

Micropaq® Monitor



Service Manual

Model 406 and Model 408
Software version 1.7X

WelchAllyn®

Advancing Frontline Care™

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

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

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1

Safety summary

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

General safety considerations

- If the monitor detects a problem that prevents it from operating properly, it displays an error message and error number. Report such errors to Welch Allyn.
- Do not service a monitor under warranty. Servicing a monitor under warranty voids the warranty. All service on monitors under warranty must be performed by Welch Allyn. Contact Welch Allyn for information about post-warranty period service.
- Frequently check all cables, both electrically and visually.

Definitions



WARNING The Warning symbol indicates a condition that could lead to illness, injury or death.



Caution In this manual indicates a condition that could damage equipment or other property.



On the product means “Consult the accompanying documentation.”

Warnings and cautions

Familiarize yourself with all warnings and cautions before using the monitor.



WARNING The monitor may not meet its performance specifications if stored or used outside the specified temperature and humidity ranges.

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

WARNING If the monitor has been dropped or severely abused, remove it from service until it has passed the functional verification.






Caution Do not autoclave the monitor. Autoclave accessories only if the manufacturer's instructions clearly approve it. Many accessories can be severely damaged by autoclaving.





Symbols

The following symbols appear on the monitor or accessories.









| Symbol | Definition | Symbol | Definition |
|-------------|--|-------------|---|
| | Direct current | IPX1 | Enclosure Protection Drip proof: Classification IPX1 per EN60529: 1991 |
| | Alternating current (battery charger) | | Fuse |
| | The CE Mark and Notified Body Registration Number signify the device has met all essential requirements of European Medical Device Directive 93/42/EEC | | This device has been tested and certified by the Canadian Standards Association International to comply with applicable U.S. and Canadian medical safety standards. |
| | Restrictions for use of wireless device in Europe. European Communities Class 2 radio equipment | | Signifies the device has met all essential requirements of European Medical Device Directive 93/42/EEC for a Class 1 product (battery charger) |
| | Protective earth ground (battery charger) | | Separate batteries from other disposables for recycling |
| Li++ | Lithium Ion battery | | |
| | Caution: Refer to Directions For Use and accompanying documentation | | For indoor use only (battery charger) |
| | See the accompanying manual | | Keep away from rain |
| | Alarm(s) off | | Recycle the monitor and battery separately from other waste. Refer to www.welchallyn.com/weee for collection point and additional information. |
| | This way up | | Patient connections are Type CF, isolated for direct cardiac application, and protected against defibrillation |
| 95% | Humidity limit | | Stacking limit (by number) |
| | Fragile | | Altitude limit |
| | Temperature limits | | IATA/ICAO Hazard Class 9 Package (International Air Transport Association/ International Civil Aviation Organization) |
| | Non-ionizing electromagnetic radiation. This device contains an approved RLAN module frequency 2402 to 2480 MHz | | Single use only |
| | | | Non-ionizing electromagnetic radiation. This device contains an approved RLAN module frequency 5150 to 5825 MHz |

| Symbol | Definition | Symbol | Definition |
|---|--|---|--|
|  | The monitor is connected to Acuity |  | The monitor is not connected to Acuity |
|  | (Flashing) The monitor is searching for a connection to Acuity | FCC ID: PGUWA11A07 IC: 4168a-WA11A07 | This device complies with FCC and Industry Canada requirements for international radiators (802.11 wireless) |

Monitor front panel keys

| | | | |
|---|---|---|---|
|  | Select key and Silence Patient Alarm/Equipment Alert key- Selects the choice highlighted on the menu. During patient alarms, silences the tone at the monitor and Acuity (if connected) for 90 seconds. During equipment alerts, silences or acknowledges (dismisses) the alert. |  | Scroll Up key and Reset Alarm Tone key- Scrolls up menus on the display. During patient alarms, resets the tone at the monitor and Acuity (if connected). |
|  | Snapshot key - When connected to Acuity, pressing this key sends Acuity a snapshot print to the Acuity central station printer. A total of 21 seconds of patient numeric and waveform data (14 seconds of history, 7 seconds after the key is pressed) will be sent to the printer. |  | Scroll Down key and Main menu key- Scrolls down menus on the display, or causes the Main menu to appear if no menu is displayed. |

Eight-bay battery charger label and LEDs (008-0651-XX)

| | | | |
|--------------------------------|---|---|---|
| Green LED on continuously |  |  | Battery is fully charged. |
| Green LED flashing " |  |  | Battery is charging. |
| Green LED flashing very slowly |  |  | Battery detected and waiting to be charged. |
| Yellow LED on continuously |  |  | Something is wrong with the battery or the charger. |

Electrostatic discharge (ESD)



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

WARNING Assume that all electrical and electronic components of the monitor are static-sensitive.

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

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

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

2

Overview

Purpose and scope

This document provides instructions for disassembly and assembly, troubleshooting, functional testing and performance verification for the Micropaq monitor.

This document covers the following monitors:

- Micropaq Model 408 monitor, Masimo version
- Micropaq Model 408 monitor, Nellcor version
- Micropaq Model 406 monitor (ECG only)

For service information about any other monitor, refer to the service manual for that monitor.

Any 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. (For contact information, see [page ii](#).)

This manual is intended for use only by technically qualified service personnel.

Corrective service is supported to the level of field-replaceable units. Field-replaceable units include certain subassemblies, service kits, and other parts. All field-replaceable parts are listed in “[Field Replaceable Units](#)” on page 77.

The following activities are not supported:

- Repair and replacement of the main board, radio board, and SpO₂ board,
- Component-level repair of circuit boards and subassemblies,
- Performance of any service procedure or instruction in any manner other than exactly described in this manual.



WARNING Failure to observe and adhere to these restrictions could lead to serious personal injury.



Caution Failure to observe and adhere to these restrictions could damage the monitor and will invalidate the monitor warranty.

Related documents

When using this manual, it may be helpful to refer to the following documents:

- *Micropaq Directions for Use*, 810-2691-XX (Multi-language CD)
- *Welch Allyn Products and Accessories*, 810-0409-XX

Technical support and repair services

| Service activity | Monitor | Battery charger |
|-------------------------------------|--|--|
| Parts replacement | Replace the display, front case and rear case. Contact Welch Allyn (see page ii) for service and monitor exchange policy. | Replace only fuses (see procedure in this manual). Contact Welch Allyn (see page ii) for service and monitor exchange policy |
| Calibration | None required | None required |
| Periodic service^a | Every 6 months to 2 years (per hospital protocols): <ul style="list-style-type: none"> • Complete functional verification as described in this manual • Inspect the monitor for mechanical and functional damage • Inspect safety labels for legibility | Every 6 months to 2 years: <ul style="list-style-type: none"> • Complete functional verification as described in this manual • Inspect the battery charger for mechanical and functional damage • Inspect safety labels for legibility • Inspect the rear panel fuses for compliance to specified rating |

a. More frequent service may be needed in extreme environments (heat, cold, dust, etc.).

Contact Welch Allyn at one of the numbers listed on [page ii](#).

Returning products

To return a product for service, contact Welch Allyn (see [page ii](#)) and request a Return Material Authorization (RMA) number.

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

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

- Product name, model number, and serial number.
- 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 warranty.
- A full description of the problem or service request.

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

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

Before shipping the monitor, please observe these packing guidelines:

- Remove from the package all hoses, connectors, cables, sensors, power cords, and other ancillary products and equipment, except those items that might be associated with the problem.

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

Product configurations

All models have FlexNet/Acuity communication enabled. Configurations for the available model numbers are as follows:

| Model | Monitoring parameters | Radio Card | Part numbers |
|-------|-------------------------------|------------|--------------------------|
| 406 | ECG only | 2.4 GHz | 007-0056-05, 007-0399-00 |
| 406 | ECG only | 5 GHz | 007-0417-XX |
| 408 | ECG, Nellcor SpO ₂ | 2.4 GHz | 007-0094-03, 007-0398-00 |
| 408 | ECG, Nellcor SpO ₂ | 5 GHz | 007-0419-XX |
| 408 | ECG, Masimo SpO ₂ | 2.4 GHz | 007-0053-05, 007-0397-00 |
| 408 | ECG, Masimo SpO ₂ | 5 GHz | 007-0418-XX |
| PPO+ | ECG, Masimo SpO ₂ | 2.4 GHz | 007-0221-01 |
| PPO+ | ECG, Masimo SpO ₂ | 5 GHz | 007-0420-XX |

Service options

Warranty service

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



Caution Unauthorized repairs will void the product warranty.

Non-warranty service

Welch Allyn Beaverton factory service and authorized service centers support non-warranty repairs. Contact any Welch Allyn regional service center for pricing and service options.

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

Micropaq monitor service training is available from Welch Allyn for biomedical/clinical engineers. Contact Welch Allyn Technical Support Services for information.

Connectors, indicators and controls



Indicators

Visual Alarm indicator

| | |
|--------|--|
| Green | Flashes slowly during normal operation. |
| Red | Flashes during patient alarm. Remains on continuously when alarms are silenced or suspended. |
| Yellow | Flashes during an equipment alert and while the monitor is not connected to the network. Remains on continuously if the operator suspends an alert at Acuity for 90 seconds or acknowledges (dismisses) a low battery alert from the monitor or Acuity. |

Note Flashing green indicates that the monitor is connected to the network but not necessarily connected to a patient. If the monitor is actively monitoring a patient, continuous green indicates that no alarms or alerts are detected.

Audible Alarm indicator

Beeps to indicate a patient alarm, and beeps faster for life-threatening arrhythmia alarms.

Beeps when the equipment needs attention. This beep tone is slower than the patient alarm tones.

Volume can be configured at Acuity as high, low, or off.

Volume can be configured at Acuity for network connection or for when communications with the FlexNet network are interrupted.

Controls

Snapshot key

When connected to Acuity, pressing this key sends a snapshot of the patient's numeric and waveform data to the Acuity Central Monitoring System. Depending on how Acuity is configured, this will cause Acuity to print a 21-second snapshot (14 seconds of history, 7 seconds of data after the button is pressed) to the Acuity central station printer.

Note Snapshot is the default selection of the monitor. However, the connected monitor will inherit the configuration previously defined by Acuity. For example, if Acuity has defined the Snapshot key to respond with a Nurse Call function and a new monitor is introduced to the system, the Snapshot key definition will remain as Nurse Call.

For more information about using the Acuity Central Monitoring System, refer to *Acuity Directions For Use* (810-1605-XX)

Scroll up and reset Patient Alarm Tone key

- Scrolls up menus on the display.
- Resets a silenced patient alarm tone.

Scroll Down and Main menu key

- Scrolls down menus on the display.
- Displays the Main menu.

Select and Silence Patient Alarm/Equipment Alert key

- Selects the choice highlighted on the menu.
- During patient alarms, silences the tone at the monitor and Acuity (if connected) for 90 seconds. During equipment alerts, silences or acknowledges (dismisses) the alert at the monitor and at Acuity.

Battery

Insert the battery to turn on power. Remove the battery to turn off power. (While the battery is removed, no monitoring occurs.)

Recharge the battery while it is removed from the monitor.

To order a new battery, contact Welch Allyn (see [page ii](#)).

Service menu

Refer to “[Functional verification](#)” on page 11 for service menus and test screens.

