CP 150 12-lead resting electrocardiograph

Service manual

Software version 2.00.XX

Welch Allyn®

Advancing Frontline Care™

For information about any Welch Allyn product, call Welch Allyn Technical Support (http://www.welchallyn.com/support) or visit http://www.welchallyn.com/en/about-us/locations.html.

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This manual applies to the REF 901049 ELECTROCARDIOGRAPH

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Advancing Frontline Care™

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Symbols

Documentation symbols

	**WARNING** The warning statements in this manual identify conditions or practices that could lead to illness, injury, or death.		**Caution** The caution statements in this manual identify conditions or practices that could result in damage to the equipment or other property, or loss of data. This definition applies to both yellow and black and white symbols.
	Consult operating instructions/directions for use (DFU). A copy of the DFU is available on this website. A printed copy of the DFU can be ordered from Welch Allyn for delivery within 7 calendar days.		CE Mark for Class Is, Im, IIa, IIb & III

Power symbols

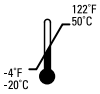
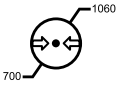
	Power on/standby		Battery
	Alternating Current power present, battery fully charged		Battery absent or faulty
	Alternating Current power present, battery is charging		Battery charge level
	Alternating current (AC)		Battery Charging - AC powered
	Dangerous voltage		Power plug
	Fuse		Rechargeable battery

	Protective Earth (PE)		Non-ionizing electromagnetic radiation
	Equipotential Ground		Rated power input, AC

Connectivity symbols

	USB		Ethernet

Shipping, storing, and environment symbols

	This way up		Keep away from rain
	Fragile		Humidity limitation
	Temperature limit		Atmospheric pressure limitation
	Do not dispose of in trash, for batteries only		Recyclable
	Do not dispose of in trash, for devices		China RoHs
Li-ion	Lithium ion battery		Keep away from sunlight
	Expiration Date	**IP20**	Protected against the ingress of solid foreign objects ≥ 12.5 mm diameter, not protected against the ingress of water.

Miscellaneous symbols

	Manufacturer		Defibrillation-proof Type CF applied part
	Product Identifier		Serial Number
	Reorder Number		Lot Code
	Intertek ETL listed		Do not re-use, Single use device
	By prescription or order of physician		Global Trade Item Number

Safety

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

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

General warnings

Warnings indicate conditions or practices that could lead to illness, injury, or death.

Warnings related to the environment

WARNING The power cord is considered the disconnect device for isolating this equipment from supply mains. Do not position the equipment so that it is difficult to reach or disconnect.

WARNING To avoid a possible explosion, do not use the electrocardiograph in the presence of flammable anesthetics: mixtures containing air, oxygen, or nitrous oxide.

WARNING When transporting the electrocardiograph on a cart, tuck the patient cable away to keep them clear of the wheels and to minimize trip hazards.

Warnings related to accessories and other equipment

WARNING To avoid the risk of electric shock, this equipment must only be connected to a supply mains with protective earth.

WARNING For operator and patient safety, peripheral equipment and accessories that can come in direct patient contact must be in compliance with all appropriate safety, EMC, and regulatory requirements.

WARNING All signal input and output (I/O) connectors are intended for connection of only devices complying with IEC 60601-1, or other IEC standards (for example, IEC 60950), as appropriate to the device. Connecting additional devices to the electrocardiograph might increase chassis or patient leakage currents.

WARNING The electrocardiograph has not been designed for use with high-frequency (HF) surgical equipment and does not protect against hazards to the patient.

WARNING Defective batteries can damage the electrocardiograph. Visually inspect the battery at least monthly, if the battery shows any signs of damage or cracking, it must be replaced immediately and only with a battery approved by Welch Allyn.

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

WARNING All signal input and output (SIP/SOP) connectors should not be contacted by patient directly and indirectly through the user during operation.

Warnings related to using the electrocardiograph

WARNING No modification of this equipment is allowed.

WARNING This device captures and presents data reflecting a patient's physiological condition. When reviewed by a trained physician or clinician, this data can be useful in determining a diagnosis. However, the data should not be used as a sole means for determining a patient's diagnosis or prescribing treatment.

WARNING To provide CF protection 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 To avoid serious injury or death, take these precautions during patient defibrillation:

- Avoid contact with the electrocardiograph, patient cable, and patient.
- Verify that the patient leads are properly connected.
- Place defibrillator paddles properly in relation to electrodes.
- After defibrillation, pull each patient lead out of the patient cable and inspect the tips for charring (black carbon marks). If there is any charring, the patient cable and individual leads must be replaced. If there is no charring, fully reinsert the leads into the patient cable. (Charring can occur only if a lead is not fully inserted into the patient cable before defibrillation.)

WARNING To prevent the spread of infection, take these precautions:

- Dispose of single-use components (for example, electrodes) after using them once.
- Regularly clean all components that come in contact with patients.
- Avoid ECG testing for patients with open, infectious sores.

WARNING Avoid positioning any leads or cables so that they could easily trip someone or become wrapped around a patient's neck.

WARNING To ensure safe use of the device, follow the documented maintenance procedures.

WARNING Only qualified service personnel should attempt to repair the electrocardiograph. In case of a malfunction, call Technical Support.

WARNING Do not perform ST segment analysis on the ECG screen display, since these ECG representations are scaled. Make manual measurements of ECG intervals and magnitudes on printed ECG reports only.

WARNING To maintain diagnostic accuracy and to comply with IEC 60601-02-51 and IEC 60601-02-25, do not scale (re size) when sending a saved ECG to an external printer.

WARNING To avoid injury, do not touch the print head immediately after printing. It might be hot.

Warnings related to using the spirometry option

WARNING Do not perform spirometry tests if any of the following conditions apply to the patient:

- hemoptysis of unknown origin (forced expiratory maneuver may aggravate the underlying condition)
- pneumothorax
- unstable cardiovascular status (forced expiratory maneuver may worsen angina or cause changes in blood pressure)
- recent myocardial infarction
- pulmonary embolus
- thoracic, abdominal, or cerebral aneurysms (danger of rupture due to increased thoracic pressure)
- recent eye surgery (for example, cataract)
- presence of an acute disease process that might interfere with test performance (for example, nausea, vomiting)
- recent surgery of thorax or abdomen

WARNING The spirometer captures and presents data reflecting a patient's physiological condition. When reviewed by a trained physician or clinician, this data can be useful in determining a diagnosis. However, the data should not be used as a sole means for determining a patient's diagnosis.

WARNING To minimize the chance of a misdiagnosis, it is the physician's responsibility to assure that spirometry tests are properly administered, evaluated, and interpreted.

WARNING To prevent the spread of infection, do not try to clean the flow transducers and nose clips. Discard these items after a single patient use.

WARNING Read and observe all safety information provided in the flow transducer instructions.

General cautions

Cautions indicate conditions or practices that could damage the equipment or other property.

CAUTION When removing the electrocardiograph from storage, allow it to thermally stabilize to surrounding environmental conditions before using it.

CAUTION To prevent possible damage, do not use sharp or hard objects to press the touch screen or the buttons. Only use fingertips.

CAUTION Do not expose the patient cable to strong ultraviolet radiation.

CAUTION Do not pull or stretch the patient cable. Doing so could result in mechanical or electrical failures. Form the patient cable into a loose loop before storing.

CAUTION Avoid positioning the patient cable where it might get pinched, stretched, or stepped on. Otherwise, measurements might no longer be accurate, and repair might be necessary.

CAUTION Using the equipotential terminal for anything but grounding purposes may contribute to damage of the device.

CAUTION Use only parts and accessories, including thermal paper, that were supplied with the device and available through Welch Allyn. The use of accessories other than those specified may result in degraded performance or unsafe use of this device.

CAUTION Portable and mobile RF communications equipment can affect the performance of the electrocardiograph.

CAUTION The electrocardiograph meets the Class A requirements of IEC 60601-1-2 regarding incidental emission of radio frequency interference. As such it is suitable for use in commercial grade electrical environments. If the electrocardiograph is used in residential grade electrical environments and you experience incidental interference with other equipment that uses radio frequency signals to operate, minimize the interference.

CAUTION Other medical equipment—including but not limited to defibrillators, ultrasound machines, pacemakers, and other stimulators—may be used simultaneously with the electrocardiograph. However, such devices may disturb the electrocardiograph signal.

CAUTION The power cord must be disconnected from AC power before cleaning, maintaining, transporting, or servicing.

CAUTION The requirements of AAMI EC11, Section 3.2.7.2, Frequency and Impulse Response, for an impulse triangle waveform may be impacted by up to 5 milliseconds of small amplitude dampened ringing immediately after the impulse when the muscle filter (35 Hz) is turned on or a small amplitude offset when the baseline filter (0.5 Hz) is turned on. These filters, in any combination turned on or off, meet the AAMI requirements. Measurements performed by the optional interpretation algorithm are unaffected by any filter selections.

Note The entire patient cable, up to and including the electrodes are considered to be an Applied Part.

General safety considerations

- To ensure patient safety, use only accessories recommended or supplied by Welch Allyn. Always use accessories according to your facility's standards and according to the manufacturer's recommendations and instructions. Always follow the manufacturer's directions for use.
- Welch Allyn recommends that only Welch Allyn service personnel or an authorized repair center perform warranty service. Performing unauthorized service on a device that is within warranty may void the warranty.

Electrostatic discharge (ESD)

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

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

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

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

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

Overview

Purpose and scope

The purpose of this manual is to assist with some common troubleshooting scenarios you may encounter and to explain the export, import, update and upgrade process. It is intended for use only by trained and qualified service personnel.

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

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

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

Find instructions for functional testing and performance verification in the Welch Allyn Service Tool help files (http://www.welchallyn.com/promotions/services/serviceTool.htm.)

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

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

Related documents

When using this manual, refer to the following:

- *CP 150 12-lead resting electrocardiograph Directions for use, software version 2.00*
- *CP 150 spirometry option Directions for use, software version 2.00*
- *Welch Allyn Service Tool Install guide*
- Welch Allyn website: www.welchallyn.com

Technical support services

Welch Allyn offers the following technical support services:

- Telephone support

- Loaner equipment
- Service Agreements
- Service training
- Replacement service parts
- Product service

For information on any of these services, contact the Welch Allyn Service Center nearest you.

Service loaners

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

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

Loaner equipment for the individual component modules is not available.

Service options

Partners in Care service agreements

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

Warranty service

All repairs on products under warranty must be performed or approved by Welch Allyn. Refer all warranty service to Welch Allyn Product Service or another authorized Welch Allyn Service Center. Obtain a Return Material Authorization (RMA) number for all returns to Welch Allyn Product Service.

CAUTION Unauthorized repairs will void the product warranty.

Non-warranty service

Welch Allyn product 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.

Repairs

A Welch Allyn Service Center must perform all repairs on products under warranty, unless you have purchased a Welch Allyn support agreement allowing you to service the device while under warranty.

CAUTION Unauthorized repairs will void the product warranty.

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

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

Welch Allyn Technical Support

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

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

An RMA number must be obtained prior to any return. Be sure to note this number on the outside of your shipping box and include a copy of the RMA in the box.

Returns without an RMA number will not be accepted for delivery.

Technical support is available during local business hours.

Configuration options for CP150 electrocardiograph

Model		Accessories	Language	Power cord
CP150		1 - AHA, disposable	EN - English	2 - Europe
	A - Interpretation	2 - IEC, disposable	FR - French	3 - Israel
	None	3 - AHA, reusable	DE - German	4 - UK
		4 - IEC, reusable	ES - Spanish	5 - Switzerland
			NL - Dutch	66 - Australia
			BP - Brazilian Portuguese	7 - S. Africa
			PT - Portuguese	B - North America
			ZH - Simplified Chinese	C - China
			RU - Russian	G – Argentina
			NO - Norwegian	N – India/UAE
			SV - Swedish	Z - Brazil
			DA - Danish	
			FI - Finnish	
			IT - Italian	

Examples: CP150-1ENB, CP150A-1ENB, CP150A-4DE5

Configurations for CP150 electrocardiograph with spirometry option

Model		Accessories	Language	Power cord
CP150		1 - AHA, disposable	EN - English	B - North America
	A - Interpretation	2 - IEC, disposable		
	S - Spirometry	3 - AHA, reusable		
		4 - IEC, reusable		

Note The spirometry option is only available in English.

Examples: CP150S-1ENB and CP150AS-1ENB

The Welch Allyn Service Tool

The Welch Allyn Service Tool is available in the **Silver** edition. Download from Welch Allyn website.

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

- **Review device information**. When connected to the device, the service tool lists installed modules, installed firmware and hardware versions, warranty and repair information, status, and usage history.
- **Receive notifications when periodic maintenance is needed**. The service tool can help you manage and maintain your entire inventory of supported Welch Allyn products. Through the remote service function, the service tool can connect to Welch Allyn Customer Service. With this functionality you can automatically receive firmware updates and feature upgrades for your supported products, including software upgrades for the service tool.
- **Install updates**. The service tool can read the firmware version of the CP 150 and check for available updates or upgrades.
- **Install upgrades**. An interpretation option is available for purchase. The CP 150 basic can be upgraded to a CP 150A (with the Interpretation option) through the Welch Allyn Service Tool.
- **Create a work list**. The work list provides information about service actions—referred to as work orders—that are waiting for you to perform on your maintained devices. Work orders may include periodic calibrations, upgrades, or license installations.
- **Schedule periodic maintenance**. You can use the service tool to set the service interval for each maintained device.
- **View and save logs**. You can download and save log files from the device for analysis to help diagnose and identify reported issues.
- **Create user accounts**. Administrators can create user accounts and set permission levels to control access to the features, allowing one group to perform administrative tasks and another to perform service tasks. Restricting access prevents the service tool from being used to make unauthorized changes on a connected device.
- **Perform functional verification**. The service tool can be used to test the device to ensure that it meets performance specifications.
- **Recover devices**. In the rare case where a device can no longer boot because of corrupted firmware, the service tool can connect the device to Welch Allyn Technical Support to reinstall the firmware.
- **Extensible**. The device accepts new plug-ins to support future Welch Allyn products.

Returning products

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

- Product name, model number, and serial number. This information may be found on the product and serial number labels on the bottom of the device.
- A complete return shipping address.
- A contact name and phone number.

- Any special shipping instructions.
- A purchase-order number or credit-card number if the product is not covered by a warranty.
- A full description of the problem or service request.

1. Contact Welch Allyn and request an RMA number.

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

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

      Recommendations for returning the Lithium Ion battery

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

      Packaging

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

      If the original shipping carton or replacement battery shipping box is unavailable, consult the manufacturer website for information regarding shipping lithium ion batteries:

      www.nexergy.com/lithium-shipping.htm

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

      Note In the United States, the applicable regulations can be found in the Code of Federal Regulations (CFR). Refer to 49 CFR 173.185 for shipping lithium batteries by air or ground. Use 49 CFR 172.102 sections 29, 188, 189, A54, A55, A100, A101, A103, and A104 to find the special provisions for shipping lithium batteries.

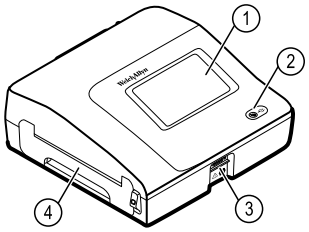
   b. Clean the device.

Note To ensure safe receipt of your device by the service center and to expedite processing and return of the device to you, **thoroughly clean all residues from the device before you ship it to Welch Allyn**. For decontamination and cleaning requirements, see "Decontamination and cleaning" in the appendices. If a returned device is found to be contaminated with bodily fluids, it will be returned at the owner's expense. United States federal regulations prohibit the processing of any device contaminated with blood-borne pathogens. Welch Allyn thoroughly cleans all returned devices on receipt, but any device that cannot be adequately cleaned cannot be repaired.

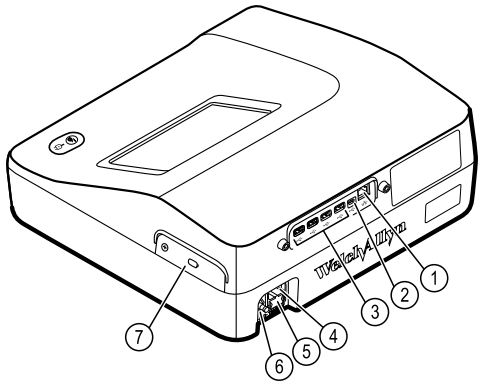
c. Put the device, enclosed in a plastic bag **with a packing list**, into the original shipping carton with the original packing materials or into another appropriate shipping carton.

d. Write the Welch Allyn RMA number with the Welch Allyn address on the outside of the shipping carton.

Controls, indicators, and connectors



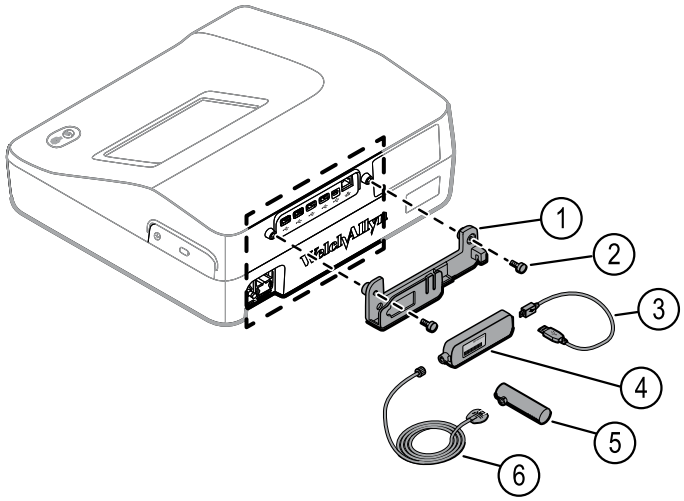
No.	Feature	Description
1	LCD screen	800 x 480 pixels color touchscreen provides a graphical user interface.
2	Power switch and LED	Power-on/Standby switch. The LED indicates the charging status when connected to AC power: • Green: The battery is charged. • Amber: The battery is charging.
3	Patient cable connector	Provides connection for patient cable.
4	Printer	Spirometry FVC report Efforts: • All efforts: Prints all efforts. • Three best efforts: Prints the three best efforts of each type that was saved. • Only the best effort: Prints only the best effort of each type that was saved — best FVC, FVC-pre, FVC-post. **Note** The printer also provides a printout of patient Auto ECG, Stat ECG, or Rhythm ECG.



Back view

No.	Feature	Description
1	Ethernet connector	Provides a hardwired connection to the computer network. The LEDs indicate active network status when the ethernet cable is connected to a network.
2	Clients USB	USB, type "mini B." Provides connection to an enabled host.
3	Host USB	USB, type "A." Provides four host USB connections for optional accessories.
4	Power connection	Provides an external AC power connection.
5	AC fuse	Provides access to AC fuse.
6	Ground lug (equipotential terminal)	Provided for electrical safety testing and as a means for connection of a potential equalization conductor.
7	Battery compartment (behind cover)	Houses the Li-ion battery.

