Propaq® LT
Vital Signs Monitor

Service Manual

Software version 1.5X or later

WelchAllyn®

Advancing Frontline Care™

For information about any Welch Allyn product, call the nearest Welch Allyn representative:

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This device complies with Part 15 of the FCC rules and with the rules of the Canadian ICES-003. Operation is subject to the following two conditions: (1) This device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

Caution! Changes or modifications not expressly approved by Welch Allyn could void the purchaser's authority to operate the equipment.

REF 810-2712-XX
DIR 810-2713-01 A

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Printed in USA

Contents

1 Safety summary

All users of the monitor must read this safety summary and all warning and caution statements in the manual.

Warnings

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

WARNING Do not connect more than one patient to a monitor.

WARNING Do not connect more than one monitor to a patient.

WARNING Do not use the monitor in an MRI suite or hyperbaric chamber.

WARNING To avoid explosion, do not operate the monitor in the presence of flammable anesthetics.

WARNING Do not use cables with abraded or broken insulation.

WARNING Do not use a monitor that has been damaged. If a monitor has been damaged, remove it from service until it has been verified for proper operation by qualified service personnel.

WARNING Use only accessories approved by Welch Allyn. Visit www.welchallyn.com. The use of any other accessories can result in inaccurate patient data, can damage the equipment, and can void your product warranty.

WARNING Always use accessories according to the standards of your facility and according to the manufacturer's directions.

Caution Do not use cables that do not operate properly.

Caution Do not autoclave the monitor.

Caution Autoclave accessories only if the manufacturer’s instructions direct you to do so. Many accessories can be severely damaged by autoclaving.

General safety considerations

- Frequently check all cables, both electrically and visually.
- If the monitor detects an unrecoverable problem, it displays a brief 'Fault' message. See "Alert Messages and Status Messages", Propaq LT Vital Signs Monitor Directions for Use (810-2713-XX). Report all such errors to Welch Allyn.
- Do not service a monitor under warranty. Servicing a monitor under warranty voids the warranty. All service on monitors under warranty must be performed by Welch Allyn or at a Welch Allyn authorized service center.

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.

Symbols

WARNING Indicates conditions that could lead to illness, injury, or death.

Caution In this manual, indicates conditions that could damage equipment or other property.

2 Overview

Purpose and scope

This is a reference for periodic preventive maintenance and corrective service procedures for the Propaq LT monitors, models 802LTAN, 802LT0N, 802LTRN, 802LTAS, 802LT0S, and 802LTRS.

Corrective service is supported to the level of field-replaceable units. Field-replaceable units include certain circuit-board assemblies, subassemblies, case parts, and other parts. All field-replaceable parts are listed in "Replacement parts" on page 71.

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.

Note Repair and replacement of the main board is not supported. Any service work on the main board must be performed by certified and qualified service personnel at an authorized Welch Allyn service center. (For contact information, see page ii.)

Repair and replacement of the radio and the antenna is not supported. Any service work on the radio and the antenna must be performed by certified and qualified service personnel at an authorized Welch Allyn service center. (For contact information, see page ii.)

This guide provides troubleshooting information, assembly procedures, and instructions for functional testing and performance verification. It is intended for use only by technically qualified service personnel.

This guide applies only to the Propaq LT monitor. For service information about any other model of the Propaq monitor, refer to the service manual for that product.

Technical support services

Welch Allyn offers the following technical support services:

Telephone support (1-800-289-2501 and 1-503-530-7500)
Loaner equipment
Service agreements
Service training
Replacement service parts
Factory service

For information on any of these services, call one of the numbers listed on page ii.

Returning products

To return a product for service, contact Welch Allyn Technical Support and request a Return Material Authorization (RMA) number.

Note Welch Allyn does not accept returned products without an RMA.

When requesting an RMA, please have the following information available:

- Product name, model number, and serial number.
- Your customer number.
- A contact name and phone number.
- A complete return shipping address.
- Any special shipping instructions.
- A purchase-order number or credit-card number if the product is not covered by warranty.
- A full description of the problem or service request.

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

United States federal regulations prohibit the processing of any device contaminated with blood-borne pathogens. Welch Allyn thoroughly cleans all returned monitors on receipt, but any monitor that cannot be adequately cleaned cannot be repaired.

Before shipping the monitor, please observe these packing guidelines:

- Remove from the package all hoses, connectors, cables, sensors, power cords, and other ancillary products and equipment, except those items that might be associated with the problem.
- Put the monitor, 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.
- Write the Welch Allyn RMA number with the Welch Allyn address on the outside of the shipping carton.

Product configurations

Model numbers for the configurations are as follows:

Model	Monitoring Parameters	FlexNet/Acuity Communication Enabled	Top-Level Assembly	Serial # Prefix
802LT0N	ECG, NIBP, Nellcor SpO_2	No	007-0160-XX	KA
802LTRN	ECG, NIBP, Nellcor SpO_2	Yes 802.11 FHSS	007-0161-XX	KA
802LTAN	ECG, NIBP, Nellcor SpO_2	Yes 802.11a	007-0384-XX	KA
802LT0S	ECG, NIBP, Masimo SpO_2	No	007-0268-XX	KA
802LTRS	ECG, NIBP, Masimo SpO_2	Yes 802.11 FHSS	007-0269-XX	KA
802LTAS	ECG, NIBP, Masimo SpO_2	Yes 802.11a	007-0383-XX	KA

Recommended service intervals

Interval or condition	Action recommended	Procedure
Every 6 - 24 months (per hospital protocols)	Verify functionality	"Functional verification" on page 55
Every 36 months	Replace the air filter	"Replacing the air filter" on page 30
Every 36 months	Replace the battery	"Removing the lithium ion battery assembly" on page 29
The battery does not hold a charge	Check battery capacity Replace the battery	"Functional verification" on page 55 "Removing the lithium ion battery assembly" on page 29
The monitor has been dropped or otherwise damaged	Verify functionality	"Functional verification" on page 55
The monitor is not functioning properly	Verify functionality	"Functional verification" on page 55
The monitor does not pass the functional verification	Troubleshoot and repair, and then verify functionality	"Troubleshooting and repair" on page 11 "Disassembly and reassembly" on page 25 "Functional verification" on page 55
	Return the monitor to an authorized Welch Allyn service center	"Returning products" on page 6

Service options

Warranty service

All repairs on products under warranty must be performed or approved by Welch Allyn. Refer all warranty service to Welch Allyn Factory Service or another authorized Welch Allyn Service Center. Obtain an RMA number for all returns to Welch Allyn Factory Service. (See "Returning products" on page 6.)

Caution Unauthorized repairs will void the product warranty.

Non-warranty service

Welch Allyn Beaverton Factory Service and authorized Service Centers 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.

Related documents

Title	Reorder Number
Propaq LT Vital Signs Monitor Directions for Use	810-1828-XX

Controls

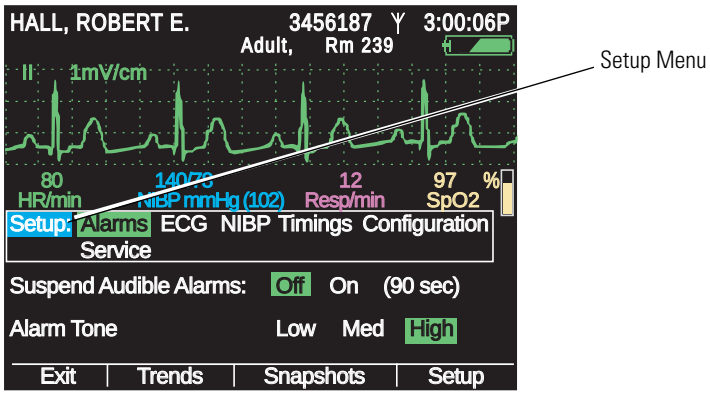
Monitor			
	Power - Turn the monitor power on or off.		Down - Move the cursor down to the next display item.
	Action - Act based on what is highlighted.		Silence/Reset - Silence the current alarm tone for 90 seconds or reset a silenced alarm tone.
	Left - Move the cursor left to the next display item; decrease the parameter value.		Display - Cycle to the next configured display format, or cancel the current control, setup, or pop-up menu.
	Right - Move the cursor right to the next display item; increase the parameter value.		Snapshot - Record a 21-second period of numeric and waveform data.
	Up - Move the cursor up to the next display item.		Start/Stop NIBP - Start or stop an NIBP measurement.
Cradle			
	Monitor Release - Press and hold while removing the monitor from the cradle.		

Service menu

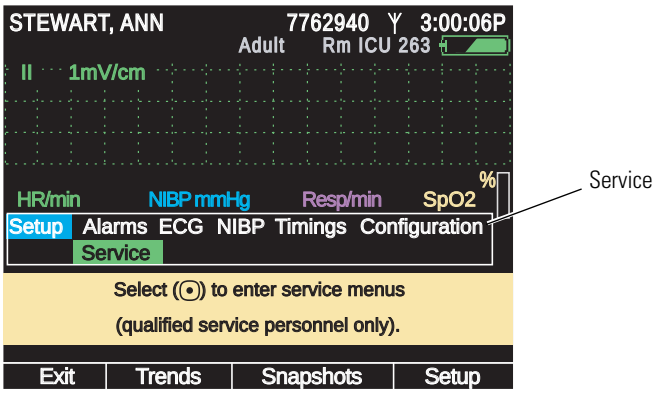
To access the monitor service menu:

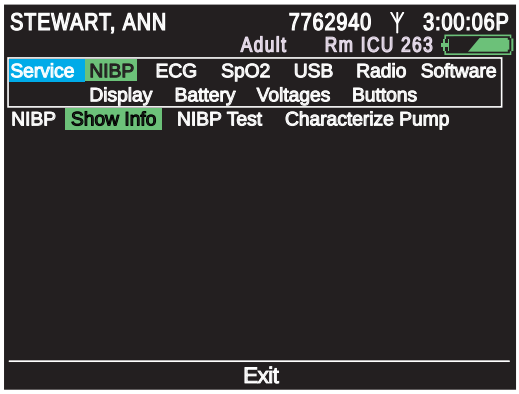
From any main display screen (such as Large Numerics, Dual Waveform, ...):

1. Highlight , **HR/PR**, **SpO2**, **NIBP**, **Resp**, or , and then press ⦿.
2. Highlight **Setup** (at the bottom of the screen) and press ⦿. The setup menu appears.



3. Scroll right (▶) to highlight **Service**, and press ⦿. The service menu appears, with **NIBP** and **Show Info** highlighted.





The service menu contains 10 sections:

Section	Operations	Status displays
NIBP	Test NIBP, Characterize Pump	Show Info
ECG	Setup (Enable/Disable HR/PR Alarms)	Parameters
SpO_2	(none)	Show Info
USB	(none)	Show Info
Radio	Monitoring (Monitor the radio), Set Netname	Show Info, View and Set Netname
Software	(none)	View Error Log, View RAM Dump, View System Info
Display	Run Pixel Test, Set Bias	View Fonts
Battery	(none)	Show Info
Voltages	(none)	Show Info
Buttons	Test Buttons	(none)

3 Troubleshooting and repair

Troubleshooting chart

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 monitor performance and will void the product warranty.

General

Refer to "Service chart" on page 19 for information on the suggested corrective actions.

Symptom	Possible cause	Possible corrective action
The power-on self-test fails. (Indicator: 2 yellow LED flashes followed by an LED flash of any combination of green, yellow, and red).	Internal RAM failure.	Cycle the power. If the error persists, send the monitor to an authorized Welch Allyn Service Center for service. (See "Returning products" on page 6.)
	Software error.	
	Unexpected reset detected.	
"Recoverable Fault. Restart monitor."	An invalid condition has been detected that might be resolved by restarting the monitor.	Restart the monitor. If the fault does not reappear, continue to use the monitor.
"System Fault. Service monitor."	An unrecoverable system error has occurred.	Send the monitor to an authorized Welch Allyn Service Center for service. (See "Returning products" on page 6.)
"System Fault. Service radio."	Radio fault detected.	Send the monitor to an authorized Welch Allyn Service Center for service. (See "Returning products" on page 6.)
"Battery Fault. Install new battery."	The battery is not performing to specification.	Install a new battery. "Removing the lithium ion battery assembly" on page 29.
	Charging has timed out (Charger state 5).	Remove the monitor from the cradle and reinsert it, and then attempt again to charge the battery. If the timeout reoccurs, replace the battery. "Removing the lithium ion battery assembly" on page 29.
"Equipment Alert. Charger Fault. Service Charger."	Cradle power board failure.	Insert another monitor and battery pack in the cradle and verify that the symptoms persist. If yes, then replace the cradle power board. "Disassembling the cradle" on page 47.

Symptom	Possible cause	Possible corrective action
Monitor fails to power up beyond the initial screen.	Button board not connected.	Connect the button board to the main board. "Separating the top and bottom chassis halves" on page 31.
Monitor is in the cradle and does not power up, and the cradle power indicator is off.	The battery is discharged and the cradle is not powering the monitor.	Verify that AC power is on, that the power adapter is plugged into AC power and into the cradle, and that the monitor is fully seated in the cradle.
	Defective power adapter.	Replace the power adapter.
	The charger input fuse is blown.	Replace the fuse. "Replacing the fuse" on page 47.
Monitor is latched in the cradle but does not power up. Power indicator on the cradle is on.	Open the monitor power switch.	Replace the bottom chassis (which includes the power switch). "Removing the main board from the bottom chassis assembly" on page 36.
	Problem with the cradle power board.	Replace the cradle power board. "Disassembling the cradle" on page 47.
	Problem with the monitor.	Send the monitor to an authorized Welch Allyn Service Center for service. (See "Returning products" on page 6.)
Monitor battery fails to charge. DC power is applied but the power indicator on the cradle remains off.	Blown power input fuse on the charger I/O panel.	Replace the fuse. "Replacing the fuse" on page 47.
Monitor battery run time duration is less than specified.	The battery is deficient.	Replace the battery. "Removing the lithium ion battery assembly" on page 29.
	Radio cannot link up to the Acuity Central Station.	See "Radio" on page 14.
Yellow indicator on the cradle.	Monitor current draw is too high. Cradle circuit breaker is tripped. Charger state 1.	Service the monitor or the cradle.
	Monitor has no battery pack. Charger state 4.	Install the monitor battery pack. "Removing the lithium ion battery assembly" on page 29.
	Battery pack temperature is out of range. Charger state 3.	Return the battery pack to within the specified temperature range (0°C - 40°C).
	Battery pack voltage is too low or the battery fuse is blown. Charger state 4.	Replace the battery pack. "Removing the lithium ion battery assembly" on page 29.
	Battery pack fails to charge in the specified time. Charger state 5.	Remove the monitor from the cradle and reinsert it, and then attempt again to charge. If the timeout reoccurs, replace the battery pack. "Removing the lithium ion battery assembly" on page 29.
	Battery cell(s) over voltage; probably a charge imbalance. Charger state 7.	Replace the battery pack. "Removing the lithium ion battery assembly" on page 29.
	Charger board failure.	Examine the cradle internal cabling, the cradle power board, and the interconnect board. "Removing the power/USB flex connector from the bottom chassis" on page 46.
Missing or erroneous LCD characters	Faulty LCD.	Replace the LCD. "Disassembling the top chassis" on page 34.

Symptom	Possible cause	Possible corrective action
Button or buttons inoperative.	Faulty button or buttons.	Replace the top chassis assembly. "Disassembling the top chassis" on page 34.
Voltages displayed on the service menu are out of range.	Main board fault.	Send the monitor to an authorized Welch Allyn Service Center for service. (See page ii.)
Repeated occurrence of "SpO_2 Fault. No sensor detected."	The internal SpO_2 connector is loose.	Secure the internal SpO_2 connector. "Removing the main board from the bottom chassis assembly" on page 36.
	Faulty SpO_2 connector panel.	Replace the connector panel. "Removing the patient connector panel from the bottom chassis" on page 45.
The NIBP air leak exceeds the specification.	Worn O-ring in the NIBP hose connector.	Try a different NIBP hose or replace the O-ring.
	Deficient NIBP check valve, bleed valve, or overpressure valve.	Replace the valve. "Removing the NIBP assembly from the main board" on page 41.
	NIBP tubing not properly connected.	Connect the internal tubing. "Removing the NIBP assembly from the main board" on page 41.
"Equipment Alert. NIBP Fault. Air leak. Check hose."	If hoses and external fittings are not leaking, internal tubing might be disconnected.	Connect the internal tubing. "Removing the NIBP assembly from the main board" on page 41.
Repeated occurrence of "NIBP Fault. Air leak. Check hose."	Internal tubing is disconnected.	Connect the internal tubing. "Removing the NIBP assembly from the main board" on page 41.
	Internal tubing is damaged.	Replace the damaged section of internal tubing. "Removing the NIBP assembly from the main board" on page 41.
"Equipment Alert. NIBP Fault. Kinked or neonate hose."	If the correct hose is connected and not kinked, then the internal tubing might be blocked.	Verfify that the internal in-line NIBP pneumatic components are properly installed, with no pinching or kinking of tubing. "Removing the NIBP assembly from the main board" on page 41.
"Equipment Alert. NIBP Fault. Overpressure condition."	A transient pressure pulse was introduced into the cuff via sudden and excessive patient motion.	Restart the monitor.
"Equipment Alert. NIBP Fault. Calibrating. Please wait."	An NIBP measurement was attempted within 45 seconds of monitor power-up.	Wait 45 seconds after turning on the monitor before starting an NIBP measurement.
	An NIBP measurement was attempted while the NIBP system was performing a baseline calibration.	Wait 15 seconds and retry the NIBP measurement.
"Calibrating. Minimize motion."	Excessive cuff artifact.	Reduce patient motion.
"Equipment Alert. NIBP Fault. Service required. NIBP disabled." The NIBP system self-test has failed 3 times without passing.	Excessive artifact.	Minimize patient motion.
	NIBP subsystem failure.	Send the monitor to an authorized Welch Allyn Service Center for service. (See "Returning products" on page 6.)

Radio

Radio-equipped Propaq LT monitors support wireless connection to one of the two types of Acuity networks.

Model	Wireless connection
802LTRN, 802LTRS	802.11 FHSS Acuity network
802LTAN, 802LTAS	802.11a Acuity network
802LT0N, 802LT0S	none

In facilities with 802.11a networks, administrators can reconfigure the radio, the Acuity network, or both, to meet local security or policy requirements. When you send a model 802LTAN or 802LTAS monitor to Welch Allyn for service, the radio is reset to the factory configuration.

Caution If you send a model 802LTAN or model 802LTAS monitor to Welch Allyn for service and the monitor is then returned to you, you must reapply any custom radio settings to the monitor before you attempt to reconnect the monitor to your Acuity network.

Radio troubleshooting information applies only to radio-equipped monitors. It is not intended for comprehensive troubleshooting of the Acuity system. To troubleshoot the Acuity system, refer to the appropriate Acuity service contact for your system.

