



**Hillrom™**

# Welch Allyn® Connex® Spot Monitor



## Service manual

Software version 1.X

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This manual applies to **#** 901058 VITAL SIGNS CORE MONITOR.

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Welch Allyn, Inc.  
4341 State Street Road  
Skaneateles Falls, NY 13153 USA

[hillrom.com](http://hillrom.com)

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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. This definition applies to both yellow and black and white symbols.
	Follow instructions 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		Equipotential Ground
	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		Direct current (DC)
	Protective Earth (PE)		









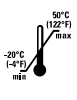
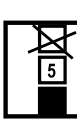







## Connectivity symbols

	Bluetooth®		Ethernet
	USB		Nurse call
	Wireless signal strength <ul style="list-style-type: none"> <li>• Best (4 bars)</li> <li>• Good (3 bars)</li> <li>• Fair (2 bars)</li> <li>• Weak (1 bar)</li> <li>• No signal (no bars)</li> <li>• No connection (blank)</li> </ul>		

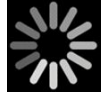
## Miscellaneous symbols

	Manufacturer		Defibrillation-proof Type BF applied parts
	Product Identifier		Serial Number
	Reorder Number		China RoHS markings for control of pollution caused by electronic information products. XX indicates



			Environmentally Friendly Use Period in years.
	Do not reuse, Single use device		Separate collection of Electrical and Electronic Equipment. Do not dispose as unsorted municipal waste.
	Non-ionizing electromagnetic radiation		Call for maintenance
	Task Light	<b>R<sub>x</sub> ONLY</b>	Prescription only or "For Use by or on the order of a licensed medical professional"
	This way up		Fragile
IPX2	IP = International Protection Marking X = No object ingress rating 2 = Protected against vertically falling water drops when enclosure tilted up to 15°		Australian Communications and Media Authority (ACMA) Radio Compliance Mark (RCM).
	Temperature limit	<b>GTIN</b>	Global Trade Item Number
	Stacking limit by number		Keep dry
	Humidity limitation		Recyclable
	Maximum safe working load limits		Mass in kilograms (kg)
	Japan's PSE approval symbol for Category A	<b>MD</b>	Medical device
	Atmospheric pressure limitation		

## Screen symbol



Process indicator for activities like acquiring measurements and connecting to a laptop

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## Safety

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

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

## Warnings and cautions



**WARNING** Safety risk. Make frequent electrical and visual checks on cables, sensors, and electrode wires. All cables, sensors, and electrode wires must be inspected and properly maintained and in proper working order to allow the equipment to function properly and to protect patients.



**WARNING** Safety risk. Place the monitor and accessories in locations where they cannot harm the patient should they fall from a shelf or mount.



**WARNING** Fire and explosion hazard. Do not operate the monitor in the presence of a flammable anesthetic mixture with air, oxygen, or nitrous oxide; in oxygen-enriched environments; or in any other potentially explosive environment.



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



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



**CAUTION** Before disassembling the device or installing options, disconnect the patient from the monitor, power down the device, and 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** To ensure that the monitor meets its performance specifications, store and use the monitor in an environment that maintains the specified temperature and humidity ranges.



**CAUTION** The monitor may not function properly if dropped or damaged. Protect it from severe impact and shock. Do not use the monitor if you notice any signs of damage.



**CAUTION** Do not connect more than one patient to a monitor or connect more than one monitor to a patient.



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

## General safety considerations

- If the monitor 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 or <https://direct.hill-rom.com/hillromUS/en>.) 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 monitor 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 monitor power turned off.
- Insert and seal static-sensitive components and assemblies into their original static-shielding bags before removing them from static-protected areas.
- Always test your ground strap, bench mat, conductive work surface, and ground cord before removing components and assemblies from their protective bags and before beginning any disassembly or assembly procedures.



# 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 Connex Spot Monitor. 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 monitor, 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 monitor, 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:

- *Connex® Spot Monitor 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 Braun ThermoScan® PRO 6000 Thermometer Instructions for use CD*
- *Welch Allyn Braun ThermoScan® PRO 6000 Charging Station Instructions for use CD*
- *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. A list of available service and support agreements is presented in the "Field replaceable units" section of this manual.

For more information, call your sales representative or visit our website:

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

### **SmartCare Remote Management**

SmartCare Remote Management is a secure cloud-based portal that offers biomedics access to manage their Hillrom connected devices remotely in a centralized portal.

For more information and a complete list of compatibility information, refer to the SmartCare Remote Management Instructions for use.

### **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.hillrom.com/en/services/explore-our-self-service-tools/repair-status-request/>.



**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.

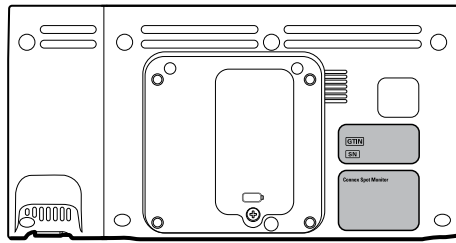
If your product requires warranty, extended warranty, or non-warranty repair service, a Welch Allyn Technical Support representative will record all necessary information to issue an RMA number. The support representative will provide you with the address of the Welch Allyn Service Center to send your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



**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.** For decontamination and cleaning requirements, see: *Decontamination and cleaning requirements for returns* in the Cleaning requirements section.

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 the design specifications, perform periodic service as indicated in the following table. 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.

Component	Service interval	Service procedure
NIBP module	Annually	Basic functional verification
SpO2 module	Annually	Basic functional verification
SureTemp Plus	Annually	Basic functional verification
Braun ThermoScan PRO 6000	Annually <sup>1</sup>	Basic functional verification
Battery	Annually <sup>2</sup>	Replace the battery

<sup>1</sup> In addition to this annual service interval, Welch Allyn recommends cleaning the contacts of the Braun thermometer and dock every 4 months because debris that accumulates in the contacts can interfere with data transmission. See "Clean the Braun ThermoScan PRO 6000 contacts" later in this manual.

<sup>2</sup> Battery performance is a function of clinical use and charge/discharge patterns. Welch Allyn recommends replacing the battery after 1 year or when its remaining capacity no longer meets workflow requirements.

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 exist:

- 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 monitor battery
- Replace the APM work surface 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.
- **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 supplemented by an optional, rechargeable, 9-cell Lithium-ion battery in the Accessory Power Management (APM) work surface. Internal circuitry enables the batteries to report their condition to the device and the APM work surface. 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 APM battery indicates the percent of total charge to user on the front of the work surface as follows:

Number of LEDs	Percent of total charge
1	0 – 19
2	20 – 39
3	40 – 59
4	60 – 79
5	80 – 95
6	96 – 100

The battery status indicator on the device displays the remaining total charge of both batteries combined if the configuration has both an internal battery and an extended battery in the APM.

Battery information may be collected using the service tool.

New batteries are shipped from the manufacturer with a 40 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 status message when 30 minutes of power remain and again when 5 minutes remain. The 30-minute message is a very low priority technical alarm. The alarm message appears on a cyan background in the Device Status area. This alarm is dismissible by the user, and all functions of the device remain available. The 5-minute message is a high priority technical alarm that appears on a red background in the Device Status area, is not dismissible, 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 high priority technical alarm, the device will shut down at or close to 0 minutes of remaining battery charge.

Battery charging is provided by the device's 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 monitor 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  $-4^{\circ}\text{F}$  and  $122^{\circ}\text{F}$  ( $-20^{\circ}\text{C}$  and  $50^{\circ}\text{C}$ ).
  - For storage between 30 days and 90 days: Maintain temperature between  $-4^{\circ}\text{F}$  and  $104^{\circ}\text{F}$  ( $-20^{\circ}\text{C}$  and  $40^{\circ}\text{C}$ ).
  - For storage more than 90 days up to 2 years: Maintain temperature between  $-4^{\circ}\text{F}$  and  $95^{\circ}\text{F}$  ( $-20^{\circ}\text{C}$  and  $35^{\circ}\text{C}$ ).
- 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 <http://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



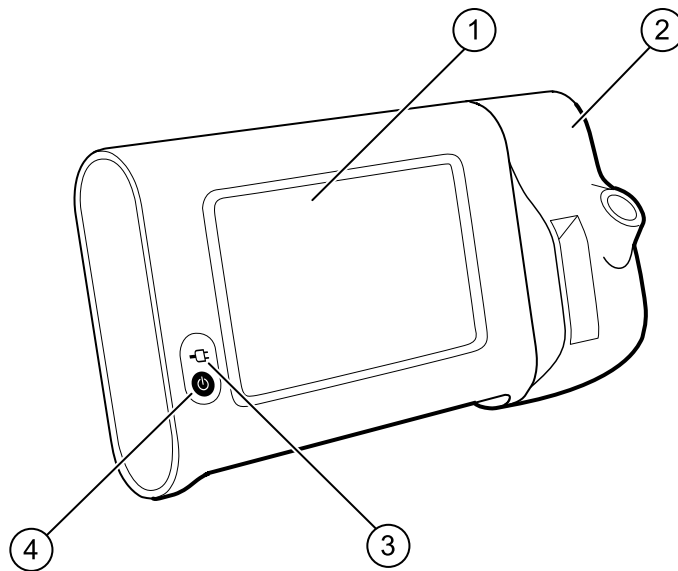


## Controls, indicators, and connectors



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

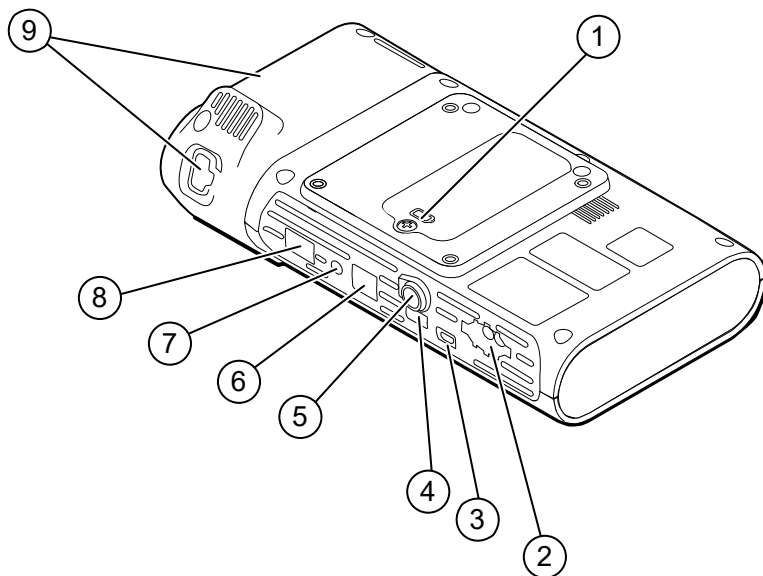
### Front-Left view



No.	Feature	Description
1	LCD screen	7" color touchscreen provides a graphical user interface
2	Thermometry	Secures the SureTemp unit to the monitor
3	Battery charge and power-up status indicator	The LED indicates the charging and power-up status when connected to AC power: <ul style="list-style-type: none"> <li>• Green: The battery is charged</li> <li>• Amber: The battery is charging</li> <li>• Flashing: The monitor is powering up</li> </ul>
4	Power button	Blue button on lower-left corner of the monitor: <ul style="list-style-type: none"> <li>• Powers on the monitor</li> </ul>

No.	Feature	Description
		<ul style="list-style-type: none"> <li>Places the monitor into Sleep mode, except when an alarm condition is active (brief press)</li> <li>Wakes up the monitor from Sleep mode</li> </ul>

**Back-Bottom-Left view**

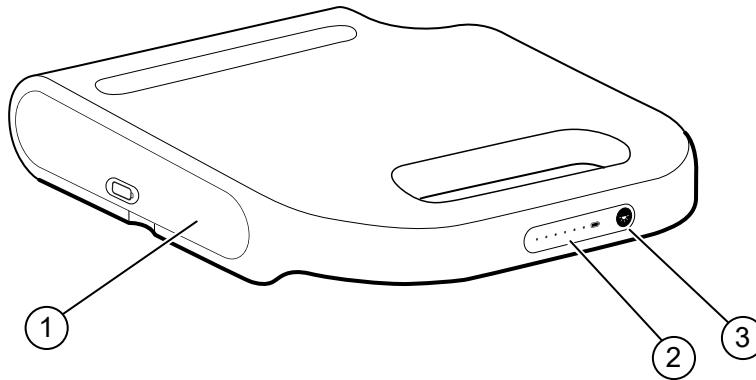


No.	Feature	Description
1	Battery compartment (behind cover)	Houses the battery (captive screw secures cover to monitor)
2	NIBP	Connects NIBP cable to monitor
3	USB client port	Provides a connection to an external computer for testing and software upgrades
4	USB port	Connects APM work surface to monitor
5	Power connection	Connects APM work surface or any accessory to the monitor
6	Ethernet RJ-45	Provides a hardwired connection to the computer network
7	Nurse call	Provides a connection to a hospital nurse call system
8	SpO2	Connects chosen SpO2 system to monitor
9	Thermometry	Configuration shown features SureTemp module and probe connection port

## APM

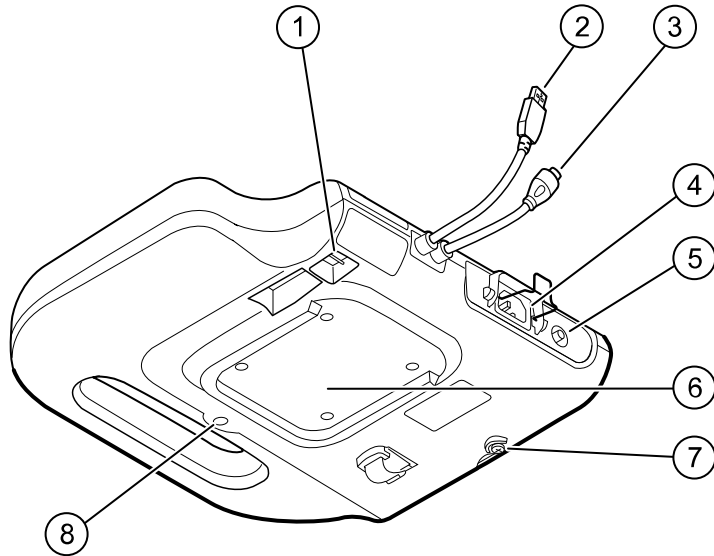
This section applies only to devices with an Accessory Power Management (APM) stand. The APM is an accessory stand with work surface, power supply for enhanced device run time, and organizational bins to arrange sensors and cables for available parameters.

### Front-Top-Left view



No.	Feature	Description
1	Battery compartment (behind cover)	Houses the battery
2	Battery charge status indicator	Indicates charge level of battery
3	Light power switch	Powers light under APM work surface

**Back-Bottom-Right view**



No.	Feature	Description
1	USB ports (2)	Connect optional accessories
2	USB cable	Connects APM work surface to monitor
3	APM power cable	Connects APM work surface to monitor
4	Power connection	Provides an external AC power connection
5	Ground lug (equipotential terminal)	Provided for electrical safety testing and for connecting a potential-equalization conductor
6	Recess for mounting	Secures the APM work surface when it is mounted on the APM stand (with 4 screws)
7	Battery cover screw	Secures APM work surface battery cover
8	APM light	Illuminates accessory bins and path for APM stand

## Advanced settings

---

Advanced settings provide access to device settings and service menu information with an access code. This section covers the following primary tabs:

- General. Settings for system language as well as date and time, plus open source software disclosure.
- Parameters. Settings for physiological parameters, averaging, and intervals.
- Network. Settings for the internal Ethernet and security, as well as WiFi radio and Bluetooth subsystems.
- Service. Settings and features that support installation and on-device troubleshooting.



**NOTE** Changes made in Advanced settings take effect immediately, but they do not change the configuration file and cannot be used to clone settings from one device to another. Follow the instructions in "Device configuration and setup" to create, edit, download, and install any settings you want available on multiple devices.

## Access Advanced settings



**NOTE** You cannot access Advanced settings if sensors or physiological alarms 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. Enter **6345** as the access code and touch **OK**.



**NOTE** This access code is configurable and could be different at your location.

The General tab appears.

4. Perform service tasks by making selections or touching other tabs.



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

5. When you are done, touch **Exit**.

The Home tab appears.

## General tab

### Specify the language

When you first access Advanced settings, the General tab appears, displaying the Language tab.

1. Select a language.
2. Do one of the following:
  - To continue in Advanced settings, touch another tab.
  - To exit Advanced settings and return to the Home tab, touch **Exit**.

### Specify profile settings

Profiles support multiple clinical workflows.



**CAUTION** Switching from the Office profile drops the Bluetooth connection. Switching to the Office profile clears both patient information and current readings. Switching to another profile retains patient information, but current readings are cleared.

1. In Advanced settings, touch the **General** > **Profiles** tabs.
2. Specify settings.

Setting	Action/Description
Profile types	Select the profile types to display: Intervals, Office, and Spot.
Primary profile	Select the primary profile.
Custom profile name	If desired, modify the profile names.

3. Touch **Apply**.
4. Do one of the following:
  - To continue in Advanced settings, touch another tab.
  - To exit Advanced settings and return to the Home tab, touch **Exit**.

### Specify date and time settings

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

Setting	Action/Description
Date format	Select a date format for display.
Time zone	Displays UTC time zone (read only)
Use Network Time Protocol	Enable the monitor to query the correct date and time from a trusted time server. When enabled, manual date and time entry on the Settings tab is disabled.

3. Touch **Test network connection**.  
Test results appear for the Time sync test, IP address, and DNS query status.
4. Touch **OK**.

5. Do one of the following:
  - To continue in Advanced settings, touch another tab.
  - To exit Advanced settings and return to the Home tab, touch **Exit**.

## 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. Do one of the following:
  - To continue in Advanced settings, touch another tab.
  - To exit Advanced settings and return to the Home tab, touch **Exit**.

## 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.
Tube type	Select the number of tubes that are connected to the NIBP cuff that is used with this monitor. If you select <b>1 tube</b> , the device sets the algorithm to <b>Step</b> , disabling other options.
Algorithm default	Select the default algorithm used to determine NIBP measurements.
Cuff inflation target	Enter a default cuff inflation pressure for each type of patient.

3. Do one of the following:
  - To continue in Advanced settings, touch another tab.
  - To exit Advanced settings and return to the Home tab, touch **Exit**.

### Specify advanced temperature settings

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

Setting	Action/Description
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. Do one of the following:
  - To continue in Advanced settings, touch another tab.
  - To exit Advanced settings and return to the Home tab, touch **Exit**.

## Specify advanced averaging interval settings

Averaging intervals are available in the Office profile.

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

Setting	Action/Description
NIBP averaging program	Select the averaging program to view or modify. You can change the name of the averaging program.
Readings to average	Select which readings in a series to use for averaging (and the number of readings to average as a result).
Delay to start (minutes)	Enter the number of minutes to wait before the averaging program starts (after touching "Start intervals") and the start of the first reading.
Time between (minutes)	Enter the number of minutes to wait between readings.
Keep if + or – (mmHg)	Enter the range that the program uses as criteria to accept or reject readings and establish the baseline reading. For more information about how this setting affects the program, refer to the section "Excluded readings" below.
Summary display box	Displays currently selected settings.

3. Do one of the following:
  - To continue in Advanced settings, touch another tab.
  - To exit Advanced settings and return to the Home tab, touch **Exit**.

## Specify advanced program interval settings

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

Setting	Action/Description
Program	Select the program to view or modify. You can change the name of the program.
Intervals	Specify up to five sets of interval readings for this program. For each set, specify the number of minutes between interval readings and the number of times that each interval should run (repetitions) before proceeding to the next set.

3. Do one of the following:
  - To continue in Advanced settings, touch another tab.
  - To exit Advanced settings and return to the Home tab, touch **Exit**.

## Network tab

### Specify radio settings

This task is applicable only to monitors that have a wireless radio installed. Devices can be configured with a wireless or a Bluetooth radio.



1. In Advanced settings, touch the **Network > Radio** tabs.
2. Specify settings.

Setting	Action/Description
Enable radio	Enable the radio for WiFi communications. When disabled, the radio is not available.
ESSID	Enter the service set identifier (SSID) for the enterprise. Enter a maximum of 16 characters.
Radio mode	Select the radio band.
Dynamic Frequency Selection	Enable to allow the site to transmit data on changing frequencies for added security. This option applies most frequently to military or government enterprises.
Enable radio network alarms	Activate radio network alarms when an wireless dropout alarm condition occurs. When disabled, radio network alarms are not available.
Roaming	Select the type of roaming (only available with WPA/WPA2 Enterprise).
Regulatory	Display the WiFi regulatory certification information.
Update radio	Touch <b>Update radio</b> to activate all new radio settings not selected previously. Touch <b>OK</b> in the confirmation popup.



**NOTE** None of the changed radio settings take effect until you touch **Update radio**.

3. Do one of the following:
  - To continue in Advanced settings, touch another tab.
  - To exit Advanced settings and return to the Home tab, touch **Exit**.

## Specify security settings


1. In Advanced settings, touch the **Network > Security** tabs.
2. Select the encryption method to secure data transfer from the device.



**NOTE** Network server certificates are required for all EAP security options. Use the Welch Allyn Service Tool to load these certificates.

3. Specify settings. Do one of the following:

Setting	Action/Description
Authentication type	Select the preferred encryption option. Then specify any additional settings that appear. The default is Open or no encryption.
WEP 64	Select a WEP key and then enter a 10-character key in the selected field. Repeat this process to create multiple WEP keys. Then click <b>Update radio</b> .
WEP 128	Select a WEP key and then enter a 10-character key in the selected field. Repeat this process to create multiple WEP keys. Then click <b>Update radio</b> .

WPA-Personal and WPA2-Personal	Enter a Passphrase (8 to 63 characters). The characters you enter appear as asterisks. Then click <b>Update radio</b> .
WPA-Enterprise and WPA2-Enterprise	Specify the following settings and then click <b>Update radio</b> .
Anonymous identity	Enable this option to disable the User name field.
User name	Enter the EAP identity (maximum of 32 characters). This is disabled EAP type TTLS.
Password	Enter the EAP password (maximum of 32 characters). This is disabled EAP type TLS.
Enable server validation	Enable or disable server validation. This is disabled EAP type PEAP-TLS.
EAP type	Select the authentication protocol (TLS, TTLS, PEAP-MSCHAPv2, PEAP-GTC, PEAP-TLS, EAP-FAST).
Option	Select more specific EAP settings (Inner EAP Setting: Auto or PAP, PAC Provisioning: Auto or Manual).
Update radio	Touch <b>Update radio</b> to activate all new radio settings not selected previously. Touch <b>OK</b> in the confirmation popup.
	 <b>NOTE</b> None of the changed radio settings take effect until you touch <b>Update radio</b> .
Enable FIPS mode	Select <b>Enable FIPS mode</b> if you are connecting to a FIPS environment. Check the Enable FIPS mode box, and then touch <b>Update radio</b> .

4. Do one of the following:
  - To continue in Advanced settings, touch another tab.
  - To exit Advanced settings and return to the Home tab, touch **Exit**.

## Specify server settings

1. In Advanced settings, touch the **Network > Server** tabs.
2. Select the method used to identify the IP address of the server with which the device will communicate.
3. Specify settings.

<b>Setting</b>	<b>Action/Description</b>
Network connectivity method	Select the preferred method to connect to the server.
Data encryption	Turn the security data encryption on or off, and enable or disable the server authentication.
Server authentication	Turn the server authentication on or off.
Host IP	Enable the device to connect to a host or other server at a fixed IP address. In the IP address entry field, enter the IP address. In the Port entry field and enter the port number. The range of entry is 0 to 65535. Select either a Welch Allyn host or a direct EMR connection.
NRS	Enable the device to connect to a Network Rendezvous Service (NRS) at a fixed IP address. In

DNS hostname	<p>the IP address entry field, enter the IP address. In the Port entry field and enter the port number. The range of entry is 0 to 65535.</p> <p>Enable the device to connect to a Network Rendezvous Service (NRS) by entering a hostname to be sent to a Domain Name Server (DNS) to retrieve the NRS IP address. In the Hostname field, enter the DNS name. In the NRS Service Port entry field, enter the port number. The range of entry is 0 to 65535.</p>
DHCP	<p>Enable the device to connect to a Network Rendezvous Service (NRS) by entering a port number and then connecting at a provided IP address. In the NRS Port entry field, enter the port number. The range of entry is 0 to 65535. After successfully connecting to the server, the NRS IP addresses and the Vendor class identifier appear onscreen.</p>
Server connectivity	<p>Select the preferred server connection:</p> <ul style="list-style-type: none"> <li>• Welch Allyn host</li> <li>• Direct EMR connection</li> </ul>



**NOTE** The DNS option is only available in the following conditions:

- The version of the installed radio is 3.00.02 or greater
- The radio is disabled
- No radio is installed

4. Touch **Test network connection**.  
The status of the server connections appears.
5. Touch **OK**.
6. Do one of the following:
  - To continue in Advanced settings, touch another tab.
  - To exit Advanced settings and return to the Home tab, touch **Exit**.

## Specify Bluetooth settings

This task is applicable only to monitors that have a Bluetooth radio installed. Devices can be configured with a wireless or a Bluetooth radio. A configuration must be loaded to view regulatory information.

1. In Advanced settings, touch the **Network > Bluetooth®** tabs.
2. Specify settings.

<b>Setting</b>	<b>Action/Description</b>
Allow Bluetooth configuration	<p>Enable the device to connect to a host or other server with the Bluetooth radio.</p> <ul style="list-style-type: none"> <li>• Bluetooth®</li> <li>• If enabled, Bluetooth® Low Energy</li> </ul>
Device name	Enter the 8-character device name.
Regulatory	Displays the WiFi regulatory certification information.

3. Do one of the following:
  - To continue in Advanced settings, touch another tab.
  - To exit Advanced settings and return to the Home tab, touch **Exit**.

## Specify device IP settings

A radio card must be installed and operational to specify the device IP settings.

1. In Advanced settings, touch the **Network > Device IP** tabs.
2. Specify settings.

Setting	Action/Description
Ethernet	Select <b>Use DHCP</b> or <b>Static ID</b> .
IP address	If Static ID is selected, specify these settings.
Subnet mask	
Gateway	
DNS IP address	Enter the IP address of the DNS server.

3. Touch **Apply**.
4. Do one of the following:
  - To continue in Advanced settings, touch another tab.
  - To exit Advanced settings and return to the Home tab, touch **Exit**.

## Specify Active Directory settings

Use the Active Directory settings to manage the device communication address and access settings.



**NOTE** See "Connex Direct" for further information.

1. In Advanced settings, touch the **Network > Active Directory** tabs.
2. Select **Enable Active Directory**.
3. Specify settings.

Setting	Action/Description
Domain name	Enter the domain name.
Group	Enter the domain name group.
Clinician ID type	Select the clinician ID type (User name, Account name, or Employee ID).
Authentication user name	Enter the user name.
Authentication password	Enter the password.
Search subtree	Enter the subtree alpha-numeric characters.

4. Touch **Test network connection**.  
The device displays the Active Directory test status.
5. Click **OK**.
6. Do one of the following:
  - To continue in Advanced settings, touch another tab.
  - To exit Advanced settings and return to the Home tab, touch **Exit**.

# Service tab

## Ethernet status

In Advanced settings, touch the **Service > Ethernet status** tabs. This Ethernet status vertical tab displays read-only data about the Ethernet connection:

### Network

- MAC address
- IP address
- Subnet mask
- Gateway
- DHCP server
- DHCP lease time

### Network statistics

- Rx bytes
- Tx bytes
- Rx packets
- Tx packets
- Rx multicast packets

### Errors

- Rx errors
- Tx errors
- Rx packets dropped
- Tx packets dropped

## Radio status

In Advanced settings, touch the **Service > Radio status** tabs. This Radio status vertical tab displays the following read-only data about the WiFi or Bluetooth radio connection:

### Network

- MAC address
- IP address
- Subnet mask
- Gateway
- DHCP server
- DHCP lease time

### Network statistics

- Rx bytes
- Tx bytes
- Rx packets
- Tx packets
- Rx multicast packets

### Errors

- Rx errors
- Tx errors
- Rx packets dropped
- Tx packets dropped


### Radio settings

- Version
- Radio status string
- SSID
- Access point MAC
- Authentication type
- RSSI
- Radio band
- Channel
- Power mode
- FIPS mode

If the device cannot communicate with the radio through the internal radio IP address, the radio error 35002c appears. A Mac address text field appears on the Radio status tab approximately three to four minutes after the error message. Contact Welch Allyn for assistance in entering the correct Mac address in this field.

## Enter general device information

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

2. Touch  and enter up to 20 characters in the following data fields to support device identification:
  - Asset tag
  - Device location
  - Device location ID
3. If desired, select **Allow Display Lock**.  
The display lock prevents clinician input, which may be useful when cleaning the display.
4. If desired, select **Disable USB ports**.
5. Touch **OK** and repeat for each data field.  
The General vertical tab appears.



**NOTE** You can enter general device information in the Welch Allyn Service Tool as well.

6. To calibrate your touchscreen, touch **Start** in the right pane and follow the onscreen prompts.  
The Home tab appears.
7. To synchronize with the Service Monitor, touch **Sync now**.  
If the software version is 1.30 or greater, the screen displays information about the connection and whether a new configuration or firmware is available.
8. Touch **Close**.
9. To verify the NIBP pressure valve accuracy, touch **Close Valve**.  
The pressure displays in the NIBP Pressure Verification field. If the software version is 1.33 or greater, you can check the functionality of NIBP accuracy on the device without use of the Welch Allyn Service Tool.
10. To stop the accuracy test, touch **Open Value** or navigate away from the screen.

## Review and update configuration information

1. In Advanced settings, touch the **Service > Config file** tabs.



**NOTE** Loading the Config file sets the initial configuration. However, manually changing settings on the device, overrides the configuration file settings.

2. In the left pane, review the following configuration information:
  - Configuration file
  - Active Config file name
  - Date of generation
  - Date loaded to device
  - Supported features (examples include: RRp, Bluetooth® Low Energy)
  - Licensed features (examples include: Bluetooth® Low Energy, RRp)
3. To load a new configuration from the network, touch **Load** in the right pane and follow the onscreen prompts.
4. To save the current configuration to a USB drive, connect a compatible flash drive to the USB port, touch **Save to USB** in the right pane, and follow the onscreen prompts.



**NOTE** Not all flash drives are supported. See "USB flash drive requirements" in the Appendix for details.

## 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.



**NOTE** The Welch Allyn Service Tool enables you to save only the 2 most recent log files.

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



**NOTE** Not all flash drives are supported. See "USB flash drive requirements" in the Appendix for details.

3. Touch **Save to USB** and follow the onscreen prompts.  
Copies of the service log files are saved to the drive.

## Restore factory default settings



**NOTE** This process does not restore the monitor 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. Reset to defaults:
  - To restore radio settings to factory default values, select **Radio settings only**.
  - To restore all current settings to factory default values, select **All settings**.
3. Touch **Reset** and follow the onscreen prompts.

The factory default settings are restored.

If you selected **Radio settings only**, the radio reboots, and the device remains powered on.

If you selected **All settings**, the device reboots.

## Review firmware status and load firmware from the network

1. In Advanced settings, touch the **Service > System** tabs.
2. In the right pane, review the firmware status information.



**NOTE** If the firmware is up-to-date, take no further action.

3. To update the firmware, touch **Load** and follow the onscreen prompts.



**NOTE** You can also load new firmware by rebooting the device.



## 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 and the user interface screen for the default configuration appears (either the Home tab or a login/profile selection screen), 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 monitoring 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. Upon each power up, 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. A beep sounds, followed by one chime.



**NOTE** If no chimes sound, replace the speaker as specified in "Remove the speaker."

- e. The Home tab or the login/profile selection screen appears.



## Bluetooth wireless technology



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

Bluetooth wireless technology is available in the Office profile.

### Bluetooth status

A monitor with Bluetooth wireless technology displays the status between the monitor and the device in the Status area.

Image	Description
No image	Bluetooth radio is OFF
Bluetooth icon appears in Status area	Bluetooth radio is ON
Bluetooth icon is blinking on / off slowly	The monitor is pairing with the device
Bluetooth icon is blinking on / off quickly	The monitor is connecting with the device
Bluetooth icon appears with a border around the icon in the Status area	The monitor and the device are connected and the monitor is ready to transmit data

In order to transmit data, you must first pair and then connect the monitor and the device.

### Enable Bluetooth pairing


You can pair a device and a PC configured with Bluetooth wireless technology.

1. In Advanced settings, touch the **Network > Bluetooth®** tabs.
2. Touch **Allow Bluetooth® configuration** to enable pairing.

### Pair a device with Bluetooth wireless technology

When a monitor with Bluetooth wireless technology powers on and there are devices already paired with the monitor, a pop-up screen appears showing the devices available for connection with the monitor. Follow the directions below to pair an additional device with the monitor.



1. Touch .
2. Touch **Add new device**.
3. For a laptop, select the monitor from the list of available devices in your Bluetooth program manager on your laptop task bar.



**NOTE** For a tablet, select the monitor (WACSM device) from the list of available devices in your Bluetooth program manager on your tablet. A message appears on the monitor that indicating that "This device is now discoverable" and a confirmation number displays on both the device and monitor screens. Touch **Pair** in the tablet device.

4. Confirm that the numbers match on the device and on the monitor, and then touch **Accept** in the laptop device.

A message appears indicating that the monitor and device are paired.

5. Touch **OK** on the monitor screen.

Touch the keyboard icon in the *Name this connection:* field and begin to type the name to a preferred name of the device.

6. After preferred name is entered, touch **Save**.

The new name appears in the Bluetooth device list of paired devices.

## Connect devices with Bluetooth wireless technology and download data

1. In the Bluetooth connection screen, select a laptop from the list of paired devices.  
The Bluetooth icon in the Device Status area quickly blinks on and off as the monitor and laptop are connecting.  
When the monitor and the laptop connect, an information message briefly appears that names the connected laptop. When the message disappears, the name of the connected laptop appears on the top left of the screen, and the Bluetooth connected icon appears in the connection area.
2. As the laptop downloads data, the progress indicator spins in the connection area.  
The Bluetooth connection remains active until the download is complete. After a successful download, the system clears data from the monitor and disconnects the monitor from the laptop.
3. Repeat the process as needed, or touch **Cancel** to dismiss the Bluetooth connection screen.

## Rename a device (applies only to standard Bluetooth)

You can rename a paired device from a system or generic name to a specific name.

1. Select the arrow button to the right of the device name you want to edit in the *Bluetooth device list*.  
Touch the keyboard icon in the *Name this connection:* field and begin to type the name to a preferred name of the device.
2. Enter the name, touch **OK** on the keyboard screen, and then touch **Save**.

The new name appears in the list of paired *Bluetooth device list*.

## Bluetooth Low Energy (BLE) workflow

For more information, contact your sales representative.

Use the Welch Allyn Product Configuration Tool (version 1.9.0, or later) to allow and enable the Bluetooth Low Energy (BLE) connection and update the Connex Spot Monitor (monitor) configuration file.

Refer to the "Advanced Settings" instructions on how to allow the Bluetooth Low Energy configuration.

1. Power on the Connex Spot Monitor.
2. Open the mobile application on the device. A list of Vitals devices appears.
3. Select the Vitals device in the mobile application. If this is the first time connecting the mobile device with the Connex Spot Monitor or if "Requiring pairing confirmation" is enabled:
  - a. The Bluetooth Pairing request prompt appears: "WACSM... would like to pair with your ..."
  - b. Pair the device and the Connex Spot Monitor by touching **OK** on the Connex Spot Monitor at the prompt, "A Bluetooth® Low Energy device is attempting to connect."
  - c. At the pairing confirmation screen, touch **Pair** on the mobile application.

The mobile application home screen appears.



## Disassembly and repair

---

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 monitor, 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 #1 screwdriver
- T-10 Torx screwdriver
- 3mm hex key

## Torque value table

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

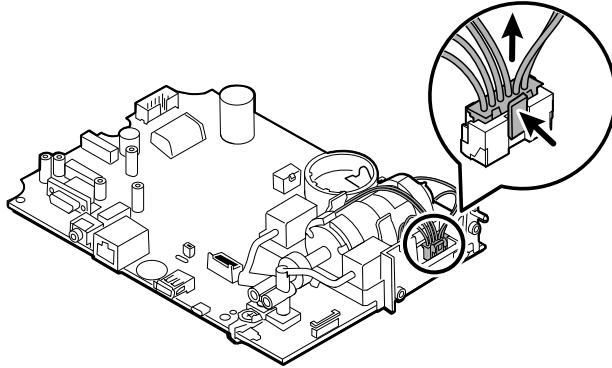
Description	Torque specification	Bit type	Where used
SCR,4-20X.31 PLASTITE PH TORX	4.5 +/-0.5 in-lbs	Torx	Chassis and SpO2 Insert to Main CSM PCA. Radio/Bluetooth PCBA to Chassis
SCREW 4-40 .250 PAN PHILLIPS STEEL ZINC	4.5 +/-0.5 in-lbs	Phillips	SpO2 boards
SCREW, M2 X 6 INTERNAL TOOTH SEMS PHP	2.5 +/-0.25 in-lbs	Phillips	Radio PCA to Radio Interface PCA
SCREW, M4 X 10 PAN HEAD W NYLOC	7.5 +/-0.5 in-lbs	Phillips	Front to Back Housing and Temperature Module/Dock
SCR, M4 PAN HD, PHD, SHOULDER	4.5 +/-0.5 in-lbs	Phillips	Battery Door



## Connector types

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

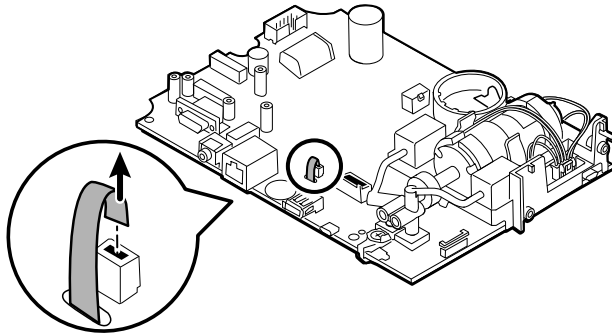
- **Locking (squeeze-release):** Locking connectors use a latching mechanism to prevent accidental disconnection during assembly and use. The latch is located on one end of a tab so it may flex and lock into place when coupled with its matching connector. The tab provides a lever to release the latch.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

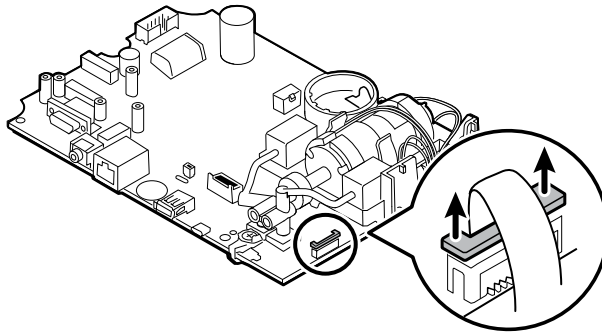


**CAUTION** Do not use excessive force to disconnect the connector. Excessive force may result in pulling the mounted connector off the circuit board.

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.



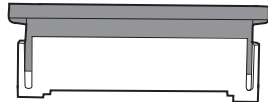
**CAUTION** Do not use excessive force when releasing pressure on the connector. Excessive force may result in breaking the sliding outer piece.

#### To remove a ZIF connector



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

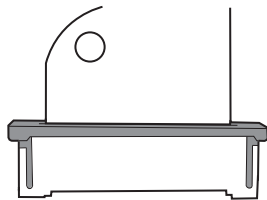
1. Using a suitable tool (for example, a paper clip, small flat-head screwdriver, or needle-nose pliers), slide the latching piece of the connector away from the connector body.



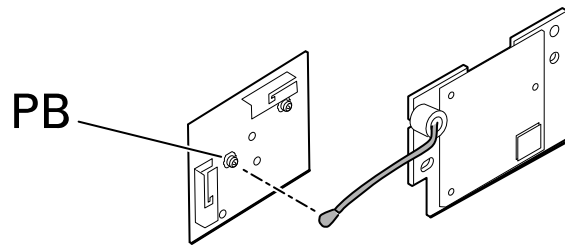
2. Remove the cable.

#### 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.



- **Coaxial:** Coaxial connectors, a type of pressure connector in this case, are components attached to the ends of a coax cable—they make it possible to connect to other devices. The connector has a wire conductor in the center, surrounded by an outer conductor, and an insulation between the two. In this device, the coaxial connector connects the antenna to the wireless radio board.



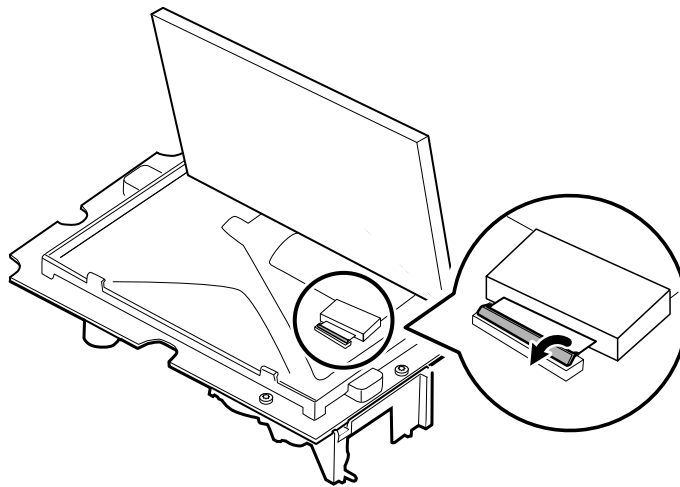
**NOTE** This connector is labeled PB because of its location on the wireless radio board.

To remove a coaxial connector, lift the connector away from the board.

To connect a coaxial connector, align the connector over the mount on the board and press to snap it 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.