Spirometry option back view



No.	Feature	Description
1	Bracket	Spirometer sensor mounting bracket
2	Thumb screws	Thumb screws to attach bracket to device
3	USB cable	Provides spirometer sensor connection to device
4	Spirometer sensor	USB spirometer sensor
5	Disposable flow transducers	Measures patient air velocity. Connects to pressure tubing.
6	Pressure tubing	Connects flow transducer to USB spirometer sensor

Service menu

Access the Service screen

Note The service menu ID and password are based on a telephone keypad.
ID: 7378423 (=SERVICE)

PASSWORD: 6676737 (=NORMSER)

1. From the ECG home tab, touch the **Settings** tab. The ECG tab and the vertical ECG configuration tab appear.
2. Touch the **Service** tab.
3. Enter **7378423** as the User ID code and touch the **OK** button.
4. Enter **6676737** as the Password and touch the **OK** button.
5. Touch the **OK** button again.
6. When you are done, touch  .

   The ECG home tab appears.

Performing the full-functional tests

Complete the full-functional CP 150 tests to verify device functionality.

Note The functional verification tests help to confirm the proper operation of the device and its options. The tests may also be useful as a diagnostic tool to help isolate a malfunction.

The following off-the-shelf tools are required to complete the functional verification tests:

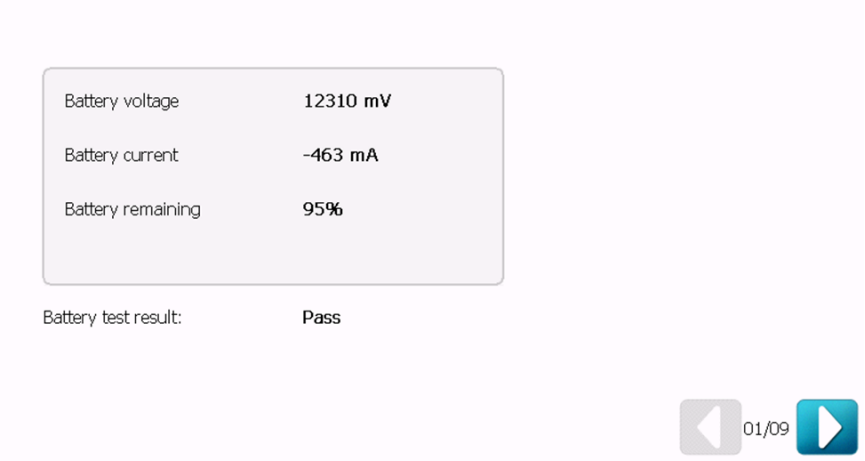
- Standard ECG Patient Simulator (example: Model 430B, Medi Cal Instrument, Inc. or equivalent)
- USB Cable (Type A connector to mini-B connector)
- Standard USB Thumb drive (256M to 64Gb, recommend 2 Gb)
- RJ45 Ethernet cable (less than 3 M in length)

With the Service tab open, touch the **CP 150** button to perform a hardware test.

Battery test

Note Ensure that the battery is installed and has been charged for a minimum of four hours before preforming this test.

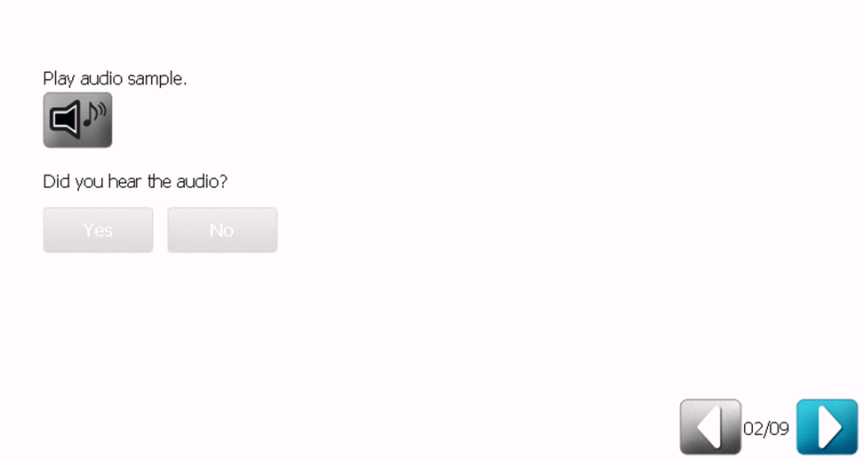
1. If the *Battery remaining* field shows 70% or less, replace the battery.



2. Touch the (Next) button to perform the next functional test.

Audio test

1. Touch the button to play the audio sample.

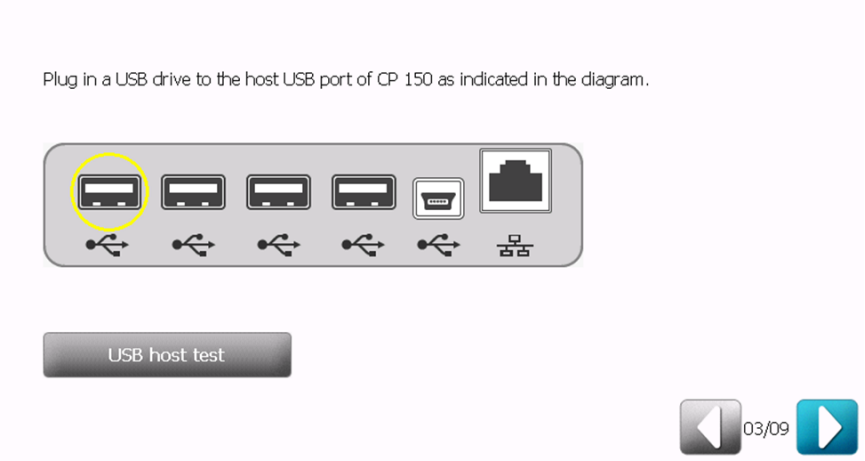


2. Touch the **Yes** button if you are able to hear the sound, or touch the **No** button if you are not able to hear the sound.
3. Touch the (Next) button to perform the next functional test.

USB host test

Note Welch Allyn has not validated specific USB flash drives. Use only 64Gb or less USB flash drives.

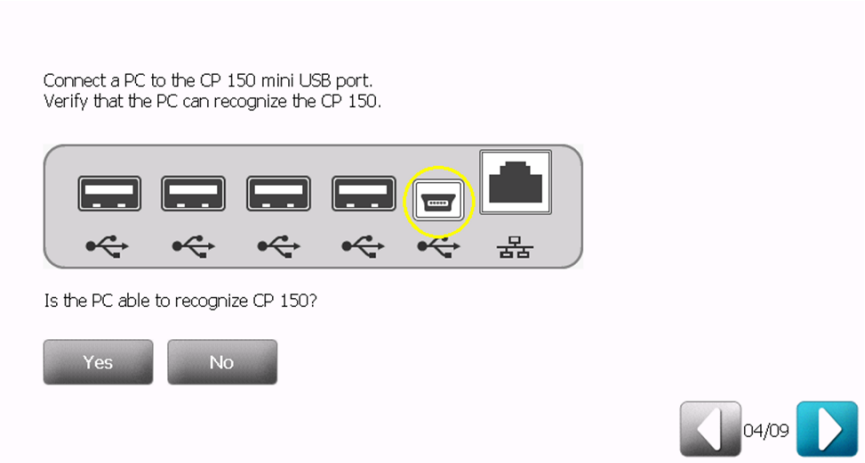
1. Insert a USB flash drive into each of the four ports on the back of the device and follow the instructions on the screen to test each of the ports.



2. Touch the **USB host test** button to test each port from left to right.
3. Touch the (Next) button to perform the next functional test.

USB client test

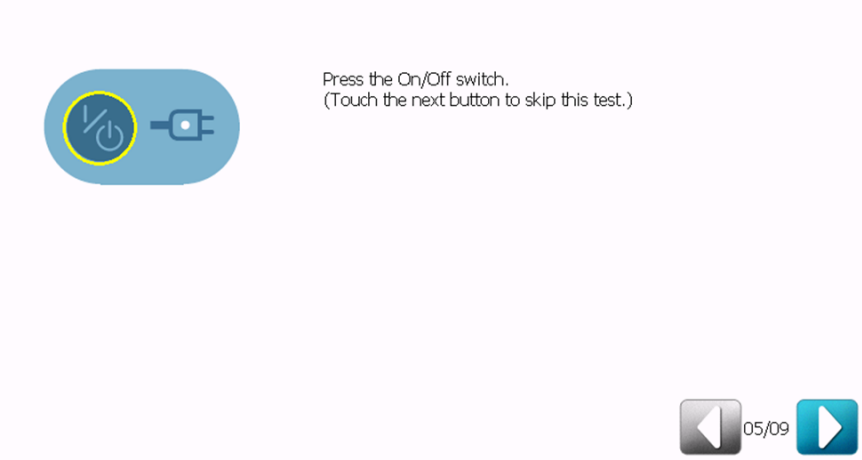
1. Connect a USB type mini-B connector to the device client USB port and a type A connector to a free USB port on the PC. Verify that the PC is able to recognize CP150 device.

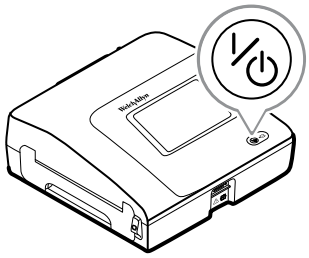


2. Touch the **Yes** button to confirm that your PC recognized the CP 150 device, or touch the **No** button if your PC did not recognized the CP 150 device.
3. Touch the (Next) button to perform the next functional test.

Keypad test

1. Press the ⏻ button on the device to check the On/Off keypad. "Pass" is indicated with a √ (check mark) and "fail" is indicated with an **X**.





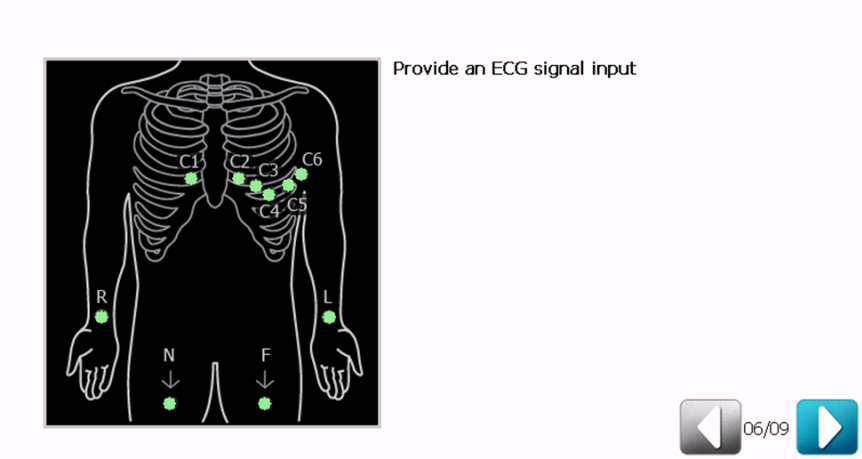
2. Touch the ▶ (Next) button to perform the next functional test.

ECG lead test

1. Connect a set of known good Patient Cables, with leads, to an ECG simulator.

   Note Any yellow dots on the lead-status screen indicate unattached or poorly attached leads.

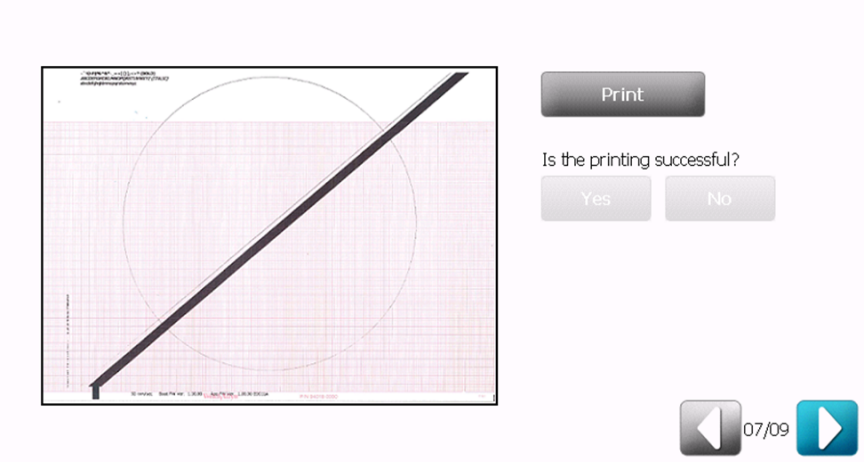
2. Verify the lead placement on the screen by observing that all leads appear green.



3. Touch the (Next) button to perform the next functional test.

Printer pattern test

1. Touch the **Print** button to print a test page.

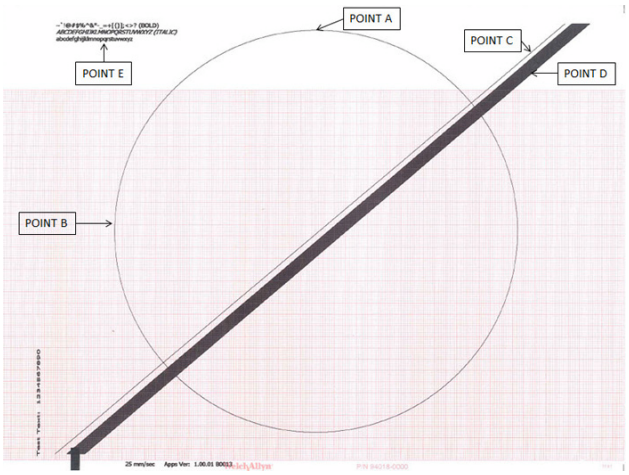


2. Use the specifications in the *Print verification checklist* table and the *Printer pattern test and check point* graphic to verify the correct operation of the device printer by comparing the pattern printed on the test page.

Print verification checklist

Point	Description
Point A	Verify the distance of the arc on the circle from the top edge of the paper is 11 mm +/- 3 mm
Point B	Verify the distance of the arc on the circle from the left edge of the paper is 50 mm +/- 5 mm
Point C	Verify that the line is straight and without breaks from top to bottom
Point D	Verify that the thick black line is uniform in blackness without breaks from top to bottom
Point E	Verify the print is readable
Point F	Verify line is straight and measures 100 mm +/ -5 mm

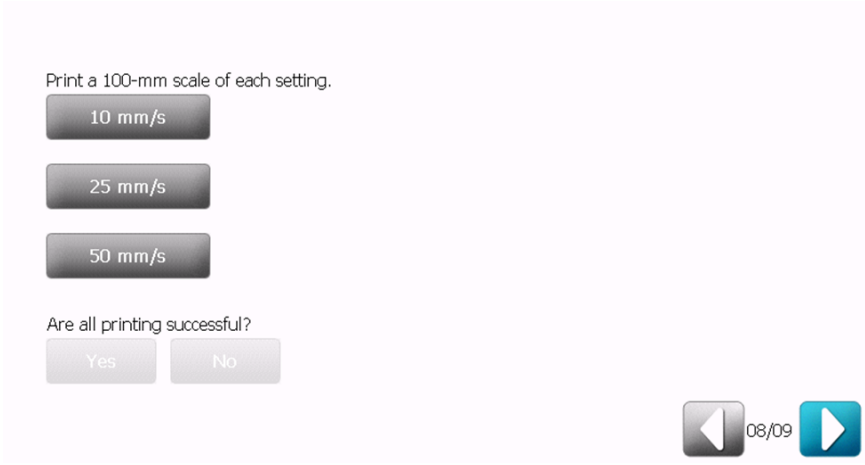
Printer pattern test and check point



3. Touch the **Yes** button if the test page printed correctly, or touch the **No** button if the test page did not print correctly.
4. Touch the (Next) button to perform the next functional test.

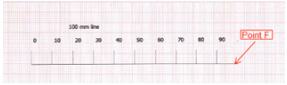
Printer speed test

1. Touch each of the **10 mm/s**, **25 mm/s**, and **50 mm/s** buttons to print a test page.



2. Use the speed test print page to verify the correct operation of the device printer by comparing the pattern printed on the test page to point F in the *Printer speed test and check point* graphic. The line should be a straight line that measures 100 mm (+/-5 mm).

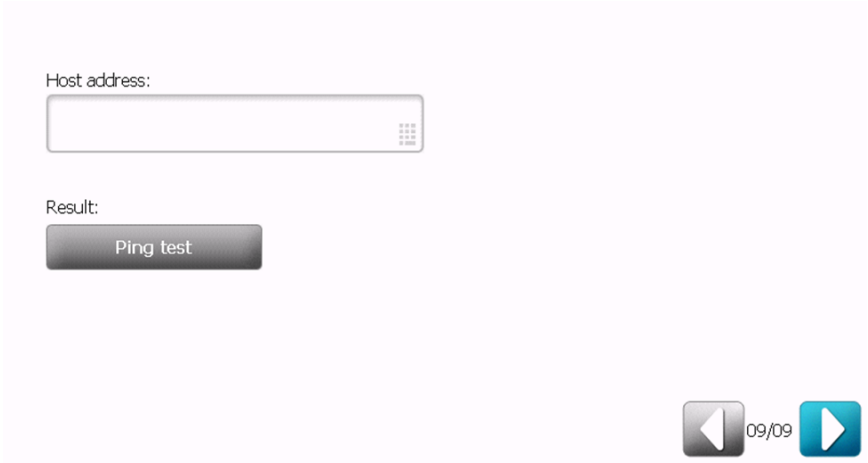
Printer speed test and check point



3. Touch the **Yes** button if the test page printed correctly, or touch the **No** button if the test page did not print correctly.
4. Touch the (Next) button to perform the next functional test.

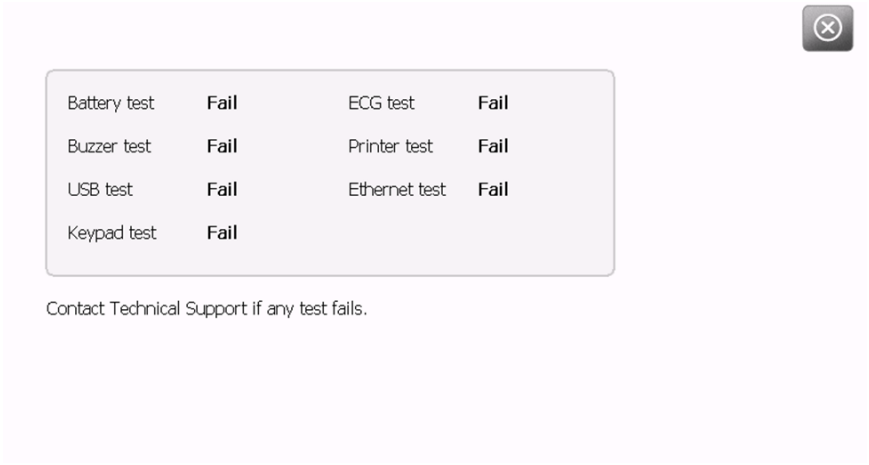
Ping test

1. Use an ethernet cable to connect the device to a known network and setup the CP 150 DHCP. (Refer to the CP 150 DFU for setup instructions.) Under the Host address, enter the IP of a PC connected to the network. Touch the **Ping test** button to perform the test.