Symptom	Possible Cause	Possible Corrective Action
No Acuity connection—network communication icon (Y) is not displayed on the monitor screen.	Wireless communication disabled in the monitor configuration.	Use the configuration utility to enable wireless communication for the monitor.
No Acuity connection—network communication icon with slash (Y) is displayed on the monitor screen and the yellow indicator above the screen is lit.	Monitor is out of radio range. 802LTRN/S: RSSI > approx. 60. 802LTAN/S: RSSI > approx. 70.	Move the monitor within range of an Acuity access point.
	Netname (ESSID) set wrong.	Set the monitor network name to the Acuity network name. (Default: com.protocol.)
	USB connected to the monitor through the cradle.	Disconnect the USB cable from the cradle.
No Acuity connection—network communication icon with slash (Y) and “Disconnected” are displayed on the monitor screen, and the green indicator above the screen is flashing.	Monitor is intentionally disconnected from the network by the user.	Use the monitor interface to connect to the network.
Radio Monitoring service screen persistently displays “Searching for access point”; monitor displays (Y).	Monitor radio cannot find a signal from the network.	Move the monitor within range of an access point on the current network.
		Verify the Netname.
Radio Monitoring service screen persistently displays “Searching for access point” and “Radio sleeping”; monitor displays (Y). (802LTAN/802LTAS)		Move within range of an access point and wait for up to 3 minutes.
Display alternates between “search” and “radio sleeping”.	The monitor Netname does not match the Acuity network name.	Set the monitor Netname to the Acuity network name (default: com.protocol).

Symptom	Possible Cause	Possible Corrective Action
Radio Monitoring service screen persistently displays "Searching for access point"; monitor displays (Ɣ). (802LTAN/802LTAS)	Invalid authentication credentials; default network settings.	Reset the monitor radio to factory defaults: **1.** Enter the service screen. **2.** Press simultaneously ◀ ▲ ▶. **3.** Select **Yes** and press ●.
	Invalid authentication credentials; custom network settings.	Refer to your Acuity network administrator.
Radio Monitoring service screen persistently displays "Requesting an IP address" and (Ɣ) is displayed on the monitor.	DHCP server is down.	Contact Welch Allyn Acuity technical support. (See page ii.)
	DHCP server has no more addresses.	Contact Welch Allyn Acuity technical support. (See page ii.)
Radio Monitoring service screen persistently displays "Sending Acuity broadcast."	All Acuity systems with wireless are unavailable.	Wait.
	The Acuity system is at capacity for licenses.	Turn off another wireless monitor.
Frequent communication faults with no apparent cause. On the Radio Monitoring service screen, TX/RX errors (PERCENT) is > 5%.	Faulty antenna or poor antenna connection.	Send the monitor to an authorized Welch Allyn Service Center for service. (See "Returning products" on page 6.)
	Faulty radio connection.	Send the monitor to an authorized Welch Allyn Service Center for service. (See "Returning products" on page 6.)
	Poor radio coverage.	Verify that the network has a sufficient density of access points on the current network.

Battery states and service

State	Description	Type of State	Possible Corrective Action
0	Battery state unknown.	Normal transitory. Should not persist.	If the state persists, replace the battery pack. "Removing the lithium ion battery assembly" on page 29.
1	Battery voltage too high. (Indication can occur with the monitor in or out of the cradle.)	Fault—possible cell imbalance or charger fault	Replace the battery pack ("Removing the lithium ion battery assembly" on page 29) or the cradle power board ("Disassembling the cradle" on page 47).
2	Battery fully charged.	Normal operating state.	
3	Battery partially charged.	Normal operating state.	
4	30 minutes of charge remaining, undocked.	Normal operating state.	
5	30 minutes of charge remaining, docked.	Normal transitory state.	
6	5 minutes of charge remaining, undocked.	Normal operating state.	
7	5 minutes of charge remaining, docked.	Normal transitory state.	
8	Battery is exhausted, undocked.	Normal operating state.	
9	Battery is exhausted, docked.	Normal operating state.	
10	Battery voltage is too low for recharging, docked.	Faulty battery pack.	Replace the battery pack. "Removing the lithium ion battery assembly" on page 29.

Charger states and service

State	Description	Charger Status LED	Charger Power LED	Type of State	Possible Corrective Action
0	Charger state unknown.	n/a	n/a	Normal initial transitory state of very short duration.	n/a
1	Monitor docked, No-power fault.	Off	Off	Normal operating state when the monitor is in the cradle and the cradle is not powered.	If the power adapter is not connected, connect it.
				Fault state if the cradle fuse is open.	Replace the fuse. "Replacing the fuse" on page 47.
		Yellow	On	Fault—power to the monitor automatically disconnected by the cradle. Possible monitor fault.	Attempt to recharge by removing the monitor from the cradle and reinserting the monitor in the cradle. If the fault persists, attempt to recharge another monitor to determine whether the problem is with the cradle or with the monitor main board.
				Fault—no monitor in the cradle, power input and input fuse OK.	Power board fault. Replace the power board. "Disassembling the cradle" on page 47.
2	Monitor docked, charging.	Green	Green	Normal operating state.	n/a
3	Monitor docked, temperature fault.	Yellow	Green	Fault—battery pack temperature is out of range high or low.	Bring the battery pack temperature into specified range (0° C - 40° C).
4	Monitor docked, battery voltage too low for charging.	Yellow	Green	Fault—battery pack can no longer be charged.	Replace the battery pack. "Removing the lithium ion battery assembly" on page 29.
5	Monitor docked, timeout fault.	Yellow	Green	Fault—Battery pack failed to charge within the specified time.	Attempt again to charge by removing the monitor from the cradle and reinserting the monitor in the cradle.
					Replace the battery pack. "Removing the lithium ion battery assembly" on page 29.
6	Monitor docked, charging complete.	Off	Green	Normal operating state.	n/a
7	Monitor docked, overcharge fault.	Yellow	Green	Fault—battery pack cells are unbalanced or the cradle is faulty.	Replace the battery pack ("Removing the lithium ion battery assembly" on page 29).
					Replace the power board in the cradle ("Disassembling the cradle" on page 47).
8	Monitor not docked.	n/a	n/a	Normal operating state.	n/a

Battery use and care

The battery meets specification when used in an environment between 0° C and 40° C.

- Operating the monitor in a cold environment (below 20° C) reduces battery run time. When the battery is returned to a warmer environment, battery run time returns to normal.
- Sustained charging at high temperatures (near 40° C) reduces battery life.
- The battery continues to discharge when removed from the monitor, but at a much slower rate than if it were in the monitor.
- The battery, when removed from the monitor, discharges more slowly at low temperatures and more quickly at high temperatures.
- Maintain battery capacity by storing the battery:
  - in a discharged state
  - removed from the monitor
  - in a cool, dry place

Service chart

This chart shows which procedure to use for specific service operations on monitors not covered by warranty.

Caution Do not service a monitor under warranty. Any service not performed at a Welch Allyn service center voids the product warranty.

Note Do not attempt to replace any component, including the NIBP pressure transducers, soldered onto the main board. All service of the main board must be performed at the Welch Allyn factory service center.

Monitor

Service	Action
Replace the NIBP air filter.	"Replacing the air filter" on page 30.
Replace the battery pack.	"Removing the lithium ion battery assembly" on page 29.
Replace the connector panel	**1.** "Removing the patient connector panel from the bottom chassis" on page 45. **2.** "Functional verification" on page 55.
Replace the LCD assembly	**1.** "Disassembling the top chassis" on page 34. **2.** "Set LCD bias" on page 23 **3.** "Functional verification" on page 55.
Replace the top case assembly (with button board and window)	**1.** "Disassembling the top chassis" on page 34. **2.** "Functional verification" on page 55.
Replace the bottom case assy (with power switch, power flex cable, and connector panel)	**1.** "Removing the main board from the bottom chassis assembly" on page 36. **2.** "Functional verification" on page 55.
Replace the NIBP pump, bleed and dump valves, check valve, or internal tubing	**1.** "Removing the NIBP assembly from the main board" on page 41. **2.** "Characterize NIBP" on page 21. **3.** "Functional verification" on page 55.
Update the software	Send the monitor to a Welch Allyn service center. (See "Returning products" on page 6.)
Replace the main board	Send the monitor to a Welch Allyn service center. (See "Returning products" on page 6.)

Cradle

Service	Action
Replace the fuse	**1.** "Replacing the fuse" on page 47.
Replace the interconnect board	**1.** "Disassembling the cradle" on page 47. **2.** "Functional verification" on page 55.
Replace the power board	**1.** "Disassembling the cradle" on page 47 **2.** "Functional verification" on page 55.
Replace the I/O panel	**1.** "Disassembling the cradle" on page 47 **2.** "Functional verification" on page 55.
Replace the upper housing	**1.** "Disassembling the cradle" on page 47 **2.** "Functional verification" on page 55.
Replace the lower housing	**1.** "Disassembling the cradle" on page 47 **2.** "Functional verification" on page 55.

Service menus for repair and network troubleshooting

In addition to the service menus supporting functional verification, these menus support the following service procedures:

Note Before beginning any service procedure, read the entire procedure to verify that you have all tools and equipment needed and that you understand each step.

Characterize NIBP

NIBP characterization sets the volume constants for the NIBP system to assure proper cuff detection. You must characterize the NIBP system if any of the following occurs:

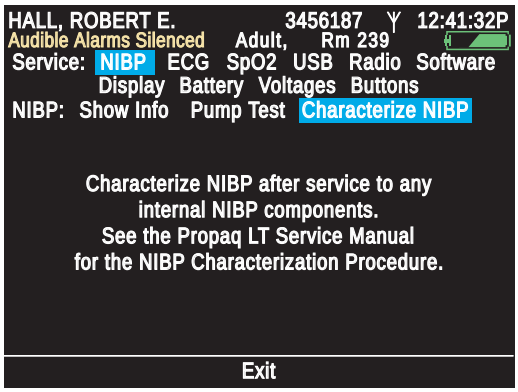
- Characterization test failure
- Pump failure
- Internal tubing replacement (any or all)
- Bleed valve, dump valve, or check valve replacement
- Main board replacement or repair

Caution Main board repair must be performed at the Welch Allyn Factory Service Center. Any change to the main board requires system testing, calibration, and verification, which can be done only at the Factory Service Center.

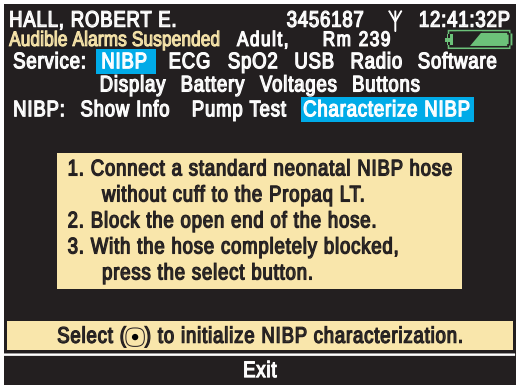
Caution Perform this characterization procedure only if you are prepared and equipped to perform the "Characterization test" on page 61. To complete this test, you must have the 35-ml test syringe described in "35-ml test volume" on page 73.

1. Attach a neonatal hose (008-0265-XX) to the monitor NIBP hose connector. Verify that the hose length is 8 feet ± 4 inches (2.44 meters ± 10 cm).
2. On the monitor, navigate to the **Characterize NIBP** screen.

   HR/min ⦿ Setup ⦿ Service ⦿ NIBP ▼ Characterize NIBP.



3. Simultaneously press ◀ and ▶ to access the NIBP characterization service screens. A warning message appears: "NIBP characterization affects neonatal cuff detection."
4. Press ⦿ to continue. The first steps of the procedure appear:



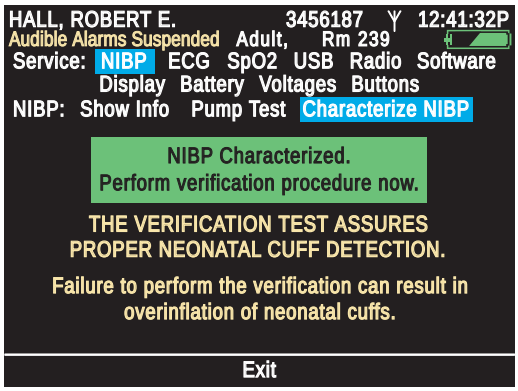
5. Follow the steps as presented on the screen.

Note The standard neonatal NIBP hose (008-0265-xx) can be effectively blocked with firm thumb pressure over the fitting opening.

Note In this procedure, 'the select button' refers to ⦿.

6. Press ⦿ to begin characterization.

   When the characterization is complete, this screen appears:



7. Verify the characterization. ("Characterization test" on page 61.)

WARNING Always verify after characterization. Failure to verify a new characterization could result in overinflation of a neonatal cuff.

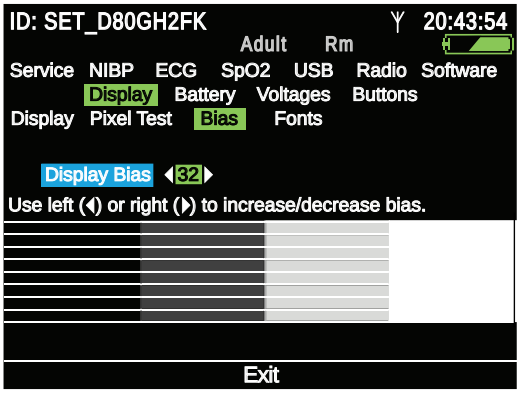
Set LCD bias

When the display module has been replaced, you must then set the LCD bias.

Note Perform this test only under fluorescent lighting.

1. On the monitor, navigate to the **Bias** screen.

   HR/min ⦿ Setup ⦿ Service ⦿ Display ▼ Bias.



Use the controls indicated to set the bias. Bias is optimized when the visible shimmer in the test pattern is reduced to the minimum level.

Check radio status

The Radio Status screens provide information that might be required if you have to troubleshoot the Acuity system network.

4 Disassembly and reassembly

Procedures overview

This describes all disassembly steps required for module-level and board-level service procedures.

Disassembly is presented here as a sequence of procedures.

Do not perform any unnecessary procedures.

> Example: Remove the air filter assembly and replace the air filter **only** if it appears that the filter is clogged and is restricting air flow to the pump.
>
> Example: Disconnect and remove the NIBP pump **only** if you are going to replace the pump or the NIBP air valve assembly.

Caution Perform all repair procedures at a static-protected station.

Caution Regard all monitor parts as extremely fragile, and execute all procedure steps with care and precision.

Except where noted, reassembly is the reverse of the disassembly.

Reassembly notes are identified by underlined text.

Screws

Caution Observe recommended screw torque specifications, especially with screws that secure directly into plastic standoffs.

Note To avoid mismatching screws and holes, keep the screws for each piece with that piece as you remove modules, circuit assemblies, and other components.

Following are recommended torque specs for all screws used in the monitor:

Qty.	Part number	Location	Type	Size/length	Torque
			Monitor		
2	620-0383-xx	Battery Pack	Captive screw	#6-32, 7/16"	2 inch lbs
4	620-0049-xx	Case	Machine screw	#6-32, 1"	6 inch lbs
2	620-0048-xx	Case	Machine screw	#6-32, ½"	6 inch lbs
4	620-0290-xx	Main Board	Machine screw	#4-40, ¼"	4 inch lbs
1	620-0278-xx	Valve bracket	Machine screw	#4-40, ½"	4 inch lbs
2	620-0290-xx	Pump bracket	Machine screw	#4-40, ¼"	4 inch lbs
4	620-0149-xx	Display bracket	Thread-forming screw	#2-28, ¼"	2 inch lbs
2	620-0408-xx	Input flex assy. bracket	Thread-forming screw	#4-24, 3/8"	4 inch lbs
2	630-0260-xx	Power/flex conn.	Guide pin	#4-40, ½"	---
2	620-0418-xx	Power/flex conn.	Flat washer	0.215 OD	---
2	620-0217-xx	Power/flex conn.	Kepnut	#4-40	Loctite
			Cradle		
2	620-0423-xx	Bed rail hook	Shoulder screw	M 4x4, hex	12 inch lbs
2	620-0424-xx	Bed rail hook	Machine screw	M 4x5	12 inch lbs
4	620-0188-xx	Interconnect Bd.	Machine screw	#4-20, 3/8"	4 inch lbs
4	620-0188-xx	Latch bracket	Machine screw	#4-20, 3/8"	4 inch lbs
7	620-0415-xx	Lower housing	Machine screw	#6/32, 3/8"	6 inch lbs
3	620-0414-xx	Lower housing	Washer	0.281" OD	---
1	620-0149-xx	I/O panel	Thread forming screw	#2-28, ¼"	2 inch lbs
1	620-0413-xx	I/O panel	Nylon washer	0.187" OD	---

Connectors

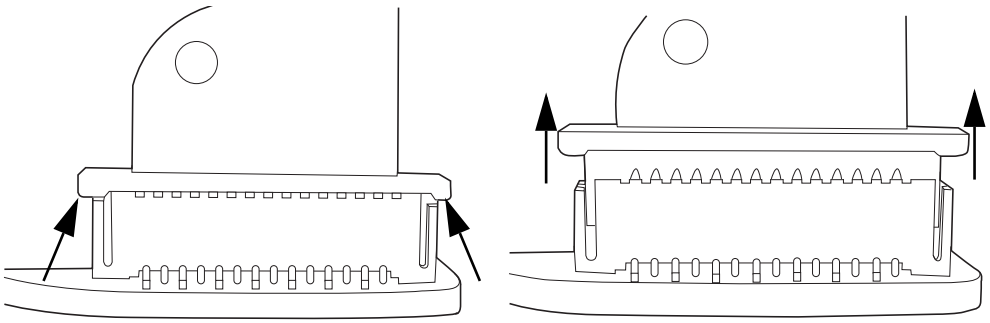
Note All connectors are keyed or labeled to facilitate proper connection. Take care to correctly align all connector halves before attempting to connect them.

Zero insertion force (ZIF) flex cable connectors

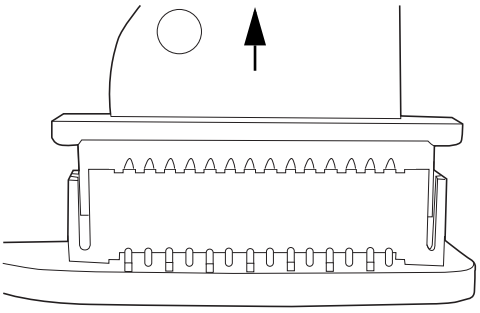
ZIF connectors use a sliding outer piece that latches and unlatches to secure and release the flex cable. ZIF cables cannot be successfully connected or disconnected without properly unlatching and latching the sliding outer piece.

To disconnect a ZIF cable

1. Using a suitable tool (paper clip, small flat-blade screwdriver, or small needle-nose pliers), slide the latching piece of the connector away from the connector body and toward the cable, releasing the cable from the connector.