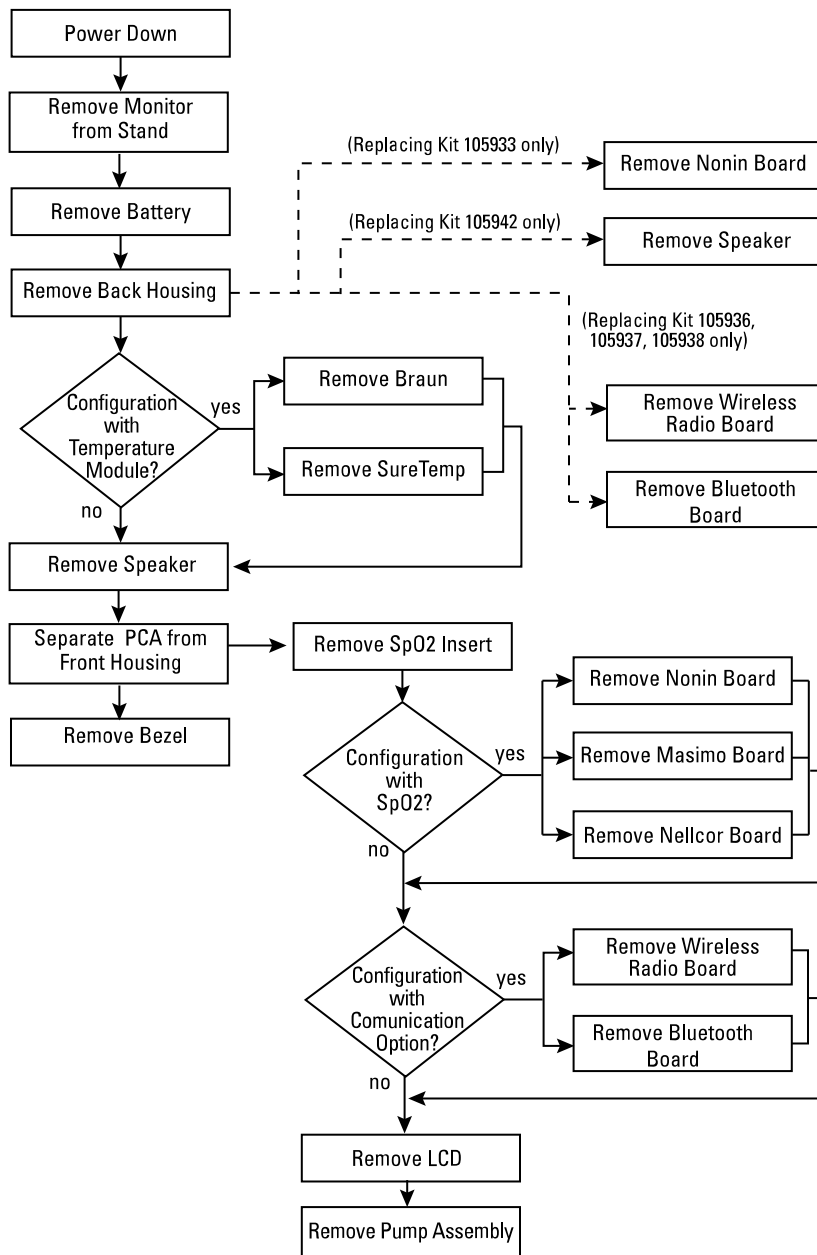
1. Lift the latching piece of the connector up off the the connector body.
2. Remove the cable.

#### 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 monitor

You can power down the device as follows: 1) by briefly pressing the power button on the housing and then following the onscreen prompts, or 2) by using onscreen controls alone.

**Option 1.** Press the power button. An onscreen dialog opens with the following options:

- **Power down.** Device behavior is the same for all profiles.
- **Sleep.** The Sleep button clears the display and puts the device into Display power-saving mode.
- **Cancel.** The Cancel button dismisses the dialog.

Touch **Power down** and complete the power-down procedure as described in Option 2, steps 3 and 4.

**Option 2.** Use onscreen controls alone to power down the device:

1. Touch the **Settings** tab.
2. Touch the **Device** tab.
3. Touch **Power down**.
4. Select the desired option and then touch **Power down**.

### The Power-down options dialog

The buttons in this dialog produce varied effects, as noted below:

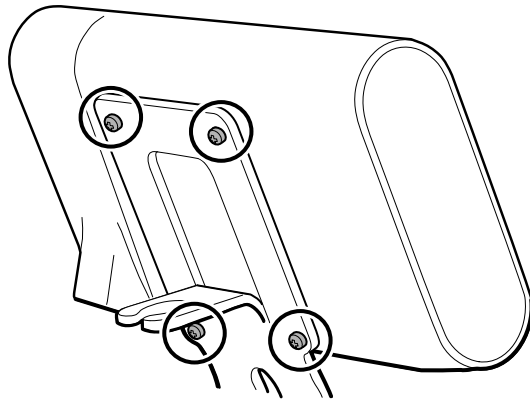
- **Power down.** The device clears all data onscreen and performs a complete software shutdown.
- **Cancel.** This button dismisses the dialog and returns you to the previous screen.



**NOTE** If your monitor is configured with a Braun thermometer, avoid powering down the monitor between patient measurements to help maintain an adequate charge to the Braun dock.

## Remove the monitor from the stand

1. Disconnect the power cord from the wall.
2. If the system has an APM, disconnect the power and communication cables from the monitor. If the system has an external power supply, disconnect the power supply from the monitor.
3. Remove the 4 Phillips screws from the back of the stand mount to remove the monitor from the stand.

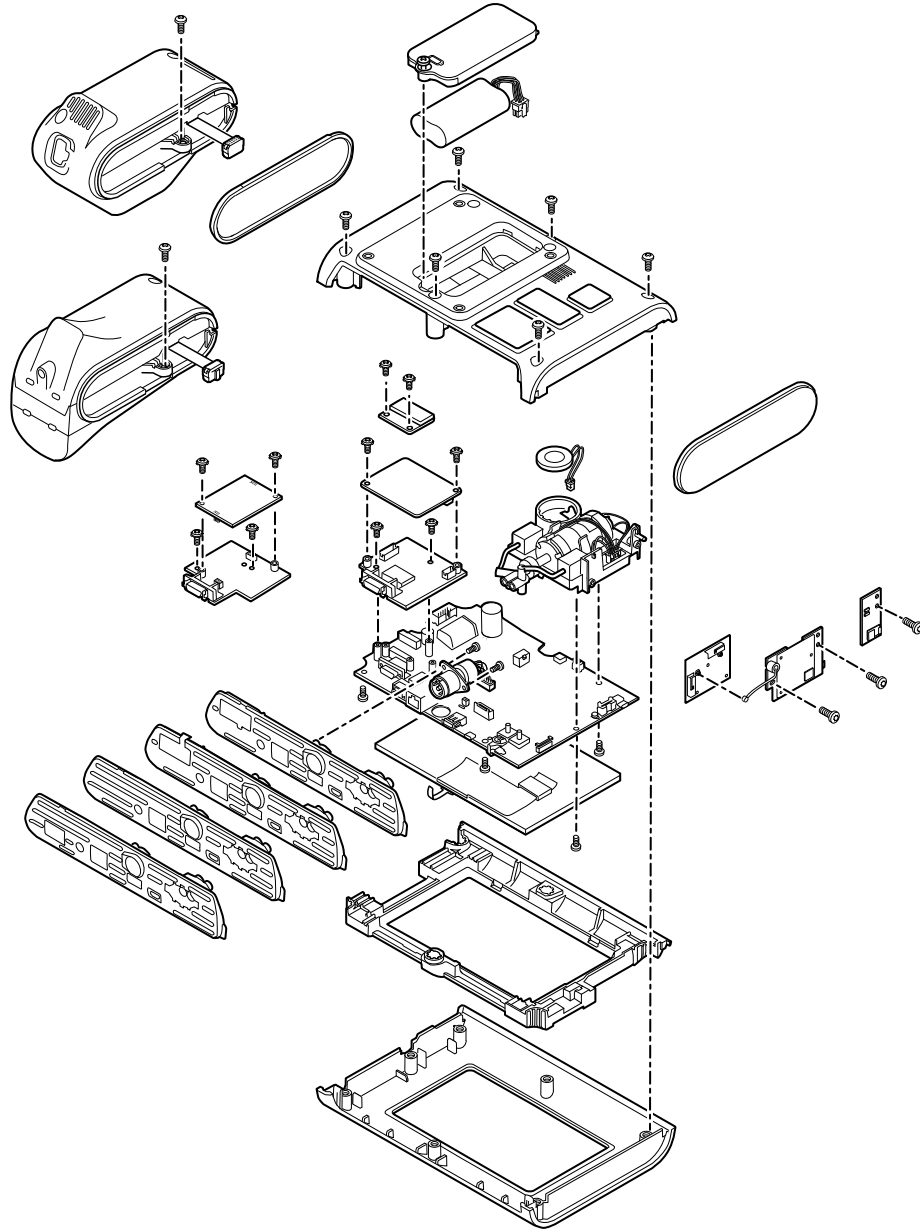


**NOTE** This artwork features the APM stand. Other stand mounts look slightly different.

**Reassembly notes:** Reassembly is the reverse of disassembly.

## Exploded view diagram

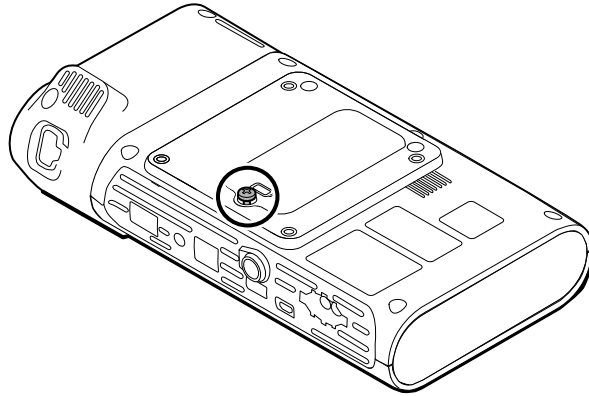
The drawing below shows individual components of the device and their relationships to one another.



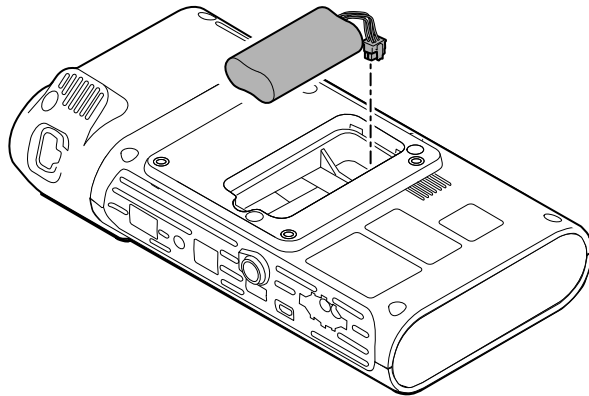
## Remove the battery

Before removing the battery, power down the monitor as described in this manual.

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



3. Disconnect and remove the battery.



## Reassembly notes

### Kit item:

- Batt22, Srv Kit 2 Cell Lithium-ion Battery



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

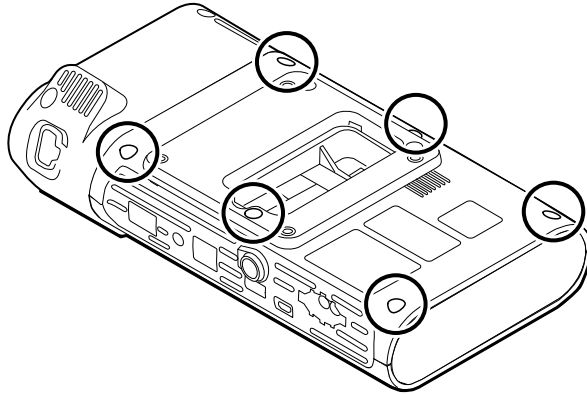


**WARNING** Defective batteries can damage the monitor. If the battery shows any signs of damage or cracking, it must be replaced immediately and only with a battery approved by Welch Allyn.

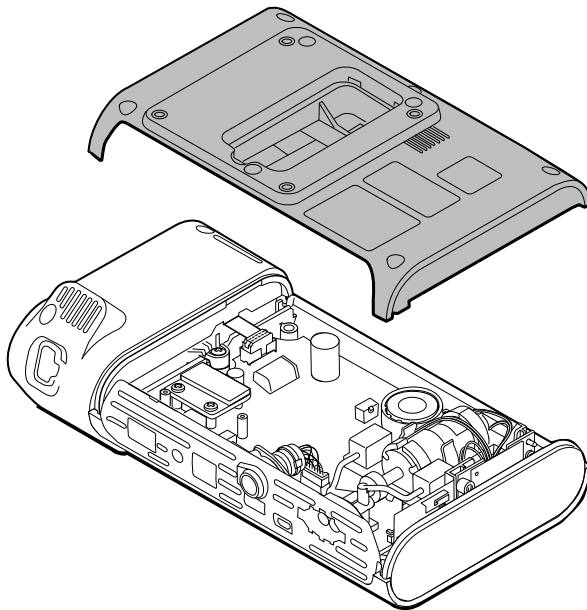


## Remove the back housing

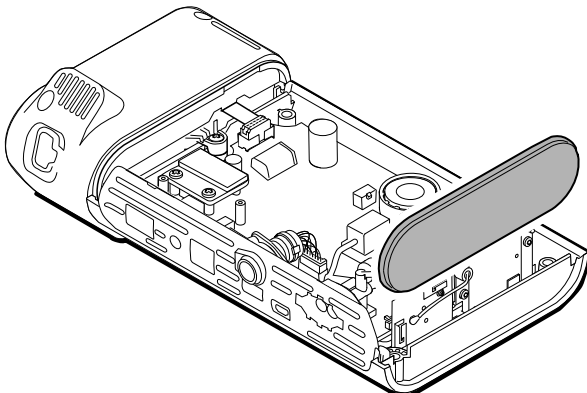
1. Remove the 6 Phillips screws on the back of the device to remove the back housing.



2. Lift the back housing straight up off the device.



3. Remove end cap on the right by pulling it out of its slot.



## Reassembly notes

### Kit items:

- 105939, End cap
- 105923, Back housing (includes battery, speaker foam, 6 screws, and 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.



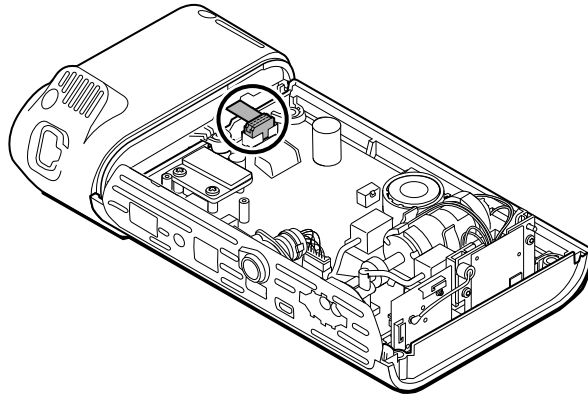
**NOTE** Reassembly is the reverse of disassembly.

## Remove the temperature module or housing

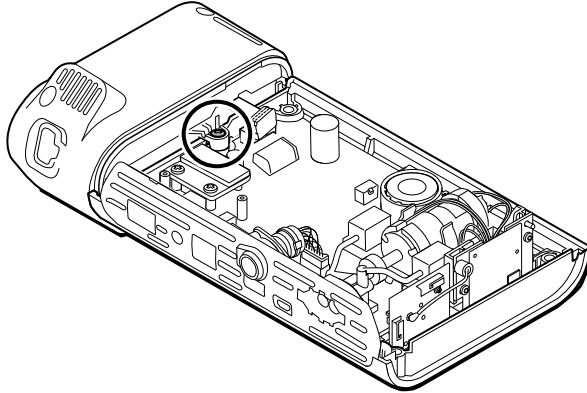
The monitor is configured with either a SureTemp or Braun ThermoScan PRO 6000 temperature module. Proceed with the disassembly steps that apply to your device.

### Remove the SureTemp module

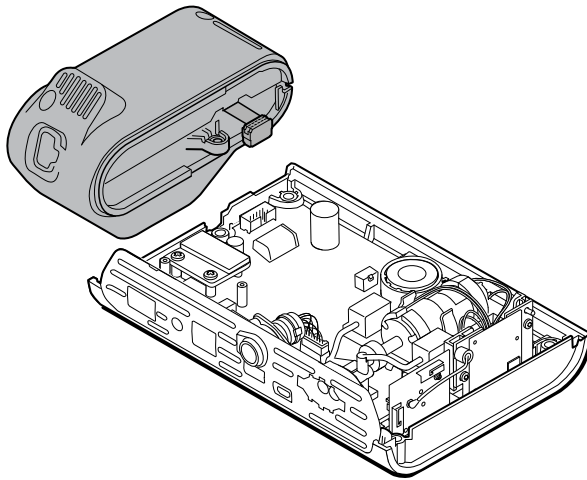
1. Disconnect the ribbon cable by lifting the connector.



2. Remove the Phillips screw that holds the module in place.



3. Lift the module out of the left side slot.



## Reassembly notes

### Kit item:

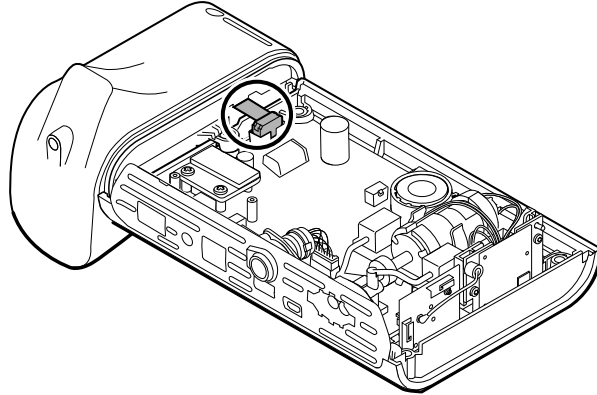
- 105940, SureTemp Plus module



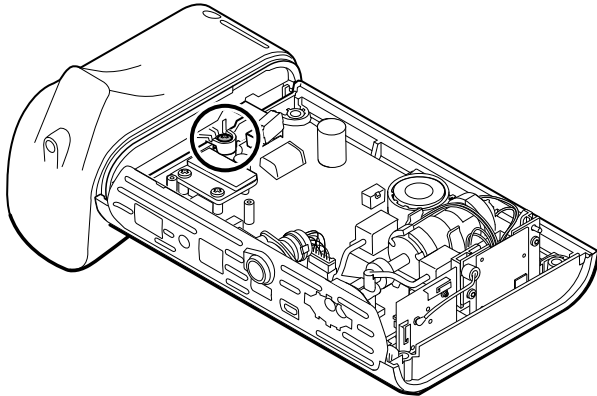
**NOTE** Reassembly is the reverse of disassembly.

## Remove the Braun ThermoScan PRO 6000 module

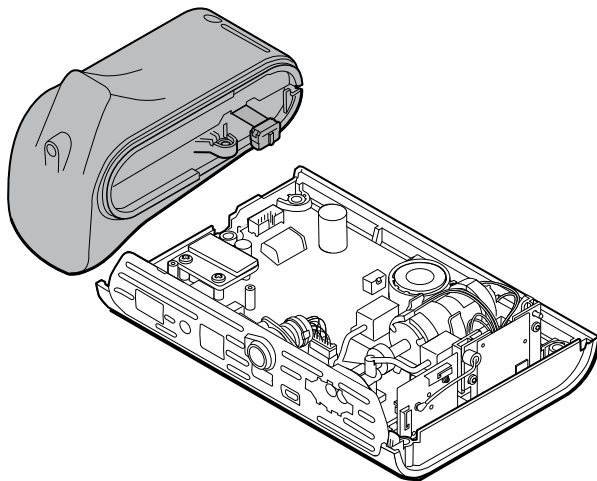
1. Disconnect the ribbon cable by lifting the connector.



2. Remove the Phillips screw that holds the module in place.



3. Lift the module out of the left side slot.



## Reassembly notes

### Kit item:

- 105941, Braun ThermoScan PRO 6000 dock

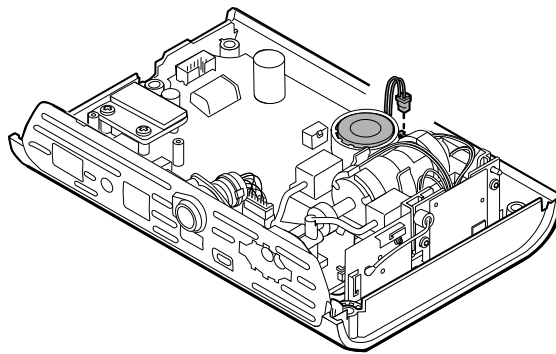


**NOTE** Reassembly is the reverse of disassembly.

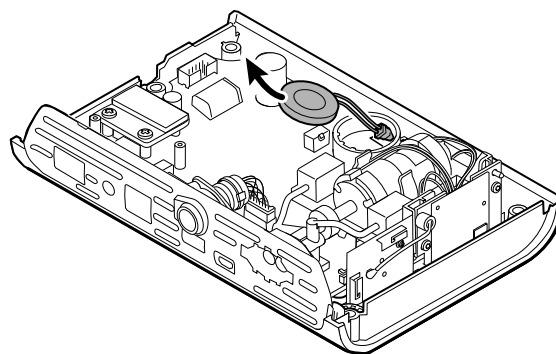
## Disassemble the main PCA board

### Remove the speaker

1. Disconnect the speaker wire.



2. Remove the speaker.



## Reassembly notes

### Kit item:

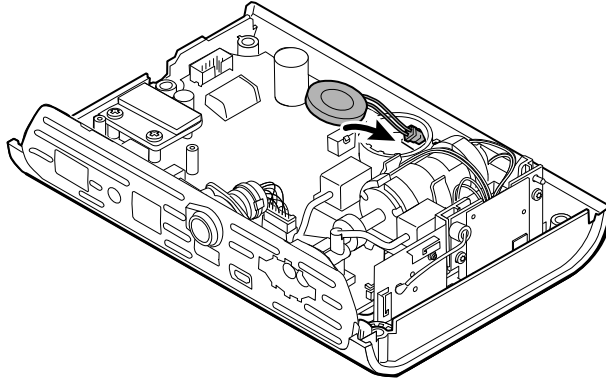
- 105942, Speaker



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

### When replacing the speaker

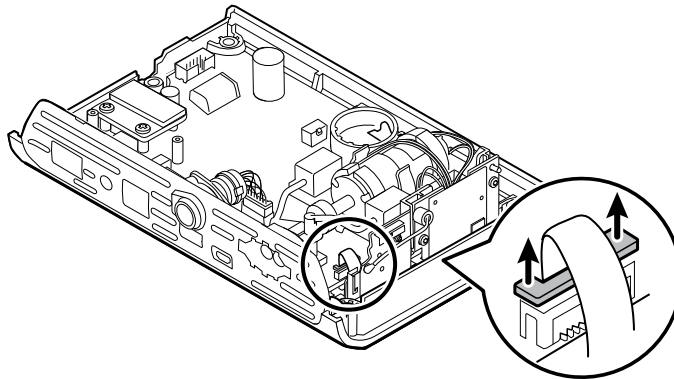
1. While holding the speaker, guide the wire through the hole in the pump assembly and drop the speaker into place.



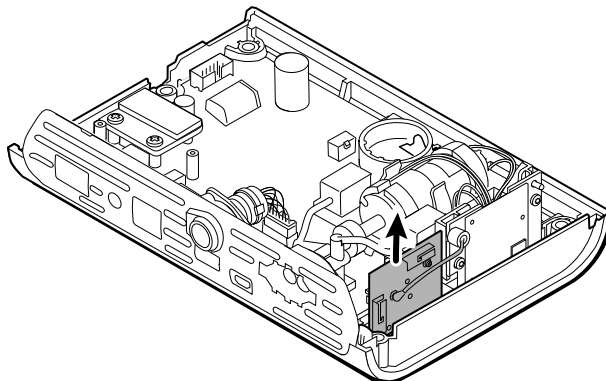
2. Connect the speaker wire to the main PCA board.

### Separate the main PCA board from the front housing

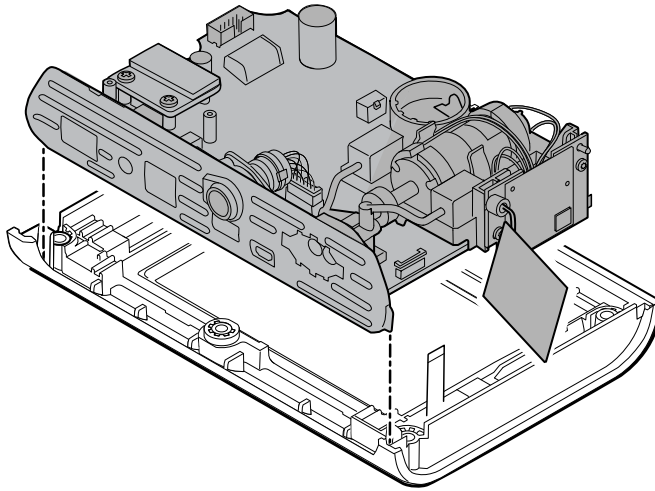
1. Disconnect the power switch flex cable from the main PCA board.



2. Lift the antenna board straight up out of its slot and let it hang.



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



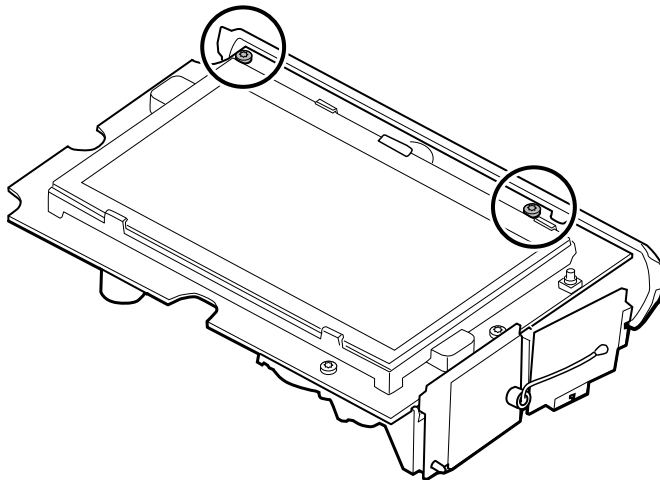
## Reassembly notes



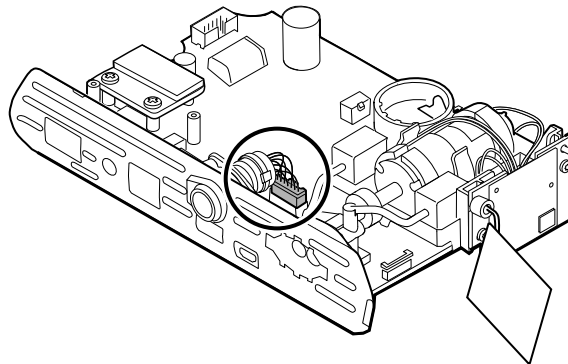
**NOTE** Reassembly is the reverse of disassembly.

## Remove the SpO2 insert

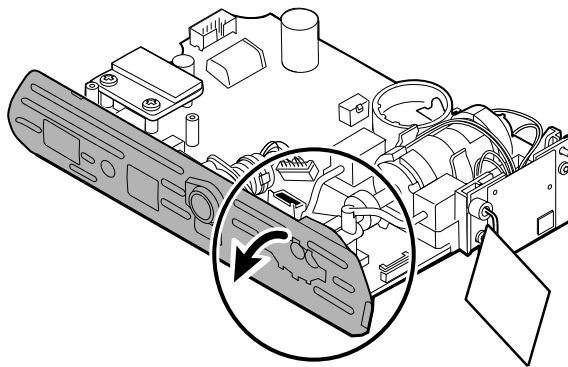
1. Turn over the main PCA board and remove the 2 T-10 Torx screws attaching the sensor insert to the main PCA board.



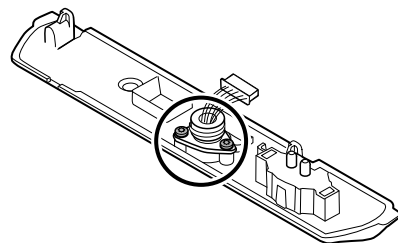
2. Turn over the main PCA board again so that the SpO2 board is facing you; then disconnect the power harness from the main PCA board.



3. To disconnect the insert 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.



4. Remove the 2 T-10 Torx screws from the power harness, and remove the power harness from the SpO2 insert.



## Reassembly notes

SpO2 insert options are Masimo, Nellcor, Nonin, or none.

### Kit items:

- 105926, Masimo insert only
- 105927, Nellcor insert only
- 105929, Nonin insert only
- 105928, No SpO2 insert only





**NOTE** Reassembly is not the reverse of disassembly, but it is the same for each insert.

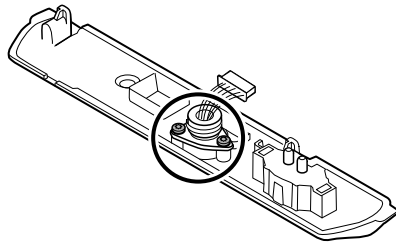
## When replacing the SpO2 insert

Complete the following steps:

- Attach the power harness to the SpO2 insert. (See "Attach the power harness to the insert.")
- Install any new SpO2 board, if applicable. (See the reassembly notes in "Remove the SpO2 board.")

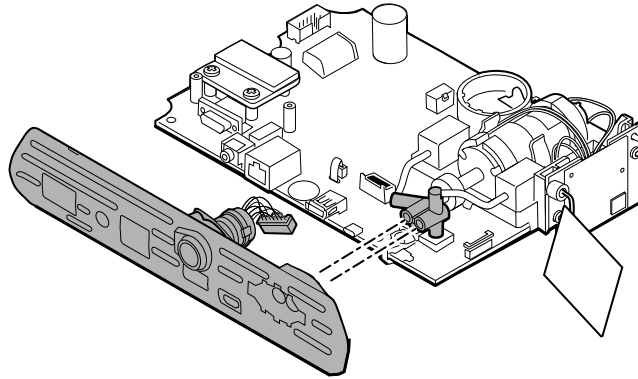
## Attach the power harness to the insert

Align the power harness with the insert and secure it with 2 T-10 Torx screws (see the Torque Value Table).

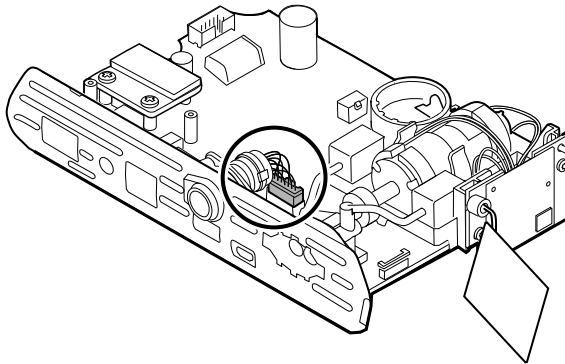


## Attach the SpO2 insert to the main PCA board

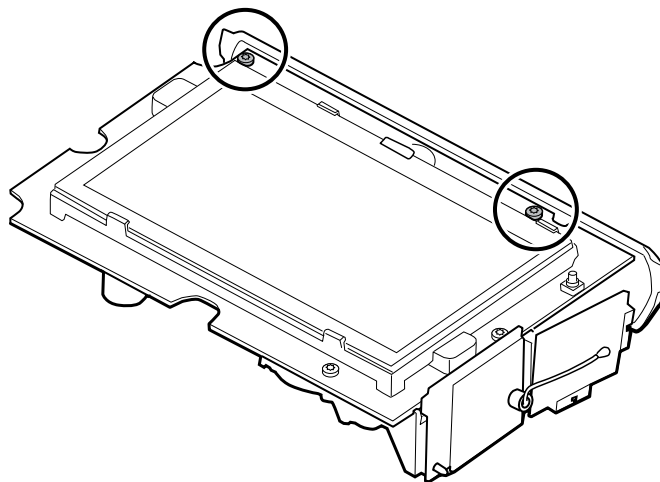
1. Align the insert with the edge of the main PCA board. Connect the pump tubing to the insert as shown and press firmly. Adjust the insert to fit snugly along the side of the board.



2. Connect the power harness to the main PCA board.



3. Turn over the board and secure the insert to the main PCA board with 2 T-10 Torx screws.

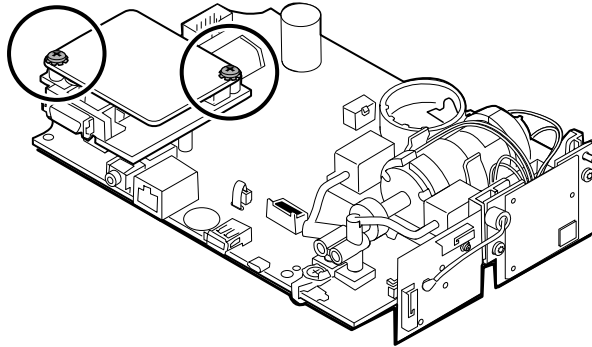


## Remove the SpO2 board

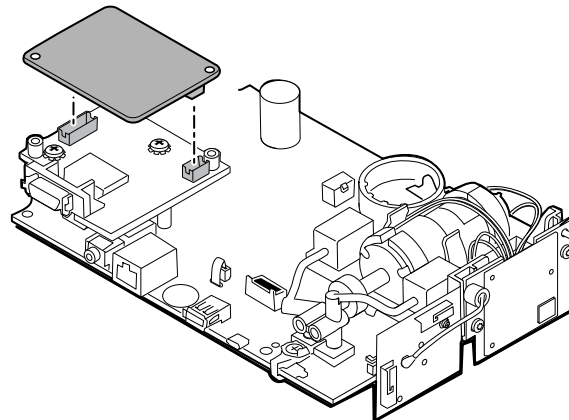
The monitor is configured with one of the following SpO2 boards: Masimo, Nellcor, Nonin, or none. Proceed with the disassembly steps that apply to your device.

### Remove the Masimo board

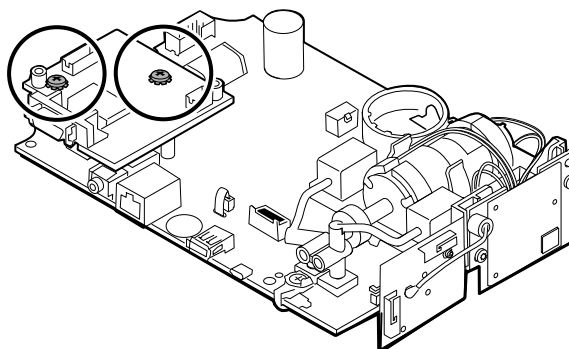
1. Remove the 2 Phillips screws from the SpO2 board.



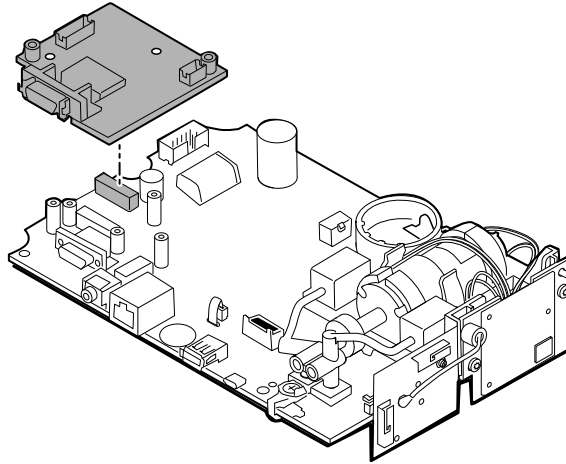
2. Lift the SpO2 board to remove it from the adapter board.



3. Remove the 2 Phillips screws that hold the adapter board to the main PCA board.

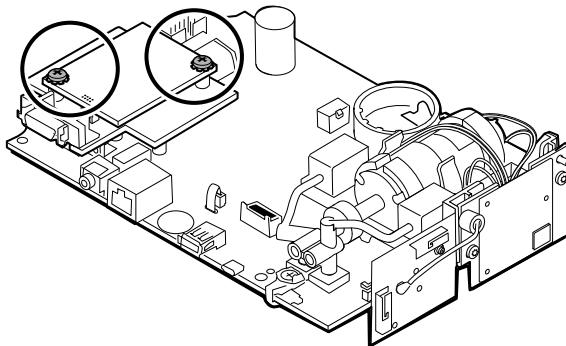


4. Firmly grasp the adapter board and lift it straight up to disconnect the pins.

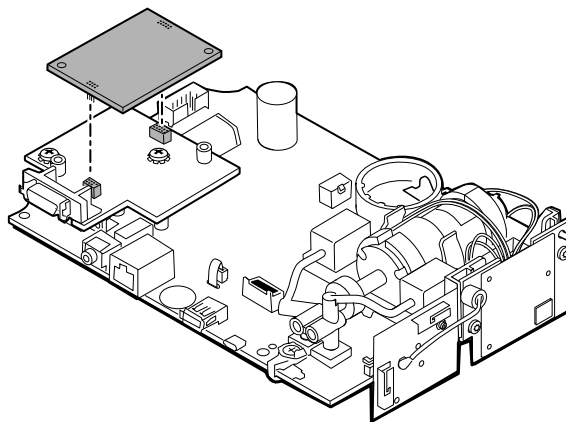


## Remove the Nellcor board

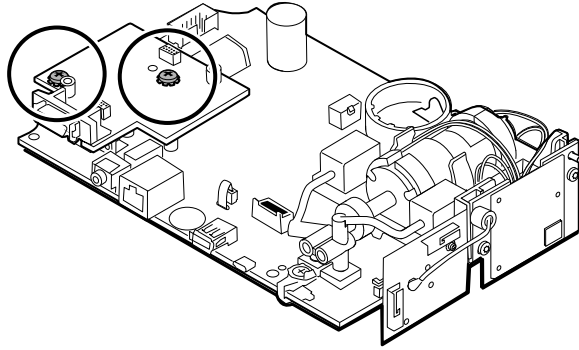
1. Remove the 2 Phillips screws from the SpO2 board.



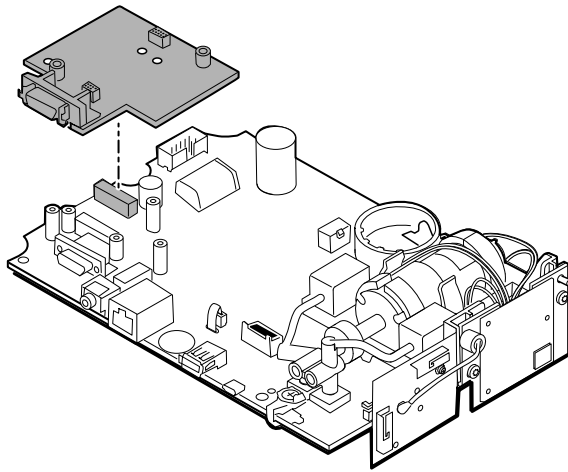
2. Lift the SpO2 board to remove it from the adapter board.



3. Remove the 2 Phillips screws that hold the adapter board to the main PCA board.

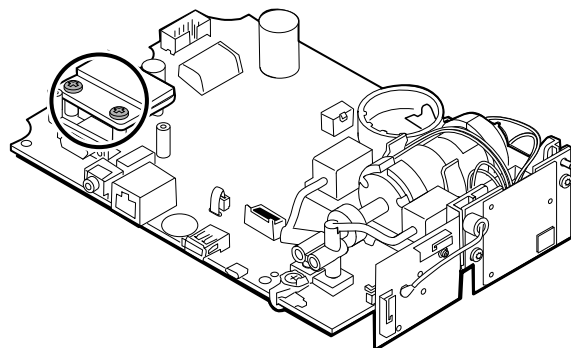


4. Firmly grasp the adapter board and lift it straight up to disconnect the pins.

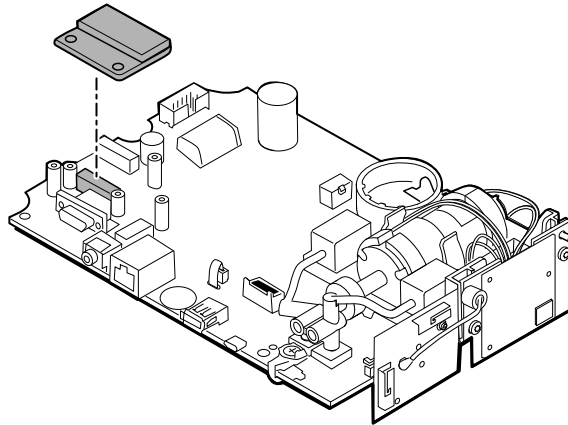


## Remove the Nonin board

1. Remove the 2 Phillips screws that attach the SpO2 board to the main PCA board.



2. Remove the board.



## Reassembly notes

SpO2 board options are Masimo, Nellcor, and Nonin.

### Kit items:

- 105931, adapter board, Masimo board, and 2 Phillips screws (4-40 0.250 pan steel zinc)
- 105932, adapter board, Nellcor board, and 2 Phillips screws (4-40 0.250 pan steel zinc)
- 105933, Nonin board and 2 Phillips screws (4-40 0.250 pan steel zinc)



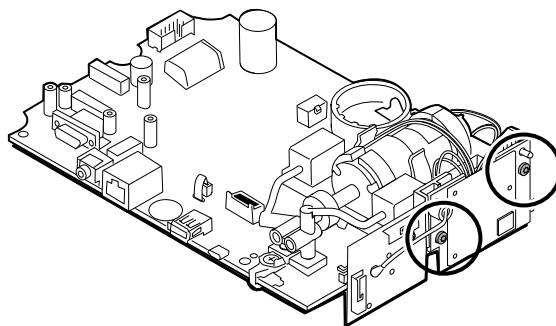
**NOTE** Reassembly is the reverse of disassembly for each board.

## Remove the communications board

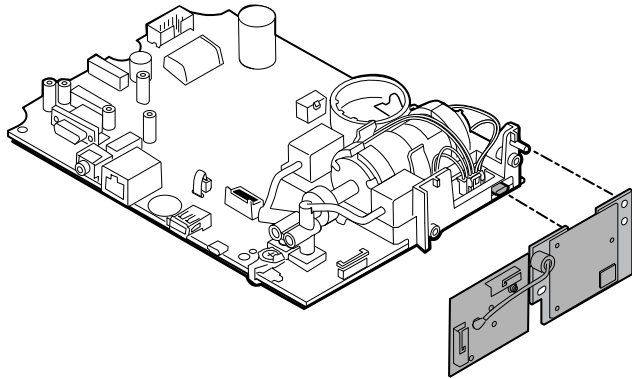
The monitor is configured with one of the following communications boards: wireless radio, *Bluetooth* wireless technology, or none. Proceed with the disassembly steps that apply to your device.

### Remove the wireless radio board from the main PCA board

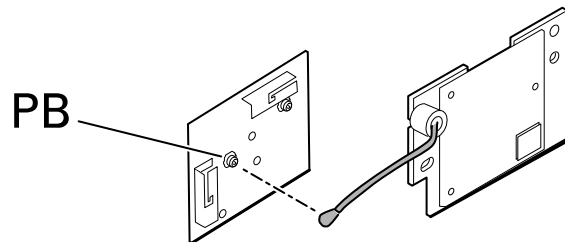
1. Remove the 2 T-10 Torx screws from the wireless radio board attached to the pump assembly.