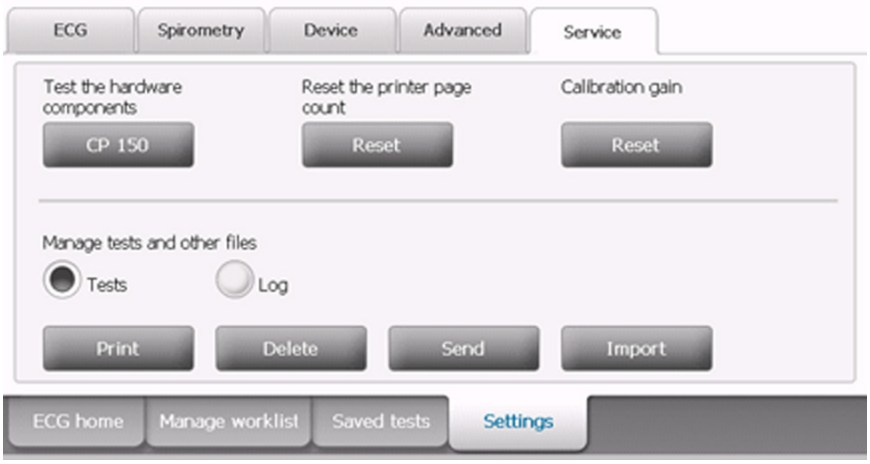
2. Touch the (Next) button to exit the functional test.

Test results



Note To perform an optional spirometry calibration, refer to the *CP 150 spirometry option Directions for use*.

Manage tests and other files



Tests:

Button	Feature
CP 150	Tests the hardware components
Reset (the printer page count)	Resets the printer page count to zero
Reset (calibration gain)	Resets the spirometry calibration gain to 1.0
Tests + Print	Prints the patient list from the internal memory of the CP 150
Tests + Delete	Deletes the patient test list from the internal memory of the CP 150
Tests + Send	Sends the patient test list to a USB flash drive
Tests + Import	Imports the patient test list from a USB flash drive

Logs:

Button	Feature
Log + Delete	Deletes the log file
Log + Send	Sends the log file to a USB flash drive

Troubleshooting

Complete the full-functional tests prior to troubleshooting the CP 150 device

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

- **Symptoms and solutions**
  - **System problems**
  - **Printer problems**
  - **User interface problems**
  - **Post test error messages**

These tables list symptoms you might observe, list possible causes, and suggest actions that might eliminate the problem. These tables can help you diagnose and fix a problem. They do not replace basic troubleshooting skills. You must still trace the source of the problem to the board or module level to decide the best course of action.

Welch Allyn does not support component-level repair to the board or module.

For available replacement parts, see *Field Replaceable Units*.

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

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

Symptoms and solutions

System problems:

Symptom	Possible cause	Suggested action
The electrocardiograph does not power up when it is plugged into AC power and the AC power LED is not lit	There is no AC power	Check the AC fuses.
	AC fuse is blown	Check the AC fuses.
	Loose, disconnected, or faulty switch power flex	Reseat or replace the switch power flex.
	Faulty or disconnected 60W power supply	Reseat or replaced the PSU-BAT harness CP150-0025. Replace the 60W power supply.
The electrocardiograph does not power up when it is plugged into AC power and the AC power LED is lit	LCD screen is faulty	Replace the 7 inch display assembly.
	Loose or faulty flex SMCE-LCD	Reseat the flex SMCE-LCD at SMCE or replace the flex SMCE-LCD.
	I/O board harness has a loose connection or is faulty	Reseat or replace the I/O harness.
	I/O board is faulty	Replace the I/O board.
The electrocardiograph does not power up when it is unplugged	The battery power is low	Charge the battery.
	The battery is disconnected	Check the battery connections.
	The battery is not charging, is depleted, or is faulty	Replace the battery.
The battery will not charge or the battery status displays a disconnected battery	Faulty battery	Replace the battery.
	Damaged pins on the battery connection point	Replace the battery case assembly.
	Smart bus harness has a loose connection or is faulty	Reseat or replace the harness.
When connected to AC power and with the battery installed, the battery status displays a faulty battery	Faulty battery	Replace the battery.
The electrocardiograph prints fewer than 10 reports on a full battery charge	The battery is degraded	Replace the battery.
While powered-on, the electrocardiograph does not respond when you touch the screen	The electrocardiograph cannot perform an immediate action because the software is unresponsive.	Reset the electrocardiograph by pressing and holding the power button for at least six seconds until the screen goes blank. Press the power button again to restart.

Symptom	Possible cause	Suggested action
		Note: The electrocardiograph will go through some diagnostic tests that will cause it to take longer than usual to power up.
Off-colored display	Loose or faulty flex SMCE-LCD	Reseat the flex SMCE-LCD at the SMCE or replace the flex SMCE-LCD.
	Faulty LCD display assembly	Replace the 7 inch display assembly.
No response when LCD screen is touched	Loose or faulty flex SMCE-LCD	Reseat the flex SMCE-LCD at the SMCE or replace the flex SMCE-LCD.
	Faulty LCD display assembly	Replace the 7 inch display assembly.
Unable to obtain a valid IP address when DHCP is turned on	Local network problem	Verify working network connection.
	The communication board is disconnected	Reseat the communication board connection.
Incorrect waveform while connected to a simulator	Faulty patient cable	Replace the patient cable.
	Loose ECG harness	Reseat the ECG harness.
	Faulty ECG board	Replace the ECG board.
All leads showing off	Faulty patient cable	Replace the patient cable.
	Loose ECG harness	Reseat the ECG harness.
	Faulty ECG board	Replace the ECG board.

Printer

Printer problems:

Symptom	Possible cause	Suggested action
The paper does not feed	The paper is jammed	Reload the paper.
	Lost communication	Reseat the printer harness.
	The printer door is open	Close the printer door.
	The door sensor is faulty	Replace the door sensor.
	The motor is faulty	Replace the motor.
	The motor gear is faulty	Replace the gear assembly.
The paper is blank	Lost communication	Reseat or replace the printer harness.
	Faulty print head	Replace the print head assembly.
	Error loading the paper	Check to ensure that the printer door is fully closed. Check the orientation of the paper.
	The wrong type of paper is being used	Use only Welch Allyn approved paper.
The electrocardiograph shuts down during printing when in battery mode	The battery is low or faulty	Recharge or replace the battery.
Printing is not clear or is garbled	Foreign particles on the printer heating element	Clean the heating element of the printer to remove any foreign particles. Apply isopropyl alcohol to a cotton swab and wipe off the heating element surface. Allow to dry completely.
	Faulty print head	Replace the print head assembly.
	Loose platent roller	Reseat the platent roller on the paper tray assembly.
		Check the platent roller catch for a crack. If a crack is found, replace the paper tray assembly.
Door open message even when door is closed	Loose door sensor harness connection	Reseat door sensor harness connector.
	Faulty door sensor	Replace door sensor.
	Missing dowel pin on one side of the paper tray assembly	Replace paper tray assembly.
Grinding sound in the gear	Wear of the gear assembly	Replace gear assembly.

Symptom	Possible cause	Suggested action
	Presence of a foreign object in the teeth of the gear	Clean and remove foreign object from the gear assembly.

User interface

User interface problems:

Symptom	Possible cause	Suggested action
Battery is critically low. Shutting down...	Device automatically shuts down when it reaches the shutdown capacity. This prevents file system corruption. (May lose the last unsaved test.)	If you are unable to charge the battery, replace the battery.
ECG front-end microprocessor board error. Contact Technical Support.	ECG Front End detects CPLD Voltage error which indicates that any ECG data received from it is invalid. The Front End will notify the microcompute engine and will display this error. When the error is acknowledged, the device will shutdown.	Check connection to the ECG board. If connection is okay, replace ECG board. If the ECG front end error is still received, replace the small microcompute engine board.
Export/Import unsuccessful	Faulty communication module	Replace I/O board.
	Loose or faulty I/O harness	Reseat or replace I/O harness.
	USB flash drive is at wrong port	Insert flash drive at correct port and try again.
	Faulty Small microcompute engine	Replace small microcompute engine.
Internal printer error. Contact Technical Support.	The printer error includes the following: 1. RAM error. 2. Print head temperature above 70°C (replace printer FSS). 3. Flash memory error.	Check communication between the printer board and communication board. If the board tries to communicate with the printer and the printer responds with an error message, then complete a printer functional test to ensure printer is operating properly. Check harnesses on printer to see if they are loose. If problem persists, replace the print head assembly and printer board.
Internal printer is overheated. Try to print again after 10 minutes to let the printer cool down.	Extended printing has caused the print head to overheat.	If printing at a high speed for an extended period of time, the printer will overheat and will notify the small microcompute engine board that it is overheating and needs to stop and cool down. Contact Technical Support if printer displays this message when high-speed printing has not taken place.
The read-back file is corrupted.	During the Service USB Host test, the content read back from file does not match the content previously written.	Ensure that the thumb drive and port are working properly. If using another thumb drive results

Symptom	Possible cause	Suggested action
		in the same error, contact Technical Support.
Internal printer is out of paper. Reload.	The cue marker on the paper sensor is causing the printer to incorrectly identify that paper tray is empty.	Check Que Sensor board and harness.

Post test error messages

Post test error messages:

Symptom	Possible cause	Suggested action
System Fault code 01	Battery capacity is at critical capacity and auxiliary power is not present	Ensure that AC power is plugged in.
		Check for faulty battery and/or 60W power supply.
		Check all harness to power supply.
System Fault code 02	Core image verification fails	Reload software through the Welch Allyn Service Tool.
System Fault code 03	Core image is missing	Reload software through the Welch Allyn Service Tool.
System Fault code 04	Software update failure	Reload software through the Welch Allyn Service Tool.
System Fault code 05	RAM Test failure	Check for faulty SMCE board.

CP 150 spirometry option symptoms and solutions

Problem-solving suggestions:

If you try these suggestions and still have problems, contact Welch Allyn.

Symptom	Possible cause	Suggested action
Unable to calibrate	Poor connection between flow transducer and sensor	Check the connection between flow transducer and sensor.
	Damage to flow transducer	Replace the flow transducer if it is damaged.
	Leak during calibration.	Ensure that the connection between the calibration syringe and flow transducer is tight with no leaks.
	Uneven calibration strokes.	Use even strokes in calibration.
	Pressure tubing is kinked	Replace pressure tubing.
Calibration fails consistently. Unable to achieve a ± 3% error percentage margin	Altitude and atmospheric pressure beyond tolerance causes the	After a failed calibration, touch **Accept** even though the calibration result is above the 3% error margin.

Symptom	Possible cause	Suggested action
(with confirmed good syringe and tubing and correct calibration techniques).	calibration reading to be above the 3% error margin.	Accepting the calibration result will adjust the gain value closer to the correct atmospheric pressure. Perform the calibration again.
No sensor detected	Poor connection between the sensor and the device	Connect to another USB port. Replace the USB cable.
Does not print	Out of paper	Load paper. See the electrocardiograph manual.
	Paper jam	If the paper is jammed, clear it, then reload.
Values are too high (intermittent)	Patient's fingers obstructed the screen on the back of the flow transducer, causing high back pressure and false reading	Retest.
	Patient's lips were not tightly sealed around the flow transducer	Retest.
	Spirometer was calibrated with the wrong size syringe	Recalibrate with a 3-liter syringe. See *Performing a calibration*.
Values are too high (consistently)	Pressure connection is partially obstructed	Remove any foreign substance from the flow transducer or pressure tubing.
Predictive values are blank	The selected norm does not support certain values, and composite norm values are disabled	Re-enter age/birth date, height, gender, race. (Fill in the fields. All mandatory fields must be filled in before you can proceed.)
		Enable composite norm values. See *Viewing or changing the spirometry settings*.
The flow sensor has been dropped.	Accident	Recalibrate. See *Performing a calibration*.
Report does not print parameters or graphs.	Improper parameter settings	Check print settings. See *Viewing or changing the spirometry settings*.
Patient test values differ from values expected by physician.	Various	If the transducer is contaminated with sputum or secretions, replace it. Verify that proper barometric pressure has been entered. See *Performing a calibration*. Verify the patient data. Eliminate any leaks in the pressure tubing. Retest using a nose clip.

Symptom	Possible cause	Suggested action
		Replace the sensor if damaged. Recalibrate. Replace the transducer and retest.

EMC guidance and manufacturer's declarations

EMC compliance

Special precautions concerning electromagnetic compatibility (EMC) must be taken for all medical electrical equipment. This device complies with IEC EN 60601-1-2:2007.

- All medical electrical equipment must be installed and put into service in accordance with the EMC information provided in this document and the *Welch Allyn CP 150 12-lead resting electrocardiograph Directions for Use*.
- Portable and mobile RF communications equipment can affect the behavior of medical electrical equipment.

The electrocardiograph complies with all applicable and required standards for electromagnetic interference.

- It does not normally affect nearby equipment and devices.
- It is not normally affected by nearby equipment and devices.
- It is not safe to operate the electrocardiograph in the presence of high-frequency surgical equipment.
- However, it is good practice to avoid using the electrocardiograph in extremely close proximity to other equipment.

Emissions and immunity information

For information about electromagnetic compatibility (EMC), see the Welch Allyn website.

http://www.welchallyn.com/apps/products/product_category.jsp?catcode=CARDIO

Disassembly, repair, and reassembly

These procedures provide instructions for system disassembly and board removal. Except where otherwise noted, the assembly procedure is the reverse of the disassembly procedure.

Each procedure may include the following:

- **Reassembly notes**: This contains information specific to reassembly not addressed in the disassembly instructions.

WARNING Electrical shock hazard. Disconnect power before opening the device.

CAUTION Before disassembling the device, disconnect the AC power cord and any attached accessories.

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

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

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

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

CP 150 Disassembly Flow chart

Required tools and equipment

- #1 Phillips bit
- #2 Phillips bit
- #10 Torx bit
- 3/16" Hex Socket
- 1/4" Hex Socket
- Torque driver calibrated for 3.5 in-lb ±0.5 in-lb
- Torque driver calibrated for 4.0 in-lb ±0.5 in-lb
- Torque driver calibrated for 5.0 in-lb ±0.5 in-lb
- Tie-wrap cutter

Note The torque specifications are only applicable for the assembly processes.

Tools and torque value used during reassembly of Main Unit:

Part Number	Description	Torque Specification	Bit/Socket Type
713017	Shoulder Screw, EAR G-411-1 Metric	5 +/- 0.5 in-lbs.	PH2
106124-34	Screw 4-20 .375 Pan Phillips	5 +/- 0.5 in-lbs.	PH1

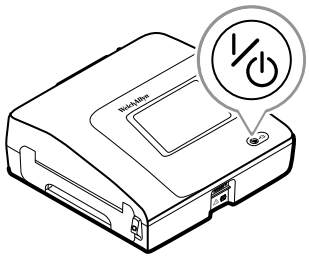
Part Number	Description	Torque Specification	Bit/Socket Type
713016	Screw, M3 x 5 Pan Head	5 +/- 0.5 in-lbs.	PH1
761077-1	Wire Tie	INT	N/A
713031	Screw, M4 X 10 Pan Head	5 +/- 0.5 in-lbs.	PH2
716960	Shoulder Screw M3 PHD	2 +/- 0.5 in-lbs.	PH1

Tools and torque value used during reassembly of Printer Assembly:

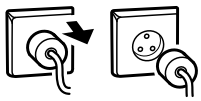
Part Number	Description	Torque Specification	Bit/Socket Type
703246	Screw, M3 X 0.5, Pan Phillips	5 +/- 0.5 in-lbs.	PH1
700118	Shoulder Screw M3 X .5	4 +/- 0.5 in-lbs.	3/16” Hex Socket
106137-1	Nut,4-40X.250 Hex, KEPS Extlock	3.5 +/- 0.5 in-lbs.	1/4" Hex Socket
703258	Screw M3 X 6 PHP FH	5 +/- 0.5 in-lbs.	PH1
106124-34	4-20 0.375 Pan Head Screw	5 +/- 0.5 in-lbs.	PH1
713015	4-20x.5 Pan Head Plastite Screw	5 +/- 0.5 in-lbs.	T10
761077-1	Wire Tie	INT	N/A

Power down the electrocardiograph

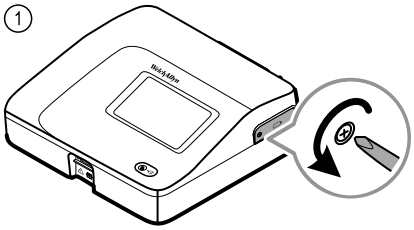
1. Press and hold the  button for 6-8 seconds to shut down the electrocardiograph.

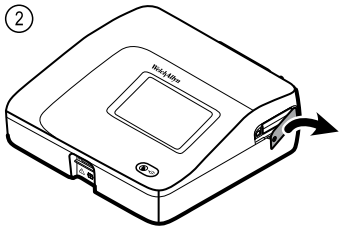


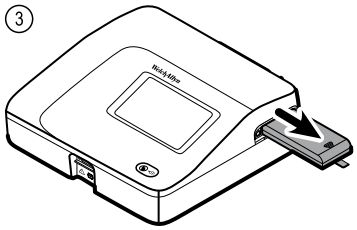
2. Remove the power supply.



Remove the battery

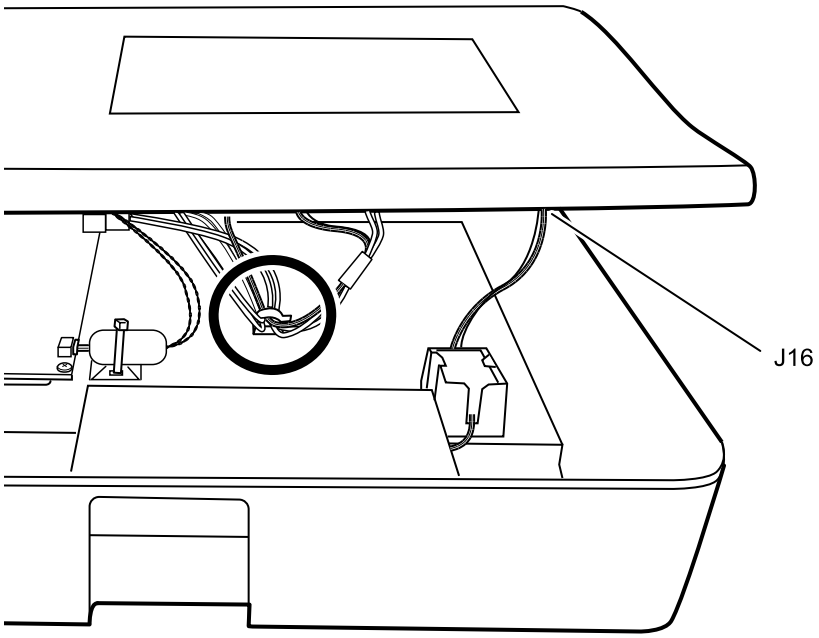




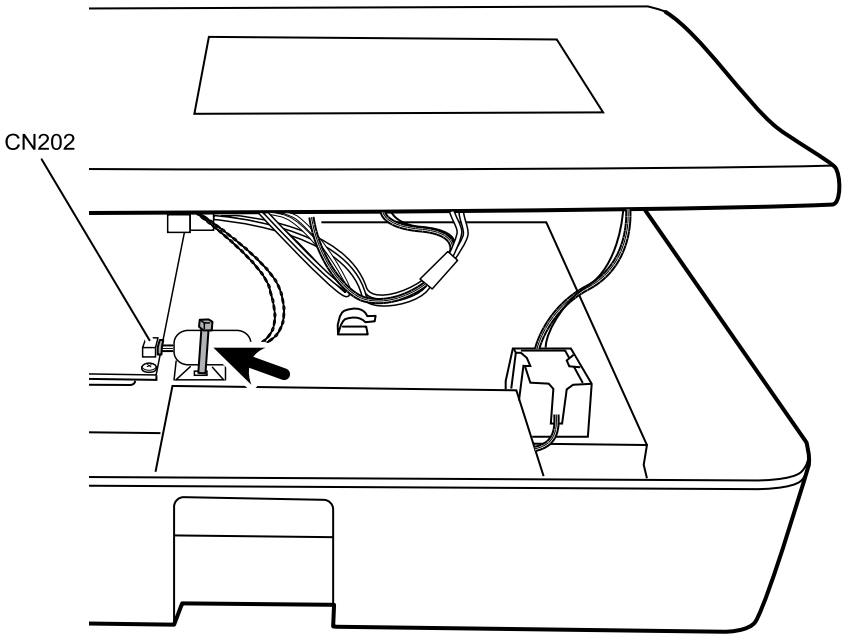


Separate the top housing assembly from the bottom housing assembly

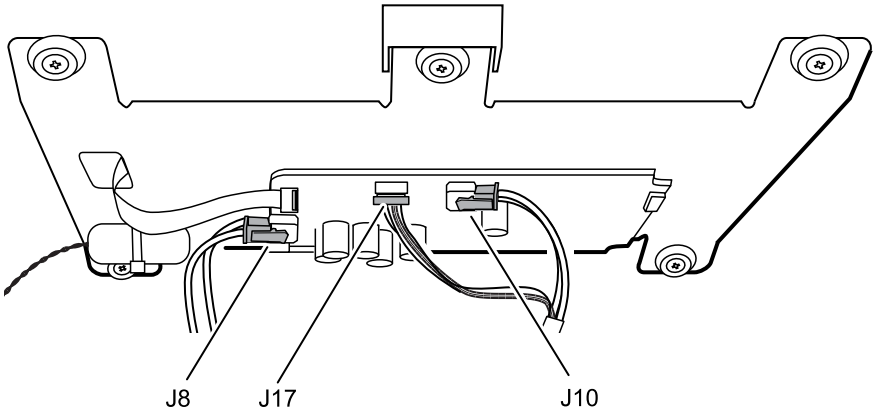
1. Turn the electrocardiograph over to access the bottom housing assembly.
2. Remove the eight M4x10 screws from the bottom housing assembly using a #2 Phillips bit.
3. Turn the electrocardiograph over again to access the top housing assembly.
4. Lift up the top housing assembly to access the printer board.
5. Unhook the harness cables from the printer top assembly.
6. Disconnect the harness cable at J16 from the small-medium compute engine (SMCE) board.