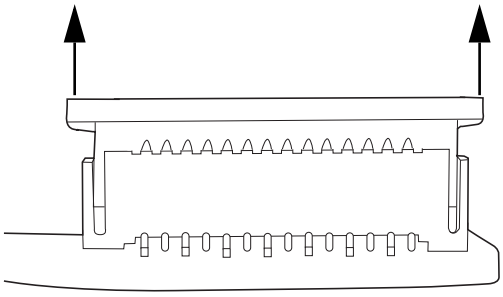


2. Remove the cable.

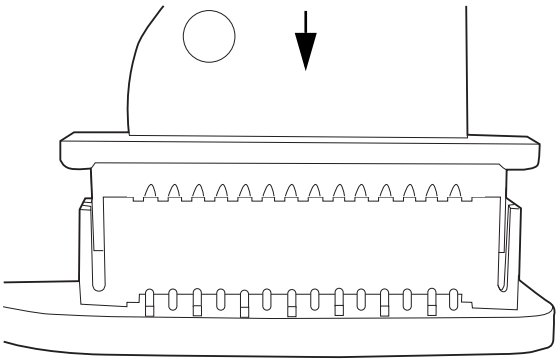


To connect a ZIF cable

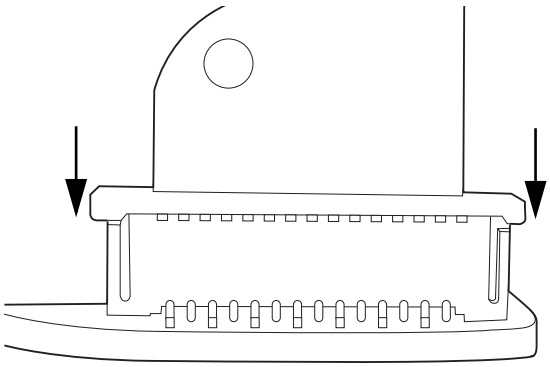
1. Slide the latching piece of the connector body away from the body.



2. Insert the flex cable into the connector.



3. Slide the latching piece toward the connector body until it clicks into place.



Caution Do not attempt to remove a flex cable until the ZIF latch has been opened.

Caution Never attempt to disconnect any cable by pulling on the cable wires. Always disconnect cables by grasping and pulling only on the connector halves.

Connector locations

Connector	Connects with:	Connector	Connects with:
Main Board		**Charging Cradle - Interconnect Board**	
J1	ECG (flex)	J1	Cradle power board (3-conductor)
J2	On/Off Switch	J2	Cradle power board (10-conductor)
J3	SpO_2 (flex)	JP1	External USB
J4	Display module	P1	Propaq LT Monitor
J5	BDM	**Charging Cradle - Cradle Power Board**	
J6	PCMCIA (radio) card	J1	I/O panel (DC input)
J7	Button pad	J2	Cradle interconnect board (10-conductor)
J8	Battery pack	J4	Cradle interconnect board (3-conductor)
J9	Pump/bleed valve	**Radio Card**	
J10	Dump valve	(flex)	Antenna
J11	Speaker		
P2	Power/USB (flex)		

Procedures

Removing the lithium ion battery assembly

WARNING The lithium ion battery can deliver currents sufficient to cause serious personal injury and to damage the monitor. Before opening the monitor for any reason, and before you begin any procedure described in this manual, always remove the battery first.

WARNING The only safe method for charging the monitor battery is to insert the completely assembled monitor, with the completely assembled battery pack correctly installed, into the completely assembled charging cradle. Attempting to charge the monitor battery by any other method creates a significant risk of explosion or patient shock hazard.

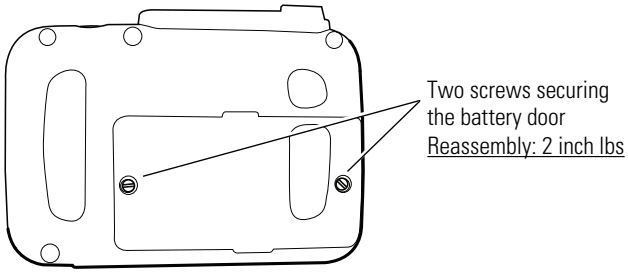
WARNING Do not short the battery connector pins.

WARNING Do not attempt to disassemble the battery. The battery pack contains no user-serviceable parts.

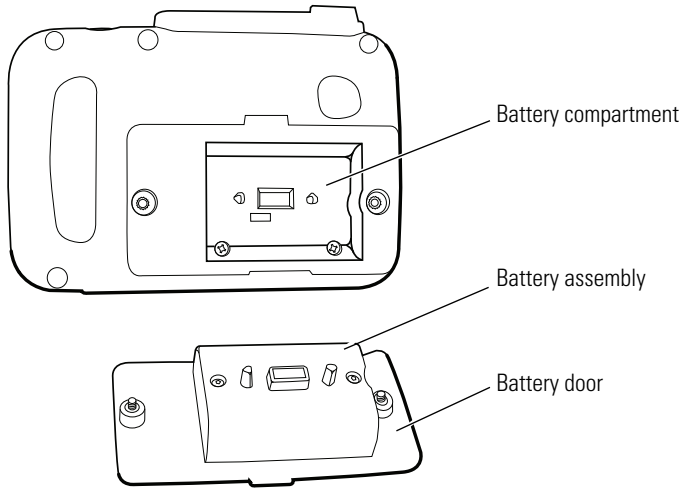
Note When the monitor, the cradle, or the battery reaches end of life, recycle it locally according to national, state, and local regulations, or return it to Welch Allyn.

The battery pack assembly consists of the rechargeable lithium ion cells, a protection board, and the battery door. It can be replaced only as an assembly.

1. Remove the two screws securing the battery door.



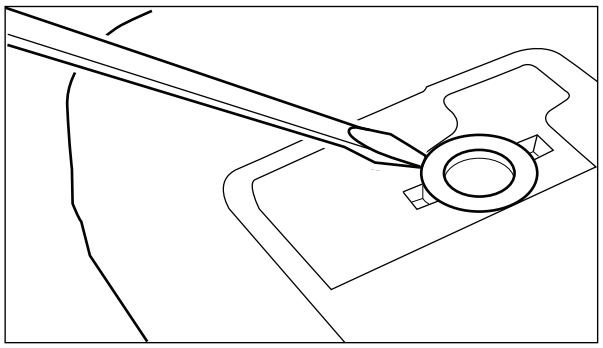
2. Remove the battery assembly from the battery compartment.

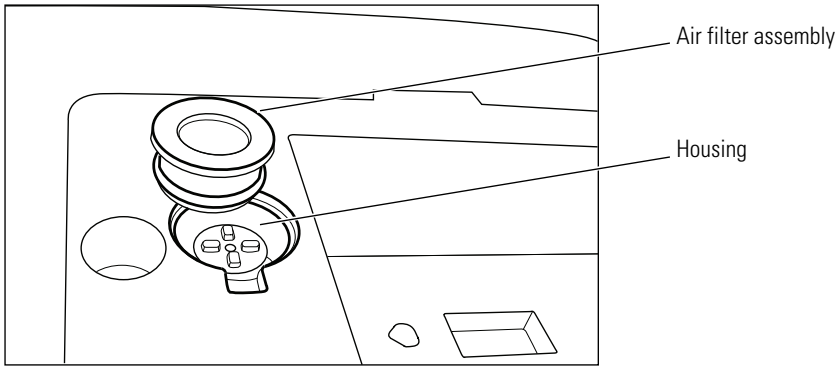


Replacing the air filter

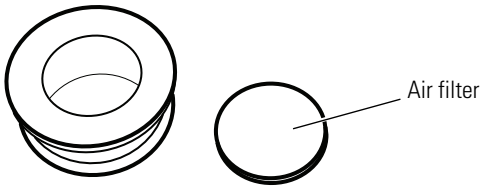
Note It is not necessary to replace the air filter each time you service or repair the monitor. See "Recommended service intervals" on page 7.

1. Remove the air filter assembly.





2. Remove and discard the air filter, and replace it with a new one.

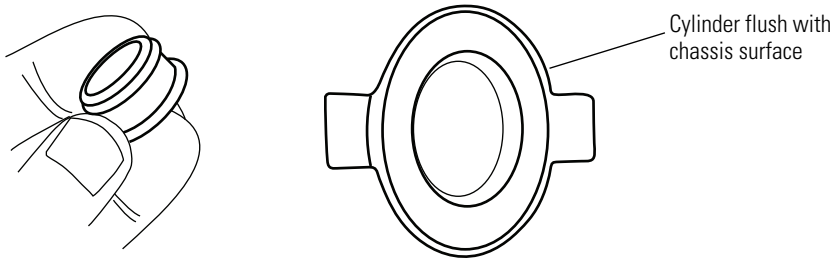


3. If the O-ring shows signs of wear, replace it with a new one.

REASSEMBLY:

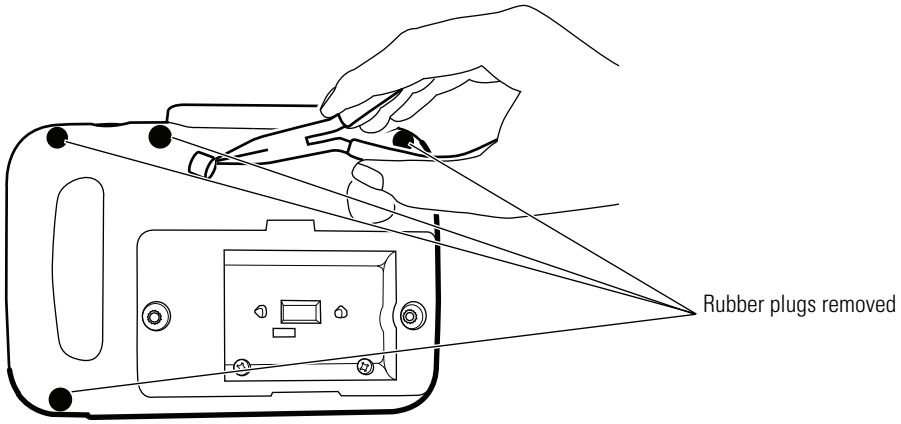
Lubricate the outside of the O-ring with a drop of alcohol to prevent it from riding up the side of the cylinder when inserted.

When properly installed, the filter cylinder is perfectly flush with the chassis surface.



Separating the top and bottom chassis halves

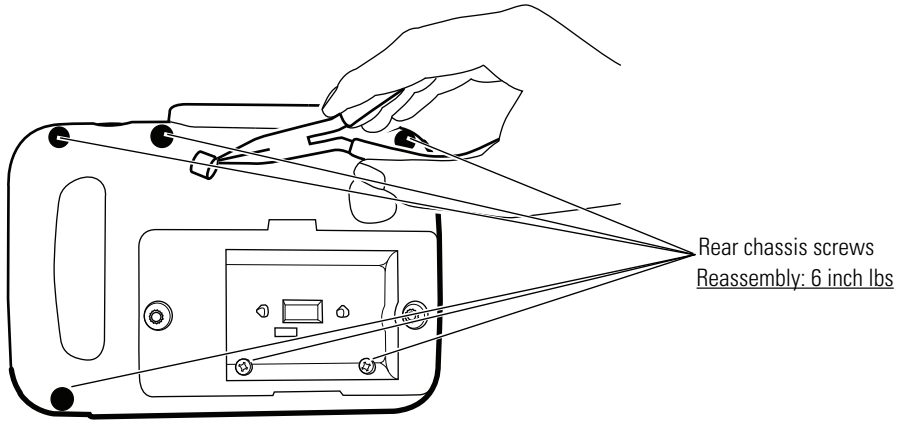
1. "Removing the lithium ion battery assembly" on page 29.
2. Remove the four cylindrical rubber plugs from the screw holes in the bottom chassis.



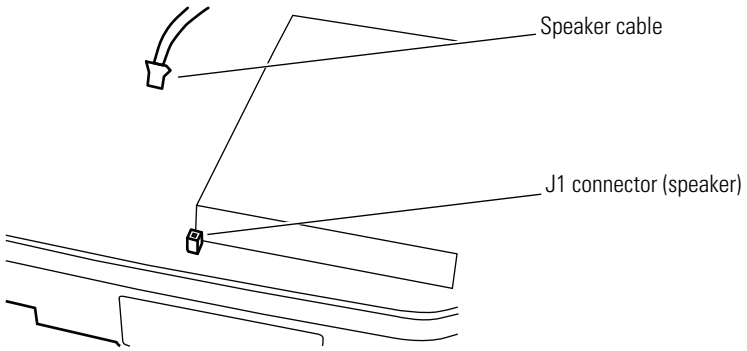
REASSEMBLY:

When reinstalling the rubber plugs, lubricate the screw holes with water applied with a damp cotton swab.

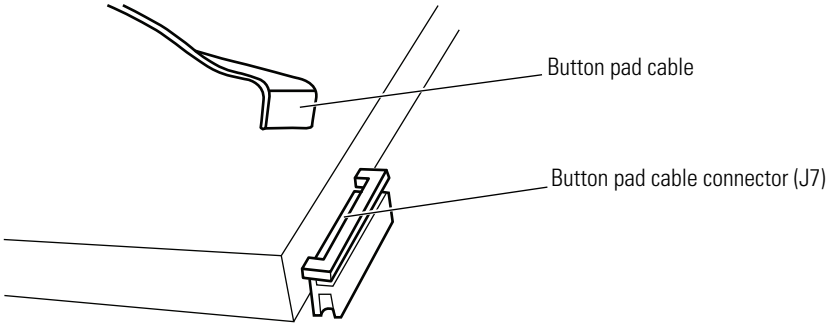
3. Remove the screws from the bottom chassis.
   - Remove three screws from the top and one from the bottom left corner.
   - Remove two screws from inside the battery compartment.



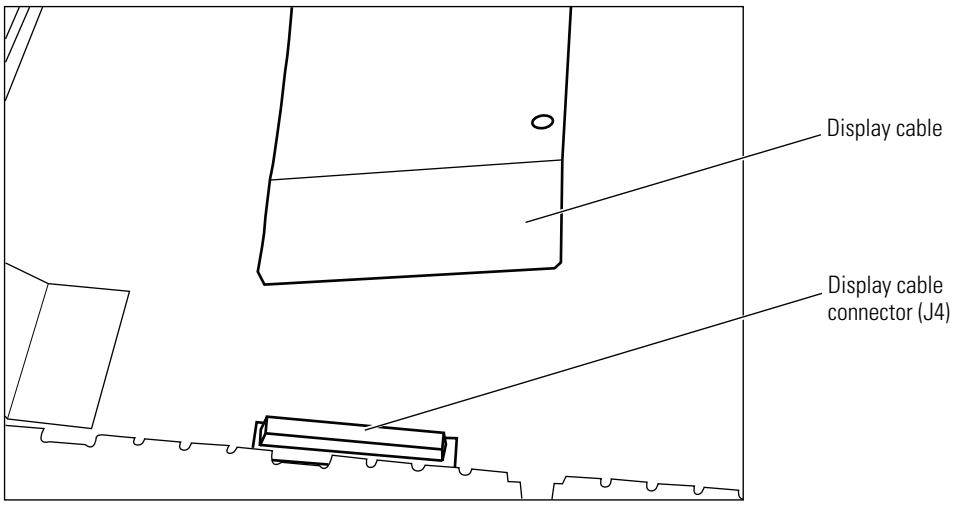
4. With the monitor face-up, lift the bottom of the top chassis enough to access the speaker cable, and disconnect the speaker cable from J11 on the Main board.



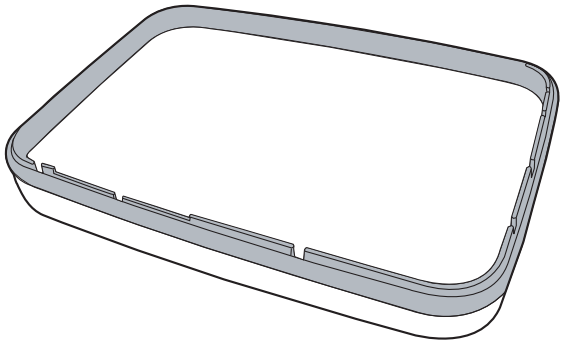
5. Rotate the monitor 180° to access the top of the top chassis.
6. Disconnect the blue button pad cable from ZIF connector J7.



7. Rotate the monitor 90° to access the display cable connector (J4).
8. Disconnect the display cable from connector J4.



9. Remove the slotted blue gasket that runs around the chassis halves.



REASSEMBLY:

The slotted blue gasket between the top and bottom chassis halves is directional; it can be correctly aligned in only one way. Take care to reinstall the gasket correctly.

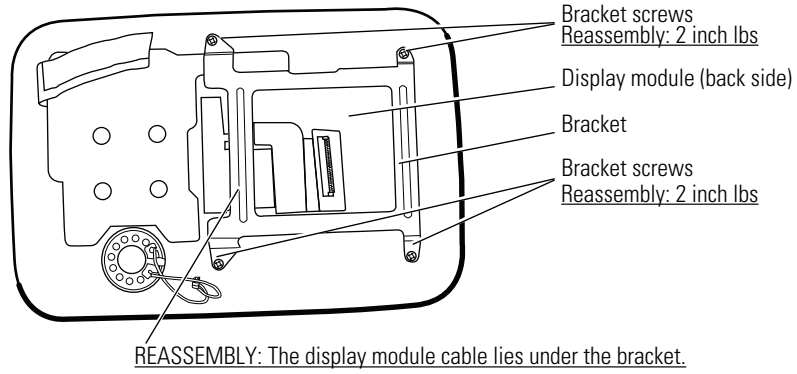
Disassembling the top chassis

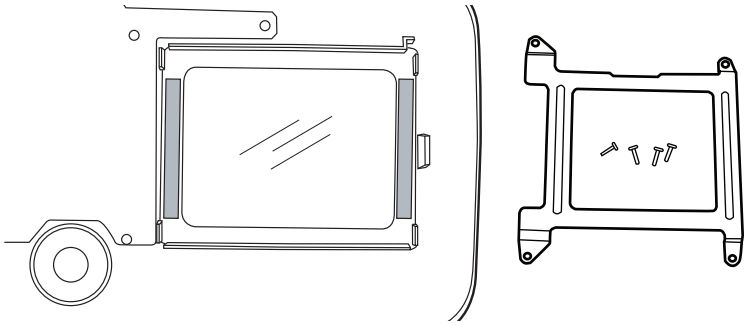
The top chassis assembly contains the top plastic panel assembly (including the integrated overlay for buttons, window, LEDs, and trim), the display module, and the speaker.

1. "Removing the lithium ion battery assembly" on page 29.
2. "Separating the top and bottom chassis halves" on page 31.
3. Remove the display module.

Caution Take care to protect the front surface of the display module and all surfaces of the display screen from scratching and contamination.

a. Remove the four screws from the display bracket, and remove the bracket to free the display module.

