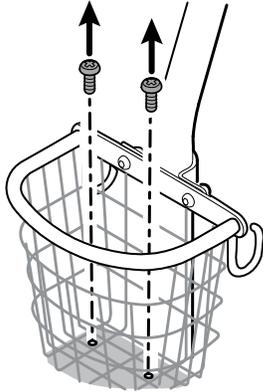
- 4400-MBS mobile stand manufactured after 02/2022\* or later
- 4400-PS power supply manufactured before 02/2022\* or earlier
- Power supply model: MENB1035A1500F02



1. Power down the device.
2. Disconnect the power cable from the device and disconnect the power cord from the wall.
3. With one hand holding the power supply, remove the 2 Phillips screws that attach the power supply to the bracket.



**NOTE** Set the screws, adapter plate, and well nuts aside for reassembly.



4. Remove the power supply unit.

Recycle or dispose of the power supply unit in an environmentally safe manner consistent with local regulations.

### Section D, attach the power supply to the stand

This section applies to Spot 4400 devices with a 4400-MBS mobile stand meeting these criteria:

- 4400-MBS mobile stand manufactured after 02/2022\* or later
- 4400-PS power supply manufactured before 02/2022\* or earlier
- Power supply model: MENB1035A1500F02

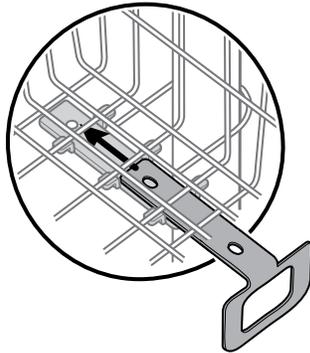


**NOTE** See the model number and label for further information.

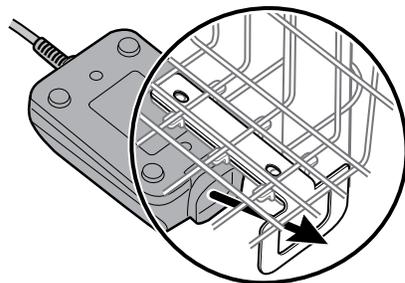
Kit item:

- 4400-PS, SRV KIT, POWER SUPPLY

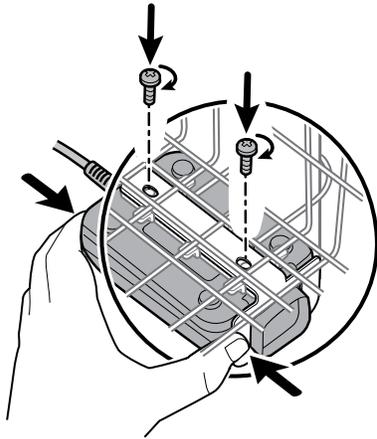
1. Install the adapter plate onto the wire bracket of the mobile stand.



2. Attach the power supply to the adapter plate by aligning the holes.



3. Holding the power supply unit snugly to the support bracket, tighten the 2 Phillips screws.



4. Thread the power cable from the power supply through one of the spaces next to the pole to reach the device, and then connect the power cable to the device.
5. Connect the power cord to the mains outlet.
6. Power up the device.



## Field replaceable units

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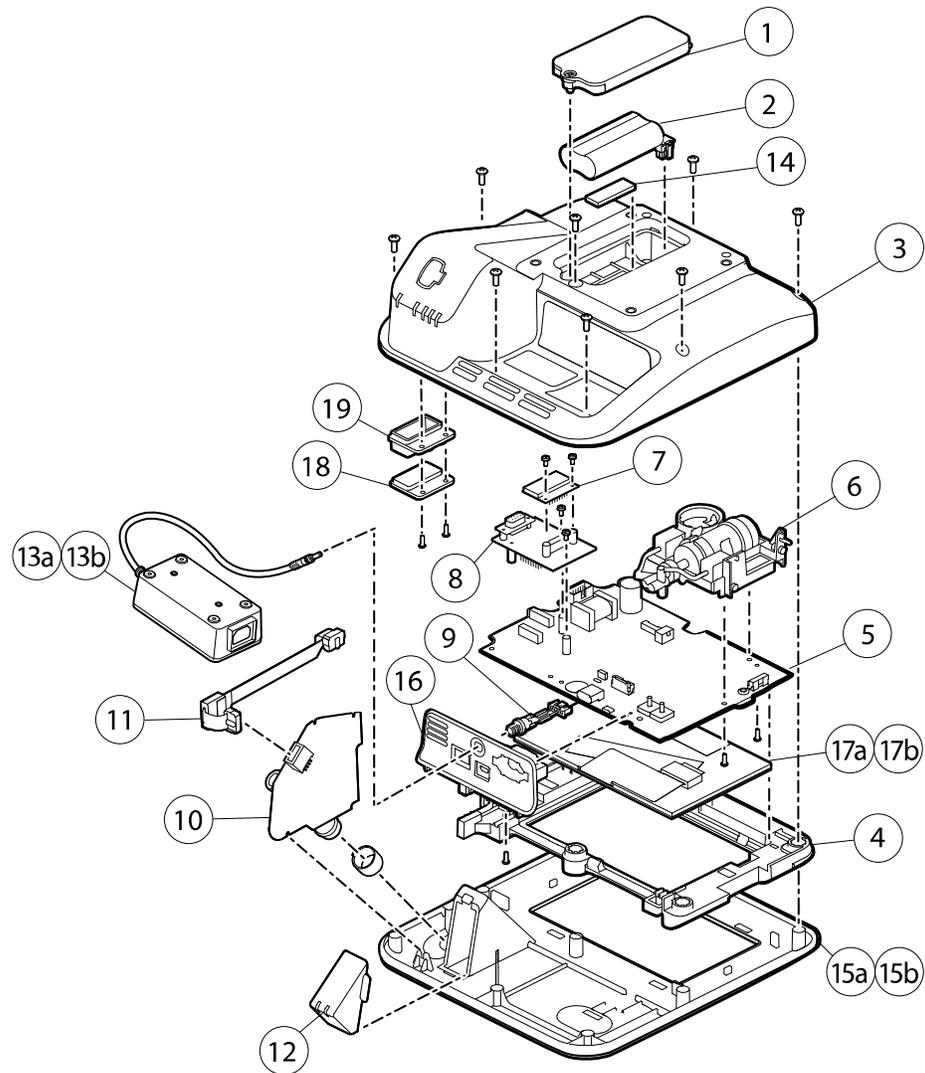
This listing includes only field-replaceable service parts. Product accessories—including patient sensors, probes, cables, batteries, probe covers, and other consumable items—are listed separately in the accessories list in the Appendix of the Instructions for use.

This section begins with an illustration of the entire device followed by lists of service kits.

Repair parts/kits can be purchased through Hillrom sales channels. You can also visit the [Hillrom Parts Store](#) online to purchase replacement parts and accessories for your Welch Allyn device.



**NOTE** Welch Allyn may limit availability of certain parts to Authorized Service Personnel only. These limitations are required to maintain product safety, or maintain current regulations. After the End of Manufacturing (EoM) date, repair and service parts will be provided for 5 years or until parts are no longer available. The Expected Service Life, per IEC60601-1 3rd Edition Sub-clause 4.4, is defined as a period of 5 years.



## About service kits

The table describes the components of the device and the associated service kits for replaceable parts.

Future revisions of a part might not always be backwards compatible with a legacy part.

## List of service kits

To determine the correct replacement part for your unit, always provide the serial number and model number when ordering.

Service Kit Number	Material Number	Description
1	107352	Srv Kit, Battery Door
2	BATT22	Srv Kit, Battery Pack, 2 Cell Lithium-ion Battery

Service Kit Number	Material Number	Description
3	107214	Srv Kit, Back Housing with Labels*
4	107183	Srv Kit, LCD Bezel
5	107184	Srv Kit, Main PCA, and LCD Frame
6	105920	Srv Kit, NIBP Pump Assembly
7	105933	Srv Kit, NoninSpO2 PCBA
8	107185	Srv Kit, NoninSpO2 PCBA with Adapter Board
9	107186	Srv Kit, Power Harness
10	107187	Srv Kit, SureTemp Module with O-Ring
11	107189	Srv Kit, SureTemp Ribbon Cable
12	107354	Srv Kit, Probe Box Cap
13a	4400-PS	Srv Kit, Power Supply Spot Vital Signs 4400
13b (not shown)	4400-HPS	Srv Kit, Power Supply 40W Spot Vital Signs 4400 Extended Care
14	107212	Srv Kit, Battery Door Foam
15a	107213	Srv Kit, Front Housing with Power Switch Spot Vital Signs 4400
15b	108202	Srv Kit, Front Housing with Power Switch Spot Vital Signs 4400 Extended Care
16	107215	Srv Kit, Sensor Housing with Power Harness
17a	108241	Srv Kit, LCD with Touchscreen Spot Vital Signs 4400 Extended Care
17b	105924	Srv Kit, LCD with Touchscreen Spot Vital Signs 4400
18	107350	Srv Kit, SpO2 Insert Blank
19	107351	Srv Kit, SpO2Nonin Insert
*Not available for direct purchase.		



## Cleaning the device

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This section presents cleaning procedures that pertain to service and repair. For daily cleaning requirements and approved cleaning agents, refer to the *Instructions for use*.



**WARNING** Patient injury risk. Clean all accessories, including cables and tubes, before storing the accessories on the device or stand. This helps reduce the risk of cross contamination and nosocomial infection.



**WARNING** Electric shock hazard. Before cleaning the device, disconnect the AC power cord from the mains outlet and the power source.



**WARNING** Electric shock hazard. DO NOT immerse or autoclave the device or accessories. The device and the accessories are not heat-resistant.



**WARNING** Liquids can damage electronics inside the device. Prevent liquids from spilling on the device.



**CAUTION** Do not sterilize the device. Sterilization can harm the device.

## Remove liquid spills from the device

Liquids can damage electronics inside the device. Follow these steps if liquids spill on the device.

1. Power down the device.
2. Disconnect the power cord from the mains outlet and the power source.
3. Remove battery pack from the device.
4. Dry excess liquid from the device.
5. Reinstall battery pack.
6. Reconnect the power cord.
7. Power on the device and verify that the device functions normally before using it.

If liquids possibly entered the device, remove the device from use until it has been properly dried, inspected, and tested by qualified service personnel.

## Dry the equipment

1. Allow all components except the LCD screen to air dry.
2. Wipe the LCD screen dry with a clean cloth.

## Store the device

Store the device according to facility guidelines to keep the device clean, dry, and ready for service.

# Functional verification and calibration overview

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## Functional verification tests

The functional verification tests help to confirm the proper operation of the device and its options. The tests may also be useful as a diagnostic tool to help isolate a malfunction. It is not necessary to disassemble the device to perform these tests.

For periodic service, you can—at a minimum—perform the basic functional verification tests described in this manual. If you have the Gold edition of the service tool, you have the additional capability to perform a complete functional verification and calibration of the device, but this is not required for minimal periodic service.

In contrast, any time you open the device case, you must use the service tool, Gold edition, to perform a complete functional verification and calibration of the device before returning the device to service.



**NOTE** For instructions on using the Gold edition, see the service tool help files.

## About the Welch Allyn Service Tool

The service tool is required to complete functional verification and calibration tests. The service tool is available in the following editions:

- **Standard unlicensed edition:** Enables NIBP functional verification tests to satisfy the recommended annual service. If any Standard unlicensed edition testing shows an out-of-specification result, use the Gold edition to perform a full calibration.
- **Gold edition:** Checks the functionality and calibration of the device. As it checks the device, the Gold edition also performs any needed calibration to bring the device within specifications. This full suite of tests is required to complete a repair. Each time you open the case, you must use the Gold edition to test the device before returning the device to normal use.



**NOTE** Verify that the final test service record from the Welch Allyn Service Tool shows evidence that each of the tests required for a given model number are present and the test was performed.

For information about the service tool, see the following:

- For instructions on installing and using the service tool, see the *Welch Allyn Service Tool Installation and Configuration Guide*.

- To use the Standard unlicensed edition to test the NIBP module, follow the instructions in this service manual.
- For instructions on using the Gold edition, see the service tool help files.

### Standard unlicensed edition service tool tests performed

The service tool performs the following functions on the host device and installed options.

Test	Description	NIBP	Temp	SpO2	Host
Reads firmware	Displays the firmware version	✓	✓	✓	✓
Firmware upgrade	Loads the latest firmware into the module				✓
Leak test	Verifies leaks using 100 cc volume	✓			
Accuracy test (NIBP)	Checks the accuracy of transducers across the pressure range	✓			
Overpressure test	Verifies the maximum cuff pressure	✓			

### Gold edition service tool tests performed

The service tool tests the host device and installed options as listed in the following table.

Test	Description	NIBP	Temp	SpO2	Host
POST	Performs the power-on self test (POST) <sup>1</sup>	✓	✓	✓	✓
Firmware version	Checks the firmware version	✓	✓	✓	✓
Firmware upgrade	Loads the latest firmware into the module				✓
Leak	Verifies leaks using 100 cc volume	✓			
AD noise	Checks noise on the pressure channel	✓			
Calibration	Calibrates pressure transducers	✓			
Accuracy (NIBP)	Checks the accuracy of transducers across the pressure range	✓			
Dump	Checks dump valves	✓			
Pump inflation	Verifies the pneumatic pump	✓			
Overpressure	Verifies pump limits	✓			

Test	Description	NIBP	Temp	SpO2	Host
Probe detect	Verifies the operation of the probe detect switch <sup>2</sup>		✓		
Accuracy (Temp)	Verifies the accuracy of the thermometer across range		✓		
Temperature functional check	Verifies temperature module with cal-key <sup>2</sup>		✓		
SpO2 functional check	Verifies module operation with an SpO2 simulator			✓	
Display	Verifies video output				✓
Back light interface	Verifies display LED back light				✓
Touchscreen interface	Verifies touchscreen calibration				✓
LED	Verifies the LED				✓
Beeper	Verifies the buzzer				✓
Battery operation	Verifies the internal battery				✓

<sup>1</sup> POST testing checks the following:

- **NIBP:** ROM, RAM, A/D channels, calibration, and user configuration.
- **Temperature:** ROM, RAM, calibration, and heater.
- **SpO2:** ROM and RAM, and connection to the SpO2 board.