7. Cut the wire tie on the EMC ferrite.
8. Disconnect the CN202 connector from the printer board.



9. Disconnect the three harness cables at J8, J17, and J10 from the small-medium compute engine (SMCE) board.

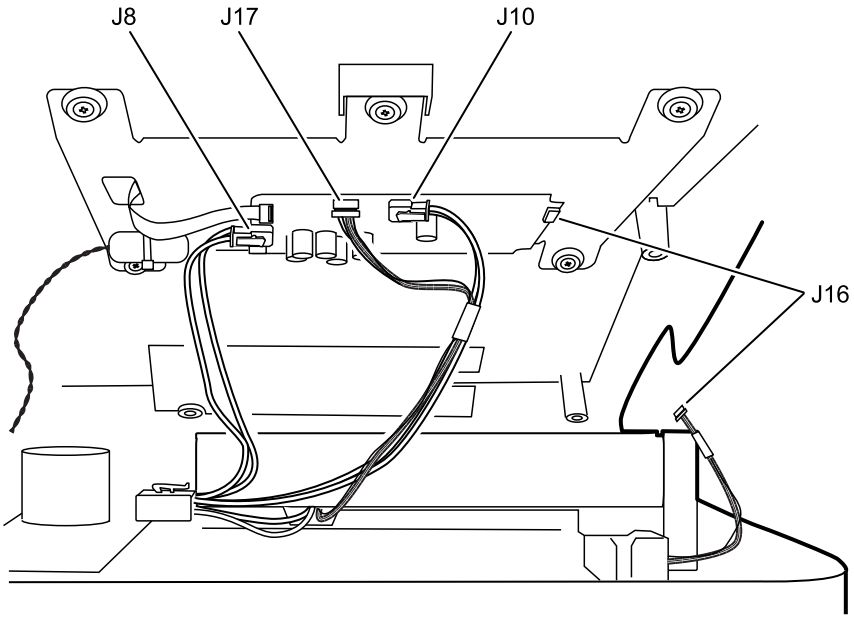


10. Lift off the top housing and set aside for reuse during reassembly.

Reassembly note

- Use a #2 Phillips bit and a Torque driver calibrated to 5.0 in-lb ± 0.5 in-lb to secure the bottom housing screws.

Cable identification for reassembly:


J8
J17
J10
J16

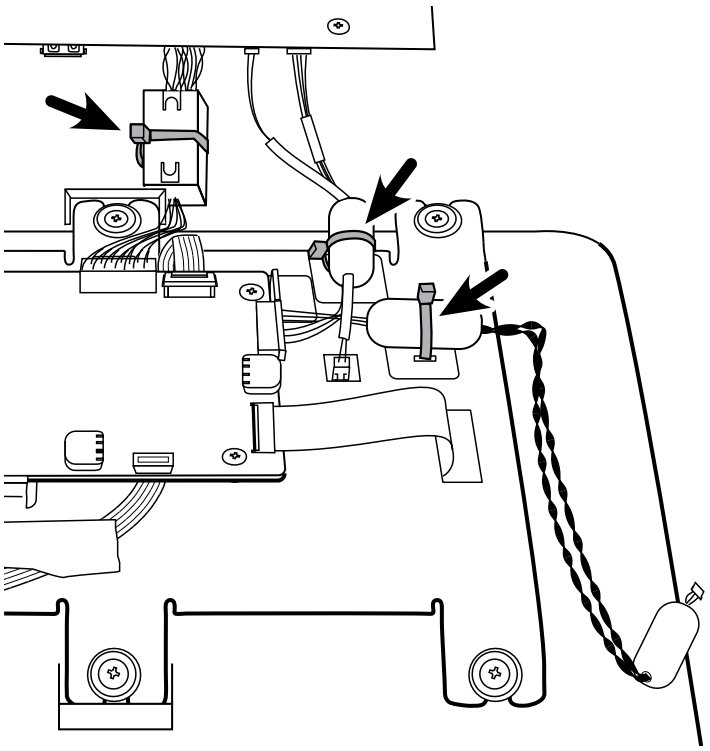
Top housing disassembly

These procedures provide instructions for system disassembly and board removal. Except where otherwise noted, the assembly procedure is the reverse of the disassembly procedure.

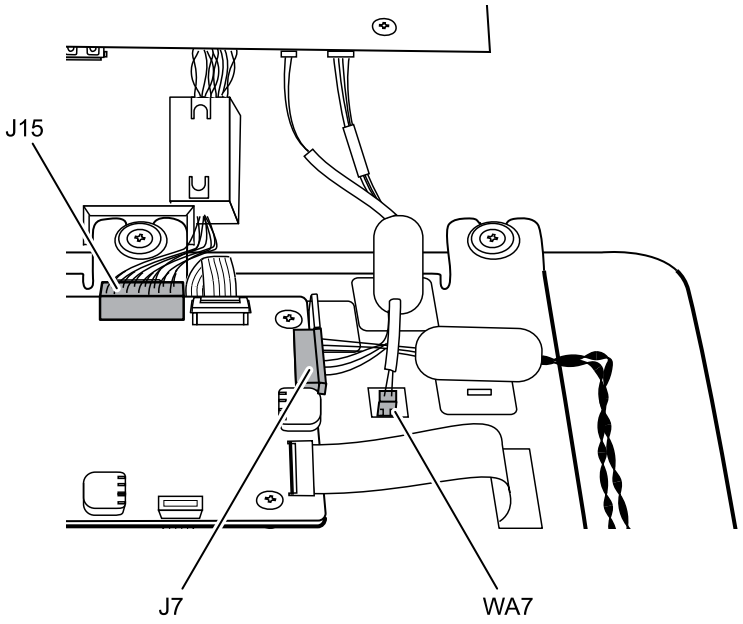
Remove the Input/Output (I/O) communication board

- Separate the top housing assembly from the bottom housing assembly as described.

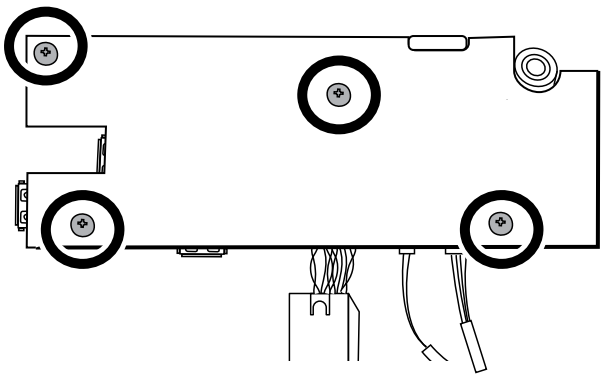
1. Cut the wire tie on the ECG ferrite and the two wire ties on the EMC harness ferrites.



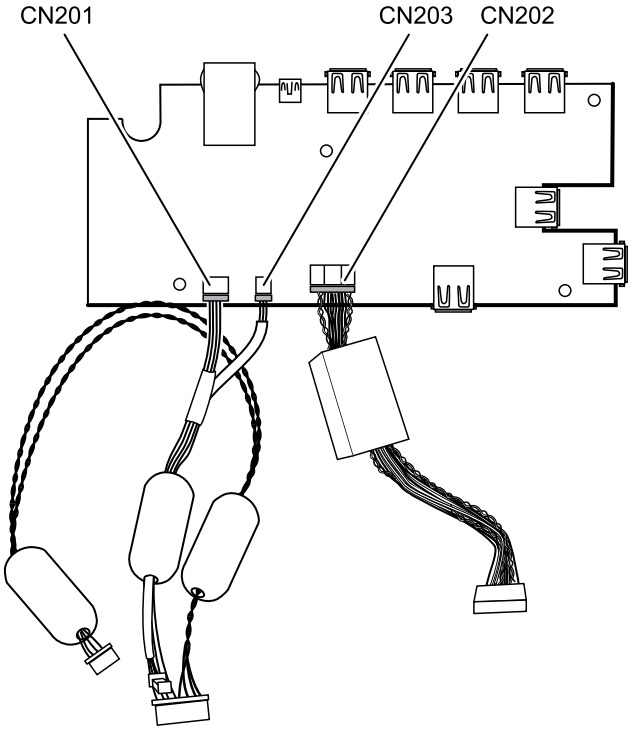
2. Disconnect the J7 and J15 connectors from the SMCE board.
3. Disconnect the WA7 connector from the display assembly.



4. Remove the four 4-20 self-tapping screws from the I/O board using a #1 Phillips bit.



5. Disconnect the three harness cables at CN201, CN203, and CN202 from the I/O board and remove the harnesses.



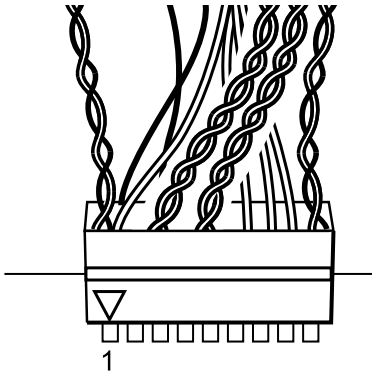
Note Set the harness cables aside for reuse during reassembly.

Reassembly note

- Use a #1 Phillips bit and a Torque driver calibrated to 5.0 in-lb ± 0.5 in-lb to secure the SMCE board screws.

SMCE I/O harness cable connection for reassembly:

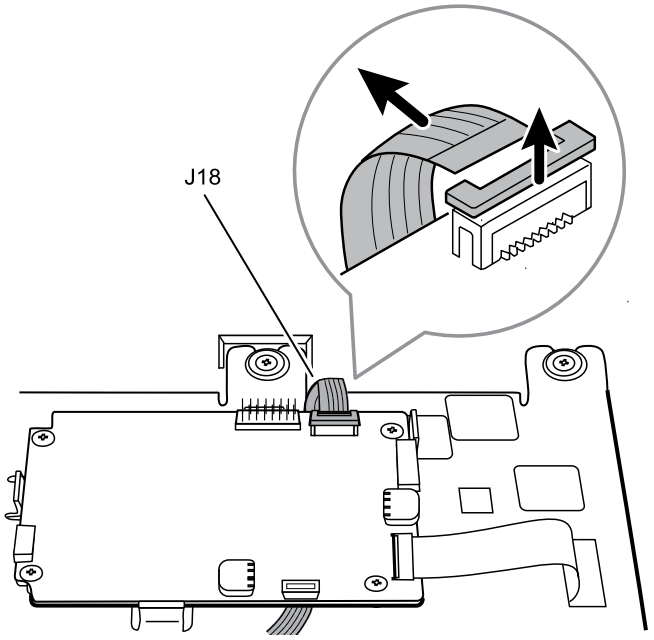
Note Ensure that the twisted white wires of the J15 SMCE I/O harness face the center of the SMCE board so that the pins line up correctly.



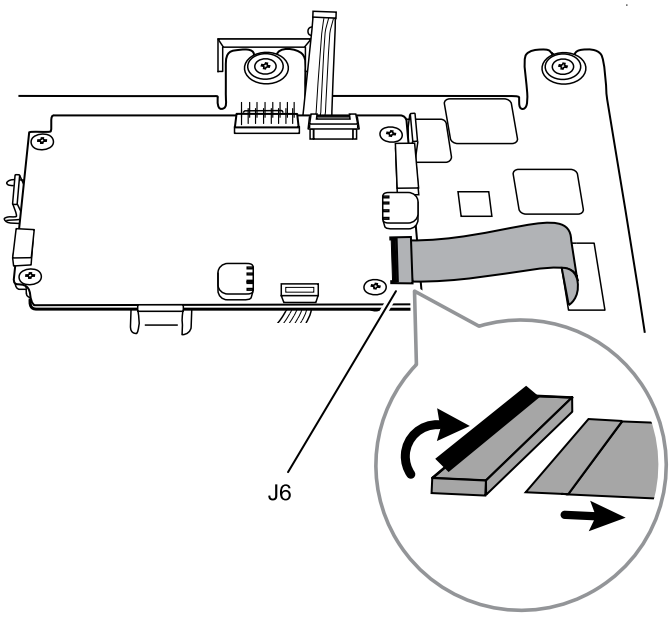
Remove the SMCE board

- Separate the top housing assembly from the bottom housing assembly as described.

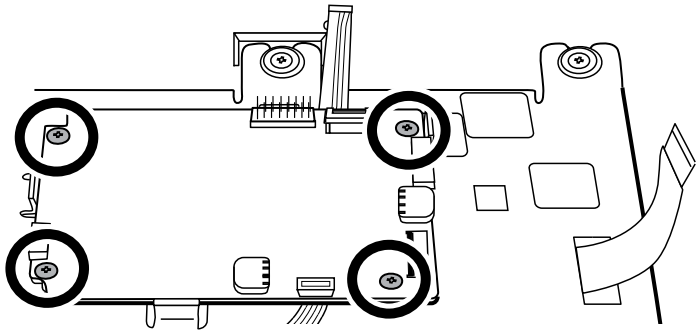
1. Lift up the latch of the J18 connector on the SMCE board and disconnect the flex cable.



2. Gently pull up on the locking tab latch of the J6 connector on SMCE board and slide out the flex cable.



3. Remove the four M3x5 screws from the SMCE board using a #1 Phillips bit.



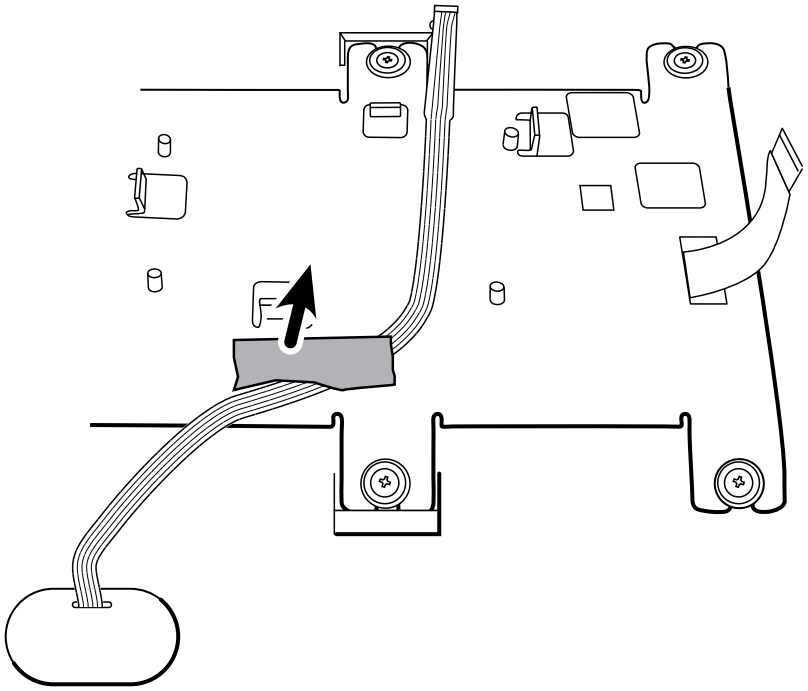
Reassembly note

- Use a #1 Phillips bit and a Torque driver calibrated to 5.0 in-lb ± 0.5 in-lb to secure the SMCE board M3x5 screws.

Remove the LCD frame and display assembly

- Separate the top housing assembly from the bottom housing assembly as described.

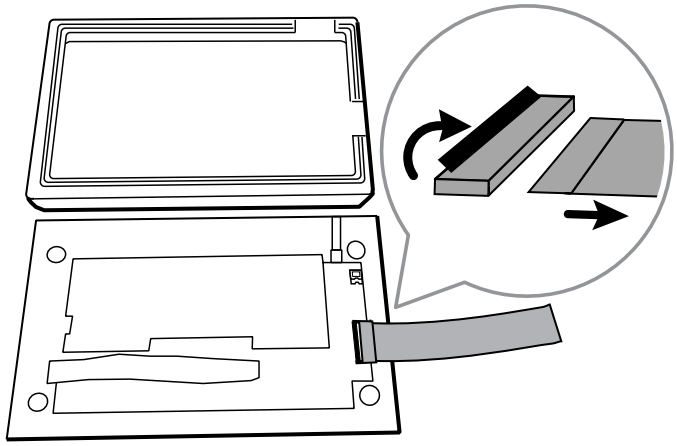
1. Remove the Pro-Gaff tape that holds the power switch flex cable to the LCD frame.



2. Remove the six shoulder screws on the LCD frame using a #1 Phillips bit.
3. Remove the LCD frame.
4. Remove the LCD display and gasket from the top housing assembly.

   Note: Be sure to support the LCD display if you are removing it with the frame.
5. Remove the LCD display gasket.

   Set aside the LCD gasket for reassembly.
6. Unlock the LCD flex connector from the LCD display assembly.



Reassembly notes

- Use a #2 Phillips bit and a Torque driver calibrated to 5.0 in-lb ± 0.5 in-lb to secure the LCD frame shoulder screws.

Ensure that the LCD flex cable is not under the LCD frame.