Maintenance

For monitor maintenance information, refer to “Operator Maintenance” in *Micropaq Directions for Use*. Covered topics include the following:

- Inspecting and cleaning the monitor and accessories
- Charging or replacing the battery

3

Functional verification

This procedure helps to confirm the proper operation of the Micropaq monitor. No monitor disassembly is required. The following equipment is required:

| Model | Required equipment |
|------------------|--|
| 406 and 408 | <ul style="list-style-type: none"> Fluke Patient Simulator PS415, PS420, or MPS450 (or equivalent ECG patient simulator) Micropaq ECG Cable (008-0522-XX) Fully charged battery Access to a properly functioning FlexNet network with an access point within range |
| 408 with Masimo | <ul style="list-style-type: none"> Masimo adult SpO₂ sensor for finger (008-0960-00) Fluke Index 2 Pulse Oximetry Simulator with optical finger for sensor connection (or equivalent) |
| 408 with Nellcor | <ul style="list-style-type: none"> Nellcor adult SpO₂ sensor for finger (900-0021-00) Fluke Index 2 Pulse Oximetry Simulator with optical finger for sensor connection (or equivalent) |

Note The screen shot examples in this section are for reference only. The content of the examples may differ from the screens on your monitor.

Visual check

Perform this check if the monitor is being serviced in the field by a biomedical/clinical engineer.

1. Verify the rubber gasket is not protruding from the case.
2. Verify the rubber feet and screw plugs have been installed.
3. Verify the screw covers are in place over all four screws in the battery compartment and the small recessed connector next to the battery connector is covered.
4. Verify the SpO₂ connector and connector clip (Model 408) or cover (Model 406) are not cracked or broken.
5. Verify the correct labels have been applied to the case. (See [“Attaching labels”](#) on page 58 for Model 408 monitors or [“Attaching labels”](#) on page 74 for Model 406 monitors.)
 - a. Verify the correct rear case label and battery label are attached.
 - b. Verify the serial number label is attached and that the correct information has been recorded for the model number, part number and serial number.
 - c. Verify the clear label cover has been applied over the serial number label, if serial number label has been replaced.

Power-up test




1. Disconnect any patient cables connected to the monitor and remove the battery (if installed).
2. Insert a fully charged battery into the monitor.

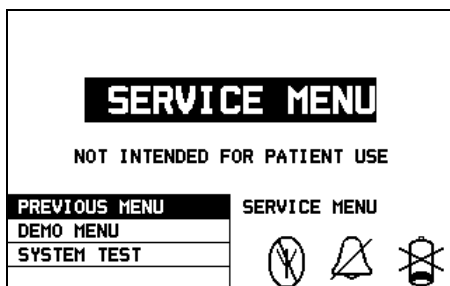
During power-up, the monitor performs a comprehensive self test of software. If software testing is successful, the monitor then tests internal hardware. If all tests are successful, the monitor completes power-up and displays the initial monitoring screen.

3. Confirm the following:
 - The screen is initially blank for a few seconds, that the LED displays each of the three colors (red, yellow and then green), and that the monitor emits two short beeps while booting—a quiet beep followed by a second, louder beep.
 - A power-up screen with the model number appears for a few seconds, followed by an initial monitoring screen with no error messages.



If the monitor does not power up properly, contact Welch Allyn Technical Support ([page ii](#)) for assistance.

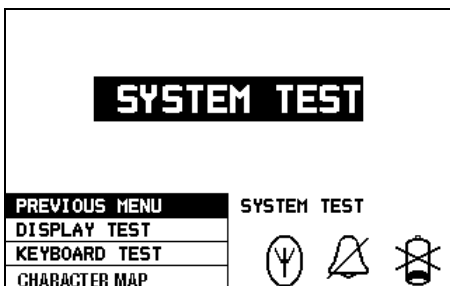
System test

1. Press  to access the Main menu, and then repeatedly press  until **SERVICE MENU** is highlighted.
2. Press  to display the Service menu screen.





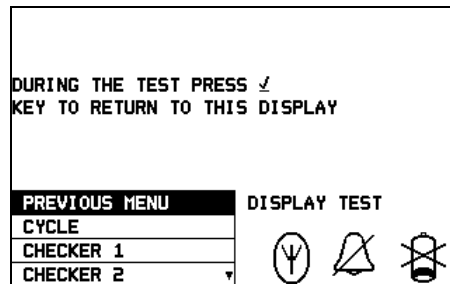
Service menu screen

3. Press  to highlight **SYSTEM TEST**, and then press  to display the System Test screen.





System Test screen



4. Press  to highlight **DISPLAY TEST**, and then press  to display the Display Test screen.







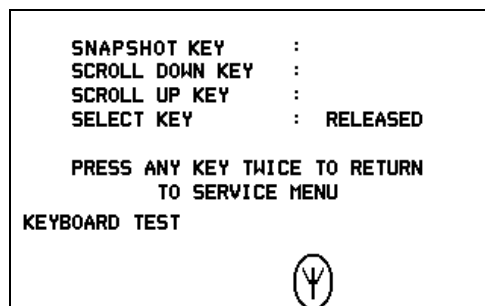
Display Test screen

5. Press  once to highlight **CYCLE**, and then press .





Press  to cycle through all display tests while observing the screen. Watch for any defects such as pixel deficiencies, stuck pixels, or nonuniform illumination.

Optionally, you can run any of the other display tests (CHECKER 1 through CHECKER 4, and BORDER). Press  to exit the display test, and then scroll to another test and press  again to run the highlighted display test.


6. Press  to exit the display test and return to the Display Test screen.
7. Press  again to exit the Display Test screen and return to the System Test screen.
8. Press  as needed to highlight **KEYBOARD TEST**, and then press  to display the Keyboard Test screen.



Keyboard Test screen

9. Observe the screen. For each of the front panel monitor keys (, , , and ) , press, hold and then release the key.

Confirm that the screen displays **PRESSED**, **HELD** and then **RELEASED** for each key.

10. Exit the Keyboard Test screen by quickly pressing one of the keys twice.
11. Repeatedly press  as needed to exit the service screens and return to the normal monitoring screen.

ECG and alarm indicators test

1. Turn on power to the ECG simulator and set the values as:
 - ECG waveform: Normal sinus rhythm
 - ECG rate: 80 beats per minute (bpm)
 - ECG size: 1mV amplitude
2. Power up the monitor by inserting the battery if it is not already on.
3. Connect the ECG cable to the monitor and to the ECG simulator using all five leads.
4. On the monitor, press the scroll down key (▼) to access the Main menu and use the scroll up (▲), scroll down and select (✓) keys to access the following menu items and settings:
 - ECG Lead: ECG 1 set to II, ECG II set to III
 - ECG scale: 1 mV/cm
 - Waveform: 1 Waveform
 - Heart rate limits: 50 bpm (lower), 120 bpm (upper)
5. Confirm the monitor displays a normal sinus rhythm ECG waveform with a heart rate of 80 bpm, ± 4 bpm.

Note If not connecting to Acuity the Micropaq LED will flash yellow and the acuity indicator on the display will have a slash mark through it.




If connected to Acuity the Micropaq LED will flash green and the Acuity indicator on the display will not blink. In the next step the LED will flash yellow when a lead is disconnected.

6. Conduct an ECG lead fail test:
 - a. Remove the far left (LA) lead from the simulator.
 - b. Confirm an audio alarm sounds (1 second on, 4 seconds off).

Note If the monitor is connected to Acuity, the alarms must be configured at Acuity to allow the audio alarms to sound on the monitor.

- c. Confirm a skeletal torso appears in the monitor display, with five dots arrayed on it.
 - d. In the monitor display, verify that the dot corresponding to the LA electrode on the skeletal torso is blinking.
 - e. Reconnect the LA lead to the simulator.
 - f. Remove each lead at the simulator in turn.
 - g. Confirm the corresponding dot blinks with each removed simulator lead, and stops blinking when the lead is reconnected.
7. Remove the ECG cable from the monitor.
8. Verify an audio alert sounds on the monitor and the following message appears:

EQUIPMENT ALERT
NO ECG CABLE DETECTED

9. Press  to acknowledge the alert and suspend the alarm.
10. Verify the audio alert stops and the equipment alert is no longer displayed.
11. Reconnect the ECG cable from the monitor.
12. Increase the heart rate to 140 bpm on the patient simulator.
13. Verify the LED flashes red, an audio alert sounds, the HR bpm numeric flashes and "Patient Alarm" is displayed.
14. Press  and verify the audio alarm suspends for 90 seconds, "Patient Alarm" is displayed and the LED remains red but is no longer flashing.
15. Decrease the heart rate to 100 bpm on the patient simulator.
16. Verify the HR bpm numeric changes to "100" \pm 4 BPM, the LED returns to flashing yellow or green (depending on whether the monitor is connected to Acuity), the audio alert turns off, the HR bpm numeric stops flashing, and "Patient Alarm" is not displayed.
17. Disconnect the ECG cable from the simulator and monitor, and turn off power to the simulator.
18. Press  to acknowledge the alert.

Model 406: Testing is complete. Remove the monitor battery.


Model 408: Continue to the next section to test SpO₂.

SpO₂ test (Model 408 only)

1. Turn on power to the SpO₂ simulator.
2. Connect the SpO₂ cable to the monitor and the SpO₂ sensor.
3. Apply the SpO₂ sensor to the SpO₂ simulator optical finger.
4. Set the SpO₂ simulator manufacturer type ("MAKE") as appropriate: Masimo or Nellcor.
5. Set the simulator output to SpO₂ saturation 94 percent and pulse rate 60 beats per minute (with no motion artifact selected).


Confirm the following:

- The monitor displays SpO₂ data and the pulse amplitude indicator is moving.
 - The displayed saturation = 94 percent \pm 4 counts.
 - The displayed pulse rate = 60 \pm 4 bpm.
6. Set the lower SpO₂ limit to 90. Access the main menu, scroll down and select "Limits," scroll down and select "SpO₂ LO," scroll down to "+" or "-" and set the Lower limit to 90.
 7. Set the lower HR/PR limit to 50. Access the main menu, scroll down to and select "Limits," scroll down and select "HR/PR LO," scroll down to "+" or "-" and set the Lower limit to 50.
 8. On the simulator output, set SpO₂ saturation to 84 percent and pulse rate to 40 bpm (with no motion artifact selected).

9. Verify the LED flashes red, an audio alert sounds, the SpO₂ and PR-BPM numeric flashes, and "Patient Alarm" is displayed.
10. Press  and verify the audio alarm suspends for 90 seconds, "Patient Alarm" is displayed and the LED remains red but is no longer flashing.
11. On the patient simulator, return the SpO₂ saturation setting to 94 percent and pulse rate setting to 60 bpm (with no motion artifact selected).
12. Verify the SpO₂ numeric changes to "94" \pm 4 percent, the LED returns to flashing yellow or green (depending on whether the monitor is connected to Acuity), the audio alert turns off, the SpO₂ and PR-BPM numeric stops flashing, and "Patient Alarm" is no longer displayed.
13. Remove the SpO₂ cable from the monitor.
14. Verify an audio alert sounds on the monitor, or sounds at Acuity if configured, and the following message appears:

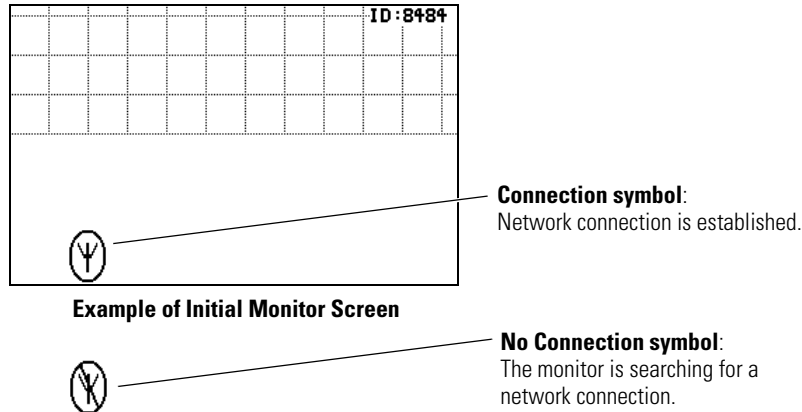
EQUIPMENT ALERT
NO SPO2 SENSOR DETECTED

Note If the monitor is connected to Acuity, the LED will change from flashing green to flashing yellow.