<sup>2</sup> SureTemp Plus only.

## Electrical safety testing

Welch Allyn recommends performing ground continuity and leakage current tests after all open-case repairs and dielectric strength testing is not recommended.



**NOTE** Perform dielectric strength testing only if there is a reason to doubt the integrity of the electrical insulation (e.g. multiple trips of a residual-current device or liquid ingress of a saline solution). If you determine this test should be performed, return the device to Welch Allyn for service.

These recommendations trace to EN/IEC 60601-1 – Medical Electrical Equipment – Part 1: General Requirements for Basic Safety and Essential Performance or EN/IEC 62353 – Medical Electrical Equipment – Recurrent Test and Test After Repair of Medical Electrical Equipment.

Because of the variability of test equipment in the field, Welch Allyn does not include specific instructions to perform electrical safety tests. When performing electrical safety tests, refer to your test equipment manuals for detailed instructions to ensure proper test equipment setup that aligns with the appropriate standard. The following table provides connections and test limits to assist you in performing these tests.

Test	Limits
Ground continuity (see Note above)	Ground continuity from EP stud (equipotential terminal)* to the Gnd pin of the IEC power connector shall be no greater than 0.1 ohms.
Leakage current (see Note above)	Leakage current shall be less than 500 $\mu$ A from EP stud* to mains (Line and Neutral pins of the IEC power connector).
Insulation resistance	Dielectric strength shall be 500 V (DC) EP stud* to IEC mains (Line and Neutral pins of the IEC power connector), and insulation resistance is measured.

\* To locate the equipotential terminal, see "Controls, indicators, and connectors."

## Devices with an external power supply

The power bricks are CB Certified and UL Listed; they meet ALL of the requirements that the Medical Device standard requires for power supplies. The manufacturer is required to perform 100% electrical safety testing on all of their power bricks prior to shipment. Welch Allyn does not perform nor recommend testing on these external power bricks because additional testing would put undue stress on the insulation system and possibly cause premature failures in the field. Open case repairs of devices with external power supplies are only dealing with DC circuitry and robust isolation circuits built into the printed circuit boards. No additional after-servicing testing is required in that instance. The patient isolation systems within the device (Temperature Probe, SpO2 sensor, etc.) all have visible isolation gaps built into the printed circuit board. The quality control on the PCB and the thorough type-testing performed by the testing agency (ETL) eliminates the need for further testing on the devices that are downstream from the mains isolation device.

## Devices with an internal power supply

The internal power supplies are CB Certified and UL Registered. These power supplies are an open frame style (no protective enclosure). Therefore, the products that contain an internal power supply require electrical safety testing. Open case repairs of devices with an internal power supply require the recommended testing because those devices contain the open frame power supply, and the testing involves the manipulation of wiring that carries 120 or 240 volts AC. Welch Allyn does not recommend HiPot / Dielectric Withstand testing because of a potential stress on the insulation system, which could cause premature failures.

# Basic functional verification

## Basic functional verification checks



**NOTE** Calibration is available only with the service tool, Gold edition.

These tests verify basic functionality of the NIBP, SpO2, and thermometry parameters. These tests support the requirements of routine preventive maintenance. However, they are not a substitute for the complete functional tests available with the service tool, Gold edition. Welch Allyn recommends using the service tool, Gold edition, to perform preventive maintenance and verification of the device when completing a repair.

## Basic functional verification tools

The list of tools below is what Welch Allyn uses to perform a basic device functionality check. Most facilities use a device simulator or equivalent products to perform this test.

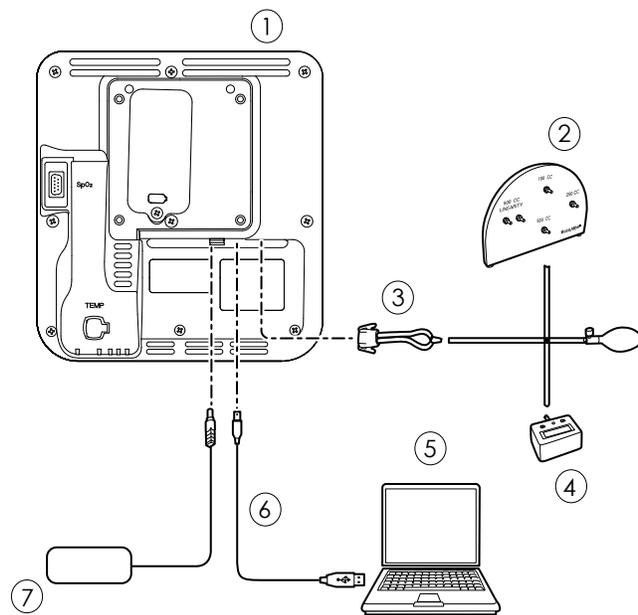
Material no.	Description	Qty	Component
407672	BP test volume repair fixture 113670	1	NIBP
N/A	SpO2 simulator	1	SpO2
06138-000	Cal-key, assembly, M690/692	1	SureTemp Thermometry Module
N/A	Pressure meter (must include at least two decimal points and be accurate to within $\pm 0.5$ mmHg)	1	NIBP
N/A	PC running the Welch Allyn Service Tool on Windows 10	1	All
web download	Welch Allyn Service Tool <a href="http://hillrom.com/en/services/welch-allyn-service-tool/">hillrom.com/en/services/welch-allyn-service-tool/</a>	1	NIBP, Software updates
N/A	Blood Pressure Y-tube	1	NIBP
620216	Fitting "Y" 1/8 X 1/8 X 1/8	1	NIBP

## NIBP test setup



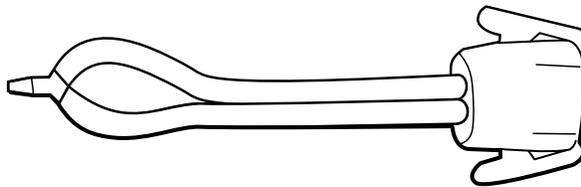
**NOTE** Connect the power supply to the Spot Vital Signs 4400 device. Failure to connect the power supply to the Spot Vital Signs 4400 device will result in the failure of the Welch Allyn Service Tool to recognize the NIBP module of the Spot Vital Signs 4400 device.

For the NIBP leak test, overpressure test, or accuracy check, connect the test equipment shown below. Connect the manifold to the volume repair fixture as indicated by the service tool or the test procedure.



No.	Item	No.	Item
1	Spot Vital Signs 4400 device	5	PC
2	Test volume repair fixture with test manifold, bulb, and valve	6	USB 2.0/5-pin type A to mini-B cable
3	Blood pressure Y-tube	7	AC power supply and connector
4	Pressure meter (must include at least two decimal points and be accurate to within $\pm 0.5$ mmHg)		

## Create a blood pressure Y-tube



The blood pressure Y-tube is a piece of custom test equipment that connects the device to the test setup. The Y-tube is composed of a modified blood pressure hose and a Y-type fitting. Follow these instructions to create a Y-tube.

1. Cut a 4500-30 blood pressure hose approximately 6 inches from the connector that connects to the device.
2. Split the end of the dual-lumen hose to create two separate hoses. Make sure not to puncture either hose.
3. Insert one end of the Y-type fitting into each end of the hose.

## NIBP tests

For the NIBP leak test, overpressure test, or accuracy check, connect the test equipment according to the test setup diagram for your configuration presented earlier in this section. Connect the manifold to the volume repair fixture as indicated by the service tool or the test procedure.

### NIBP leak test (Standard unlicensed edition)

The NIBP leak test is performed automatically using the service tool. The leak test pressurizes the system with a start pressure ( $P_s$ ) of 250 mmHg  $\pm$  10 mmHg. After 15 seconds ( $T_t$ ) the end pressure ( $P_e$ ) is measured. The leak rate is calculated using the formula  $L = (P_s - P_e) / T_t$ . The test fails if the leak rate exceeds 5 mmHg in 15 seconds.

#### Perform an NIBP leak test



**NOTE** Connect the power supply to the Spot Vital Signs 4400 device. Failure to connect the power supply to the Spot Vital Signs 4400 device will result in the failure of the Welch Allyn Service Tool to recognize the NIBP module of the Spot Vital Signs 4400 device.

1. Set up the test equipment including the Spot Vital Signs 4400 device power supply.
2. Connect AC power to a power source and then connect the power adapter to the device before powering on the device.
3. Launch the service tool on the PC.
4. If the simplified interface is active, choose the Service option.
5. Power on the device.
6. Log on with your user ID and password or with ADMIN as the user ID and leave the password field blank.
7. Select the device you want to test from the device list.
8. Click **NIBP Sensor** under the Device Information tab.
9. Click **Leak Test** in the NIBP Sensor pane on the right side of the window.
10. Follow the prompts until the test completes.
11. Click **Close**.
12. To view the results, open the active log file by selecting **File > View Log File > Active log file > Ok**.
13. To record the results of your test, go to "Service record."

### NIBP overpressure test (Standard unlicensed edition)

The NIBP overpressure test is performed automatically using the service tool. The overpressure test verifies that the NIBP system will prevent the pressure from exceeding 329 mmHg. To pass this test, the device must shut down the pump and open the valves when the pressure is between 280 mmHg and 329 mmHg.

#### Perform an NIBP overpressure test



**NOTE** Connect the power supply to the Spot Vital Signs 4400 device. Failure to connect the power supply to the Spot Vital Signs 4400 device will result in the failure of the Welch Allyn Service Tool to recognize the NIBP module of the Spot Vital Signs 4400 device.



**NOTE** If you are performing this test after performing the NIBP leak test, skip to step 7.

1. Set up the test equipment including the Spot Vital Signs 4400 device power supply.
2. Connect AC power to a power source and then connect the power adapter to the device before powering on the device.
3. Launch the service tool on the PC.
4. If the simplified interface is active, choose the Service option.
5. Log on with your user ID and password or with ADMIN as the user ID and leave the password field blank.
6. Power on the device.
7. Select the device you want to test from the device list.
8. Click **NIBP Sensor** under the **Device Information** tab.
9. In the NIBP Sensor pane on the right side of the window, click **Over Pressure Test**.
10. Follow the prompts until the test completes.
11. Click **Close**.
12. To view the results, open the active log file by selecting **File > View Log File > Active log file > Ok**.
13. To record the results of your test, go to "Service record."

### NIBP accuracy check (Standard unlicensed edition)

The NIBP accuracy check is performed manually using the service tool to control the valves. The accuracy check compares the reading from the primary transducer pressure shown in the service tool window with the reading from an external calibrated digital pressure meter. The results of this check are not recorded in the service tool log file. To record the results for your records, copy the table in the service record section of the service manual. If a calibration is required, run the NIBP calibration included with the Gold edition of the service tool.



**WARNING** Patient safety risk. If the primary transducer fails, the system might not identify an overpressure condition at the right limit, causing injury when the device is re-connected to a patient. To ensure patient safety, Welch Allyn recommends that a qualified service technician perform a full functional verification and calibration on an annual basis.



**CAUTION** Equipment calibration error can occur. This accuracy check verifies only the accuracy of the primary transducer. If the safety transducer is out of calibration, a calibration error can occur due to the pressure difference between the primary transducer and the safety transducer. To avoid equipment calibration errors, Welch Allyn recommends that a qualified service technician perform a full functional verification and calibration on an annual basis.

### Perform an NIBP accuracy check



**NOTE** Connect the power supply to the Spot Vital Signs 4400 device. Failure to connect the power supply to the Spot Vital Signs 4400 device will result in the failure of the Welch Allyn Service Tool to recognize the NIBP module of the Spot Vital Signs 4400 device.



**NOTE** If you are performing this test after performing a previous NIBP check, skip to step 7.

1. Set up the test equipment including the Spot Vital Signs 4400 device power supply.
2. Connect AC power to a power source and then connect the power adapter to the device before powering on the device.

3. Launch the service tool on the PC.
4. If the simplified interface is active, choose the Service option.
5. Log on with your user ID and password or with ADMIN as the user ID and leave the password field blank.
6. Power on the device.
7. Select the device you want to test from the device list.
8. Click **NIBP Sensor** under the **Device Information** tab.
9. Click **Accuracy Check** in the NIBP Sensor pane on the right side of the window.
10. Connect the 500 CC volume.
11. Turn on the pressure meter and zero if necessary.
12. Check the accuracy at 0 mmHg.
13. Record the reading on the pressure meter and the service tool and compare the results.
14. Using the hand bulb, pressurize the NIBP system to 50 mmHg  $\pm$  5 mmHg and allow 10 seconds for the pressure to stabilize.
15. Record the reading on the pressure meter and the service tool and compare the results.
16. Using the hand bulb, pressurize the NIBP system to 150 mmHg  $\pm$  5 mmHg and allow 10 seconds for the pressure to stabilize.
17. Record the reading on the pressure meter and the service tool and compare the results.
18. Using the hand bulb, pressurize the NIBP system to 250 mmHg  $\pm$  5 mmHg and allow 10 seconds for the pressure to stabilize.
19. Compare the reading on the pressure meter to the service tool reading and record the results.
20. Click **Open valve** to open the NIBP valves. Verify that the pressure on the meter and service tool change to zero.
21. Click **Done** to complete the check.
22. To record the results of your test, go to "Service record."