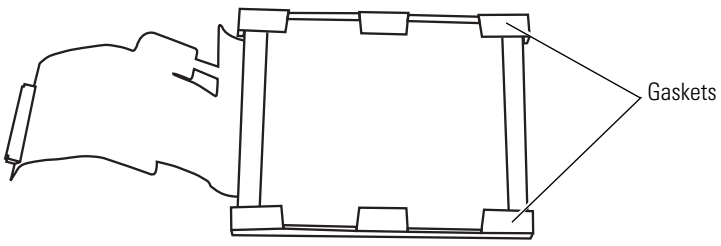




b. Remove the display module.

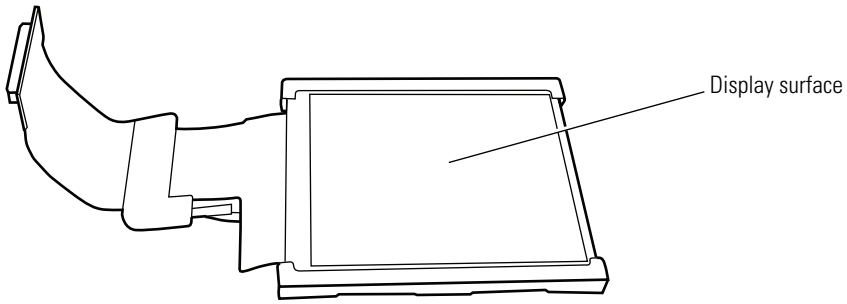
REASSEMBLY:

Tighten the display bracket screws to a torque of 2 inch lbs. Take care to avoid stripping the plastic screw mounts.



c. Remove the rubber gaskets from the display module.

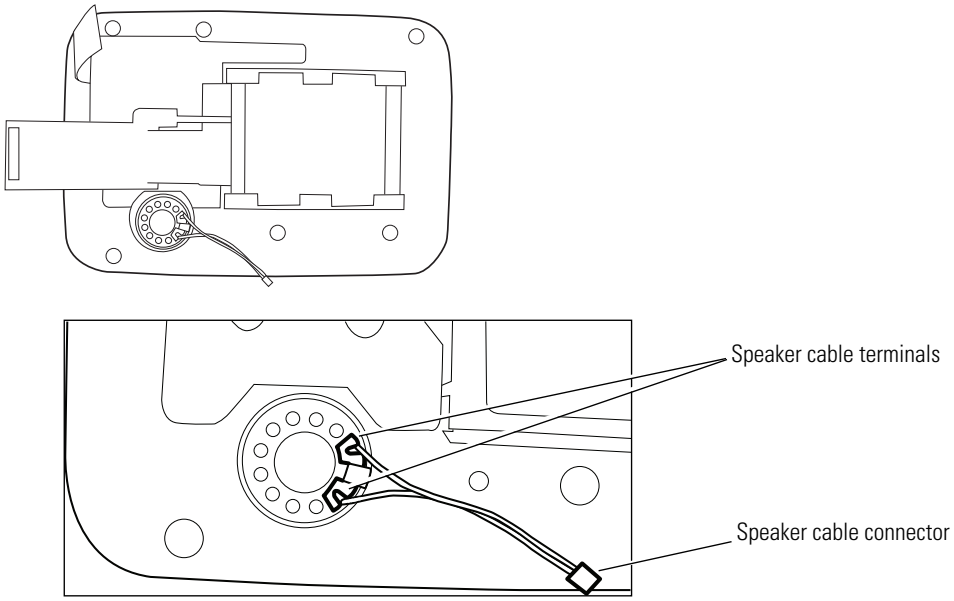
d. Set aside the display module, protecting the display surface from damage.



4. Remove the speaker.

REASSEMBLY:

Before removing the speaker, note the alignment of the speaker cable terminals for rerouting the cable.



a. Pry the speaker from the adhesive gasket securing it to the chassis.

b. Remove any remaining gasket pieces from the front panel and discard them.

REASSEMBLY:

1. Install a new gasket.

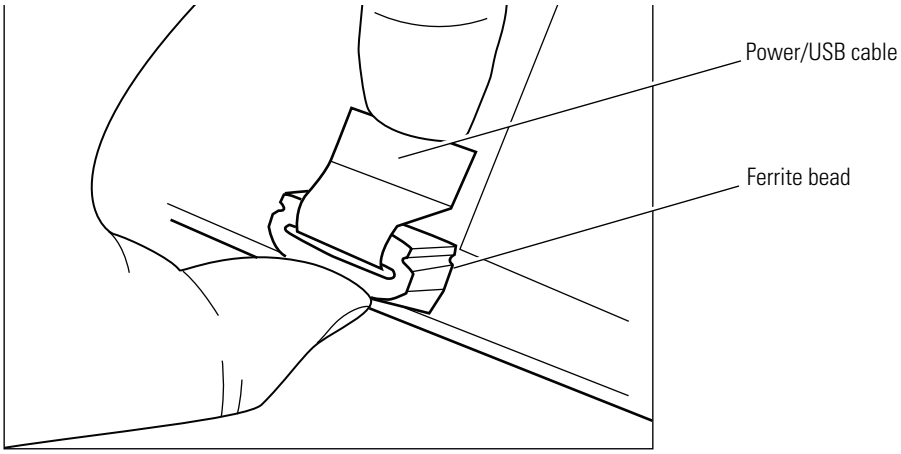
2. Align the new speaker for proper cable routing.

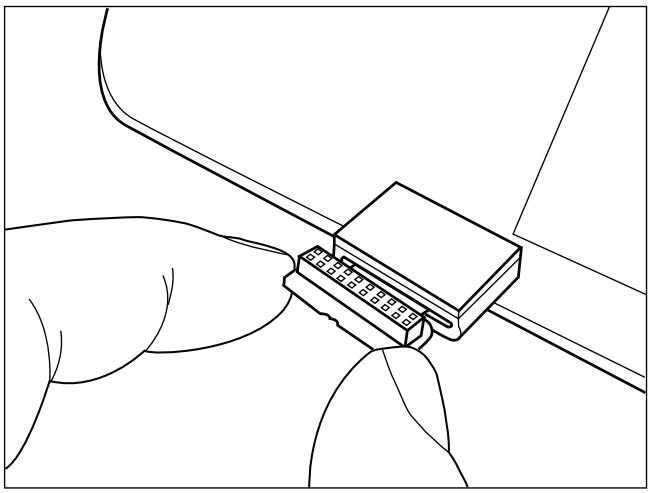
3. Seat the speaker on the gasket.

Removing the main board from the bottom chassis assembly

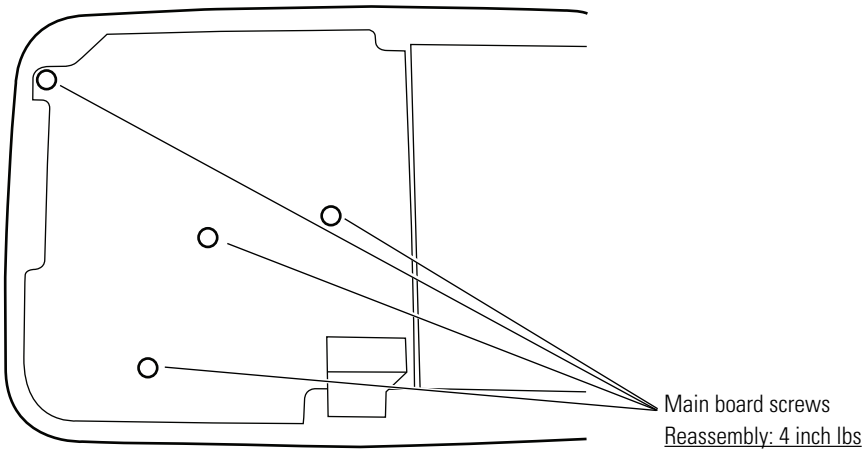
Caution Do not touch, move, or adjust the radio antenna. The radio antenna is extremely fragile and is exposed during this procedure. If the antenna is damaged, the monitor must be returned to a Welch Allyn authorized Service Center for repair.

1. "Removing the lithium ion battery assembly" on page 29.
2. "Separating the top and bottom chassis halves" on page 31.
3. Disconnect the power/USB flex cable from the main board connector (P2).

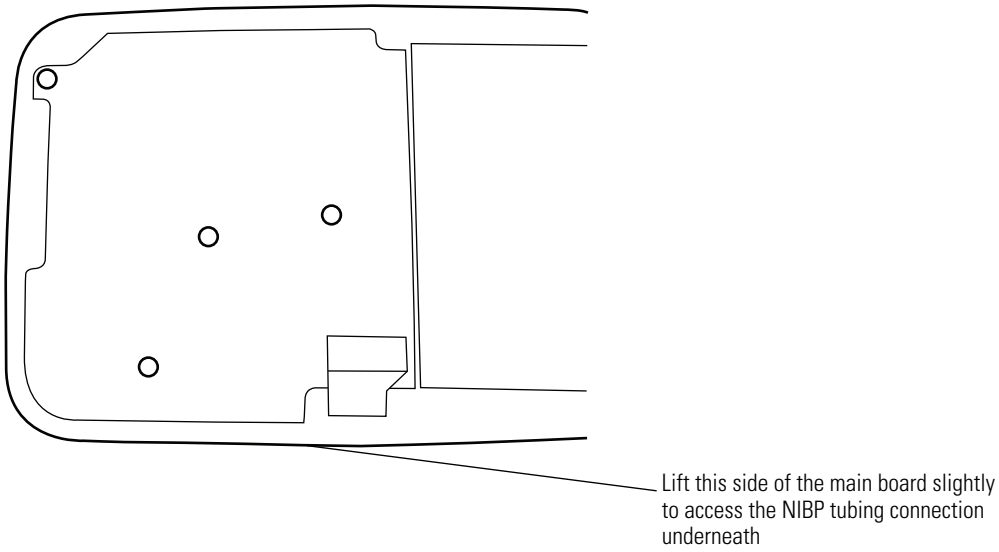




4. Remove the four screws holding the main board to the bottom chassis.



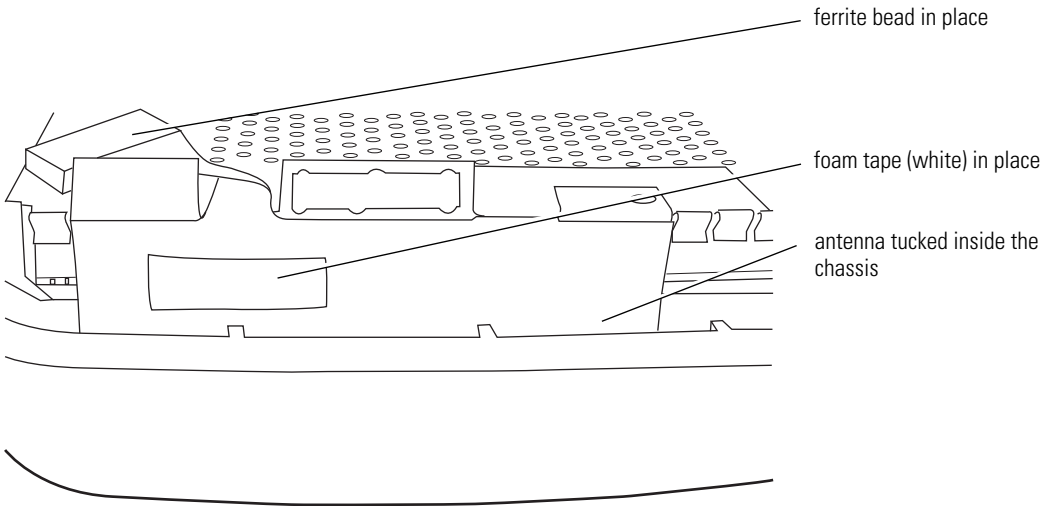
5. Lift the top of the main board slightly away from the chassis to access the NIBP tubing connection to the air inlet/filter.



6. Disconnect the NIBP tubing from the air inlet/filter port.

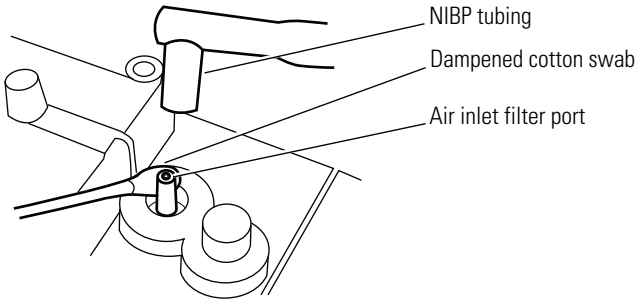
Caution Do not apply tool edges or serrations to the tubing. The tubing is fragile, especially at the joints. To avoid damaging the tubing, disconnect using only your fingers or unserrated pliers.

REASSEMBLY: When you reassemble the bottom chassis, verify that the radio card and the antenna are still in the correct positions:

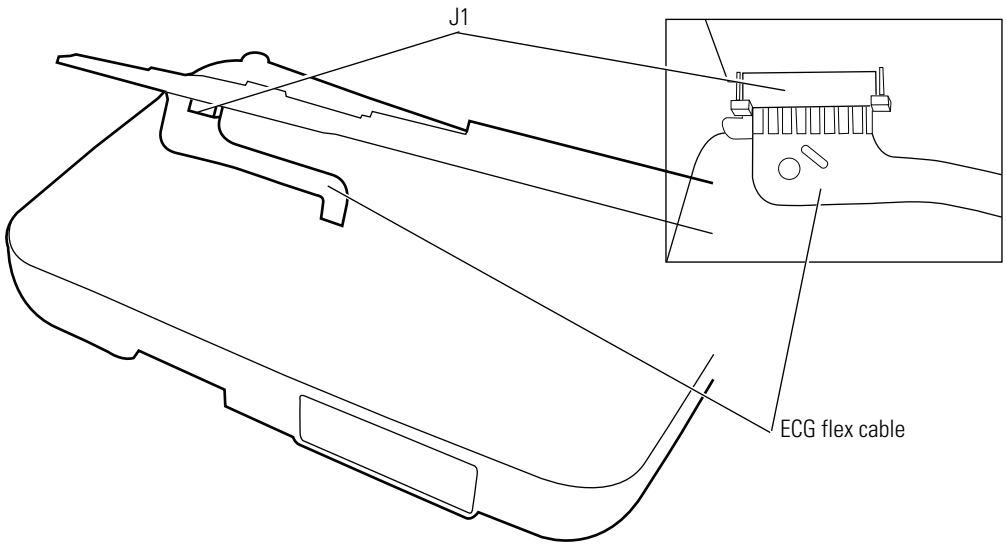


Note If the radio card or the antenna has been moved out of position, return the monitor to a qualified Welch Allyn service center. The radio and the antenna are not field-serviceable components.

REASSEMBLY: When reconnecting the tubing, lubricate the inlet port, using a cotton swab dampened with water.

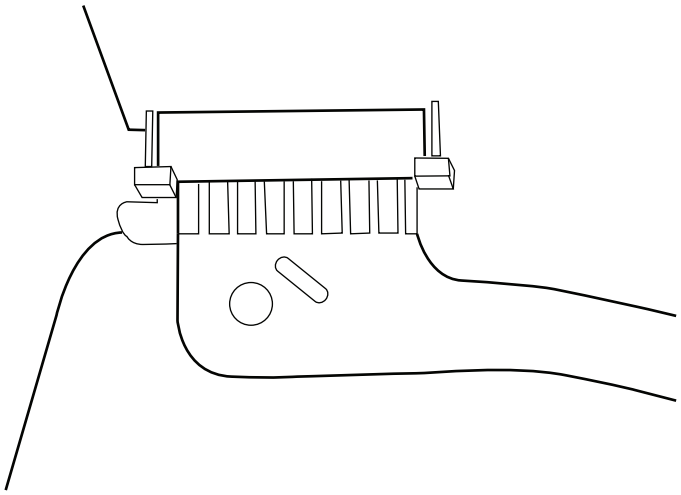


7. Disconnect the ECG (flex) cable from ZIF connector J1 on the back of the main board.

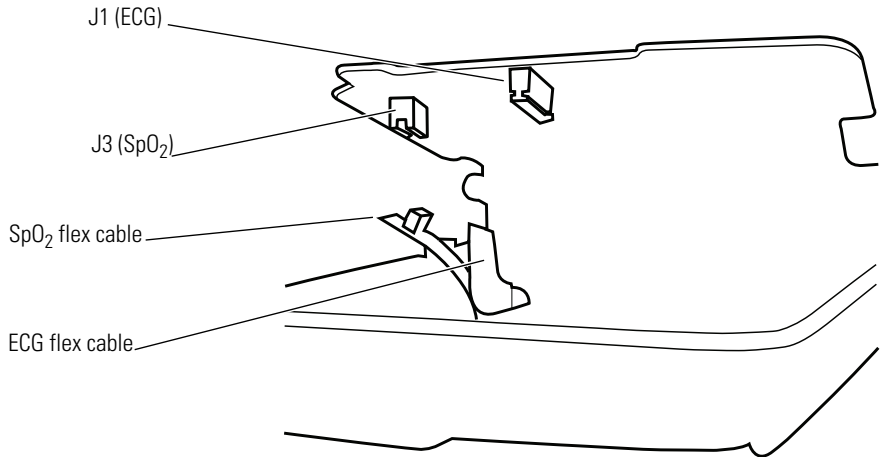


REASSEMBLY:

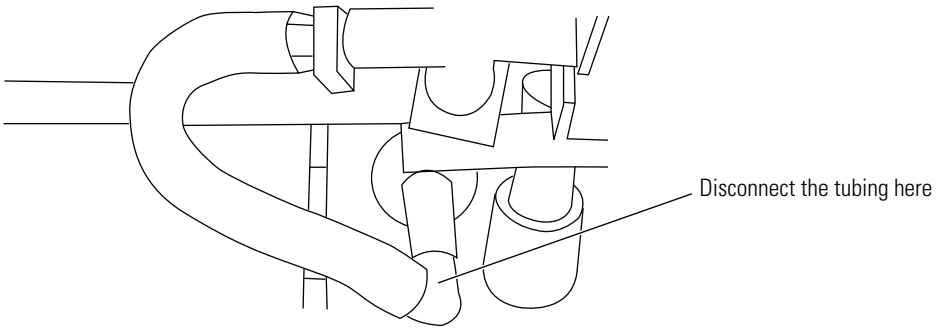
When reconnecting the ECG cable, be certain that the cable leads are perpendicular to the board and to the ZIF connector before you lock the connector clips.



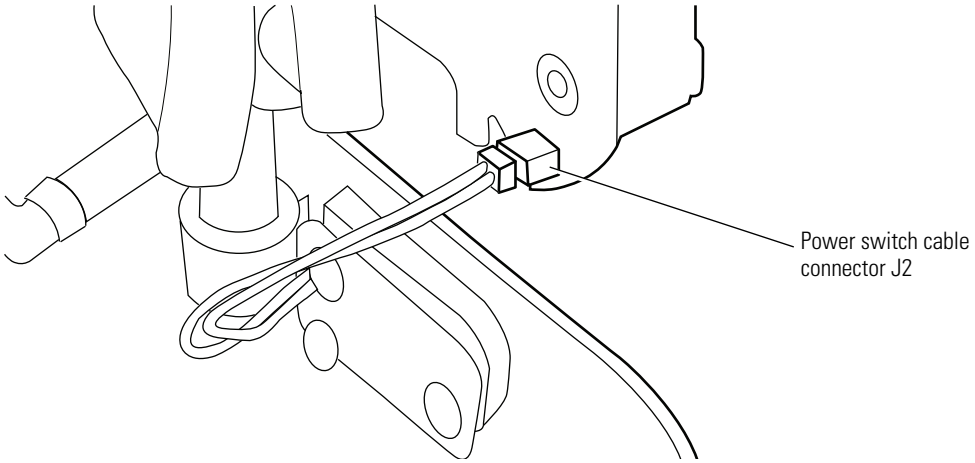
8. Disconnect the SpO_2 (flex) cable from connector J3 on the back of the main board.