15. Press  to acknowledge the alert.
 16. Verify the audio alert stops sounding and the Equipment Alert message disappears from the display.
- SpO₂ testing is complete.

Network test

Observe the screen and confirm that the network connection symbol appears (indicating that the monitor is communicating with the network).



If the network connection is not yet established, wait a short time (60 seconds or less) and confirm that the connection symbol appears.

Wireless to Acuity Central Communication



Caution Before beginning the following procedure, advise Acuity monitoring personnel that you will be testing the monitor.

To confirm proper communication between the monitor and the Acuity system:

In an area of RF coverage, perform the following test on each monitor:

1. Insert a newly charged battery into the battery compartment of the monitor. A power-up screen appears and is soon replaced by a blank monitoring screen.
2. If the network is configured to allow multiple Acuity systems to view the monitor, select the system from the unit list that will be the primary link in the test.

If this is a single system, or if the monitor is configured to communicate only with a specific Acuity system, select a patient from the patient list.
3. On Acuity, verify that the Monitor Connecting icon (a blue hourglass) appears in the Wireless area on the Acuity Central Monitor Map (in the Map View). Wait for the Monitor Connecting icon to change to an Unconfirmed Patient ID icon.
4. Verify that the proper last four digits of the monitor serial number appear as the Room Number in the Waveform window and ID screen.

5. Verify that the LED above the screen in the upper right corner of the monitor is blinking green. This indicates communication between the monitor and the Acuity system. Refer to the communication status symbols below, as they appear in the lower left corner of the monitor display.



Monitor with access point association and Acuity communication.



(Flashing) Monitor with access point association, but no Acuity communication.



Monitor with no access point association.

Eight-bay battery charger functional verification

This procedure helps to confirm the proper operation of the monitor battery charger (008-0651-XX).

- No battery charger disassembly is required.
- A monitor battery is required.

To verify charger function:

1. Remove any batteries installed in the charger battery wells.
2. Unplug the ac power cord from the rear of the charger.
3. Plug the ac power cord into the rear of the charger and observe the charger top panel.

Confirm the following:

- Each green LED blinks in sequence, and then each yellow LED blinks in sequence. This confirms proper operation of the LEDs and the charger software.
 - The green LED by the ac power symbol (at the far right side of the charger's top panel) is on, and that no other LED is on.
4. Insert the battery into a battery well and confirm that the corresponding green LED begins to flash. (The green LED flashes while charging, and remains on continuously when the battery is fully charged.) Remove the battery.
 5. Repeat Step 4 for each of the other seven battery wells.

Replace fuses in the eight-bay battery charger

If the battery charger ac power cord is connected but the green ac power LED is not on, the battery charger fuses may need replacement.

To replace the fuses:

1. Disconnect the ac power cord from the rear panel of the battery charger (008-0651-XX). The fuse module is located directly beneath the ac power receptacle.
2. Use a small flat-blade screwdriver to pry open the black fuse module.
3. Slide out the fuse module, and then unlatch and slide out the fuse holder.
4. Use the screwdriver to dislodge the two fuses.

5. Insert two fuses of the appropriate rating into the fuse holder:

Fuses: T1.25 A/250 V, Time-Delay, 5x20 mm (503-0111-XX)



WARNING Fire Hazard. To protect against fire hazard, always replace fuses with the specified type, size, current rating, and voltage rating.




6. Slide the fuse holder back into the black fuse module until it latches securely, and then slide the fuse module back into the charger. Press it firmly and verify that it latches securely.
7. Connect the ac power cord to the rear panel of the battery charger and to an ac power source appropriate for the power rating of the battery charger.
8. Confirm that the green ac power LED is on.

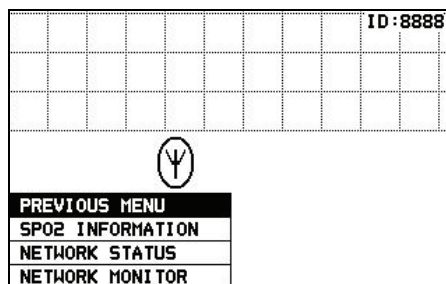
Note If the fuses blow soon after reconnecting ac power, the battery charger may need replacement.

System Information menu

The System Information menu provides additional information that may be required during service activity.

To access the System Information menu:

1. From the monitoring screen, press  to access the Main menu.
2. Press  again to highlight **SYSTEM INFORMATION**, and then press  to display the System Information menu.

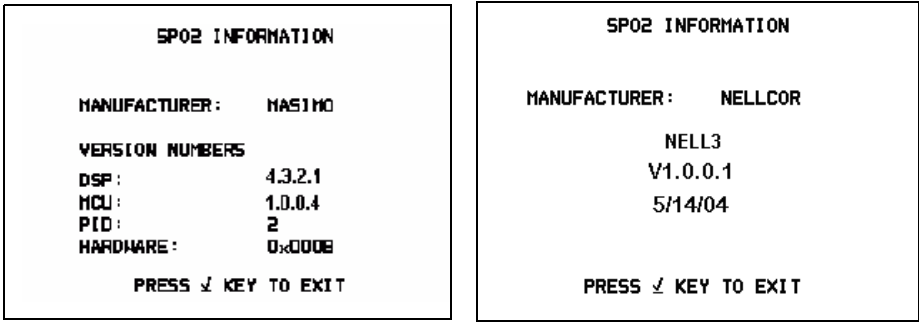


System Information menu

3. To access one of the menu items, press  or  to highlight the menu item, and press .

Note Although the System Information menu functions are not intended to be used while the monitor is connected to a patient, they can be used to troubleshoot network activity while the monitor is communicating (or attempting to communicate) with the network.

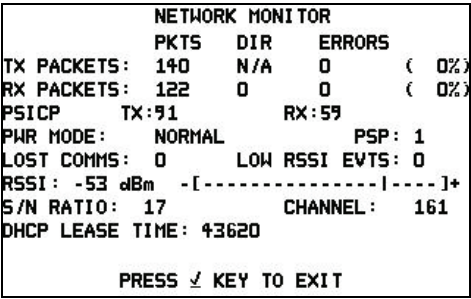
SpO₂ information



SpO₂ Information screen examples

Network Monitor

Use the Network Monitor screen as a diagnostic aid for troubleshooting wireless connections between the monitor and a network access point.



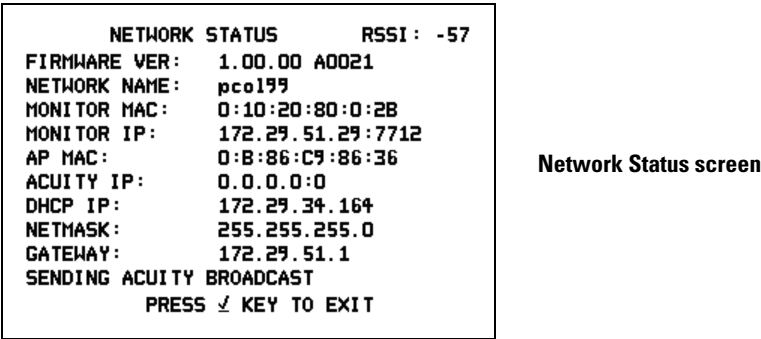
Network Monitor screen

| | | |
|---------------|---|--|
| TX PACKETS | PKTS: | Total number of packets sent |
| | DIR: | Total number of directed packets sent (2.4 GHz radio card) or "N/A" (5 GHz card) |
| | ERRORS: | Total number of TX packet errors |
| | (xxx%) | The calculated percentage of errors during the last update period |
| RX PACKETS | PKTS: | Total number of packets received |
| | DIR: | Total number of directed packets received |
| | ERRORS: | Total number of RX packet errors |
| | (xxx%) | The calculated percentage of errors during the last update period |
| PSICP TX / RX | Total number of PSICP packets sent and received in this PSICP session. Welch Allyn internal use only. | |

| | |
|---------------------------------|--|
| PWR MODE/PSP | <p>PWR MODE (5 GHz radio card): Settings are NONE, ERROR, INITIALIZING, CHANGING, FLASHING, HIBERNATE, STANDBY, IDLE, NORMAL, FAST, RESET.</p> <p>PWR MODE (2.4 GHz radio card): Power state ON, OFF</p> <p>PSP: Power Save Poll Mode, 1-10 or CAM</p> |
| LOST COMMS / LOW RSSI EVENTS | <p>LOST COMMS: The number of times communication has been lost since power up. Any non-zero value may indicate a problem with the WLAN or the access points.</p> <p>LOW RSSI EVTS: The number of times communication was lost and RSSI was less than a given threshold. Any non-zero value may indicate either inadequate WLAN coverage or that a monitor was on the edge of coverage for an extended period and was having difficulty passing data to the associated access point.</p> |
| RSSI/RSSI METER | <p>RSSI (Received Signal Strength Indicator) indicates the strength (in dBm) of the radio signal as seen by the associated access point as a negative number. The closer the number is to zero, the stronger the signal.</p> <p>RSSI meter: Current RSSI value and plot of RSSI value. The bar represents the current RSSI. The closer the bar is to the plus sign the stronger the signal.</p> <p>A value smaller than -65 dBm for the 5 GHz radio card or -60 dBm for the 2.4 GHz radio card indicates either:</p> <ul style="list-style-type: none"> • a fault in the monitor or in the radio card, or • an area of poor or no radio coverage |
| S/N RATIO / CHANNEL | <p>S/N RATIO: If equipped with the 5 GHz radio card, this indicates the mobile unit's Signal-to-noise ratio from an Access Point. If equipped with the 2.4GHz radio card, then the value will read "N/A"</p> <p>CHANNEL: If equipped with the 5 GHz radio card, mobile unit's radio band channel. If equipped with the 2.4 GHz. radio card, then the value will read "N/A"</p> |
| DHCP LEASE TIME | DHCP Lease Time in seconds or "STATIC" if static assigned |

Network status

The Network Status screen displays the current status of the monitor and its communication channel.



| | |
|--------------|--|
| RSSI | Current RSSI (Received Signal Strength Indicator) value. Displayed as a negative number. Indicates the strength (in dBm) of the radio signal as seen by the associated access point. The closer the value is to zero, the stronger the signal. A value smaller than -65 dBm for the 5 GHz radio card or -60 dBm for the 2.4 GHz radio card indicates either: <ul style="list-style-type: none">• an area of poor or no radio coverage or• a fault in the monitor or radio card |
| FIRMWARE VER | Firmware version of the radio card |
| NETWORK NAME | Radio card/monitor's network name, same as SSID |
| MONITOR MAC | Radio card/monitor's MAC address |
| MONITOR IP | Radio card/monitor's IP address (possibly statically assigned) |
| AP MAC | Associated access point's MAC address |
| ACUITY IP | Connected Acuity's IP address |
| DHCP IP | DHCP server's IP address or N/A if static IP is used |
| NETMASK | Radio card/monitor's netmask setting (DHCP or static assigned) |

| | |
|---------|---|
| GATEWAY | Radio card/monitor's gateway setting (DHCP or static assigned) |
| STATUS | <p>Normal startup messages include:</p> <ul style="list-style-type: none"> • RADIO INITIALIZING • SEARCHING FOR AN ACCESS POINT • AUTHENTICATING • RADIO ASSOCIATED • REQUESTING IP ADDRESS • IP ADDRESS ASSIGNED • SENDING ACUITY BROADCAST • ACUITY CONNECTED <p>Status messages that indicate a problem include</p> <ul style="list-style-type: none"> • NO RADIO CARD • ACUITY CLOSED CONNECTION • RADIO CARD HARDWARE FAULT • RADIO CARD VERSION WRONG • RADIO CARD UNOPERABLE • RADIO LOST ASSOCIATION • DHCP REQUEST TIMED OUT • ACUITY LINK DROPOUT • ACUITY CONNECTION TMEOUT • TCPIP COFIGURATION ERROR • TCPIP SOCKET ERROR |

For additional information, see ["Radio troubleshooting chart"](#) on page 29.