### Perform an NIBP accuracy test without the Welch Allyn Service Tool

The following tools are required to perform this test:

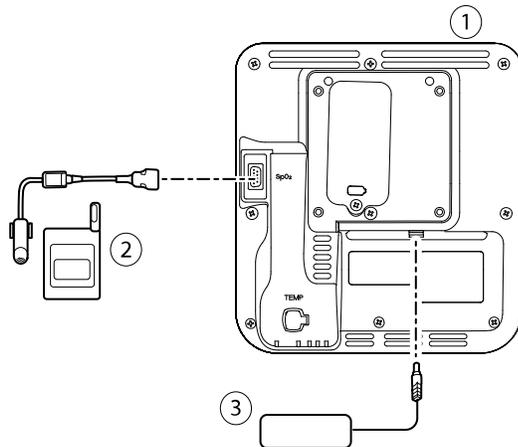
- Blood Pressure Bulb
  - Pressure Meter
  - Dual Lumen Pressure Tubing
  - Pressure Test Box
1. In Advanced settings, navigate to **Service > General**.
  2. Connect the dual lumen tubing to the device.
  3. Connect one end of the tubing to the pressure meter and the other end to the test box. Ensure each end is connected tightly and there are no leaks.
  4. To initiate the verification process, touch **Close Valve**.
  5. Use the blood pressure bulb to adjust the pressure to each threshold of 50/150/250 mmHg.
  6. Compare the pressure displayed on the NIBP Pressure Verification screen and the pressure meter.

## SpO2 tests

Select the procedure here that applies to your configuration to test the device's SpO2 function. Connect the test equipment according to the test setup diagram for your configuration presented here.

### SpO2 test setup

For the SpO2 test, connect the test equipment shown below.



No.	Item
1	Spot 4400
2	SpO2 simulator
3	Power supply

### Perform an SpO2 accuracy test

Use this procedure to test only the device SpO2 function.

1. Power on the device.
2. Connect the SpO2 functional simulator to the SpO2 input connector.



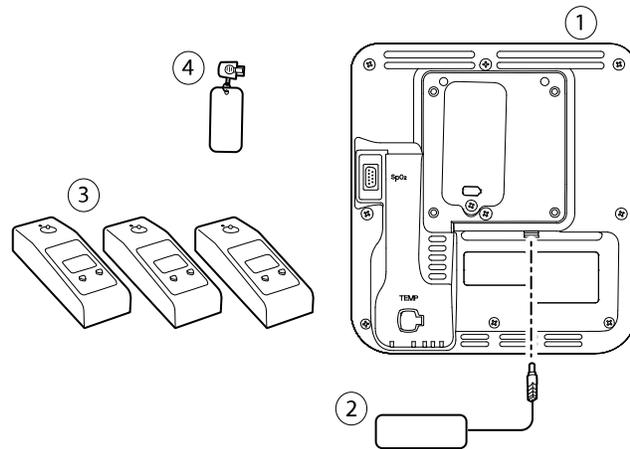
**NOTE** In the following tests, if the simulator defaults are outside the device alarm limits, adjust the limits or silence the alarms.

3. Set the simulator SpO2 saturation to 90% and pulse rate to 60 bpm.
4. Give the device up to 30 seconds to stabilize.
5. Verify the displayed saturation is 90%  $\pm$ 1 sat point, and the pulse rate is 60  $\pm$ 1 bpm.
6. Disconnect the simulator.

## Thermometry tests

### Thermometry test setup

For the thermometry test, connect the test equipment shown below.



No.	Item	No.	Item
1	Spot 4400	3	Tester, calibration, 9600 Plus
2	Power supply	4	Cal-key, assembly, M690/692

### SureTemp temperature system test

The SureTemp temperature system test is performed using a calibration key (cal-key). The calibration key tests the system using a fixed resistance to display a temperature of  $97.3 \pm 0.2$  °F ( $36.3 \pm 0.1$  °C).



**NOTE** If your facility requires you to test the temperature probes, you will also need to have heaters at three temperature settings to test the probes. See "SureTemp temperature probe and system test."

### Perform a SureTemp temperature system test

1. With the system power on and the temperature probe in the well, disconnect the probe cable from the temperature input connector on the front of the device.
2. Connect the calibration key to the temperature input connector.
3. Remove the probe from the well.
4. Verify that the displayed temperature is  $97.3 \pm 0.2$  °F ( $36.3 \pm 0.1$  °C).

### SureTemp temperature probe and system test

Use this procedure to test the temperature function while verifying the temperature probe. To achieve accurate results, you must perform this test with the device in Direct mode.

Test each probe at the low, medium, and high set points on the tester. Repeat the procedure for each thermometer and temperature to test.

### Set up the 9600 Plus calibration tester

Place the tester on a level surface away from sunlight, drafts, and other sources of heat or cold.

The tester takes approximately 20 minutes to heat to the lowest set point.

To expedite testing, Welch Allyn recommends the following practices:

- To eliminate waiting for the tester to heat to the next set point, use three testers, each set to one of three different set points.
- When using only one tester to test several thermometers at all three temperatures, test all thermometers at one set point before proceeding to the next set point.
- To eliminate waiting for the tester to cool down, start at the lowest set point. Because the tester does not have an internal fan, it requires more time to cool down than to heat up.

### Change the 9600 Plus set point

To scroll from one set point to the next, press and hold the Temperature Selection button until a beep sounds.

The new set point appears in the upper left corner of the display. The device's current temperature appears, flashes, and continues flashing until the cavity reaches equilibrium at the new set point. The 9600 Plus beeps when the set point is reached.

### Perform a SureTemp temperature probe and system test

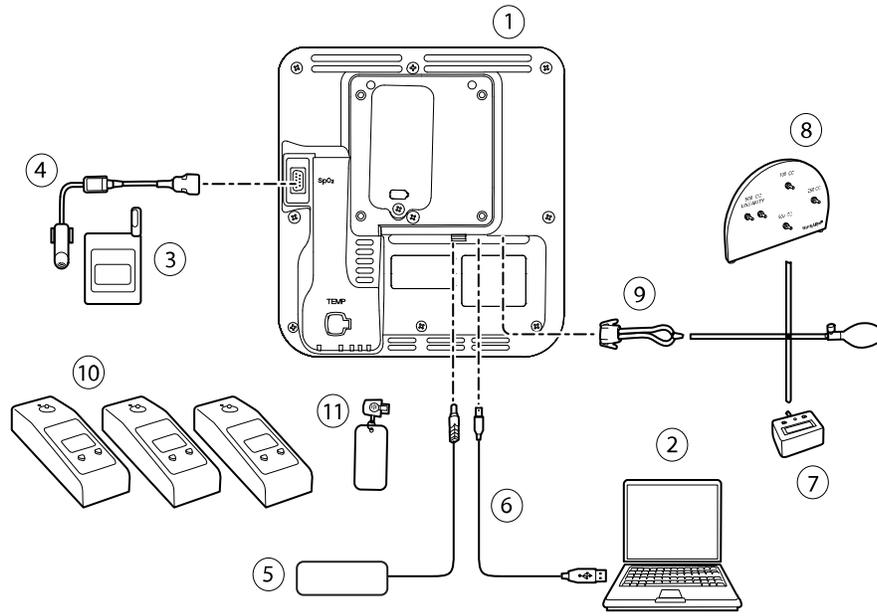
1. Set the 9600 Plus to the desired set point and wait for the display to stop flashing.
2. Insert the temperature probe, without a probe cover, into the thermistor device port on the tester.
3. When  appears on the display, touch it to switch to Direct mode.
4. Wait for up to two minutes for the temperature reading to stabilize.
5. Record the results in the temperature service record.
6. Return the temperature probe to the probe well on the device.
7. Repeat the procedure as necessary until all thermometers are tested at each temperature.

To record the results of your test, go to "Service record."

## Full functional verification and calibration

### Functional verification test setup

Connect the test equipment to your device as shown in these drawings to complete the functional tests described in this section.



Item No.	Material No.	Description	Qty	Required	Optional
				Welch Allyn purchase	Welch Allyn purchase
1	Varies	Spot 4400	1	X	
2	N/A	PC running the Welch Allyn Service Tool on Windows 10	1		
3	N/A	SpO2 simulator	1		
4	3278-010	8000AA-2 WA REUSABLE SENSOR ADULT, 2M	1		X
5	4400-PS	Power supply	1	X	
6	106275	Micro USB cable	1		X
7	N/A	Pressure meter (must include at least two decimal points and be accurate to within $\pm 0.5$ mmHg)	1		
8	407672	Test volume repair fixture (113670) with test manifold, bulb, and valve	1		X
9	N/A	Blood pressure Y-tube	1		See instructions for creating the Y-tube in the Basic functional verification section.

Item No.	Material No.	Description	Qty	Required Welch Allyn purchase	Optional Welch Allyn purchase
				(see Notes)	
10	01802-110	Tester, calibration, 9600 Plus, SureTemp	3		X
11	06138-000	Cal-key, assembly, M690/692	1	X	



**NOTE** All items listed in this table are required to complete a full functional verification and calibration. If Welch Allyn does not make an item available for purchase, you must provide it yourself.



**NOTE** You may substitute items marked as an optional Welch Allyn purchase with comparable OEM products.

## Full functional verification check and calibration tools

The tools listed below are required to perform a full device functionality check and calibration. The tools are used in conjunction with the Welch Allyn Service Tool, Gold license, to perform a device calibration.

Material no.	Description	Qty	Component
01802-110	Tester, calibration, 9600 Plus	3	SureTemp Plus probes
407672	BP test volume repair fixture 113670	1	NIBP
N/A	SpO2 simulator	1	SpO2
06138-000	Cal-key, assembly, M690/692	1	SureTemp Plus Thermometry Module
N/A	Pressure meter (must include at least two decimal points and be accurate to within $\pm 0.5$ mmHg)	1	NIBP
106275	Micro USB cable	1	All
N/A	PC running Windows 10	1	All
107334	Welch Allyn Service Tool Gold license for Spot 4400	1	NIBP, Software updates
web download	Welch Allyn Service Tool <a href="http://hillrom.com/en/services/welch-allyn-service-tool/">hillrom.com/en/services/welch-allyn-service-tool/</a>	1	NIBP, Software updates and calibration
4500-30	Blood pressure hose, 5 ft.	1	NIBP
620216	Fitting "Y" 1/8 X 1/8 X 1/8	1	NIBP

Material no.	Description	Qty	Component
N/A	USB Flash Drive	1	Host Controller, Log File Capture

## Initialize the NIBP board

Functional verification and calibration must be performed each time the device is disassembled or more frequently if your facility's procedures require a full calibration on a specified basis. If you have just replaced a Main PCA board, your first step before performing a full verification and calibration is to initialize the NIBP Board.

1. Set up the equipment for full functional verification as shown earlier in this section.
2. Log in to the Welch Allyn Service Tool, highlight your device in the Device list, and click **Select**.

This action opens the **Spot 4400 > Device information** subtab. Depending on your configuration, it could take 30-45 seconds to populate this subtab.

3. Select the **Verify and calibrate** subtab.
4. Select **NIBP sensor** in the Device field.
5. Click **Calibrate**.

This opens the Verify and calibrate NIBP Sensor dialog.

6. Click **Begin**.

A list of tests appears in the left pane of the dialog along with three controls in the right pane.

7. Click **Initialize NIBP Board** in the right pane.

A confirmation window appears with the message, "Are you sure you want to reset the calibration offsets of the NIBP Board?"

8. Click **Yes**.

This action places two tests in the queue for initialization: the Power Calibration Test – Primary/Safety and the Pressure Calibration – Primary/Safety.



**NOTE** A message appears in the right pane to indicate the first test is in progress. If the test passes, a green check appears to the left of the test name, and the second test begins. If the test fails, a red check appears to the left of the test name, followed by a prompt to rerun the test. You cannot proceed to the second test until the first test passes.

9. Rerun the Power Calibration Test as needed until the test passes.
10. If you did not set up your equipment for a full calibration initially, connect the 500cc volume to the device when prompted and then click **Next**.



**NOTE** You cannot initialize the board without setting up the equipment for the Pressure Calibration test.

11. Observe the pressure calibration messages onscreen and follow the onscreen prompts to manually adjust device pressure with the hand bulb to  $250 \pm 5$  mmHg.
12. Once you reach the targeted pressure, enter the exact value on the pressure meter in the Meter pressure field, then click **Next** to record this value.

If the test passes, a green check appears to the left of the test name. If the test fails, a red check appears to the left of the test name, followed by a prompt to rerun the test.

13. Rerun the Pressure Calibration test as needed until the test passes.
14. If the second test passes, click **Close**.

The NIBP board is now initialized.

## Configure the main PCA board

After installing a new PCA board, use the Welch Allyn Service Tool, Gold Edition, to prepare the board for first-time use. This includes programming the device serial number into the new board and initializing the NIBP board.

1. Log in to the Welch Allyn Service Tool, highlight your device in the Device list and click **Select**.
2. Select **Spot 4400 > Configure**, and then click **Change**.

The **Change device configuration settings** dialog box appears.

3. Enter the device serial number.

The device serial number is located on the bottom of the device.

4. If the serial number of the main circuit board does not appear, enter it as the host controller serial number.

The serial number is located on the circuit board.

5. Select the appropriate device model number from the drop-down list.
6. Click **Save**.

If you have not done so already, complete functional verification and calibration before using the device.