2. Pull the board straight out to disconnect the mini USB connector.



3. Disconnect the antenna wire from the PB connector on the antenna board.



## Reassembly notes

### Kit items:

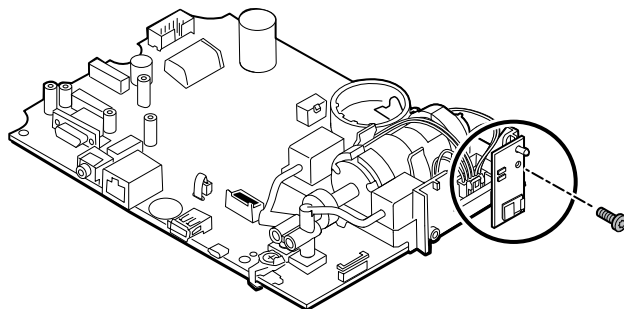
- 105936, Wireless radio board, antenna, and 2 T-10 Torx screws
- 105938, Antenna board



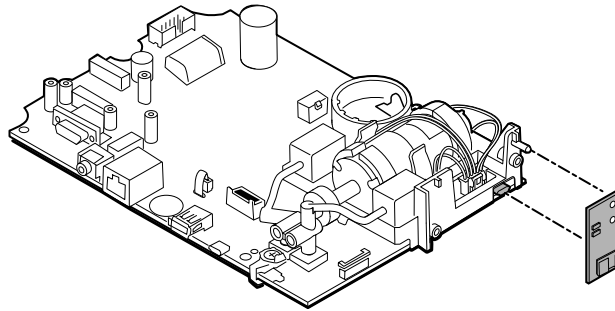
**NOTE** Reassembly is the reverse of disassembly.

## Remove the *Bluetooth* board from the main PCA board

1. Remove the T-10 Torx screw from the *Bluetooth* radio board.



2. Pull the board straight out to disconnect the mini USB connector.



## Reassembly notes

### Kit items:

- 105937, *Bluetooth* board and a T-10 Torx screw



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

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

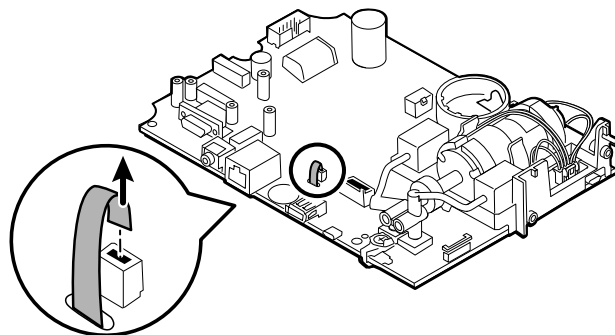


**NOTE** The touchscreen contains a serial number: TFC-K9700RTWV37TR or TFC-K9700RTWV55. Removal and Reassembly steps are the same for both serial numbers, except that the TFC-K9700RTWV37TR serial number has an integrated (soldered) LCD flex cable.



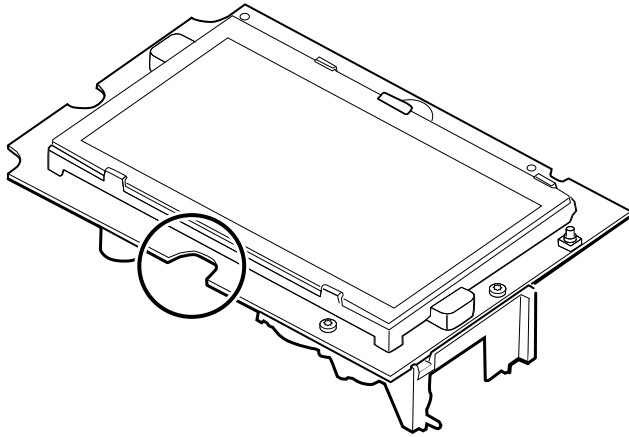
**NOTE** The TFC-K9700RTWV55 touchscreen and display ribbon cable (available as service kit item: 108241, Srv Kit HW A-F, LCD with Touchscreen) works with the 409703-16 CSM Main Board and with existing software versions. When using the TFC-K9700RTWV37TR touchscreen and display ribbon cable (available as service kit item 108121, Srv Kit CSM, LCD with Touchscreen New), you are required to upgrade your device with the newer 409703-18 CSM Main Board, the new LCD Touchscreen, and upgrade the software to 1.41 or greater.

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.

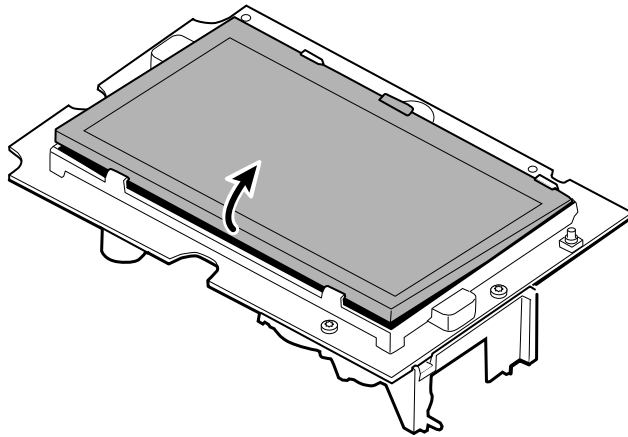


2. Turn over the main PCA board so that the notch on the board faces you.

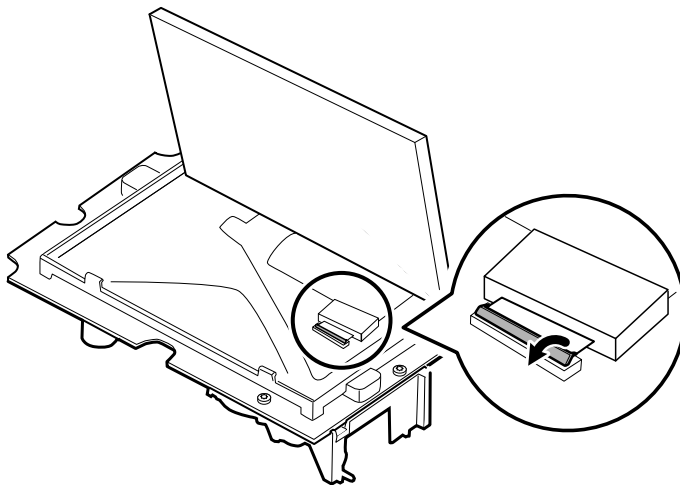




3. On the side of the main PCA board with the notch, carefully lift the LCD past the tabs, and tilt the LCD upward.



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

### Kit item:

- 108241, Srv Kit HW A-F, LCD with Touchscreen
- 108121, Srv Kit CSM, LCD with Touchscreen New



**NOTE** The TFC-K9700RTW55 touchscreen and display ribbon cable (108241, Srv Kit HW A-F, LCD with Touchscreen) works with the 409703-16 CSM Main Board and with existing software versions.



**NOTE** When using the TFC-K9700RTW37TR touchscreen and display ribbon cable (available as service kit item 108121, Srv Kit CSM, LCD with Touchscreen New), you are required to upgrade your device with the newer 409703-18 CSM Main Board, the new LCD Touchscreen, and upgrade the software to 1.41 or greater.



**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

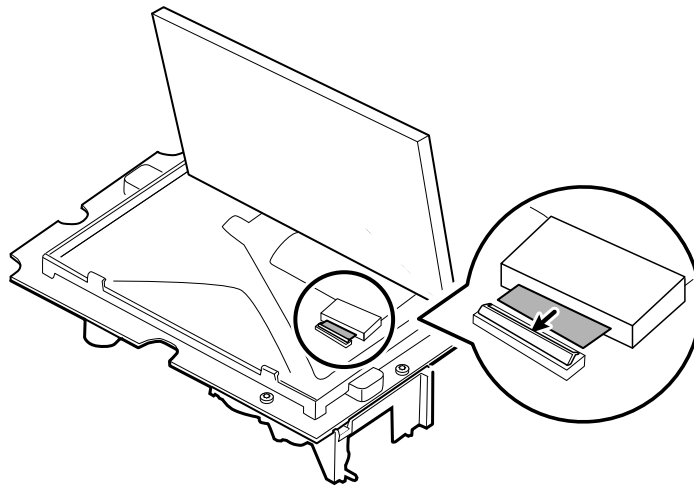


**NOTE** The touchscreen contains a serial number: TFC-K9700RTW37TR or TFC-K9700RTW55. Reassembly steps are the same for both serial numbers, except that the TFC-K9700RTW37TR serial number has an integrated (soldered) LCD flex cable.

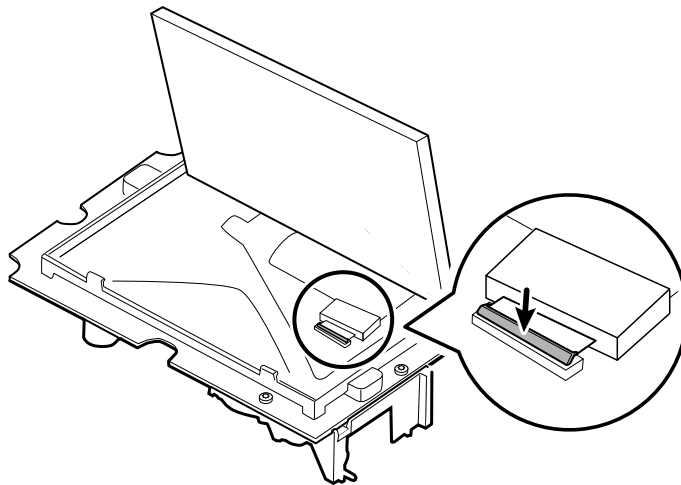


**NOTE** The TFC-K9700RTW55 touchscreen and display ribbon cable (available as service kit item: 108241, Srv Kit HW A-F, LCD with Touchscreen) works with the 409703-16 CSM Main Board and with existing software versions. When using the TFC-K9700RTW37TR touchscreen and display ribbon cable (available as service kit item 108121, Srv Kit CSM, LCD with Touchscreen New), you are required to upgrade your device with the newer 409703-18 CSM Main Board, the new LCD Touchscreen, and upgrade the software to 1.41 or greater.

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.

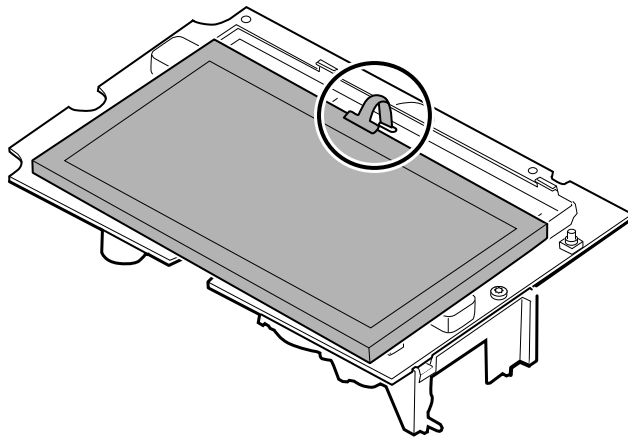


3. Apply the Gaff tape (removed during disassembly) to the connector bale and the LCD flex.



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

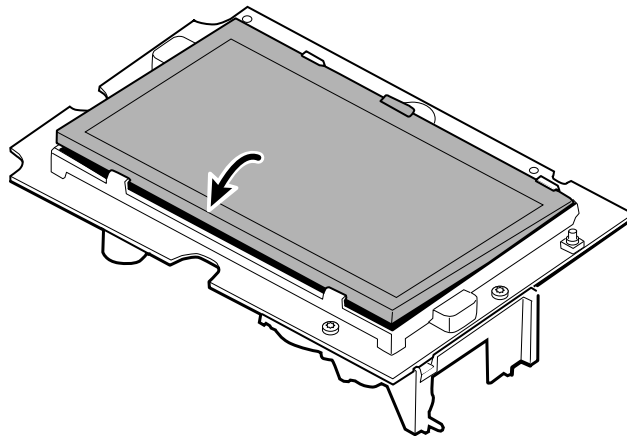
4. For the TFC-K9700RTWW55 serial number, insert the small touchscreen flex cable into the hole on the main PCA board.



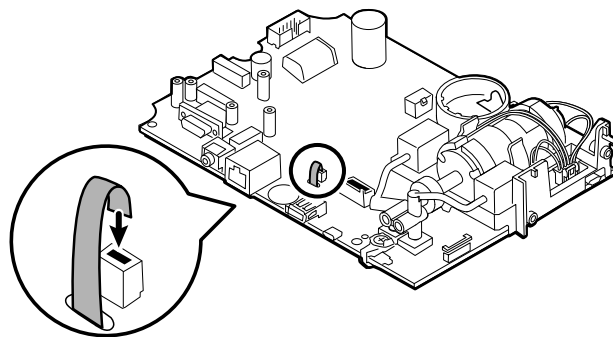
5. Place the LCD at an angle under the tabs on the flex cable side of the LCD.
6. Lower the LCD into place and carefully move the tabs on the opposite side just enough to catch and secure the LCD in the frame.



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

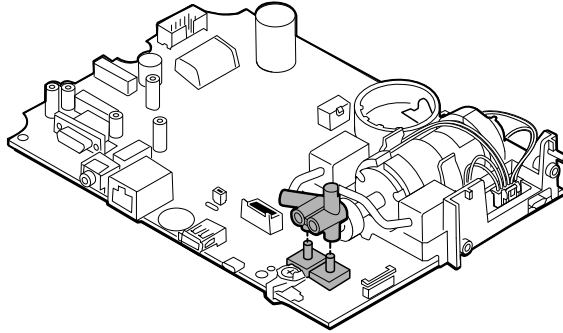


7. Turn over the main PCA board.
8. For the TFC-K9700RTWW55 serial number, insert the flex cable into its connector.

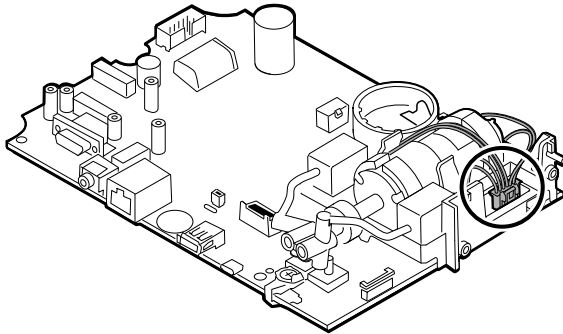


## Remove the pump assembly

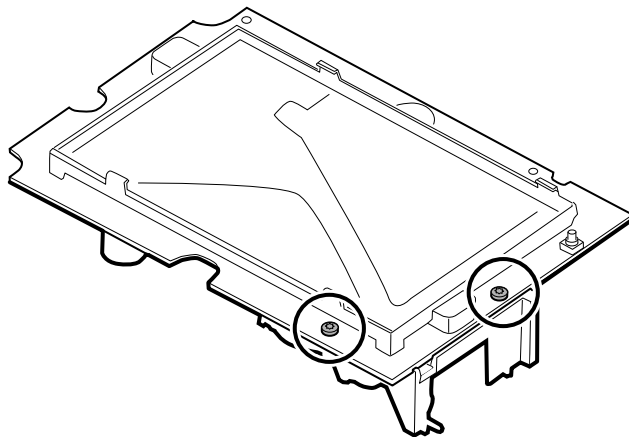
1. Remove the pump manifold from the main PCA board transducers.



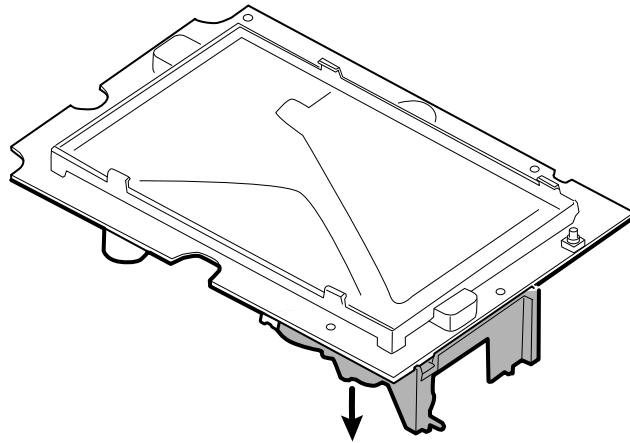
2. Pinch and remove the pump assembly connector from the main PCA board.



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



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



## Reassembly notes

### Kit items:

- 105920, Pump assembly and 2 T-10 Torx screws



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

## Attach the pump assembly to the main PCA board

1. Place the pump manifold onto the main PCA board transducer. Ensure that the pump manifold is fully seated on the transducer.  
(See "Remove the pump assembly," step 1.)
2. Connect the pump to the main PCA board.  
(See "Remove the pump assembly," step 2.)
3. Turn over the main PCA board.
4. Secure the pump assembly to the main PCA board with 2 T-10 Torx screws (see the Torque Value Table).  
(See "Remove the pump assembly," steps 3 and 4.)

## Replace the main PCA board

Replace the main PCA board as needed after removing all other components.



**NOTE** New PCA boards must be prepared for first use after installing them. Perform an NIBP board initialization during the full device functionality and calibration using the Welch Allyn Service Tool, Gold edition. See "Initialize the NIBP board" in the "Full functional verification and calibration" section.

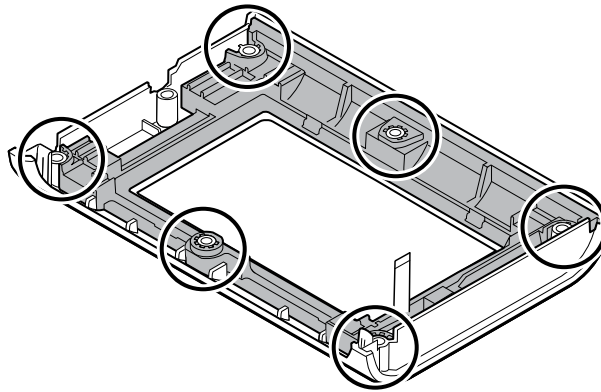


**NOTE** When repairs are complete and the device is calibrated, the Welch Allyn Service Tool CSM Configuration screen includes a tab for "First Boot Settings" that allows you to place the device into the following First Boot states: **Production Complete** (formerly described as 'State when it leaves the factory'). On boot up the language and date/time are shown.

## Disassemble the front housing

### Remove the bezel from the front housing

Lift the rubber bezel up and over the power switch cable and the 6 bosses on the housing.



## Reassembly notes

### Kit items:

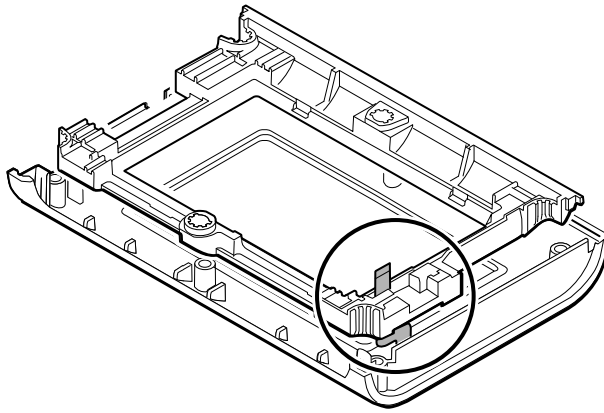
- 105922, Bezel
- 105921, Front housing (housing, power switch, and 6 Phillips screws)



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

## Attach the bezel to the front housing

1. Align the bezel with the front housing and feed the power switch flex cable through the slot in the bezel.



2. Place the bezel onto the 6 bosses on the housing.

## Accessory Power Management (APM) work surface

This section applies only to devices with an APM stand.

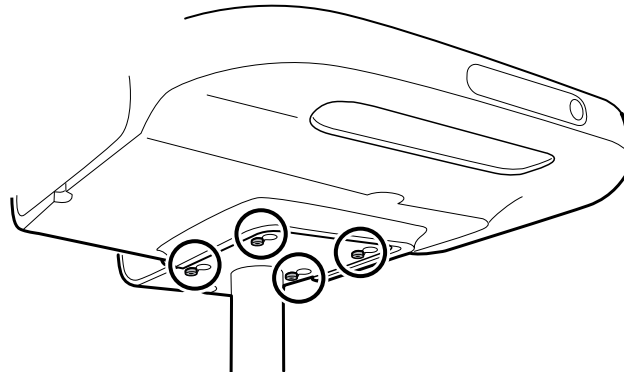
### Remove the APM work surface from the stand

Before removing the APM work surface, power down the monitor, disconnect the power and communication cables from the monitor, and disconnect the power cord from the wall.

1. Using a 3mm hex key, remove the 4 screws from the stand bracket and put them aside.



**NOTE** Save the screws for reassembly.



2. Lift the APM work surface off the stand.
3. If replacing the APM, remove the battery and put aside for reassembly.

## Reassembly notes

### Kit item:

- 105943, APM work surface

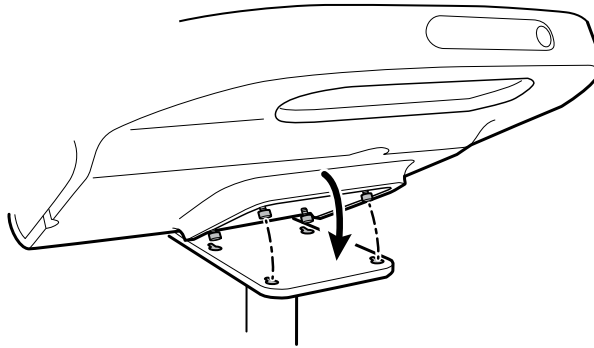




**NOTE** Reassembly is the not the reverse of disassembly.

## Attach the APM work surface to the stand

1. Take the 4 screws used to attach the APM work surface to the stand and partially screw them into the APM work surface with your fingers. Do not tighten.
2. Lower the screws into the stand bracket keyholes.



3. Slide the APM work surface backward on the stand bracket.
4. Tighten the 4 screws using a 3mm hex key.
5. Insert the battery.

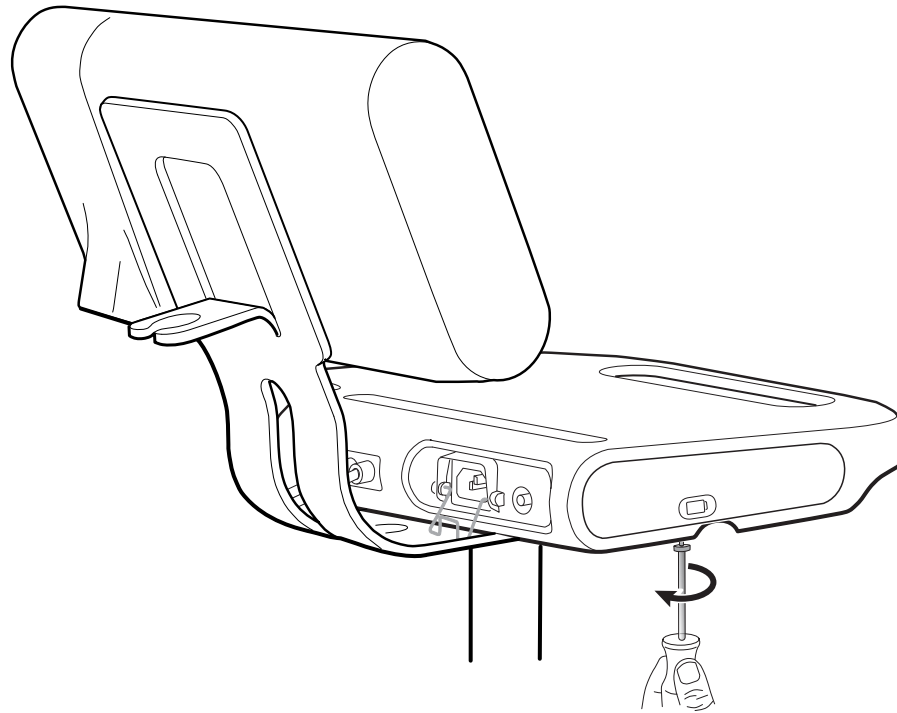
## Remove the APM work surface battery

Before removing the APM work surface battery, power down the monitor and disconnect the power cord from the wall.

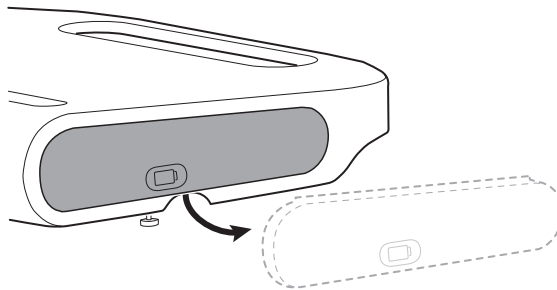


**NOTE** You do not have to remove the APM work surface from the stand to remove the APM work surface battery.

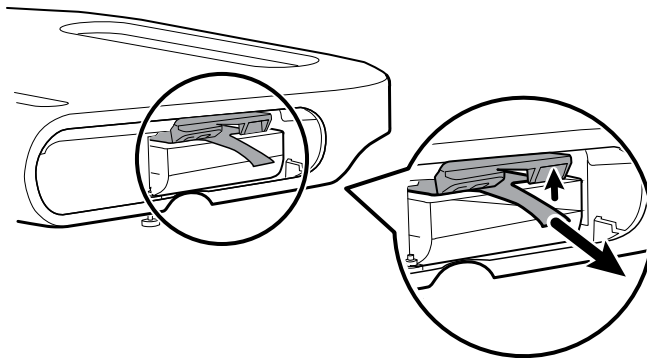
1. Loosen the captive screw on the bottom of the APM work surface that secures the battery door.



2. Remove the battery door and put it aside.



3. Gently lift the latch with one hand and pull the tab on the top of the battery with your other hand to remove the battery from its slot.



## Reassembly notes

### Kit items:

- Batt99, 9-cell Lithium-ion battery, single pack
- 105972, APM work surface, battery door (if needed)

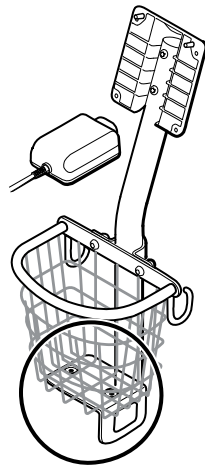


**NOTE** Reassembly is the reverse of disassembly.

## 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.

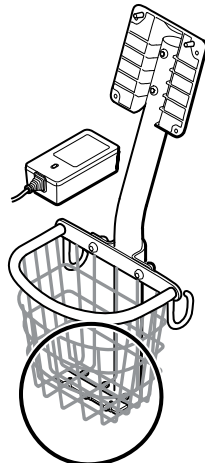
### Section A



CSM devices with a 4400-MBS or 7000-MS3 mobile stand meeting these criteria:

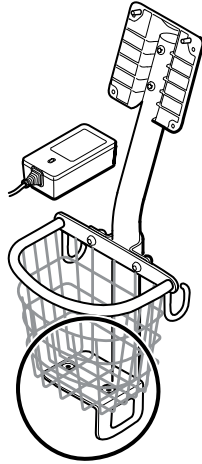
- 4400-MBS or 7000-MS3 mobile stand manufactured before 02/2022\* or earlier
- 7000-PS power supply manufactured before 02/2022\* or earlier
- Power supply model: MENB1035A1500F02

### Section B



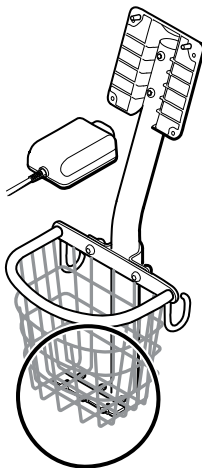
CSM devices with a 4400-MBS or 7000-MS3 mobile stand meeting these criteria:

- 4400-MBS or 7000-MS3 mobile stand manufactured after 02/2022\* or later
- 7000-PS power supply manufactured after 02/2022\* or later
- Power supply model: FW8031M/DT/15

**Section C**

CSM devices with a 4400-MBS or 7000-MS3 mobile stand meeting these criteria:

- 4400-MBS or 7000-MS3 mobile stand manufactured before 02/2022\* or earlier
- 7000-PS power supply manufactured after 02/2022\* or later
- Power supply model: FW8031M/DT/15
- Adapter plate kit REF 411626

**Section D**

CSM devices with a 4400-MBS or 7000-MS3 mobile stand meeting these criteria:

- 4400-MBS or 7000-MS3 mobile stand manufactured after 02/2022\* or later
- 7000-PS power supply manufactured before 02/2022\* or earlier
- Power supply model: MENB1035A1500F02

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

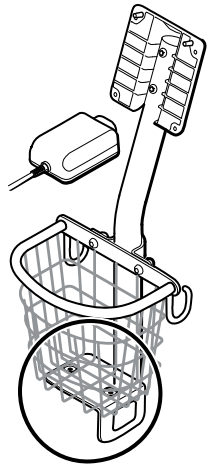
Examine your mobile stand and power supply to determine which subsection you should follow to complete disassembly and assembly procedures.

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 CSM devices with a 4400-MBS or 7000-MS3 mobile stand meeting these criteria:

- 4400-MBS or 7000-MS3 mobile stand manufactured before 02/2022\* or earlier
- 7000-PS power supply manufactured before 02/2022\* or earlier
- Power supply model: MENB1035A1500F02

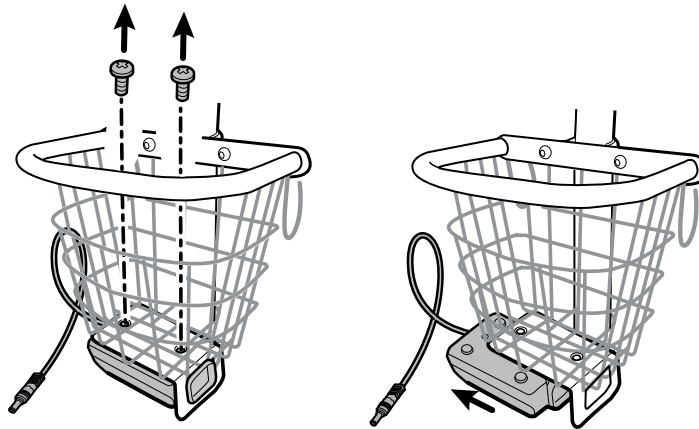


**NOTE** See the model number and label for further information.

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 CSM devices with a 4400-MBS or 7000-MS3 mobile stand meeting these criteria:

- 4400-MBS or 7000-MS3 mobile stand manufactured before 02/2022\* or earlier
- 7000-PS power supply manufactured before 02/2022\* or earlier
- Power supply model: MENB1035A1500F02



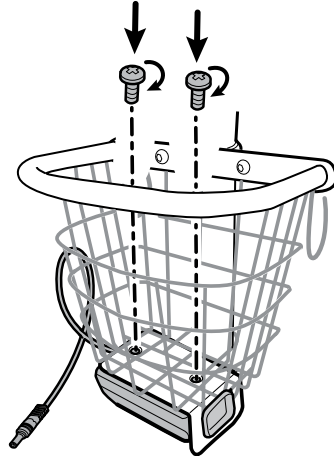
**NOTE** See the model number and label for further information.

Kit item:

- 7000-PS, Connex Spot 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.



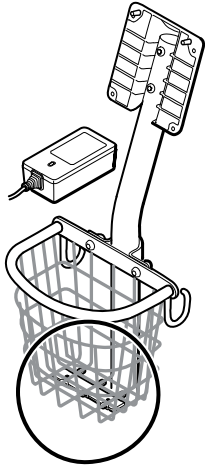
3. Thread the power cable from the power supply through one of the spaces next to the pole to reach the device, and then connect the power cable to the device.
4. Connect the power cord to the mains outlet.
5. Power up the device.

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

This section applies to CSM devices with a 4400-MBS or 7000-MS3 mobile stand meeting these criteria:

- 4400-MBS or 7000-MS3 mobile stand manufactured after 02/2022\* or later
- 7000-PS power supply manufactured after 02/2022\* or later

- Power supply model: FW8031M/DT/15

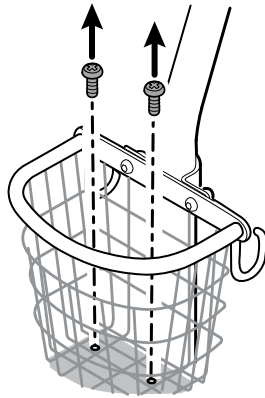


**NOTE** See the model number and label for further information.

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.



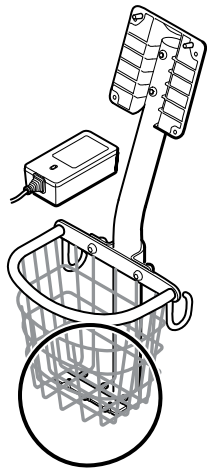
4. Remove the power supply unit.

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 CSM devices with a 4400-MBS or 7000-MS3 mobile stand meeting these criteria:

- 4400-MBS or 7000-MS3 mobile stand manufactured after 02/2022\* or later
- 7000-PS power supply manufactured after 02/2022\* or later
- Power supply model: FW8031M/DT/15

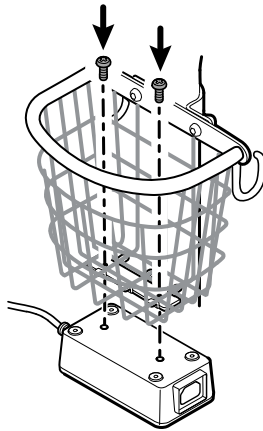


**NOTE** See the model number and label for further information.

Kit item:

- 7000-PS, Connex Spot 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.



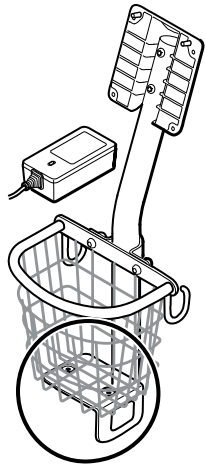
2. Thread the power cable from the power supply through one of the spaces next to the pole to reach the device, and then connect the power cable to the device.
3. Connect the power cord to the mains outlet.
4. Power up the device.

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

This section applies to CSM devices with a 4400-MBS or 7000-MS3 mobile stand meeting these criteria:

- 4400-MBS or 7000-MS3 mobile stand manufactured before 02/2022\* or earlier
- 7000-PS power supply manufactured after 02/2022\* or later
- Power supply model: FW8031M/DT/15



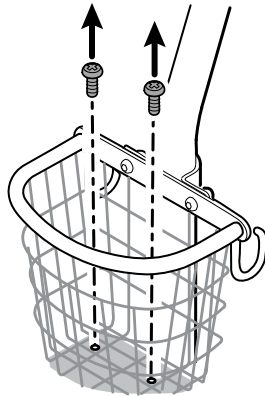


**NOTE** See the model number and label for further information.

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.



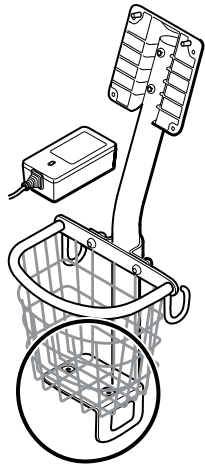
4. Remove the power supply unit.

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 CSM devices with a 4400-MBS or 7000-MS3 mobile stand meeting these criteria:

- 4400-MBS or 7000-MS3 mobile stand manufactured before 02/2022\* or sooner
- 7000-PS power supply manufactured after 02/2022\* or later
- Power supply model: FW8031M/DT/15

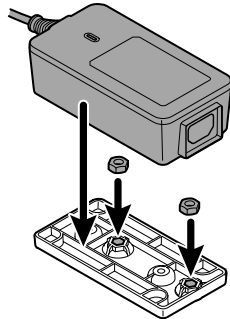


**NOTE** See the model number and label for further information. To install the new power supply onto an existing stand, you need to use the adapter plate kit REF 411626.

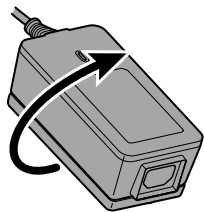
Kit item:

- 7000-PS, Connex Spot Power Supply
- 411626, MS3 Power Supply Bracket Kit

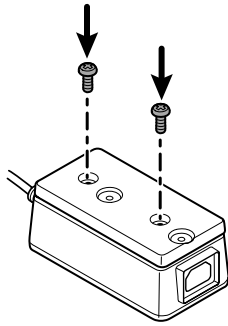
1. Install the 2 nuts by placing each nut into the adapter plate well. With one hand holding the power supply, use the other hand to close up the power supply onto the adapter plate.



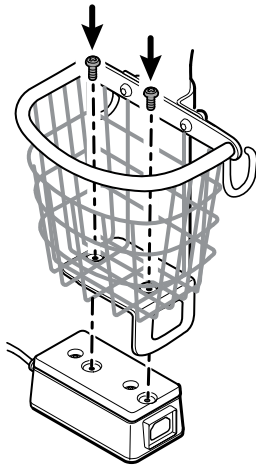
2. Flip the power supply over to ensure that the side with the screw holes is facing upward,



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.

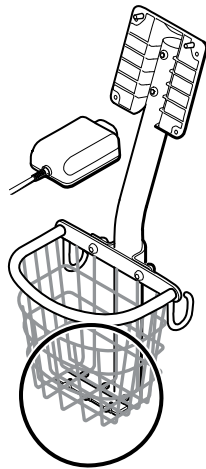


4. Thread the power cable from the power supply through one of the spaces next to the pole to reach the device, and then connect the power cable to the device.
5. Connect the power cord to the mains outlet.
6. Power up the device.

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

This section applies to CSM devices with a 4400-MBS or 7000-MS3 mobile stand meeting these criteria:

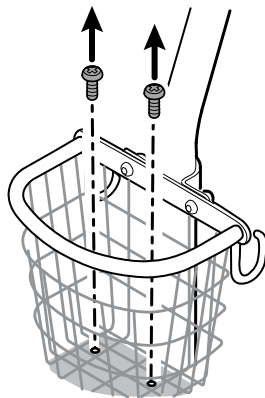
- 4400-MBS or 7000-MS3 mobile stand manufactured after 02/2022\* or later
- 7000-PS power supply manufactured before 02/2022\* or earlier
- Power supply model: MENB1035A1500F02



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.



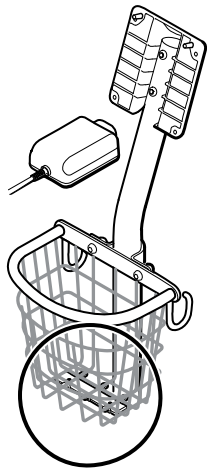
4. Remove the power supply unit.

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 CSM devices with a 4400-MBS or 7000-MS3 mobile stand meeting these criteria:

- 4400-MBS or 7000-MS3 mobile stand manufactured after 02/2022\* or later
- 7000-PS power supply manufactured before 02/2022\* or earlier
- Power supply model: MENB1035A1500F02

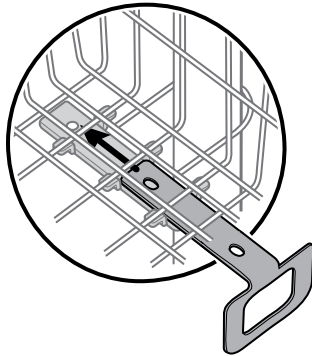


**NOTE** See the model number and label for further information.

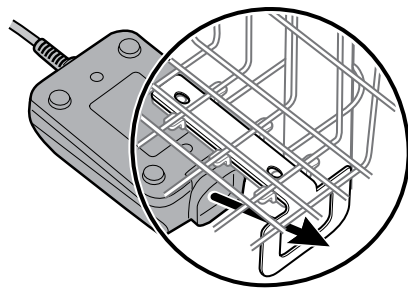
Kit item:

- 7000-PS, Connex Spot Power Supply

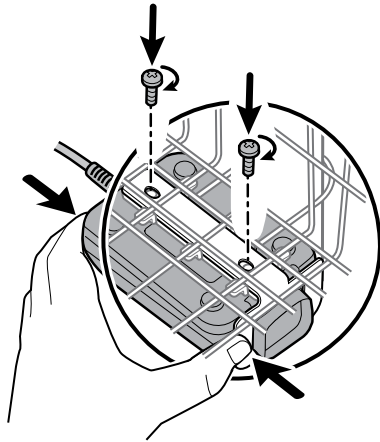
1. Install the adapter plate onto the wire bracket of the mobile stand.



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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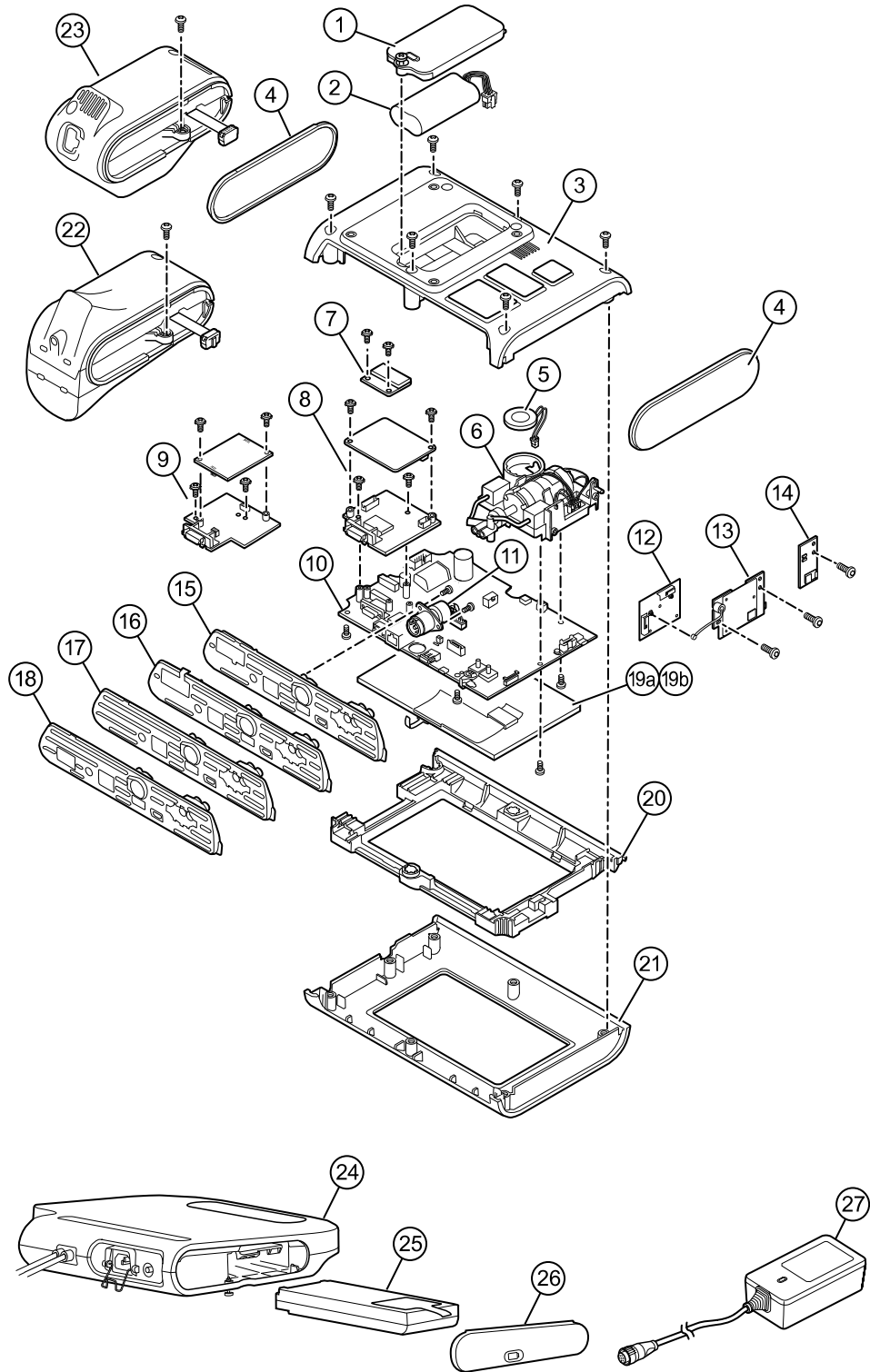
This listing includes only field-replaceable service parts. Product accessories—including patient sensors, probes, cables, batteries, probe covers, and other consumable items—are listed separately in the accessories list in the Appendix of the Instructions for use or at <https://direct.hill-rom.com/hillromUS/en>.