Reset Radio menu

For monitors containing a 5 GHz radio card, a concealed menu is provided that allows resetting the 5 GHz card's configuration back to its factory default configuration.

It may be necessary to return the radio card to its default settings if:





- A network security setting was enabled that is not supported by the network infrastructure
- The network name was changed incorrectly
- The default password was changed and forgotten

The Reset Radio Defaults menu can only be entered under the following conditions:


- The monitor is equipped with a working 5 GHz radio card
- The monitor is currently displaying either the Network Status or Network Monitoring Radio Information Screen and both the scroll up ▲ and scroll down ▼ keys are pressed and held
- There is no patient connection active
- There is no Acuity connection active
- The 5 GHz radio card has finished its initialization and is ready to accept the Reset Defaults command
- No Radio Card Shutdown has been initiated
- No 5 GHz Firmware Update Operation has been initiated
- No other 5 GHz Reset Radio Defaults request has been accepted (only one active request allowed)

Resetting the radio to factory defaults

The menu may be entered from either the Network Status screen or the Network Monitor screen.

1. Press the scroll down key  to access the Main menu, and then repeatedly press until **SYSTEM INFORMATION MENU** is highlighted.
2. Press the select key  to display the **SYSTEM INFORMATION MENU** screen.
3. Press scroll down key  repeatedly until **NETWORK STATUS MENU** is highlighted.
4. Press select key  to display the **NETWORK STATUS MENU** screen.
5. While the Network Status screen is displayed, press and hold the scroll down key. While holding the scroll down key press the scroll up key. The Reset Radio menu screen appears:

| | |
|---------------------------------------|------------------|
| RESET RADIO MENU | |
| NOT INTENDED FOR PATIENT USE | |
| RESET RADIO CARD TO DEFAULT SETTINGS? | |
| ARE YOU SURE ? | |
| NO | RESET RADIO MENU |
| YES | |
| | |

6. To reset the radio card to its default settings use the scroll down key  to select YES and press the select key.
7. To exit the Reset Radio menu without resetting the radio card use the scroll keys to select NO and press the select key.

If "YES" was selected in step 6, the Micropaq monitor waits for the Radio Card to complete its reset operation and then the Micropaq powers itself off. Remove and reinsert the battery to restart the unit.

If "NO" was selected the monitor returns to the Network Status screen.

Change the network name

Use this procedure to change the network name assigned to the monitor.

Note This procedure applies only if the current net name is one of the names available in the Network Name menu. For other network names, see [“Changing a custom network name”](#) on page 26.



Caution Changing the monitor network name will cause the monitor to restart and seek to connect with the FlexNet network corresponding to the new name. Do not attempt to change the network name unless you are a qualified biomedical service engineer or technician.

Changing a factory-defined network name

To change the network name:

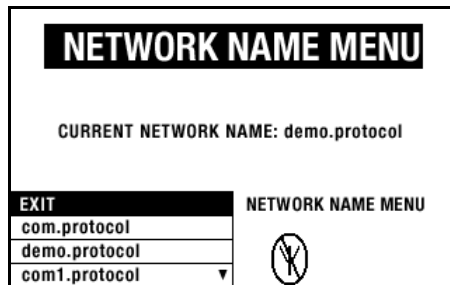
1. Press to access the Main menu, and then repeatedly press until **SERVICE MENU** is highlighted.
2. Press to display the Service menu screen.
3. Press and hold in this order: , , and . The Network Name menu appears.

If the current monitor network name is one of the following factory-defined names:

| | |
|---------------|---------------|
| com.protocol | demo.protocol |
| com1.protocol | com2.protocol |
| com3.protocol | com4.protocol |
| com5.protocol | com6.protocol |
| com7.protocol | com8.protocol |

then the monitor displays the following screen:

4. Verify that **YES** is highlighted, and press to display the following screen:

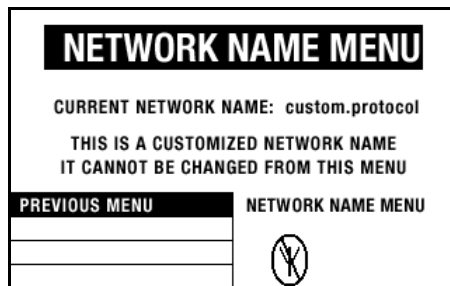


5. Press ▲ or ▼ to highlight the desired network name, and then press ✓.

The monitor turns itself off, and then turns on and seeks to connect to a FlexNet network with the new network name.

Changing a custom network name

If the current monitor network name is a custom name, the monitor displays the following screen:



You cannot change the network name using the Network Name menu. Press ✓ to return to the Service menu. Contact Welch Allyn ([page ii](#)) for assistance.

4

Troubleshooting

Troubleshooting chart

This troubleshooting chart includes system faults and equipment alerts related to possible internal failures. If other error codes appear, refer to the directions for use for information on the cause and suggested remedy for those errors.




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

| Symptom | Possible cause | Possible corrective action |
|--------------------------------------|--|--|
| Keyboard buttons stuck or locked up. | Monitor lock function is engaged. | Refer to <i>Micropaq Monitor Directions for Use</i> (810-2691-00). |
| | Bad keyboard connection to the main board at connector J3. | Check the keyboard flex cable connection at J3: unlock the ZIF connector, reseal the flex cable, and then relock the connector. |
| | Keyboard flex cable is damaged. Check for sharp bends in the keyboard flex cable. | Replace the front case assembly. See "Removing the front case and/or replacing the display (5 GHz)" on page 39 (model 408) or "Removing the front case and/or replacing the display (5 GHz)" on page 61 (model 406). |
| | Defective keyboard. | Replace the front case assembly. See "Removing the front case and/or replacing the display (5 GHz)" on page 39 (model 408) or "Removing the front case and/or replacing the display (5 GHz)" on page 61 (model 406). |
| Display intermittent. | Poor battery connection. | Check the battery connection. |
| | Bad display connection to the main board at connector J4. | Check the display flex cable connection at J4: unlock the ZIF connector, reseal the flex cable, and then relock the connector. |
| | Display flex cable is damaged. Check for sharp bends in the display flex cable. Check for damage at the connection between the flex cable and the display. | Replace the display assembly. See "Removing the front case and/or replacing the display (5 GHz)" on page 39 (model 408) or "Removing the front case and/or replacing the display (5 GHz)" on page 61 (model 406). |
| | Defective or damaged display. | Replace the display assembly. See "Removing the front case and/or replacing the display (5 GHz)" on page 39 (model 408) or "Removing the front case and/or replacing the display (5 GHz)" on page 61 (model 406). |








| Symptom | Possible cause | Possible corrective action |
|---|--|--|
| Lines in the display. | Check for display circuit damage caused by improper display installation. Solder connections on the ECG or SpO ₂ connectors may damage the display circuit. | Replace the display assembly. See "Removing the front case and/or replacing the display (5 GHz)" on page 39 (model 408) or "Removing the front case and/or replacing the display (5 GHz)" on page 61 (model 406). |
| SpO ₂ is not working. | Bad connection to the SpO ₂ board. Possible error code OXB87 on the display. | Check connections at the SpO ₂ board assembly. |
| | Bad SpO ₂ flex cable connection to the main board at connector J8. | Check the SpO ₂ flex cable connection at J8: unlock the ZIF connector, reseal the flex cable, and then relock the connector. |
| | SpO ₂ sensor has no LED. | Check the ground connection to the main board at connector J9. On Nellcor models, verify the dip switch is set to 0110. |
| | Broken SpO ₂ flex cable solder connection. | Check for fractured solder joints on the SpO ₂ connector (often caused by dropping the monitor). Send the monitor to Welch Allyn factory service for repair. |
| | Broken SpO ₂ flex cable. | Replace the rear case assembly. See "Removing the rear case" on page 38. |
| | SpO ₂ external connector is damaged. | Replace the rear case assembly. See "Removing the rear case" on page 38. |
| | Bad SpO ₂ assembly. | Send to Welch Allyn factory service for repair. |
| ECG "LEADS OFF" message when ECG leads are connected. | Broken ECG flex cable solder connection. | Check for fractured solder joints on the ECG connector (often caused by dropping the monitor). Send to Welch Allyn factory service for repair. |
| ECG is not working. | Bad ECG connection. | Check the ECG connection to the main board at connector J1: unlock the ZIF connector, reseal the flex cable, and then relock the connector. |
| | Broken ECG flex cable solder connection. | Check for fractured solder joints on the ECG connector (often caused by dropping the monitor). Repair solder joints and retest the monitor. |
| | Broken ECG flex cable. | Replace the appropriate rear case assembly. See "Removing the rear case" on page 38 (model 408) or "Remove the ECG flex cable from connector J1 on the main board. The rear case may now be replaced." on page 60 (model 406). |
| | ECG external connector is damaged. | Replace the appropriate rear case assembly. See "Removing the rear case" on page 38 (model 408) or "Remove the ECG flex cable from connector J1 on the main board. The rear case may now be replaced." on page 60 (model 406). |
| | Bad main board. | Send the monitor to Welch Allyn factory service for repair. |
| No power or power intermittent. | Broken battery connector. | Send the monitor to Welch Allyn factory service for repair. |
| The monitor causes rf/emi interference. | Nylon washers and metal washers are incorrectly installed on the SpO ₂ board/shield. | Install nylon washers in the correct locations according to the instructions in "Installing the SpO₂ shield" on page 55. |
| | SpO ₂ shield is not correctly installed. | Check that the SpO ₂ shield is installed according to the instructions in "Installing the SpO₂ shield" on page 55. |

Radio troubleshooting chart

This radio troubleshooting chart applies issues specific to the Micropaq wireless patient monitor and is not intended for comprehensive troubleshooting of the Acuity system. To troubleshoot the Acuity system, refer to the appropriate service documentation for your system.