## Options and upgrades

Welch Allyn may support option and software upgrades for Spot Vital Signs 4400 (Spot 4400).

Option upgrades for devices still under warranty that require any installation inside the device must be performed by a Welch Allyn service center unless you participate in the Partners in Care Biomed Partnership Program. If you want to install the options, we recommend you attend either the classroom or online technical training course for the device. The training is required to be eligible to receive the Welch Allyn Service Tool Gold edition. The Gold edition is required to verify that the device is functioning correctly after it has been serviced. Although all of the option upgrades are calibrated and tested before leaving the factory, Welch Allyn recommends performing a complete functional test whenever the device is serviced.



**NOTE** For the Welch Allyn Service Tool to support updates and upgrades, adjust your firewall settings to permit access for IP address 169.254.10.10 (the local feed server for the software upgrade process).

Software upgrades, when available, can be purchased or provided at no charge if your device is covered by a Welch Allyn Service Agreement. The upgrades can be installed by either a Welch Allyn service center or by using the service tool, Standard unlicensed or Gold edition.

If you choose to install software upgrades on your own, you will receive the software through the internet. When ordering software, provide the serial number of the device you want to install the software on.



**NOTE** The device must be plugged in to AC power and have at least 15 minutes of battery charge remaining to execute software upgrades. You can download software upgrades on battery power, but you cannot implement them without AC power.

## Available options



**CAUTION** Before installing any option, disconnect the patient from the device and power down the device.

### Options

Model	44WT	44XT
Spot 4400 with NIBP, SureTemp, NoninSpO2	●	○
Spot 4400 with NIBP, SureTemp	○	●

● Standard with this model.

○ Not available

## Upgrading software with the Welch Allyn Service Tool

The Spot 4400 and the Welch Allyn Service Tool (WAST) interact through Ethernet over USB technology, enabling the device to function as a USB device with both a network and an IP address. This connection separates logically into two distinct interfaces: a generic USB serial connection and a Remote Network Driver Interface Specification (RNDIS) network interface, which is a Microsoft Windows driver. Most interactions between the WAST and the Spot 4400 take place over the generic USB serial connection. In contrast, software upgrades require the RNDIS interface for the device to connect the WAST and download the firmware.

During software upgrade, the Ethernet over USB interface with the WAST is auto-configured with the specifications noted in the table below. When the Spot 4400 reaches out to the WAST for the firmware package, it uses either one of the following TCP ports: 80/443. Be prepared to modify any firewall(s) that prevent incoming connections to allow this traffic. The WAST attempts to configure the Windows firewall by opening this specific port on the RNDIS interface. If administrative controls such as a Group Policy Object (GPO) or third-party software have been implemented to prevent this change, the WAST attempts to diagnose the problem and then inform you of possible remediation steps. Work with your IT staff or Network Administrator as needed to enable this functionality.

Interface specifications	IP address	Network mask
Device Ethernet over USB interface	169.254.10.10	255.255.255.255
WAST RNDIS interface	169.254.10.1	255.255.255.255

At the start of a software upgrade, the Welch Allyn Service Tool creates a local HTTP server and uses the USB connection to transfer necessary file package to the Spot 4400. Once the file package is on the device, it launches the installation of host controller firmware and reboots the device immediately following the installation. When the device auto-reboots, the software upgrade of individual modules and sensors (NIBP, SpO<sub>2</sub>, and/or Temperature) is complete.

### Software rollback capability

The Spot 4400 utilizes a primary and secondary software structure. In the final step of the software upgrade, the device rolls the previous firmware package to a secondary image and identifies the newly installed firmware as its primary image. This structure allows rollback to previous versions as needed. For example, if you performed a software upgrade and then determined that it didn't meet your expectations or conform to your workflow, you can execute a software rollback in seconds and limit device downtime. To roll back your software, follow these steps:

1. Connect the device to your laptop and open the Welch Allyn Service Tool.
2. Click the **Configure** tab.
3. In the Current settings window, click **Change...**
4. Click the **Device Software Rollback** tab.
5. Click **Rollback**.
6. In the Confirm Device Software Rollback dialog, click **Yes** to confirm.

In addition, because the software upgrade is already loaded on your device, you can use the rollback capability at a later time to implement the upgrade and complete the associated setup activities. Follow the same steps presented above to activate the new firmware.

## Upgrade the device firmware

Updating a device requires a PC, a USB cable and an Internet connection.

1. To launch the Welch Allyn Service Tool, from the Start menu select **All Programs > Welch Allyn > Welch Allyn Service Tool**.
2. Click **Service**.
3. Click **Login**.
  - a. Enter the user name: **ADMIN**.
  - b. Leave the password blank.
4. Connect the device to the computer with a USB cable.
5. Turn on the device.
6. In the Welch Allyn Service Tool, under the Device List tab, click on the device and click **Select**.
7. Under the Welch Allyn Connex Device, select **Upgrade**.  
The list of available upgrades appears.
8. Select the desired upgrade, click **Upgrade** and then click **Yes**.  
When the upgrade is complete, the Upgrade tab will display **No Upgrade Available**.
9. Close the Device tab, and then close the Service Tool.
10. Disconnect the USB cable from the device, and then turn off the device.

## SmartCare services for maintenance and repair

### SmartCare protection plans

Material no.	Item
S1-4400-PRO-1	4400 SmartCare Protection 1YR
S1-4400-PRO-3	4400 SmartCare Protection 3YR
S1-4400-PRO-PS	4400 SmartCare Protection 3YR POS

### SmartCare protection plus plans

SmartCare protection plus plans include onsite repair.

Material no.	Item
S9-4400-PROPLUS-1	4400 SmartCare Protection Plus 1YR

Material no.	Item
S9-4400-PROPLUS-3	4400 SmartCare Protection Plus 3YR
S9-4400-PROPLUS-PS	4400 SmartCare Protection Plus 3YR POS

## SmartCare biomed plans

Material no.	Item
S1-4400	4400, Comprehensive partnership program point of sale
S1-4400-2	4400, Comprehensive partnership program 1 year renewal

## Service and repair training



**NOTE** Required to be eligible to receive the Welch Allyn Service Tool, Gold edition.

Material no.	Item
4400REP-TRN	4400, Repair training
4400REP-WEB-TRN	4400, Repair web training
4400REPRC-WEB-TRN	4400, Repair re-certification web training

# Appendix

## Specifications

### Physical specifications

<b>Protection classifications, all device configurations</b>	
<b>Characteristic</b>	<b>Specification</b>
Electrical rating	Power supply model: FW8031M/DT/15 Input: 100 – 240 V AC, 50 – 60 Hz, 0.6 A – 0.3 A Output: 15 V DC, 2.0 A  Power supply model: MENB1035A1500F02 Input: 100 – 240 V AC, 50 – 60 Hz, 0.8 A – 0.5 A Output: 15 V DC, 2.33 A
Duty cycle	Continuous operation
Type of protection against electric shock	Class I internally powered
Degree of protection against electric shock, for parts applied to patients	Type BF defibrillator proof IEC EN 60601-1, 2nd and 3rd Editions
Recovery time following defibrillator discharge	Less than or equal to 15 seconds
Flammable anesthetics	 <b>WARNING</b> Not suitable for use with flammable anesthetics.
Degree of protection provided by the enclosure with respect to harmful ingress of liquids	IPX2 Protected against vertically falling water drops when enclosure tilted up to 15°
Height	10.1 in. (25.7 cm)
Width	9.3 in. (23.6 cm)
Depth	4.9 in. (12.4 cm)

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**Protection classifications, all device configurations**


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Weight (including battery)	3.8 lb (1.7 kg)
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**Graphical display resolution**


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Dimensional outline	6.5 in. (W) x 4.1 in. (H) x 0.13 in. (D) (164.9 mm [H] x 103.8 mm [W] x 3.40 mm [D])
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Active area	6.1 in. (W) x 3.4 in. (H) (154.08 mm [W] x 85.92 mm [H])
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Resolution	800 x 480 pixels
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Pixel arrangement	RGB (red, green, blue)
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Pixel size	63.2 μm (W) x 179 μm (H)
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Luminance	530 cd/m <sup>2</sup>
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## Battery specifications

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**2 Cell battery specifications**
**Hours of use**


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Ambulatory care continuous 12 minute cycles - 40 patient cycles	8
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## NIBP specifications

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**NIBP specifications**


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Cuff pressure range	Meets or exceeds IEC/ISO 80601-2-30 standards for cuff pressure range
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Systolic range	Adult: 30 to 260 mmHg (StepBP, SureBP) Pediatric: 30 to 260 mmHg (StepBP, SureBP)
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Diastolic range	Adult: 20 to 220 mmHg (StepBP, SureBP) Pediatric: 20 to 220 mmHg (StepBP, SureBP)
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Cuff Inflation Target	Adult: 160 mmHg (StepBP) Pediatric: 140 mmHg (StepBP)
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Maximum Target Pressure	Adult: 280 mmHg (StepBP, SureBP) Pediatric: 280 mmHg (StepBP, SureBP)
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Blood pressure determination time	Typical: 15 seconds Maximum: 150 seconds
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**NIBP specifications**


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Blood pressure accuracy	Meets or exceeds ANSI.AAMI SP10:2002 standards for noninvasive blood pressure accuracy ( $\pm 5$ mmHg mean error, 8 mmHg standard deviation)
Mean Arterial Pressure (MAP) range The formula used to calculate MAP yields an approximate value.	Adult: 23 to 230 mmHg (StepBP, SureBP) Pediatric: 23 to 230 mmHg (StepBP, SureBP)
Pulse rate range (using blood pressure determination)	Adult: 30 to 200 bpm (StepBP, SureBP) Pediatric: 30 to 200 bpm (StepBP, SureBP)
Pulse rate accuracy (using blood pressure determination)	$\pm 5.0\%$ ( $\pm 3$ bpm)
Overpressure cutoff	Adult: 300 mmHg $\pm 15$ mmHg Pediatric: 300 mmHg $\pm 15$ mmHg

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## SureTemp Plus temperature module specifications

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**SureTemp Plus temperature module specifications**


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Temperature range (all measurement sites)	80 °F to 110 °F (26.7 °C to 43.3 °C)
Calibration accuracy	$\pm 0.2$ °F ( $\pm 0.1$ °C) (Direct mode)

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**Laboratory accuracy**


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Temperature measurement range	Ambient	Ambient
	64.4 °F (18 °C) to 82.4 °F (28 °C)	50 °F (10 °C) to 64.4 °F (18 °C) or 82.4 °F (28 °C) to 113 °F (40 °C)
Less than 95.9 °F (35.5 °C)	$\pm 0.36$ °F ( $\pm 0.2$ °C)	$\pm 0.36$ °F ( $\pm 0.2$ °C)
95.9 °F (35.5 °C) to less than 96.4 °F (35.8 °C)	$\pm 0.18$ °F ( $\pm 0.1$ °C)	$\pm 0.36$ °F ( $\pm 0.2$ °C)
96.4 °F (35.8 °C) to less than 98.0 °F (37.0 °C)	$\pm 0.18$ °F ( $\pm 0.1$ °C)	$\pm 0.3$ °F ( $\pm 0.2$ °C)
98.0 °F (37.0 °C) to 102.0 °F (39.0 °C)	$\pm 0.18$ °F ( $\pm 0.1$ °C)	$\pm 0.2$ °F ( $\pm 0.1$ °C)
Greater than 102.0 °F (39.0 °C) to 106.0 °F (41.0 °C)	$\pm 0.18$ °F ( $\pm 0.1$ °C)	$\pm 0.3$ °F ( $\pm 0.2$ °C)
Greater than 106.0 °F (41.0 °C) to 107.6 °F (42.0 °C)	$\pm 0.18$ °F ( $\pm 0.1$ °C)	$\pm 0.36$ °F ( $\pm 0.2$ °C)
Greater than 107.6 °F (42.0 °C)	$\pm 0.36$ °F ( $\pm 0.2$ °C)	$\pm 0.36$ °F ( $\pm 0.2$ °C)

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## Thermometry clinical accuracy validation

For a copy of our Clinical Validation Study, please contact Hillrom Customer Care.

## SpO2 specifications

Refer to sensor manufacturer's directions for use for additional information.



**WARNING** Functional testers cannot be used to assess the accuracy of a pulse oximeter device.

While functional testers may be useful for verifying that the pulse oximeter sensor, cabling, and device are functional, they are incapable of providing the data required to properly evaluate the accuracy of a system's SpO2 measurements. Fully evaluating the accuracy of the SpO2 measurements requires, at a minimum, accommodating the wavelength characteristics of the sensor and reproducing the complex optical interaction of the sensor and the patient's tissue. These capabilities are beyond the scope of known bench-top testers. SpO2 measurement accuracy can only be evaluated in vivo by comparing pulse oximeter readings with SaO2 measurements obtained from simultaneously sampled arterial blood made using a laboratory CO-oximeter.



**NOTE** Contact the sensor manufacturer for further SpO2 clinical testing information.



**NOTE** Refer to sensor manufacturers' directions for use for further accuracy information.

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### SpO2 specifications

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SpO2 performance measurement range	1 to 100%
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### Nonin sensor accuracy guide

SpO2 accuracy testing is conducted during induced hypoxia studies on healthy, non-smoking, light-to-dark-skinned subjects during motion and no-motion conditions in an independent research laboratory. The measured arterial hemoglobin saturation value (SpO2) of the sensors is compared to arterial hemoglobin oxygen (SaO2) value, determined from blood samples with a laboratory co-oximeter. The accuracy of the sensors in comparison to the co-oximeter samples measured over the SpO2 range of 70 – 100%. Accuracy data is calculated using the root-mean-squared ( $A_{rms}$  value) for all subjects, per ISO 9919:2005, Standard Specification for Pulse Oximeters for Accuracy.