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.



**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.





## Device serial number and model label

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

Serial number and format code	
Serial number	MMMMXXXWYY
MMMM	Manufacturing plant
XXXX	Sequential number
WW	Week of manufacture
YY	Year of manufacture

## About 4th Edition Service kits

The table describes the components of the device and APM and the associated service kits for replaceable parts for devices manufactured per IEC60601-1 4th Edition from 2019 and later. To determine which year your device was manufactured in, refer to the serial number. The year of manufacture is listed as the last two digits of the serial number.

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

## List of 4th edition service kits

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

Service Kit Number	Material Number	Description
1	105945	Srv Kit CSM, Battery Door
2	Batt22	Srv Kit 2 Cell Lithium-ion Battery
3	105923	Srv Kit CSM, Back Housing*
4	105939	Srv Kit CSM, End Cap
5	105942	Srv Kit CSM, Speaker
6	105920	Srv Kit CSM, NIBP Pump Assembly
7	105933	Srv Kit CSM, Nonin SpO2 PCBA
8	105931	Srv Kit CSM, Masimo SpO2 PCBA
9	105932	Srv Kit CSM, Nellcor SpO2 PCBA

Service Kit Number	Material Number	Description
10	105925	Srv Kit CSM, Main PCA, and LCD Frame
11	105930	Srv Kit CSM, Power Harness
12	105938	Srv Kit CSM, Newmar Antenna PCBA
13	105936	Srv Kit CSM, Newmar Radio PCBA
14	105937	Srv Kit CSM, Bluetooth Radio PCBA
15	105926	Srv Kit CSM, Masimo SpO2 Insert
16	105927	Srv Kit CSM, Nellcor SpO2 Insert
17	105928	Srv Kit CSM, No SpO2 Insert
18	105929	Srv Kit CSM, Nonin SpO2 Insert
19a	108241	Srv Kit HW A-F, LCD with Touchscreen
19b	108121 <sup>1</sup>	Srv Kit CSM, Combined LCD with Touchscreen New
20	105922	Srv Kit CSM, LCD Bezel
21	105921	Srv Kit CSM, Front Housing
22	105941	Srv Kit CSM, Braun ThermoScanPRO 6000 Module <sup>2</sup>
23	105940	Srv Kit CSM, Sure Temp Plus Module
24	105943	Srv Kit CSM, APM Work Surface
25	Batt99	Srv Kit 9 Cell Lithium Ion Battery
26	105972	Srv Kit CSM, APM Work Surface, Battery Door
27	7000-PS	Connex Spot Power Supply

\* Not available for direct purchase.

<sup>1</sup> When using the 108121 (Srv Kit CSM, Combined LCD with Touchscreen New), you are required to upgrade your device with the newer 409703-18 CSM Main Board, the new LCD Touchscreen, and to upgrade the software to 1.41 or greater. Contact Welch Allyn for further details.

<sup>2</sup> When using a replacement service kit (Srv Kit CSM, Braun ThermoScanPRO 6000 Module) in China substitute 108189 for 105941. This kit contains the new software version 5.28.

## About 3rd Edition service kits

The tables describes the components of the device and APM and the associated service kits for replaceable parts for devices manufactured per IEC60601-1 3rd Edition from 2015 through 2018. To determine which year your device was manufactured in, refer to the serial number. The year of manufacture is listed as the last two digits of the serial number.

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

To repair a 3rd edition device component, you might need to use a service kit to upgrade the component. To determine whether you need to use an upgrade kit to replace a component for the first failure, consult the 3rd edition service kits for the first component failure table to locate the correct service kit to use with your device.



**NOTE** Upgrading a component does not make the device 4th edition compliant.

If the device encounters a failure after you upgrade a device component, consult the 3rd edition service kits for subsequent component failure table to determine which service kit to use.

## 3rd edition service kits for first component failure

Use this table to determine the correct part to order for the first component failure.

Device Model Number	Main Board	SureTemp Plus	Masimo	Nelcor	Nonin	Braun Dock	Braun Thermometer
7*CE	107156	-	-	107156	-	107156	107156
7*CT	107155	107155	-	107155	-	-	-
7*CX	107162	-	-	107162	-	-	-
7*ME	107157	-	107157	-	-	107157	107157
7*MT	107154	107154	107154	-	-	-	-
7*MX	107158	-	107158	-	-	-	-
7*XE	107153	-	-	-	-	107153	107153
7*XT	107152	107152	-	-	-	-	-
7*XX	107163	-	-	-	-	-	-
7*WE	107153	-	-	-	105933	107153	107153
7*WT	107152	107152	-	-	105933	-	-
7*WX	107163	-	-	-	105933	-	-

\*Varies depending on the model number of your device.

## 3rd edition service kits for a subsequent component failure

Use this table to determine the correct part to order if you encounter a component failure after upgrading using the components in the 3rd edition service kit for first component failure.



**NOTE** For a first component failure, refer to the 3rd edition service kits for a first component failure table.

Device Model Number	Main Board	SureTemp Plus	Masimo	Nellcor	Nonin	Braun Dock	Braun Thermometer
7*CE, 7*CT, 7*CX, 7*ME, 7*MT, 7*MX, 7*XE, 7*XT, 7*XX, 7*WE, 7*WT, 7*WX	105925	105940	105931	105932	105933	105941	105948

\*Varies depending on the model number of your device.

## List of 3rd edition service kits

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

Service Kit Number	Material Number	Description
1	105945	Srv Kit CSM, Battery Door
2	Batt22	Srv Kit 2 Cell Lithium-ion Battery
3	105923	Srv Kit CSM, Back Housing*
4	105939	Srv Kit CSM, End Cap
5	105942	Srv Kit CSM, Speaker
6	105920	Srv Kit CSM, NIBP Pump Assembly
7	105933	Srv Kit CSM, Nonin SpO2 PCBA
8	105931	Srv Kit CSM, Masimo SpO2 PCBA
9	105932	Srv Kit CSM, Nellcor SpO2 PCBA
10	105925	Srv Kit CSM, Main PCA, and LCD Frame
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12	105938	Srv Kit CSM, Newmar Antenna PCBA
13	105936	Srv Kit CSM, Newmar Radio PCBA

Service Kit Number	Material Number	Description
14	105937	Srv Kit CSM, Bluetooth Radio PCBA
15	105926	Srv Kit CSM, Masimo SpO2 Insert
16	105927	Srv Kit CSM, Nellcor SpO2 Insert
17	105928	Srv Kit CSM, No SpO2 Insert
18	105929	Srv Kit CSM, Nonin SpO2 Insert
19a	108241	Srv Kit CSM, LCD with Touchscreen
19b	108121 <sup>1</sup>	Srv Kit CSM, Combined LCD with Touchscreen New
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22	105941	Srv Kit CSM, Braun ThermoScanPRO 6000 Module <sup>2</sup>
23	105940	Srv Kit CSM, Sure Temp Plus Module
24	105943	Srv Kit CSM, APM Work Surface
25	Batt99	Srv Kit 9 Cell Lithium Ion Battery
26	105972	Srv Kit CSM, APM Work Surface, Battery Door
27	7000-PS	Connex Spot Power Supply

\* Not available for direct purchase.

<sup>1</sup> When using the 108121 (Srv Kit CSM, Combined LCD with Touchscreen New), you are required to upgrade your device with the newer 409703-18 CSM Main Board, the new LCD Touchscreen, and to upgrade the software to 1.41 or greater. Contact Welch Allyn for further details.



## Cleaning requirements

This section presents procedures for cleaning the Connex Spot Monitor (including the monitor, stands, APM work surface, accessories, and accessory basket and bins).

Welch Allyn has validated these instructions to be capable of preparing your Connex Spot Monitor devices and above accessories for re-use. Clean on a routine basis according to your facility's protocols and standards or local regulations. If the monitor is on, lock the display.



**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 monitor, disconnect the AC power cord from the mains outlet and the power source.



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



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



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

If liquids are spilled on the monitor:

1. Power down the monitor.
2. Disconnect the power cord from the mains outlet and the power source.
3. Remove battery pack from the monitor.
4. Dry off excess liquid from the monitor.



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

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

## Prepare to clean the equipment



**CAUTION** Some cleaning agents are not appropriate for all components of the device. Use only approved cleaning agents, and observe restrictions noted for some components in the following table. Using unapproved cleaning agents may cause damage to components.



**CAUTION** Do not use bleach solutions of any kind when cleaning metal electrical contacts. They will damage the device.

Select a cleaning agent from the following table.

### Section 1. Approved for all Connex Spot Monitor components

Cleaning agent	Additional information
Accel INTERvention	
Accel TB	
CaviWipes	
Clinell® Universal Wipes	
Oxiver TB	
Sani-Cloth® Plus	
Super Sani-Cloth®	
70 percent isopropyl alcohol solution	Applied to a clean cloth

### Section 2. Not approved for all Connex Spot Monitor components



**NOTE** The following cleaning agents are NOT approved for cleaning Connex Spot Monitors equipped with the Braun ThermoScan PRO 6000.

Cleaning agent	Additional information
Bacillol® AF Wipes	Not approved for use on the display
Cleancide	
Clinitex® Detergent Wipes	Not approved for use on the display
Clorox Dispatch Wipes	Not approved for use on the display
Clorox Fuzion	Not approved for use on the display
Clorox HealthCare Bleach Germicidal Cleaner	
Mikrozyd® AF Wipes	Not approved for use on the display
Oxivir® 1 Wipes	Not approved for use on the display
Oxivir Plus 1:40 Solution	Not approved for use on the display



<b>Cleaning agent</b>	<b>Additional information</b>
Reynard Neutral Detergent Wipes	Not approved for use on the display
Reynard Premier Disinfectant Wipes	Not approved for use on the display
Sani-Cloth Active Wipes	Not approved for use on the display
Sani-Cloth® Bleach	Not approved for use on the display
Sani-Cloth® Prime Wipes	Not approved for use on the display
Sekusept™ Plus 1.5% Solution	Not approved for use on the display
Super HDQ® L10	Dilution rate of ½ oz per gallon of water (1:256) applied to a clean cloth
Tuffie5 Cleaning Wipes	
Viraguard Wipes	Not approved for use on the display
Virex II (256)	Dilution rate of ½ oz per gallon of water (1:256) applied to a clean cloth
10 percent bleach solution	(.5% - 1% sodium hypochlorite) applied to a clean cloth

## Remove liquid spills from the monitor

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

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

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

## Clean the equipment

The screen lock blocks the display of patient information and prevents any input, which may be useful when cleaning the display.

Follow the cleaning agent manufacturer's instructions to prepare solution, if applicable, and clean all exposed surfaces of the monitor, APM work surface, accessory bin(s) and basket, cords and cables, and stand. Wipe all surfaces until no visible soil remains. Change the wipe or cloth throughout the cleaning procedure as needed.



**WARNING** Electric shock hazard. Do not open the monitor or attempt repairs. The monitor has no user-serviceable internal parts. Only perform routine cleaning and maintenance procedures specifically described in this manual. Inspection and servicing of internal parts shall only be performed by qualified service personnel.



**CAUTION** Sterilizing the monitor could damage the device.

1. Disconnect the AC power cord from the mains outlet.
2. Wipe the top of the monitor.
3. Wipe the sides, front, and rear of the monitor.
4. Avoid residual film buildup on the LCD screen. After cleaning and disinfecting, wipe the LCD screen with a clean cloth dampened with water, and then wipe the screen dry with a dry clean cloth.
5. Wipe the bottom of monitor.
6. Wipe the APM work surface.
7. Wipe the accessory bins or basket.
8. Wipe the AC power cord and the APM work surface power/USB cable assembly.
9. Wipe the stand from top to bottom.

## 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.

## Cleaning accessories

Accessories include components like blood pressure cuffs and hoses, SpO2 sensors and cables, thermometers, and the barcode scanner. Follow accessory manufacturer's instructions for cleaning and disinfection.

For cleaning the wallboard and VESA mount, use only 70 percent isopropyl alcohol solution applied to a clean cloth.

For the Braun ThermoScan PRO 6000 thermometer, use only the approved cleaning agents published in the manufacturer's instructions for cleaning. Unapproved cleaning agents can damage the device and interfere with data transmission.

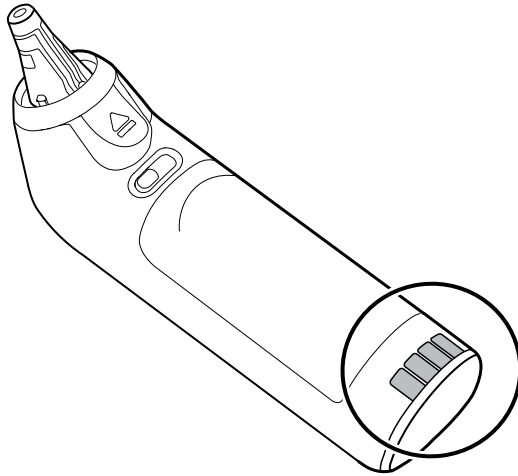
## Clean the Braun ThermoScan PRO 6000 contacts

Debris that accumulates on the Braun ThermoScan PRO 6000 electrical contacts can interfere with data transmission. Welch Allyn recommends cleaning the contacts on the thermometer and the dock once every 4 months to maintain optimal performance.

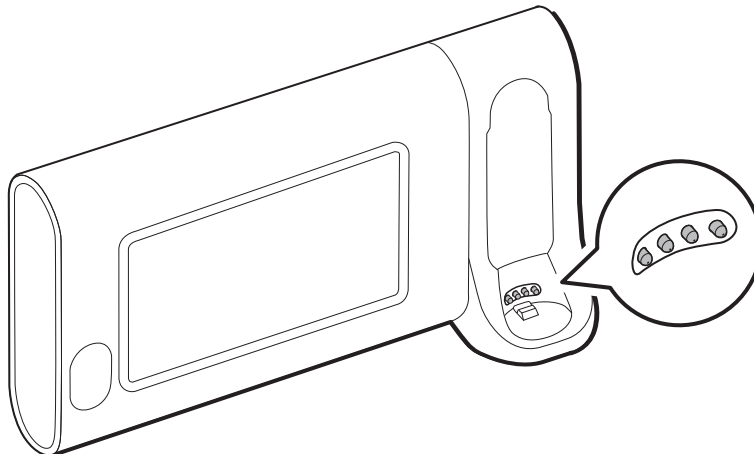


**CAUTION** Do not use bleach solutions of any kind when cleaning metal electrical contacts. They will damage the device.

1. Slightly dampen a cotton swab with 70% isopropyl alcohol.
2. Remove the thermometer from the dock and clean the metal electrical contacts on the thermometer with the cotton swab.



3. Place the thermometer aside for 1 minute, allowing the contacts to air dry.
4. Clean the metal electrical contacts on the device dock with the cotton swab.



5. Allow the contacts to air dry for 1 minute.
6. Return the Braun thermometer to the dock.

## Decontamination and cleaning requirements for returns

As a general safety precaution, the monitor must undergo decontamination before being returned to Welch Allyn for service, repair, inspection, or disposal. Cleaning is an essential prerequisite for effective disinfection or decontamination. Follow the cleaning instructions presented earlier in this section.



**NOTE** Contaminated items must not be returned without prior, written agreement.



**NOTE** Decontaminate the monitor according to your facility's procedures and local regulations.

# Device configuration and setup

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## Configuration overview

A configuration file can be created that specifies preferences for all Connex Spot Monitor options. When powered on, the monitor recognizes all available options and features and applies the associated configuration file preferences.

If no customized configuration file has been loaded onto the device, the device applies factory defaults to all available options. See "Factory defaults" in the Appendix.

In addition to creating or modifying a configuration file, it is possible to change some settings by navigating to Advanced settings. Changes made in Advanced settings take effect immediately on the device, but they do not change the configuration file.



**NOTE** The device does not support configuration filenames that include parentheses. If these are present in the filename, the device will not recognize the file. This is a common issue if you've downloaded the same file multiple times from your web browser. For example, the web browser may automatically rename "MyFile.config" to "MyFile.config(2)" if you download it a second time. If this happens, rename the file by deleting the parentheses; then it will appear in the list on the CSM.


The remainder of this section instructs you how to do the following:

- Edit a configuration file
- Copy a configuration file
- Download a configuration file to install on another device
- Create a new configuration file
- Install a configuration file

## Edit a configuration file

To edit a saved configuration file, complete the following steps:

1. Access the Configuration Tool at <http://config.welchallyn.com>.
2. Log in with a username and password.
3. Click **List Configurations** on the navigation bar.

4. Locate the configuration file to be edited in the list, and click the  on the right side of the table to launch the editor.


5. Under Progress Summary, locate the section you want to edit (Clinical, Informatics, IT, or Biomed) and click the specific step you want to edit.
6. Review the selections in each step and modify them as desired.
7. Click **SAVE AND CONTINUE** to accept the changes or **BACK** to return to the previous screen without saving.

Clicking **SAVE AND CONTINUE** automatically moves you to the next step in that section of the Progress Summary. When you reach the last step in a section, clicking **SAVE AND CONTINUE** returns you to the Progress Summary.

8. Repeat steps 5 through 7 until you complete all desired edits.
9. Click **List Configurations** on the navigation bar to see a new date stamp in the Updated column for your configuration file.

## Copy a configuration file


To copy a saved configuration file, complete the following steps:

1. Access the Configuration Tool at <http://config.welchallyn.com>.
2. Log in with a username and password.
3. Click **List Configurations** on the navigation bar.
4. Locate the configuration file to be copied in the list, and click the  on the right side of the table.
5. Either accept or enter a new name for the copied file in the Copy Configuration dialog, then click **Copy**.
6. Observe your new configuration file on the List Configurations tab.

## Download a configuration file to install on another device

To download a saved configuration file, complete the following steps:

### From the Configuration Tool

1. Access the Configuration Tool at <http://config.welchallyn.com>.
2. Log in with a username and password.
3. Click **List Configurations** on the navigation bar.
4. Locate the configuration file to be downloaded in the list, and click the  on the right side of the table.

The configuration file downloads to the tray on your PC.
5. Using the dropdown menu on the right side of the downloaded file, select **Show in folder**.

Windows Explorer opens the Downloads folder with the most recent download selected.
6. Copy the downloaded configuration file to a USB flash drive.
7. See "Install a configuration file" for instructions to load this configuration on another device.

## Create a new configuration file

To create a new configuration file, complete the following steps:

1. Access the Configuration Tool at <http://config.welchallyn.com>.
2. Log in with a username and password.
3. Click **New Configuration** on the navigation bar.
4. Select **Connex Spot Monitor** as the product you would like to configure.
5. Enter a user-friendly name for your configuration, then click **CONTINUE**.  
The Configuration Tool advances to the Product Use Location screen.
6. Select your location type, then click **SAVE AND CONTINUE**.  
The Progress Summary screen appears.
7. Under Progress Summary, click the first step you want to configure.
8. Review the selections in each step and modify them as desired.
9. Click **SAVE AND CONTINUE** to accept the selections or **BACK** to return to the previous screen without saving.  
Clicking **SAVE AND CONTINUE** automatically moves you to the next step in that section of the Progress Summary. When you reach the last step in a section, clicking **SAVE AND CONTINUE** returns you to the Progress Summary.
10. Repeat steps 7 through 9 until you configure each section.
11. When you are finished, click **List Configurations** on the navigation bar to see your configuration file.

## Install a configuration file

To install a configuration file, you must first download the configuration file to a USB flash drive. If you have not done so already, complete the steps in "Download a configuration file to install on another device," then complete the following steps:

1. Insert the flash drive into the device which needs to have the configuration loaded onto it.  
A pop-up dialog appears listing the configuration file(s) on your flash drive.
2. Select the desired configuration file and touch **Load**.
3. Repeat this process on as many devices as you wish.





# 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.

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	APM
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 for adults and neonates	✓				
Charge LED	Verifies the LED					✓
Bin light	Verifies on/off light					✓

## 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	APM
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	APM
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				✓	
Nurse call relay	Verifies the nurse call relay				✓	
Battery operation	Verifies the internal battery				✓	✓
Speaker	Verifies the speaker				✓	
USB host port communication	Verifies the USB ports				✓	✓
Ethernet communication	Verifies the Ethernet port				✓	
Wireless communication	Verifies the wireless radio				✓	
Bluetooth communication	Verifies the Bluetooth radio				✓	
Charge LED	Verifies LED					✓
Bin light	Verifies on/off light					✓

<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.

<sup>3</sup> Normal mode.

## 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.

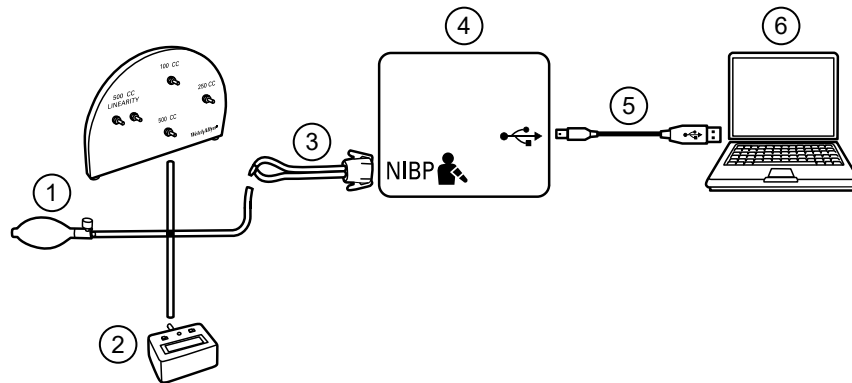
### Basic functional verification tools

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
DOC-10	Nellcor SpO2 extension cable	1	Nellcor 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
6000-30	Single-tube blood pressure hose, 5 feet	1	NIBP
N/A	PC running Windows 10	1	All
web download	Welch Allyn Service Tool <a href="https://www.hillrom.com/en/services/welch-allyn-service-tool/">https://www.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

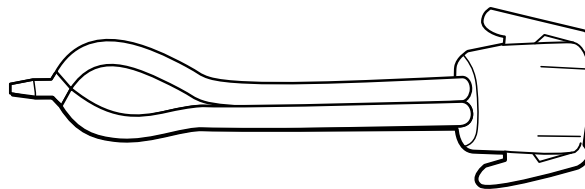
## NIBP test setup

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	Test volume repair fixture with test manifold, 4 bulb, and valve	4	Device
2	Pressure meter (must include at least two decimal points and be accurate to within $\pm 0.5$ mmHg)	5	USB 2.0/5-pin type A to mini-B cable
3	Blood pressure Y-tube	6	PC

## 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

1. Set up the test equipment.
2. Launch the service tool on the PC.
3. If the simplified interface is active, choose the Service option.
4. Log on with your user ID and password or with ADMIN as the user ID and leave the password field blank.
5. Power on the device.
6. Select the device you want to test from the device list.
7. Click **NIBP Sensor** under the Device Information tab.
8. Click **Leak Test** in the NIBP Sensor pane on the right side of the window.
9. Follow the prompts until the test completes.
10. Click **Close**.
11. To view the results, open the active log file by selecting **File > View Log File > Active log file > Ok**.
12. 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 in adult mode and 164 mmHg in neonate mode. 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 in adult mode, or 130 mmHg to 164 mmHg in Neonate mode.

#### Perform an NIBP overpressure test



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

1. Set up the test equipment.
2. Launch the service tool on the PC.
3. If the simplified interface is active, choose the Service option.
4. Log on with your user ID and password or with ADMIN as the user ID and leave the password field blank.
5. Power on the device.
6. Select the device you want to test from the device list.
7. Click **NIBP Sensor** under the **Device Information** tab.

8. In the NIBP Sensor pane on the right side of the window, click **Over Pressure Test**.
9. Follow the prompts until the test completes.
10. Click **Close**.
11. To view the results, open the active log file by selecting **File > View Log File > Active log file > Ok**.
12. 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** If you are performing this test after performing a previous NIBP check, skip to step 7.

1. Set up the test equipment.
2. Launch the service tool on the PC.
3. If the simplified interface is active, choose the Service option.
4. Log on with your user ID and password or with ADMIN as the user ID and leave the password field blank.
5. Power on the device.
6. Select the device you want to test from the device list.
7. Click **NIBP Sensor** under the **Device Information** tab.
8. Click **Accuracy Check** in the NIBP Sensor pane on the right side of the window.
9. Connect the 500 CC volume.
10. Turn on the pressure meter and zero if necessary.
11. Check the accuracy at 0 mmHg.
12. Record the reading on the pressure meter and the service tool and compare the results.
13. Using the hand bulb, pressurize the NIBP system to 50 mmHg  $\pm$  5 mmHg and allow 10 seconds for the pressure to stabilize.
14. Record the reading on the pressure meter and the service tool and compare the results.



15. Using the hand bulb, pressurize the NIBP system to 150 mmHg  $\pm$  5 mmHg and allow 10 seconds for the pressure to stabilize.
16. Record the reading on the pressure meter and the service tool and compare the results.
17. Using the hand bulb, pressurize the NIBP system to 250 mmHg  $\pm$  5 mmHg and allow 10 seconds for the pressure to stabilize.
18. Compare the reading on the pressure meter to the service tool reading and record the results.
19. Click **Open valve** to open the NIBP valves. Verify that the pressure on the meter and service tool change to zero.
20. Click **Done** to complete the check.
21. 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:

- CSM with SWF ver. 1.33.00 -X0006 or greater
- Blood Pressure Bulb
- Pressure Meter
- Dual Lumen Pressure Tubing
- Pressure Test Box

1. Navigate to the **Advanced** tab.
2. In the Advanced settings code box, enter **6345**.
3. Navigate to **Service > General**.

The NIBP Pressure Verification feature is located in the bottom right of the screen.

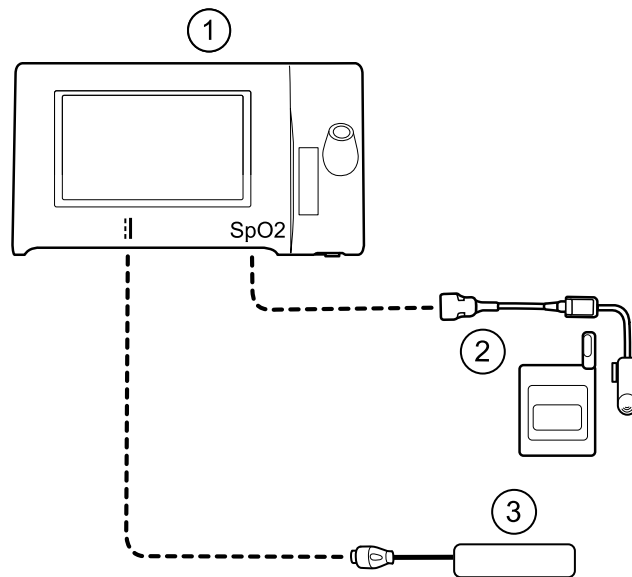
4. Connect the dual lumen tubing to the device.
5. Connect one end of the tubing to the pressure meter and the other end to the test box. Ensure each end is connected tightly and there are no leaks.
6. To initiate the verification process, touch **Close Valve**.
7. Use the blood pressure bulb to adjust the pressure to each threshold of 20/50/100/150/250 mmHg.
8. 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	Connex Spot Monitor
2	SpO2 simulator
3	Power supply

## Perform an SpO2 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.



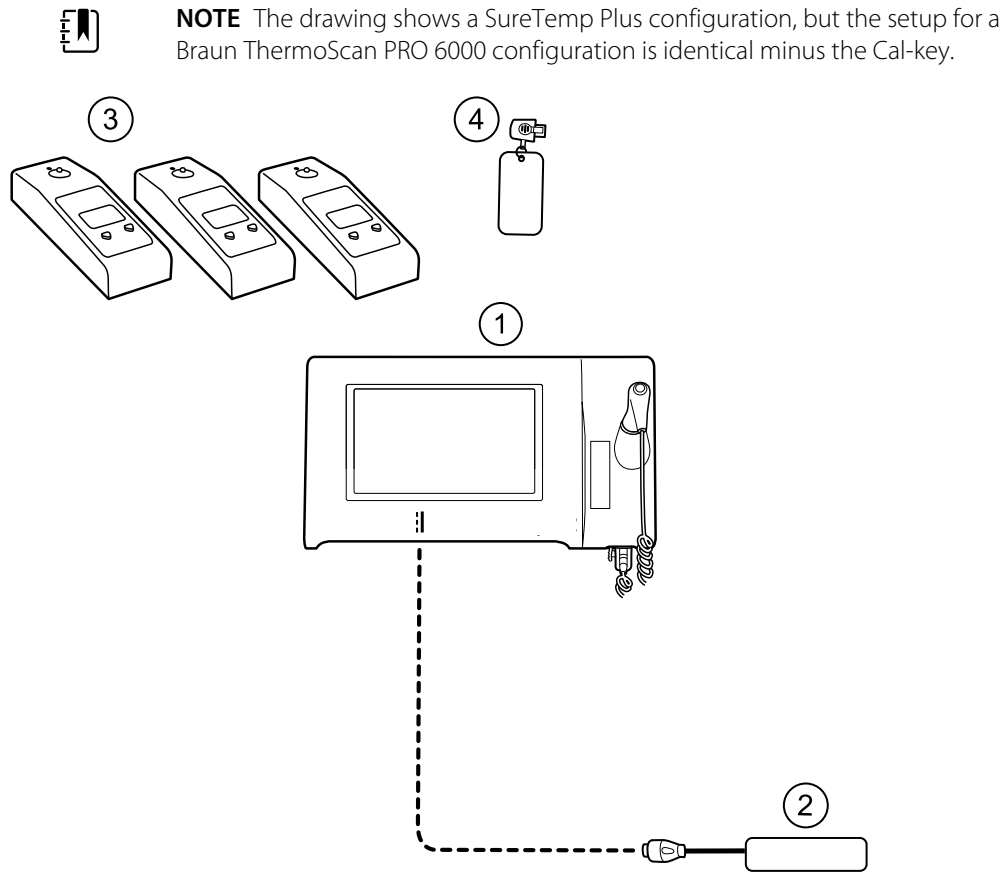
**NOTE** In the following tests, if the simulator defaults are outside the device alarm limits, adjust the limits or silence the alarms.

3. Adjust the simulator settings as follows:
  - For **Nonin** and **Nellcor** configurations, set the simulator SpO2 saturation to 90% and pulse rate to 60 bpm.
  - For **Masimo** configurations, set the simulator SpO2 saturation to 80% and pulse rate to 61 bpm.
4. Give the device up to 30 seconds to stabilize.
5. Verify the displayed saturation and pulse rate as follows:
  - For **Nonin** and **Nellcor** configurations, saturation should be  $90\% \pm 1$  sat point, and pulse rate should be  $60 \pm 1$  bpm.
  - For **Masimo** configurations, saturation should be  $80\% \pm 3$  sat point, and pulse rate should be  $61 \pm 1$  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	Connex Spot Monitor	3	Tester, calibration, 9600 Plus
2	Power supply	4	Cal-key, assembly, M690/692 (used only with SureTemp)

### 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 bottom 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 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 bottom 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).

### Braun ThermoScan PRO 6000 thermometer test

This explains how to perform a functional verification on the Braun ThermoScan PRO 6000 thermometer using the 9600 Plus Calibration Tester.



**NOTE** Use this procedure with the Welch Allyn Service Tool version 1.8.0 and later.



**CAUTION** Before the test, place thermometers and tester in the same room for approximately 30 minutes so that they adjust to the ambient temperature.

For more information, see the *Welch Allyn 9600 Plus Calibration Tester Directions for use*.

### Perform a Braun ThermoScan PRO 6000 functional verification test

Complete the preliminary checks as described in step 1, then test each thermometer at the low, medium, and high set points on the tester. After placing the thermometer in calibration mode, repeat the procedure from step 4 for each thermometer and temperature to be tested.

1. Before testing the thermometer verify the following:
  - a. The sensor (probe tip) is functional. Check the position of the sensor with a magnifying glass if necessary. If the sensor is displaced, the unit is damaged and must be replaced. There should be no visible gap between the bezel and the lens.
  - b. The sensor is clean. Clean the sensor using a Q-tip lightly moistened with isopropyl alcohol, using a minimum amount of pressure to avoid displacing the sensor. Use a dry Q-tip to remove any excess alcohol. Allow 5 minutes for any remaining alcohol to evaporate.
  - c. The room temperature is within the range of 65.0 °F (18.3 °C) to 80.0 °F (26.7 °C).
  - d. The thermometer is allowed to reach the ambient room temperature. Remove the thermometer from the product packaging and wait at least 30 minutes before beginning the test.
  - e. The thermometer is fully charged.
2. Place the thermometer from sleep mode into calibration (CAL) mode as follows:
  - a. Remove the device from the dock.
  - b. Wait for 20 seconds for the device to go into sleep mode (the display goes blank).
  - c. Press and release the C/F button.
  - d. When the self check/startup display appears, press and hold the C/F and Mem buttons for 5 to 7 seconds.
  - e. When the device beeps, release the C/F and Mem buttons.
 

If the device is in CAL mode, the display will alternate between the '- -' lines and "CAL".
  - f. If the device doesn't enter CAL mode, wait for the device to return to sleep mode and repeat from substep c.
3. Apply a new probe cover. Place the probe firmly into the Ear Device Port.
4. Wait approximately 3 seconds, and then press the thermometer Measure button.
 

The ExacTemp light flashes.
5. Leave the thermometer in the tester until a long beep sounds.
6. Remove the thermometer from the tester and read the temperature in the thermometer's display. If the temperatures are within  $\pm 0.2$  °C ( $\pm 0.4$  °F) of the tester's set point, the thermometer is within calibration.
7. Record the results in the thermometer service record.
8. Press the Measure button once to clear the previous reading.
9. Wait 1 minute, and then take another reading with the same thermometer. Repeated measurements in short sequence might cause higher readings.



**NOTE** If using only one tester, test all available thermometers for calibration verification at the current set point, before raising the set point.

10. Repeat the procedure from step 3 as necessary until all thermometers are tested at each temperature.
11. Exit CAL mode using one of the following methods:
  - Press and hold the C/F and mem buttons until you hear the beep and the display is blank.
  - Wait and don't press any buttons for 10 minutes. The thermometer automatically exits CAL mode.

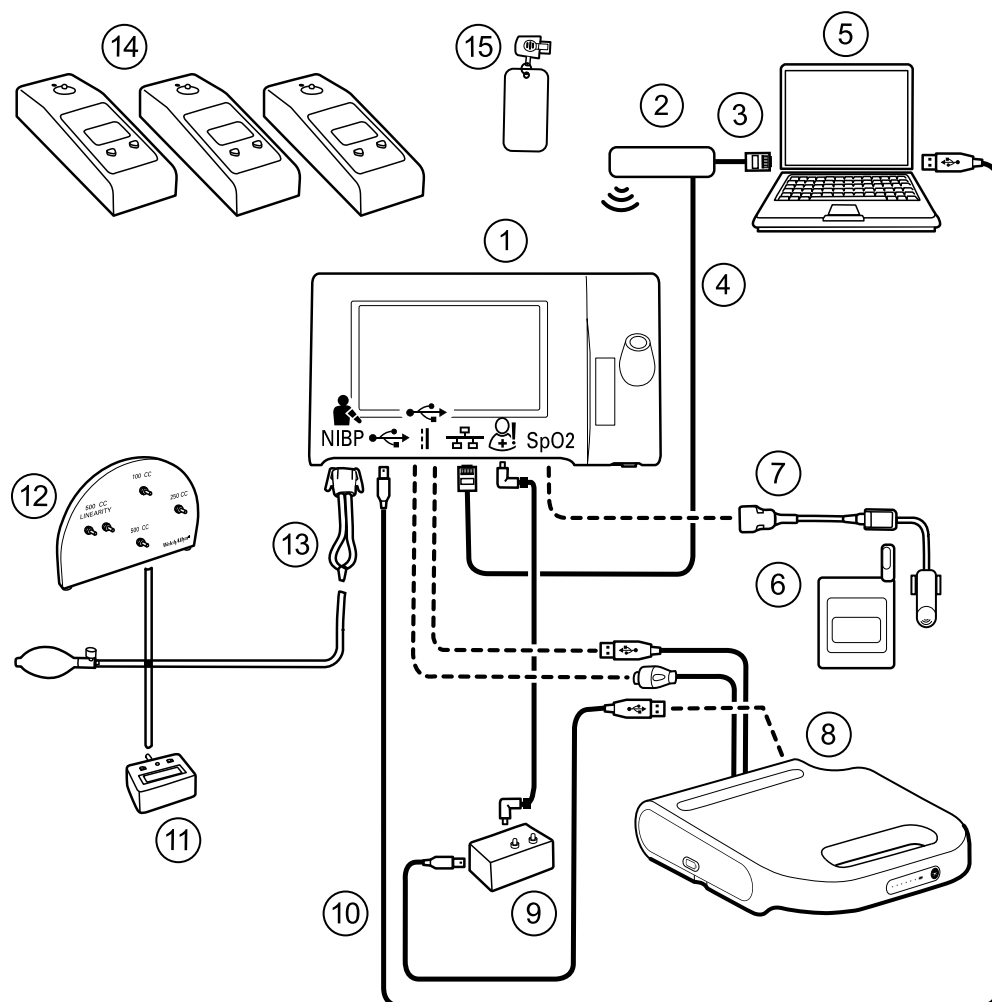
To record the results of your test, go to "Service record."

## Full functional verification and calibration

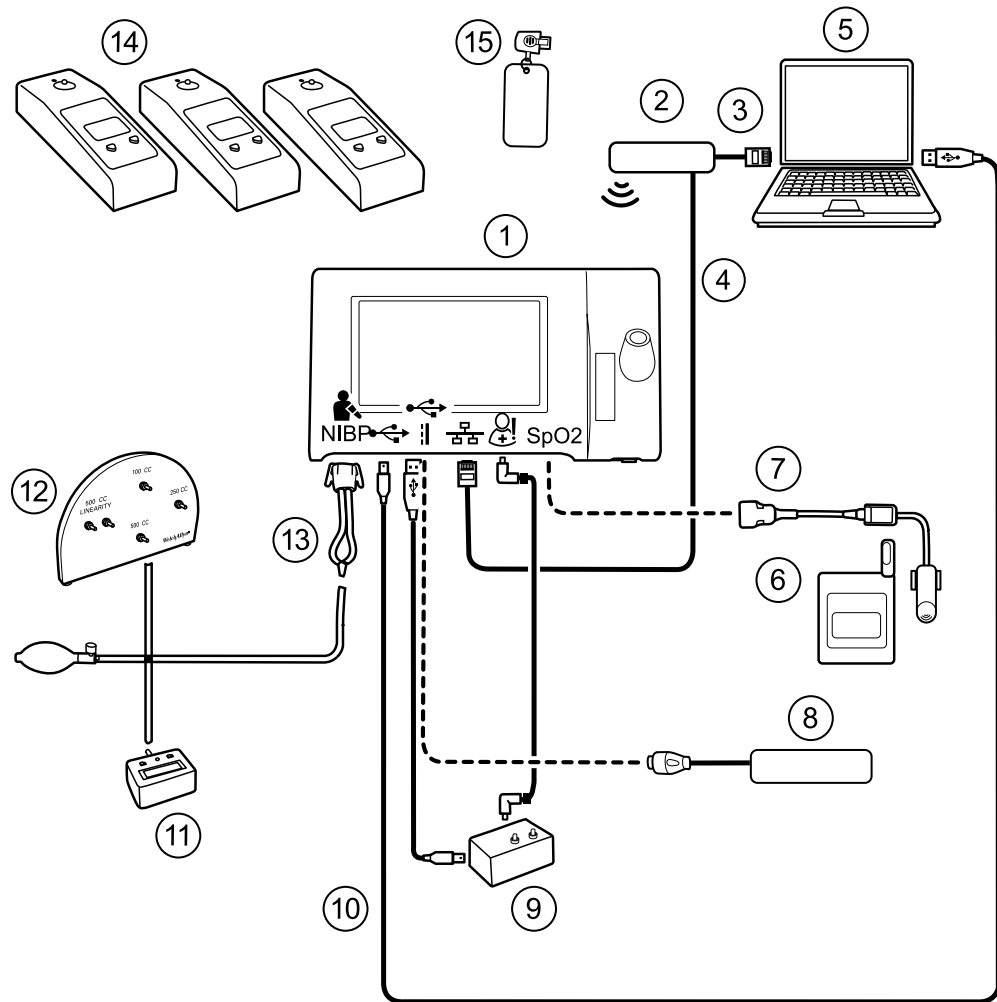
### Functional verification test setup

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

#### Option 1. Configurations with Accessory Power Management (APM)



**Option 2. Configurations without Accessory Power Management (APM)**



Item No.	Material No.	Description	Qty	Required Welch Allyn purchase	
				Optional Welch Allyn purchase	(see Notes)
1	Varies	Connex Spot Monitor	1	X	
2	N/A	Wireless router, a/b/g or equivalent	1		
3	N/A	Ethernet cable	1		
4	N/A	Ethernet cable	1		
5	N/A	PC running the Welch Allyn Service Tool on Windows 10	1		
6	N/A	SpO2 simulator	1		

Item No.	Material No.	Description	Qty	Required Welch Allyn purchase	Optional Welch Allyn purchase
				(see Notes)	
7	Doc-10	Nellcor SpO2 extension cable	1		X
8 (Option 1)	Varies	APM (configurations with Accessory Power Management)	1	X	
8 (Option 2)	Varies	Power supply (configurations with no APM)	1	X	
9	106270	Service test box	1	X	
10	106275	Micro USB cable	1		X
11	N/A	Pressure meter (must include at least two decimal points and be accurate to within $\pm 0.5$ mmHg)	1		
12	407672	Test volume repair fixture (113670) with test manifold, bulb, and valve	1		X
13	N/A	Blood pressure Y-tube	1	See instructions for creating the Y-tube in the Basic functional verification section.	
14	01802-110	Tester, calibration, 9600 Plus, SureTemp	3		X
15	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 list of tools below is what is 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	Braun ThermoScan PRO 6000 & 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
DOC-10	Nellcor SpO2 extension cable	1	Nellcor SpO2
106270	Service test box	1	Nurse Call, USB ports
N/A	Ethernet cable	1	Ethernet Test
106275	Micro USB cable	1	All
6000-30	Single tube blood pressure hose, 5 feet	1	NIBP
N/A	Wireless router, a/b/g or equivalent	1	Wired & Wireless Test
N/A	PC running the Welch Allyn Service Tool on Windows 10	1	All
1001120	Welch Allyn Service Tool Gold license	1	NIBP, Software updates
web download	Welch Allyn Service Tool <a href="https://www.hillrom.com/en/services/welch-allyn-service-tool/">https://www.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

## 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 **Connex Spot Monitor > 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.