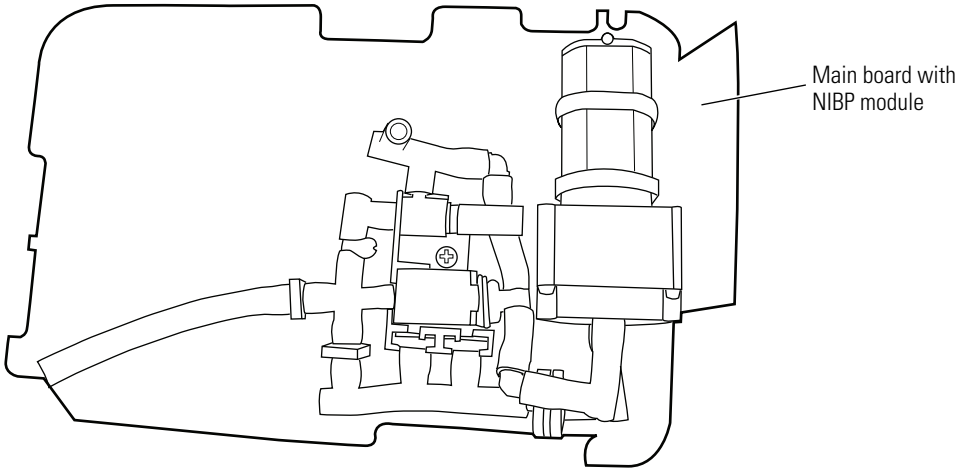
9. Disconnect the tubing section at the point shown here:



10. Disconnect the power switch cable from connector J2 on the back of the main board.



11. Remove the main board.



Removing the NIBP assembly from the main board

WARNING After replacing **any part** of the NIBP assembly, you must characterize NIBP. Failure to characterize NIBP could lead to excessive cuff pressure for neonatal patients.

This procedure consists of 3 parts:

- Part 1: Removing the Tubing
- Part 2: Removing the Pump
- Part 3: Removing the Valve Assembly

. Depending on what you are replacing, do one of the following:

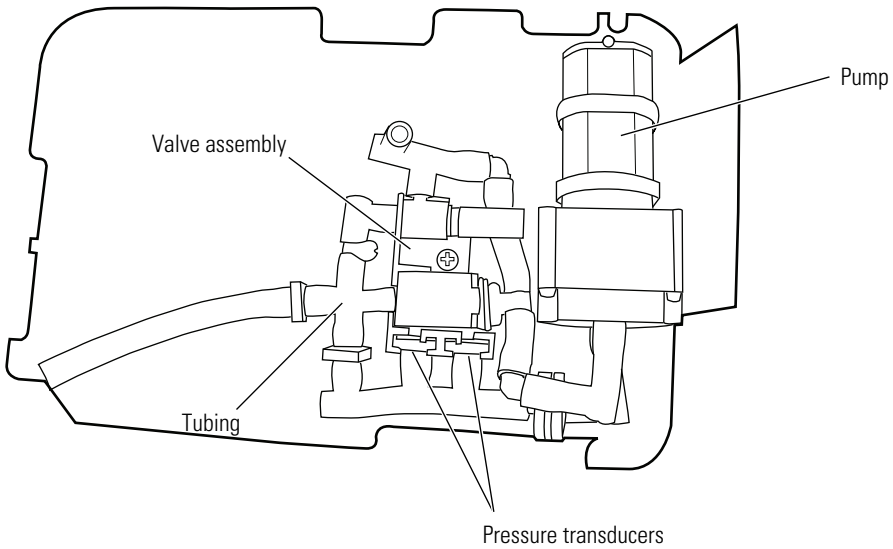
- Part 1
- Parts 1 and 2
- Parts 1 and 2 and 3

NIBP disassembly, part 1: Removing the tubing

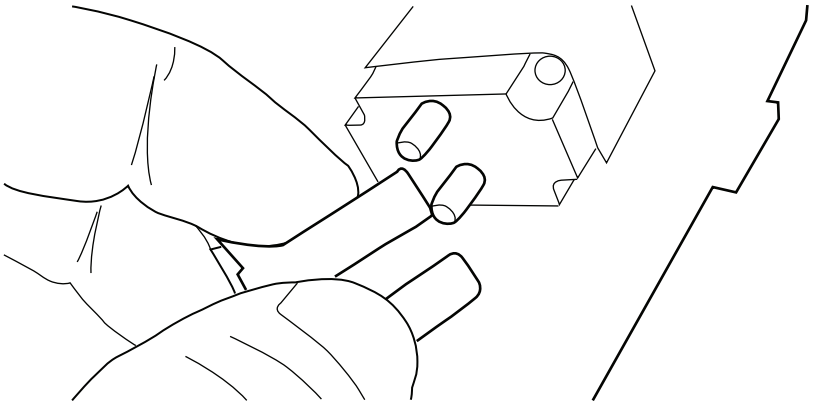
1. "Removing the lithium ion battery assembly" on page 29.
2. "Separating the top and bottom chassis halves" on page 31.
3. "Removing the main board from the bottom chassis assembly" on page 36.

Caution Use extra care when handling the tubing. The tubing, especially at the joints, is very fragile.

- Never use sharp-edged tools to grip or remove the tubing.
- Always grip the tubing as close as possible to the point of contact with the connector.

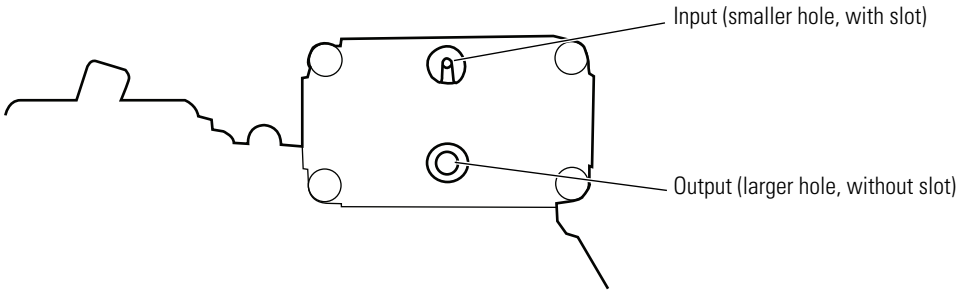


4. Disconnect the two tubing sections from the pump.

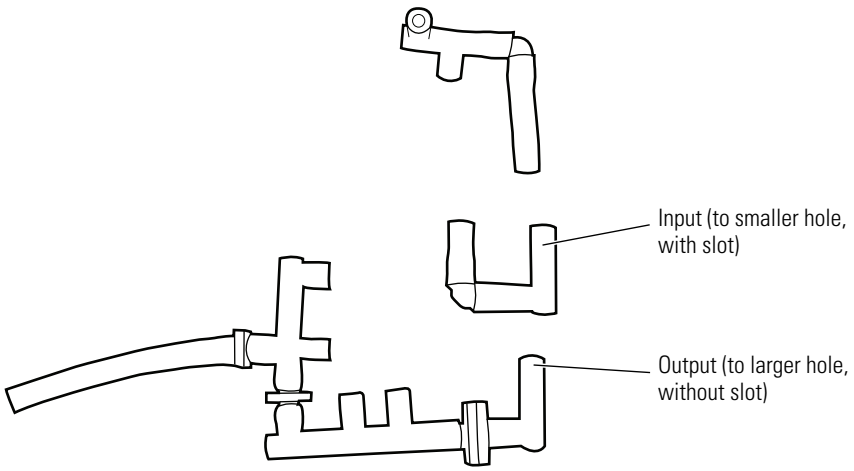


REASSEMBLY:

The pump input (suction) port is slotted and is oriented away from the main board. The output port (pressure) is not slotted and is oriented toward the main board.

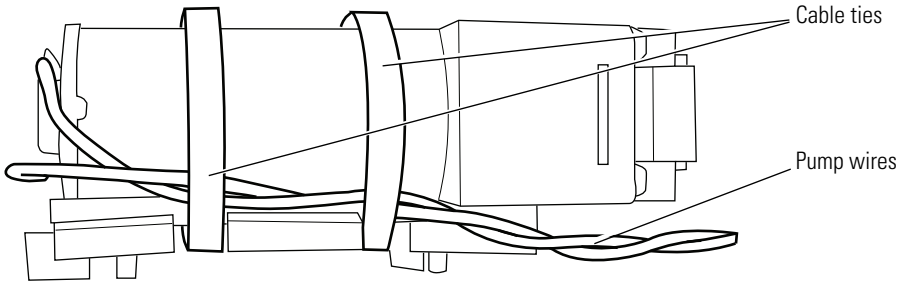


5. Disconnect and set aside the three tubing assemblies.

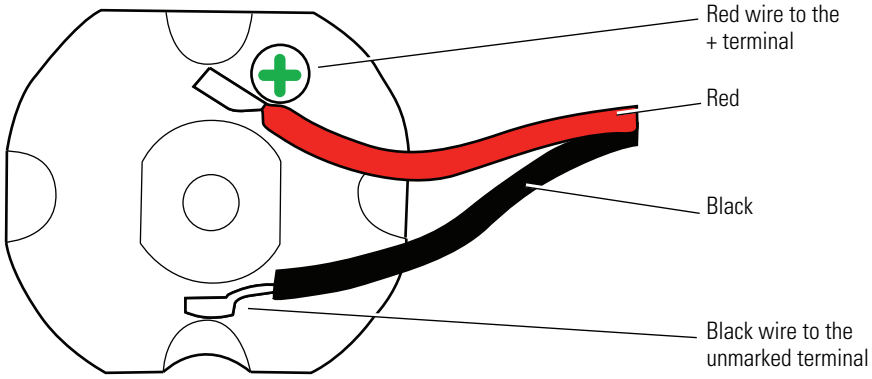


NIBP disassembly, part 2: Removing the pump

6. Note the relative positions of the pump, the pump wires, and the cable ties securing the pump.



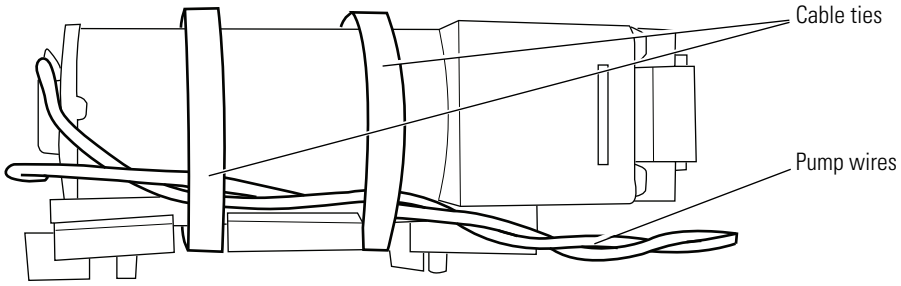
7. Note how the two pump wires are connected to the pump.



8. Desolder the two pump wires connected to the pump.
9. Clip the pump cable ties.

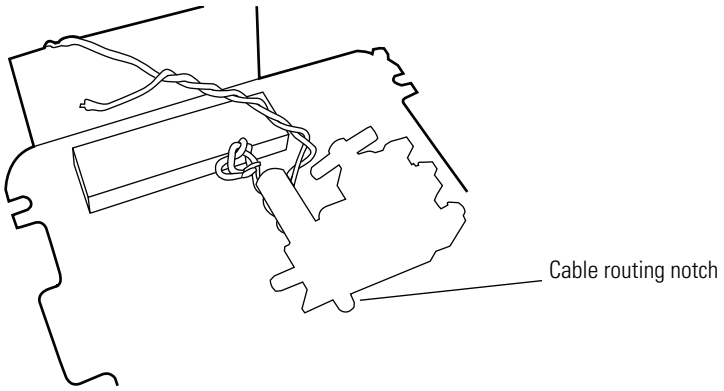
REASSEMBLY:

Secure the pump wires INSIDE the cable ties. Position the pump and replacement cable ties in the locations noted in step 6 on page 42. The back of the pump should align with the back of the pump bracket. Note that the pump wires go inside the cable ties as shown:

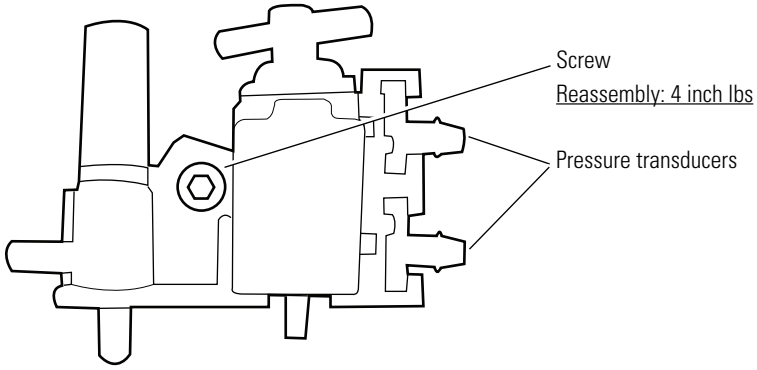


NIBP disassembly, part 3: Removing the valve assembly

10. Note the routing of the cable pack through the notch in the bottom of the valve assembly.



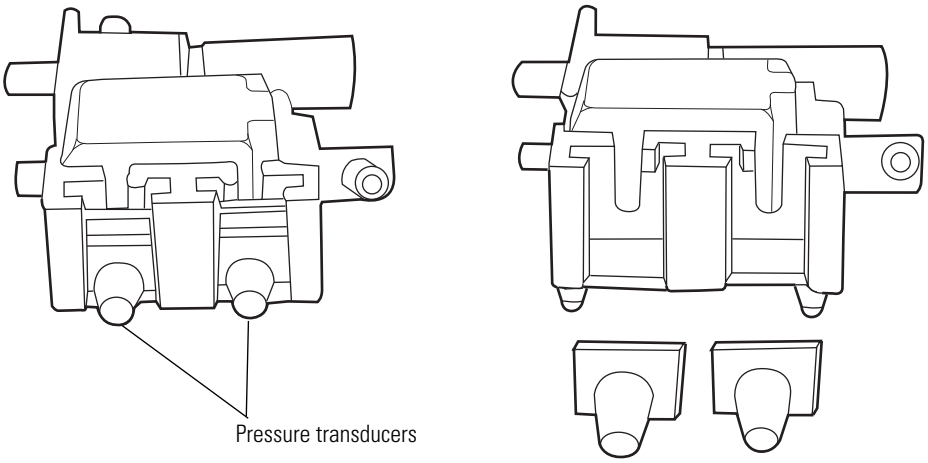
11. Remove the single screw securing the valve assembly to the main board.



Caution Do not attempt to remove the pressure transducers. The pressure transducers are not user-serviceable.

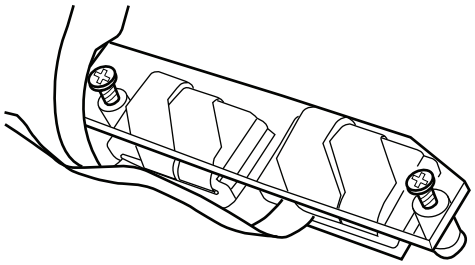
Caution Take extra care to protect the pressure transducers as you remove the valve assembly.

12. Lift the valve assembly straight up and off of the pressure transducers.



Removing the patient connector panel from the bottom chassis

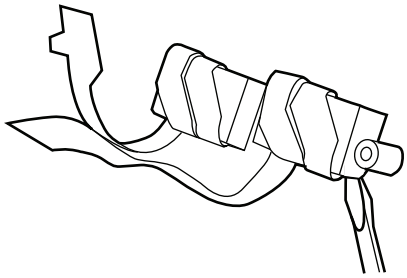
1. "Removing the lithium ion battery assembly" on page 29.
2. "Separating the top and bottom chassis halves" on page 31.
3. "Removing the main board from the bottom chassis assembly" on page 36.
4. Remove the clear plastic cover from the ferrite beads by removing the two screws (one is under a strip of foam tape) securing it to the chassis.



Reassembly: 4 inch lbs

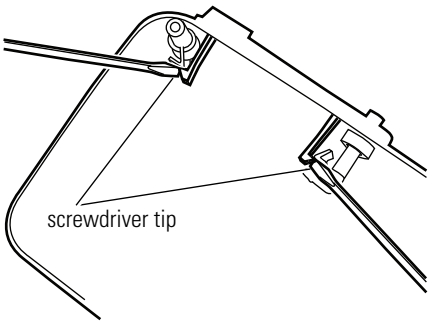
5. Pry the ferrite beads from the adhesive on the bottom case.

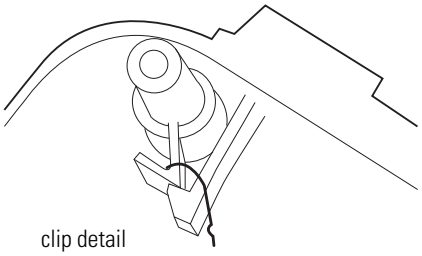
Caution The ferrite beads are extremely brittle and can chip or crack if mishandled.



6. The connector assembly is held in place by the two snap-in clips and by an adhesive gasket. Remove the assembly by pushing in the clips while applying upward pressure on the assembly to break the grip of the gasket.

Caution The clips are fragile. Excessive bending will break them.





REASSEMBLY:

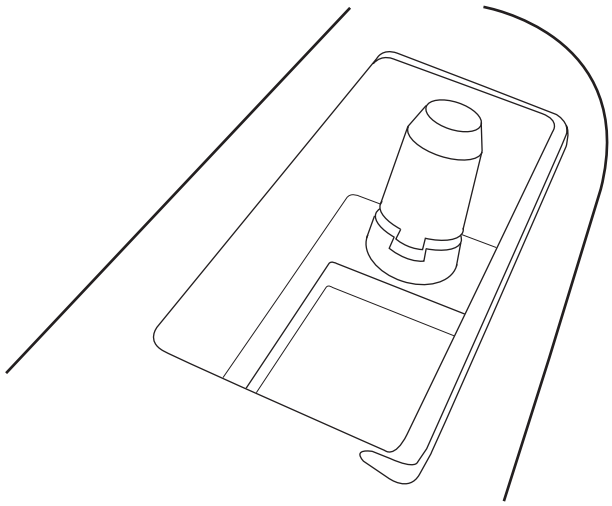
Remove all adhesive tape from the ferrite beads and remove all pieces of the adhesive gasket. Use all new adhesive tape on the ferrite beads and a new adhesive gasket on the connector assembly.