Pulse rate	18 to 300 bpm: ± 3 digits
	Low perfusion (40 to 240 bpm): ± 3 digits

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Saturation	70% to 100%
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**NOTE** Saturation accuracy varies by sensor type. **Adult/Pediatrics**

**No Motion**

Finger Clip: ± 2 digits  
Flex: ± 3 digits

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**SpO2 specifications**


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**Motion**Finger Clip:  $\pm 2$  digitsFlex:  $\pm 3$  digits**Low Perfusion**All Sensors:  $\pm 2$  digits

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## Environmental specifications

Operating temperature	50 °F to 104 °F (10 °C to 40 °C)
Storage/Transport temperature	-4 °F to 122 °F (-20 °C to 50 °C)
Storage/Transport/Operating altitude and atmospheric pressure	-1250 to 10,000 ft. (-381 m to 3,048 m) 70 kPA to 106 kPA
Operating humidity	15% to 90% noncondensing
Storage/Transport humidity	15% to 95% noncondensing

## USB flash drive requirements

The multiple vendor technologies used in the manufacture of USB flash drives make some of them incompatible with this device. Common issues that cause flash drives not to function are NTFS formatting, proprietary drive security, and the need for Windows drivers to run or access them.

The requirements for a USB flash drive to work with this device are the following:

- Linux compatibility
- Up to 32 GB storage
- FAT 32 formatting
- USB 2.0 compliant

Dimensions: Assuming the USB flash drive will be inserted into the device, the length of the stick does not matter. The size of the stick surrounding the USB metal head should be no larger than 9.5 mm x 18.5 mm to fit in the USB port.

Welch Allyn recommends the following USB flash drive for use with the device: Kingston DataTraveler SE9 32 GB drive, part number DTSE9H/32GBZ.

## Factory defaults



**NOTE** Factory defaults are the settings in the device when it comes off the manufacturing floor. Customized configuration files modify these defaults based on preferences for specific sites. Restoring default settings on a device returns it to its manufacturing floor defaults, not the custom configuration.

## Device

Settings	Default value
Date format	MM/DD/YYYY
Time zone	Europe/London
Daylight Saving Time enabled	Yes
Patient mode	Adult
Allow auto sleep mode	Yes
Sleep mode interval	2 min
Allow auto shutdown	Yes
Auto shutdown timeout interval	15 min
Brightness	5
Language	English

## Manual parameters

Settings	Default value
Display height	Yes
Display weight	Yes
Display pain	Yes
Display respiration	Yes
Display BMI	Yes
Height units	inches
Weight units	lbs

## NIBP

Settings	Default value
NIBP views	SYS/DIA
NIBP units	mmHg

Settings	Default value
NIBP algorithm	SureBP
NIBP adult inflation preset (CIT) or Default inflation pressure	160 mmHg (21.3 kPa)
NIBP pediatric inflation preset (CIT) or Default inflation pressure	140 mmHg (18.7 kPa)
Adult max cycle pressure	Auto (300 mmHg, 40.0 kPa )
Pediatric max cycle pressure	Auto (300 mmHg, 40.0 kPa)
<b>NIBP Averaging</b>	
Include readings	1 - No 2 - Yes 3 - Yes 4 - No 5 - No 6 - No
Delay to start	1 min
Time between	1 min
Keep if +/-	20mmHg

## Temperature

Settings	Default value
Temperature units	Fahrenheit
Allow temperature conversion display	Yes
Default site for oral probe	Oral

## Troubleshooting

This section provides the following tables to help troubleshoot the device.

- **Interpreting log file output:** The tables and sample calculations in this topic show you how to parse and interpret error log messages.
- **Symptoms and solutions:** This simple table lists symptoms you might observe, possible causes, and suggested actions that might eliminate the problem.
- **Information and error messages:** These tables list messages generated by the device software when a problem is detected. The tables explain possible causes and suggest actions that can resolve the problem. Compare to the Symptoms and solutions table, these tables are much more exhaustive.

These tables can help you diagnose and fix a problem. They do not replace basic troubleshooting skills. You must still trace the source of the problem to the board or module level to decide the best course of action. Welch Allyn does not support component-level repair to the board or module. For available replacement parts, see "Field Replaceable Units."



**WARNING** Do not perform troubleshooting on a device that is emitting smoke or exhibits other signs of excessive overheating. Disconnect the device from AC power and call Welch Allyn Technical Support immediately.



**CAUTION** Replace parts, components, or accessories only with parts supplied or approved by Welch Allyn. The use of any other parts can lead to inferior device performance and will void the product warranty.

## Interpreting log file output

The device supports saving log files to a USB flash drive. You can then read saved log files on a PC to assist in analysis. This method allows access to the log files without having to connect the device to a PC.

### Save log files

Complete the following steps to save a log file to a USB flash drive:

1. Insert a compatible USB flash drive into the USB port of the device.
2. Access Advanced settings.
3. Navigate to **Service > Log file**.
4. Touch **Save to USB**. A "Save successful" message appears after a successful save.
5. Remove the USB flash drive from the USB port.

### Access log files

Complete the following steps to access and start working with log files saved to a USB flash drive:

1. Insert the USB flash drive into a USB port on your PC.
2. Open the USB flash drive and identify the saved log files. Look for .zip files that resemble this example, with the first set of numbers being a timestamp in the YYYYMMDD format:

**logfiles\_20150108\_193903\_179.zip**

3. Open the .zip file, and then open the desired messages .zip file. Multiple messages files might be saved on the USB drive, so check the timestamp in the filename to select the desired .zip file. For example,

**messages\_2015\_01\_08.zip**

The available log files appear onscreen. The largest file is the latest file of the day. The filenames resemble this example:

**messages\_2015\_01\_08\_000000008**

4. Right-click on the desired log file, select **Open**, and then select Notepad ++ as the program to open the file.

The log file opens and is ready for analysis.

### Log message format

Knowing how to interpret log file output can help you to troubleshoot issues on the device. All log messages follow this format:

**<PRI>ISODATE(sp)MSGHDR:(sp)MSG(new-line)**

The following table defines each element of the log message.

<PRI>	The facility number and the severity number concatenated into an 8-bit value.
	 <b>NOTE</b> The PRI values and calculations performed with them are useful primarily to Welch Allyn engineers. Most biomed and service personnel can focus on the other details of log messages to complete their analysis.
ISODATE	The date and time at which the message was generated in the ISO 8601 compatible standard timestamp format (yyyy-mm-ddThh:mm:ss.mmm+-ZONE). This is picked up from the device system time.
MSGHDR	Message header: The name and the PID of the program or process that sent the log message in PROGRAM[PID]: format. It includes a trailing whitespace.
MSG	The text of the log message from the sending program or process. This is a free-format text string, terminating with a new-line character.
(sp)	A single-space character.
(new-line)	A new-line character.

Sample log messages:

**<13>2014-09-26T12:18:45.000+00:00 wa\_nibpd[1326]: NibpManualBpCancelState->Enter**

**<150>2014-09-08T05:55:00.000+00:00 wa\_spo2nonind[1521]: Code 1, SPO2 sensor not connected**

As noted above, the calculations performed using PRI values have little significance for most users but are valuable for Welch Allyn engineers. Therefore, the following instructions for calculating facility and severity numbers target Welch Allyn engineers.

To obtain the facility number, divide the PRI value by 8 (dropping the fraction from the result). The facility number is one of the following:

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#### Facility Number Description

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0	Kernel messages
1	User-level messages
2	Mail system
3	System daemons
4	Security/authorization messages (auth)
5	Messages generated internally by syslogd
6	Line printer subsystem
7	Network news subsystem
8	UUCP subsystem

---

Facility Number	Description
9	Clock daemon
10	Security/authorization messages (authpriv)
11	FTP daemon
12	NTP subsystem
13	Log audit
14	Log alert
15	Clock daemon (cron)
16	BioMed messages (aka local-0)
17	Manufacturing messages (aka local-1)
18	Service messages (aka local-2)
19	Engineering messages (aka local-3)
20	Not Used (aka local-4)
21	Not Used (aka local-5)
22	Not Used (aka local-6)
23	Not Used (aka local-7)

To obtain the severity number, subtract the (facility times 8) value from the PRI value. The severity number is one of the following:

Severity Number	Severity Name	Description
0	EMERG	A panic condition
1	ALERT	A condition that should be corrected immediately
2	CRITICAL	Critical conditions, such as hard device errors
3	ERROR	Error messages
4	WARNING	Warning messages
5	NOTICE	Conditions that are not errors but may require attention
6	INFO	Information messages
7	DEBUG	Debug messages

## Sample calculation/interpretation

For each of the sample error logs presented, we can determine the following:

**<13>2014-09-26T12:18:45.000+00:00 wa\_nibpd[1326]: NibpManualBpCancelState->Enter**

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<PRI> = 13

ISODATE = 2014-09-26T12:18:45.000+00:00

MSGHDR = wa\_nibpd[1326]:

MSG = NibpManualBpCancelState

Facility = <PRI> ÷ 8 = 13 ÷ 8 = 1.625 = 1 when rounded down = User-level messages

Severity = <PRI> - (Facility x 8) = 13 - (1 x 8) = 13 - 8 = 5 = NOTICE

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**<150>2014-09-08T05:55:00.000+00:00 wa\_spo2nonind[1521]: Code 1, SPO2 sensor not connected**

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<PRI> = 150

ISODATE = 2014-09-08T05:55:00.000+00:00

MSGHDR = wa\_spo2nonind[1521]:

MSG = Code 1, SPO2 sensor not connected

Facility = <PRI> ÷ 8 = 150 ÷ 8 = 18.75 = 18 when rounded down = Service messages (aka local-2)

Severity = <PRI> - (Facility x 8) = 150 - (18 x 8) = 150 - 144 = 6 = INFO

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## Symptoms and solutions

Symptom	Possible cause	Suggested action
<b>General</b>		
All tests for the device were not run with the Welch Allyn Service Tool.	The device is not connected to a power supply.	Plug the device into the electrical outlet and then connect the power supply to the device.
	Initialization of the device and the Welch Allyn Service Tool is required.	Re-boot the device and the PC. Relaunch the Welch Allyn Service Tool and retest the device.
The device does not power up.	A new battery was installed.	Connect AC power to wake up the battery.
	The battery is discharged.	Connect AC power to charge the battery.
	The power switch is defective.	Replace the power switch.

Symptom	Possible cause	Suggested action
	The power supply is defective.	Check the output voltage on the power supply. The voltage should be 15 V ± 0.45V DC. If it is not, replace the power supply.
	The battery is dead or defective.	Charge the battery for 5 hours. If the battery icon on the display still shows an empty battery symbol, replace the battery.
	The main board is defective.	Replace the main board.
The touchscreen is unresponsive.	Touchscreen needs calibration.	<p>Calibrate the touchscreen.</p> <hr/> <p>Run the Host Calibration Sequence from the Service Tool.</p> <hr/> <p>Replace the LCD / touchscreen.</p> <hr/> <p>Replace the main board.</p>
The device is powered on but the display is blank.	The device is in Sleep mode.	Touch the screen.
	A hardware component has failed.	<p>Run the Host Calibration Sequence from the Service Tool.</p> <hr/> <p>Replace the LCD / touchscreen.</p> <hr/> <p>Replace the main board.</p>
<b>NIBP</b>		
Blood pressure readings are inaccurate.	Incorrect cuff size, improperly placed cuff, or incompatible cuff.	<p>Determine correct cuff size by measuring patient's arm circumference midway between the elbow and the shoulder. Then use a properly sized cuff.</p> <hr/> <p>Use reference markings on the cuff to place it properly.</p> <hr/> <p>Use only Welch Allyn cuffs.</p>
	Patient's arm is not positioned properly or moves during blood pressure cycle.	<p>Ensure patient's arm is resting on a surface at heart level.</p> <hr/> <p>Keep arm still to reduce artifact.</p>

Symptom	Possible cause	Suggested action
	Blood pressure cuff is placed over clothing.	Take blood pressure on a bare arm.
	The patient is experiencing arrhythmia.	Check for regularity of heart rate (palpate pulse or check device).
	There is a leak in the pneumatic system.	<p>Ensure all cuff attachments are tight. Carefully check for leaks in blood pressure cuff and tubing attached to the device.</p> <p>Replace the cuff.</p> <p>Update the software.</p> <p>Perform NIBP functional checks.</p> <p>Perform NIBP calibration checks.</p> <p>Replace the pump assembly.</p> <p>Replace the main board.</p>
	The NIBP module needs calibration.	<p>Update the software.</p> <p>Perform NIBP functional checks.</p> <p>Perform NIBP calibration checks.</p> <p>Replace the pump assembly.</p> <p>Replace the main board.</p>
	The NIBP module malfunctioned.	<p>Update the software.</p> <p>Perform NIBP functional checks.</p> <p>Perform NIBP calibration checks.</p> <p>Replace the pump assembly.</p> <p>Replace the main board.</p>
	The dual lumen switch failed.	<p>Ensure that the cuff is the properly sized.</p> <p>Clean the cuff connections.</p> <p>Replace the cuff and tubing.</p>

Symptom	Possible cause	Suggested action
		Replace the main board.
The NIBP cuff does not inflate. NIBP is not functioning.	There is a leak in the pneumatic system.	<p>Ensure all cuff attachments are tight. Carefully check for leaks in blood pressure cuff and tubing attached to the device.</p> <p>Replace the cuff.</p> <p>Update the software.</p> <p>Perform NIBP functional checks.</p> <p>Perform NIBP calibration checks.</p> <p>Replace the pump assembly.</p> <p>Replace the main board.</p>
	The NIBP module malfunctioned.	<p>Update the software.</p> <p>Perform NIBP functional checks.</p> <p>Perform NIBP calibration checks.</p> <p>Replace the pump assembly.</p> <p>Replace the main board.</p>
	The main board malfunctioned.	<p>Update the software.</p> <p>Perform NIBP functional checks.</p> <p>Perform NIBP calibration checks.</p> <p>Replace the pump assembly.</p> <p>Replace the main board.</p>
	The dual lumen switch failed.	<p>Ensure that the cuff is the properly sized.</p> <p>Clean the cuff connections.</p> <p>Replace the cuff and tubing.</p> <p>Replace the main board.</p>
	The NIBP module needs calibration.	Update the software.