## Options and upgrades

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Welch Allyn supports option and software upgrades for most models.



**NOTE** Software in the Braun ThermoScan PRO 6000 is not upgradable in the field when installed in the Connex Spot Monitor. To upgrade the Braun ThermoScan PRO 6000 software, return the monitor to a service center.

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

The following options can be added to each model's base configuration.



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



**NOTE** Some model numbers and product features described in this publication might not be available in your country. For the latest information about products and features, please contact Hillrom Customer Care.

## Options

Model	7100	7300	7400	7500
Masimo	X	○ <sup>1</sup>	● <sup>1 3</sup>	● <sup>1 3</sup>
Masimo SpO2 with RRp	X	● <sup>2</sup>	● <sup>2</sup>	● <sup>2</sup>
Nonin	○	○	● <sup>3</sup>	● <sup>3</sup>
Nellcor OxiMax	X	○	● <sup>3</sup>	● <sup>3</sup>
SureTemp Plus	○	○	○	○
Braun ThermoScan PRO 6000	○	○	○	○
Wireless radio	X	X	○	●
Bluetooth radio	X	●	X	○ <sup>4</sup>

<sup>1</sup> Contact Hillrom Customer Care to purchase the optional respiration rate software license: 7000-RRP Masimo MX5 RRp CSM license.

<sup>2</sup> Configurations 73RE, 73RT, 73RX, 74RE, 74RT, 74RX, 75RE, 75RT, and 75RX come with Masimo SpO2 and RRp.

<sup>3</sup> This configuration comes with either Masimo, Nonin, or Nellcor.

<sup>4</sup> Contact Hillrom Customer Care to purchase the optional Bluetooth Low Energy software license: 108060BLE CSM 7300 BLE license.

● Standard with this model.

○ Software upgrade available for this model. Hardware upgrade available only on a case-by-case basis.

X No software upgrade available for this model. Hardware upgrade available only on a case-by-case basis.

## Install options

All internal option installations entail opening the device case and performing some disassembly. Because this process requires disconnecting internal components, Welch Allyn requires that the device undergo a full functional test after reassembly and before placing the device back in service.

Before installing a new option, read information about removing the option in “Disassembly and repair.” After familiarizing yourself with the process, follow the instructions in the disassembly section.

## Upgrading software with the Welch Allyn Service Tool

The Connex Spot Monitor and the Welch Allyn Service Tool (WAST) interact through Ethernet over USB technology, enabling the monitor 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 Connex Spot Monitor 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 Connex Spot Monitor reaches out to the WAST for the firmware package, it uses TCP port XXXX. 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 Connex Spot Monitor. 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, SpO2, and/or Temperature) is complete.

## Software rollback capability

The Connex Spot Monitor 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 computer's Start menu select **All Programs > Welch Allyn > Welch Allyn Service Tool**.

The user interface appears.

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

Part number	Description
S1-CSM-PRO-1	CSM SmartCare Protection 1YR
S1-CSM-PRO-3	CSM SmartCare Protection 3YR
S1-CSM-PRO-PS	CSM SmartCare Protection 3YR POS

## SmartCare protection plus plans

SmartCare protection plus plans include onsite repair.

Part number	Description
S9-CSM-PROPLUS-1	CSM SmartCare Protection Plus 1YR
S9-CSM-PROPLUS-3	CSM SmartCare Protection Plus 3YR
S9-CSM-PROPLUS-PS	CSM SmartCare Protection Plus 3YR POS

## SmartCare biomed plans

Part number	Description
S1-CSM	CSM, Comprehensive partnership program, 1 year
S1-CSM-2	CSM, Comprehensive partnership program, 2 years
S1-CSM-5	CSM, Comprehensive partnership program, 5 years
S1-CSM-C	CSM, Comprehensive partnership program, 1 years + Calibration
S1-CSM-2C	CSM, Comprehensive partnership program, 2 years + Calibration
S1-CSM-5C	CSM, Comprehensive partnership program, 5 years + Calibration
S2-CSM	CSM, Biomed partnership program, 1 year
S2-CSM-2	CSM, Biomed partnership program, 2 years
S2-CSM-5	CSM, Biomed partnership program, 5 years

## SmartCare biomed plans (available only in selected international countries)

Part number	Description
S4-CSM	CSM, Warranty Extension, 1 year
S4-CSM-2	CSM, Warranty Extension, 2 years
S4-CSM-5	CSM, Warranty Extension, 5 years

## Service and repair training



**NOTE** Required to be eligible to receive the service tool, Gold edition.


Part number	Description
CSMREP-TRN	CSM repair training
CSMREPW-TRN	CSM repair web training



# Appendix

## Specifications

### Physical specifications

Protection classifications, all monitor configurations	
Characteristic	Specification
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
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 Protection against vertically falling water drops when enclosure tilted up to 15°
Height	Standard chassis: 6.3 in. (16.1 cm) Extended chassis: 6.5 in. (16.5 cm) with Braun Extended chassis: 6.4 in. (16.3 cm) with SureTemp
Width	Standard chassis: 9.2 in. (23.4 cm) Extended chassis: 11.7 in. (29.8 cm) with Braun Extended chassis: 11.7 in. (29.8 cm) with SureTemp

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**Protection classifications, all monitor configurations**


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Depth	Standard chassis: 2.3 in. (5.8 cm )
	Extended chassis: 4.4 in. (11.0 cm ) with Braun
	Extended chassis: 4.2 in. (10.6 cm ) with SureTemp

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Weight (including battery)	Standard chassis: 2.9 lb (1.3 kg )
	Extended chassis: 3.7 lb (1.7 kg ) with Braun
	Extended chassis: 3.5 lb in. (1.6 kg ) with SureTemp

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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] )
Active area	6.1 in. (W) x 3.4 in. (H) (154.08 mm [W] x 85.92 mm [H])
Resolution	800 x 480 pixels
Pixel arrangement	RGB (red, green, blue)
Pixel size	63.2 $\mu\text{m}$ (W) x 179 $\mu\text{m}$ (H)
Luminance	530 cd/m <sup>2</sup>

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**Speaker volume**


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Minimum Output sound pressure	60 dB at 1.0 meter
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**Alarm and pulse tones**


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Pulse frequency ( $f_0$ )	150 – 1000 Hz
Number of harmonic components in the range 300 Hz to 4000 Hz	minimum of 4
Effective pulse duration ( $t_d$ )	high priority: 75 –200 ms medium and low priority: 125 – 250 ms
Rise time ( $t_r$ )	10 – 20% of $t_d$
Fall time <sup>1</sup> ( $t_f$ )	$t_f \leq t_s - t_r$

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**NOTE** The range of the relative sound pressure level of the harmonic components should be between a minimum of at least 53 dBa and a maximum of at least 80 dBa at the pulse frequency.

<sup>1</sup>Prevents overlap of pulses

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## Battery specifications

2 Cell battery specifications <sup>1</sup>	Hours of use
Continuous run time (Nellcor)	5.22
6 patients/hour - 41 patient cycles (Nellcor)	6.83
8 patients/hour - 54 patient cycles (Nellcor)	6.78
8 patients/hour - 55 patient cycles (Nonin)	6.90
Acute care continuous 10 minute cycles - 49 patient cycles - BP, temp, SpO <sub>2</sub> , no radio, no scanner (Nellcor)	8.22
Acute care continuous 10 minute cycles - 50 patient cycles - BP, temp, SpO <sub>2</sub> , no radio, no scanner (Nonin)	8.37
Acute care continuous 10 minute cycles - 49 patient cycles - BP, temp, SpO <sub>2</sub> , no radio, no scanner (Masimo)	8.29
Acute care continuous 10 minute cycles - 41 patient cycles - BP, temp, SpO <sub>2</sub> , radio, scanner (Nellcor)	6.84
Acute care continuous 10 minute cycles - 41 patient cycles - BP, temp, SpO <sub>2</sub> , radio, scanner (Nonin)	6.96
Acute care continuous 10 minute cycles - 41 patient cycles - BP, temp, SpO <sub>2</sub> , radio, scanner (Masimo)	6.90

<sup>1</sup> Nellcor is the default for these examples.

## Nurse Call specifications

Nurse Call connection specifications	
Nurse Call	25 V AC or 60 V DC maximum at 1A maximum

## NIBP specifications

NIBP specifications	
Cuff pressure range	Meets or exceeds IEC/ISO 80601-2-30 standards for cuff pressure range
Systolic range	Adult: 30 to 260 mmHg (StepBP, SureBP) Pediatric: 30 to 260 mmHg (StepBP, SureBP) Neonate: 20 to 120 mmHg (StepBP)
Diastolic range	Adult: 20 to 220 mmHg (StepBP, SureBP) Pediatric: 20 to 220 mmHg (StepBP, SureBP)

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**NIBP specifications**


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	Neonate: 10 to 110 mmHg (StepBP)
Cuff Inflation Target	Adult: 160 mmHg (StepBP) Pediatric: 140 mmHg (StepBP) Neonate: 90 mmHg (StepBP)
Maximum Target Pressure	Adult: 280 mmHg (StepBP, SureBP) Pediatric: 280 mmHg (StepBP, SureBP) Neonate: 130 mmHg (StepBP)
Blood pressure determination time	Typical: 15 seconds Maximum: 150 seconds
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) Neonate: 13 to 110 mmHg (StepBP)
Pulse rate range (using blood pressure determination)	Adult: 30 to 200 bpm (StepBP, SureBP) Pediatric: 30 to 200 bpm (StepBP, SureBP) Neonate: 35 to 220 bpm (StepBP)
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 Neonate: 150 mmHg maximum

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### SureTemp Plus temperature module specifications

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**SureTemp Plus temperature module specifications**


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Temperature range	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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## Braun ThermoScan Pro 6000 specifications

### Braun ThermoScan PRO 6000 thermometer specifications (refer to Braun ThermoScan Pro 6000's Instructions for use for additional information)

Temperature range	68 °F to 108 °F (20 °C to 42.2 °C)
Calibration accuracy	<ul style="list-style-type: none"> <li>±0.4 °F (±0.2 °C) for temperatures ranging from 95 °F to 107.6 °F (35.0 °C to 42 °C)</li> <li>±0.5 °F (±0.25 °C) for temperatures outside of this range</li> </ul>
Display resolution	0.1 °F or °C

## SpO2 specifications

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



**NOTE** Functional testers cannot be used to assess the accuracy of a pulse oximeter monitor.

While functional testers may be useful for verifying that the pulse oximeter sensor, cabling, and monitor 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.


### SpO2 specifications (Masimo specifications, see footnotes 1, 2, 3, 4, 5, and 6)

SpO2 performance measurement range	1 to 100%
<b>Masimo SpO2 specifications</b>	Accuracy specified when used with Masimo SET pulse oximetry monitors or with licensed Masimo SET pulse oximetry modules using PC series patient cables, during no motion. Numbers present ± 1 standard deviation. Plus or minus one standard deviation represents 68% of the population.
Masimo SpO <sub>2</sub> , No Motion	<p>60 – 80 ± 3%, adults/pediatrics/infants</p> <p>70 – 100 ± 2%, adults/pediatrics/infants; ± 3%, neonates</p>

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**SpO<sub>2</sub> specifications (Masimo specifications, see footnotes 1, 2, 3, 4, 5, and 6)**


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Masimo SpO <sub>2</sub> , Motion	70 – 100 ± 3%, adults/pediatrics/infants/ neonates
Masimo SpO <sub>2</sub> , Low perfusion	70 – 100 ± 2%, adults/pediatrics/infants/ neonates
Perfusion	0.02 % to 20 %
Masimo pulse rate , No Motion	25 – 240 ± 3 bpm, adults/pediatrics/infants/ neonates
Masimo pulse rate, Motion	25 – 240 ± 5 bpm, adults/pediatrics/infants/ neonates
Masimo pulse rate, Low perfusion	25 – 240 ± 3 bpm, adults/pediatrics/infants/ neonates
Pulse rate	25 to 240 beats per minute (bpm) No motion: ± 3 digits Motion: ± 5 digits
Saturation	60% to 70% Adults, Neonates: ± 3 digits
 <b>NOTE</b> Saturation accuracy varies by sensor type. Refer to the sensor <i>Directions for use</i> for additional accuracy information.	

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<b>Masimo respiration rate specifications</b>	4 to 70 respirations per minute (rpm), 3 RPM ARMS 1 RPM Mean Error Adult and pediatric patients
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<b>Nellcor sensor accuracy guide</b> <sup>7,8</sup>	SpO <sub>2</sub> measurement accuracy can only be evaluated in vivo by comparing pulse oximeter readings with SpO <sub>2</sub> measurements obtained from simultaneously sampled arterial blood made using a laboratory CO-oximeter. SpO <sub>2</sub> accuracy was validated through breathe-down-equivalent testing by Covidien using electronic measurements to prove equivalence to the Nellcor N600x predicate device. The Nellcor N600x predicate device was validated by performing human-subject, “breathe-down” clinical trials.
Pulse rate	25 to 240 beats per minute (bpm) ± 3 digits (no motion)
Saturation	70% to 100% Adult, neonate: ± 3 digits

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**SpO2 specifications (Masimo specifications, see footnotes 1, 2, 3, 4, 5, and 6)**

	<b>NOTE</b> Saturation accuracy varies by sensor type.	Low Perfusion: 0.02 % to 20 % ± 2 digits
Detected pulse rate	20 to 250 beats per minute (bpm) ± 3 digits	

**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.

Perfusion	40–240 BPM. Adult/Ped = +/- 3 digits; Neonate = +/- 3 digits
Pulse rate	18 to 321 beats per minute (bpm) No motion (18 to 300 bpm): ± 3 digits Motion (40 to 240 bpm): ± 5 digits

	<b>NOTE</b> Saturation accuracy varies by sensor type.	70% to 100%	70% to 100%
		<b>Adult/Pediatrics</b>	<b>Neonates</b>
		<b>No Motion</b>	<b>No Motion</b>
		Finger Clip: ± 2 digits	Finger Clip: ± 3 digits
		Flex: ± 3 digits	Flex: ± 3 digits
		Soft Sensor: ± 2 digits	Soft Sensor: N/A
		8000R: ± 3 digits	8000R: N/A
		8000 Q: ± 4digits	8000 Q: N/A
		<b>Motion</b>	<b>Motion</b>
		Finger Clip: ± 2 digits	Finger Clip: ± 3 digits
Flex: ± 3 digits	Flex: ± 4 digits		
Soft Sensor: ± 3 digits	Soft Sensor: ± 4 digits		
<b>Low Perfusion</b>	<b>Low Perfusion</b>		
All Sensors: ± 2 digits	All Sensors: ± 3 digits		

<sup>1</sup> SpO2, accuracy was determined by testing on healthy adult volunteers in the range of 60-100% SpO2 against a laboratory pulse oximeter. SpO2 accuracy was determined on 16 neonatal NICU patients ranging in age from 7-135 days old and weighing between 0.5-4.25 kg. Seventy-nine (79) data samples were collected over a range of 70-100% SaO2 with a resultant accuracy of 2.9% SpO2.

<sup>2</sup> The Masimo sensors have been validated for no motion accuracy in human blood studies on healthy adult male and female volunteers with light to dark skin pigmentation in induced hypoxia studies in the range of 70-100% SpO<sub>2</sub> against a laboratory pulse oximeter and ECG monitor. This variation equals plus or minus one standard deviation. Plus or minus one standard deviation encompasses 68% of the population.

<sup>3</sup> The Masimo sensors have been validated for motion accuracy in human blood studies on healthy adult male and female volunteers with light to dark skin pigmentation in induced hypoxia studies in the range of 70-100% SpO<sub>2</sub> against a laboratory CO-oximeter and ECG monitor. This variation equals plus or minus one standard deviation which encompasses 68% of the population.

<sup>4</sup> The Masimo SET Technology has been validated for low perfusion accuracy in bench top testing against a Biotek Index 2 simulator and Masimo's simulator with signal strengths of greater than 0.02% and transmission of greater than 5% for saturations ranging from 70–100%. This variation equals plus or minus one standard deviation which encompasses 68% of the population.

<sup>5</sup> The Masimo sensors have been validated for pulse rate accuracy for the range of 25-240 bpm in bench top testing against a Biotek Index 2 simulator. This variation equals plus or minus one standard deviation which encompasses 68% of the population.

<sup>6</sup> The following substances may interfere with pulse oximetry measurements:

- Elevated levels of Methemoglobin (MetHb) may lead to inaccurate SpO<sub>2</sub> measurements
- Elevated levels of Carboxyhemoglobin (COHb) may lead to inaccurate SpO<sub>2</sub> measurements
- Severe anemia may cause erroneous SpO<sub>2</sub> readings
- Dyes, or any substance containing dyes, that change usual blood pigmentation may cause erroneous readings
- Elevated levels of total bilirubin may lead to inaccurate SpO<sub>2</sub> reading

<sup>7</sup> Some models of commercially available bench-top functional testers and patient simulators can be used to verify the proper functionality of Nellcor pulse oximeter sensors, cables and monitors. See the individual testing device's operator's directions for use for the procedures specific to the model of tester being used.

<sup>8</sup> Many functional testers and patient simulators have been designed to interface with the pulse oximeter's expected calibration curves and may be suitable for use with Nellcor monitors and/or sensors. Not all such devices, however, are adapted for use with the Nellcor OXIMAX digital calibration system. While this will not affect use of the simulator for verifying system functionality, displayed SpO<sub>2</sub> measurement values may differ from the setting of the test device. For a properly functioning monitor, this difference will be reproducible over time and from monitor to monitor within the performance specifications of the test device.

## Environmental specifications

Operating temperature	50 °F to 104 °F (10 °C to 40 °C)
Storage temperature	-4 °F to 122 °F (-20 °C to 50 °C)
Operating altitude/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 humidity	15% to 95% noncondensing
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## USB flash drive requirements

The multiple vendor technologies used in the manufacture of USB flash drives make some of them incompatible with this monitor. 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 monitor 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 in the APM, 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 Connex Spot Monitor and the APM work surface: Kingston DataTraveler SE9 32 GB drive, part number DTSE9H/32GBZ.

## Monitor radio

The monitor's radio operates on 802.11 networks.

<b>Wireless network interface</b>	IEEE 802.11 a/b/g/n	
<b>Frequency</b>	<b>2.4 GHz frequency bands</b>	<b>5 GHz frequency bands</b>
	2.4 GHz to 2.483 GHz	5.15 GHz to 5.35 GHz, 5.725 GHz to 5.825GHz
<b>Channels</b>	<b>2.4 GHz channels</b>	<b>5 GHz</b>
	Up to 14 (3 non-overlapping); country-dependent,	Up to 23 non overlapping; country-dependent
<b>Authentication/Encryption</b>	Wireless Equivalent Privacy (WEP, RC4 Algorithm); Wi-Fi Protected Access (WPA); IEEE 802.11i (WPA2); TKIP, RC4 Algorithm; AES, Rijndael Algorithm; Encryption Key Provisioning; Static (40-bit and 128-bit lengths); PSK; Dynamic; EAP-FAST; EAP-TLS; EAP-TTLS; PEAP-GTC <sup>1</sup> PEAP-MSCHAPv2; PEAP-TLS;	
<b>Antenna</b>	Ethertronics WLAN_1000146	
<b>Wireless data rates</b>	802.11a (OFDM): 6, 9, 12, 18, 24, 36, 48, 54 Mbps	
	802.11b (DSSS, CCK): 1, 2, 5.5, 11 Mbps	
	802.11g (OFDM): 6, 9, 12, 18, 24, 36, 48, 54 Mbps	
	802.11n (OFDM,HT20,MCS 0-7): 6.5,13,19.5, 26, 39,52, 58.5, 72.2 Mbps	

<b>Agency approvals</b>	US: FCC Part 15.247 Subpart C, FCC Part 15.407 Subpart E Europe: EN 300 328 (EDR) (v1.8.1), EN 300 328 (LE) (v1.8.1), EN 301 489-1 (v1.9.2), EN 301 489-17 (v2.2.1), EN 301 489-17 (v2.2.1), EN 62311:2008, EN 60950-1 Canada: (IC) RSS-210 standard. IC 3147A-WB45NBT based on FCC testing Singapore: Complies with IDS standard
<b>Protocols</b>	UDP, DHCP, TCP/IP
<b>Data transfer protocols</b>	UDP/TCP/IP
<b>Output power</b>	39.81 mW typical, country-dependent
<b>Ancillary IEEE standards</b>	802.11d, 802.11e, 802.11h, 802.11i, 802.1X

<sup>1</sup>One time passwords are not supported.

Channel restrictions in the 5-GHz band are determined by country.

To ensure compliance with local regulations, be sure the correct country in which the access point is installed is selected. This product can be used with the following restriction(s):

Norway - Does not apply for the geographical area within a radius of 20 km from the center of Ny-Ålesund.

France - Outdoor use is limited to 10 mW EIRP within the band 2454 to 2483.5 MHz.



**NOTE** Effective Isotropic Radiated Power (EIRP).



**NOTE** Some countries restrict the use of 5-GHz bands. The 802.11a radio in the monitor uses only the channels indicated by the access point with which the radio associates. The hospital IT department must configure access points to operate with approved domains.

## Bluetooth module

Category	Feature	Implementation
<b>Wireless specification</b>	Bluetooth	2.1 + EDR
	Frequency	2.402 - 2.480 GHz
	Maximum transmit power	Class 1 +8 dBm from antenna
	Receive sensitivity	-89 dBm
	Range	Circa 100 meters
	Data rates	Up to 3 Mbps (over the air)

<b>Host interface</b>	USB	Full speed USB 2.0
	GPIO	Four configurable lines (1.8V/3.3V configurable by VDD_PADS)
<b>Operational modes</b>	HCI	Host Controller Interface over USB
	HID proxy mode	Human Interface Device
<b>EEPROM</b>	2-wire	64K bits
<b>Coexistence</b>	802.11 (WiFi)	Three wire CSR schemes supported (Unity-3, Unity-3e, and Unity+)
<b>Supply voltage</b>	Supply	5V ± 10%
<b>Power consumption</b>	Current	Idle mode ~5 mA File transfer ~58 mA
<b>Antenna option</b>	Internal	Multilayer ceramic antenna with up to 41% efficiency
<b>Physical</b>	Dimensions	8.5 × 13 × 1.6 mm (BT800 module) 16 × 43 × 11 (BT820 USB dongle)
<b>Environmental</b>	Operating	-30 °C to 85 °C
	Storage	-40 °C to 85 °C
<b>Miscellaneous</b>	Lead free	Lead-free and RoHS compliant
	Warranty	1 year
<b>Approvals</b>	Bluetooth	Controller subsystem approved
	FCC / IC / CE	All BT800 series

## 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
Active Config file name	Factory
Device location displayed	Yes
First-time startup screen displayed	Yes
Touchscreen lockout interval	2 minutes
Auto sleep mode allowed	Yes
Sleep mode duration	2 minutes
Auto shutdown allowed	Yes
Auto shutdown timeout	15 minutes
Display brightness	5
Touchscreen calibration	55, 57, 4003, 3993, 193, 3910, 200, 3900 (array of 8 integers)
Splash screen	Hillrom logo
Load new software on power cycle enabled	No
Load new software to device	Greyed out
Screen off allowed	Yes
Screen off timeout	1 minute
Power line frequency	60 <sup>1</sup>

<sup>1</sup> Power line frequency can be modified in the Configuration Tool to support specific parameters like Masimo SpO2. With both new and existing configurations, follow these steps:

1. Navigate to the Progress Summary page.
2. Scroll down to **Section: Biomed (Required)** at the bottom of the page and click **General Device Settings**.
3. Select **Custom**.
4. Scroll down to **Other** on the General Device Settings page and select the desired Power Line Frequency.

Settings	Default value
5. Click <b>DONE</b> at the bottom of the page.	
6. Click <b>SAVE AND CONTINUE</b> .	

## Data management

Settings	Default value
Date format	MM/DD/YYYY
Prevent date and time changes	No
Display date and time	Yes
Daylight savings time (DST) enabled	No
Device time zone offset (minutes)	0
Configured language	English
Office profile option enabled	Yes
Intervals profile option enabled	Yes
Spot Check profile option enabled	Yes
Profile	Spot Check
Automatically send confirmed readings on Save	No
Delete confirmed readings after successful send	No
Automatically send unconfirmed interval readings	No

## General alarms

Settings	Default value
Alarm volume	Medium
Audio pause time	120 seconds
Minimum alarm volume	Low
Alarm condition priority to activate Nurse call	Medium
Allow global audio off (Note: Must be enabled in configuration file for No option to be available,)	No

Settings	Default value
Alarm audio on and Alarm audio off controls available	Yes (if "Allow global audio off" is enabled in configuration)
Allow alarms to be disabled	Yes

## Patient and Clinician information

Settings	Default value
Patient	
Default patient type	Adult
Name format	Full name
Primary label	Name
Secondary label	Patient ID
Require patient ID to save readings	No
Clear patient information on manual save	Yes
Patient ID match required for save	No
Search/Query by patient ID	No
Clinician	
Clinician ID display format	Clinician ID
Require clinician ID to save readings	No
Require clinician ID match to save readings	No
Retrieve clinician information from clinician ID	No
Require password to save readings	No
Clear clinician information on manual save	No
Require entry of "required modifiers" to save readings	No
Require prescribed login	No

## NIBP

Settings	Default value
Systolic upper limit enabled	Yes
Systolic: Upper limit	Adult: 220 mmHg (29.3 kPa) Pediatric: 145 mmHg (19.3 kPa) Neonate: 100 mmHg (13.3 kPa)
Systolic lower limit enabled	Yes
Systolic: Lower limit	Adult: 75 mmHg (10.0 kPa) Pediatric: 75 mmHg (10.0 kPa) Neonate: 50 mmHg (6.7 kPa)
Diastolic upper limit enabled	Yes
Diastolic: Upper limit	Adult: 110 mmHg (14.7 kPa) Pediatric: 100 mmHg (13.3 kPa) Neonate: 70 mmHg (9.3 kPa)
Diastolic lower limit enabled	Yes
Diastolic: Lower limit	Adult: 35 mmHg (4.7 kPa) Pediatric: 35 mmHg (4.7 kPa) Neonate: 30 mmHg (4.0 kPa)
MAP upper limit enabled	No
MAP: Upper limit	Adult: 120 mmHg (16 kPa) Pediatric: 110 mmHg (14.7 kPa) Neonate: 80 mmHg (10.7 kPa)
MAP lower limit enabled	No
MAP: Lower limit	Adult: 50 mmHg (6.7 kPa) Pediatric: 50 mmHg (6.7 kPa) Neonate: 35 mmHg (4.7 kPa)
<b>Advanced</b>	
Default view	sys_dia_map
Tube type	2 tubes
Unit of measure	mmHg
Algorithm default	SureBP

Settings	Default value
Cuff inflation target (step algorithm)	
Adult	160 mmHg (21.3 kPa)
Pediatric	140 mmHg (18.7 kPa)
Neonate	90 mmHg (12.0 kPa)
Maximum cycle pressure	
Adult	Automatic
Pediatric	Automatic

## Intervals

Settings	Default value
Time between each Automatic interval	15 minutes
Intervals profile default intervals mode	Automatic
Office profile intervals mode	Averaging (fixed)
Selected interval parameter	NIBP
Automatic mode time interval	15 minutes

## SpO2

Settings	Default value
SpO2 upper limit enabled	Yes
Upper limit	Adult: 100% Pediatric: 100% Neonate: 100%
SpO2 lower limit enabled	Yes
Lower limit	Adult: 90% Pediatric: 90% Neonate: 90%
Default view	% SpO2



Settings	Default value
<b>Advanced</b>	
SpO2 alarm condition delay	10 seconds
SatSeconds™ (Nellcor only)	25 seconds

## RR

RRp alarm condition delay - The quickest detection of a change in respiratory rate would take at least two breaths. Depending on respiratory rate, anything less than 6 breaths per minute must be greater than 10 seconds.

Settings	Default value
RR upper limit enabled	Yes
Upper limit	Adult: 30 Pediatric: 30 Neonate: 80
RR lower limit enabled	Yes
Lower limit	Adult: 6 Pediatric: 6 Neonate: 12
Default view	BPM

## Temperature

Settings	Default value
Temperature upper limit enabled	No
Upper limit	101 °F (38.3 °C)
Temperature lower limit enabled	No
Lower limit	94 °F (34.4 °C)
<b>Advanced</b>	
Unit of measure	°F (Fahrenheit)
Display temperature conversion	Yes

Settings	Default value
Default SureTemp Plus site	Oral
Braun antitheft time undocked before alarm	2 hours
Braun temperature conversion enabled	Yes
Braun timer icon enabled	Yes
Braun technique compensation algorithm enabled	Yes
Braun °F or °C hardware switch enabled (in the battery compartment)	Yes
Braun unadjusted mode enabled	No

## Manual parameters

Settings	Default value
Custom Score feature active	No
Display height	Yes
Display weight	Yes
Display pain	Yes
Display respiration	Yes
Display BMI	No
Height units	in
Weight units	lb
Enable manual override NIBP	Yes
Enable manual override Pulse rate	Yes
Enable manual override Respiration rate	Yes
Enable manual override Temperature	Yes
Enable manual override SpO2	Yes

## Network

Settings	Options	Selections	Default value
ESSID selection	Alphanumeric entry (32)		com.welchallyn
Radio mode	a/b/g/n, a/b/g, a/n, a only		a/b/g/n
Radio enabled	Yes / No		Yes
Radio alarms enabled	Yes / No		No
Ethernet MAC address	MAC address		00:1A:FA:FF:FC:00
Wireless MAC	Alphanumeric entry (18)		
Authentication/ Encryption type	Open, WPA Personal(TKIP), WPA Enterprise(TKIP), WPA2- Personal(AES/CCMP), WPA2-Enterprise(AES/ CCMP), WEP n(could be 64(40), 128(104) specific)		WPA2-Personal
Authentication/ Encryption method	Alphanumeric entry (64)		1234567890ABCDEF1234 567890ABCDEF12345678 90ABCDEF1234567890A BCDEF
Enhanced Auth Protocol (EAP) type	TLS, TTLS, PEAP- MSCHAPv2, PEAP-GTC, PEAP-TLS, EAP-FAST		PEAP-MSCHAPv2
Enhanced Auth Protocol (EAP) identity	Alphanumeric entry (32)		vitalsigns
Enhanced Auth Protocol (EAP) password	Alphanumeric entry (32)		password
Dynamic Frequency Selection	Yes / No		Yes
Roaming type	PMK Caching, OKC, CCKM		OKC
Server validation enabled	Yes / No		No
Auth server type	Type 1, Type 2		Type 2
Inner EAP setting type	Auto, PAP		Auto
PAC provisioning field	Auto, Manual		Auto
Active WEP Key number for WEP 64 and for WEP 128	1, 2, 3, 4		1

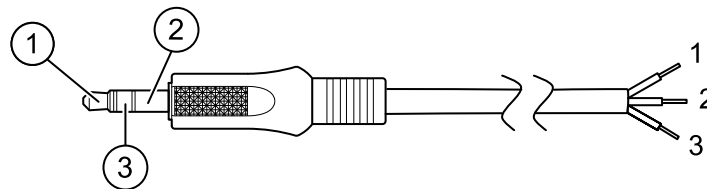
Settings	Options	Selections	Default value
	WEP Key 1 Alphanumeric entry (26)		0123456789 or 0123456789ABCDEF0123 456789
	WEP Key 2 Alphanumeric entry (26)		0123456789 or 0123456789ABCDEF0123 456789
	WEP Key 3 Alphanumeric entry (26)		0123456789 or 0123456789ABCDEF0123 456789
	WEP Key 4 Alphanumeric entry (26)		0123456789 or 0123456789ABCDEF0123 456789
Network Connectivity Method	Host IP, NRS, DNS, DHCP		DNS
	Host IP	Host IP address	127.0.0.1
		Port	281
	NRS	Network rendezvous service (NRS) IP address (###.###.###.###)	0.0.0
		Port (####)	7711
	DNS	Network rendezvous service DNS name	WANRS
		Port (####)	7711
	DHCP	DHCP vendor class identifier	welchallyn-nrs
		Port (####)	7711
		NRS IP addresses (multiple)	Those network rendezvous service (NRS) IP addresses used by your organization
	Data Encryption		No

Settings	Options	Selections	Default value
	Radio Static IP Enabled		No
	Radio Static IP Address		0.0.0.0
	Radio Static IP Mask		255.255.255.0
	Radio Static IP Gateway		0.0.0.0
	Radio Static IP DNS		0.0.0.0
	Ethernet Static IP Enabled		No
	Ethernet Static IP Address		0.0.0.0
	Ethernet Static IP Mask		255.255.255.0
	Ethernet Static IP Gateway		0.0.0.0
	Ethernet Static IP DNS		0.0.0.0
	Time Zone		GMT
	Display Time Zone		GMT
	NTP Enable		No
	NTP DNS Name		blank
	Patient Query and Vitals Send HL7 Enable		No
	HL7 DNS Name		127.0.0.1
	HL7 IP port		281
	Server Authentication Enable		No
	FIPS Enable		No
	WiFi Power Save Poll Mode		Max
Bluetooth®			
	MAC address for Bluetooth pairing		00:1A:FA:FF:FC:00
	Bluetooth configuration allowed	Yes / No	No

Settings	Options	Selections	Default value
Pairing new laptop allowed	Yes / No		No
Name of device as shown on a paired laptop	##### is unique based on serial #		WACSM - #####
Enable BLE (Bluetooth® Low Energy)	Yes / No		No

## Install the Nurse Call cable

Use this drawing and the following table as a reference for the Nurse Call cable and wiring a Nurse Call system.



No.	Cable connector	Wires (terminate according to manufacturer's specifications)
1	Tip (red wire)	Normally open wire (red)
2	Barrel (black wire)	Arm wire (black)
3	Center (white wire)	Normally closed wire (white)

## Configure a remote VNC connection

To allow a view-only remote session to the device from a device on the same network, complete the following steps:

1. Create a configuration file with VNC enabled on the Config Tool.
2. Load the configuration file on to the device.
3. Connect the device to the network.
4. On the device, navigate to **Setting > Device**, and click **Authorize under Remote Screen Sharing**.
5. Note the password in the Remote Screen Sharing box.
6. Navigate to **Settings > Advanced**. Locate the device's IP address under Ethernet IP or Radio IP.

7. Using VNC Remote Viewer app on the network, connect to the IP address. Enter the password noted from the Remote Screen Sharing box.
8. To end the remote session, navigate to **Setting > Device**, and click **Stop Sharing**.





## Troubleshooting

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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.
- **Technical alarm 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 monitor or the APM work surface if one is configured for your 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 datestamp 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 datestamp 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 WordPad 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 CSM 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:

---

<b>Facility Number</b>	<b>Description</b>
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
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**

---

<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

---

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

---

<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

---

## Symptoms and solutions

Symptom	Possible cause	Suggested action
<b>General</b>		
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.
	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.	Calibrate the touchscreen.
		Run the Host Calibration Sequence from the Service Tool.
		Replace the LCD / touchscreen.
The device does not signal alarm conditions for the Nurse Call option.	Alarm limit settings are set too high or too low.	Adjust the alarm limit settings.
	Audio alarms have been silenced.	Turn on audio alarms.
	A hardware component has failed.	Run the Host Calibration Sequence from the Service Tool. Replace the main board.
The device is powered on but the display is blank.	The device is in Sleep mode.	Touch the screen.
	A hardware component has failed.	Run the Host Calibration Sequence from the Service Tool.

Symptom	Possible cause	Suggested action	
		Replace the LCD / touchscreen.	
		Replace the main board.	
<b>Bluetooth®</b>			
The monitor cannot connect with a Bluetooth device.	A pairing issue occurred.	Pair the monitor to the device.	
		Ensure that the monitor and the device are within range.	
		The Bluetooth device driver has not been installed properly.	
		PC Service for the device has not started.	
		Perform a Bluetooth radio functional check.	
			Update the device software.
			Replace the Bluetooth radio.
			Replace the main board.
		A connectivity issue occurred.	Configure monitor to network settings.
			Verify local network settings.
	Ensure that the monitor and the device are within range.		
	Perform a Bluetooth radio functional check.		
	Update the device software.		
		Replace the Bluetooth radio.	
		Replace the main board.	
	A hardware component has failed.	Perform a Bluetooth radio functional check.	
		Replace the Bluetooth radio.	
		Replace the main board.	
	The software has failed.	Update the software.	
		Replace the Bluetooth radio.	

Symptom	Possible cause	Suggested action	
		Replace the main board.	
<b>Wireless radio</b>			
The monitor cannot connect with a Wireless network.	A connectivity issue occurred.	Configure monitor to network settings.	
		Verify local network settings.	
		Ensure that the monitor and the device are within range.	
		Perform a Newmar radio functional check.	
		Update the device software.	
			Replace the Newmar radio.
			Replace the main board.
	A hardware component has failed.	Perform a Newmar radio functional check.	
		Replace the Newmar radio.	
		Replace the main board.	
The software has failed.	Update the software.		
	Replace the Newmar radio.		
	Replace the main board.		
Attempt to upgrade the software failed.	The hardware or software between the Host and the Newmar radio is incompatible.	Retry software update.	
		Replace Newmar radio.	
		Replace main board.	
	The monitor lost communication with the network or a timing issue occurred during the upgrade.	Retry software update.	
		Replace Newmar radio.	
Replace the main board.			
The Newmar radio malfunctioned.	Update the software.		
	Replace Newmar radio.		
	Replace the main board.		
The main board malfunctioned.	Update the software.		
	Replace the main board.		



Symptom	Possible cause	Suggested action
<b>Ethernet</b>		
The monitor cannot connect to the network.	A connectivity issue occurred.	Verify local network settings.
		Verify that the port on the network is configured and functional.
		Perform an Ethernet functional check.
		Update the software.
	Replace the main board.	
	A hardware failure occurred.	Perform an Ethernet functional check.
Replace the main board.		
A software failure occurred.	Update the software.	
Replace the main board.		
Attempt to upgrade the software failed.	The hardware or software between the Host and the Ethernet module is incompatible.	Retry software update.
		Replace the main board.
	The monitor lost communication with the network or a timing issue occurred during the upgrade.	Retry software update.
		Replace the main board.
	The Ethernet module malfunctioned.	Update the software.
Replace the main board.		
The main board malfunctioned.	Update the software.	
Replace the main board.		
<b>NIBP</b>		
Blood pressure readings are inaccurate.	Incorrect cuff size, improperly placed cuff, or incompatible cuff.	Determine correct cuff size by measuring patient's arm circumference midway between the elbow and the shoulder. Then use a properly sized cuff.
		Use reference markings on the cuff to place it properly.
	Use only Welch Allyn cuffs.	
Patient's arm is not positioned properly or moves during blood pressure cycle.	Ensure patient's arm is resting on a surface at heart level.	

Symptom	Possible cause	Suggested action
		Keep arm still to reduce artifact.
	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 single or dual lumen switch failed.	Ensure that the cuff is the properly sized.

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

Symptom	Possible cause	Suggested action
		Replace the main board.
	The NIBP module needs calibration.	Update the software. 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 Ethernet module is incompatible.	Retry software update. Replace the main board.
	The monitor 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.

Symptom	Possible cause	Suggested action
Temperature measurements are not displayed.	The probe is disconnected from the monitor.	Ensure that the temperature probe is connected and 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.
Attempt to upgrade the software failed. <b>Braun failures</b>	The hardware or software between the Host and the Ethernet module is incompatible.	Retry software update. Replace the temperature module. Replace the main board.
	The monitor lost communication with the network or a timing issue occurred during the upgrade.	Retry software update. Replace the temperature module. Replace the main board.
	The temperature module malfunctioned.	Update the software.

Symptom	Possible cause	Suggested action
		Replace the temperature module.
		Replace the main board.
	The main board malfunctioned.	Update the software.
		Replace the main board.
	The thermometer is not in the cradle.	Placed the thermometer in the cradle.
	The thermometer contacts are dirty.	Clean the thermometer contacts.
		Replace the thermometer.
		Replace the thermometer module.
	The thermometer batteries are dead.	Place the thermometer in the cradle to charge.
		Clean the thermometer contacts.
		Replace the thermometer batteries.
		Replace the thermometer.
		Replace the thermometer module.
	The thermometer malfunctioned.	Place the thermometer in the cradle to charge.
		Clean the thermometer and module contacts.
		Clean the probe or window.
		Replace the probe cover.
		Perform temperature functional checks.
		Update the software.
		Replace the thermometer batteries.
		Replace the thermometer.
		Replace the thermometer module.

Symptom	Possible cause	Suggested action
		Replace the main board.
	The temperature module malfunctioned.	Perform temperature functional checks. 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. Perform temperature functional checks. Replace the probe.
	The main board malfunctioned.	Update the software. Replace the main board.

## SpO2

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.
	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.

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



## Technical alarm and information messages

This section presents tables of technical alarm and information messages to help you troubleshoot issues on the monitor.

When the monitor detects certain events, a message appears in the Device Status area at the top of the screen. Message types include the following:

- Information messages, which appear on a blue background.
- Very low-priority alarms, which appear on a cyan background.
- Low- and medium-priority alarms, which appear on an amber background.
- High-priority alarms, which appear on a red background.

Technical alarm messages are low or very low priority unless noted in the Message column.

Alarm 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.

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 monitor 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.