CAUTION The LCD flex cable is extremely fragile and easily damaged. Do not cause creases that may break the connections.

Insert the LCD display into the gasket with the exposed printed circuit board on the bottom. Verify that the LCD flex cable feeds through the gasket's notched clearance feature.

Place the LCD frame over the display. Verify that the LCD frame does not cover the LCD flex cable.

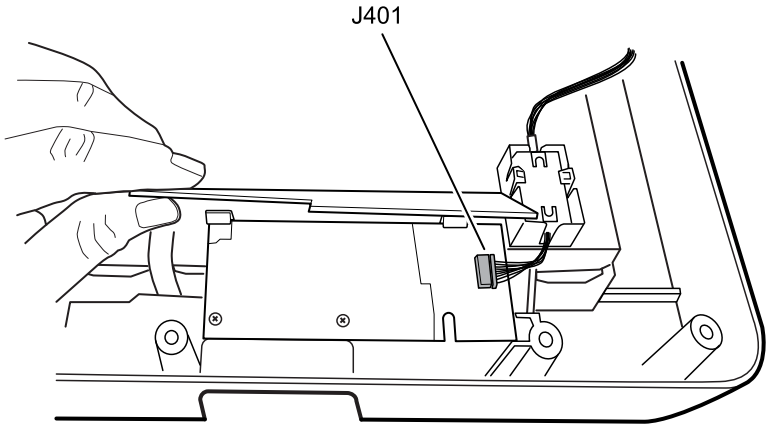
Bottom housing disassembly

These procedures provide instructions for system disassembly and board removal. Except where otherwise noted, the assembly procedure is the reverse of the disassembly procedure.

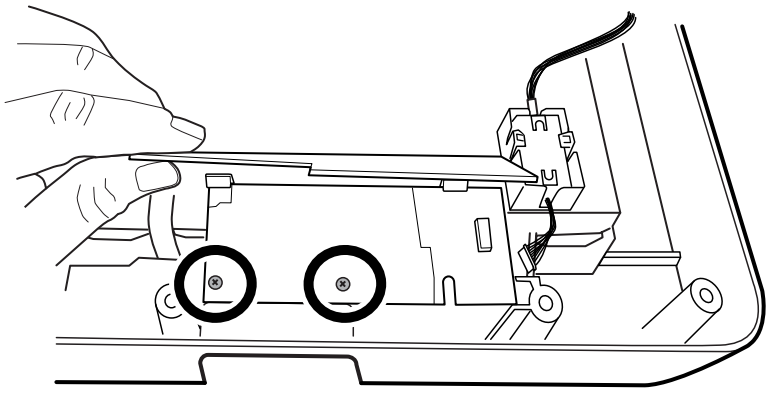
Remove the ECG board

- Separate the top housing assembly from the bottom housing assembly as described.

1. Lift up the ECG cover to access the ECG board.
2. Disconnect the J401 connector from the ECG board.



3. Remove the two M3x5 screws from the ECG board using a #1 Phillips bit.



4. Push back slighty on the two latches to remove the ECG board from the bottom assembly.

Reassembly note

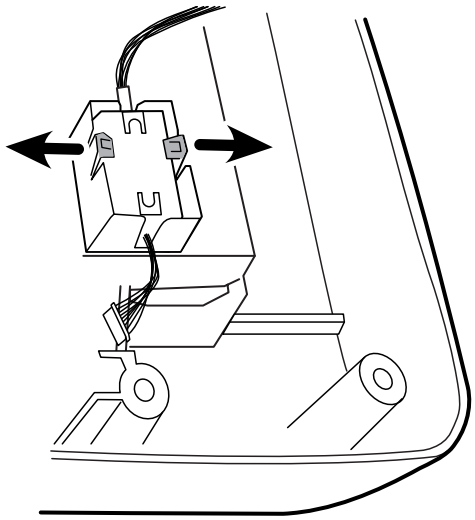
- Use a #1 Phillips bit and a Torque driver calibrated to 5.0 in-lb ± 0.5 in-lb to secure the SMCE board screws.

Remove the ECG ferrite

- Separate the top housing assembly from the bottom housing assembly as described.

Gently open the two side-catches to remove the ECG ferrite and the ECG board harness from the printer top assembly.

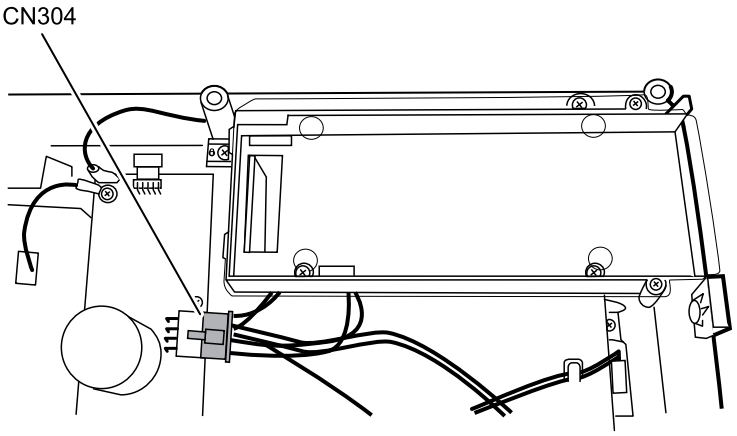
Note Set the harness cable aside for reuse during reassembly.



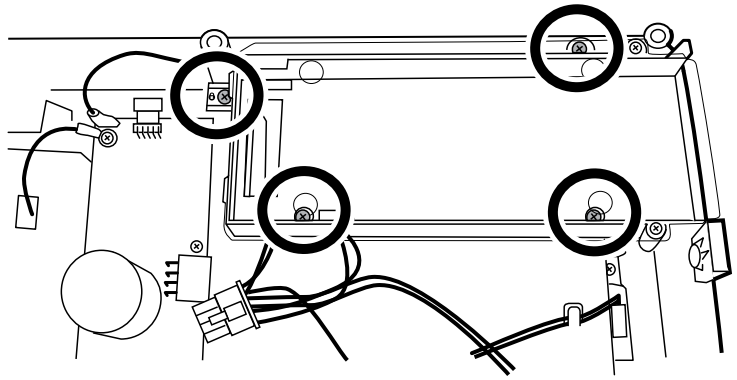
Remove the battery housing cover and the battery connector board

- Separate the top housing assembly from the bottom housing assembly as described.

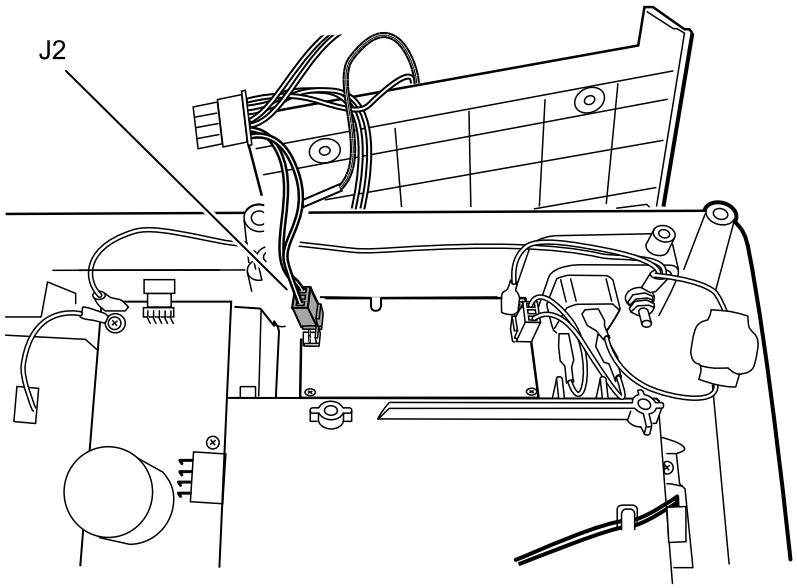
1. Disconnect the CN304 connector from the printer board.



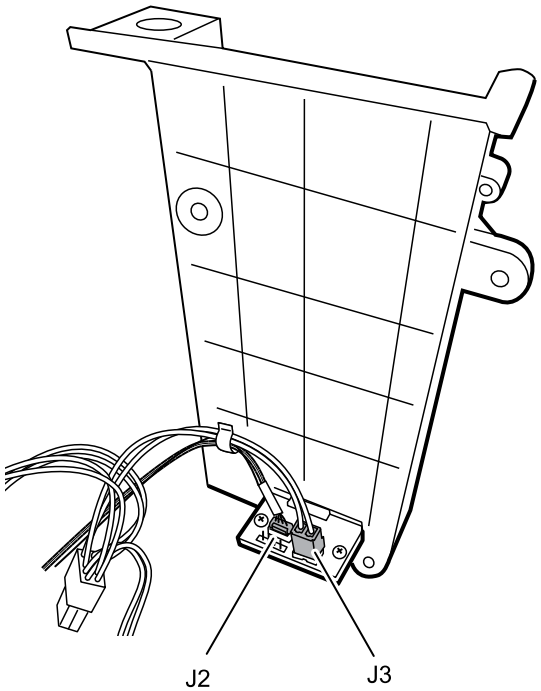
2. Remove the four 4-20 self-tapping screws from the battery housing top cover using a #1 Phillips bit.



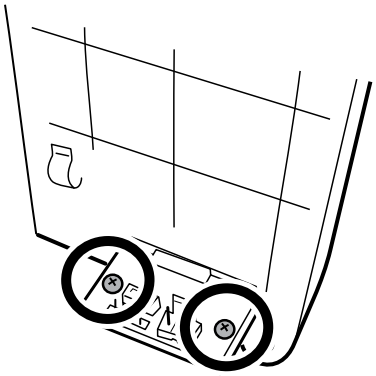
3. Lift up the battery housing bottom cover and disconnect the J2 connector from the power supply board.



4. Disconnect the J2 and J3 connectors from the battery connector board to remove the cables.



5. Remove the two 4-20 self-tapping screws from the battery connector board using a #1 Phillips bit.



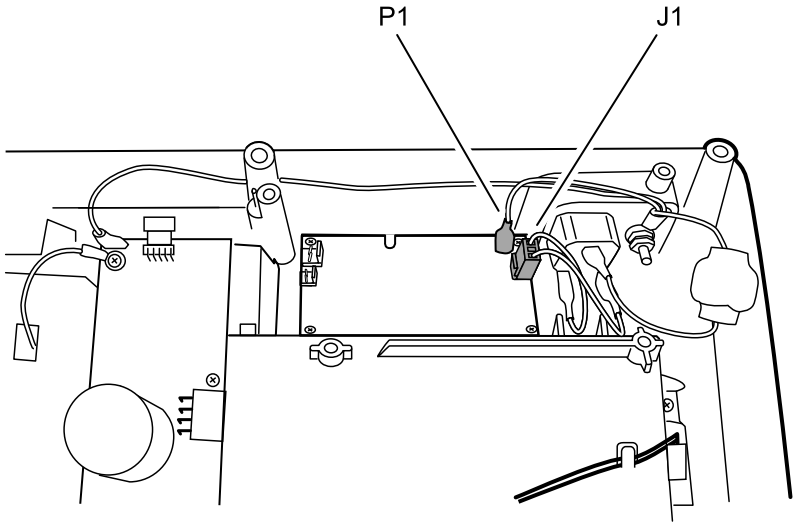
Reassembly notes

- Use a #1 Phillips bit and a Torque driver calibrated to 5.0 in-lb ± 0.5 in-lb to secure the two 4-20 self-tapping screws to the battery connector board.
- Use a #1 Phillips bit and a Torque driver calibrated to 5.0 in-lb ± 0.5 in-lb to secure the four 4-20 self-tapping screws to the battery housing top cover.

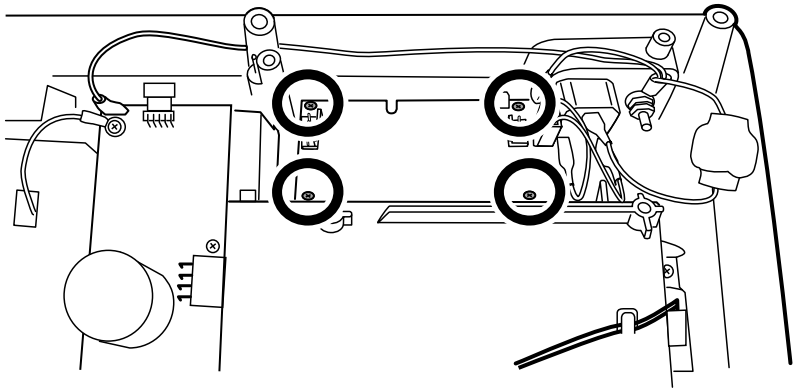
Remove the power supply assembly

- Separate the top housing assembly from the bottom housing assembly as described.

1. Remove the P1 and J1 connectors from the power supply assembly.



2. Remove the four 4-20 self-tapping screws from the power assembly using a #1 Phillips bit.



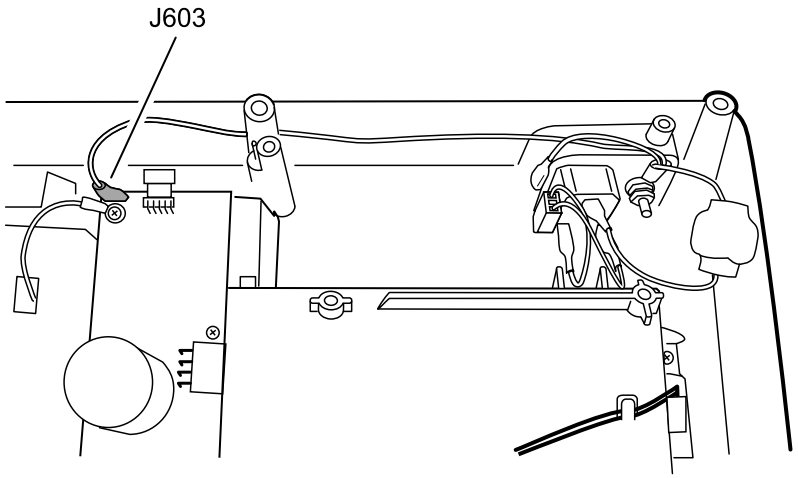
3. Remove the power supply.

Reassembly note
Use a #1 Phillips bit and a Torque driver calibrated to 5.0 in-lb ± 0.5 in-lb to secure the power supply screws.

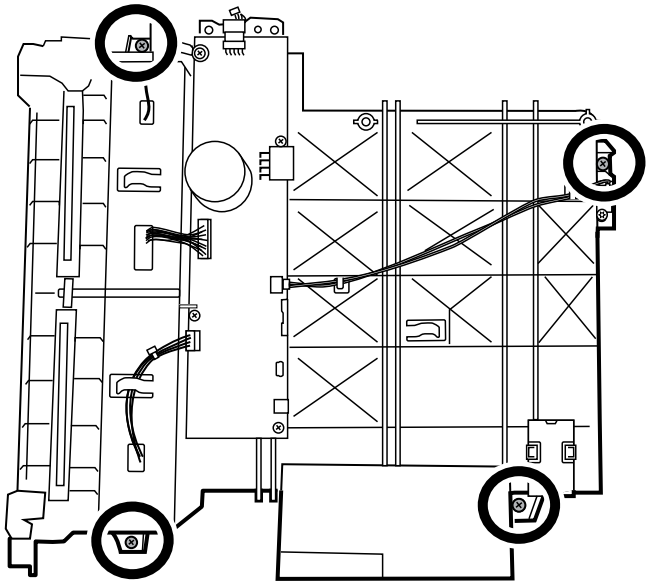
Remove and disassemble the printer assembly

- Separate the top housing assembly from the bottom housing assembly as described.

1. Remove the ground cable at the J603 connection from the printer board (PCA).



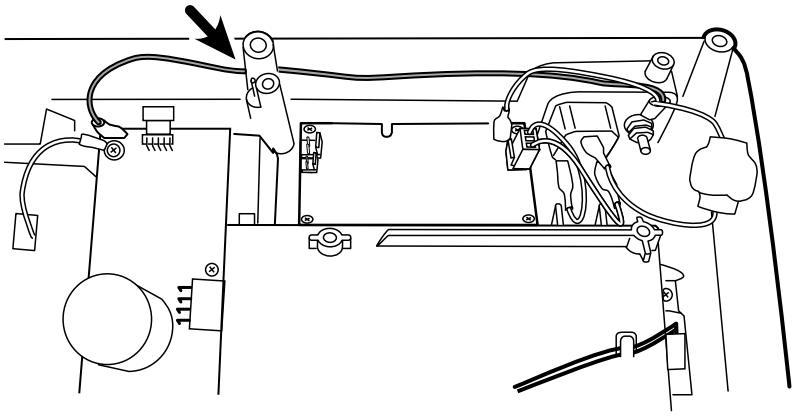
2. Remove the four M4x7 screws from the printer assembly using a # 2 Phillips bit.



Reassembly notes

- Use a #2 Phillips bit and a Torque driver calibrated to 5.0 in-lb ± 0.5 in-lb to secure the printer assembly M4x7 screws.
- Route the ground cable around the outside of the screw boss during reassembly.

Ground cable routing for reassembly:

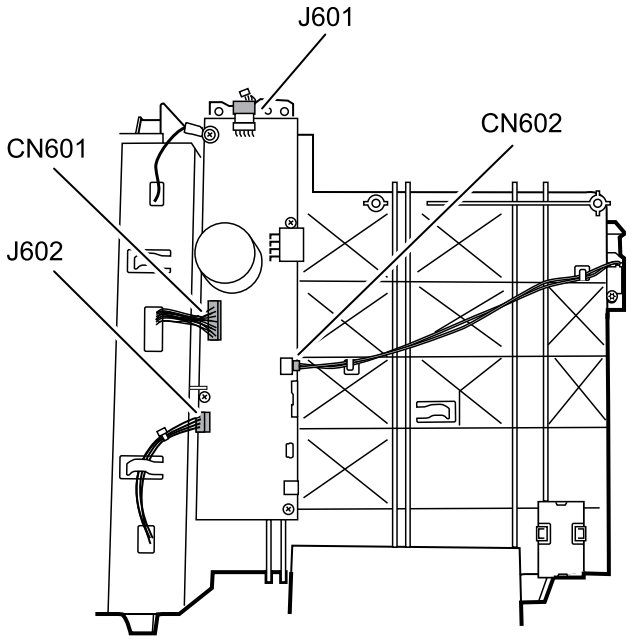


Remove the printer board

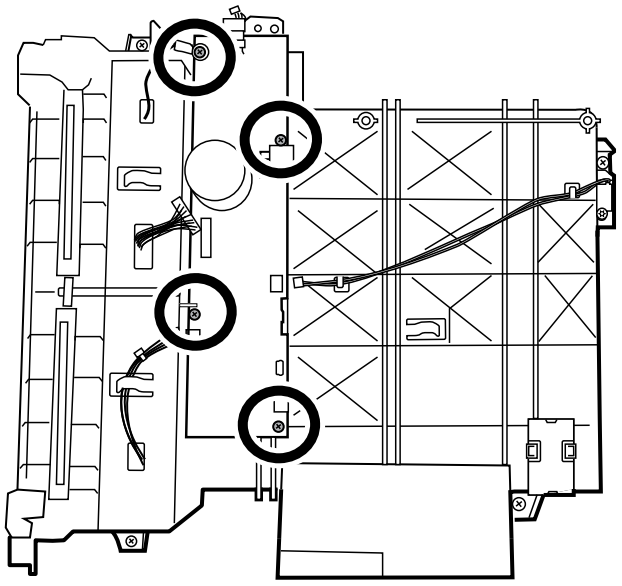
- Separate the top housing assembly from the bottom housing assembly as described.