Removing the power/USB flex connector from the bottom chassis

1. "Removing the lithium ion battery assembly" on page 29.
2. "Separating the top and bottom chassis halves" on page 31.
3. "Removing the main board from the bottom chassis assembly" on page 36.
4. Remove the two hex nuts from the rear of the flex connector.
5. Remove the connector guide posts from the connector well.

Caution Use extra care during this procedure to protect all components of the flex circuit.

Note The hex nuts and the connector guide posts cannot be reused after removal. The hex nuts are secured with Loctite adhesive. Removing the nuts damages them and damages the guide posts.



6. Remove the Power/USB flex connector assembly.

REASSEMBLY:

(1) Install the washers onto the new connector guide posts.

(2) Seat the guide posts inside the connector well, noting the proper alignment of the flat side of the guide posts.

(3) Install the flex connector assembly.

(4) Add threadlocker to the screws and tighten the hex nuts enough to slightly compress the foam pad.

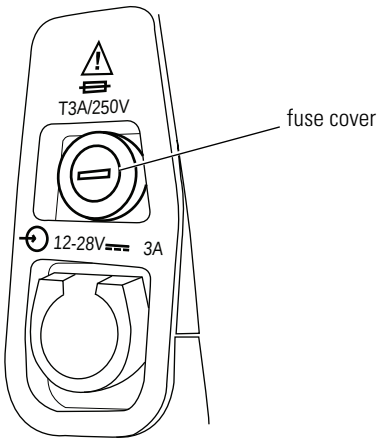
Disassembling the cradle

Note To facilitate reassembly, observe carefully while disassembling.

Replacing the fuse

3A, slow blow, 2AG

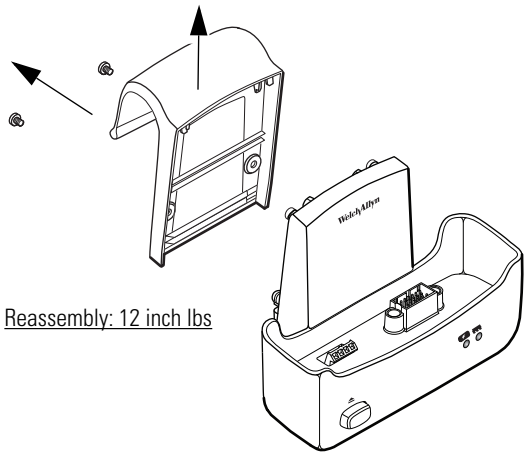
1. Remove the fuse cover by rotating it (using a screwdriver) 90° counterclockwise.



2. Remove and replace the fuse.
3. Replace the fuse cover.

Removing the bed rail hook

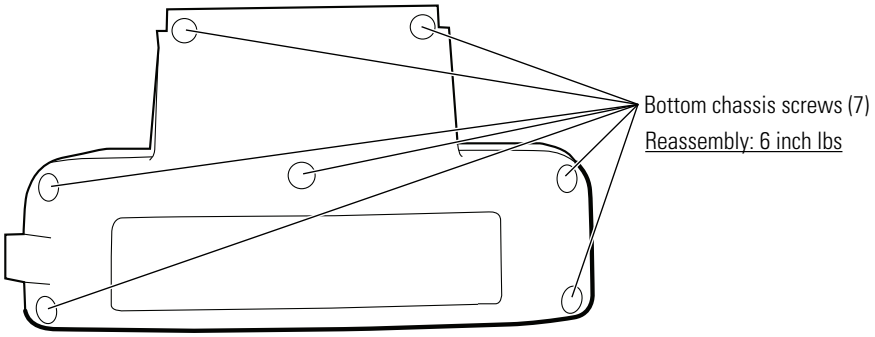
1. Remove the two screws securing the handle to the rear of the cradle.



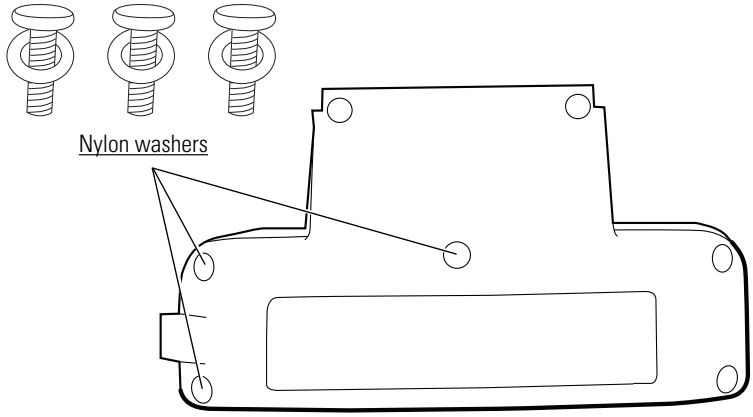
2. Slide the handle up and off of the shoulder screws.

Removing the lower housing, I/O panel, and power board

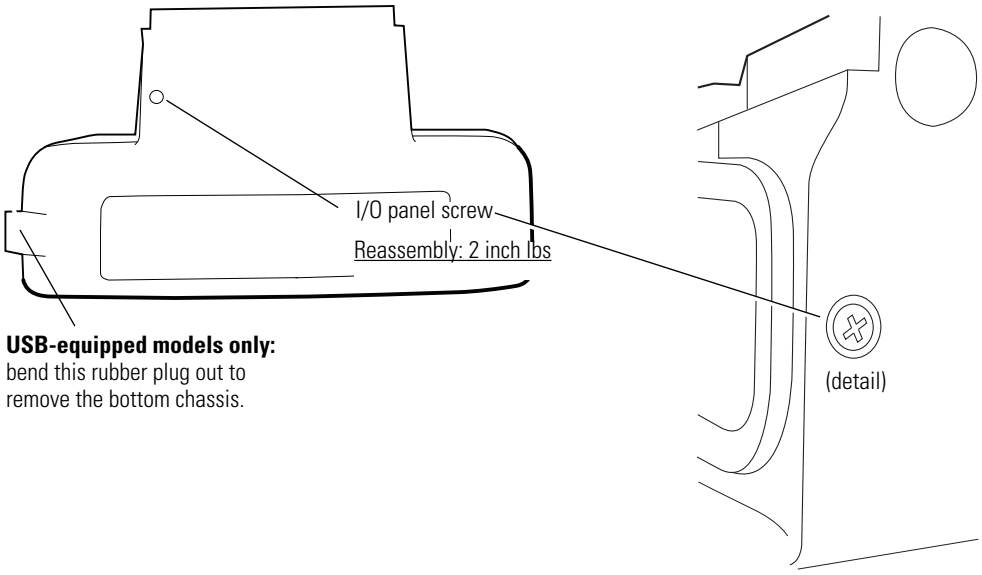
1. Remove the seven machine screws from the bottom of the lower housing.



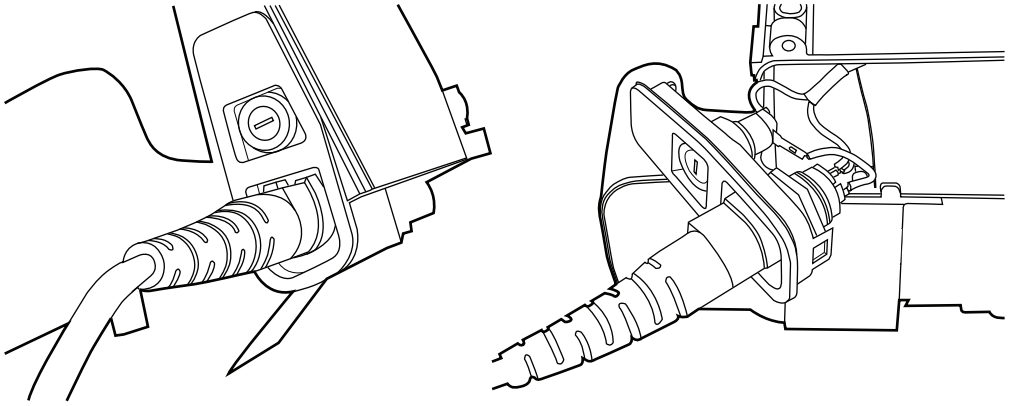
REASSEMBLY:Note the three screw holes that have nylon washers. These washers must be used in these screw holes.



2. Remove the threadlocking screw and nylon washer from the bottom of the I/O panel.

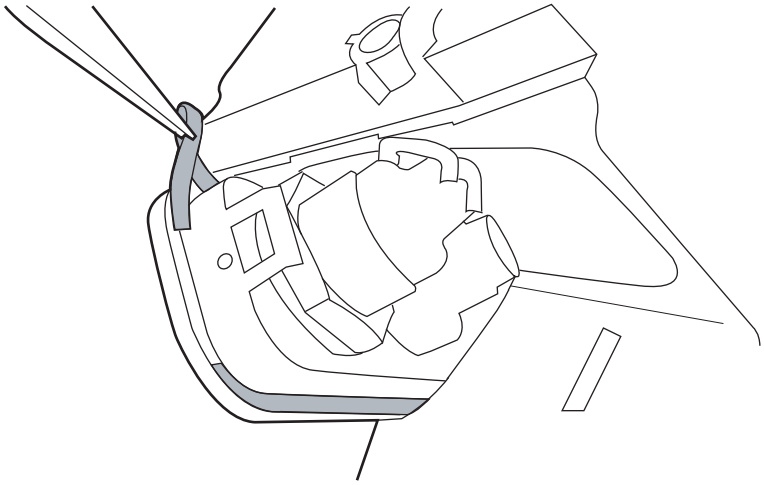


3. **With the AC power adapter unplugged from the wall**, plug the AC power adapter into the cradle AC power input connector.
4. Using the AC power adapter connector for leverage, carefully rock the I/O panel from side to side to break the bond of the adhesive gasket, and then separate the I/O panel from the upper housing.

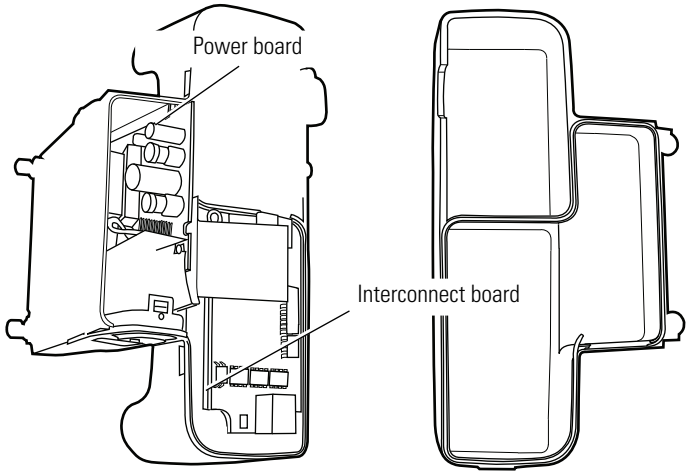


Note Do not attempt to save the adhesive gasket around the I/O panel. This gasket cannot be reused.

5. Remove and discard all pieces of the I/O panel adhesive gasket.

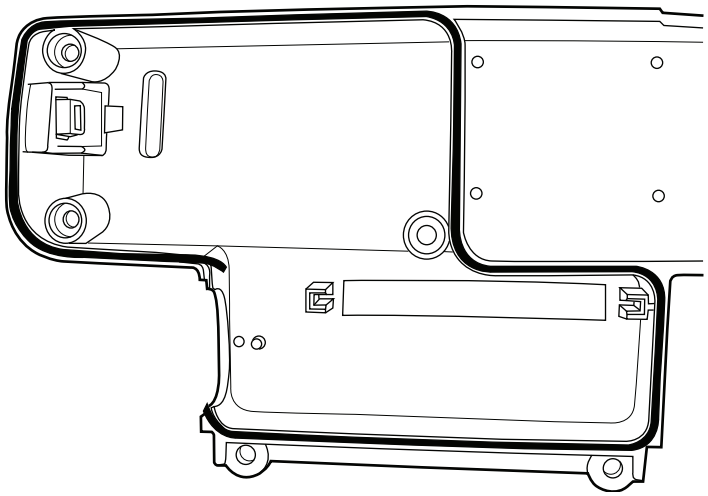


6. Unplug the AC power adapter from the cradle.
7. Separate the upper and lower cases.

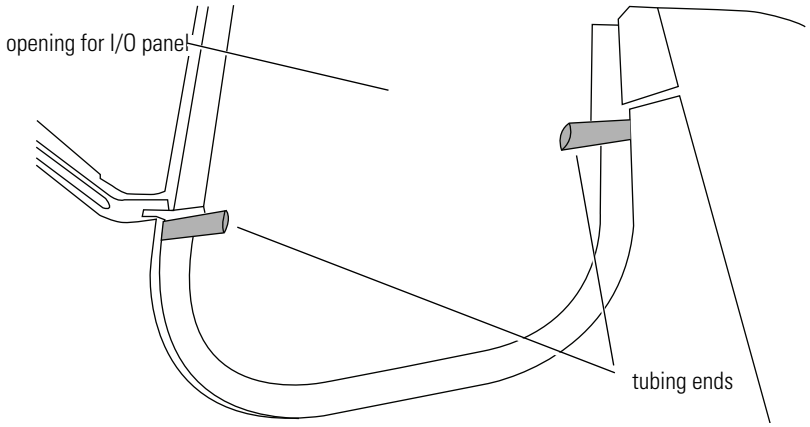


8. Carefully detach the thin, black rubber seal from the upper case.

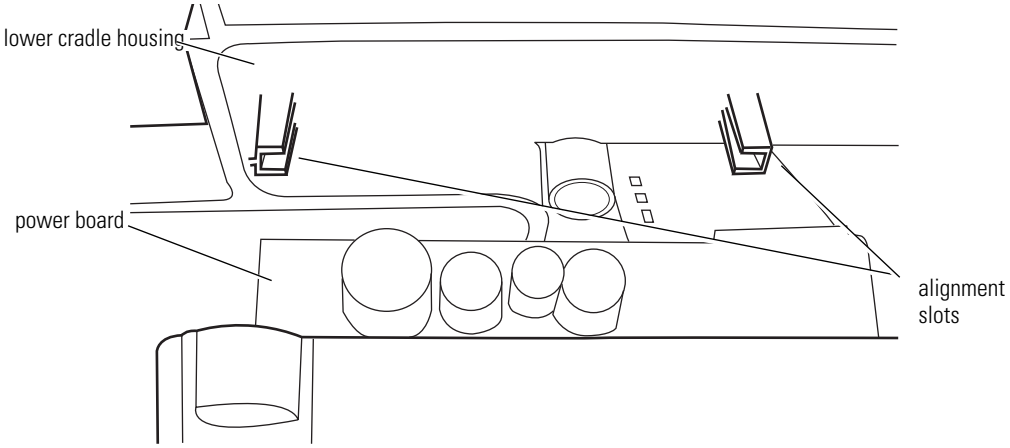
REASSEMBLY: Carefully install the thin, black rubber seal in the trough in the lower case before joining the upper and lower case halves.



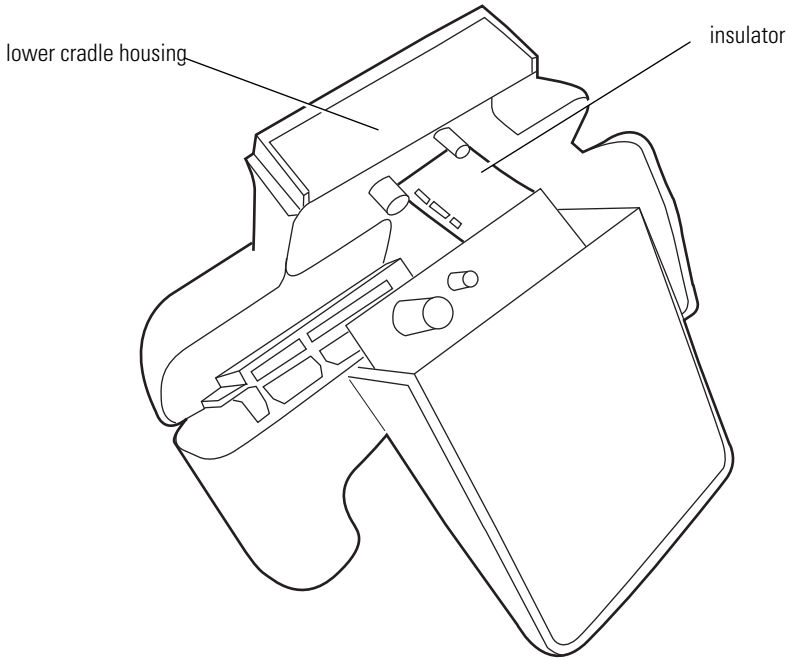
REASSEMBLY: When the rubber seal is properly installed, the ends of the seal extend into the I/O panel opening.



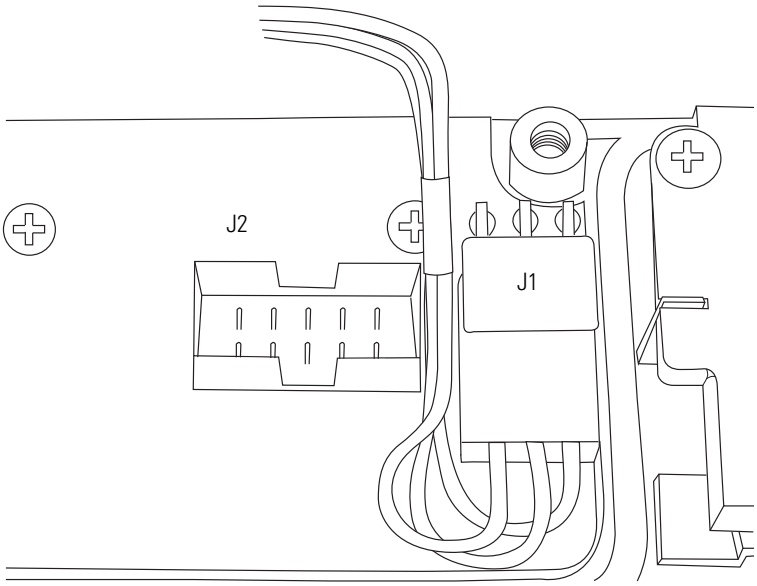
REASSEMBLY: Align the power board with the slots in the lower cradle housing.



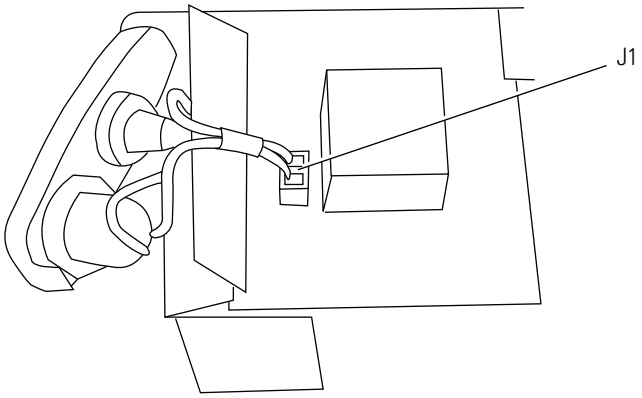
REASSEMBLY: When closing the cradle, bend the white insulator on the power board to slide along the wall of the lower cradle housing.