## NIBP messages

Message	Possible cause	Suggested action	Alarm priority
User cancelled NIBP reading.	The NIBP measurement was cancelled by user	Clear the alarm and retry NIBP.	Information
NIBP not functional. 050002	The NIBP measurement is not available	Internal malfunction. If the problem persists, replace the module.	Medium
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, replace the module.	Medium
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 problem persists, replace module	Low
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	Low

Message	Possible cause	Suggested action	Alarm priority
		the problem persists, replace the module.	
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, replace the module.	Medium
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, replace the module.	Low
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.	Low
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, replace the module.	Medium
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.	Low
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.	Low
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.	Medium
NIBP air leak; check cuff and tubing connections. 05000D	Leak was detected in BP cycle.	Check the tubing and connections.	Low
No display	The safety check failed on the measurement attempt	Internal malfunction. If the problem persists, replace the module.	
Unable to determine NIBP; check connections; limit patient movement. 05000F	The NIBP pressure is not stable and the transducer zero value cannot be set	The NIBP pressure is not stable and the transducer zero value cannot be set. If problem persists, replace module.	Medium
NIBP not functional. 050105	WACP message CRC mismatch on NIBP module	Internal malfunction. If the problem persists, replace the module.	Very low

Message	Possible cause	Suggested action	Alarm priority
NIBP not functional. 050201	This message is not implemented by the NIBP module	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 050202	This message is not supported by the NIBP module	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 050203	The NIBP module has run out of memory	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 050205	The NIBP module has received a invalid parameter	Internal malfunction. If the problem persists, replace the module.	Very low
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, replace the module.	Very low
NIBP not functional. 050207	The NIBP module message requires an object, but did not contain one	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 050208	The NIBP module object provided with the message could not be deserialized	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 050209	The NIBP module object could not be serialized	Internal malfunction. If the problem persists, replace the module.	Very low
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, replace the module.	Very low
NIBP not calibrated. 050503	Factory EEPROM checksum error on NIBP. Units internal configuration was corrupted	Internal malfunction. If the problem persists, replace the module.	Very low
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, replace module.	Very low
NIBP not functional. 050505	Post failure of A/D convertor	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not calibrated. Calibrate the module. 050509	NIBP module calibration failure, the calibration signature is zero	Calibrate the NIBP module.	Very low

Message	Possible cause	Suggested action	Alarm priority
Invalid algorithm. Select correct algorithm and retry. 05050A	Invalid NIBP Algorithm. NIBP component software tried to configure the sensor in an illegal manner	Verify the algorithm. If the problem persists, replace the module.	Very low
NIBP not functional. 050513	Invalid NIBP initiation code	Internal malfunction. If the problem persists, replace the module.	Very low
Invalid patient mode. Select correct patient mode and retry. 050514	Invalid patient mode on NIBP. The NIBP component software tried to configure the sensor in an illegal manner	Verify correct patient mode. If the problem persists, replace the module.	Very low
NIBP not functional. 050515	Invalid module configuration for NIBP	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 050516	NIBP module malfunction	Internal malfunction. If the problem persists, replace the module.	Very low
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.	Very low
Low battery. Plug into outlet. 050518	The NIBP module power rail is too low	Plug device into an AC outlet to charge the battery.	Very low
Battery overcharged. Disconnect from outlet. 050519	The NIBP module power rail is too high.	Battery is overcharged. Remove from charging source.	Very low
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, replace the module.	Very low
NIBP not functional. 050602	NIBP safety processor failed ROM checksum	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not calibrated. Calibrate the module. 050603	NIBP safety processor not calibrated, missing calibration signature	Calibrate the NIBP module. If the problem persists, replace the module.	Very low
Cuff pressure limits exceeded. 050604	NIBP system failure. Overpressure	Restrict patient movement.	Medium
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.	Very low
Cuff pressure too high. Clear error to retry. 050606	NIBP cuff pressure above SVRP for too long	Verify cuff connections. If the problem persists, replace the module.	Medium

Message	Possible cause	Suggested action	Alarm priority
NIBP not functional. 050607	NIBP cannot clear the failsafe alerts	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 050608	NIBP safety processor has stopped responding	Internal malfunction. If the problem persists, replace the module.	Very low
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, replace the module.	Very low
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, replace the module.	Medium
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, replace the module.	Very low
NIBP not functional. 05060C	NIBP command not implemented	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 05060D	NIBP wrong data count	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 05060E	NIBP data range error	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 05060F	NIBP no POST error to clear	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 050610	NIBP cannot clear this POST error	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 050611	NIBP command not command type	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 050612	NIBP communication timeout	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 050613	NIBP response header wrong	Internal malfunction. If the problem persists, replace the module.	Very low

Message	Possible cause	Suggested action	Alarm priority
NIBP not functional. 050614	NIBP response checksum wrong	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 050615	Too much NIBP data was received	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 050616	NIBP FEPROM erase error	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 050617	NIBP FEPROM programming error	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 050618	Invalid NIBP target pressure	Internal malfunction. If the problem persists, replace the module.	Very low
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.	Information
Tube type does not match device configuration.	Switching to step BP	Change tube type to dual lumen or change the algorithm configuration to step BP	Information
NIBP not functional. 05FF01	Unrecognized WACP parameter received from sensor	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 05FF02	Timeout waiting for sensor response	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 05FF03	Error deserializing the WACP message received from the sensor	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 05FF04	WACP stack send message failure	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 05FF05	Timeout waiting for asynchronous sensor message	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 05FF06	One or more undetermined numerics when reading status indicates OK	Check connections. Restrict patient movement.	Very low
NIBP not functional. 05FF07	Unrecognized sensor reading status code	Internal malfunction. If the problem persists, replace the module.	Very low

Message	Possible cause	Suggested action	Alarm priority
NIBP not functional. 05FF08	Sensor power up failure	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 05FF09	WACP rendezvous failure	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 05FF0A	Application firmware retrieval error during POST	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 05FF0B	Upgrade .pim file is corrupt	Internal malfunction. If the problem persists, replace the module.	Very low
NIBP not functional. 05FF0C	Configured upgrade firmware directory cannot be accessed	Internal malfunction. If the problem persists, replace the module.	Very low
Device configuration issue. 05FF0D	Configured parameter (NIBP or SpO2) used in Intervals is missing	Use configured parameters for Intervals	Very low
NIBP not functional. 05FF0E	The NIBP sensor unexpectedly reset	Clear the error and try again	Very low
NIBP not functional. 05FF0F	The NIBP sensor firmware failed to upgrade	Internal malfunction. If the problem persists, replace the module.	Very low
Tube type does not match device configuration.	The tube type settings and the actual tube type do not match	Change the tube type setting to match the actual tube type.	Information

## SpO2 messages

### General SpO2 messages

Message	Possible cause	Suggested action	Alarm priority
SpO2 not functional. 044900	SpO2 module is not responding	Internal Hardware malfunction in SpO2 module. Replace module.	Very low
SpO2 rebooting. 044a00	SpO2 module is not responding	Informational error. Indicates that host software is attempting to clear an error by rebooting the SpO2 module. No action required.	Very low
SpO2 rebooting. 044b00	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.	Very low

Message	Possible cause	Suggested action	Alarm priority
SpO2 rebooting. 044c00	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.	Very low
SpO2 rebooting. 044d00	The SpO2 power on self test failed	Internal hardware malfunction in SpO2 module. Replace the module.	Very low
SpO2 rebooting. 044e00	The SpO2 power on self test timed out	Internal hardware malfunction in SpO2 module. Replace the module.	Very low

## Masimo messages

Message	Possible cause	Suggested action	Alarm priority
Sensor not connected. Clear to retry. 040600	The SpO2 cable is not connected	Connect SpO2 cable. If the problem is still present, replace the SpO2 sensor. If the problem is still present, verify the module functionality by replacing the sensor with an applicable SpO2 tester. If the message persists, replace the module.	Very low
Replace the SpO2 cable. 040700	The SpO2 cable life has expired	Replace the SpO2 cable. If the problem is still present, verify module functionality by replacing the sensor with an applicable SpO2 tester. If the message persists, replace the module.	Very low
Replace the SpO2 cable. 040800	The SpO2 cable is incompatible with the monitor	Replace the SpO2 cable. If the problem is still present, verify module functionality by replacing the sensor with an applicable SpO2 tester. If the message persists, replace the module.	Very low
Replace the SpO2 cable. 040900	The SpO2 cable is not recognized by the monitor	Replace the SpO2 cable. If the problem is still present, verify module functionality by replacing the sensor with an applicable SpO2 tester. If the message persists, replace the module.	Very low
Replace the SpO2 cable. 040a00	The SpO2 cable is defective	Replace the SpO2 cable. If the problem is still present, verify module functionality by replacing the sensor with an applicable SpO2 tester. If the message persists, replace the module.	Very low
Sensor not connected. Clear to retry. 040b00	The SpO2 sensor is not connected to the monitor	Connect SpO2 sensor. If the problem is still present, replace	Very low



Message	Possible cause	Suggested action	Alarm priority
		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, replace the module.	
The sensor has expired. Replace the SpO2 sensor. 040c00	The SpO2 sensor has expired	Replace 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, replace the module.	Very low
Incompatible sensor. Replace the SpO2 sensor. 040d00	The SpO2 sensor is not recognized by the monitor	Replace 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, replace the module.	Very low
Incompatible sensor. Replace the SpO2 sensor. 040e00	The SpO2 sensor is not recognized	Replace 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, replace the module.	Very low
Replace the SpO2 sensor. 040f00	The SpO2 sensor is defective	Replace 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, replace the module.	Very low
Replace the SpO2 sensor. Replace the SpO2 cable. 041000	There was a fault with the SpO2 sensor and cable.	Check the sensor and cable connection. 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 the module functionality by replacing the sensor with an applicable SpO2 tester. If the message persists replace the module.	Very low
Sensor not connected. Clear to retry. 041100	An adhesive 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	Very low

Message	Possible cause	Suggested action	Alarm priority
		tester. If the message persists, replace the module.	
The sensor has expired. Replace the SpO2 sensor. 041200	The adhesive SpO2 sensor is expired	Replace 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, replace the module.	Very low
Incompatible sensor. Replace the SpO2 sensor. 041300	The adhesive SpO2 sensor is incompatible	Replace 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, replace the module.	Very low
Incompatible sensor. Replace the SpO2 sensor. 041400	The adhesive SpO2 sensor is not recognized	Replace 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, replace the module.	Very low
Replace the SpO2 sensor. 041500	The adhesive SpO2 sensor is defective	Replace 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, replace the module.	Very low
Searching for pulse signal. 041800	SpO2 pulse search	Pulse search is part of normal operation, and does not have an associated corrective action.	High
SpO2 interference detected. Clear to retry. 041900	SpO2 module interference detected.	No action required.	Very low
Low perfusion index. Clear to retry. 041a00	There is marginal SpO2 pulse quality or artifact.	Reapply the sensor to a better perfused monitoring site. Assess the patient and, if indicated, verify oxygenation status through other means. 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, replace the module.	Very low

Message	Possible cause	Suggested action	Alarm priority
Demo mode active. 041b00	The SpO2 parameter is in demo mode	None. <sup>1</sup>	Very low
Sensor not connected. Clear to retry. 041c00	Check the SpO2 sensor connection	Check the sensor and cable connection. 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 the module functionality by replacing the sensor with an applicable SpO2 tester. If the message persists replace the module.	Very low
SpO2 rebooting. 041e00	There is an SpO2 raw queue overrun	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 041f00	There is an SpO2 hardware failure	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 042000	There is an SpO2 MCU failure	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 042100	There is an SpO2 watchdog failure	A malfunction is detected. There are two possible causes of these	Very low

Message	Possible cause	Suggested action	Alarm priority
		failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	
SpO2 not functional. 042200	There is an invalid SpO2 board type	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 042300	There is an invalid SpO2 master control state	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 042400	There is an SpO2 SRAM transfer failure	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 042500	There is an SpO2 SRAM task queue overrun	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of	Very low

Message	Possible cause	Suggested action	Alarm priority
		specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	
SpO2 rebooting. 042600	There is an SpO2 database failure	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 042700	There is an invalid SpO2 flash memory device	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 042800	There is an SpO2 anode voltage configuration failure	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 042900	There is a problem with the SpO2 analog ground	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the	Very low

Message	Possible cause	Suggested action	Alarm priority
		underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	
SpO2 rebooting. 042a00	There is a problem with the SpO2 digital ground	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 042b00	There is a problem with the SpO2 LED ground	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 042c00	There is a problem with the SpO2 reference voltage	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 042d00	There is a problem with the SpO2 DSP core voltage	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual	Very low

Message	Possible cause	Suggested action	Alarm priority
		hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	
SpO2 rebooting. 042e00	There is a problem with the SpO2 filtered input voltage	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 042f00	There is a problem with the SpO2 DSP I/O voltage	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 043000	There is a problem with the SpO2 positive detector voltage	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 043100	There is a problem with the SpO2 negative detector voltage	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended	Very low

Message	Possible cause	Suggested action	Alarm priority
		that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	
SpO2 rebooting. 043200	There is a problem with the SpO2 positive LED Voltage	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 043300	There is a problem with the SpO2 LED drive voltage	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 043400	There is a problem with the SpO2 positive preamp voltage	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 043500	There is a problem with the SpO2 Sensor ID	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still	Very low



Message	Possible cause	Suggested action	Alarm priority
		present replace the monitor's main board.	
SpO2 rebooting. 043600	There is a problem with the SpO2 thermistor	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 043700	There is a problem with the SpO2 LED current	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 043800	There is a problem with the SpO2 preamp	A malfunction is detected. There are two possible causes of these failures. First, the power provided to the board is out of specification. In this case, the failure may be cleared once the underlying cause is removed. Second, the board has an actual hardware failure and recovery is not possible. It is recommended that the SpO2 module be replaced, and if problem is still present replace the monitor's main board.	Very low
SpO2 rebooting. 044300	The SpO2 module received bad packet	There is an internal software malfunction in the main PCBA. Update the software. If the problem persists, replace the module.	Very low
SpO2 rebooting. 044400	The SpO2 module received an invalid command	There is an internal software malfunction in the main PCBA. Update the software. If the problem persists, replace the module.	Very low

Message	Possible cause	Suggested action	Alarm priority
SpO2 rebooting. 044500	The SpO2 module received a command that would result in more output than the baud rate can support	There is an internal software malfunction in the main PCBA. Update the software. If the problem persists, replace the module.	Very low
SpO2 rebooting. 044600	The SpO2 module received a command that requires an application that is not present	There is an internal software malfunction in the main PCBA. Update the software. If the problem persists, replace the module.	Very low
SpO2 rebooting. 044700	The SpO2 module received a command while still locked	There is an internal software malfunction in the main PCBA. Update the software. If the problem persists, replace the module.	Very low
SpO2 low signal quality. Check sensor. 044f00	SpO2 low Sat signal quality	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, replace the module.	Very low
SpO2 rebooting. 045000	Low PR confidence	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, replace the module.	Very low
SpO2 low signal quality. Check sensor. 045100	Low PI confidence	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, replace the module.	Very low
RRp low confidence. Check sensor. 045200	Low RRp confidence	Reapply the sensor to the patient. Move the sensor to a better perfused site, or a site with less movement. 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	Very low

Message	Possible cause	Suggested action	Alarm priority
		tester. If the message persists, replace the module.	

<sup>1</sup>Demo mode is reported when you plug a Masimo demo tool into the patient cable connector. This tool simulates a patient being connected, and is only used in a development environment. Because this tool simulates a patient without a patient actually being connected, it should NEVER be present in a clinical setting.

## Nellcor messages

Message	Possible cause	Suggested action	Alarm priority
Sensor not connected. The SpO2 sensor is not Clear to retry. 043900	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, replace the module.	Very low
Searching for pulse signal. 043a00	SpO2 pulse search	None <sup>1</sup>	High
SpO2 interference detected. Clear to retry. 043c00	SpO2 module 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, replace the module.	Very low
SpO2 rebooting. 043d00	SpO2 module hardware error	A module hardware error is detected. Replace module.	Very low
SpO2 rebooting. 043e00	SpO2 module hardware error	A module hardware error is detected. Replace module.	Very low
SpO2 rebooting. 043f00	SpO2 module software error	A module software error is detected. Wait for module to reset itself.	Very low
SpO2 rebooting. 044000	SpO2 module received a bad message	None. Contact Hillrom Technical Support: <a href="http://hillrom.com/en-us/about-us/locations/">hillrom.com/en-us/about-us/locations/</a> .	Very low
Replace the SpO2 sensor. 044100	SpO2 defective sensor.	Replace the SpO2 sensor. 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	Very low

Message	Possible cause	Suggested action	Alarm priority
		message persists, replace the module.	
SpO2 rebooting. 044200	The SpO2 module received a bad message	None. Contact Hillrom Technical Support: <a href="http://hillrom.com/en-us/about-us/locations/">hillrom.com/en-us/about-us/locations/</a> .	Very low
<sup>1</sup> Pulse search is a normal part of operation and does not have an associated corrective action.			

## Nonin messages

Message	Possible cause	Suggested action	Alarm priority
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, replace the module.	Very low
Searching for pulse signal. 040200	None	None <sup>1</sup>	High
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, replace the module.	Very low
Low SpO2 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, replace the module.	Very low
<sup>1</sup> Pulse search is a normal part of operation and does not have an associated corrective action.			

## Temperature messages

### SureTemp messages

Message	Possible cause	Suggested action	Alarm priority
Temperature not functional. 30105	WACP message CRC mismatch on temperature module	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30201	This message is not implemented by the temperature module	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30202	This message is not supported by the temperature module	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30203	The temperature module has run out of memory.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30205	The temperature module received a invalid parameter	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30206	The parameter provided by the temperature module is outside of the allowable range for the specified message.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30207	The temperature module message requires an object, but did not contain one.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30208	The temperature module object provided with the message could not be deserialized.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30209	The temperature module object could not be serialized.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3020A	The temperature module message is performing a request/action when the module state prohibits the request/action.	Internal malfunction. If the problem persists, replace the module.	Very low

Message	Possible cause	Suggested action	Alarm priority
Temperature not functional. 3020B	The temperature module requested item is not currently available due to the module state.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30503	The temperature module factory settings, and calibration information is corrupt.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30504	The temperature module user settings are corrupt.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30509	The temperature module calibration is not set.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3050C	The temperature module error log is corrupt.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30516	A hardware malfunction on the temperature module has been detected.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30518	The temperature module power rail is too low.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30519	The temperature module power rail is too high.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3051A	The temperature module reference voltage circuit was detected to be under voltage or unstable.	Internal malfunction. If the problem persists, replace the module.	Very low
Ambient temperature out of range. Clear to retry. 30801	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 still persists, replace the module.	Very low
Ambient temperature out of range. Clear to retry. 30802	The temperature module measurement is above the allowable temperature values	Verify conditions are less than 104 °F or 40 °C. If conditions are valid and the problem persists, replace the probe. If the problem still persists, replace the module.	Very low

Message	Possible cause	Suggested action	Alarm priority
	and beyond the high ambient or patient limits.		
Temperature not functional. 30803	The temperature module internal calibration resistor (RCAL) on the board is damaged or contaminated (pulse too long).	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30804	The temperature module internal calibration resistor (RCAL) on the board is damaged or contaminated (pulse too short).	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30805	The temperature module internal circuit validation resistor (PTB) on the board is damaged (value is over).	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30806	The temperature module internal circuit validation resistor (PTB) on the board is damaged (value is under).	Internal malfunction. If the problem persists, replace the module.	Very low
Ambient temperature out of range. Clear to retry. 30807	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 still persists, replace the module.	Very low
Replace temperature probe. 30808	The temperature module probe was not characterized/ calibrated	Probe malfunction. Replace the probe. If the problem persists, replace the module.	Very low
Insert correct color-coded probe well. 30809	The temperature module is missing the probe well	Insert the probe well	Very low
Temperature not functional. 3080A	The temperature module has a problem saving to the monitor EEPROM in biotech mode	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3080B	The temperature module error detection	Internal malfunction. If the problem persists, replace the module.	Very low

Message	Possible cause	Suggested action	Alarm priority
	mechanism detected an error		
Replace temperature probe. 3080C	The temperature module probe error detection mechanism detected an error	Probe malfunction. Replace probe. If the problem persists, replace the module.	Very low
Temperature not functional. 3080D	The temperature module log error detection mechanism detected an error	Probe malfunction. Replace probe. If the problem persists, replace the module.	Very low
Temperature not functional. 3080E	The temperature module calibration error detection mechanism detected an error	Probe malfunction. Replace probe. If the problem persists, replace the module.	Very low
Connect temperature probe. 3080F	The temperature module detected no probe connected	Probe malfunction. Replace probe. If the problem persists, replace the module.	Very low
Replace temperature probe. 30810	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, replace the module.	Very low
Temperature not functional. 30811	The temperature module has an invalid events index	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30812	There is a problem reading the temperature module EEPROM or saving to the monitor EEPROM in biotech mode.	Internal malfunction. If the problem persists, replace the module.	Very low
Replace temperature probe. Code 30813	The temperature module has a problem reading the probe EEPROM.	Probe malfunction. Replace probe. If the problem persists, replace the module.	Very low
Temperature not functional. 30814	The temperature module TEMP CONFIG ACQUIRE FAILURE	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30815	The temperature module TEMP CONFIG RELEASE FAILURE	Internal malfunction. If the problem persists, replace the module.	Very low



Message	Possible cause	Suggested action	Alarm priority
Temperature not functional. 30816	The temperature module TEMP CONFIG INVALID PTR FAILURE	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30817	The temperature module internal error. EEPROM not initialized	Internal malfunction. If the problem persists, replace the module.	Very low
Unable to detect new temperature. Retry measurement. 30818	The temperature module heater indicates on when turned off.	Probe malfunction. Replace probe. If the problem persists, replace the module.	Very low
Unable to detect new temperature. Retry measurement. 30819	The temperature module heater indicates off when turned on.	Probe malfunction. Replace probe. If the problem persists, replace the module.	Very low
Temperature not functional. 3081A	The temperature module HTR_Q is on and HTRC is off but still has voltage.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3081B	The temperature module HTR_Q is tri-stated with HTRC enabled and has heater power.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3081C	The temperature module turned Q&C on and the heater voltage is not high enough.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3081D	The temperature module heater hardware failsafe should have turned off but did not.	Internal malfunction. If the problem persists, replace the module.	Very low
Replace temperature probe. 3081E	The temperature module probe is above 112°F or 43.3°C.	Probe malfunction. Replace probe. If the problem persists, replace the module.	Very low
Replace temperature probe. 3081F	The temperature module has excessive heater energy	Probe malfunction. Replace probe. If the problem persists, replace the module.	Very low
Temperature not functional. 30820	The temperature module host interface error	Internal malfunction. If the problem persists, replace the module.	Very low

Message	Possible cause	Suggested action	Alarm priority
Ambient temperature out of range. Clear to retry. 30821	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 still persists, replace the module.	Very low
Ambient temperature out of range. Clear to retry. 30822	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 still persists, replace the module.	Very low
Temperature not functional. 30823	The temperature module has an invalid SureTemp algorithm	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30824	The temperature module is over max battery volts	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30825	The temperature module is under min battery volts	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30826	The temperature module battery volts not set	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30827	The temperature module predict algorithm is not set	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30828	The temperature module ambient temp is not set	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 30829	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, replace the module.	Very low
Temperature not functional. 3082A	The temperature module is experiencing bad probe gain	Probe malfunction. Replace probe. If the problem persists, replace the module.	Very low
Temperature not functional. 3082B	The temperature module has a bad probe response value	Probe malfunction. Replace probe. If the problem persists, replace the module.	Very low
Temperature not functional. 03C800	The temperature module is not functional	Internal malfunction. If the problem persists, replace the module.	Very low

Message	Possible cause	Suggested action	Alarm priority
Temperature not functional. 03C900	Unable to deserialize messages from the temperature module	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 03CA00	Unsupported message received from the Temperature module	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 03CB00	Unable to send message to the Temperature module	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 03CC00	Temperature module communication times out	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 03CD00	Failed to upgrade the temperature module	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 03CE00	Unable to read PIM file	Retry the device update.	Very low
Temperature not functional. 03CE01	Upgrade file directory could not be accessed	Retry the device update	Very low
Direct mode reading timed out	None	None	Information
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.	Information
Temperature module reset. 03D000	Temperature sensor reset unexpectedly	None	Very low

## Braun 6000 messages

Message	Possible cause	Suggested action	Alarm priority
Temperature not functional. 3F0105	WACP message CRC mismatch.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3F0201	This message is not implemented by the module.	Internal malfunction. If the problem persists, replace the module.	Very low

<b>Message</b>	<b>Possible cause</b>	<b>Suggested action</b>	<b>Alarm priority</b>
Temperature not functional. 3F0202	This message is not supported by the module.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3F0203	The module has run out of memory.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3F0204	No parameter provided for the specified message.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3F0205	The parameter provided is invalid for the specified message.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3F0206	The parameter provided is outside of the allowable range for the specified message.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3F0207	The message requires an object, but did not contain one.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3F0208	The object provided with the message could not be deserialized.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3F0209	The object could not be serialized.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3F020A	The message is performing a request/action when the module state prohibits the request/action.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3F020B	The requested item is not currently available due to the module state.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3F0503	The factory settings, and calibration information is corrupt.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3F0504	The user settings are corrupt.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3F0509	The calibration is not set.	Internal malfunction. If the problem persists, replace the module.	Very low

Message	Possible cause	Suggested action	Alarm priority
Temperature not functional. 3F050C	The error log is corrupt.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3F0516	A hardware malfunction has been detected	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3F0518	The module power rail is too low.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3F0519	The module power rail is too high.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3F051A	The reference voltage circuit was detected to be under voltage or unstable.	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3F0821	The ambient temperature is too high		Very low
Temperature not functional. 3F0822	The ambient temperature is too low		Very low
Temperature not functional. 3F0824	The battery is over the maximum voltage	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3F0833	The sensor not functional	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3F0E04	Low battery	Recharge the battery. If the problem persists, check the battery.	Very low
Unable to detect new temperature. Retry measurement.	No temperature measurement was available from the thermometer at the time it was docked.	If a measurement should have been available, retry the measurement. If problem the persists, replace the module.	Information
Thermometer might be docked improperly. Check contacts and connections.	Communication failure with docked Braun	The thermometer might be docked improperly. Check contacts and connections. If problem the persists, replace the module.	Information
Temperature not functional. 3FFF01	Unrecognized WACP parameter received from sensor	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3FFF02	Timeout waiting for sensor response	Internal malfunction. If the problem persists, replace the module.	Very low
Temperature not functional. 3FFF03	Error deserializing WACP message received from sensor	Internal malfunction. If the problem persists, replace the module.	Very low

Message	Possible cause	Suggested action	Alarm priority
Temperature not functional. 3FFF04	WACP stack send message failure	Internal malfunction. If the problem persists, replace the module.	Very low
Re-dock Braun. 3FFF05	Anti-theft timer expired	Re-dock the thermometer after taking a measurement.	Very low

## Patient and clinician data messages

Message	Possible cause	Suggested action	Alarm priority
Unable to identify clinician. No provider configured at host.	Clinician authentication failure	Information status message; press OK button to dismiss.	Information
Unable to identify clinician. Security provider error.	Clinician authentication failure	Information status message; press OK button to dismiss.	Information
Unable to identify clinician. User not found.	Clinician authentication failure	Information status message; press OK button to dismiss.	Information
Unable to identify clinician. Invalid ID or system password.	Clinician authentication failure	Information status message; press OK button to dismiss.	Information
Unable to identify clinician. Account disabled/expired.	Clinician authentication failure	Information status message; press OK button to dismiss.	Information
Unable to identify clinician. Password expired/reset required.	Clinician authentication failure	Information status message; press OK button to dismiss.	Information
Unable to identify clinician. Group membership error.	Clinician authentication failure	Information status message; press OK button to dismiss.	Information
Unable to identify clinician. Touch Clear to delete all data.	Clinician authentication failure	Information status message; press OK button to dismiss.	Information
Unable to identify patient. Touch Clear to delete all data.	Patient authentication failure	Information status message; press OK button to dismiss.	Information
Database schema out of data; recreating.	The database was cleared due to a schema update	Information status message; press OK button to dismiss.	Information

<b>Message</b>	<b>Possible cause</b>	<b>Suggested action</b>	<b>Alarm priority</b>
Database is unreadable during startup; recreating. 1F0001	The database was unreadable during startup	Press OK button to dismiss.	Very low
Error accessing PDM database; restarting PDM. 1F0002	Database corrupted when device is in operation	Press OK button to dismiss.	Very low
Maximum number of patient records + Oldest record overwritten.	Data was deleted as it contained more than 400 records	Information status message; press OK button to dismiss.	Information
No data saved.	A manual save is not allowed	Information status message; press OK button to dismiss.	Information
Save successful.	A manual record was saved	Information status message; press OK button to dismiss.	Information
Patient ID required to save data.	A Patient ID is required to save data	Information status message; press OK button to dismiss.	Information
Patient ID required to start intervals.	A Patient ID is required to start intervals	Information status message; press OK button to dismiss.	Information
Clinician ID required to save data.	A Clinician ID is required to save data	Information status message; press OK button to dismiss.	Information
Clinician ID required to start intervals.	A Clinician ID is required to start intervals	Information status message; press OK button to dismiss.	Information
Patient ID required to save data.	A Patient ID match is required to save data	Information status message; press OK button to dismiss.	Information
Patient ID required to start intervals.	A Patient ID match is required to start intervals	Information status message; press OK button to dismiss.	Information
Clinician ID required to save data.	A Clinician ID match is required to save data	Information status message; press OK button to dismiss.	Information
Clinician ID required to start intervals.	A Clinician ID match is required to start intervals	Information status message; press OK button to dismiss.	Information
Unable to auto save.	The device was unable to auto save	Information status message; press OK button to dismiss.	Information
Barcode scan not accepted.	Barcode scanning is not available	Information status message; press OK button to dismiss.	Information

Message	Possible cause	Suggested action	Alarm priority
Invalid NIBP interval parameter during interval capture.	An invalid interval parameter was detected.	Information status message; press OK button to dismiss.	Information
Save successful.	The auto save is successful in Office Profile	Information status message; press OK button to dismiss.	Information
Unsent records: N of M	There are unsent records waiting when the device is powered down	Information status message; press OK button to dismiss.	Information
Barcode scanning is not available. Enter patient information manually.	Barcode scanning is not available. Enter patient information manually.	Information status message; press OK button to dismiss.	Information
Invalid SpO2 interval parameter during interval capture.	An invalid interval parameter was detected.	If SpO2 intervals are enabled and SpO2 clip was removed, either stop the intervals or reattach the SpO2 clip. Information status message; press OK button to dismiss.	Information

## Radio messages

Message	Possible cause	Suggested action	Alarm priority
Radio not functional. 350001	Deserialization failure. There is a software communication issue between the host and the radio	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350002	Permissions. There is an internal software error on the radio	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350003	Unsupported operating system. There is an internal software error on the radio	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350004	Unknown. There is an internal software error on the radio	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350006	Invalid authentication. There is an internal software error on the radio	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350008	Unknown SDC Error. There is an internal software error on the radio	Check for a software update and apply it. If still present, replace the radio.	Very low



Message	Possible cause	Suggested action	Alarm priority
Radio not functional. 350009	Invalid SDC configuration. There is an internal software error on the radio	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 35000a	Invalid SDC profile. There is an internal software error on the radio	Check for a software update and apply it. If still present, replace the radio.	Very low
Invalid radio configuration. Reconfigure and try again. 35000b	Invalid SDC WEP type. There is an internal software error on the monitor. Attempt to configure settings that don't apply in current authentication mode on radio	Check the radio configuration. If the problem is still present, reset the radio to factory defaults. If the problem persists, check for software update and apply it. If still present, replace the radio.	Very low
Invalid radio configuration. Reconfigure and try again. 35000c	Invalid SDC EAP type. There is an internal software error on the monitor: attempt to configure settings that don't apply in current authentication mode on radio	Check the radio configuration. If the problem is still present, reset the radio to factory defaults. If the problem persists, check for software update and apply it. If still present, replace the radio.	Very low
Invalid radio configuration. Reconfigure and try again. 35000d	Invalid SDC parameter. The Laird SDK rejects a parameter being configured.	Check the radio configuration. If the problem is still present, reset the radio to factory defaults. If the problem persists, check for software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 35000e	Unrecognized. There is a version compatibility error if the radio or the monitor adds new features and software upgrade of the radio fails after the monitor successfully updates	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 35000f	No statistics file. There is an internal software error on the radio indicating a Linux kernel error	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350010	Missing interface. There is an internal software error on the radio indicating a Linux kernel error or failure to initialize the network interface	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350011	Unknown interface. There is a software communication issue between the host and the radio	Check for a software update and apply it. If still present, replace the radio.	Very low
Invalid radio configuration. Reconfigure and try again. 350012	Invalid WEP key length. WEP keys should be 10 or 26 characters long.	Check the radio configuration. If the problem is still present, reset the radio to factory defaults. If the problem persists, check for software	Very low

Message	Possible cause	Suggested action	Alarm priority
		update and apply it. If still present, replace the radio.	
Invalid radio configuration. Reconfigure and try again. 350013	Not in EAP mode. There is an internal software error on the monitor: attempt to configure settings that don't apply in current authentication mode on radio	Check the radio configuration. If the problem is still present, reset the radio to factory defaults. If the problem persists, check for software update and apply it. If still present, replace the radio.	Very low
Invalid radio configuration. Reconfigure and try again. 350014	Invalid inner EAP method. There is an internal software error on the monitor: attempt to configure settings that don't apply in current authentication mode on radio	Check the radio configuration. If the problem is still present, reset the radio to factory defaults. If the problem persists, check for software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350015	Out of memory. There is an internal software error on the radio	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350016	Invalid log level. There is a software communication issue on the radio	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350017	Certificate path too long. There is an internal software error on the radio. The radio has a fixed path length	Check for a software update and apply it. If still present, replace the radio.	Very low
Invalid radio configuration. Reconfigure and try again. 350018	Missing client certificate. The radio attempted to configure for an EAP mode that requires a client certificate and no certificate is installed	Check the radio configuration. If the problem is still present, reset the radio to factory defaults. If the problem persists, check for software update and apply it. If still present, replace the radio.	Very low
Invalid radio configuration. Reconfigure and try again. 350019	Missing CA certification. The radio attempted to enable server validation and CA certification is missing	Check the radio configuration. If the problem is still present, reset the radio to factory defaults. If the problem persists, check for software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 35001e	MAC request failed. There is an internal software error on the radio indicating a Linux kernel error or a failure to initialize the network interface	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 35001f	Invalid power mode. There is an internal software error on the radio	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350020	Post results missing. There is an internal software error on the radio	Check for a software update and apply it. If still present, replace the radio.	Very low

Message	Possible cause	Suggested action	Alarm priority
Radio not functional. 350021	Post results format. There is an internal software error on the radio	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350025	Unrecognized component. There is a version compatibility error if the radio or the monitor adds new features and software upgrade of the radio fails after the monitor successfully updates	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350027	Missing release file. There is an internal software error on the radio with a missing file	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350028	Not ready. Displays when logging verbosity is turned on	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350029	Disconnected. There is a software communication issue between the host and the radio. Socket connection is down	Check for a software update and apply it. If still present, replace the radio.	Very low
Invalid radio configuration. Reconfigure and try again. 35002a	Invalid parameter. There is a software issue on the monitor while trying to configure radio	Check the radio configuration. If the problem is still present, reset the radio to factory defaults. If the problem persists, check for software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 35002b	Timeout. There is a software communication issue between the host and the radio	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 35002c	Socket error. There is a software communication issue between the host and the radio	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 35002e	Cannot parse DHCP lease. There is an internal software error on the radio (error reading and converting DHCP lease file)	Check for a software update and apply it. If still present, replace the radio.	Very low
Invalid radio configuration. Reconfigure and try again. 350032	Invalid certificate password. The radio is misconfigured with a password that does not match the certificate.	Check the radio configuration. If the problem is still present, reset the radio to factory defaults. If the problem persists, check for software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350033	Serialization failure. There is an internal software error on the radio or the monitor	Check for a software update and apply it. If still present, replace the radio.	Very low

Message	Possible cause	Suggested action	Alarm priority
Radio not functional. 350034	Missing PAC file. There is a misconfiguration of the radio (configured for EAP-FAST and manual PAC but none supplied)	Check the radio configuration. If the problem is still present, reset the radio to factory defaults. If the problem persists, check for software update and apply it. If still present, replace the radio.	Very low
Invalid radio configuration. Reconfigure and try again. 350035	Invalid PAC file password. There is a misconfiguration of the radio (configured for EAP-FAST and manual PAC but password for PAC is incorrect)	Check the radio configuration. If the problem is still present, reset the radio to factory defaults. If the problem persists, check for software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350036	Invalid BSSID format. There was an internal software error on the radio (related to AP scan feature, may not occur with current Laird software)	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350037	Unknown certificate ID. There is an internal software error on the monitor: attempt to query a certificate status for a certificate that does not exist	Check the radio configuration. If the problem is still present, reset the radio to factory defaults. If the problem persists, check for software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350038	Certificate information absent. The device queries certificate status for a certificate that isn't installed on the radio.	Check the radio configuration. If the problem is still present, reset the radio to factory defaults. If the problem persists, check for software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350039	Invalid sequence number. The device queries certificate status fragment that does not exist.	Check the radio configuration. If the problem is still present, reset the radio to factory defaults. If the problem persists, check for software update and apply it. If still present, replace the radio.	Very low
Invalid radio configuration. Reconfigure and try again. 35003c	CCKM not allowed. There is an attempt to use CCKM when not in WPA-Personal or WPA2-Enterprise modes	Check the radio configuration. If the problem is still present, reset the radio to factory defaults. If the problem persists, check for software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 35003d	Send failure. The radio failed to send a message to the host	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 35003e	Unable to store global configuration settings to the backup file	Check for a software update and apply it. If still present, replace the radio.	Very low

Message	Possible cause	Suggested action	Alarm priority
Radio not functional. 35003f	Configuration hookup. There is an internal software error on the radio	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350041	Unable to configure DHCP 60 on the radio	Check the radio configuration. If the problem is still present, reset the radio to factory defaults. If the problem persists, check for software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350042	DHCP option corrupt. The DHCP option file is not in the expected format	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350043	Cannot delete file. There is an internal software error on the radio (occurs for Option 60 upload and factory default)	Check for a software update and apply it. If still present, replace the radio.	Very low
Radio not functional. 350046	Invalid SDC value. There is a software issue on the when trying to configure the radio.	Check for a software update and apply it. If still present, replace the radio.	Very low
Unable to establish network communications. Radio out of network range. 350100	No IP address after 30 seconds. Unable to associate.	Check ESSID and radio mode settings.	Very low
Invalid radio configuration. Reconfigure and try again. 350200	No IP address after 30 seconds. Unable to authenticate	Check radio security settings.	Very low
Radio card DHCP timeout. 350300	No IP address after 30 seconds. Unable to obtain DHCP address.	Check DHCP server settings.	Very low
Lost network communications. Radio out of network range. 350400	Radio lost association	Ensure the access point is still powered on and in range.	Very low
Radio not functional. 350500	POST failure	Power cycle the device and re-enable the radio. If the problem persists, replace the radio.	Very low
Radio software upgrade failed. 350600	The radio software upgrade failed.	Restart the monitor.	Information
Radio certificate is out of date. 350800	Indicates that the radio certificate is out of date. The clock may be incorrect causing the certificate to not be in the valid date range.	Clock needs to be set properly, or the certificate needs to be updated.	Very low

Message	Possible cause	Suggested action	Alarm priority
Certificate load successful.	The radio customer certificate was successfully loaded from the host	None.	Information
Certificate load failed.	The radio customer certificate was not loaded	Try again.	Information

## Connectivity messages

Message	Possible cause	Suggested action	Alarm priority
Unable to obtain wired device IP address. 210000	No wired connection	Verify DHCP functionality and configuration.	Very low
Network not found; check network cable connection. 210100	Lost ethernet DHCP address	Check wired connection into device then verify DHCP functionality and configuration.	Very low
Unable to communicate with NRS. 360000	Cannot communicate with NRS	Verify NRS IP configuration and functionality.	Very low
Communication error with host. 1A0000	Communication timeout failure with external Host	Verify the external host services are loaded and started on the server. If the problem persists, check for available software upgrades of the monitor or the system.	Very low
Data rejected. CRC mismatch. 1A0001	The WACP stack has detected a CRC mismatch in the message	Check the data and try again. If the problem persists, contact your system administrator.	Very low
Data rejected. Unsupported message. 1A0002	External Host NACK - The host does not support the message/object.	Check the monitor and try again. If the problem persists, contact your system administrator.	Very low
Data rejected. Invalid parameter. 1A0003	The message has an invalid parameter.	Check the data and try again. If the problem persists, contact your system administrator.	Very low
Data rejected. Deserialize the object. 1A0004	The monitor failed to deserialize the object.	Check the data and try again. If the problem persists, contact your system administrator.	Very low
Data rejected. Unsupported message. 1A0005	The host is in a state that cannot accept the message.	Check the data and try again. If the problem persists, contact your system administrator.	Very low
Data rejected. Patient ID required. 1A0006	The message has a missing patient ID	Add the patient ID to the record.	Very low

Message	Possible cause	Suggested action	Alarm priority
Data rejected. Clinician ID required. 1A0007	The message is missing a clinician ID	Add the clinician ID to the record.	Very low
Data rejected. Time mismatch. 1A0008	The message has a mismatched time	Ensure that the clock on the monitor and the server match.	Very low
Unable to establish network communications. 1A0009	No network connection is available	Connect the device to an active network so that the clinician ID can be imported.	Very low
No connection for send.	No connection for send.	None	Information
Send not successful.	Send not successful.	None	Information
Error in record. Try again	Connectivity NACK received for NRS/ECS/CS/NCE	NRS/ECS/CS/NCE NACK that is record specific and can be fixed by a clinician in the next record	Information
Send successful.	Data was successfully sent over USB/BT	None	Information

## System messages

Message	Possible cause	Suggested action	Alarm priority
000001	System failure	Restart the monitor	N/A
000002	System failure	Restart the monitor	N/A
000003	System failure	Restart the monitor	N/A
000004	System failure	Restart the monitor	N/A
000005	System failure	Restart the monitor	N/A
000006	System failure	Restart the monitor	N/A
Internal hardware failure.	The kernel image is corrupt, restart not possible	Replace the main PCBA.	N/A
Internal hardware failure.	The root file system is corrupted, restart not possible	Restart the monitor. If the problem persists, replace the main PCBA.	N/A
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.	Very low

Message	Possible cause	Suggested action	Alarm priority
Internal hardware failure.	SPL memory test failure, the monitor will sound an SOS pattern	Restart the monitor. If the problem persists, replace the main PCBA.	N/A
Internal hardware failure. 1C1000	The monitor PIC communications never starts or quits. The communication won't reasonably recover at startup or during operation	Restart the monitor. If the problem persists, replace the main PCBA.	N/A
Low battery 30 minutes or less remaining. 1C1005	The battery power is low	Connect the power supply to AC power to charge the monitor.	Very low
Low battery 5 minutes or less remaining. 1C1006	The battery power is extremely low	Connect the power supply to AC power to charge the monitor.	High
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 monitor.	High
Update unsuccessful. Reboot and retry. 1C1008	The software update failed	Restart the monitor. If the problem is still present, replace the main PCBA.	Very low
Host battery not charging. 1C100A	The host battery is not charging	Restart the monitor. 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.	Very low
Factory default settings now active. 3A0001	The factory configuration settings are active	The monitor has been configured to factory defaults, any user settings have been reset.	Very low
Unable to read configuration from USB. 3A0002	Unable to load file from the external USB memory device.	Retry the USB connection. If the problem is still present, check for a proper format of the USB drive. If the problem is still present, replace the USB device. If the problem persists, replace the main PCBA.	Very low
Internal hardware failure. Device will shut down. 1C100D	Power supply issue. The PMIC is too hot	Check the operating environment temperature. Allow the monitor 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.	Very low