Symptom	Possible cause	Suggested action	
		Perform NIBP functional checks.	
		Perform NIBP calibration checks.	
		Replace the pump assembly.	
		Replace the main board.	
Attempt to upgrade the software failed.	The hardware or software between the Host and the device is incompatible.	Retry software update. Replace the main board.	
	The device lost communication with the network or a timing issue occurred during the upgrade.	Retry software update. Replace the main board.	
<b>Temperature</b>			
Temperature measurements are inaccurate.	Probe is placed improperly.	Ensure that the probe is properly placed in the measurement site. For oral temps, place the probe in the most posterior sublingual pocket.	
	The probe malfunctioned.	Replace the probe. Perform temperature functional checks.	
	The probe cover is faulty or incorrectly attached.	Verify the condition of the probe cover and that it covers the probe completely. Replace the probe cover.	
	The probe or the window is dirty or contaminated.	Clean the probe or window. Replace the probe.	
	The temperature module malfunctioned.	Update the software. Replace the temperature module. Replace the main board.	
	The main board malfunctioned.	Update the software. Replace the main board.	
	Temperature measurements are not displayed.	The probe is disconnected from the device.	Ensure that the temperature probe is connected and

Symptom	Possible cause	Suggested action
		seated in the probe well before taking a measurement.
	Probe is placed improperly.	Ensure that the probe is properly placed in the measurement site. For oral temps, place the probe in the most posterior sublingual pocket.
	The probe malfunctioned.	Replace the probe. Perform temperature functional checks.
	The temperature module malfunctioned.	Update the software. Replace the temperature module. Replace the main board.
	A software issue occurred.	Update the software. Replace the temperature module. Replace the main board.
	The probe or the window is dirty or contaminated.	Clean the probe or window. Replace the probe.
	The main board malfunctioned.	Update the software. Replace the main board.
<b>SpO2</b>		
SpO2 measurements are not displayed.	The sensor is faulty or incorrectly attached.	Connect the sensor to the patient and the device. Replace the sensor. Perform SpO2 functional checks.
	The sensor is contaminated or dirty.	Clean the optical area of the sensor. Replace the sensor. Perform SpO2 functional checks.

Symptom	Possible cause	Suggested action
	The SpO2 module malfunctioned.	Perform SpO2 functional checks. Update the software. Replace the SpO2 module. Replace the main board.
	The main board malfunctioned.	Update the software. Replace the main board.
SpO2 measurements are inaccurate.	The sensor is faulty or incorrectly attached.	Connect the sensor to the patient and the device. Replace the sensor. Perform SpO2 functional checks.
	The sensor is contaminated or dirty.	Clean the optical area of the sensor. Replace the sensor. Perform SpO2 functional checks.
	The SpO2 module malfunctioned.	Perform SpO2 functional checks. Update the software. Replace the SpO2 module. Replace the main board.
	The main board malfunctioned.	Update the software. Replace the main board.
Attempt to upgrade the software failed.	The hardware or software between the Host and the SpO2 module is incompatible.	Retry software update. Replace the SpO2 module. Replace the main board.
	The device lost communication with the network or a timing issue occurred during the upgrade.	Retry software update. Replace the SpO2 module. Replace the main board.
	The temperature module malfunctioned.	Update the software.

Symptom	Possible cause	Suggested action
		Replace the SpO2 module.
		Replace the main board.
	The main board malfunctioned.	Update the software.
		Replace the main board.

## Information and error messages

This section presents tables of information and error messages to help you troubleshoot issues on the device.

When the device detects certain events, a notification appears in the Device Status area at the top of the screen. Below are the notification types.

- Information messages, which appear on a blue background.
- Error messages, which appear on a white background.

You can dismiss a message by touching the message on the screen, or, for some messages, you can wait for the message to time out.

To use these tables, locate the message that displays on the device in the left column of the table. The remainder of the row explains possible causes and suggests actions that can resolve the issue.

If you cannot resolve the issue, use the Service Tool to read the error log files or to perform a functional test on the module reporting the message.



**NOTE** Performing functional tests on modules requires the Service Tool, Gold edition.

Error logs are not viewable by clinicians. However, all logs are transferred to Welch Allyn on a regularly scheduled basis. In the event of an unplanned power failure, all information, including device logs and patient data, are retained on the system.

## NIBP messages

Message	Possible cause	Suggested action
User cancelled NIBP reading.	The NIBP measurement was cancelled by user	Clear the message and retry NIBP.
NIBP not functional. 050002	The NIBP measurement is not available	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Unable to determine NIBP; check connections; limit patient movement. 050003	The NIBP measurement may be inaccurate, patient motion occurred, or the settings for patient readings obtain might not be accurate	Make sure the NIBP settings/patient mode is appropriate. If the problem persists, have the device inspected by a qualified service technician.
Unable to determine NIBP; check connections; limit patient movement. 050004	Excessive artifact, no blood pressure parameters could be calculated	Unable to determine blood pressure. Check connections; restrict patient movement. If

Message	Possible cause	Suggested action
		problem persists, have the device inspected by a qualified service technician.
Unable to determine NIBP; check inflation settings. 050005	Low inflation on blood pressure measurement attempt	Make sure the NIBP settings/patient mode is appropriate. If the problem persists, have the device inspected by a qualified service technician.
Unable to determine NIBP; check connections and tubing for kinks. 050006	The NIBP tubing has a kink, or there is a NIBP transducer calibration failure	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Unable to determine NIBP; check connections; limit patient movement. 050007	The blood pressure measurement dumped too soon	Make sure the NIBP settings/patient mode is appropriate. If the problem persists, have the device inspected by a qualified service technician.
Unable to determine NIBP; check connections; limit patient movement. 050008	There were not enough steps on the measurement attempt	Unable to determine blood pressure. Check connections; restrict patient movement.
Unable to determine NIBP; check inflation settings. 050009	There is invalid patient information for the selected mode	Make sure the NIBP settings/patient mode is appropriate. If the problem persists, have the device inspected by a qualified service technician.
Unable to determine NIBP; check connections; limit patient movement. 05000A	The re-inflation was too late on the measurement attempt	Unable to determine blood pressure. Check connections; restrict patient movement.
Unable to determine NIBP; check inflation settings. 05000B	There were many re-inflate attempts on the measurement attempt	Unable to determine blood pressure. Check connections; restrict patient movement.
Unable to determine NIBP; check connections and tubing for kinks. 05000C	Couldn't bleed pressure below safe venous return pressure	Unable to release cuff pressure. Check tubing for kinks and connection integrity.
NIBP air leak; check cuff and tubing connections. 05000D	Air leak in cuff or tubing	Leak was detected in BP cycle. Check the tubing and connections.
Unable to determine NIBP; check connections; limit patient movement. 05000F	Auto Zero check failure	The NIBP pressure is not stable and the transducer zero value cannot be set. If problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050105	WACP message CRC mismatch on NIBP module	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050201	This message is not implemented by the NIBP module	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050202	This message is not supported by the NIBP module	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.

<b>Message</b>	<b>Possible cause</b>	<b>Suggested action</b>
NIBP not functional. 050203	The NIBP module has run out of memory	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050205	The NIBP module has received a invalid parameter	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050206	The parameter provided by the NIBP module is outside of the allowable range for the specified message	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050207	The NIBP module message requires an object, but did not contain one	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050208	The NIBP module object provided with the message could not be deserialized	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050209	The NIBP module object could not be serialized	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 05020A	The NIBP module message is performing a request or action when the module state prohibits the request or action.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not calibrated. 050503	Factory EEPROM checksum error on NIBP. Units internal configuration was corrupted	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050504	User EEPROM checksum error. Configuration data which can be set in the user's configuration menu was damaged or lost on NIBP	Calibrate the NIBP Module. If problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050505	Post failure of A/D convertor	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not calibrated. Calibrate the module. 050509	NIBP module calibration failure, the calibration signature is zero	Calibrate the NIBP module.
Invalid algorithm. Select correct algorithm and retry. 050512	Invalid NIBP Algorithm. NIBP component software tried to configure the sensor in an illegal manner	Verify the algorithm. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050513	Invalid NIBP initiation code	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Invalid patient mode. Select correct patient mode and retry. 050514	Invalid patient mode on NIBP. The NIBP component software tried to	Verify correct patient mode. If the problem persists, have the device

Message	Possible cause	Suggested action
	configure the sensor in an illegal manner	inspected by a qualified service technician.
NIBP not functional. 050515	Invalid module configuration for NIBP	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050516	NIBP module malfunction	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Ambient temperature out of range. Clear error and retry. 050517	Ambient temp out of range on NIBP	Restore device to normal temperature ranges and try again.
Low battery. Plug into outlet. 050518	The NIBP module power rail is too low	Plug device into an AC outlet to charge the battery.
Battery overcharged. Disconnect from outlet. 050519	The NIBP module power rail is too high. NIBP was calibrated without A/C connected or battery too low.	Battery is overcharged. Remove from charging source. Charge battery and initialize NIBP module and recalibrate with A/C connected.
NIBP not calibrated. Calibrate the module. 050601	NIBP failed to load safety processors calibration record from EEPROM	Calibrate the NIBP module. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050602	NIBP safety processor failed ROM checksum	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not calibrated. Calibrate the module. 050603	NIBP safety processor not calibrated, missing calibration signature	Calibrate the NIBP module. If the problem persists, have the device inspected by a qualified service technician.
Cuff pressure limits exceeded. 050604	NIBP system failure. Overpressure	Restrict patient movement.
Premature auto cycle skipped. 050605	NIBP auto cycle skipped, SVRP requirement not satisfied	Cuff pressure is not below safety return pressure long enough to allow a cycle to occur.
Cuff pressure too high. Clear error to retry. 050606	NIBP cuff pressure above SVRP for too long	Verify cuff connections. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050607	NIBP cannot clear the failsafe errors	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050608	NIBP safety processor has stopped responding	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.

<b>Message</b>	<b>Possible cause</b>	<b>Suggested action</b>
Stat mode requested too soon. Clear to retry. 050609	NIBP excessive stat mode time. The time between readings is less than one minute and the readings plus time between readings result in the device taking over 15 minutes to complete the averaging cycle.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Unable to determine NIBP; check connections and tubing for kinks. 05060A	NIBP transducers are not matched	The transducer are above 5 mmHg and the difference in pressure is greater than 40 mmHg. Check cuff for pinched or obstructed tubing. If the problem persists, have the device inspected by a qualified service technician.
NIBP not calibrated. Calibrate the module. 05060B	Factory EEPROM checksum error on NIBP. Units internal configuration was corrupted	Calibrate the NIBP module. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 05060C	NIBP command not implemented	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 05060D	NIBP wrong data count	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 05060E	NIBP data range error	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 05060F	NIBP no POST error to clear	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050610	NIBP cannot clear this POST error	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050611	NIBP command not command type	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050612	NIBP communication timeout	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician..
NIBP not functional. 050613	NIBP response header wrong	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050614	NIBP response checksum wrong	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050615	Too much NIBP data was received	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.

<b>Message</b>	<b>Possible cause</b>	<b>Suggested action</b>
NIBP not functional. 050616	NIBP FEPROM erase error	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050617	NIBP FEPROM programming error	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 050618	Invalid NIBP target pressure	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Check cuff inflation settings.	Cuff inflation target was overridden due to max pressure being too low	Change cuff inflation target or maximum pressure so that the cuff inflation target is at least 20 mmHg lower than maximum pressure.
NIBP not functional. 05FF01	Unrecognized WACP parameter received from sensor	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 05FF02	Timeout waiting for sensor response	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 05FF03	Error deserializing the WACP message received from the sensor	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 05FF04	WACP stack send message failure	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 05FF05	Timeout waiting for asynchronous sensor message	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 05FF06	One or more undetermined numerics when reading status indicates OK	Check connections. Restrict patient movement.
NIBP not functional. 05FF07	Unrecognized sensor reading status code	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 05FF08	Sensor power up failure	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 05FF09	WACP rendezvous failure	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 05FF0A	Application firmware retrieval error during POST	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.

Message	Possible cause	Suggested action
NIBP not functional. 05FF0B	Upgrade .pim file is corrupt	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 05FF0C	Configured upgrade firmware directory cannot be accessed	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
NIBP not functional. 05FF0E	The NIBP sensor unexpectedly reset	Clear the error and try again
NIBP not functional. 05FF0F	The NIBP sensor firmware failed to upgrade	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.