| Symptom | Possible cause | Possible corrective action |
|--|---|---|
| The monitor is not making a connection to Acuity. The network communication icon appears with a slash through it  . The Network Status screen displays one of the following messages: | Outside of access point coverage area. | Move into range of the access point and wait for up to 3 minutes for the radio to wake up and attempt to establish communication with the network. |
| RADIO SLEEPING | Incorrect ESSID setting | Set the monitor name to the Acuity Network name (default: com.protocol) |
| AUTHENTICATING | Unable to authenticate — incompatible settings | 5 GHz radio: Reset radio menu (see "Reset Radio menu" on page 23) |
| | Unable to authenticate — incompatible settings | Consult network administrator |
| ACUITY CONNECTION CLOSED | This session has been terminated from the Acuity Central Monitoring Station | Reconnect to Acuity. Refer to <i>Micropaq Directions for Use</i> (810-2691-XX) |
| RADIO LOST ASSOCIATION | Outside of access point coverage | Move into range of the access point |
| | Network fault | Consult the network administrator |
| DHCP REQUEST TIMED OUT | DHCP server is unavailable or no IP addresses are available | Consult network administrator to check DHCP server |
| ACUITY LINK DROPOUT | Communication was lost with the Acuity Central Monitoring Station. | The monitor will try to re-establish communications with Acuity |
| ACUITY CONNECTION TIMEOUT | The monitor was unable to find an Acuity station | Verify an Acuity station is available on the network |
| RADIO CARD HARDWARE FAULT | There is a problem with the radio card (2.4 GHz radio only) | Return the monitor to Welch Allyn factory service for repair |
| RADIO CARD WRONG VERSION | The radio card firmware is incompatible with the monitor software. (2.4 GHz radio only) | Return the monitor to Welch Allyn factory service for repair |
| RADIO CARD UNOPERABLE | There is a problem with the radio card (2.4 GHz radio only) | Return the monitor to Welch Allyn factory service for repair |
| TCP/IP CONFIGURATION ERROR | TCP/IP protocol stack has returned an error (2.4 GHz radio only) | Return the monitor to Welch Allyn factory service for repair |
| TCP/IP SOCKET ERROR | Communications dropout | This is normally a transitory condition and may occur infrequently. If this occurs frequently or the condition persists, return the monitor to Welch Allyn factory service for repair |

Alert messages and display information

| Message and display information | Possible cause(s) and suggested response |
|---|--|
| LOW BATTERY | The monitor will shut down in less than 30 minutes due to a low battery. <ul style="list-style-type: none"> Replace the battery as soon as possible. |
| VERY LOW BATTERY | The monitor will shut down in less than 5 minutes due to a low battery. <ul style="list-style-type: none"> Replace the battery as soon as possible. |
| BATTERY TOO LOW SHUT DOWN IN PROGRESS | The battery is so low the monitor has to shut down operation. <ul style="list-style-type: none"> Replace the battery immediately. |
| ACUITY CONNECTION LOST | The monitor is not connected to the network. <ul style="list-style-type: none"> Press  to acknowledge and silence the tone and cancel the message. While disconnected from the network, the off-network icon and the yellow LED continue to flash. <p>NOTE: The monitor will continue to attempt to reconnect until it is successful.</p> |
| EXCESSIVE ECG OFFSET REPLACE ELECTRODES ^a | The monitor detects poor ECG electrode contact. <ul style="list-style-type: none"> Check and replace ECG electrodes as needed. |
| Chest icon is displayed with flashing ECG electrode(s). ^a | The monitor detects that at least one ECG electrodes is disconnected. <ul style="list-style-type: none"> Check and replace or reconnect electrodes as needed. |
| NO ECG CABLE DETECTED | <ul style="list-style-type: none"> If the ECG cable has been intentionally disconnected from the monitor, press  to cancel the alert tone. If the ECG cable has been unintentionally disconnected, reconnect it. Check the patient and monitor to verify that ECG monitoring resumes properly. |
| NO SpO ₂ SENSOR DETECTED | The SpO ₂ sensor has been disconnected for more than 5 seconds. <ul style="list-style-type: none"> If disconnection is intentional, press  to acknowledge and silence the tone. If disconnection is not intentional, reconnect the sensor or replace the sensor and reconnect. |
| DEFECTIVE SpO ₂ SENSOR ^a or UNRECOGNIZED SpO ₂ SENSOR ^a | The SpO ₂ sensor is either defective or not recognized. <ul style="list-style-type: none"> Replace the SpO₂ sensor with a new, compatible SpO₂ sensor. |
| <key name> KEY STUCK ^a | During the power-up self test, the monitor detected that a key is stuck ( ,  ,  , or ). This can happen if you accidentally press a key down before the Main menu is displayed during power-up. <ul style="list-style-type: none"> Remove and then reinsert the battery to power up again and see if the key is still stuck. If it is, return the monitor to Welch Allyn for service. |
| System Error Thread: <nnn> Error ID: <nnn> | The equipment problem is so serious the monitor cannot be used. <ul style="list-style-type: none"> Return the monitor to Welch Allyn for service. |
| RADIO UPDATE, MAY TAKE XX MINS. | A 5 GHz Radio Firmware Update operation has been initiated via the 5 GHz Web Administrator tool. |

a. This alert message can be acknowledged from Acuity, but not from the monitor.

5

Repair procedures

Introduction

This section provides instructions for disassembly and reassembly of the monitor.



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



Caution When the monitor case is opened, all parts must be regarded as extremely fragile. All procedure steps must be executed with care and precision.

Required tools and equipment

- 3 in lb torque driver
- 5 in lb torque driver
- #1 Phillips screwdriver bit
- Tweezers
- Needlenose pliers
- Kapton tape
- Soft lens wipes
- Scissors or other cutting device
- Canned air
- Ultrafine-point permanent marker
- Spudger or small paper clip

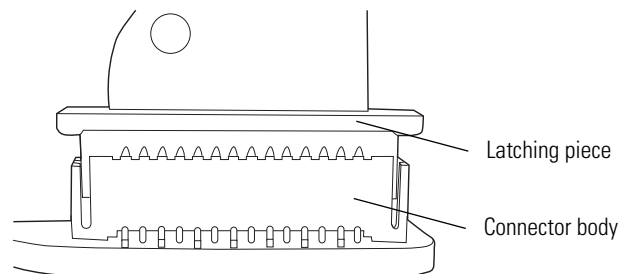
Zero Insertion Force (ZIF) connectors

The monitor uses flex cables and zero insertion force (ZIF) flex cable connectors. The flex cables are all marked with a designator number which corresponds to a PCB board designator. Flex cables and ZIF connectors require special care when handling them.

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

Disconnecting a ZIF Cable

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



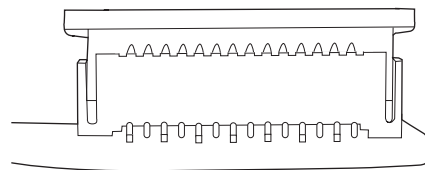
2. Remove the cable.



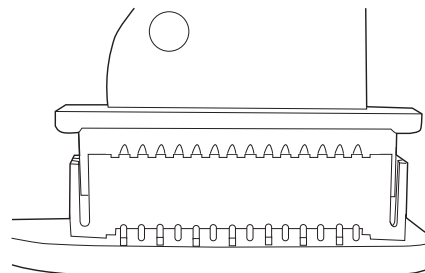
Caution Do not attempt to remove a flex cable until the ZIF latch has been opened.

Connecting a ZIF Cable

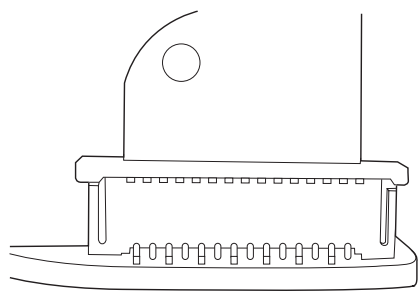
1. Slide the latching piece of the connector away from the connector body.



2. Insert the flex cable into the connector. This may require using a suitable tool to keep the latching piece elevated.



3. Push the latching piece toward the connector body until it locks into place.



Connector locations

| Connector (Main Board) | Description | Connects with | Referred to on... |
|---------------------------|-------------------------------|-------------------------------------|-------------------------|
| J1 (ZIF connector) | ECG (flex cable) | External ECG connector (flex cable) | page 37 |
| J3 (ZIF connector) | Keyboard (flex cable) | Keyboard (flex cable) | page 37 |
| J4 (ZIF connector) | Display (flex) cable | Display (flex cable) | page 39 |
| J9 (ZIF connector) | SpO ₂ (flex cable) | Main board ground (flex cable) | page 38 |

Procedures

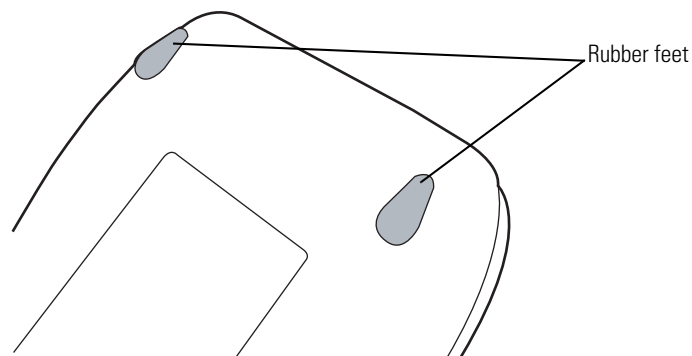
| | |
|-------------------------------|----|
| Disassembly - Model 408 | 34 |
| Reassembly - Model 408 | 42 |
| Disassembly - Model 406 | 59 |
| Reassembly - Model 406 | 64 |

Disassembly - Model 408

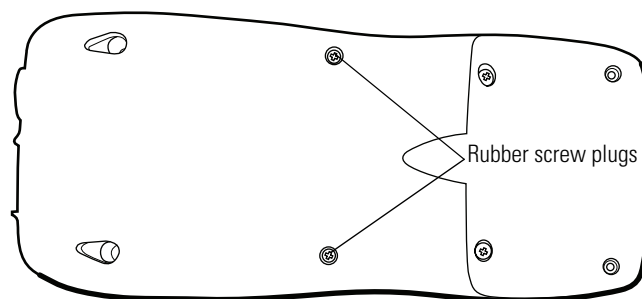
This procedure covers the Masimo and Nellcor versions of the Model 408 monitor with SpO₂.

Opening the case

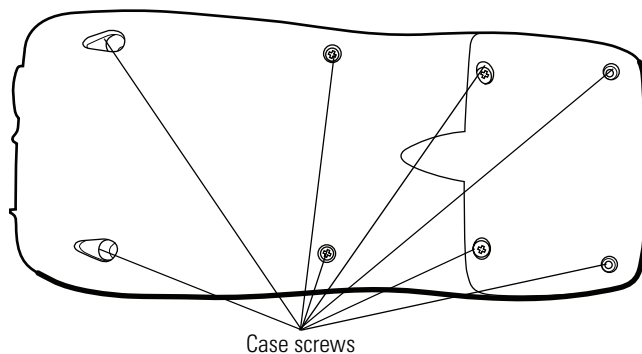
1. Remove the battery pack.
2. Remove the two rubber feet using tweezers.



3. Remove the two rubber screw plugs from the external case using a spudger or paper clip.



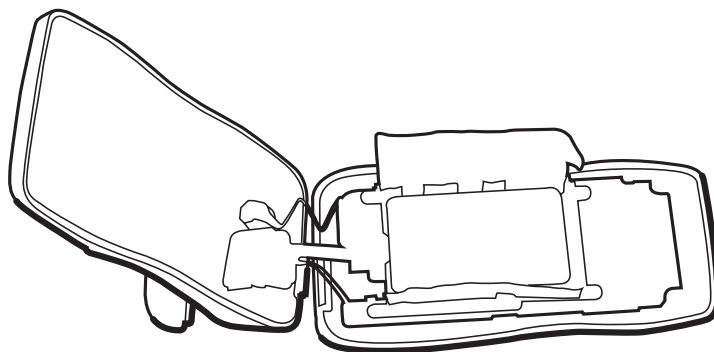
4. Remove the four screw covers in the battery compartment.
5. Remove all eight case screws.



6. Place the Micropaq display-side down and carefully lift the back case away from the front case, starting at the bottom.