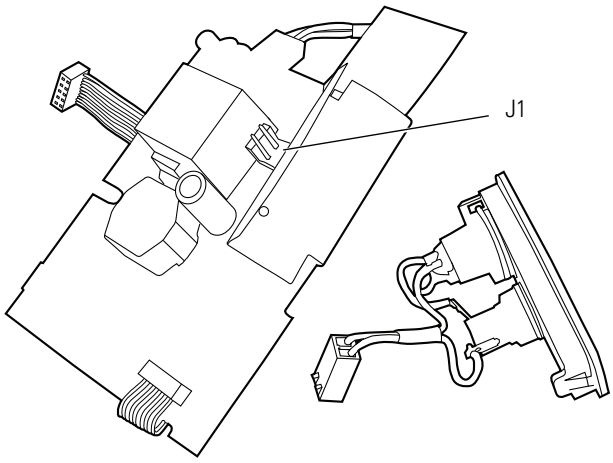
9. Note the routing of the J1 cable on the Interconnect board for later reassembly.



10. Disconnect J1 and J2 from the Interconnect board.
11. Remove the Power board and I/O panel by sliding the Power board out from the slots in the upper housing.



12. Disconnect the I/O panel connector from J1 on the Power board.



REASSEMBLY:

(1) Clean all remnants of adhesive from the upper and lower cradle cases, and from the I/O panel if you are reusing it.

(2) Apply a new adhesive gasket to the I/O panel.

Note: On USB-equipped cradles, keep the USB port cover out of the way during reassembly.

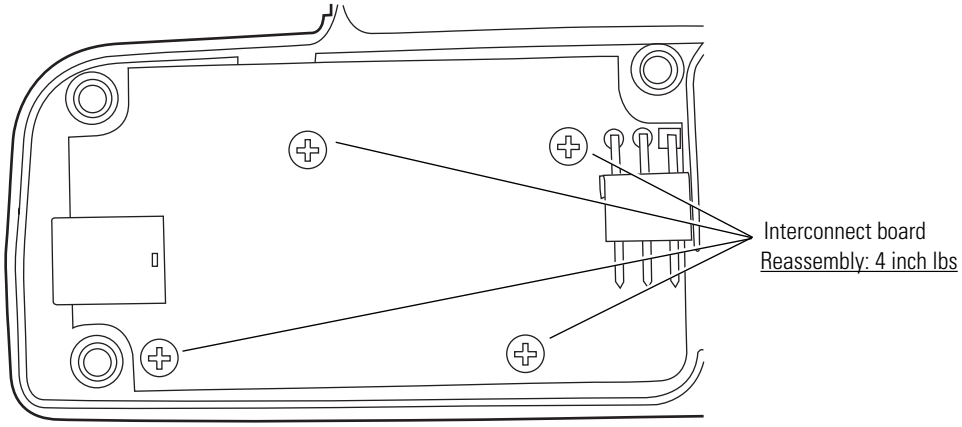
(3) Connect the I/O panel to J1 on the Power board.

(4) Install the Power board into the slots in the upper housing.

(5) Set the I/O panel in place, but do not remove the protective film from the adhesive gasket until the lower cradle housing is installed.

Removing the interconnect board

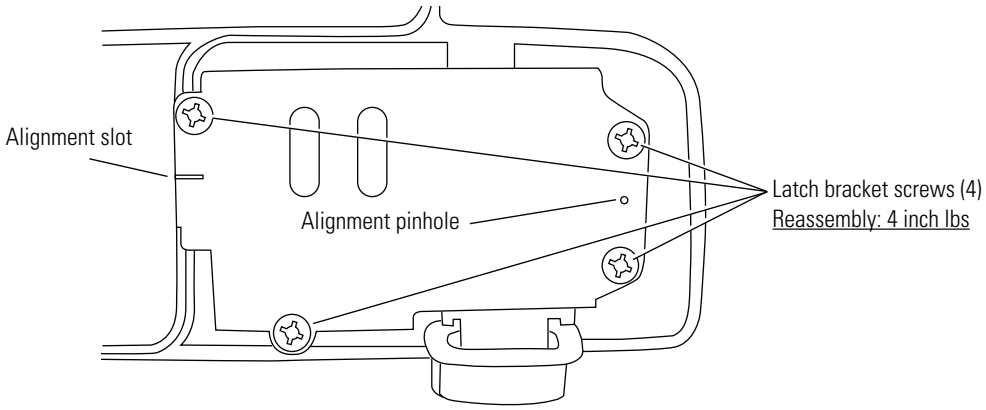
1. Remove the four screws securing the Interconnect board to the upper housing and lift the Interconnect board from the housing.



Note An early version of the Interconnect board included a photosensor attached by a 4-wire cable. If this photosensor and cable are present, clip the cables close to the board and remove the cable and photosensor.

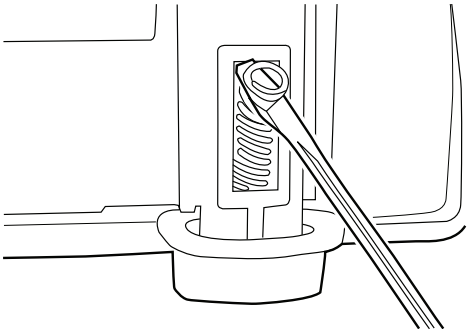
Removing the latch

1. Remove the four screws holding the latch bracket, and remove the bracket.



2. Remove the two latch springs by compressing them and lifting them off of the posts.

REASSEMBLY: Note the small alignment slot on one side of the bracket and the small alignment hole on the other.

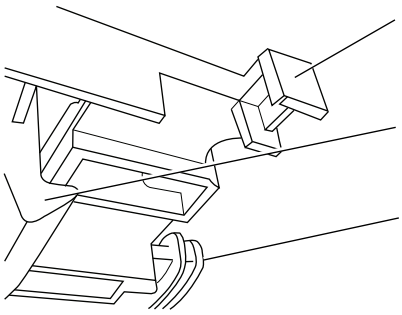


3. Remove the latch from the upper housing.

Note Interconnect boards shipped in early-production cradles included a photosensor assembly that is no longer used. Later Interconnect boards do not have the photosensor assembly.

- If you are reusing the original interconnect board, leave the reflective foil intact; otherwise, disregard the reflective foil.
- If you are replacing the latch, the replacement latch on the replacement board might not look like the original.

Reassembly: Install the blue button cap on the latch. Orient the flat side of the cap toward the catch.



5 Functional verification

Functional verification overview

This section describes the procedure for a complete functional test to support recommended preventive-maintenance schedules.

Equipment required

The following equipment is required for functional verification of a fully configured monitor.

Commercially available general-purpose/medical test equipment

Item	Manufacturer part number/specification
Power supply	Variable, 0-28 VDC, 0.100A (minimum), with voltage and current indicators (for 1mA current measurement)
Digital pressure meter	Netech Digimano 1000 or equivalent
AC withstand voltage (hi-pot) tester	Associated Research 3605 or equivalent
Hi-Pot Return Test Probe	Associated Research 38082 Return Retractor
Hi-Pot High Voltage Test Probe	Associated Research 38083 Safe-T Probe (High Voltage Test Gun)
ECG Simulator	Fluke 217A or Equivalent
SpO_2 simulator (to test the monitor and SpO_2 sensor)	Fluke (Biotek) Index2 XL/XLFE or equivalent
Masimo SpO_2	
Functional tester, Masimo SET (to test the monitor only)	Masimo SET Tester 1795
Cable, Masimo SET, DB9-LNCS (4', 10', or 14')	LNC-04-WA 4' LNCS cable or LNC-10-WA 10' LNCS cable or LNC-14-WA 14' LNCS cable
Adapter cable, Masimo	1645, MAC-1 SpO2 adapter cable (LNOP-to-LNCS)
Nellcor SpO_2	
Functional tester (to test the monitor only)	Nellcor SRC-MAX
Extension cable (required for SRC-MAX)	Nellcor DEC-8
Syringe, 60-ml, Slip-tip, Luer	BD (Becton, Dickinson) 309654 or equivalent

Welch Allyn accessories and test equipment

ECG cable, 4', 5-lead	008-0522-00 (AAMI) or 008-0522-01 (IEC)
NIBP Hose, Neonatal, 8'	008-0265-XX
Neonatal #1 cuff, disposable, box of 10	008-0620-XX
Adult Cuff	008-0628-XX
NIBP Hose, Adult	008-0864-XX
DC Input Cable	008-0290-XX
DC power adapter	503-0142-XX

Procedures

Charging cradle

This procedure verifies charger operation. It does not verify charger accuracy. Voltage and current are reported on the service screens with wide tolerances, due to measurement limitations of the monitor and limitations in how the cradle reports charging currents. Charger voltages and currents are tested to very narrow tolerances at the factory.

Inspecting the monitor connector

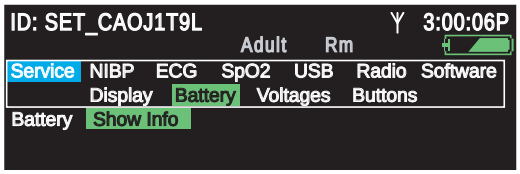
Inspect the 17-pin monitor connector to verify that it is clean and free of debris.

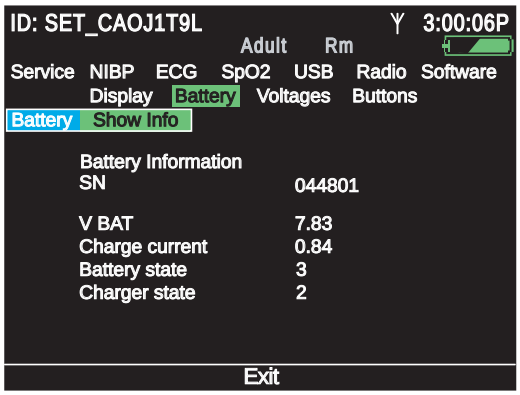
Partially discharging the battery

With the monitor out of the cradle, run the monitor until it does a low-battery shutdown.

Charging/LED operation

1. Observing correct polarity, connect the DC input cable (008-0290-XX) to the power supply.
2. Set the power supply for 28 VDC.
3. Connect the DC input cable from the power supply to the cradle.
4. With the monitor removed from the cradle, verify that the input current to the cradle is less than 50 mA, the power indicator on the cradle is green, and the status indicator on the cradle is off.
5. Disconnect the power cable from the cradle and the power supply.
6. Connect the AC power adapter (503-0142-XX) to the cradle, and verify that the power indicator on the cradle is ON and the status indicator on the cradle is OFF.
7. Dock the monitor into the cradle, and turn on the monitor if it does not turn on spontaneously.
8. Verify that the status indicator on the cradle is green.
9. After the monitor completes its power-up diagnostics, navigate to **Setup > Service > Battery** and press ⦿.





10. Verify that the charge current is between 800 mA and 1100 mA and that the charger state is 2.
11. Verify that the battery icon on the monitor is green with a lightning bolt.
12. Press to start the NIBP pump.

Note Pump startup may be delayed until power up NIBP testing is completed.

13. Verify after several seconds of pumping that the charge current is less than 220 mA.
14. Verify after several seconds of pumping that V BAT is between 8.14 V and 8.55 V.
15. Press to stop the NIBP pump.
16. Leave the monitor in the cradle until the status indicator on the cradle goes off.
17. Verify that the battery icon on the monitor display contains no lightning bolt.
18. Navigate to **Setup > Service > Battery**, press ⦿, and verify that the charger state is **6**.
19. Remove the monitor from the cradle and let the monitor continue to run for a minute.
20. Install the monitor in the cradle and verify that the status indicator on the cradle is briefly green and then goes off.

Charge time (optional procedure)

A normally discharged battery pack typically requires 3 hours (4 hours maximum) to fully charge, whether the monitor is on or off during charging.

Note A normally discharged battery pack is one on which a monitor has recently run for more than 5 minutes just before a low-battery shutdown.

1. Plug the monitor with the discharged battery into a powered cradle, in an environment with temperature in the range 0° C to 40° C.
2. Note the time required for the status indicator on the cradle to change from green to off. This may be timed during Step 16 on page 57.

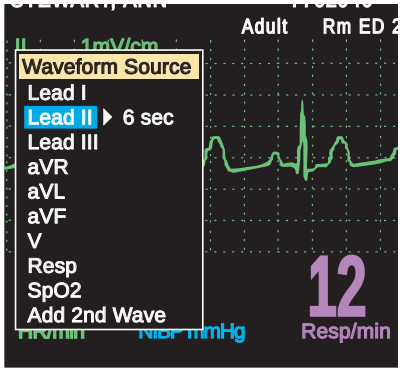
System tests

With the battery fully charged:

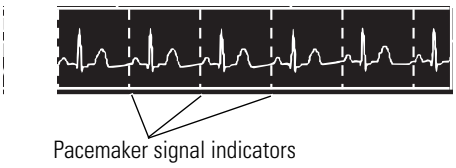
1. Power-on the monitor, observing the power-up sequence to verify that all three LED indicators light and that all three audio tones sound.
2. Start a new patient.
3. Highlight  and press ⦿.
4. Navigate to **Setup > Service > Voltages/Show Info** and press ⦿.
5. Verify that the displayed (measured) values for each supply are within the ranges shown on the screen.
6. Navigate to **Service > Display > Pixel Test** and press ⦿ twice.
7. Using the navigation arrows, cycle through the six colors on each screen half, verifying that all pixels are displayed in all colors and with uniform accuracy and brightness.
8. Press ⦿ to exit the Pixel test.
9. Go to the **Buttons** test and press ⦿ twice.
10. Push each button and verify that all button presses are shown.
11. Press ◀ and ▶ simultaneously to exit the Buttons test.
12. Navigate to **Service > Battery > Battery Info**.
13. Verify that the charger state is **8**.
14. Exit the Service menu.

ECG

1. Connect a 5-lead ECG cable between the monitor and the ECG simulator.
2. Set the simulator for **Lead II**, **normal sinus**, **80 bpm**, **1 mv**.
3. Press as needed to view a waveform display.
4. Highlight '**II**' and press ⦿ to the display the Waveform Source drop-down menu.



5. Highlight each ECG Lead (I, II, III, and V) and verify that for each one:
   - a waveform is present
   - heart rate is 80 bpm ± 3 bpm
6. Remove one lead and verify that the monitor displays an equipment alert identifying the failed lead: "Equipment Alert/ECG Fault/xx Lead failed".
7. Replace the lead and wait for the waveform to reappear.
8. Repeat Step 6 and Step 7 for each lead.
9. Reconnect all leads.
10. Set the ECG simulator to a paced signal.
11. Set the monitor pacer indicator **ON** (**Setup > ECG > Pacer Indicator**).
12. Verify that the monitor ECG waveform displays the pacers as vertical dashed markers.



Respiration

1. Set the Resp parameters on the ECG simulator to:
   - 20 breaths/minute
   - breath size = 1 ohm
   - base impedance between 200 and 1200 ohms
   - Lead Select to lead I
2. On the monitor, turn on Resp.
3. Set the Waveform Source to **Resp**. (See Step 3 and Step 4 in "ECG" on page 58.)
4. Set the monitor Resp Lead to **Ld1 (RA-LA)**. (**Resp/min ⦿ Resp Lead**.)
5. Verify that the monitor displays a Resp waveform with a rate of 20 bpm ± 2 bpm.
6. Switch the respiration simulator lead to lead **II**.
7. Set the monitor Resp Lead to **Ld2 (RA-LL)**.

8. Verify that the monitor displays a Resp waveform with a rate of 20 bpm ± 2 bpm.

SpO_2

Test either the monitor or the monitor with the sensor, as required for your application.

Note If the default simulation values are outside the monitor alarm limits, either adjust the alarm limits or silence the alarms when they occur.

Testing the Model 802LTxN monitors only

1. Power-off the monitor.
2. Connect the Nellcor SRC-MAX SpO_2 Functional Tester to the SpO_2 input connector through a Nellcor DEC-8 extension cable.
3. Power-on the monitor.

   The simulator flashes some LED indicators and initializes to a default condition in which the four test parameter indicators are lit closest to their respective selector buttons. The default should be 60 bpm and 75% saturation.
4. When the monitor display stabilizes, verify the following:
   - pulse rate is 60 bpm ± 3 bpm
   - saturation is 75% ± 3%
5. Switch the simulator to 200 bpm.
6. When the monitor display stabilizes (which could take as long as 30 seconds), verify that the pulse rate is 200 bpm ± 3 bpm.
7. Switch the simulator to 90% saturation.
8. When the monitor display stabilizes, verify that the saturation is 90% ± 3%
9. Disconnect the simulator.

Testing the Model 802LTxS monitors only

1. Connect the Masimo 1795 SET SpO_2 Tester to the monitor via a Masimo DB9-LNCS cable (4', 10', or 14') and a Masimo 1645 MAC-1 adapter cable (LNOP-to-LNCS).
2. When the monitor display stabilizes, verify the following:
   - Pulse rate from SpO_2 = 61 bpm ± 3 bpm
   - SpO_2 saturation = 81% ± 2%
3. Disconnect the simulator.

Testing the monitor and the sensor

1. Set the Fluke Index2 SpO_2 simulator to:

   Type = [**Masimo** or **Nellcor**], % = **94**, Rate = **60**, motion artifact = **No**
2. Let the simulator warm up for at least 5 minutes.
3. Connect a sensor to the optical finger of the simulator and to the monitor.
4. When the monitor display stabilizes, verify a saturation reading of 94% ± 4% and a pulse rate of 60 bpm ± 4 bpm.

NIBP

Characterization test

1. Attach a neonatal hose (008-0265-XX) to the monitor NIBP air connector.
2. Connect the test syringe, set to a volume of 35 ml, to the neonatal hose. (See "35-ml test volume" on page 73.)

Note The syringe plunger must not move when pressure is applied to the syringe cylinder.

3. Set the monitor patient mode to **Adult**.
4. Start an NIBP reading.
5. Verify that the monitor displays the message "Equipment Alert/NIBP Fault/Kinked or neonate hose".

WARNING If the message "Kinked or neonate hose" does not appear, remove the monitor from service. Characterize NIBP ("Characterize NIBP" on page 21) and then repeat this Characterization Test. If the monitor cannot pass the Characterization Test, return it immediately to an authorized Welch Allyn Service Center.

WARNING Use of an uncharacterized monitor can result in overinflation of neonatal cuffs. The monitor is characterized at the factory. If any change to the NIBP components occurs, the monitor must be withheld from service until it has been characterized again.

Leak rate test

Note If the time spent to run these tests is too long, the monitor times out and dumps pressure.