## SpO2 messages

### General SpO2 messages

Message	Possible cause	Suggested action
SpO2 not functional. 044800	SpO2 not functional	Internal hardware malfunction in SpO2 module. If the problem persists, have the device inspected by a qualified service technician.
SpO2 rebooting. 044900	The SpO2 module is not responding.	Informational error. The host software is attempting to clear an error by rebooting the SpO2 module. No action required.
SpO2 rebooting. 044901	The SpO2 module stopped sending data	Informational error. The host software is attempting to clear an error by rebooting the SpO2 module. No action required.
SpO2 rebooting. 044902	SpO2 received a packet with bad CRC from module	Informational error. The host has received a packet with bad CRC from the SpO2 module. The packet in question is ignored. No action required.
SpO2 rebooting. 044903	The SpO2 power on self test failed	Internal hardware malfunction in SpO2 module. If the problem persists, have the device inspected by a qualified service technician.
SpO2 rebooting. 044904	The SpO2 power on self test timed out	Internal hardware malfunction in SpO2 module. If the problem persists, have the device inspected by a qualified service technician.

## Nonin messages

Message	Possible cause	Suggested action
Sensor not connected. Clear to retry. 040100	The SpO2 sensor is not connected	Connect SpO2 sensor, if the problem is still present, replace the SpO2 cable. If the problem is still present, verify the module functionality by replacing the sensor with an applicable SpO2 tester. If the message persists, have the device inspected by a qualified service technician.
SpO2 interference detected. Clear to retry. 040400	The SpO2 interference detected.	Reapply the sensor to the patient. If the problem is still present, replace the SpO2 sensor. If the problem is still present, replace the cable. If the problem is still present, verify module functionality by replacing the sensor with an applicable SpO2 tester. If the message persists, have the device inspected by a qualified service technician.
Low perfusion index. Clear to retry. 040500	SpO2 marginal pulse quality or artifact	Reapply the sensor to the patient. If the problem is still present, replace the SpO2 sensor. If the problem is still present, replace the cable. If the problem is still present, verify module functionality by replacing the sensor with an applicable SpO2 tester. If the message persists, have the device inspected by a qualified service technician.

## Temperature messages

Message	Possible cause	Suggested action
Temperature not functional. 030105	WACP message CRC mismatch on temperature module	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030201	This message is not implemented by the temperature module	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030202	This message is not supported by the temperature module	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030203	The temperature module has run out of memory.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030204	No parameter provided for the specified message.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030205	The temperature module received an invalid parameter	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.

<b>Message</b>	<b>Possible cause</b>	<b>Suggested action</b>
Temperature not functional. 030206	The parameter provided by the temperature module is outside of the allowable range for the specified message.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030207	The temperature module message requires an object, but did not contain one.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030208	The temperature module object provided with the message could not be deserialized.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030209	The temperature module object could not be serialized.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 03020A	The temperature module message is performing a request/action when the module state prohibits the request/action.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 03020B	The temperature module requested item is not currently available due to the module state.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030503	The temperature module factory settings, and calibration information is corrupt.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030504	The temperature module user settings are corrupt.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030509	The temperature module calibration is not set.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 03050C	The temperature module error log is corrupt.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030516	A hardware malfunction on the temperature module has been detected.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030518	The temperature module power rail is too low.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.

Message	Possible cause	Suggested action
Temperature not functional. 030519	The temperature module power rail is too high.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Unable to detect new temperature. Retry measurement. 03051A	The temperature module reference voltage circuit was detected to be under voltage or unstable.	Probe malfunction. If problem persists, replace probe. If the problem persists, have the device inspected by a qualified service technician.
Ambient temperature out of range. Clear to retry. 030801	The temperature module measurement is below the allowable temperature values and beyond the low ambient or patient limits.	Verify conditions are greater than 50 °F or 10 °C. If conditions are valid and the problem persists, replace the probe. If the problem persists, have the device inspected by a qualified service technician.
Ambient temperature out of range. Clear to retry. 030802	The temperature module measurement is above the allowable temperature values and beyond the high ambient or patient limits.	Verify conditions are less than 104 °F or 40 °C. If conditions are valid and the problem persists, replace the probe. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030803	The temperature module internal calibration resistor (RCAL) on the board is damaged or contaminated (pulse too long).	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030804	The temperature module internal calibration resistor (RCAL) on the board is damaged or contaminated (pulse too short).	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030805	The temperature module internal circuit validation resistor (PTB) on the board is damaged (value is over).	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030806	The temperature module internal circuit validation resistor (PTB) on the board is damaged (value is under).	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Ambient temperature out of range. Clear to retry. 030807	The temperature module A/D measurement timed out	Verify conditions are greater than 50 °F or 10 °C. If conditions are valid and the problem persists, replace the probe. If the problem persists, have the device inspected by a qualified service technician.
Replace temperature probe. 030808	The temperature module probe was not characterized/calibrated	Probe malfunction. Replace the probe. If the problem persists, have the device inspected by a qualified service technician.

Message	Possible cause	Suggested action
Insert correct color-coded probe well. 030809	The temperature module is missing the probe well	Insert the probe well
Temperature not functional. 03080A	The temperature module has a problem saving to the device EEPROM in biotech mode	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 03080B	The temperature module error detection mechanism detected an error	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Replace temperature probe. 03080C	The temperature module probe error detection mechanism detected an error	Probe malfunction. Replace probe. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 03080D	The temperature module log error detection mechanism detected an error	Probe malfunction. Replace probe. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 03080E	The temperature module calibration error detection mechanism detected an error	Probe malfunction. Replace probe. If the problem persists, have the device inspected by a qualified service technician.
Connect temperature probe. 03080F	The temperature module detected no probe connected	Probe malfunction. Replace probe. If the problem persists, have the device inspected by a qualified service technician.
Replace temperature probe. 030810	The temperature module cannot read the probe EEPROM correctly or the probe left the factory without being tested.	Probe malfunction. Replace probe. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030811	The temperature module has an invalid events index	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030812	There is a problem reading the temperature module EEPROM or saving to the device EEPROM in biotech mode.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Replace temperature probe. Code 030813	The temperature module has a problem reading the probe EEPROM.	Probe malfunction. Replace probe. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030814	The temperature module TEMP CONFIG ACQUIRE FAILURE	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.

Message	Possible cause	Suggested action
Temperature not functional. 030815	The temperature module TEMP CONFIG RELEASE FAILURE	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030816	The temperature module TEMP CONFIG INVALID PTR FAILURE	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030817	EEPROM not initialized	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Unable to detect new temperature. Retry measurement. 030818	The temperature module heater indicates on when turned off.	Probe malfunction. Replace probe. If the problem persists, have the device inspected by a qualified service technician.
Unable to detect new temperature. Retry measurement. 030819	The temperature module heater indicates off when turned on.	Probe malfunction. Replace probe. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 03081A	The temperature module HTR_Q is on and HTRC is off but still has voltage.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 03081B	The temperature module HTR_Q is tri-stated with HTRC enabled and has heater power.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 03081C	The temperature module turned Q&C on and the heater voltage is not high enough.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 03081D	The temperature module heater hardware failsafe should have turned off but did not.	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Replace temperature probe. 03081E	The temperature module probe is above 112°F or 43.3°C.	Probe malfunction. Replace probe. If the problem persists, have the device inspected by a qualified service technician.
Replace temperature probe. 03081F	The temperature module has excessive heater energy	Probe malfunction. Replace probe. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030820	The temperature module host interface error	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Ambient temperature out of range. Clear to retry. 030821	The temperature module over ambient 45 °C temp	Verify conditions are less than 104 °F or 40 °C. If conditions are valid and the problem persists, replace the probe. If the problem persists, have the device inspected by a qualified service technician.

<b>Message</b>	<b>Possible cause</b>	<b>Suggested action</b>
Ambient temperature out of range. Clear to retry. 030822	The temperature module under ambient temp	Verify conditions are greater than 50 F or 10°C. If conditions are valid and the problem persists, replace the probe. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030823	The temperature module has an invalid SureTemp algorithm	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030824	The temperature module is over max battery volts	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030825	The temperature module is under min battery volts	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030826	The temperature module battery volts not set	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030827	The temperature module predict algorithm is not set	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 030828	The temperature module ambient temp is not set	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Replace temperature probe. 030829	The temperature module has a non-responsive probe. The thermistor has pulled away from the tip or the heater is broken.	Probe malfunction. Replace probe. If the problem persists, have the device inspected by a qualified service technician.
Replace temperature probe. 03082A	The temperature module is experiencing bad probe gain	Probe malfunction. Replace probe. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 03082B	The temperature module has a bad probe response value	Probe malfunction. Replace probe. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 03C800	The temperature module is not functional	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 03C900	Unable to deserialize messages from the temperature module	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 03CA00	Unsupported message received from the Temperature module	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.

Message	Possible cause	Suggested action
Temperature not functional. 03CB00	Unable to send message to the Temperature module	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 03CC00	Temperature module communication times out	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 03CD00	Failed to upgrade the temperature module	Internal malfunction. If the problem persists, have the device inspected by a qualified service technician.
Temperature not functional. 03CE00	Unable to read PIM file	Retry the device update.
Temperature not functional. 03CE01	Upgrade file directory could not be accessed	Retry the device update
Direct mode reading timed out	Direct mode reading times out	Direction mode reading times out
Tissue contact lost.	Lost tissue contact while attempting to acquire a temperature measurement or acquired measurement was performed with limited tissue contact.	Check the tissue contact and try the measurement again.
Temperature module reset. 03D000	Temperature sensor reset unexpectedly	None

## Patient data messages

Message	Possible cause	Suggested action
Database schema out of data; recreating.	The database was cleared due to a schema update	Information status message; press OK button to dismiss.
Database is unreadable during startup; recreating. 1F0001	The database was unreadable during startup	Press OK button to dismiss.
Error accessing PDM database; restarting PDM. 1F0002	Database corrupted when device is in operation	Press OK button to dismiss.
Maximum number of patient records + Oldest record overwritten.	Data was deleted as it contained more than 50 records	Information status message; press OK button to dismiss.
No data saved.	A manual save is not allowed	Information status message; press OK button to dismiss.
Save successful.	A manual record was saved	Information status message; press OK button to dismiss.

## System messages

Message	Possible cause	Suggested action
000001	System failure	Restart the device
000002	System failure	Restart the device
000003	System failure	Restart the device
000004	System failure	Restart the device
000005	System failure	Restart the device
000006	System failure	Restart the device
Internal hardware failure.	The root file system is corrupted; restart not possible	Restart the device. If the problem persists, replace the main PCBA.
Internal hardware failure. 140100	EEPROM access failed. The device boot is possible, but wired communications are disabled	Reprogram the EEPROM. If the problem persists replace the main PCBA.
Internal hardware failure.	SPL memory test failure, the device will sound an SOS pattern	Restart the device. If the problem persists, replace the main PCBA.
Internal hardware failure. 1C1000	The device PIC communications never starts or quits. The communication won't reasonably recover at startup or during operation	Restart the device. If the problem persists, replace the main PCBA.
Low battery 30 minutes or less remaining. 1C1005	The battery power is low	Connect the power supply to AC power to charge the device.
Low battery 5 minutes or less remaining. 1C1006	The battery power is extremely low	Connect the power supply to AC power to charge the device.
Battery is critically low; plug into outlet. Device is shutting down. 1C1007	The battery power is critically low	Connect the power supply to AC power to charge the device.
Update unsuccessful. Reboot and retry. 1C1008	The software update failed	Restart the device. If the problem is still present, replace the main PCBA.
Host battery not charging. 1C100A	The host battery is not charging	Restart the device. If the problem is still present, check cable connections. If the problem is still present, perform functional checks for host. If the problem is still present, replace battery. If the problem persists, replace the main PCBA.
Factory default settings now active. 3A0001	The factory configuration settings are active	The device has been configured to factory defaults, any user settings have been reset.
Internal hardware failure. Device will shut down. 1C100D	Power supply issue. The PMIC is too hot	Check the operating environment temperature. Allow the device to cool down before operating again. If the problem is still present, check the cable connections. If the problem is still present, perform functional

Message	Possible cause	Suggested action
		checks for host. If the problem is still present, replace the battery. If the problem is still present, replace the main PCBA.
Input voltage too low. Device will shut down. 1C100C	Power supply issue. The PMIC input voltage is too low	Check the operating environment temperature. Allow the device to cool down before operating again. If the problem is still present, check the cable connections. If the problem is still present, perform functional checks for host. If the problem is still present, replace the battery. If the problem is still present, replace the main PCBA.
Unexpected restart occurred. 1C1012	The device unexpectedly restarted	Continue normal operation
Device battery is not installed. 1C100E	There is no battery in the device	Check the device for a battery and install one if it is missing. If the problem is still present, perform diagnostic checks on the device. If the problem persists, replace the main PCBA.
Advanced settings unavailable.	The advanced settings are unavailable because the device is not in an idle state	Confirm that no sensors are attached to the device and there is no unsaved data.
Software upgrade is downloading. Do not shutdown.	Cannot power down device as software install is in progress	N/A
Save not successful.	The device configuration or logs were not saved to the USB device	Information status message; press OK button to dismiss
Save successful.	The device configuration or logs were saved to the USB device	Information status message; press OK button to dismiss
Send successful.	Data was successfully sent over USB.	N/A

## Power messages

Message	Possible cause	Suggested action
Device is operating in battery mode	A/C power cord has been disconnected	None
Sleep mode is unavailable. An NIBP averaging program is in progress.	Sleep mode is not allowed when intervals are in progress	Stop any active averaging programs or enter sleep mode when averaging is complete.
Sleep mode is unavailable. An error is active.	Sleep mode is not available when errors are active	Clear all active errors.

Message	Possible cause	Suggested action
Sleep mode is not available. Unsaved readings are present.	Sleep mode is not allowed with unsaved readings	Save or clear readings.