Message	Possible cause	Suggested action	Alarm priority
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 monitor 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.	Very low
Unexpected restart occurred. 1C1012	The monitor unexpectedly restarted	Continue normal operation	High
Audio system not functional 1D0100	The speaker or audio codec is faulty	Replace speaker. If the problem is still present, replace the main PCBA.	Very low
CSM battery is not installed. 1C100E	There is no battery in the monitor	Check the monitor for a battery and install one if it is missing. If the problem is still present, perform diagnostic checks on the monitor. If the problem persists, replace the main PCBA.	Very low
Device shutdown is not available at this time	System shutdown failure	Monitor cannot perform an immediate shutdown. Disconnect AC power and remove battery.	Information
No valid files found	No valid files were found on the USB flash drive	Re-insert the USB flash drive with valid files.	Information
Firmware update successful.	The software successfully updated	Information status message; press OK button to dismiss.	Information
Audio alarms are off.	The monitor alarm audio is off	Information status message; press OK button to dismiss.	Information
Advanced settings unavailable.	The advanced settings are unavailable because the monitor is not in an idle state	Confirm that no sensors are attached to the monitor, no alarms are active, and there is no unsaved data in the Spot or Intervals profile.	Information
USB accessory disconnected.	The USB device was disconnected from the monitor	Information status message; press OK button to dismiss	Information
Advanced settings	The Advanced settings code was entered correctly	Information status message; Exit Advanced settings to dismiss.	Information
Save not successful.	The device configuration or logs were not saved to the USB device	Information status message; press OK button to dismiss	Information
Save successful.	The device configuration or logs were saved to the USB device	Information status message; press OK button to dismiss	Information
Software upgrade is downloading. Do not shutdown.	The monitor is downloading a software update	Information status message; press OK button to dismiss	Information

Message	Possible cause	Suggested action	Alarm priority
Factory reset successful.	The monitor was reset to factory settings	Information status message; press OK button to dismiss	Information
Factory reset failed. Custom configuration file not deleted.	The monitor factory reset has failed.	Information status message; Exit Advanced settings to dismiss.	Information
Configuration upload successful.	The device configuration has successfully uploaded	Information status message; press OK button to dismiss	Information
Unable to load configuration; using factory defaults.	The device configuration was not successfully uploaded	Information status message; Exit Advanced settings to dismiss.	Information

## Software update messages

Message	Possible cause	Suggested action	Alarm priority
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.	Information
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.	Information
Software Update: Invalid token file.	There was an invalid token file	Verify and update the token file.	Information
Software Update: Unable to find manifest file on server.	The manifest file was not found on the server	Verify the manifest file is on the server.	Information
Software Update: Unable to verify manifest file signature.	The manifest file signature verification failed.	Regenerate the software package and retry.	Information
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.	Information
Software Update: Unable to find package file.	The package file cannot be found	Verify the package file is on the server.	Information
Software Update: Installation failed. Reboot and retry.	At least one of the sub systems failed to install	Restart the monitor.	Information

Message	Possible cause	Suggested action	Alarm priority
Software Update: Upgrade unsuccessful. Insufficient disk space.	The partition is running out of space	Free up adequate space needed to perform the upgrade.	Information
Software Update: Update unsuccessful. Incompatible firmware.	The current firmware version is lower than the one required by the token file	Try to update to an earlier software package.	Information
Software Update: SWUP internal error	SWUP NIBP is not functional	Information status message; click OK button to dismiss.	Information
Software Update: Manager internal error	The Software Update manager is not functional	Information status message; click OK button to dismiss.	Information
Radio software upgrade failed. 350600	The radio software was not upgraded.	Check for software update and apply it. If message is still present, replace the radio.	Very low

## Bluetooth® messages

Message	Possible cause	Suggested action	Alarm priority
<i>Bluetooth</i> not functional. 370001	The monitor detected a <i>Bluetooth</i> device that is not functional	Reboot the monitor. If the problem persists, replace the <i>Bluetooth</i> radio. If the problem persists, replace the main PCBA.	Very low
<i>Bluetooth</i> not functional. 370002	The monitor cannot detect a <i>Bluetooth</i> module	Replace the <i>Bluetooth</i> radio. If the problem persists, replace the main PCBA.	Very low
<i>Bluetooth</i> device connection successful	The <i>Bluetooth</i> device connected	None.	Information
N/A	The Bluetooth device failed to pair with the monitor.	Verify a successful pairing between the device and the PC. If the problem is still present, verify the Bluetooth signal strength. If the problem persists, verify authentication code, verify the computer hardware and configuration. If the problem persists, verify if the computer has prior pairing information for the monitor.	Very low
N/A	The Bluetooth device failed to pair with the monitor.	Version of stack on the PC does not support simple secure pairing. The device requires 2.1+EDR Bluetooth stack on the host PC.	Very low
Bluetooth device connection successful	The Bluetooth device connected	None.	Information

Message	Possible cause	Suggested action	Alarm priority
N/A	The Bluetooth device did not connect with the monitor	BT device connection dropped due to distance, application crash on host end. OR RF connection not possible OR RF connection possible, but cannot find device OR BT connection was established, but WACP connection not possible	N/A
Bluetooth device disconnected	The Bluetooth disconnected	None.	Information

## APM messages

Message	Possible cause	Suggested action	Alarm priority
APM not functional. 1C1001	The APM is detected as connected but there is no communication through the APM serial port	Restart the monitor and the APM. If the problem is still present, check the cable connections from the monitor to APM. If the problem still present, replace the APM. If the message persists, replace the main PCBA on the monitor.	Very low
APM not functional. 1C100B	The APM battery is installed, but does not communicate with the monitor	Perform diagnostic checks on the monitor. If the problem is still present, replace the APM battery. If the problem still present, replace the APM. If the message persists, replace the main PCBA on the monitor.	Very low
APM battery is absent or faulty. 1C100F	The APM battery is not installed	Ensure than an APM battery is installed, and install one if it is missing. If the problem is still present, perform diagnostic checks on the monitor. If the problem is still present, replace the APM. If the message persists, replace the main PCBA on the monitor.	Very low
The APM is disconnected. 1C1002	The APM is unplugged from the monitor while the monitor is powered on	Restart the monitor and the APM. If the problem is still present, check the cable connections from the monitor to APM. If the problem still present, replace the APM. If the message persists, replace the main PCBA on the monitor.	Very low

Message	Possible cause	Suggested action	Alarm priority
USB cable is disconnected. 1C1003	The APM USB hub is unplugged from the monitor while the monitor is powered on	Restart the monitor and the APM. If the problem is still present, check the cable connections from the monitor to APM. If the problem still present, replace the APM. If the message persists, replace the main PCBA on the monitor.	Very low
APM is plugged in.	The APM was plugged in while the monitor is powered on.	Restart the monitor and the APM. If the problem is still present, check the cable connections from the monitor to APM. If the problem still present, replace the APM. If the message persists, replace the main PCBA on the monitor.	Information
APM not functional. 1C1010	The APM USB hub is plugged in while the monitor communication cable is disconnected	Restart the monitor and the APM. If the problem is still present, check the cable connections from the monitor to APM. If the problem still present, replace the APM. If the message persists, replace the main PCBA on the monitor.	Very low
APM not functional. 1C1004	The APM PIC cannot communicate with the accelerometer	Restart the monitor and the APM. If the problem is still present, check the cable connections from the monitor to APM. If the problem still present, replace APM. If the message persists, replace the main PCBA on the monitor.	Very low
APM not functional. 1C1009	The APM PIC software update and any retries have failed	Restart the monitor and the APM. If the problem is still present, check the cable connections from the monitor to APM. If the problem still present, retry the software update. If still present, replace the APM. If the message persists, replace the main PCBA on the monitor.	Very low
APM not functional. 1C100B	The APM battery is not recharging	Restart the monitor and the APM. If the problem is still present, check the cable connections from the monitor to APM. If the problem still present, replace the APM. If the message persists, replace the main PCBA on the monitor.	Very low
APM not functional.	The APM USB changes from unplugged to plugged after monitor startup	Restart the monitor and the APM. If the problem is still present, check the cable connections from the monitor to APM. If the problem still present, retry the software update. If still present, replace the APM. If the message persists, replace the main PCBA on the monitor.	Information

<b>Message</b>	<b>Possible cause</b>	<b>Suggested action</b>	<b>Alarm priority</b>
Device is operating in battery mode.	AC power cord has been disconnected.	Information status message; press OK button to dismiss.	Information
Sleep mode is unavailable. Intervals monitoring is in progress.	Sleep mode is not allowed when intervals are in progress	Stop any active intervals.	Information
Sleep mode is unavailable. An alarm is active.	Sleep mode is not allowed when alarms are active	Clear all active alarms.	Information
Display lock is unavailable. Missing patient context.	Lockout is not allowed without active patient information	Enter patient information	Information
Power cable is disconnected. 1C1011	The APM communication cable is plugged in while the APM USB cable is disconnected	Restart the monitor and the APM. If the problem is still present, check the cable connections from the monitor to APM. If the problem still present, retry the software update. If still present, replace the APM. If the message persists, replace the main PCBA on the monitor.	Very low

# Connex Direct

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## Introduction

Follow these steps to:

- set up an Active Directory connection for clinician authentication
- set up an NTP connection for date/time synchronization
- install wireless network radio certificates
- set up an HL7<sup>®</sup> Direct Connection to enable a Welch Allyn device to directly send patient queries and vitals to an EMR

Active Directory and HL7 (Direct EMR Connection) features are used to identify, authenticate, and authorize users/clinicians via clinician query from the device.

These instructions apply to the following device(s):

- Connex<sup>®</sup> Spot Monitor (CSM), Version 1.32.01 or higher

## Related documents

When using this manual, refer to the following:

- *Welch Allyn Network Installation Best Practices 80018745*
- *Welch Allyn Vitals Device HL7 Interface 60080809 IDS*
- *Welch Allyn<sup>®</sup> Configuration Tool Reference guide 80027311*
- 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/>
- Hillrom website: [hillrom.com](http://hillrom.com)

## Definitions

Acronym/Term	Description
AD	A directory service developed by Microsoft for providing tree-structured information. Used for authenticating and authorizing users of the device.

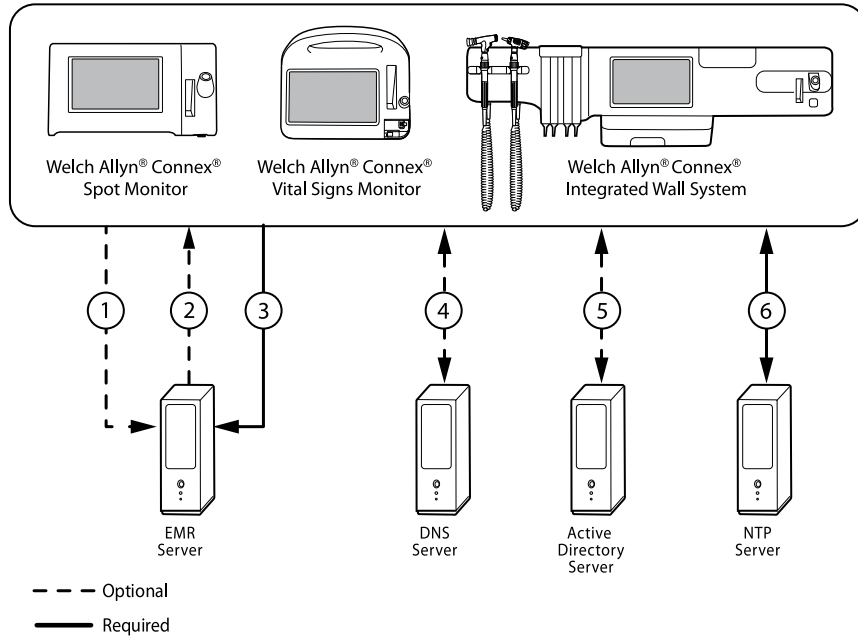
Acronym/Term	Description
Clinician Authentication	Workflow feature where a clinician is required to log in to the device. The device will assure a clinician's credentials are valid by providing an interface where the clinician logs in to the device using their ID and password, and the ID and password are validated by an authority system on the network (e.g. Active Directory).
Clinician Identification	Workflow feature where the clinician enters their ID into the device so the Clinician ID can be logged with the vitals.
Clinician Identifier	Configurable to be the clinician's User name, Account name, or Employee ID.
CSM	Connex Spot Monitor: A Welch Allyn device that supports NIBP; Temperature (SureTemp Plus and Braun); SpO2 (Nellcor; Masimo, and Nonin); Weight, Height, and BMI; Pain; and other configured parameters.
DC	Domain Component – In LDAP servers and Active Directory, a dotted domain name is split into domain components that form "dc=component" pairs separated by commas. Example: ad.welchallyn.com in an AD server will be "dc=ad,dc=welchallyn,dc=com"
FQDN	Fully Qualified Domain Name. The complete domain name of a computer on the Internet. Contains the host name and the full domain.
Gateway Software	A software application that can receive data from a device and convert the data to HL7 messages and then transmit that data via a TCP/IP socket.
HL7	Health Level 7 – A framework for the exchange, integration, sharing, and retrieval of electronic health information.
Host HL7 System or Host Application	Software System that receives the HL7 data from the device.
IDS	Interface Design Specification
LDAP	Lightweight Directory Access Protocol – An industry standard protocol for maintaining distributed directory information. Often used for user names and password information.
NTP	Network Time Protocol is a networking protocol for clock synchronization between computer systems. It is used by the devices to maintain accurate date/time in the devices.
Patient Confirmation	The act of the device configuration/behavior ensuring that the vitals record contains the patient context.
Patient Identification	The act of the device configuration/behavior that displays the patient context on the device and that



Acronym/Term	Description
SSL	allows the clinician to ensure the right vitals go to the right patient.
Vitals Device	Secure Sockets Layer– A set of cryptographic protocols to provide security of communications over a network. SSL is a predecessor to TLS.
X.509 Certificate	Generic names for CSM, CVSM, and CIWS.
	An X.509 certificate is a digital certificate that uses the widely accepted international X.509 public key infrastructure (PKI) standard to verify that a public key belongs to the user, computer or service identity contained within the certificate.

## Architecture

\*Optional setting within the device.




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### Server

#### EMR Server

- 1 Patient Query HL7 (QRY^A19) AES-128\*
- 2 Patient Demographics HL7 (RSP^K22) AES-128\*
- 3 Vitals HL7 (ORU^R01) AES-128\*

#### DNS Server

- 4 DNS Lookup

#### Active Directory Server

- 5 Clinician Authentication

#### NTP Server

- 6 Date/Time Synchronization
-

## Technical Specifications

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### Ports

Listening Port(s)	A single TCP/IP listening port on the EMR (or external server) needs to be available to receive connections from multiple devices.
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### Computer Requirements

NTP Message Frequency	The NTP host solution(s) must be capable of processing time synchronization requests every 36 seconds (see IDS for calculation details).
Active Directory Message Frequency	The host solution(s) must be capable of processing clinician authentication requests every 36 seconds (see IDS for calculation details).
Patient Lookup and/or Vitals Send	The host solution(s) must be capable of processing patient lookup requests every 1.2 seconds (see IDS for calculation details).

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### Network

Internet Connection	An Internet connection may be required depending on how NTP is configured. If NTP is configured to use an external time server (e.g., time.nist.gov), then the device must be able to connect to the Internet.
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### Device Support

Quantity	Some systems may scale up to and potentially beyond 400 devices, depending on the clinical environment.
Device(s)	Connex Spot Monitor (CSM) with software version 1.30 or higher

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## Active Directory setup

### Prerequisites:

- Confirm that the Date and Time are set correctly on the device.



**NOTE** This ensures that the device Date and Time fall between the Certificate Authority (CA) Root Certificate validity period for successful connection.

- Load the CA Root Certificate on the device and the Server Certificate on the Active Directory Server.



**NOTE** The connection to the Active Directory Server might fail due to a missing CA Root Certificate on the device and a missing Server Certificate on the AD Server. (See: "Import/Install an Active Directory server certificate on the Active Directory server" and "Import/Install a Certificate Authority (CA Root certificate on the Active Directory server"). A CA can be either: Third-Party (GoDaddy, Symantec, Comodo) or Self-Signed - Internal CA (AD CS)

- Check the DNS Server IP assignment on the device via DHCP or Static configuration.
  - Make sure that the assigned DNS Server(s) on the device can successfully query for the Domain Name entered on the Active Directory User Interface.

#### CA Root Certificate format

- The CA Root Certificate can be either in PEM or DER format and can have extensions: ".pem", ".der", ".crt", or ".cer".
- These certificate files are converted into PEM format during the load process on the device.

## Specify Active Directory settings

1. Access the Advanced Settings.
  - a. Touch the **Settings** tab.
  - b. Touch the **Advanced** tab.
  - c. Enter your password and touch **OK**.  
The General tab appears.
2. Touch the **Network** tab.
3. Touch the **Active Directory** tab.

## Active Directory settings

- Enable Active Directory (Turn the feature On or Off).



**NOTE** The device always uses TLS to encrypt communications between the Active Directory Server and the device. If an encrypted connection cannot be established, the device will not communicate with the server.



**NOTE** As part of establishing the TLS connection, the device software requests an X.509 certificate from the Active Directory Server and validates it against a stored CA Root certificate. If the AD Server cannot be validated, the device will not continue communications with the Active Directory Server.

## Domain Name

The Domain Name is the domain namespace of the server.

1. Touch the keyboard in the *Domain name* text field.

FQDN consists of the Host name and Domain name.

Examples:

- <DomainName>
- someDomain.com
- hillrom.com
- service.hillrom.com

## Group

Select the Group to which the clinician must belong to be Authenticated.

1. Touch the keyboard in the *Group* text field.
- If the Group field is blank, a group will not be checked.
  - If there is a value, the query will check for a Group match. This is an alpha-numeric string.

Examples:

- ServiceGroup
- Service Group 1

## Clinician ID type

Clinician ID type is selected from a dropdown menu of the 3 listed options. (User name, Account name, or Employee ID). These options correspond to the common fields in the Active Directory.

1. Touch the dropdown menu in the *Clinician ID type* field.
- The device performs a match by using the selected option when the Clinician logs into the device.
  - The setting for the Clinician ID type is based on the facility policy. The facility policy determines how employees are expected to log into a device and what is encoded in a barcode if using barcodes.

Examples:

- "userPrincipalName" (**User name**)
- "SAMAccountName" (**Account name**)

	"employeeid" ( <b>Employee ID</b> )
User name	A string attribute that contains the user account name and DNS Domain name combined.
Account name	Examples:  <UserAccountName>@<DomainName>  serviceUser@hillrom.com
	A SINGLE-VALUE attribute that is the user account name only. Examples:  <UserAccountName>  serviceUser
Employee ID	Is the user's employee ID stated on the Active Directory Server. Examples:  <employeeID>  1234567890

## Authentication user name

Authentication username Is the name of a user with authority to perform clinician searches on the Active Directory Server. This is an Alpha-numeric string.

1. Touch the keyboard in the *Authentication user name* text field.

Examples:                      UserName@DomainName.com  
  
   Administrator@hillrom.com

## Authentication password

Authentication password is the password of the Authentication Username. This is an Alpha-numeric string and case sensitive.

1. Touch the keyboard in the *Authentication password* text field.

Example:                      P@ssW@rd!23

## Search subtree

The Search subtree searches for a Clinician in an "Organizational Unit" (OU). An Organizational Unit (OU) is a subdivision within an Active Directory into which you can place Users, Groups, Computers, and other Organizational Units.

The Search subtree field should be empty if you are just querying for a Clinician in the Domain/ SubDomain Users or Group.

1. Touch the keyboard in the *Search subtree* text field.

Examples: OU=OUname, DC=DomainPrefix, DC=DomainSuffix  
 OU=someOU, DC=someDomain, DC=com  
 OU=serviceOU, DC=hillrom, DC=com  
 OU=serviceOU, DC=eastcoast, DC=hillrom, DC=com

### Test network connection

Perform a lookup of the Default Naming Context to test the network connection to the Active Directory Server and to test the use of the Administrator user name and password, and domain lookup.

1. Touch **Test network connection** to test the connection from the device to the Active Directory Server.

### CSM

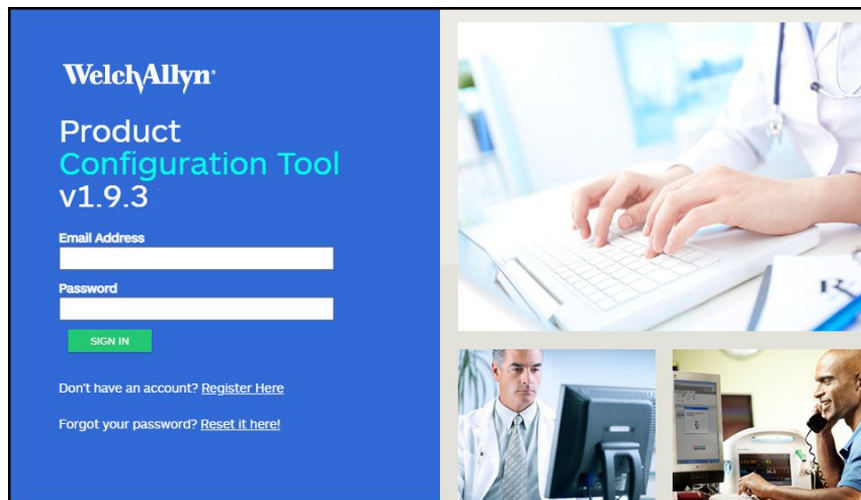
Load CA Root Certificate via Configuration file (someConfigFile-signed.waconfig) generated by WA Configuration Tool.

### Log into the Configuration Tool

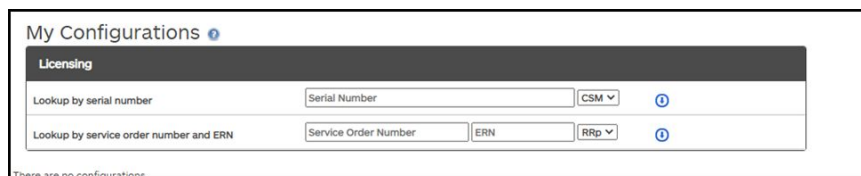
1. Log into the Configuration Tool at this link:

<https://config.welchallyn.com/configurator/>.

Enter your Email Address and Password and click **SIGN IN**.



The *My Configurations* screen appears.



## Configure a CA Root certificate using the Configuration Tool

Select the product that you would like to configure.

You can now load self-signed security certificates onto the Connex Spot Monitor (CSM) to ensure secure communication with an authenticated server on the network.

CSM is also pre-loaded with the following certificates:

Go\_Daddy\_Class\_2\_Certification\_Authority.pem  
 Symantec\_Class\_3\_Public\_Primary\_Certification\_Authority\_-\_G6.pem  
 VeriSign\_Class\_3\_Public\_Primary\_Certification\_Authority\_-\_G4.pem  
 VeriSign\_Class\_3\_Public\_Primary\_Certification\_Authority\_-\_G5.pem  
 VeriSign\_Class\_3\_Public\_Primary\_Certification\_Authority\_-\_G3.pem  
 COMODO\_ECC\_Certificate\_Authority.pem  
 COMODO\_Certificate\_Authority.pem  
 Symantec\_Class\_3\_Public\_Primary\_Certification\_Authority\_-\_G4.pem  
 Go\_Daddy\_Root\_CertificateAuthority\_-\_G2.pem  
 COMODO\_RSA\_Certificate\_Authority.pem  
 VeriSign\_Universal\_Root\_Certification\_Authority.pem

### To add a certificate from your computer:

1. From the main screen, click the **New Configuration** tab.
2. Use the drop down menu to select **CA Root certificate**.
3. Provide a name for the configuration by typing in the field to enter a user friendly name and then click **CONTINUE**.

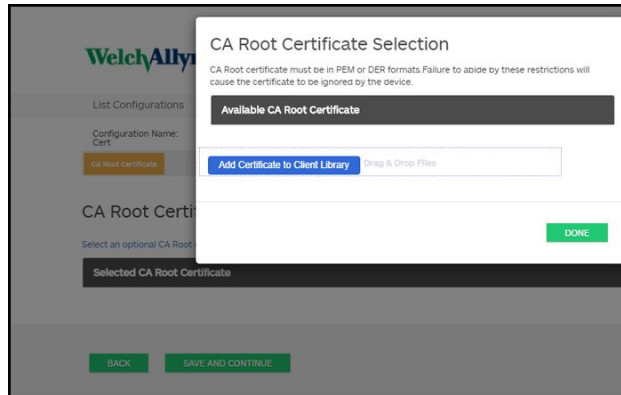
The screenshot shows the 'New Configuration' screen. At the top, there are three tabs: 'List Configurations', 'New Configuration' (which is circled), and 'Customer Verification'. Below the tabs, the title 'New Configuration' is displayed. Underneath, there is a prompt: 'Select the product that you would like to configure.' followed by a dropdown menu with 'CA Root certificate' selected. Below that is another prompt: 'Provide a user friendly name for your configuration.' followed by a text input field containing the text 'Certs'. At the bottom of the form is a green button labeled 'CONTINUE'.

4. Select the Product Use Location. (Choices include: Hospital or Physicians Office or Clinic.)
5. Click **SAVE AND CONTINUE**.
6. Click **CA Root Certificate**.

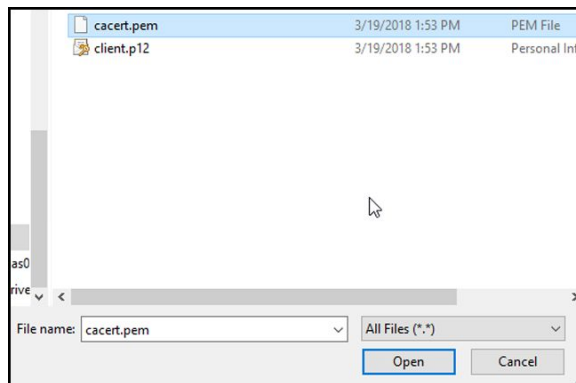
The screenshot shows the 'CA Root Certificate Setting' screen. At the top, there is a 'Configuration Name:' field with the value 'Cert'. To the right of this field are two buttons: 'Summary' and 'IT (Required)'. Below this is a dropdown menu with 'CA Root Certificate' selected. The title 'CA Root Certificate Setting' is displayed. Underneath, there is a prompt: 'Select an optional CA Root certificate.' followed by a text input field containing the text 'Selected CA Root Certificate'. At the bottom of the form are two green buttons: 'BACK' and 'SAVE AND CONTINUE'.

7. Click **Select an optional CA Root Certificate**.



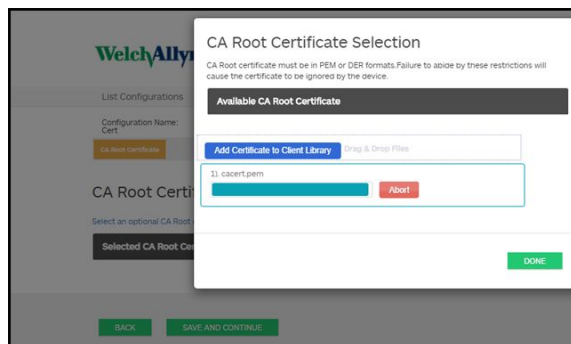


8. Click **Add Certificate to Client Library**.
9. Navigate to the .pem file, or .der file, location using your computer's Windows File Explorer window. (The sample screen shows a .pem file type.)



Select the file and click **Open**.

10. Select **DONE**.



11. Click **SAVE AND CONTINUE**.

## Active Directory - setup details (best practices)

### Prerequisites

Set up the Active Directory and the DNS Servers and ensure that your version supports this feature.

The following sections describe how to configure and use the device's Active Directory feature for clinician authentication.

## Configuration support for the Active Directory

### Install required certificates

For the device to connect to Active Directory, you need to include the Active Directory CA (Certificate Authority) Root Certificate in the device configuration.



**NOTE** The connection to Active Directory Server might fail because of: A missing **CA Root Certificate** on the device, an incorrect format certificate on the device (cacert.cer certificates are not recognized by the CSM wireless radio), or by a missing **server certificate** on the Active Directory Server. To authenticate with the Active Directory Server, CSM should have a CA root certificate from the same Certificate Authority (CA) that issued a server certificate to the Active Directory Server.



**NOTE** The CA Root Certificate must be in PEM or DER formats. Failure to abide by these restrictions will cause the device to ignore the certificate.

Examples of CA (Certificate Authority) include:

- Third party (GoDaddy, Symantec, Comodo, etc.)

or

- Internal CA (AD CS) - self-signed certificates

### Import or install third-party or AD CS Certificate Authority certificates

Request and import/install the following AD CS Certificate Authority certificates:

- Server certificate on Active Directory Server via **Windows Certificate Store**
- CA Root Certificate on Active Directory Server via **Windows Certificate Store**
- CA Root Certificate on the CSM device via **Config File** generated by the Configuration Tool

## Install wireless network radio certificates

### Wireless network authentication – radio certificates

Hillrom supports uploading your wireless certificates onto vital sign devices. Uploading certificates can be done using different methods based on the product design, however the certificates must be in a specific format and be named correctly for deployment on a device. This document does not specify instructions for a specific server, however, it does provide information on support of wireless client certificates and wireless client certificates supporting server authentication. This support pertains to Hillrom products using the Newmar 802.11 a/b/g/n radio card and the Lamarr 802.11 a/b/g radio card.



**NOTE** Customer certificates that are uploaded to Hillrom devices must adhere to the x.509 standard.

### Supported radio certificate formats

The 802.11 a/b/g/n radio supports a **DER** or **PEM** file format containing the **CA Root certificate** chain - cacert.der or cacert.pem.

The 802.11 a/b/g/n radio also supports the **P12**, **PFX**, or **PEM** file formats containing the device's **Client certificate** and private key - client.p12, or client.pfx, or client.pem.



**NOTE** If a P12 or PFX file is supplied, the Newmar Radio will automatically convert it to PEM format during installation.

## No server validation – no certificates

Devices do not need to load the corresponding CA Root Certificate to authenticate.

A certificate does not need to be created for Server Validation (such as EAP-PEAP with Enable Server Validation - Unchecked).

No Certificates need to be loaded onto the devices for successful PEAP authentication. Only the following inputs are required:

- Username
- Password

## The 'waclientcert.pim' file

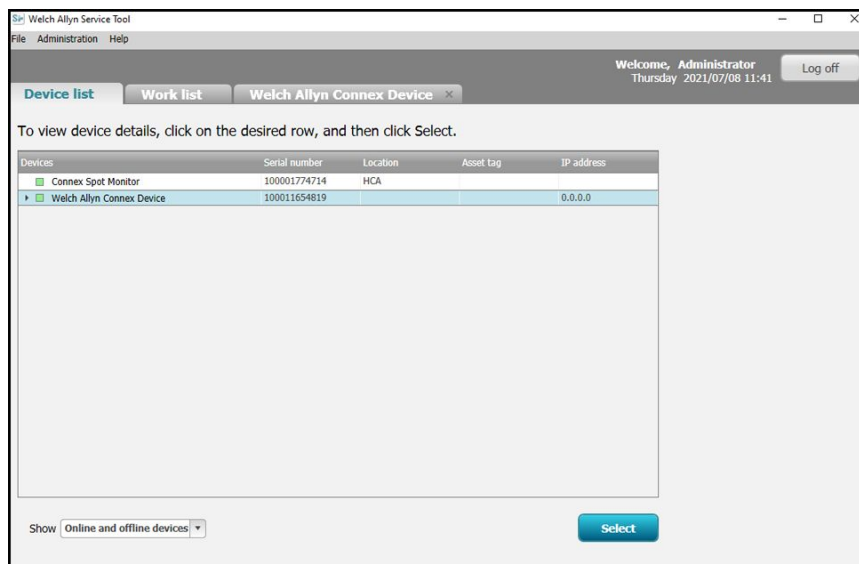
For a certificate to be loaded to the 802.11 a/b/g/n radio using the Welch Allyn Service Tool (WAST), the certificate must be formatted into the 'waclientcert.pim' file format. This '.pim' file is a Hillrom specific container that includes the customer certificates, commands, information about how the certs are to be loaded, and information about which folders the certificate(s) will be written to on the radio file system.

You cannot re-name an existing customer client certificate or ca certificate to 'waclientcert.pim' and upload it because the certificate lacks information on where the certificates need to be deployed on the radio and how the product should handle the file. The 'waclientcert.pim' file must be created using a Welch Allyn process.

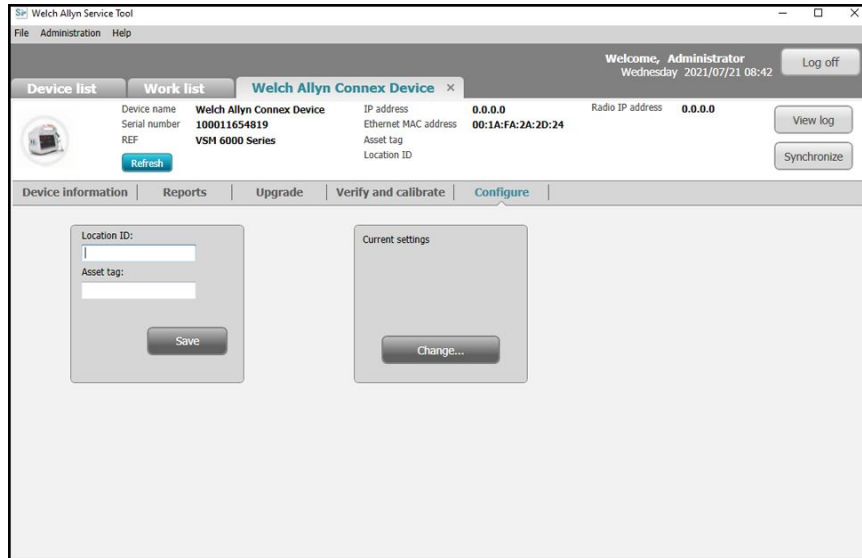
## Create a waclientcert.pim file using the Welch Allyn Service Tool (WAST)

The Welch Allyn Service Tool (WAST) can create the '**waclientcert.pim**' file using only a 'ca cert' (server verification), or a 'ca cert' and 'client cert' (for client authentication).

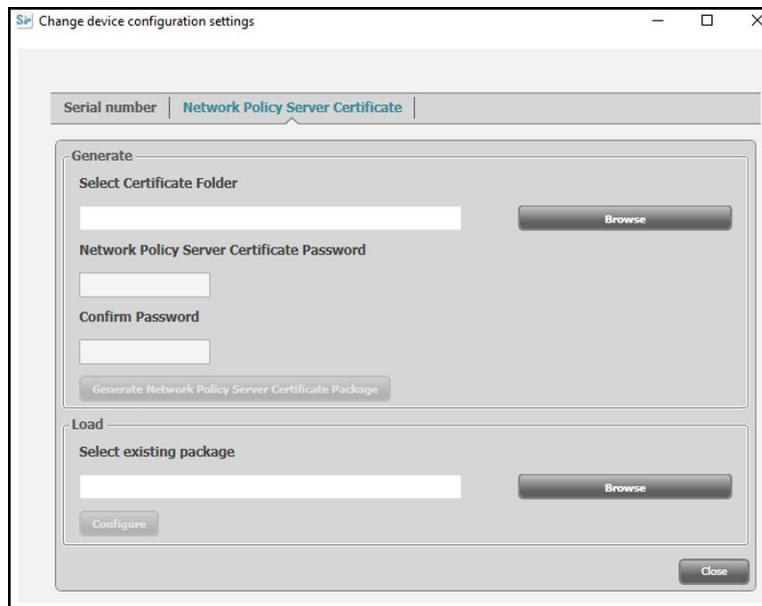
1. Create a folder on the PC or thumb drive and place the ca cert, and if needed, the client cert in the same folder.
2. Connect a device to the PC running the WAST and allow the device to come up to a usable state.
3. Click **Select** to choose the desired device from the WAST 'Device list' .



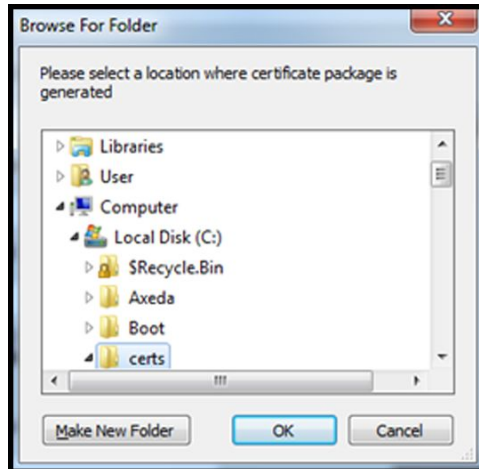
4. Click the *Configure* tab and then click **Change...** in the Current settings pane.



5. Select the *Network Policy Server Certificate* tab.



6. Use the **Browse** button to select the folder where the customer certs are kept – this will fill in the *Select Certificate Folder* field with a path to the customer certificates.



### Server validation only certificate

If the certificate created for Server Validation (such as EAP-PEAP with **Enable Server Validation** checked), the folder created should only contain a 'ca cert'. A client certificate is not required.

The Network Policy Server Certificate Password and Confirm Password fields are inactive for editing, however, the device needs to load the corresponding CA Root Certificate to authenticate.

The CA Root Certificate needs to be loaded onto both the device for successful PEAP authentication.

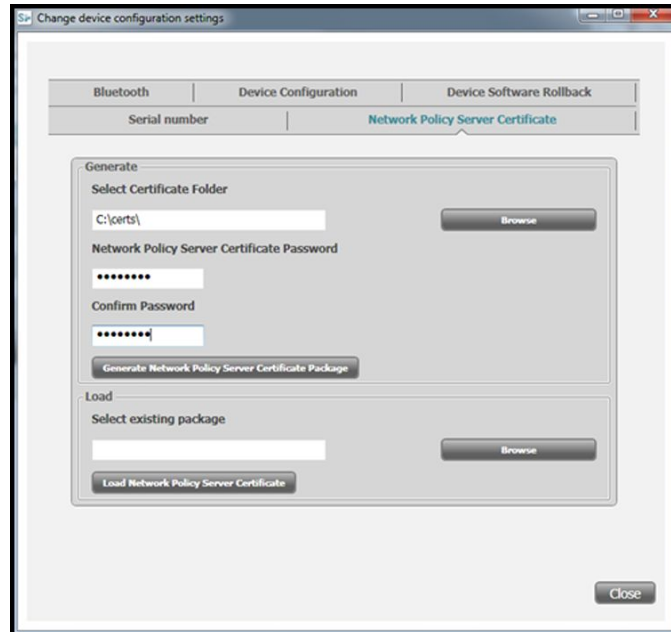
- Username
- Password
- CA Root Certificate (Installed - via WAST)

### Client authentication certificate

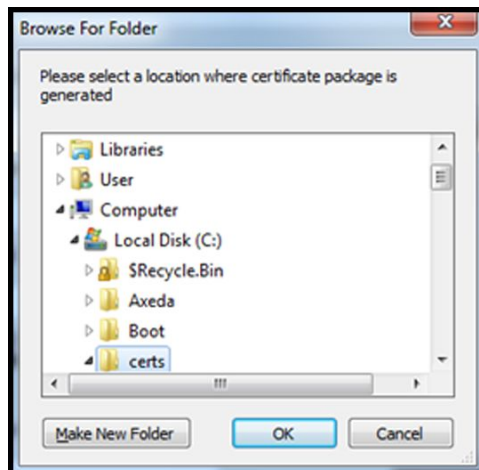
If the certificate to be created is for Client Authentication (such as EAP-TLS) the folder created should have a 'ca cert' and a 'client certificate'. The *Network Policy Server Certificate Password* field and *Confirm Password* field will need to be filled in with the password created for the client cert at creation time.



**NOTE** The WAST does not verify the client password is correct, it only loads to the CSM radio for authentication. This password must be known for the client to authenticate to the network.



1. Once the folder path of the certificates is entered, (and the Server Verification Only or Client Authentication is chosen), click **Generate Network Policy Server Certificate Package** and a browse to the destination folder where the written 'waclientcert.pim' file will appear.



For convenience, we suggest writing the 'waclientcert.pim' file into the same directory as the certificate files.

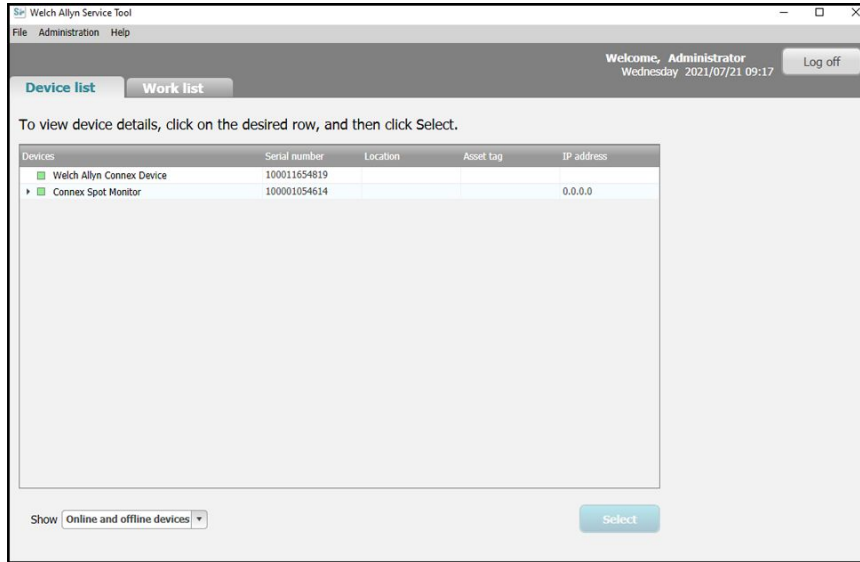
2. After selecting the destination location and clicking OK, the 'Compressing', 'Generating', and 'Success' status windows appear.

The destination folder now contains the 'waclientcert.pim' file along with the certificate files.