Caution Open the case 120 degrees and support the rear case as shown below to prevent stress on the SpO₂ flex cable.

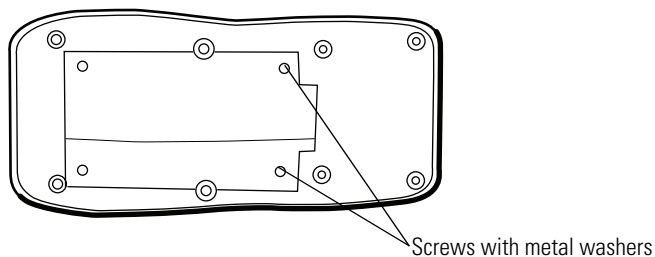


Note To remove and/or replace the front case or display, skip the next section and proceed to [“Removing the front case and/or replacing the display \(5 GHz\)”](#) on page 39.

Note There is no need to remove the SpO₂ board unless removing or replacing the rear case.

Removing the SpO₂ board

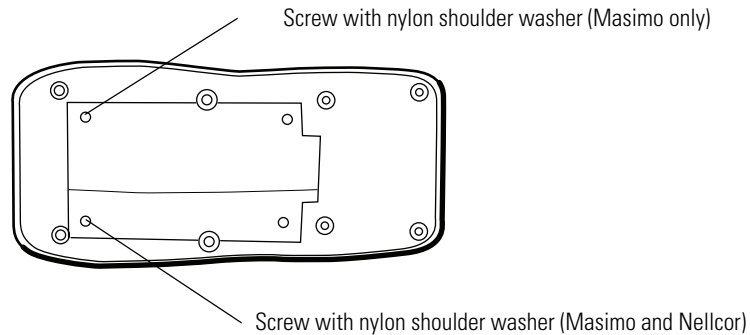
1. Remove the screws and metal washers at the locations shown below.



2. Remove the screws and nylon shoulder washers at the locations shown below.

Note Do not damage the SpO₂ foil shield when removing the nylon shoulder washers.

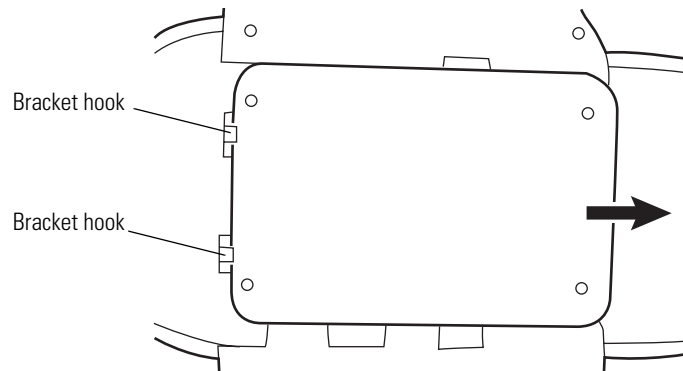
Note The Masimo version has two screws with nylon shoulder washers. The Nellcor version has only one screw with a nylon shoulder washer, as shown below.



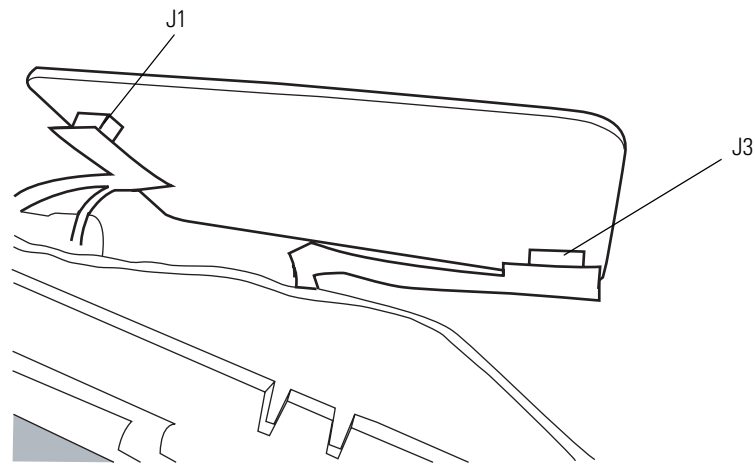
3. Unfold the SpO₂ shield.
4. For Masimo models, continue with the next section. For Nellcor models, continue with ["Disconnecting the SpO₂ board \(Nellcor models\)"](#) on page 37.

Disconnecting the SpO₂ board (Masimo models)

1. Slide the SpO₂ board out from under the two bracket hooks.



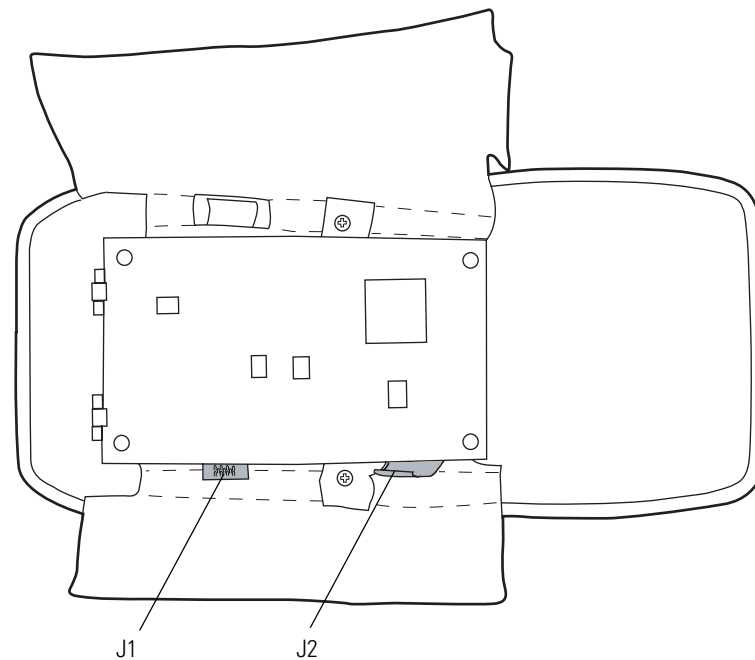
2. Lift the SpO₂ board, and disconnect the flex cables from connectors J1 and J3.



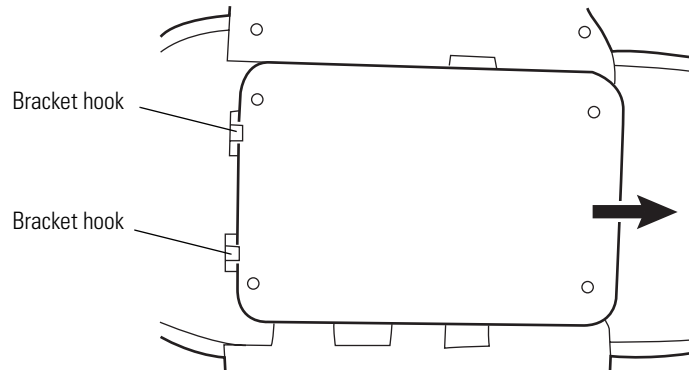
3. Continue with ["Removing the rear case"](#) on page 38.

Disconnecting the SpO₂ board (Nellcor models)

1. Unplug the flex cables from connectors J1 and J2.



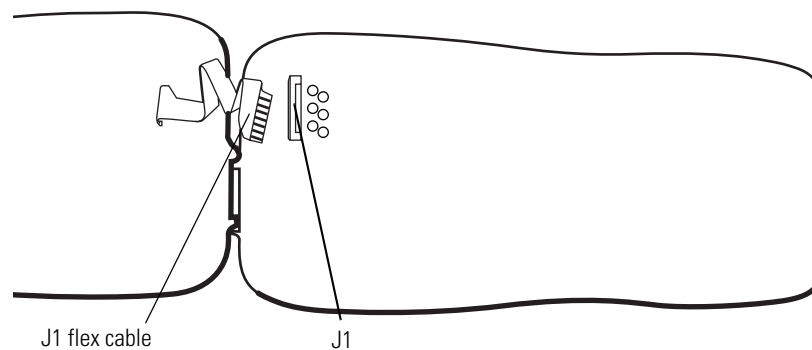
- Slide the SpO₂ board out from under the two bracket hooks (shown at left in the illustration below).



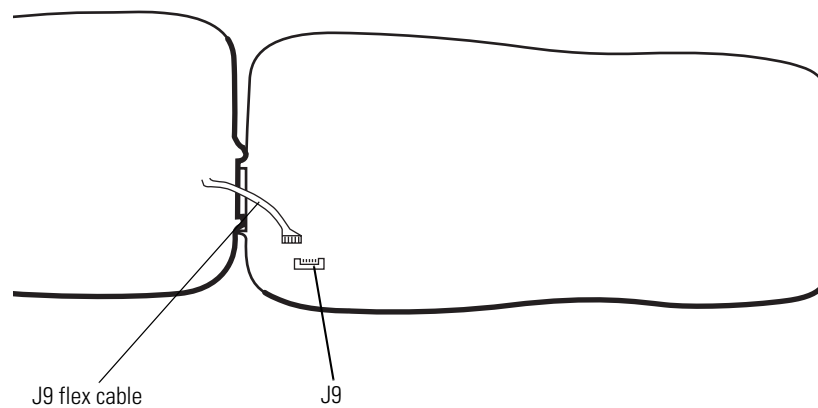
- Remove the SpO₂ board.

Removing the rear case

- Remove the ECG flex cables from connector J1 on the main board.



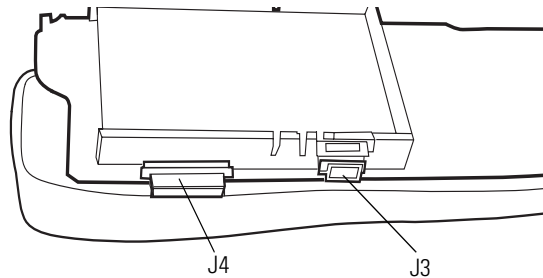
- Remove the SpO₂ flex cable from connector J9 to separate the front and rear cases.



Caution Do not separate the main board, the subframe, and the radio card. They are not serviceable. Separation will damage the single-use antenna connector, which can be replaced only at the factory.

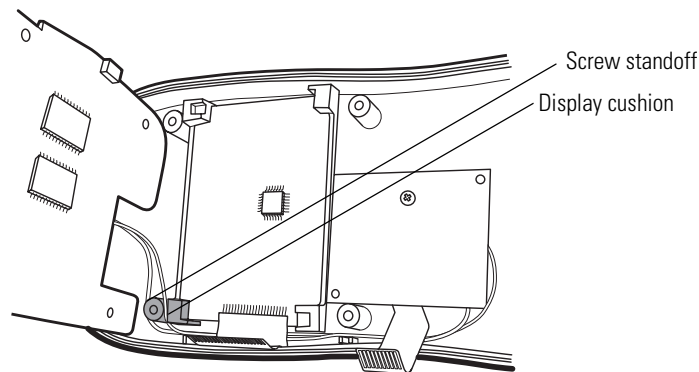
Removing the front case and/or replacing the display (5 GHz)

1. Unplug the display cable from connector J4 and keyboard cable from connector J3.



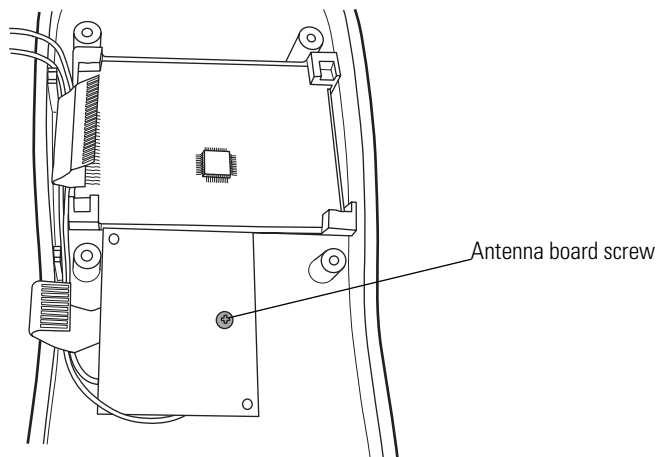
(SpO₂ shield not shown here for clarity.)