## Software update messages

Message	Possible cause	Suggested action
Software Update: Manifest transfer timed out. Verify connection and retry.	The manifest file transfer timed out or connection was lost during download	Verify the connection and retry.
Software Update: Package file transfer timed out. Verify connection and retry	The package file transfer timed out or connection was lost during download	Verify the connection and retry.
Software Update: Invalid token file.	There was an invalid token file	Verify and update the token file.
Software Update: Unable to find manifest file on server.	Unable to find manifest file on server	Verify the manifest file is on the server.
Software Update: Unable to verify manifest file signature.	Unable to verify manifest file signature	Regenerate the software package and retry.
Software Update: Package file corrupted. Regenerate package and retry.	The package file is corrupt, does not have expected SHA256 hash	Regenerate the software package and retry.
Software Update: Unable to find package file.	The package file cannot be found	Verify the package file is on the server.
Software Update: Installation failed. Reboot and retry.	At least one of the sub systems failed to install	Restart the device.
Software Update: Upgrade unsuccessful. Insufficient disk space.	The partition is running out of space	Free up adequate space needed to perform the upgrade.
Software Update: Update unsuccessful. Incompatible firmware.	The current firmware version is too low to install update	Try to update to an earlier software package.
Software Update: SWUP internal error	SWUP NIBP is not functional	SWUP internal error.
Software Update: Manager internal error	The Software Update manager is not functional	Software Update Manager internal error.

## Identifying the device and subsystems

This explanation of the device labeling is provided to assist you in identifying these particular parts by serial number. The part numbers appearing on the labels are internal part numbers and will not be found in the list of field replaceable units (FRUs) included in this manual.

Future revisions of a part may not always be backward compatible with a legacy part. To determine the correct replacement part for your unit always provide the serial number and model when ordering.

### Manufacture date: how to decode serial number

The Serial number (SN) of a device reveals many details about its manufacture. The last four digits of the device SN reveal the device's date of manufacture.

SN: XXXX####WWYY

where

XXXX = Manufacturing plant

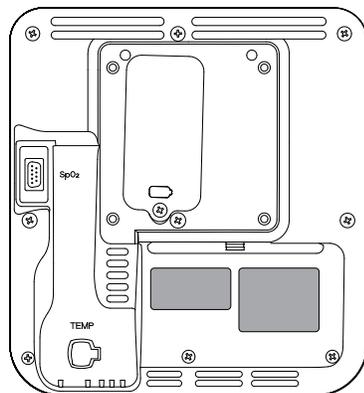
#### = Sequential number of manufacture

WW = Week of manufacture

YY = Year of manufacture

### Device serial number and model label

The model number and serial number can be found on a label on the back housing.




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#### Serial number and format code

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Serial number	XXXX####WWYY
XXXX	Manufacturing plant
####	Sequential number
WW	Week of manufacture
YY	Year of manufacture

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## Device circuit board and internal options label

Circuit board and internal option labels	
PCBA identifier	XXXXXX BOM Y DWG Z
XXXXXX	Welch Allyn material number
Y	Bill of material (BOM) revision
Z	Assembly drawing version from current version of drawing

Circuit board and internal option labels	
Serial number	XXXXWWYYID
XXXX	Sequential number
WW	Week of manufacture
YY	Year of manufacture
ID	Unique vendor identifier

## Model number format and code

### Model configurations



**NOTE** For more configuration options, including approved accessories, see the accessories list in the *Instructions for use*.



**NOTE** If options have been added to the device, the actual configuration will not match the model description.

The device is available in multiple configurations. Use the following table to determine available model configurations. Model numbers include one item from each column.

**Example:** 44WT-B (North America)

**Example:** 44XT-4 (United Kingdom)

Model	Parameter	Power cord
	SpO2                      Temperature	
44XT	<b>W</b> = Welch Allyn / Nonin <b>T</b> = SureTemp Plus <b>X</b> = Blank / None	<b>B</b> = North America <b>Y</b> = Italy <b>2</b> = Europe
44WT	<b>W</b> = Welch Allyn / Nonin <b>T</b> = SureTemp Plus	<b>3</b> = Israel <b>4</b> = United Kingdom

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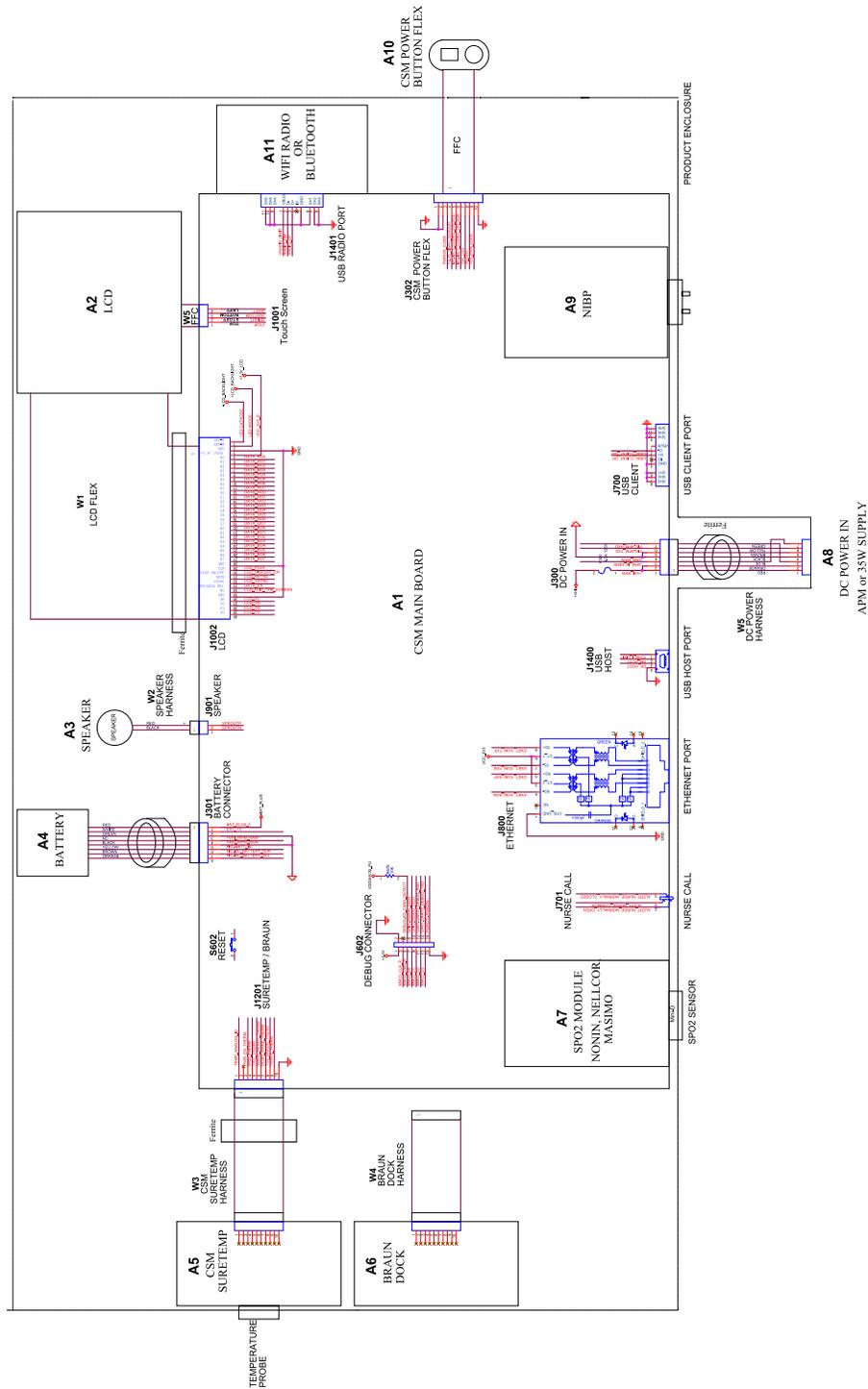
Model	Parameter SpO2	Temperature	Power cord
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6 = Australia/New Zealand

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# Interconnect diagram



## Service and maintenance toolset

### Spot Vital Signs 4400 (Spot 4400)

The following is the listing of tools and test equipment required to perform basic functional verification checks, full functional verification checks and calibration, and service and maintenance on the device.



**NOTE** Tools and test equipment must be readily available to complete Welch Allyn Technical Service Training for this device.

Material no.	Description	Qty	Usage	
			Full	Basic
<b>General test equipment</b>				
106275	Micro USB cable	1	X	
N/A	PC running Windows 10	1	X	
web download	Welch Allyn Service Tool	1	X	
107334	Welch Allyn Service Tool, Gold license	1	X	
<b>NIBP testing</b>				
407672	BP test volume repair fixture 113670	1	X	X
N/A	Pressure meter (must include at least two decimal points and be accurate to within $\pm 0.5$ mmHg)	1	X	X
N/A	Blood pressure Y-tube	1	X	X
4500-30	Blood pressure hose, 5 ft.	1	X	
620216	Fitting "Y" 1/8 X 1/8 X 1/8	1	X	X
<b>SpO2 configuration testing</b>				
N/A	SpO2 simulator	1	X	X

Material no.	Description	Qty	Usage	
			Full	Basic
<b>SureTemp Plus configuration testing</b>				
06138-000	Cal-key, assembly, M690/692	1	X	X
01802-110	Tester, calibration, 9600 Plus	3	X	

**Notes:**

- All items marked "N/A" in the Material no. column are OEM or off-the-shelf tools and equipment not available from Welch Allyn. The remaining items are available through Welch Allyn or a Welch Allyn distributor.
- All items marked in the Full column are required for full functional verification checks and calibration. The Welch Allyn Service Tool software and an active Gold license are required to perform these checks. The Gold license is obtained upon successful completion of Welch Allyn Technical Service Training.
- All items marked in the Basic column are required for basic functional verification checks. The Welch Allyn Service Tool software Standard unlicensed edition can be used to perform the NIBP checks and SWF upgrades/updates.

## Miscellaneous Tools

- Phillips #0 screwdriver
- Phillips #1 screwdriver
- T-10 Torx screwdriver
- 3/8" socket

## Service software IT setup

Installed Welch Allyn service component	Required outbound network Domain name IP address Port	Service feature description
Welch Allyn Service Tool (via Windows service called PartnerConnect)	servicehub.iot.hillrom.com/ IP: 52.224.38.138 HTTP/HTTPS port: 443	Inbound - Used by customers to receive software/device firmware upgrades.  Outbound - Used by customers to send device service information.
	IP: 12.38.86.181 TCP port: 5094	Used to activate the Service Tool and enable device feature licenses.  (This IP address does NOT respond to "ping.")
PartnerConnect software	servicehub.iot.hillrom.com IP: 52.224.38.138 HTTP/HTTPS port: 443	Used by customers to receive software/device firmware upgrades from Cumulocity.
Connex Server (via Windows service called PartnerConnect)	partnerconnect.iot.hillrom.com IP: 52.224.38.138 HTTP/HTTPS port: 443	Inbound - Used by customers to receive software/device firmware upgrades.  Outbound - Used by customers to send device service information.
	servicehub.iot.hillrom.com	
Teamviewer Host	IP: multiple depending on geographic location Default TCP port: 80/443 (can be configured to use TCP port 5938)	Used by Welch Allyn Service personnel to access a customer's machine (with customer's consent/permission) to address device issues.
Welch Allyn Service Hub	servicehub.iot.hillrom.com IP: 40.76.153.225 (inbound) IP: 52.224.38.138 (outbound) HTTP/HTTPS port: 443	Used by customers to view the status of their devices and deploy firmware upgrades and device configurations. The portal requires prior account setup.
<b>File outbound types</b>	.log, .xml, .zip, .txt	

Installed Welch Allyn service component	Required outbound network Domain name IP address Port	Service feature description
<hr/> <b>File inbound types</b>	.tar.gz, .tar, .seq, .wsf, .pim, .xml, *.txt, *.pdf	

## Service record

<b>Date:</b>	<b>Time:</b>
<b>Device name:</b>	<b>Serial number:</b>
<b>Technician:</b>	<b>Service tool version:</b>

## NIBP tests

Specification	Actual reading	Pass	Fail
Max: 5 mmHg	mmHg		

Mode	Specification	Actual reading
Adult mode:	280 . . . . 329 mmHg	mmHg

Target pressure $\pm$ 5 mmHg	Pressure meter	Service tool	Specification	Pass	Fail
0 mmHg	mmHg	mmHg $\pm$ 1 mmHg			
50 mmHg	mmHg	mmHg $\pm$ 3 mmHg			
150 mmHg	mmHg	mmHg $\pm$ 3 mmHg			
250 mmHg	mmHg	mmHg $\pm$ 3 mmHg			

## SpO2 tests

Test	Specification	Actual reading	Pass	Fail
SpO2 pulse rate	Pulse rate 60 $\pm$ 1 bpm	bpm		

60 bpm	59 to 61 bpm	
SpO2 saturation 90%	Saturation 90% $\pm$ 1 sat point 89 to 91%	%

## Thermometry tests

Temperature test	Specification $\pm$ 0.2°F ( $\pm$ 0.1°C)		Actual reading	Pass	Fail
97.3 °F (36.3 °C)	97.1 to 97.5 °F	36.2 to 36.4 °C	°F or °C		

Temperature tested	Specification $\pm$ 0.2 °F ( $\pm$ 0.1 °C)		Actual reading	Pass	Fail
96.8 °F (36.0 °C)	96.6 °F to 97.0 °F	35.9 °C to 36.1 °C	°F or °C		
101.3 °F (38.5 °C)	101.1 °F to 101.5 °F	38.4 °C to 38.6 °C	°F or °C		
105.8 °F (41.0 °C)	105.6 °F to 106.0 °F	40.9 °C to 41.1 °C	°F or °C		