Note This test method uses a higher test pressure than required for compliance to regulatory standards, because only one of the monitor choices for built-in test pressures is equal to or greater than the maximum pressure required by regulatory standards. It also uses a much smaller test volume than required.

Using this much more stringent test method assures not only that the monitor meets the requirements of all regulatory standards but also verifies that the leak rate of the monitor is sufficient for the monitor's neonatal applications.

1. Attach a #1 neonatal cuff and hose to the monitor.
2. Wrap the cuff securely around a solid cylinder of circumference between 1.6 and 1.9 inches (4.1 and 4.8 cm.).
3. Navigate to **Service > NIBP > NIBP Test**.

Note Four test pressures—0, 80, 150, and 300 mmHg—can be selected. The actual instantaneous pressure achieved, as displayed in the lower left, can vary significantly from the selected test pressure.

The variance is greatest for the smallest test volumes, where actual pressure attained can be 10 to 20 mmHg greater than the nominal value of the test pressure.

Note Wait one minute for the NIBP to initialize before you select a test pressure.

Note Before you switch from one test pressure to another, wait for the pump to fully inflate the cuff and stop pumping.

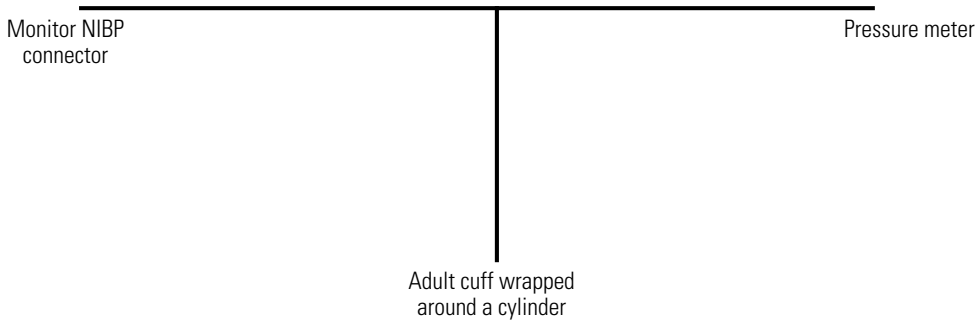
4. Press ⦿ to start the test at **80 mmHg**. The cuff inflates to approximately 95 mmHg.
5. After several seconds, press ⦿ again to inflate to 150 mmHg.
6. After several seconds more, press ⦿ again to inflate to 300 mmHg. The cuff inflates to 300 mmHg and the instantaneous pressure display at the lower left reads +++.
7. Wait until the pressure drops enough for the display to read 299 mmHg.
8. Wait 10 more seconds and then verify that the instantaneous pressure ≥ 291 mmHg.
9. Press ⦿ to select **0 mmHg** and release pressure.

Note Optionally, you can also test the leak rate at lower pressures, using the following additional steps.

10. Pump to any pressure.
11. Wait 15 seconds and note the instantaneous pressure reading.
12. Wait another 10 seconds and verify that the instantaneous pressure is within 8 mmHg of the noted pressure.

Accuracy test

1. Remove the neonate cuff from the monitor and replace it with an adult cuff and hose and a digital pressure meter.
2. Securely wrap the cuff around a solid cylinder of diameter between 3.2 and 4.3 inches (8.1 and 10.9 cm.).



3. Press ⦿ to start the test at **80 mmHg**. The cuff inflates to approximately 80 mmHg and then settles to a lower pressure.
4. Verify that the pressure reading on the monitor is within 3 mmHg of the reading on the digital pressure meter.
5. Press ⦿ to start the test at **150 mmHg**. The cuff inflates to approximately 150 mmHg and then settles to a lower pressure.

6. Verify that the pressure reading on the monitor is within 3 mmHg of the reading on the digital pressure meter.
7. Press ⦿ to start the test at **300 mmHg**. The cuff inflates to approximately 300 mmHg and then settles to a lower pressure.

Note The monitor might momentarily display **+++** (overrange reading) before settling below 300 mmHg.

8. Verify that the pressure reading on the monitor is within 6 mmHg of the reading on the digital pressure meter.
9. Press ⦿ to return to **0 mmHg** pressure.
10. Disconnect the hose from the monitor.

Radio test

This test applies only to model 802LTAN, 802LTAS, 802LTRN, and 802LTRS monitors.

1. Locate the monitor within 10 feet (unobstructed) of an Acuity System wireless access point.
2. Verify that the network connection symbol ᛉ appears on the monitor.

Note If the connection symbol does not appear, verify that the network is up and that the monitor has not been intentionally disconnected from the network.

If the connection symbol still does not appear, refer to "Radio" on page 14.

3. Navigate to **Service > Radio > Show Info**.
4. Verify:

Model 802LTRN, 802LTRS
RSSI ≥ –41 @ 10 feet

Model 802LTAN, 802LTAS
RSSI ≥ –61 @ 10 feet

Safety test (Hi-Pot)

The monitor contains no isolation barriers.

The cradle contains two 4KV isolation barriers—one between the 17-pin connector on the monitor and the dc power input connector on the cradle, and one between the 17-pin connector on the monitor and the USB connector on the cradle. These barriers are fully tested, at the factory, at 4KV rms at 60 Hz.

The power adapter also contains a 4KV isolation barrier.

Since each successive exposure to high voltage contributes to the degradation of an isolation barrier, and since no direct mains connection to the cradle exists, the following tests use a hi-pot voltage of 1.5KV as a reasonable compromise.

Optionally, this hi-pot test can also be done on the power adapter.

Electrical leakage tests for source and sink can also be done on the power adapter or on the cradle as follows:

1. Tie the ECG inputs of a leakage tester to either (a) the negative pin of the dc output connector of the power adapter or (b) pin 7 or pin 11 of the 17-pin connector on the cradle.
2. Tie the mains connector of the leakage tester to the ac cord of the power adapter or to the negative pin of the dc input connector of the cradle or to the metal shroud of the USB connector of the cradle.

Note, however, that with all insulation systems in place, the leakage current of a product's insulation barrier is determined almost entirely by the capacitance inherent in that barrier, and is thus fixed by materials and spacing within the product. A hi-pot test is more effective than a leakage test for verifying an isolation barrier.

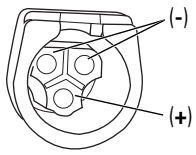
Note Check with your local regulatory authority to see whether hi-pot testing has special requirements to meet local laws and regulations.

1. Set up the hi-pot tester as follows:

Note For set-up information, refer to the tester manufacturer's instructions for use.

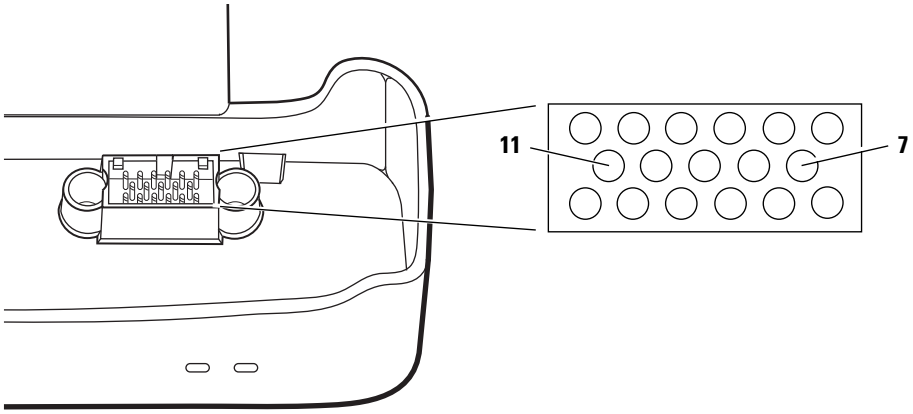
Voltage	1,500 VAC	Ramp Down	0
Max Limit	2.50 mA	Arc Sense	0
Min Limit	0.003 mA	Frequency	Set to local (50 or 60 Hz)
Ramp Up	5.0 S	Continuity	Off
Dwell	5.0 S	Connect	Off
Delay	0		

2. Connect the retractable return probe to the RETURN connector of the hi-pot tester.
3. Connect the high voltage test probe to the HIGH VOLTAGE (HV) connector of the hi-pot tester and, as required, to the remote trigger jack.
4. Extend the probe tip from the retractable return probe and touch it to either of the negative sockets of the DC input connector on the side of the cradle.



5. Extend the high voltage test probe tip and touch it to pin 7 or pin 11 of the P1 Interconnect connector inside the cradle bay.

Caution Do not bend the connector pins.



6. Holding both probes in contact with the specified pins, trigger the hi-pot test.
7. Hold the test probes in place until the test is completed. Verify that **PASS** appears in the tester display.
8. **For cradles equipped with a USB port**:
   a. Move the return probe to the metal shell of the USB connector on the cradle.
   b. Keep the high voltage probe on either pin 7 or pin 11 of the interconnect connector.
   c. With both test probes in contact, trigger the hi-pot test.
   d. Hold the test probes in place until the test is completed. Verify that **PASS** appears in the tester display.

Battery run time (optional procedure)

Charge the monitor in a cradle until the status indicator on the cradle goes off.

A new, fully charged battery pack is specified to operate the monitor, given the conditions listed below, for 8 hours under a heavy load or 24 hours under a light load:

Standalone	Acuity-connected
Continuous monitoring	Continuous monitoring
Back light **Off** and display set to shortest time-out period	Back light **Off** and display set to shortest time-out period
Display on for no more than 5 minutes per hour plus a period at the end of each NIBP measurement and a period for 'Low Battery' equipment alerts	Display on for no more than 5 minutes per hour plus a period at the end of each NIBP measurement and a period for 'Low Battery' equipment alerts
'Low Battery' equipment alerts acknowledged within 5 minutes	'Low Battery' equipment alerts acknowledged within 5 minutes
Monitor at 22°C ± 2°C	Monitor at 22°C ± 2°C
HR/PR tone set to **Low**	HR/PR tone set to **Off**
Alarm tone set to **Low**	Alarm tone set to **Low**
	In continuous communication (no dropouts) with Acuity

Light load (24 hours)

- ECG with normal sinus rhythm and 60 beats/minute
- Resp at 20 breaths/minute

Heavy load (8 hours)

- ECG with normal sinus rhythm and 60 beats/minute
- Resp at 20 breaths/minute
- SpO_2 with saturation of 98%, PR of 60 beats/minute
- NIBP autointerval of 15 minutes

Checklist and test results report form

Use a copy of this 3-page form to track your progress through the validation tests.

Test		Specification	Result	Pass	NA	Fail
Charging/LED operation						
4	Input current, cradle	< 50 mA				
	Status, cradle powered, monitor not inserted	Power indicator: ON				
		Status indicator: OFF				
6	Status, power adapter connected	Power indicator: ON				
		Status indicator: OFF				
8	Status, monitor running with discharged battery	Status indicator: GREEN				
10	Charge current, battery fully discharged	800 mA - 1100 mA				
	Charger state, battery fully discharged	2				
11	Status, battery charging	 (green)				
13	Charge current, pump running	< 220mA				
14	Battery voltage, pump running	8.14 V - 8.55 V				
17	Status, battery fully charged	 (green)				
18	Charger state, battery fully charged	6				
20	Status, cradle transition	Status indicator: green and then OFF				
Battery charge time (optional)						
2	Charge time	< 4 hours				
(continued below)						

Test		Specification	Result	Pass	NA	Fail
System						
1	Indicators, start-up	Red, yellow, and green LEDs				
		Low, medium, and loud tones				
5	Voltage, power supply	Within range				
7	Pixels	Visual				
10	Buttons	Visual				
13	Charger state	8				
ECG						
5	Waveform	Present				
	Heart rate	80 bpm ± 3 bpm				
6-8	Single lead fail (repeat for each lead)	Lead Fail message for each lead				
12	Pacer indicator	Present				
Respiration						
5	Waveform (Lead 1)	Present				
	Heart rate	20 bpm ± 2 bpm				
8	Waveform (Lead 2)	Present				
	Heart rate	20 bpm ± 2 bpm				
SpO_2 - monitor only, Nellcor						
4	Pulse rate @ 60 bpm	60 bpm ± 3 bpm				
	Saturation @ 75%	75% ± 3%				
6	Pulse rate @ 200 bpm	200 bpm ± 3 bpm				
8	Saturation @ 90%	90% ± 3%				
SpO_2 - monitor only, Masimo						
2	Pulse rate	61 bpm ± 3 bpm				
	Saturation	81% ± 2%				
SpO_2 - monitor and sensor						
	Pulse rate @ 60 bpm	60 bpm ± 4 bpm				
	Saturation @ 94%	94% ± 4%				
(continued below)						

Test	Specification	Result	Pass	NA	Fail
NIBP characterization					
5 Wrong cuff alert	"Kinked or neonate cuff" mesage appears				
NIBP leak rate					
8 Leak rate	≥ 291 mmHg				
12 Leak rate	≤ 8 mmHg in 10 seconds				
NIBP accuracy					
4 Accuracy @ 80 mmHg	monitor reading = meter reading ± 3 mmHg				
6 Accuracy @ 150 mmHg	monitor reading = meter reading ± 3 mmHg				
8 Accuracy @ 300 mmHg	monitor reading = meter reading ± 6 mmHg				
Radio					
2 Network connection	Y (symbol is present)				
4 RSSI @ 10 feet	RSSI ≥ –41 (802LTRN/RS) RSSI ≥ –61 (802LTAN/AS)				
Safety (Hi-Pot)					
7 Isolation between the monitor and the cradle power input	Isolated				
8d Isolation between the monitor and the USB port	Isolated				
Battery run time - new battery (optional)					
Light load	24 hours				
Heavy load	8 hours				

6 Replacement parts

This list includes field-replaceable service parts only. Product accessories are listed separately at www.welchallyn.com.

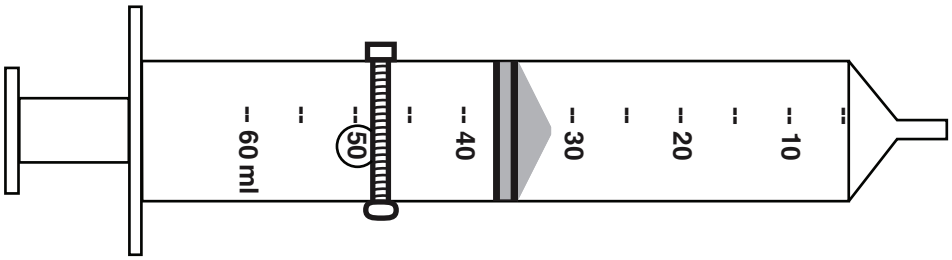
Order Number	Description
	Top chassis
020-0647-XX	Top Panel Assembly (includes buttons, window, panel overlay)
020-0631-XX	Service Kit, Display, Color LCD, QVGA with extender flex
630-0223-XX	Gasket, Display (2 each)
600-0506-XX	Bracket, Display
660-0227-XX	Cable Assembly, LCD Extender Flex
660-0257-XX	Speaker Assembly with Cable
600-0554-XX	Gasket, Speaker
	Bottom chassis
020-0649-XX	Connector Panel, ECG/SpO_2/NIBP
020-0623-XX	Bottom Case Assembly with Power Switch, Connector Panel, and Power Flex)
640-0628-XX	Label, Rear Panel
640-0647-XX	Label, Icon Descriptions
630-0241-XX	Insert, Screw Cover, Bottom Case
630-0243-XX	Insert, Rectangular, Bottom Case
660-0218-XX	Connector Assembly, Power/USB Flex
680-0074-XX	Pump, NIBP, without wires
620-0403-XX	Cable Tie (2 per pump)
020-0625-XX	Tubing Kit (3 Tubing Sections with fittings and check valve)
020-0624-XX	Valve Assembly (Including Pump Wires)
600-0396-XX	Check Valve
600-0500-XX	Filter
630-0224-XX	Cap, Filter
620-0385-XX	O-Ring, Filter
620-0397-XX	Strap Lugs
	Fasteners, monitor
620-0383-XX	Screw, 6-32 X .437, Captive, Slt, SS
620-0048-XX	Screw, 6-32 X .5, PH, Ph, NyLoc, SS
620-0049-XX	Screw, 6-32 X 1, PH, Ph, NyLoc, SS
620-0149-XX	Screw, 2-28 X .250, TF, PH, Ph, ST, Zinc, Plastite
620-0278-XX	Screw, 4-40 X .5, PHH, PNH SST, NyLoc Patch
620-0290-XX	Screw, 4-40 X .25, PHH, PNH SST with NyLoc Patch
620-0408-XX	Screw, 4-24 X .38, Flt, PHH, Type BT
630-0260-XX	Cap, Plastic, Insert/Guide Pin
620-0418-XX	Washer, Flat, .215" O.D., .115" I.D., .020" Thick, NPR
620-0217-XX	Kepnut, 4-40, Steel, Zinc-Plated
650-0021-XX	Loctite, S/LH, No. 425 Thread Locker

	Charging cradle
020-0635-XX	Interconnect PCB
020-0638-XX	Power Board Assembly, with Power and Interconnect Cables
020-0650-XX	Panel Assembly, I/O, Cradle
600-0544-XX	Gasket, Adhesive, I/O Panel
503-0058-XX	Fuse, 3A, Slo-Blo, 2AG
020-0637-XX	Housing, Upper Cradle
630-0251-XX	Latch, Cradle
630-0252-XX	Bracket, Latch, Cradle
630-0253-XX	Button, Latch, Cradle
020-0652-XX	Housing, Lower Cradle Assembly with USB
020-0651-XX	Housing, Lower Cradle Assembly without USB
640-0637-XX	Label, Cradle
630-0259-XX	Plug, USB, Cradle
600-0526-XX	Foot, Cradle (4 per)
620-0406-XX	Spring, Latch, Cradle (2 per)
600-0552-XX	Foil, Latch, Cradle
	Fasteners, cradle
620-0188-XX	Screw, Plastite, 4-20 X .375, 60-1, Pan Head, Philips
620-0415-XX	Screw, #6-32 X .375, PNH, PHH, SST, PTH
620-0414-XX	Washer, .281" O.D., .175" I.D., .031" Thick, Nylon
620-0423-XX	Screw, M4 X 4, PRCN Shoulder, AW, SST (2.5 mm Hex Drive)
620-0424-XX	Screw, M4 X 5 mm, PNH, PHH, SST
620-0149-XX	Screw, 2-28 X .250, TF, PH, PH, ST,Zinc, Plastite
620-0413-XX	Washer, .187" O.D., .125" I.D., .031 Thick, Nylon
020-0636-XX	Fastener Assortment, Monitor/Cradle

A 35-ml test volume

Refer to the illustration below:

1. Move the syringe plunger to the 35-ml line.
2. Drill a small hole (for example, 9/64") through the syringe and the plunger shaft, at a location between the plunger and the top of the syringe.
3. Insert a rod or bolt (for example, a 6-32 screw) through the hole so that the plunger cannot move, creating a constant volume in the syringe of 35 ml ± 2 ml.
4. Secure the rod or bolt so that it cannot fall out of the hole.



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