Note Service the printer board as part of the complete printer assembly. The printer board is not available as a single component. These removal procedures provide instructions for system disassembly and board removal.

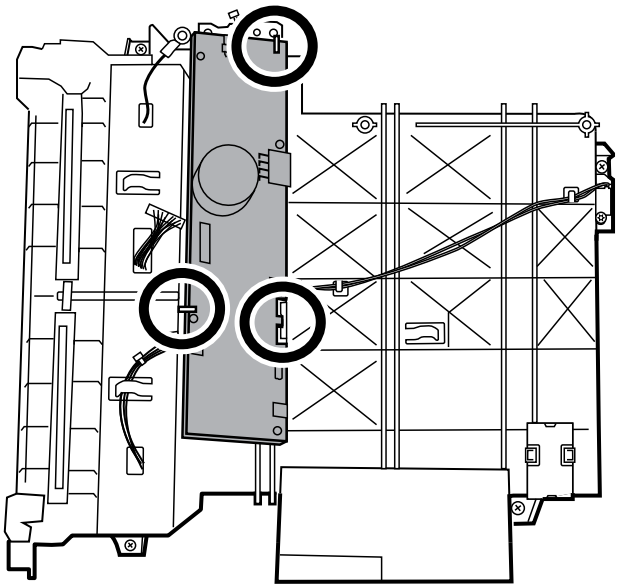
1. Remove the four connectors J602, CN601, J601, and CN602 from the printer board.



2. Remove the four 4-20 self-tapping screws from the printer board using a #1 Phillips bit.



3. Remove the printer board by lifting up the side nearest the print roller and sliding it out from the printer board catch.



4. Separate the printer tray assembly from the printer top assembly by pressing the tray eject button and sliding out the paper tray assembly.

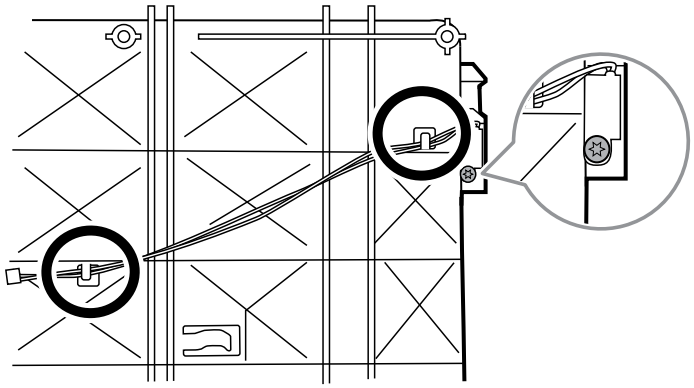
Reassembly note

- Use a #1 Phillips bit and a Torque driver calibrated to 5.0 in-lb ± 0.5 in-lb to secure the printer board 4-20 self-tapping screws.

Remove the printer door sensor

- Separate the top housing assembly from the bottom housing assembly as described.

1. Remove the printer door sensor cable from the printer top assembly catches.
2. Remove the 4-20 pan head screw from the printer top assembly using a #10 Torx bit.



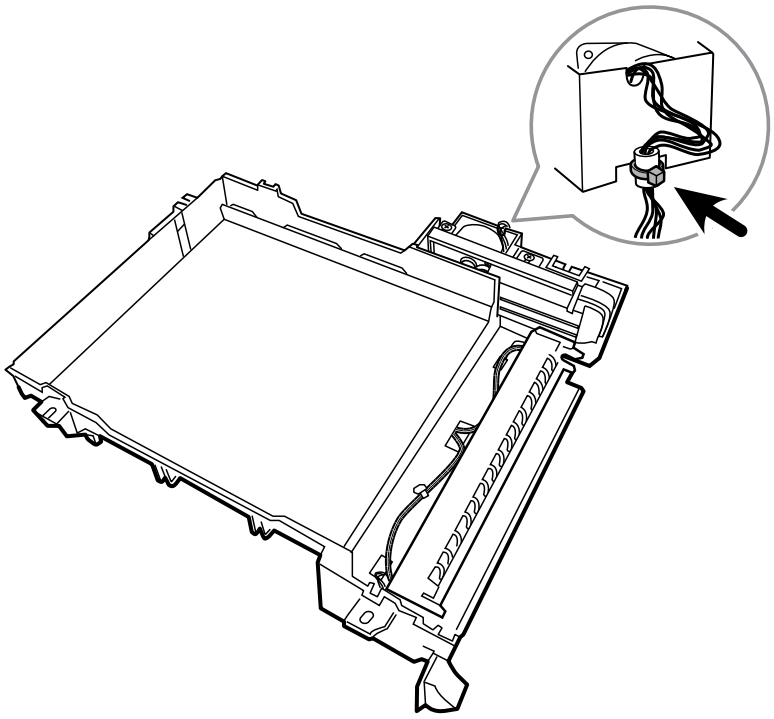
Reassembly note

- Use a #10 Torx bit and a Torque driver calibrated to 5.0 in-lb ± 0.5 in-lb to secure the 4-20 pan head screw to the printer top assembly.

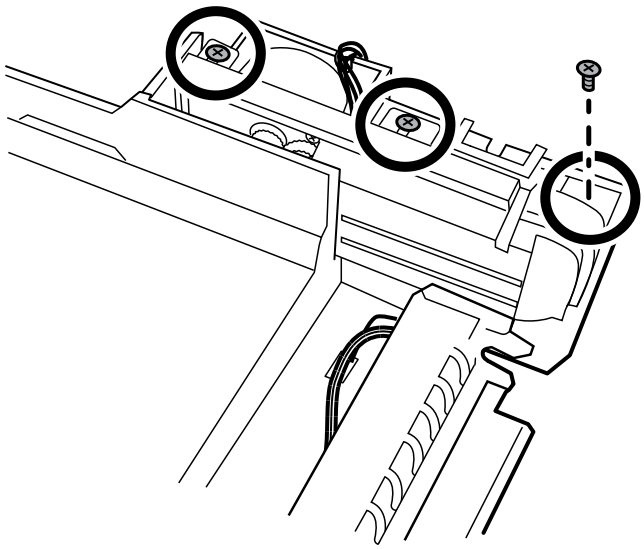
Remove the gear train and motor

- Separate the top housing assembly from the bottom housing assembly as described.

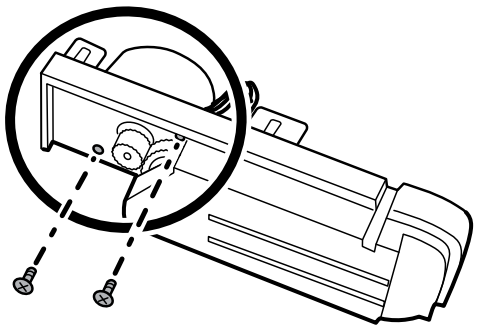
1. Cut the wire tie on the motor harness.



2. Remove the three 4-20 screws from the printer tray using a #1 Phillips bit.



3. Remove the two M3x6 screws from the gear train assembly using a #1 Phillips bit.



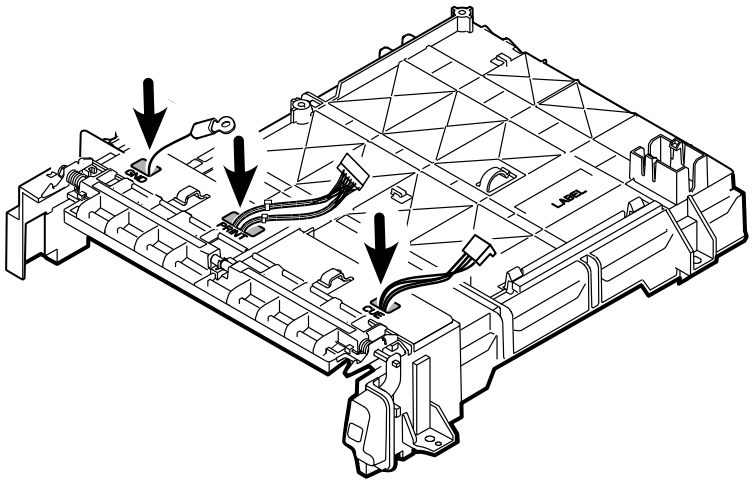
Reassembly notes

- Use a #1 Phillips bit and a Torque driver calibrated to 5.0 in-lb ± 0.5 in-lb to secure the motor assembly to the printer tray.
- Use a #1 Phillips bit and a Torque driver calibrated to 5.0 in-lb ± 0.5 in-lb to secure the gear train assembly to the motor assembly.

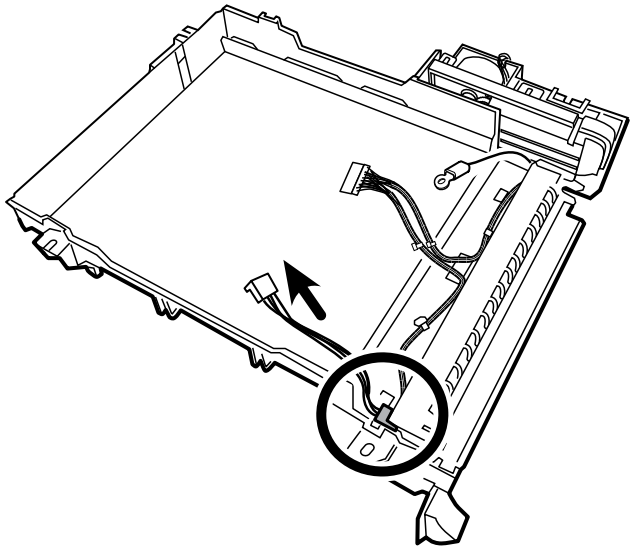
Remove the print head assembly

- Separate the top housing assembly from the bottom housing assembly as described.

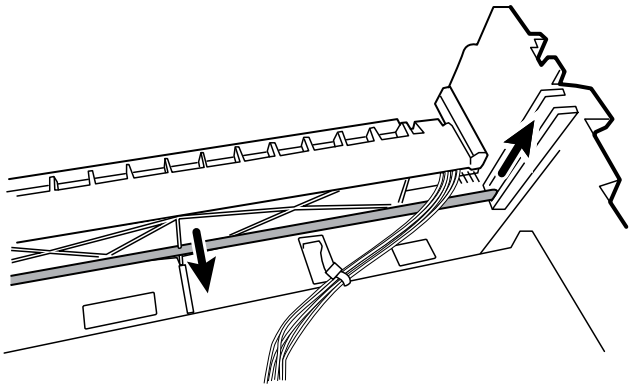
1. Feed the 3 printer harnesses through the openings of the printer top housing.



2. Disconnect one connector of the Cue sensor board to remove the harness.



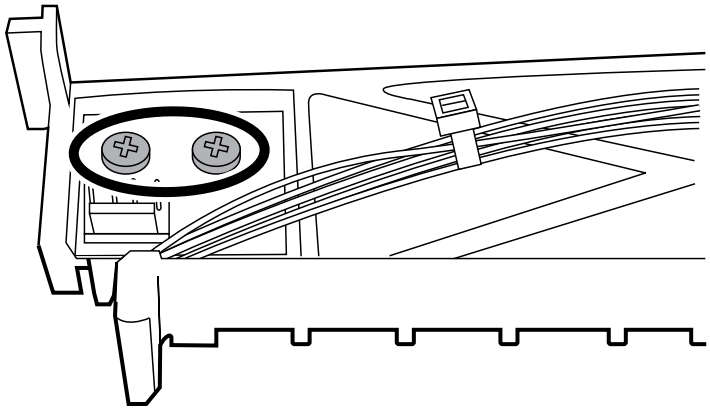
3. Pull the middle of the retaining rod slightly away from the print head and lift upward to remove the retaining rod from the ground-harness-side first.



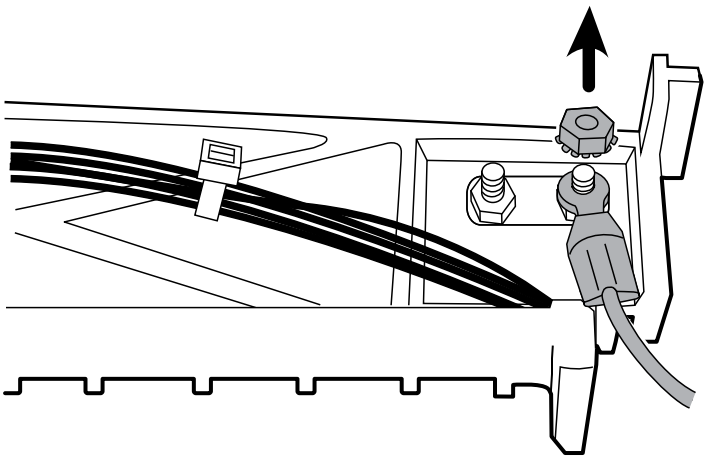
4. Slide the print head assembly inward and then upward through the retaining channel.

Remove the print head

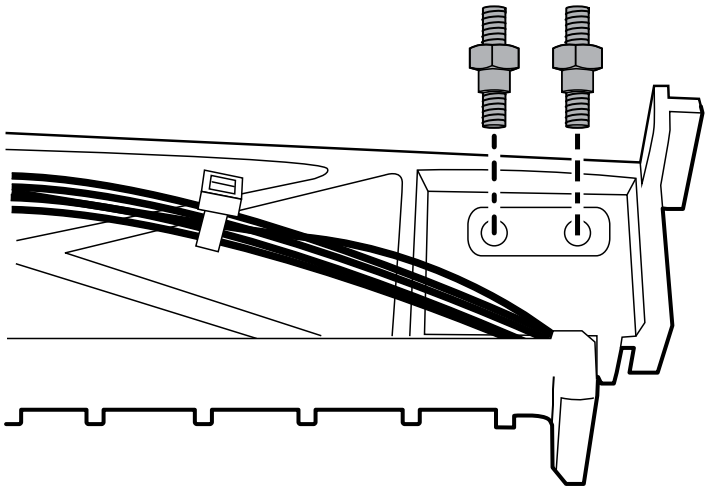
1. Remove the two M3x0.5 screws from the Cue sensor board with a #1 Phillips bit.



2. Remove the nut with ¼" Hex Socket to remove the ground harness.

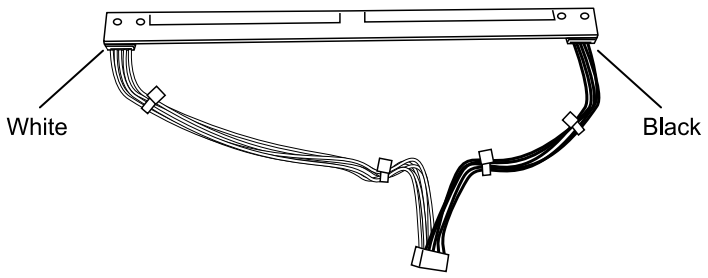


3. Remove the two shoulder screws with a 3/16" Hex Socket.



Note Take note of the shoulder screw direction during the reassembly process.

4. Remove the two connectors on each side of the print head to remove the print head harness.



Note Ensure that the connectors are reattached to their original position. Do not interchange the connectors.

Reassembly notes

- Use a #1 Phillips bit and a Torque driver calibrated to 5.0 in-lb ± 0.5 in-lb to secure the Cue sensor board M3x0.5 screws.
- Use a 1/4" Hex Socket and a Torque driver calibrated to 3.5 in-lb ± 0.5 in-lb to secure the Cue sensor board nut.
- Use a 3/16" Hex Socket and a Torque driver calibrated to 4.0 in-lb ± 0.5 in-lb to secure the Cue sensor board two shoulder screws.
- Secure the shoulder screws to the Cue sensor board with each shoulder of the screw facing the board so that they fit into the board recess.

Connecting the spirometer

WARNING To prevent the spread of infection, use a new flow transducer for each patient. Use protective gloves when replacing used flow transducers, and wash hands after touching them. Discard flow transducers after a single patient use.

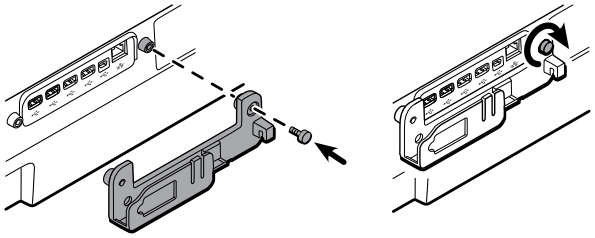
This section covers both the SpiroPerfect ® and the Welch Allyn ambient spirometers.

The spirometer consists of two elements: the spirometry sensor, and the software that runs on the computer to which the sensor is connected. Before you can start recording spirometry tests, complete the following setup tasks:

- connect the sensor to the computer
- configure the software.

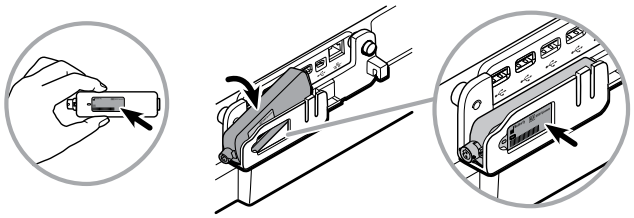
Connecting the spirometer components

1. Attach the right side of the spirometer mounting bracket to the device using one of the thumb screws. Tighten the thumbscrew.

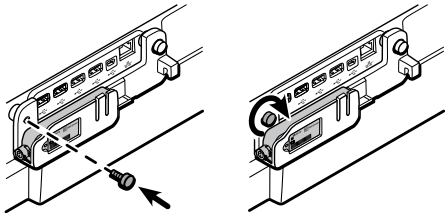


2. Insert the spirometer sensor into the mounting bracket.

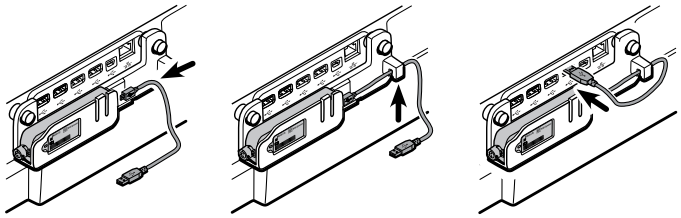
   Ensure that the spirometer sensor label is visible in the mounting bracket window so that the mini USB cable connector installs correctly during the next steps.



3. Attach the left side of the spirometer mounting bracket to the device using the second thumb screw. Tighten the thumbscrew.

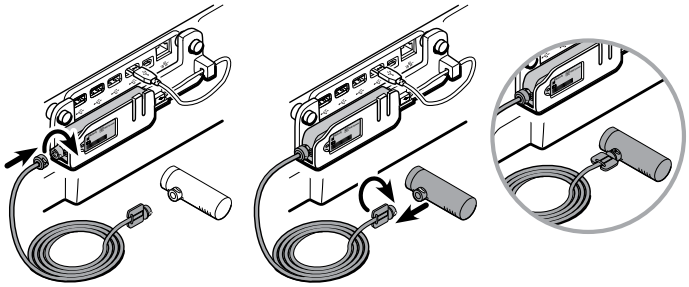


4. Insert the mini USB cable connector into the spirometer sensor mini USB port.
   a. Insert the USB cable into the spirometer sensor mounting bracket groove to secure the cable.
   b. Insert the USB cable connector into the device's first USB port, furthest to the right.