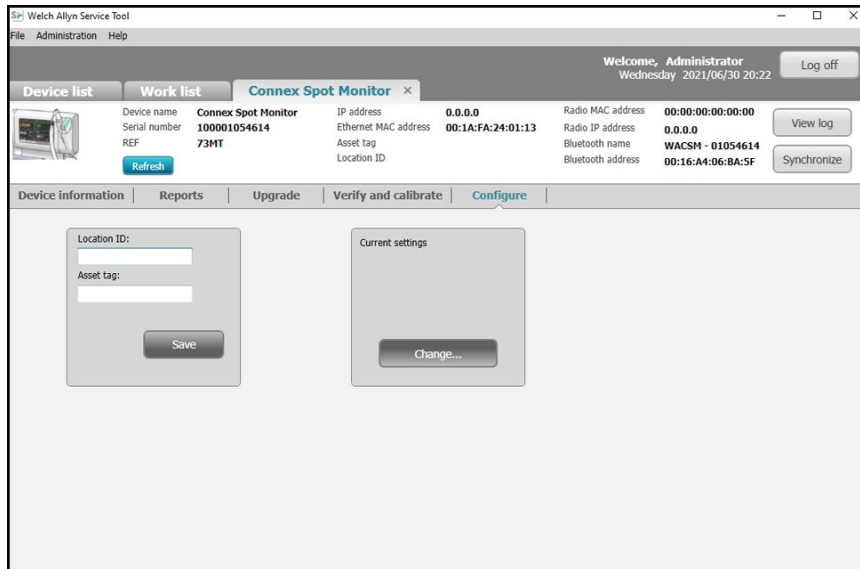
### Load a waclientcert.pim file onto the device with a Newmar Radio via the Welch Allyn Service Tool (WAST)

1. Disconnect the USB link between the PC and the device.
2. Launch the Welch Allyn Service Tool (WAST) on the PC.
3. Reboot the device and allow it to come up to a usable state.
4. Connect the USB link from the PC to the device.

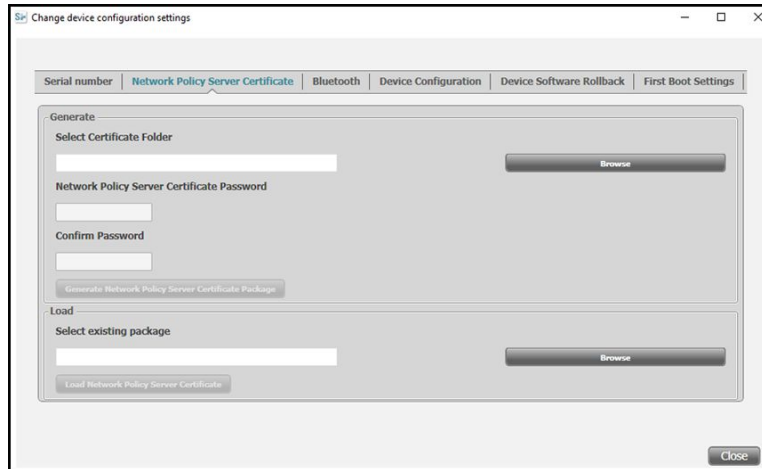
- Click **Select** to choose the desired device from the WAST 'Device list'.



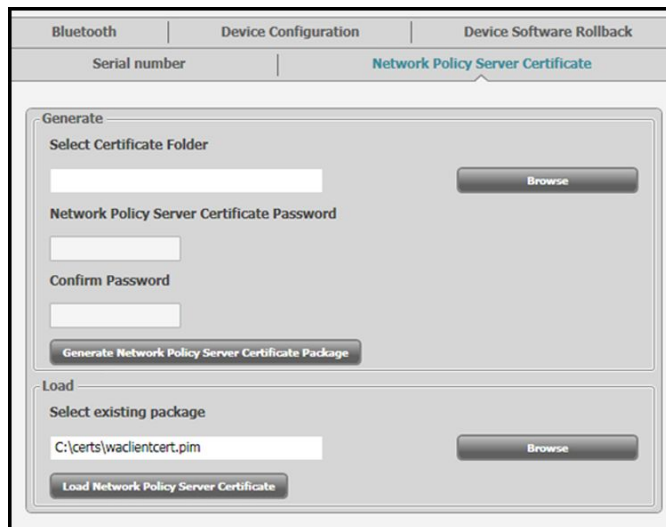
- Click the *Configure* tab and then click **Change...** in the Current settings pane.



- Select the *Network Policy Server Certificate* tab.



8. Click **Browse** from the *Load* pane and navigate to where the 'waclientcert.pim' file is located. The *Select existing package* field displays the path to the waclientcert.pim file.



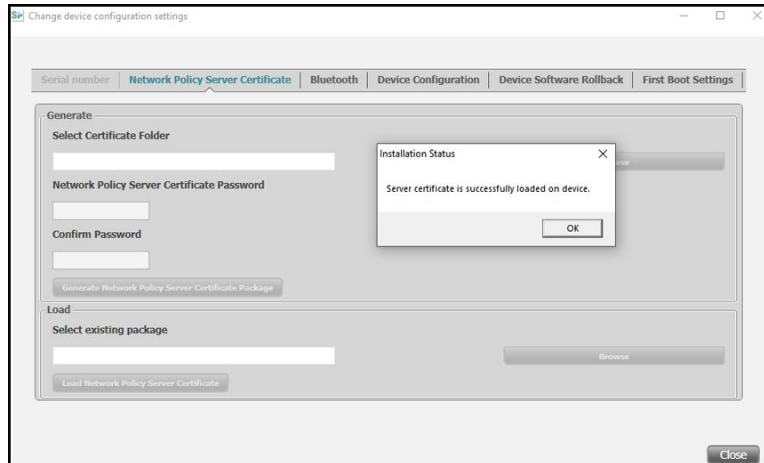
9. Click **Load Network Policy Server Certificate** to load the certificate to the device radio. A message box displays the installation progress. The process should take a maximum of three minutes.



**NOTE** If the process moves past the 6-minute mark, disconnect the device from USB, reboot it and begin again.

10. If the message box displays the message: *Server certificate is successfully loaded on device*, click **OK**.





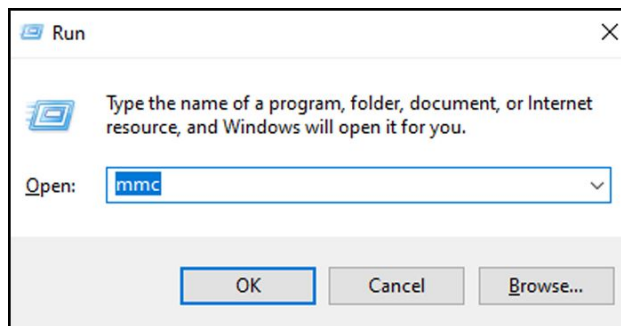
11. Close the Welch Allyn Service Tool application.
12. Disconnect the USB connection.
13. Restart the device.

You can now configure the device to use certificates on the wireless network.

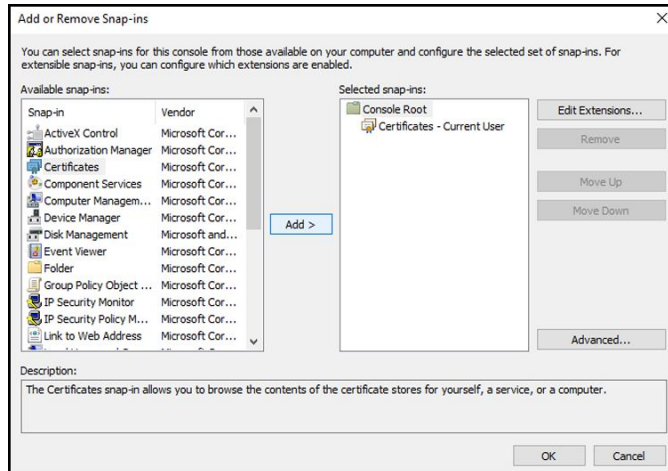
### Import/Install an Active Directory server certificate on the Active Directory server

These instructions apply to Active Directory servers with Windows Server 2012 OS and above:

1. Press the **Windows key + R** to bring up the Run command.
2. Type **mmc** and press **Enter** to open the Microsoft Management Console.



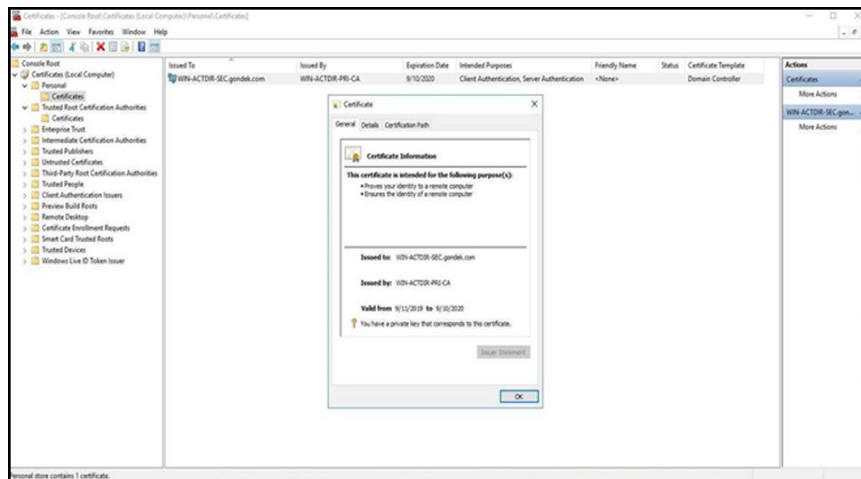
3. Click the **File** menu and then select **Add/Remove Snap-in...**
4. Select **Certificates** from the list of Snap-ins, and click **Add**.



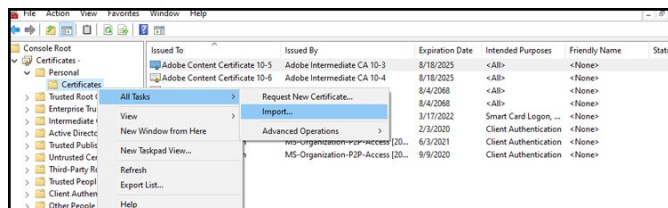
5. In the next dialog box, select **Computer account** and click **Next**.
6. Select Local computer and click **Finish**.
7. From the "Add or Remove Snap-ins" window, click **OK**.

Click > to view the certificates folder. When you open any certificates folder, you will see certificates displayed in the right pane.

8. Import/Install the AD Server Certificate into the following folder: Certificates (Local Computer) > Personal > Certificates.



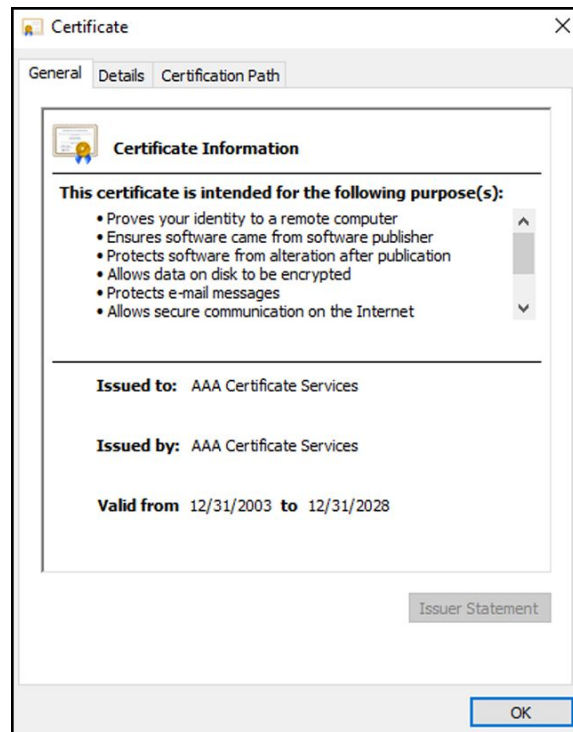
9. Right-click the Certificates folder under Personal and choose **All Tasks > Import**.



10. Follow the Certificate Import Wizard and provide the Active Directory Server Certificate file path.



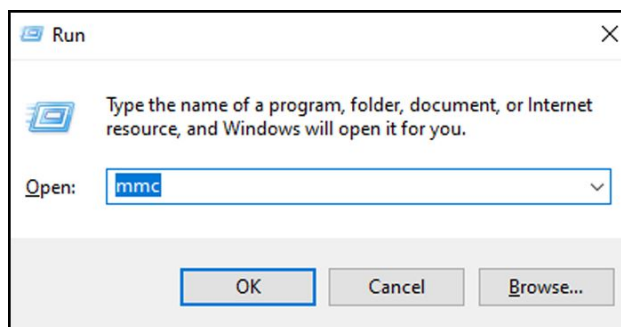
**NOTE** An example Active Directory server certificate is shown below.



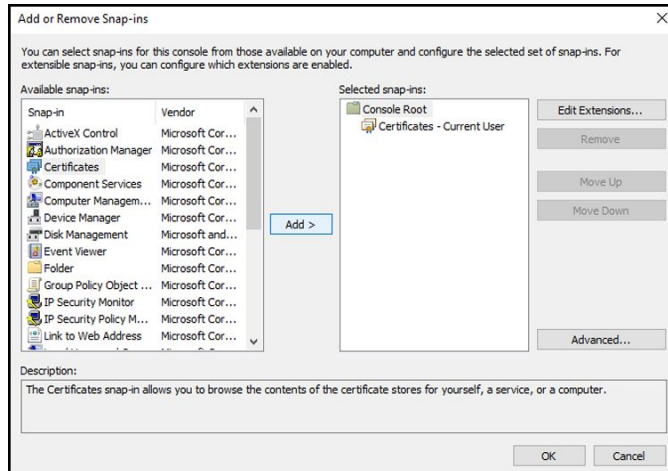
## Import/Install a Certificate Authority (CA) Root certificate on the Active Directory server

These instructions apply to Active Directory servers with Windows Server 2012 OS and above:

1. Press the **Windows key + R** to bring up the Run command.
2. Type **mmc** and press **Enter** to open the Microsoft Management Console.



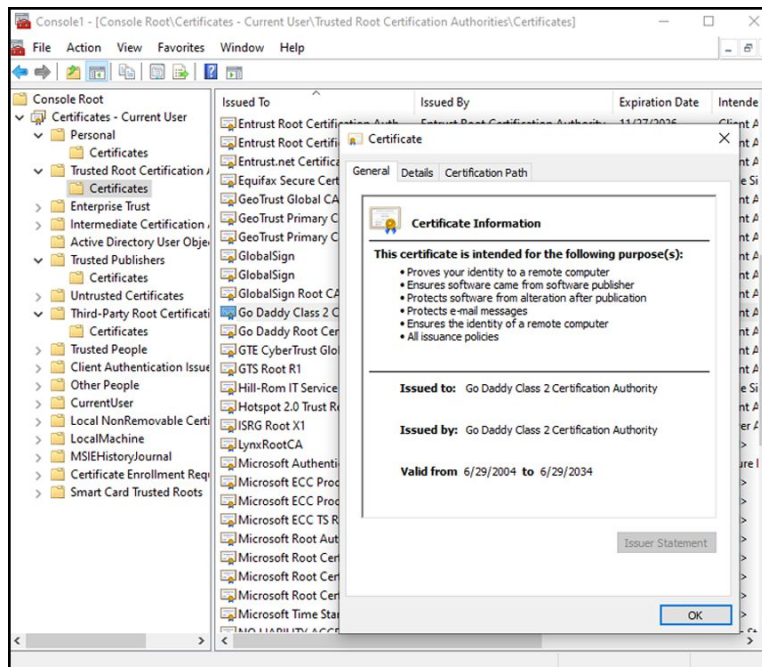
3. Click the **File** menu and then select **Add/Remove Snap-in...**
4. Select **Certificates** from the list of Snap-ins, and click **Add**.



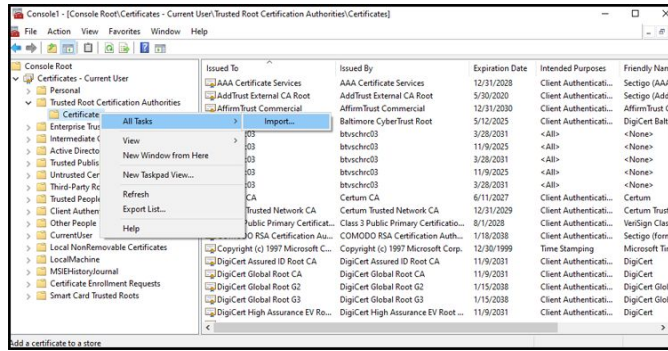
5. In the next dialog box, select **Computer account** and click **Next**.
6. Select Local computer and click **Finish**.
7. From the "Add or Remove Snap-ins" window, click **OK**.

Click > to view the certificates folder. When you open any certificates folder, you will see certificates displayed in the right pane.

8. Import/Install the CA Root Certificate into the following folder: Certificates (Local Computer) > Trusted Root Certification Authorities > Certificates.



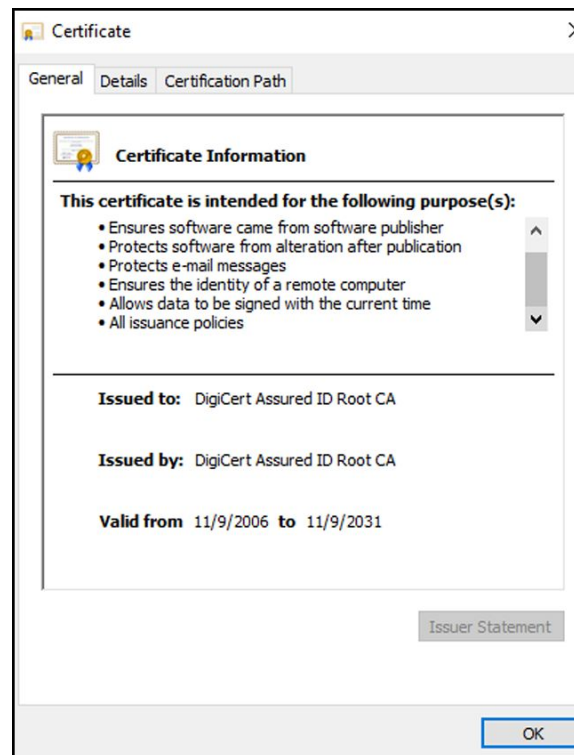
9. Right-click the Certificates folder under Trusted Root Certification Authorities and choose **All Tasks > Import**.



10. Follow the Certificate Import Wizard and provide the CA Root Certificate file path.



**NOTE** An example CA Root Certificate is shown below.



### Import/Install a CA Root Certificate onto the device (includes CSM, CVSM, and CIWS)

Use the WA CSM Configuration Tool web application to install or import a CA Root Certificate onto the device. The Config file (\*.signed.waconfig) is generated by the Configuration Tool. See "Log into the Configuration Tool" and "Configure a CA Root certificate using the Configuration Tool".

### Create third party AD CS Certificate Authority Certificates

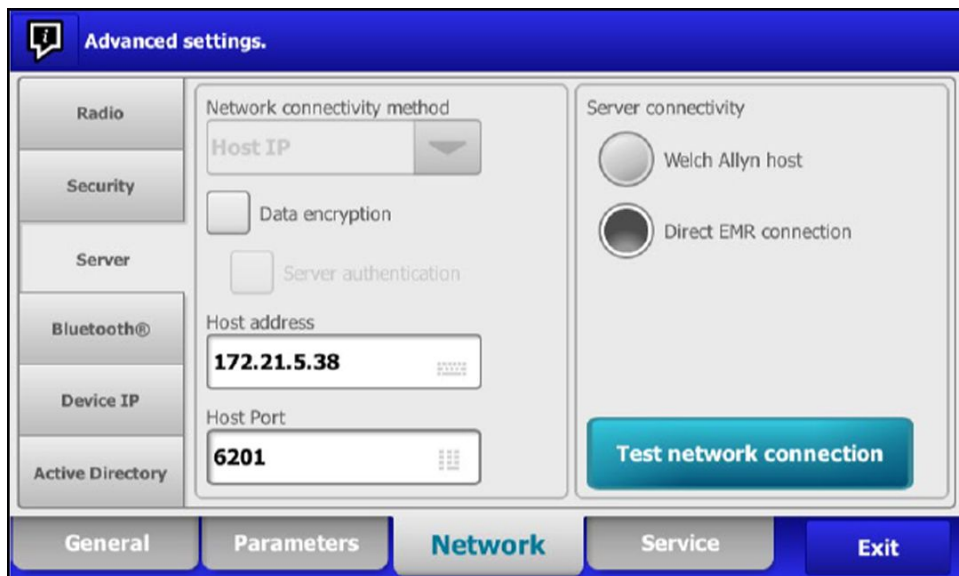
Third Party Certificates (AD Server & CA Root) need to be requested from the Third Party Certificate Authority with the required Active Directory Server information.

AD CS Certificates (AD Server & CA Root) are auto-generated during the AC CS Role Installation and Configuration on the AD Server. No specific process is required after the installation and configuration of the AD CS Role on the AD Server to generate these certificates.

## HL7 - setup details

### HL7 (Direct EMR connection) setup

1. Access the Advanced Settings.
  - a. Touch the **Settings** tab.
  - b. Touch the **Advanced** tab.
  - c. Enter your password and touch **OK**.  
The General tab appears.
2. Touch the **Network** tab.
3. Touch the **Server** tab.
4. Select **Host IP** from the drop-down list of the Network connectivity method.
5. Select the **Direct EMR connection** radio button in the Server connectivity panel.



6. Select **Data encryption** to turn the Security on or off in the network connectivity method panel.

If Data encryption is enabled, then Server Authentication can be turned on or off. Data encryption is intended to keep data secure while the data is transferred over a network.



**NOTE** Check or Uncheck Data encryption per the intended Secure (TLS) or unsecure connection.

7. Select **Server authentication** to turn the server authentication on or off in the network connectivity method panel.



**NOTE** Server Authentication is the process of confirming the identity of the EMR Server by receiving a server certificate from the server and checking it against the installed CA Root certificates on the device.

- If checked, confirm that CA Root Certificate is loaded on the device and that the Server Certificate is loaded on the EMR Server for the successful connection.
- If unchecked, the CA Root Certificate on the device and Server Certificate on the EMR Server are not required for the successful connection.

8. Touch the keyboard to enter an **IP Address** or **FQDN** of the EMR Server in the *Host address* field.
9. If needed, touch the keypad to enter a **Host Port** number in the *Host Port* field for the EMR Server that is listening for a connection.
10. Touch **Test network connection** to test the connection of the device to the EMR Server.

## NTP server- setup details

### Set up the NTP server

1. Access the Advanced Settings.
  - a. Touch the **Settings** tab.
  - b. Touch the **Advanced** tab.
  - c. Enter your password and touch **OK**.  
The General tab appears.
2. Touch the **Date/Time** tab.
3. Touch the **Enable NTP** checkbox to enable NTP.

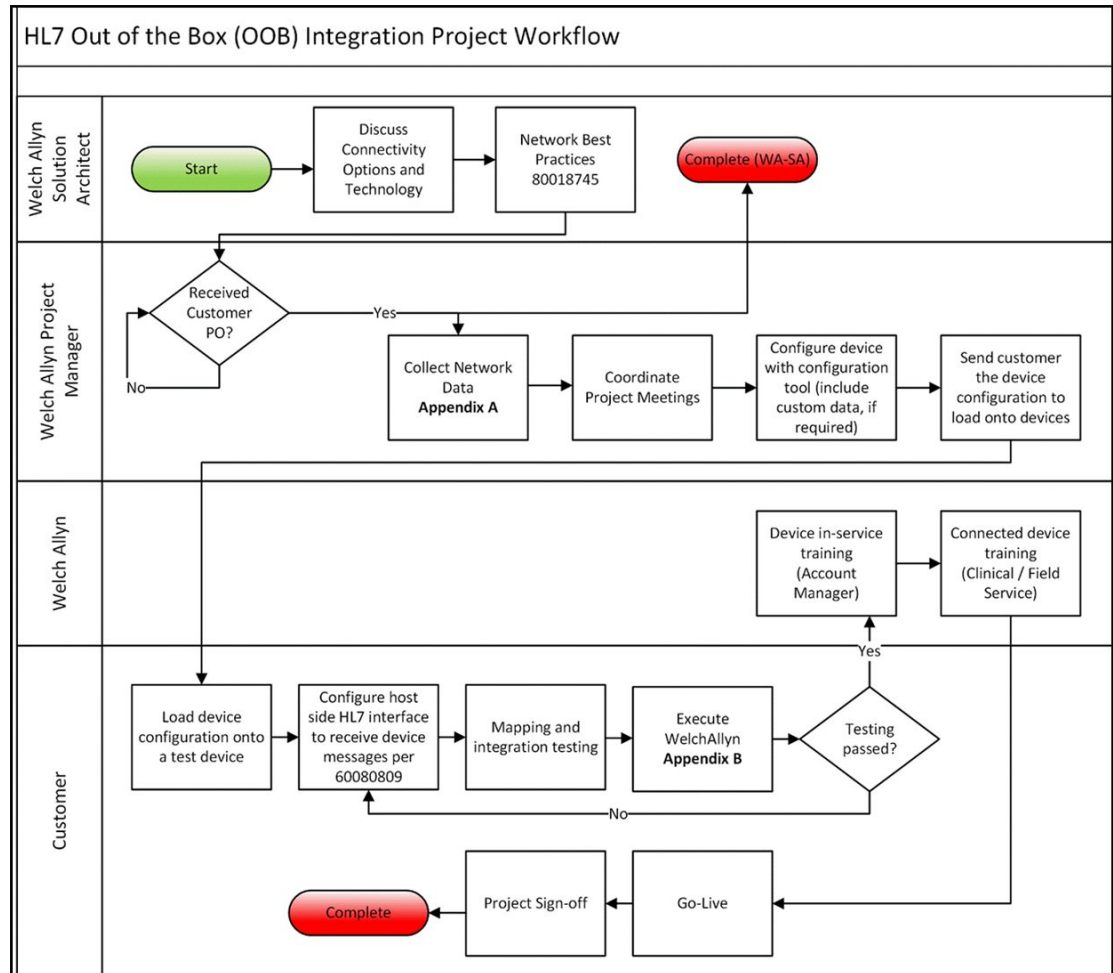


**NOTE** Check the *Enable NTP* option as the first step of connecting with the NTP server to synchronize the device Date/Time clock over the internal or external (Internet) network.

4. Enter the Domain name or FQDN or IP address of the NTP server.  
To enter this information, touch the keypad in the *Domain* text field and enter either the Domain name or Host name (FQDN) or the IP address of the NTP server.
5. Touch **Test network connection** to test the connection of the device to the NTP Server and to synchronize the device Date/Time.



## Project workflow



## Troubleshooting

Problem	Possible cause	Suggested action
Date/Time "Test network connection" failed	The device is not connected to a network and therefore does not have an IP address	Verify that the device has an IP address: Settings > Advanced > "IP address".
	The device does not have a properly configured NTP server	Review the NTP server configuration and make sure NTP is properly configured.
	The device does not have a properly configured NTP connection	Verify the Date/Time configuration on the device: Settings > Advanced > General > Date/Time: <ul style="list-style-type: none"> <li>a. "Enable NTP" is checked.</li> <li>b. The proper NTP server address appears in the</li> </ul>



Problem	Possible cause	Suggested action
		"Domain" field (Domain, FQDN, or IP Address).
	The device does not have Internet connectivity	Connect the device to the Internet. (An Internet connection is required when the NTP server is outside the local network.
	Your network firewall is blocking UDP port 123	Verify that the network's NTP port is open: typically, UDP 123.
	The path to NTP server cannot be reached	The path to NTP server cannot be reached
Server "Test network connection" failed	The device is not connected to a network and therefore does not have an IP address	Verify that the device has an IP address: Settings > Advanced > IP address.
	The device does not have a properly configured HL7 server connection	Verify the server configuration on the device: Settings > Advanced > Network > Server: <ul style="list-style-type: none"> <li>a. Server connectivity = Direct EMR Connection.</li> <li>b. Host IP is selected.</li> <li>c. The proper address appears in the Host Address field (FQDN or IP Address).</li> <li>d. The proper port appears in the Host Port field.</li> </ul>
	Server authentication failed	Load the proper Root Certificate on the server and the proper CA Root Certificate in the device using the device configuration tools.
	Your network firewall is blocking the TCP port used for the HL7 host connection	Verify that the network's TCP host port is open.
	The path to EMR server cannot be reached	Check network topology to ensure there's a valid path from the device to the EMR server.
Active Directory "Test network connection" failed	The device is not connected to a network and therefore does not have an IP address	Verify that the device has an IP address: Settings > Advanced > IP address.
	The device does not have a properly configured Active Directory server connection	Verify the server configuration on the device: Settings > Advanced > Network > Active Directory: <ul style="list-style-type: none"> <li>a. "Enable Active Directory" is selected.</li> </ul>

Problem	Possible cause	Suggested action
		<p>b. The proper domain name appears in the "Domain name" field.</p> <p>c. The proper group name appears in the "Group" field.</p> <p>d. You are using the proper Clinician ID type, it matches what you are scanning, and the clinician is in the Active Directory.</p> <p>e. You are using the proper Authentication User name.</p> <p>f. You are using the proper Authentication password.</p>
	Server authentication failed	Load the proper Root Certificate on the server and the proper CA Root Certificate in the device using the device configuration tools.
	Path to Active Directory server cannot be reached	Check network topology to ensure there's a valid path from the device to the Active Directory server.
Date/Time is incorrect on the device	Time zone is configured incorrectly	Confirm the device's time zone configuration is set to the correct time zone.
	DST adjustment is not configured correctly	Configure the DST setting appropriately (enable or disable DST adjustment depending on location).
	The device is syncing time to a different source than the rest of the network	Configure the device to configure its date and time to the same source as the rest of the network.
Failed to identify a patient	The device is not connected to a network and therefore does not have an IP address	Verify that the device has an IP address: Settings > Advanced > IP address.
	The device does not have a properly configured HL7 server connection	<p>Verify the server configuration on the device: Settings &gt; Advanced &gt; Network &gt; Server:</p> <p>a. "Server connectivity" = Direct EMR Connection.</p> <p>b. "Host IP" is selected.</p> <p>c. The proper address appears in the "Host Address" field (FQDN or IP Address).</p> <p>d. The proper port appears in the "Host Port" field.</p>

Problem	Possible cause	Suggested action
	Scanned patient ID is not the proper barcode	Verify the patient ID scanned is a valid patient ID barcode.
	Scanned patient ID could not be found in the host database containing the patient census	Verify the patient ID scanned is in the host database.
	The HL7 host is not properly configured to receive census query requests	Verify that the host is configured to receive census query requests on the configured port.
	Your network firewall is blocking the TCP port used for the HL7 host connection	Verify that the network's TCP host port is open.
	Server authentication failed	Load the proper Root Certificate on the server and the proper CA Root Certificate in the device using the device configuration tools.
Failed to authenticate a user	The device is not connected to a network and therefore does not have an IP address	Verify that the device has an IP address: Settings > Advanced > IP address.
	Scanned Clinician ID is not the proper barcode	Verify the Clinician ID scanned is a valid Clinician ID barcode.
	Scanned Clinician ID is not contained in the user authentication database	Verify the Clinician ID scanned is in the user authentication database.
	The device does not have a properly configured Active Directory server connection	<p>Verify the server configuration on the device: Settings &gt; Advanced &gt; Network &gt; Active Directory:</p> <ul style="list-style-type: none"> <li>a. "Enable Active Directory" is selected.</li> <li>b. The proper domain name appears in the "Domain name" field.</li> <li>c. The proper group name appears in the "Group" field.</li> <li>d. You are using the proper Clinician ID type, it matches what you are scanning, and the clinician is in the Active Directory.</li> <li>e. You are using the proper Authentication User name.</li> </ul>
	User ID entered is not valid	Verify that the user ID entered is accurate and a valid ID in the Active Directory.

Problem	Possible cause	Suggested action
	Server authentication failed	Load the proper Root Certificate on the server and the proper CA Root Certificate in the device using the device configuration tools.
Failed to send vitals	The device is not connected to a network and therefore does not have an IP address	Verify that the device has an IP address: Settings > Advanced > IP address.
	The device does not have a properly configured HL7 server connection	Verify the server configuration on the device: Settings > Advanced > Network > Server: <ul style="list-style-type: none"> <li>a. Server connectivity = Direct EMR Connection.</li> <li>b. Host IP is selected.</li> <li>c. The proper address appears in the Host Address field (FQDN or IP Address).</li> <li>d. The proper port appears in the Host Port field.</li> </ul>
	Your network firewall is blocking the TCP port being used for the HL7 host connection	Verify that the network's TCP host port is open.
	Server authentication failed	Load the proper Root Certificate on the server and the proper CA Root Certificate in the device using the device configuration tools.
	The configured custom data cannot be imported into the EMR	Verify the custom data configuration and make sure the fields going to the EMR match what the EMR is expecting.
	EMR response does not match device interface	Verify EMR response to the device's HL7 interface specification.
	The EMR rejected the Clinician ID	Verify Clinician ID sent from the device is a valid Clinician ID for the EMR.
	EMR or interface engine is down	Call your EMR or system administrator.
	Data was rejected for one of the following reasons: <ul style="list-style-type: none"> <li>• Patient ID not found</li> <li>• Clinician ID not found</li> <li>• vitals date/time in the future</li> </ul>	Check the EMR or interface engine message logs to determine root cause.

Problem	Possible cause	Suggested action
	<ul style="list-style-type: none"><li>• device received a message timeout notification</li></ul>	



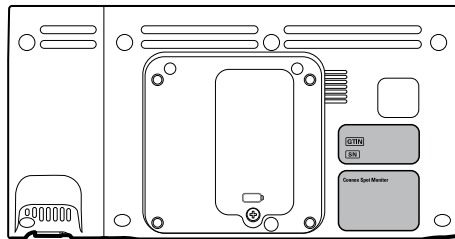
## Identifying the monitor and subsystems

This explanation of the monitor 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.

### Monitor 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

Serial number	MMMMXXXWYY
MMMM	Manufacturing plant
XXXX	Sequential number
WW	Week of manufacture
YY	Year of manufacture

---

### Monitor circuit board and internal options label

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#### Circuit board and internal option labels

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

## Model number format and code

### Model configuration



**NOTE** Some model numbers and product features described in this publication might not be available in your country. For the latest information about products and features, please contact Hillrom Customer Care.



**NOTE** For more configuration options, including approved accessories, see the accessories list in the Instructions for use on the user documentation CD or <https://direct.hill-rom.com/hillromUS/en>.



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

The device has multiple configurations. Use the following table to determine 7100, 7300, 7400, and 7500 model configurations. Not all configurations may be available. Model numbers include one item from each column.

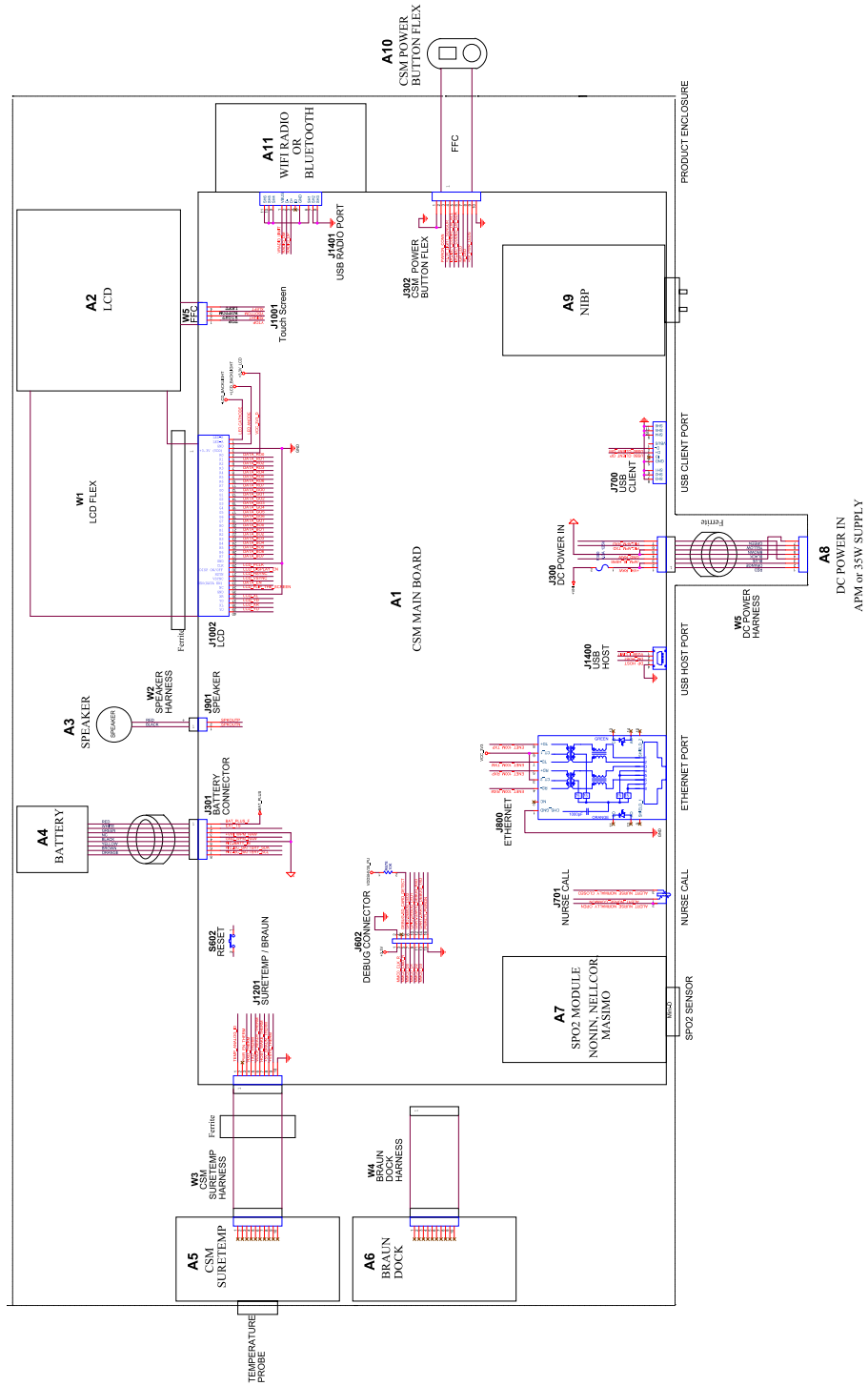
**Examples:** 75CE-B (North America), 71XE-4 (United Kingdom)

Model	Parameter		Power cord
	SpO2	Temperature	
71 = 7100 Value series	<b>W</b> = Nonin <b>X</b> = Blank / None	<b>E</b> = Braun ThermoScan PRO 6000 IR <b>T</b> = SureTemp Plus <b>X</b> = Blank / None	<b>A</b> = Denmark <b>B</b> = North America <b>C</b> = China <b>G</b> = Argentina



Model	Parameter		Power cord
	SpO2	Temperature	
<b>73</b> = 7300 Bluetooth series	<b>C</b> = Covidien / Nellcor <b>M</b> = Masimo <b>R</b> = Masimo SpO2/RRp <b>W</b> = Nonin <b>X</b> = Blank / None	<b>E</b> = Braun ThermoScan PRO 6000 IR <b>T</b> = SureTemp Plus <b>X</b> = Blank / None	<b>K</b> = South Korea <b>N</b> = India/UAE <b>P</b> = Thailand <b>T</b> = Taiwan <b>Y</b> = Italy <b>Z</b> = Brazil <b>2</b> = Europe <b>3</b> = Israel <b>4</b> = United Kingdom <b>5</b> = Switzerland <b>6</b> = Australia/New Zealand <b>7</b> = South Africa
<b>74</b> = 7400 WiFi-ready series	<b>C</b> = Covidien / Nellcor <b>M</b> = Masimo <b>R</b> = Masimo SpO2/RRp <b>W</b> = Nonin	<b>E</b> = Braun ThermoScan PRO 6000 IR <b>T</b> = SureTemp Plus <b>X</b> = Blank / None	<b>3</b> = Israel <b>4</b> = United Kingdom <b>5</b> = Switzerland <b>6</b> = Australia/New Zealand <b>7</b> = South Africa
<b>75</b> = 7500 WiFi series	<b>C</b> = Covidien / Nellcor <b>M</b> = Masimo <b>R</b> = Masimo SpO2/RRp <b>W</b> = Nonin	<b>E</b> = Braun ThermoScan PRO 6000 IR <b>T</b> = SureTemp Plus <b>X</b> = Blank / None	

# Interconnect diagram



## Service and maintenance toolset

### Connex Spot Monitor

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 Welch Allyn Connex Spot Monitor. Please refer to the device service manual for detailed instructions to service your device.



**NOTE** Tools and test equipment must also 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>				
106270	Service test box	1	X	
106275	Micro USB cable	1	X	
N/A	Wireless router, a/b/g or equivalent	1	X	
N/A	Ethernet cable	1	X	
N/A	PC running Windows 10	1	X	X
web download	Welch Allyn Service Tool	1	X	X
1001120	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
6000-30	Single tube blood pressure hose, 5 feet	1	X	X

Material no.	Description	Qty	Usage	
			Full	Basic
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
DOC-10	Nellcor SpO2 extension cable	1	X	X
<b>SureTemp Plus configuration testing</b>				
06138-000	Cal-key, assembly, M690/692	1	X	X
01802-110	Tester, calibration, 9600 Plus	3	X	
<b>Braun ThermoScan PRO 6000 configuration testing</b>				
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 is also 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 #1 screwdriver
- T-10 Torx screwdriver
- 3mm hex key

## 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

### Leak test

Specification	Actual reading	Pass	Fail
Max: 5			

## Overpressure test

Mode	Specification	Actual reading
Adult mode:	280 . . . . 329	
Neonate mode:	130 . . . .164	

## NIBP accuracy check

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	± 3 mmHg
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## SpO2 tests

### Masimo SpO2 tests

Test	Specification	Actual reading	Pass	Fail
SpO2 heart rate 61 bpm	Pulse rate 61 ±1 bpm 59 to 61 bpm	bpm		
SpO2 saturation 80%	Saturation 80% ±3% sat point 78 to 84%	%		

### Nonin or Nellcor SpO2 and pulse rate test

Test	Specification	Actual reading	Pass	Fail
SpO2 pulse rate 60 bpm	Pulse rate 60 ±1 bpm 59 to 61 bpm	bpm		
SpO2 saturation 90%	Saturation 90% ±1 sat point 89 to 91%	%		

## Thermometry tests

### Calibration key temperature test for SureTemp Plus

Temperature test	Specification ± 0.2°F (± 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		

### SureTemp Plus test

Temperature tested	Specification ± 0.2 °F (± 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

## Braun ThermoScan PRO 6000 test

Temperature tested	Specification ± 0.4 °F (± 0.2 °C)		Actual reading	Pass	Fail
96.8 °F (36.0 °C)	96.4 °F to 97.2 °F	35.8 °C to 36.2 °C	°F or °C		
101.3 °F (38.5 °C)	100.9 °F to 101.7 °F	38.3 °C to 38.7 °C	°F or °C		
105.8 °F (41.0 °C)	105.4 °F to 106.2 °F	40.8 °C to 41.2 °C	°F or °C		