2. Lift the main board subassembly (main board, subframe and radio card) out of the front case, leaving enough room to access the antenna cables. While supporting the main board subassembly, free the gray antenna cable from between the display cushion and the standoff and the black cable from around the outside of the standoff.



Caution Make sure not to stress the antenna connection cables.

3. Place the main board down next to the front case.
4. Remove the screw securing the antenna board to the front case.

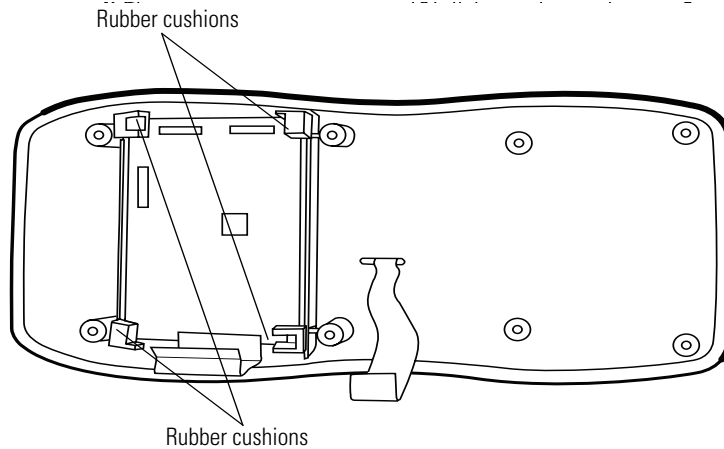


- Remove the antenna board and connecting cables from the front case.



Caution Do not disconnect the antenna cables from the antenna board. The connectors are easily damaged and may not be reused unless a special extractor tool is used to disconnect the cables from the board.

- Remove the display from the front case by lifting the rubber cushions.



- If you are installing a new display, remove and save the rubber cushions.
- Set the display down on a clean surface with the circuit board side facing up.



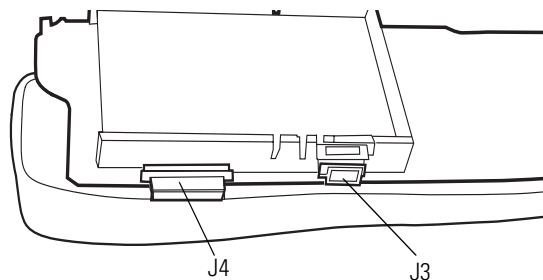
Caution Do not bend or stress the display flex cable, especially at its connection to the circuit board.



Caution Do not touch the display screen. Fingerprints are difficult to remove without damaging the display.

Removing the front case and/or replacing the display (2.4 GHz)

- Unplug the display cable from connector J4 and keyboard cable from connector J3.



(SpO₂ shield not shown here for clarity.)

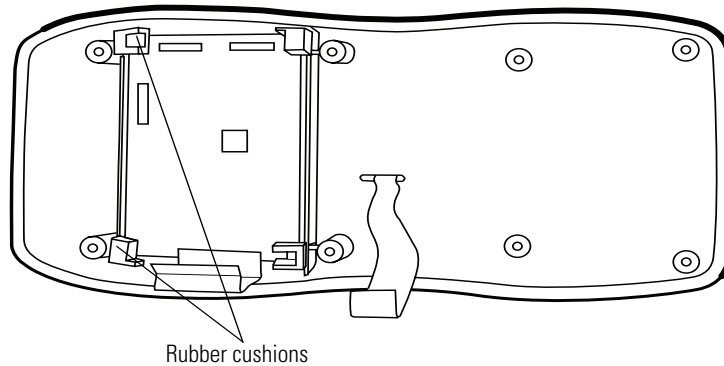
- If the rear case and mainboard subassembly are still attached by the ECG and SpO₂ flex cables, lift the mainboard, subframe, radio card and SpO₂ card as one assembly out of the front case and place it in the rear case.

Note Be sure not to damage the flex circuits connecting the mainboard subassembly to the rear case.

If the rear case has already been removed, lift the mainboard, subframe and radio card as one assembly out of the front case and set it aside.

3. Remove the display from the front case by lifting the rubber cushions.

Rubber cushions



4. If you are installing a new display, remove and save the rubber cushions.
5. Set the display down on a clean surface with the circuit board side facing up.



Caution Do not bend or stress the display flex cable, especially at its connection to the circuit board.



Caution Do not touch the display screen. Fingerprints are difficult to remove without damaging the display.

Reassembly - Model 408

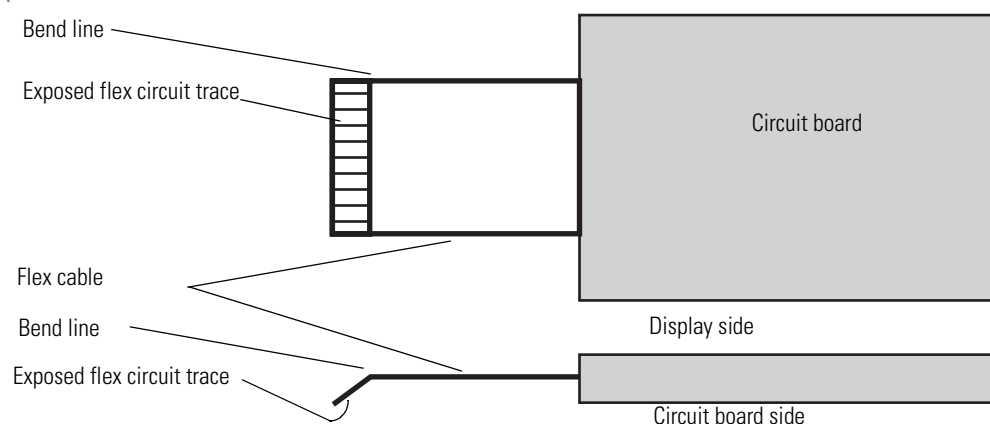
Installing the display

Note The first two steps apply only if you are installing a new display. If you are reusing a display, skip to [step 3 on page 42](#).



Caution The display flex cable is fragile. Damage may result if the flex cable is bent too sharply or if its connection with the circuit board is stressed.

Refer to the illustration.



1. Form a 45-degree bend in the end of the display cable.
 - a. With needle nose pliers, clamp the flex cable just behind the exposed flex circuit trace. You will form the bend along the edge of the pliers.
 - b. Press the end of the flex cable against a hard surface to bend it 45 degrees, toward the circuit board side, at the edge (bend line) of the exposed flex trace.

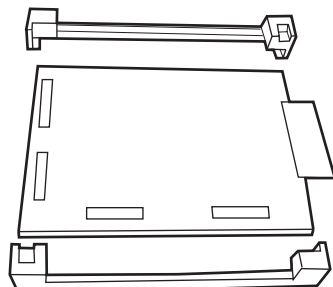


Caution The direction of the bend is toward the exposed flex circuit trace. Do not bend the cable in the opposite direction.

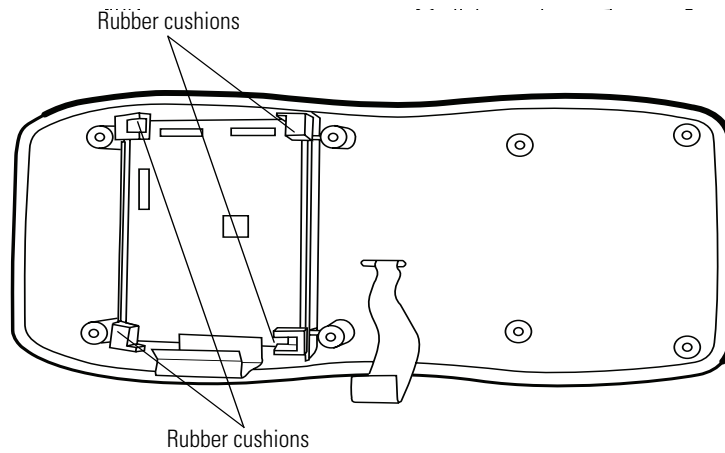
2. Peel the protective plastic liner from the front of the display.

Note Remove the protective liner before installing the display in the case.

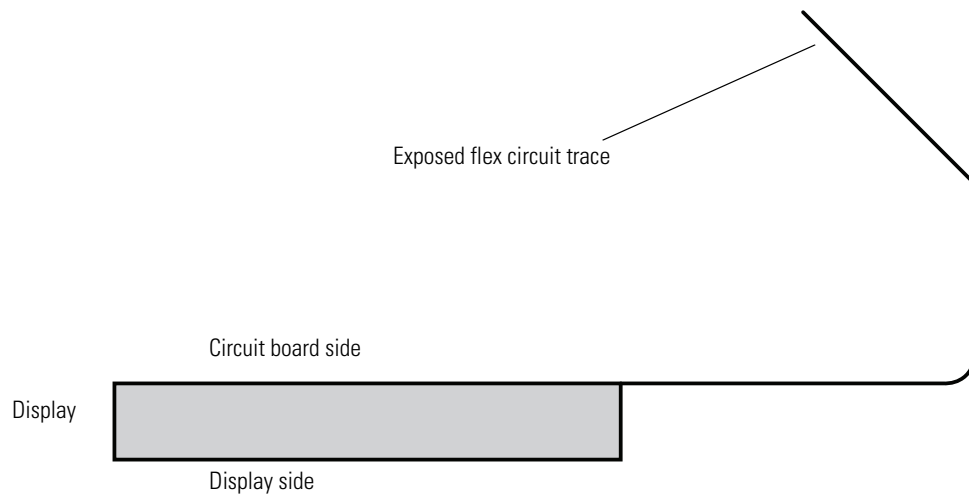
3. Press the rubber cushions onto the display, with the raised cushion corners up as shown.



4. Install the display in the front case by pressing the rubber cushions down to seat the display.



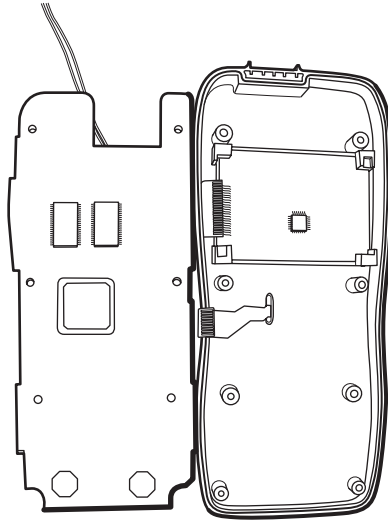
5. Carefully bend the display flex cable so that it curves back toward the circuit board, as shown in the diagram below. The curve will follow the curve of the front case.