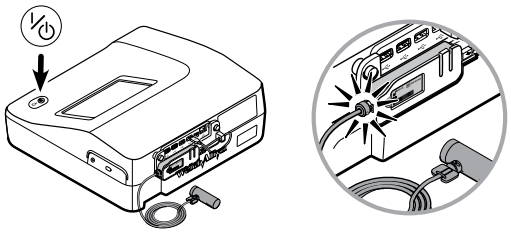


Note The mounting bracket is designed to protect the spirometer sensor and USB cable and only accepts the USB cable mini connector when the spirometer sensor label faces outward.

5. Verify that the spirometer sensor and pressure tubing are clean and undamaged. Look for signs of deterioration, including but not limited to cracks, cuts, discoloration, or oxidation. If any part exhibits any of these symptoms, replace it.
   a. Attach the pressure tubing to the spirometer sensor.
   b. Attach a flow transducer to the pressure tubing.

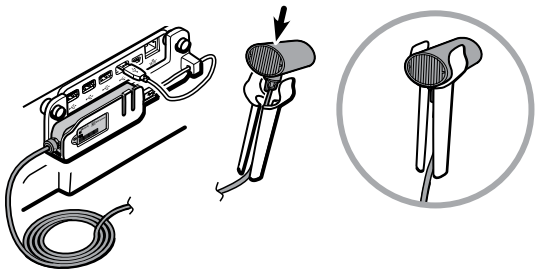


CAUTION Hand-tighten the spirometer sensor and flow transducer connectors to avoid damaging the connectors.



The CP 150 software automatically activates the spirometry functions throughout the software. Once the software recognizes the sensor, the *Spirometry* button appears in the Content area.

6. Push the flow transducer down onto the patient handle until it is secure.



WARNING Keep the reusable patient handle clean. Patient contact with contaminated equipment can spread infection.

Note Clean the patient handle after each patient use.

Electrical safety testing

Welch Allyn recommends performing ground continuity, leakage current, and insulation resistance tests[1] when replacing the power supply or primary wiring according to EN/IEC 62353 - Medical Electrical Equipment - Recurrent Test and Test After Repair of Medical Electrical Equipment.

Due to the variability of test equipment in the field, Welch Allyn does not include specific instructions to perform electrical safety tests. When performing electrical safety tests, refer to your test equipment manuals for detailed instruction. The following table provides connections and test limits to assist you in performing these tests.

Test	Limits
Ground continuity	Ground continuity from EP stud* (equipotential terminal) to the Gnd pin of the IEC power connector shall be no greater than 0.1 ohms.
Leakage current	Leakage current shall be less than 500 µA from EP stud* to mains (Line and Neutral pins of the IEC power connector).
Insulation resistance	Insulation resistance measurements shall be performed with 500V DC from EP stud to mains (Line and Neutral pins of the IEC power connector).

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

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

Software updates process

Update process

1. From the ECG home tab, touch the **Settings** tab. The ECG tab and the vertical ECG configuration tab appear.
2. Touch the **Device** tab.
3. Touch the **Updates** tab.
4. Insert a USB flash drive containing the latest software into a USB port on the back of the device and touch the **Update** button.

   "Do you want to update the device software?" appears.
5. Touch **OK**.

   "Update complete. Press OK to reboot." appears after the update is complete.
6. Touch **OK** to reboot.

   The device automatically reboots.

   Note Do NOT remove the USB flash drive or AC power from the device during reboot.
7. Remove the USB flash drive from the CP 150 after the device reboots.

To verify the software version:

1. Touch the **Settings** tab.
2. Touch the **Device** tab.
3. Touch the **About** tab.
4. Verify that the correct software version is listed for the CP 150.

You are ready to use the updated software.

Export and import of the device configuration

Configuration files can be exported and imported for backup purposes or to configure multiple CP150 devices.

Button	Feature
Update	Updates the device software from a USB flash drive.

Button	Feature
Restore	Restores the device settings to the factory defaults.
Save Configuration	Saves the device configuration to USB flash drive.
Copy Configure	Loads the device configuration from USB flash drive.

To begin the export or import process, insert a USB flash drive into one of the USB ports on the back of the device.

1. From the ECG home tab, touch the **Settings** tab. The ECG tab and the vertical ECG configuration tab appear.
2. Touch the **Device** tab.
3. Touch the **Updates** tab.
   - Touch **Update** to install the latest device software.
   - Touch **Restore** to restore factory defaults.
   - Touch **Save configuration** to save the device configuration to USB.
   - Touch **Copy configuration** to copy the configure from USB.

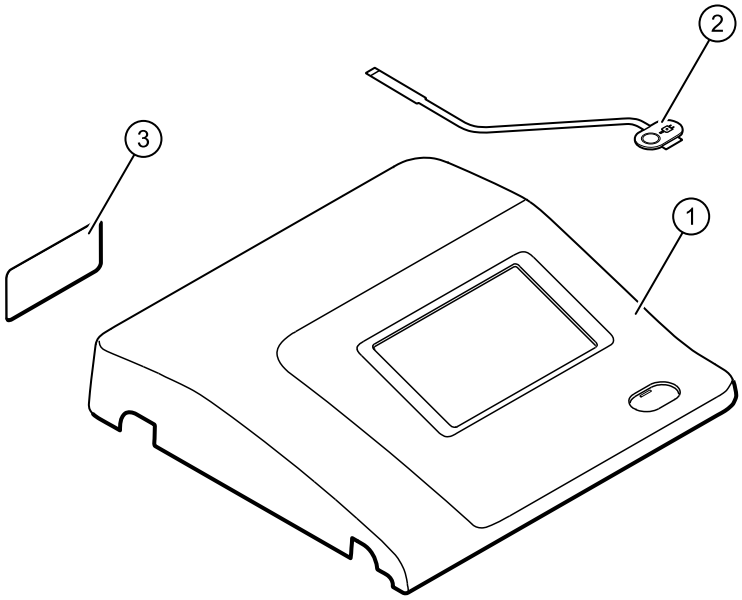
Field replaceable units

This listing includes only field-replaceable service parts. Service kits are shown with the contents listed underneath each kit.

Note Product accessories are listed separately on the CD.

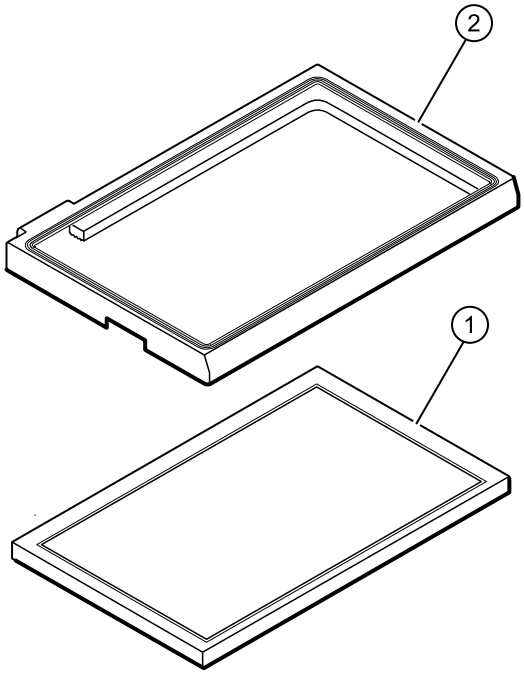
Housing top assembly

Serv Kit, CP150, Hsg Top Assy (material no. CP150-0001)



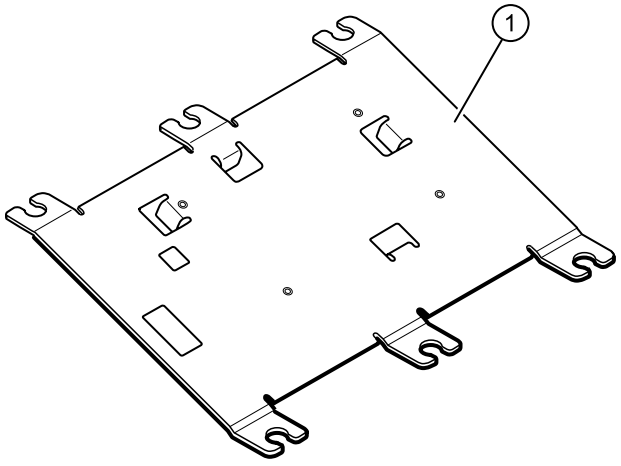
No.	Item	Qty
1	CP150 Subassembly Housing top	1 ea
2	CP150 Power Switch	1 ea
3	Product label	1 ea
n/a	Wire tie holder with adhesive	1 ea

Serv Kit, CP150, 7 Inch Display (material no. CP150-0002)



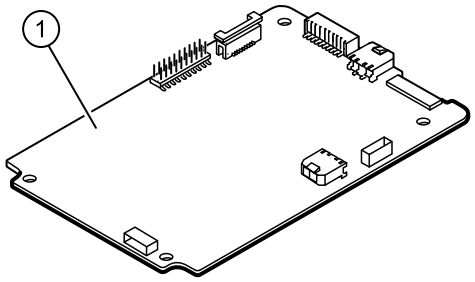
No.	Item	Qty
1	LCD Assy with Touch Panel	1 ea
2	LCD Bezel 7 inch	1 ea
n/a	Flex SMCE-LCD Display 7 inch	1 ea

Serv Kit, Frame LCD (material no. CP150-0003)



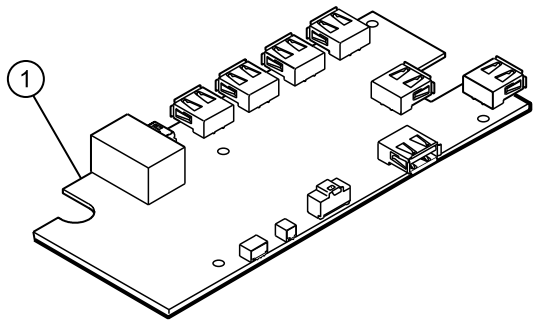
No.	Item	Qty
1	Frame LCD	1 ea
n/a	Wire tie holder with adhesive	2 ea

Serv Kit, SMCE PCA (material no. CP150-0004)



No.	Item	Qty
1	Assy, Small Med Compute Eng (SMCE)	1 ea
n/a	Harness SMCE-I/O	1 ea
n/a	Harness I/O-LCD	1 ea
n/a	CP150 EMC Harness Ferrite	3 ea
n/a	ECG Ferrite	1 ea
n/a	Wire tie	4 ea

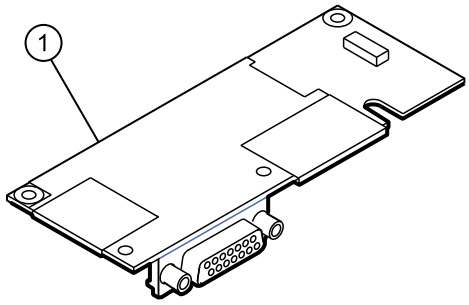
Serv Kit, CP150, I/O PCA (material no. CP150-0005)



No.	Item	Qty
1	CP150 Assy PCA	1 ea
n/a	Harness SMCE-I/O	1 ea
n/a	Harness I/O-LCD	1 ea
n/a	CP150 EMC Harness Ferrite	3 ea
n/a	ECG Ferrite	1 ea
n/a	Wire tie	4 ea

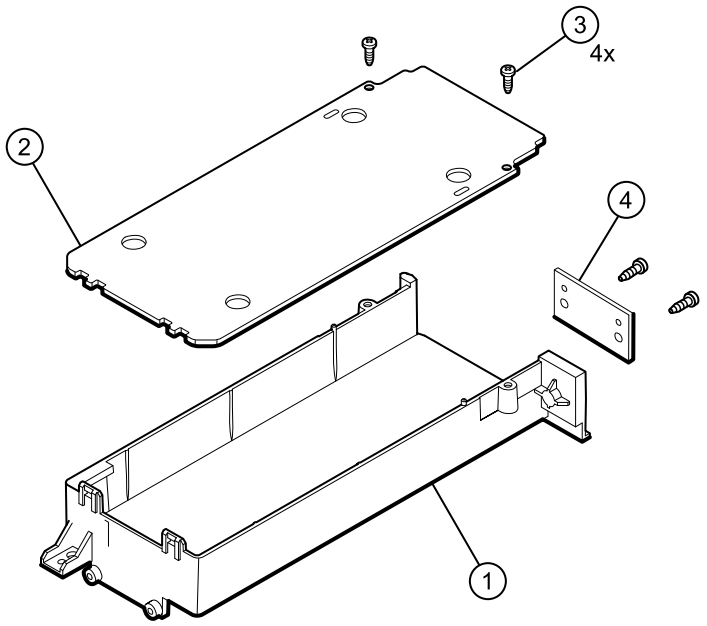
Housing base assembly

Serv Kit, CP150, ECG PCA (material no. CP150-0006)



No.	Item	Qty
1	ECG PCA Assy	1 ea
n/a	CP150 Harness ECG SMCE	1 ea
n/a	ECG Ferrite	1 ea

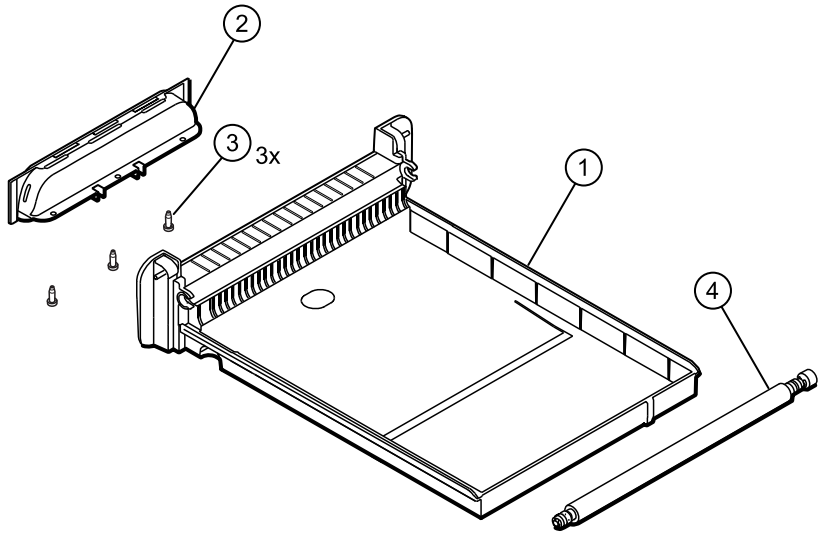
Serv Kit, Battery Case Assy (material no. CP150-0007)



No.	Item	Qty
1	Assy Battery Cover bottom	1 ea
2	Battery Cover top	1 ea
3	Screw 4-20 pan phillips	4 ea
4	PCA, Battery Connector	1 ea
n/a	Harness PSU-BAT-SMB-PRT-SMCE	1 ea

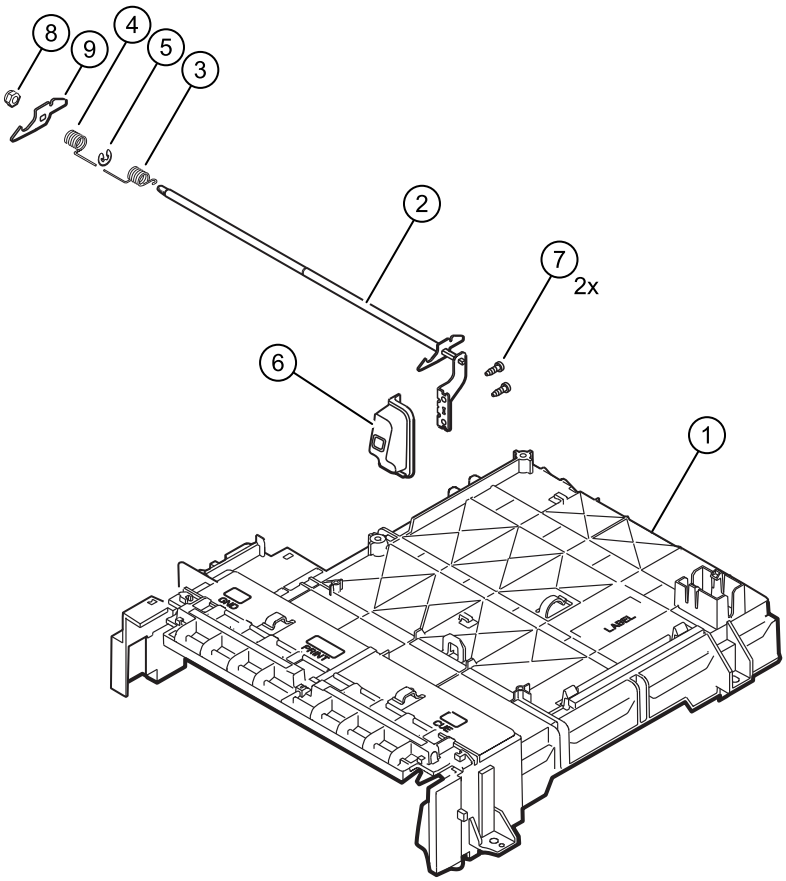
Printer 8 inch assembly tray

Serv Kit, CP150, Tray paper assy (material no. CP150-0009)



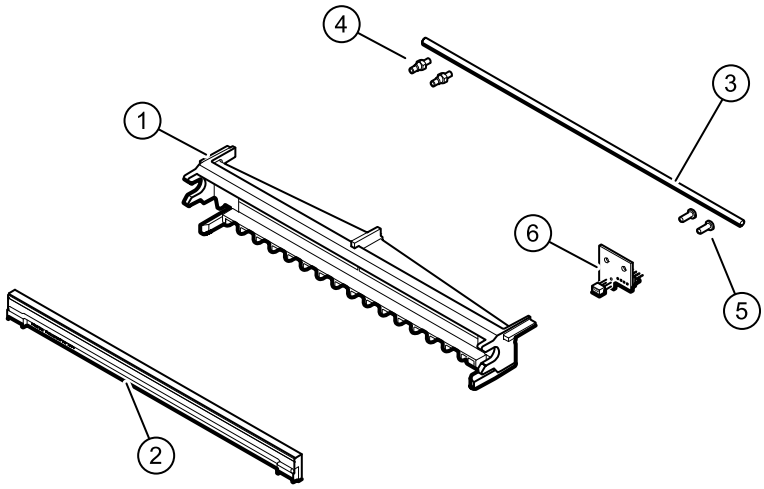
No.	Item	Qty
1	Printer 8 in Assy Tray	1 ea
2	Printer 8 in Assy top (handle)	1 ea
3	Screw 4-20 .375 pan phillips	3 ea
4	Printer 8 in Platen Roller Assy	1 ea

Serv Kit, Printer Top Assy (material no. CP150-0010)



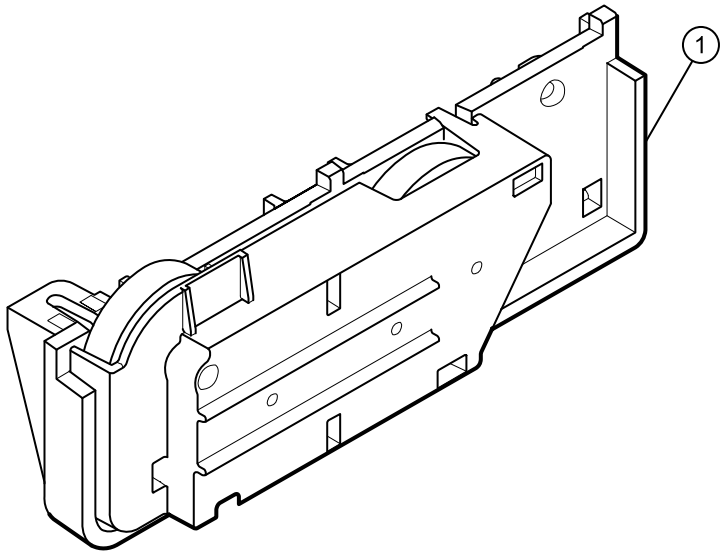
No.	Item	Qty
1	Housing top	1 ea
2	Latch assy	1 ea
3	Coil spring right	2 ea
4	Coil spring left	1 ea
5	Retaining ring	1 ea
6	Printer button	1 ea
7	Screw 4-20	2 ea
8	Locknut	1 ea
9	Latch left	1 ea
n/a	CP150 ECG cover	1 ea
n/a	Wire tie holder with adhesive	1 ea

Serv Kit, Print Head Assy (material no. CP150-0011)



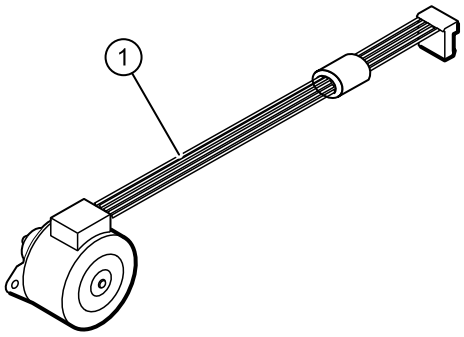
No.	Item	Qty
1	Printhead Holder	1 ea
2	Printhead	1 ea
3	Printhead spring	1 ea
4	Shoulder screws M3x0.5	2 ea
5	Screw pan head phillips M3 x 0.5	2 ea
6	Cue Sensor PCBA	1 ea
n/a	Harness Print Cue	1 ea
n/a	Brush anti-static	2 ea
n/a	Harness Printhead	1 ea
n/a	Nut 4-40	1 ea
n/a	Harness print-earth	1 ea

Serv Kit, Gear Train Assy (material no. CP150-0012)



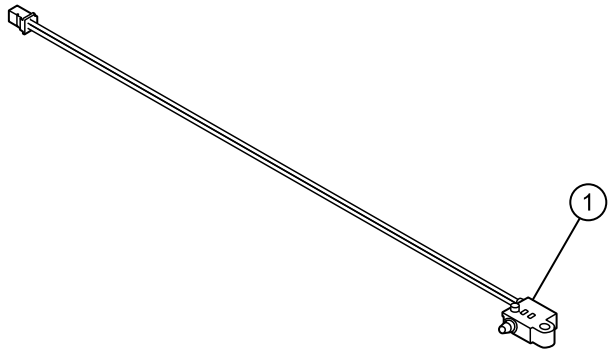
No.	Item	Qty
1	Gear train assy	1 ea

Serv Kit, Motor Assy (material no. CP150-0013)



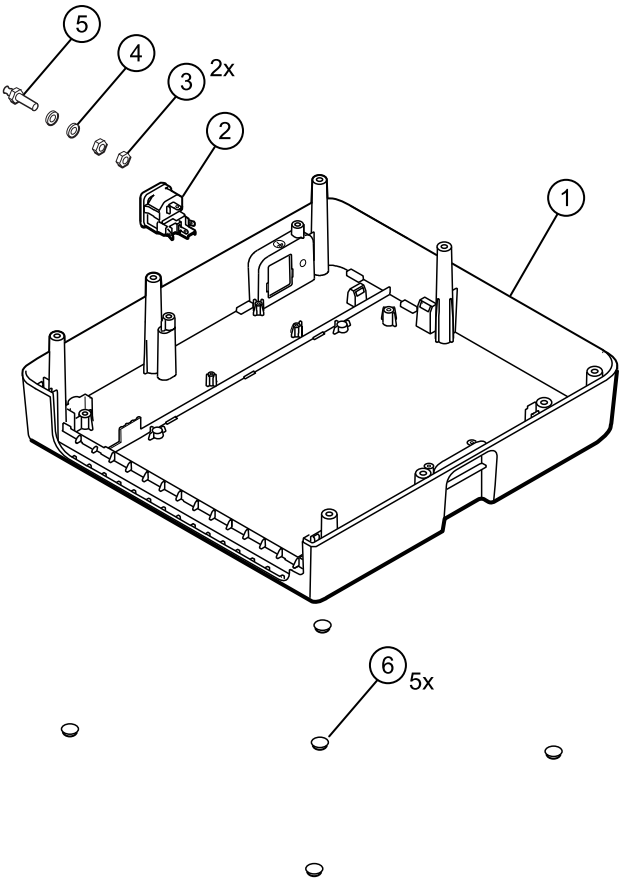
No.	Item	Qty
1	Harness motor	1 ea
n/a	Wire tie	1 ea

Serv Kit, Door Sensor (material no. CP150-0014)



No.	Item	Qty
1	Door Sensor	1 ea
n/a	Plastite 4-20x.5 pan head screw	1 ea

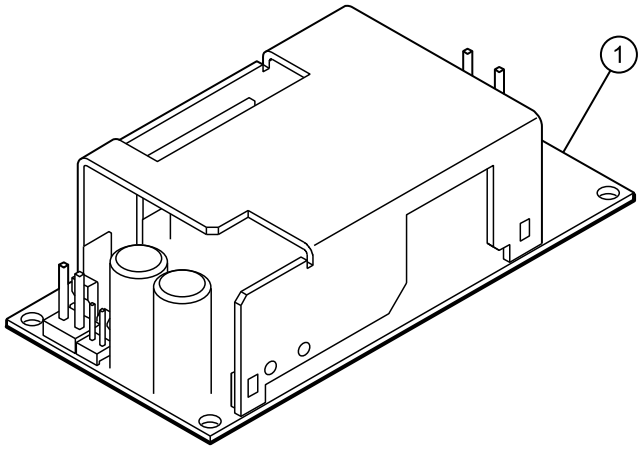
Bottom assembly



Serv Kit, Bottom assy (material no. CP150-0015)

No.	Item	Qty
1	Subassembly housing base	1 ea
2	Subassy Schurter Kea power mod	1 ea
3	Nut	2 ea
4	Washer lock serrated	1 ea
5	Ground poag	1 ea
6	Bumpers	5 ea

Serv Kit, Power supply (material no. CP150-0016)

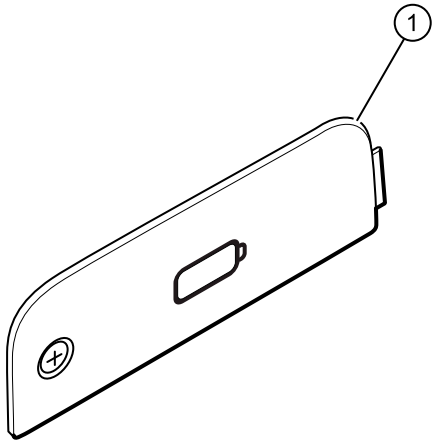


No.	Item	Qty
1	Power supply, 60 W	1 ea

Serv Kit, Software update (material no. CP150-0017)

No.	Item	Qty
n/a	Flash drive	1 ea
n/a	Software update document	1 ea

Serv Kit, Battery door (material no. CP150-0018)



No.	Item	Qty
1	Battery door	1 ea

Serv Kit, Miscellaneous (material no. CP150-0019)

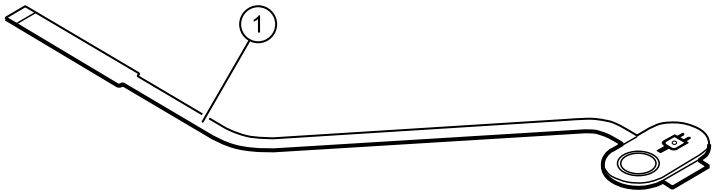
No.	Item	Qty
n/a	Screw 4-20 pan phillips	30
n/a	Screw M4X10	30
n/a	Shoulder screw	10
n/a	Pan head M3x5	10
n/a	Pan phillips M3x0.5	10
n/a	Shoulder screw M3x0.5	10
n/a	Nut 4-40	10
n/a	Screw M3x6 php	10
n/a	Screw, Plastite 4-20 pan head	10
n/a	Wire tie	20
n/a	Grommet ear	10

No.	Item	Qty
n/a	Bumper	20
n/a	Cable tie with adhesive	20
n/a	CP150 ECG cover	10

Serv Kit, Flex SMCE - LCD (material no. CP150-0020)

No.	Item	Qty
n/a	Flex SMCE - LCD	1

Serv Kit, Power switch (material no. CP150-0021)



No.	Item	Qty
1	Switch power supply	1

Serv Kit, Power harness kit (material no. CP150-0022)

No.	Item	Qty
n/a	AC PSU harness	1
n/a	AC GND harness	1

Serv Kit, SMCE - I/O harness kit (material no. CP150-0023)

No.	Item	Qty
n/a	SMCE I/O harness	1
n/a	I/O LCD harness	1
n/a	CP150 EMC harness ferrite	3
n/a	ECG ferrite	1

Serv Kit, SMCE - ECG harness kit (material no. CP150-0024)

No.	Item	Qty
n/a	SMCE - ECG harness	1
n/a	ECG ferrite	1

Serv Kit, PSU - BAT harness (material no. CP150-0025)

No.	Item	Qty
n/a	PSU - BAT - SMB - PRT - SMCE harness	1

Serv Kit, Printer harness kit (material no. CP150-0026)

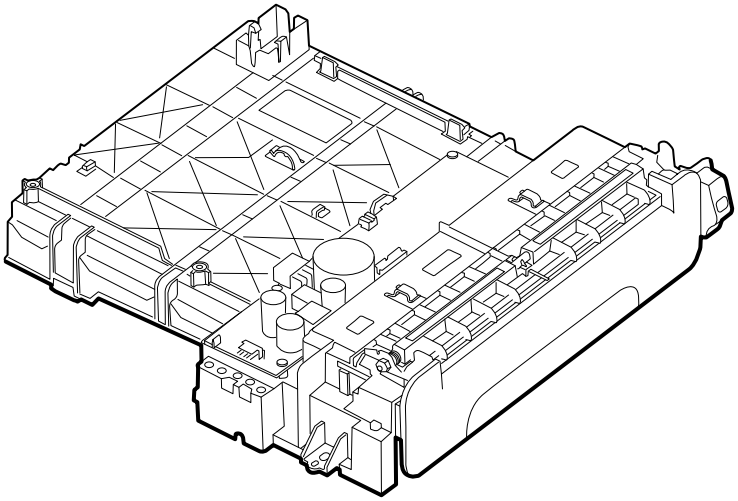
No.	Item	Qty
n/a	Print head harness	1
n/a	Print earth harness	1
n/a	Print cue harness	1

Serv Kit, USB cable (material no. CP150-0027)

No.	Item	Qty
n/a	USB cable	1

Serv Kit, Printer module (material no. CP150-0033)

No.	Item	Qty
n/a	8 inch printer assembly	1



Partners in Care service and support agreements

Material no.	Item
S1-CP150	CP150, Comprehensive partnership program 1 year
S1-CP150-2	CP150, Comprehensive, Comprehensive partnership program 2 years
S1-CP150-5	CP150, Comprehensive partnership program 5 years
S2-CP150	CP150, Bio-med partnership program 1 year
S2-CP150-2	CP150, Bio-med partnership program 2 years
S2-CP150-5	CP150, Bio-med partnership program 5 years
S4-CP150	CP150, extended warranty, 1 year
S4-CP150-2	CP150, extended warranty, 2 years
S4-CP150-5	CP150, extended warranty, 5 years

Note Service and support agreements are not available at all levels, in every market. Contact your local Welch Allyn Customer Service Center for availability.

Service and repair training

Material no.	Item
CP150REPW-TRN	CP150 repair web training
PRV-001	Preventive Svc WA Bench per unit
PRV-002	Preventive Svc planned onsite per unit

Appendices

Decontamination and cleaning requirements

As a general safety precaution, the device must undergo decontamination before being returned to Welch Allyn for service, repair, inspection, or disposal.

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

Note Decontaminate the device according to your facility's procedures and local regulations.

Cleaning is an essential prerequisite for effective disinfection or decontamination.

Note The following guidelines apply to the device only. For peripheral items, follow the cleaning instructions in the directions for use that accompany these accessories.

WARNING Before you clean the CP 150 Electrocardiograph, unplug it from the wall socket.

WARNING Electric shock hazard. DO NOT autoclave the CP 150 Electrocardiograph or accessories.

WARNING Liquids can damage electronics inside the CP 150 Electrocardiograph. Prevent liquids from spilling on or dripping into the CP 150 Electrocardiograph. If liquids are spilled on or drip into the CP 150 Electrocardiograph:

1. Disconnect the power plug.
2. Dry off excess liquid from the CP 150 Electrocardiograph.
3. Verify that the CP 150 Electrocardiograph functions normally before using it.

Clean the CP 150 Electrocardiograph on a routine basis according to your facilities protocols and standards or local regulations.

The following agents are compatible with the electrocardiograph:

- 70 percent isopropyl alcohol
- 10 percent chlorine bleach solution

CAUTION When cleaning the device, avoid using cloths or solutions that include quaternary ammonium compounds (ammonium chlorides) or glutaraldehyde-based disinfectants.

Note Disinfect according to your facility's protocols and standards or local regulations.

70 percent isopropyl alcohol

Wipe the electrocardiograph with a clean cloth slightly dampened with 70 percent isopropyl alcohol.

10 percent chlorine bleach solution

1. Wipe the electrocardiograph with a clean cloth slightly dampened with a 10 percent bleach and water solution. Follow the cleaning agent manufacturer's guidelines.
2. Rinse with a clean cloth slightly dampened with water that meets EP and USP quality standards.
3. Allow the electrocardiograph surface to dry for a minimum of 10 minutes before using the electrocardiograph.

Cleaning the spirometer, calibration syringe, and patient handle

WARNING Change the flow transducer for each patient.

WARNING Satisfactory maintenance procedures must be implemented, or equipment failure and health hazards may result. Only qualified service personnel should repair the equipment.

CAUTION You cannot clean the spirometer or any of its components.

CAUTION Do not clean the pressure tubing or sensor. Trapped moisture could affect accuracy.

CAUTION Replace the pressure tubing when it becomes dirty or every 3 months, whichever comes first. Recalibrate after replacement.

CAUTION Replace the sensor when it becomes faulty.

Cleaning the calibration syringe

Wipe the outer surface of the calibration syringe with a clean cloth slightly dampened with 70 percent isopropyl alcohol.

Cleaning the patient handle

WARNING Keep the patient handle clean. Patient contact with contaminated equipment can spread infection.

Note Clean the patient handle after each patient use.

Clean on a routine basis according to your facility's protocols and standards or local regulations.

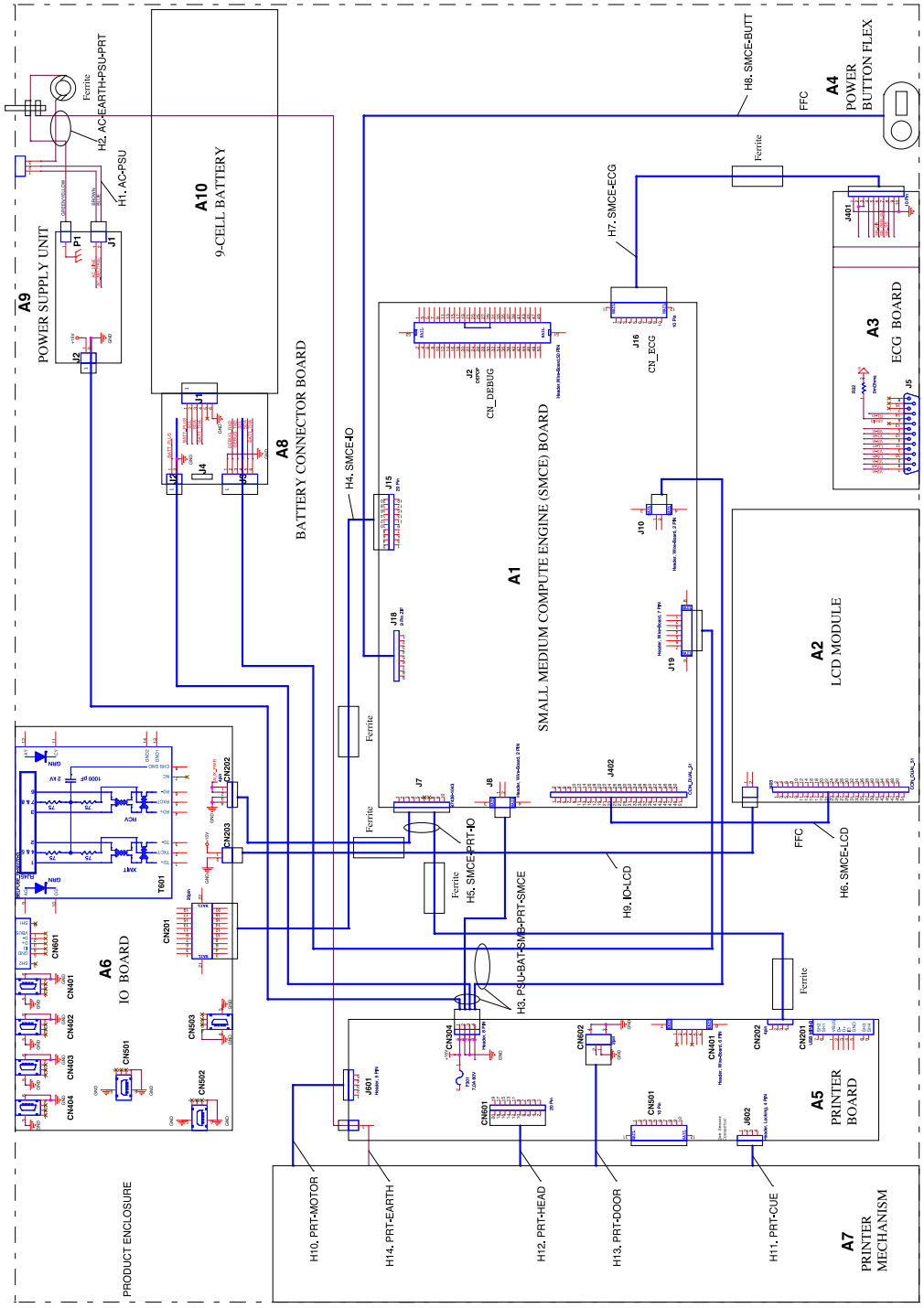
The following cleaning and disinfection agents are compatible with the patient handle:

- 70 percent isopropyl alcohol
- 10 percent chlorine bleach solution

CAUTION When cleaning the patient handle, do not use cloths or solutions that include quaternary ammonium compounds (ammonium chlorides) or glutaraldehyde-based disinfectants.

Note Disinfect according to your facility's protocols and standards or local regulations.

Interconnect diagram



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Material No. 719489