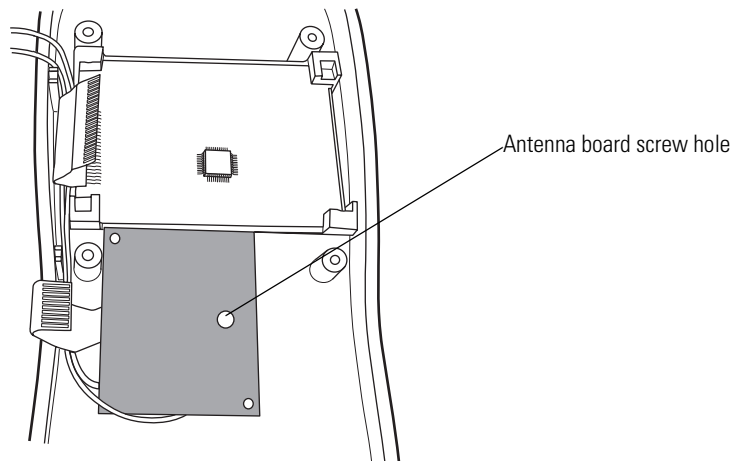
Caution The display flex cable is fragile. Damage may result if the flex cable is bent too sharply, or if its connection with the circuit board is stressed.

Installing the main board, subframe and radio card (5 GHz)

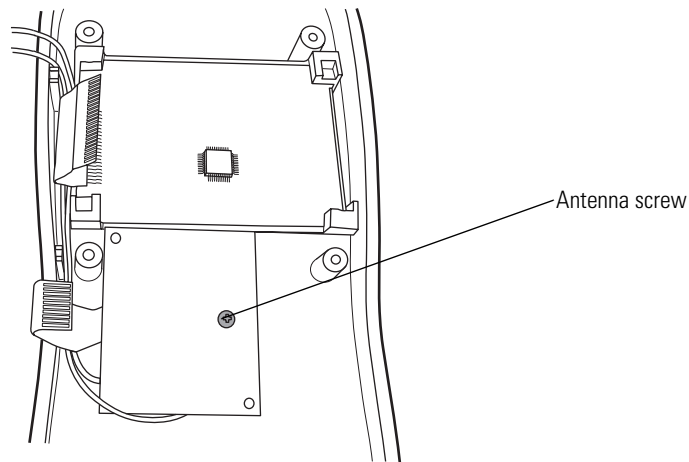
1. Place the main board subassembly (main board, subframe and radio card) with the radio-card side down to the left of the front case as shown.



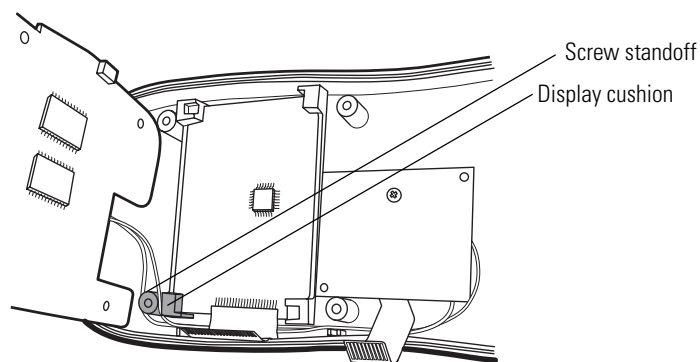
2. Place the antenna board in the front case and line up the screw hole. Route the black wire out of the side of the antenna board and the gray wire out of the bottom of the antenna board.



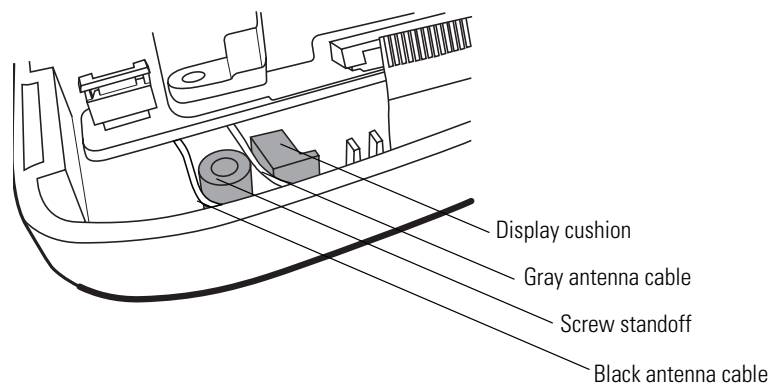
3. Screw the antenna on to the front case.



4. Route the cable underneath the display and keyboard cables as shown.

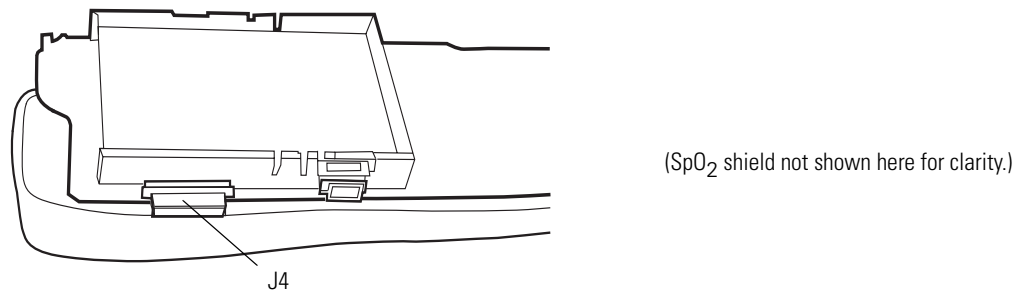


5. While supporting the main board subassembly, carefully route the shorter gray antenna cable between the screw standoff and the display cushion. Route the longer black antenna cable around the outside of the screw standoff.

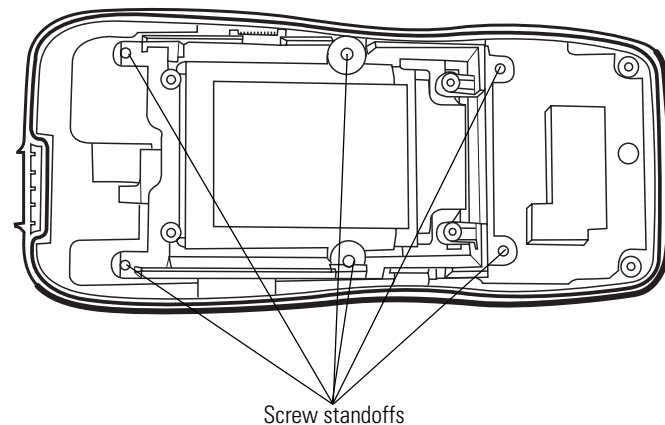


6. Seat the main board into the front case with the subframe and the radio card facing up. Make sure the antenna wires are not pinched between the board and the screw insert.
7. Connect the display cable to the J4 connector and lock the latching piece (refer to ["Zero Insertion Force \(ZIF\) connectors"](#) on page 32 for complete ZIF connector installation instructions.)

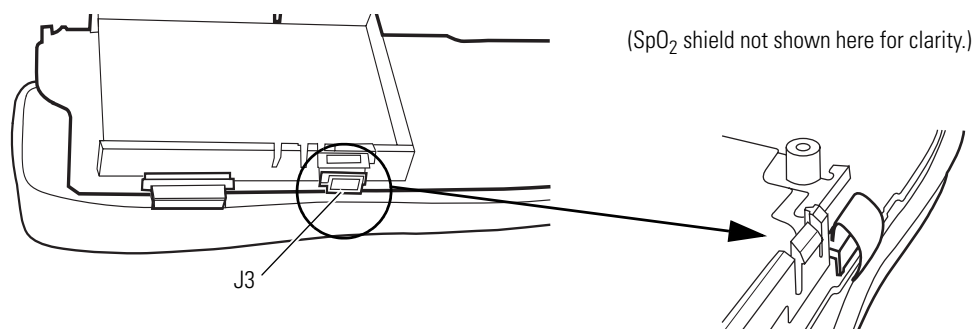
Note Tilt the assembly slightly toward the connectors, as shown, to allow insertion of the display flex cable into the J4 connector.



8. Make sure the main board screw holes align with the standoffs in the case, and the antenna cables are not pinched between the board and the screw insert.



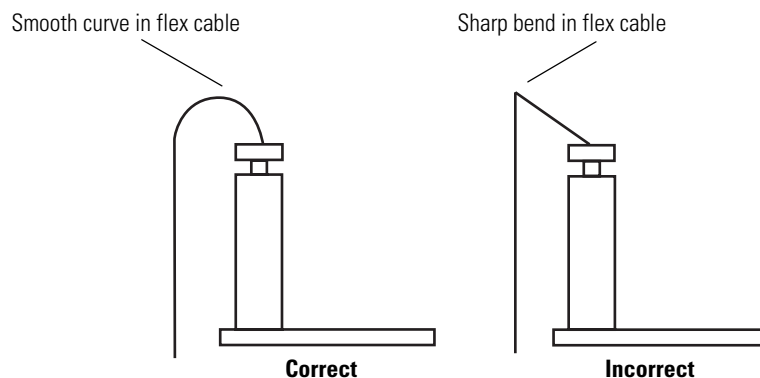
9. Insert the keyboard cable into the J3 connector and lock the latching piece.



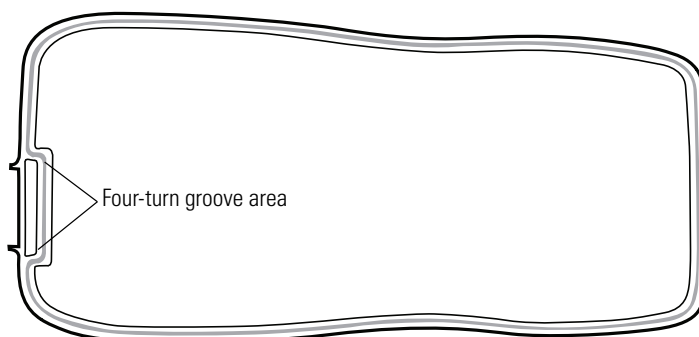
Note It may be necessary to use the round end of a small paper clip to guide the keyboard cable into the J3 connector to prevent the cable from slipping between the connector and the subframe. Make sure not to scratch the exposed circuit trace of the keyboard cable.



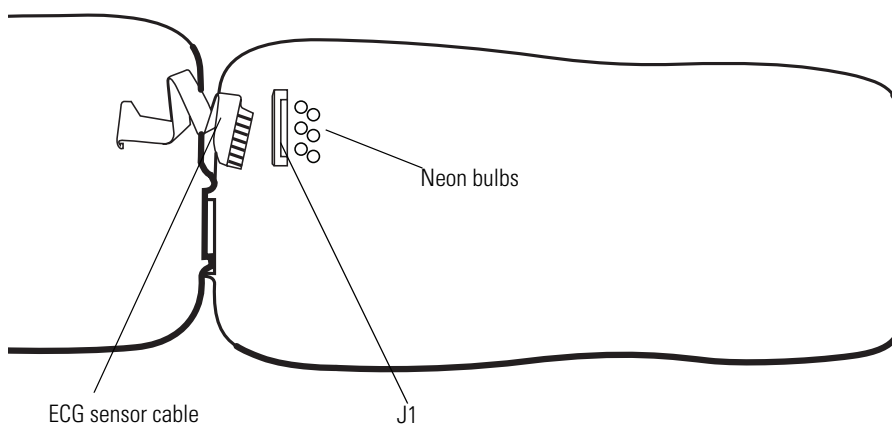
Caution When attaching the J3 connector, bend the flex cable toward the connector in a smooth radius curve (as shown below) to avoid cable damage.



10. Re-insert the rubber gasket (part of the fastener kit) into the groove in the front case. Begin inserting the gasket at the top of the rear case in the four-turn groove area. Position the rubber gasket flat in the groove of the front case.

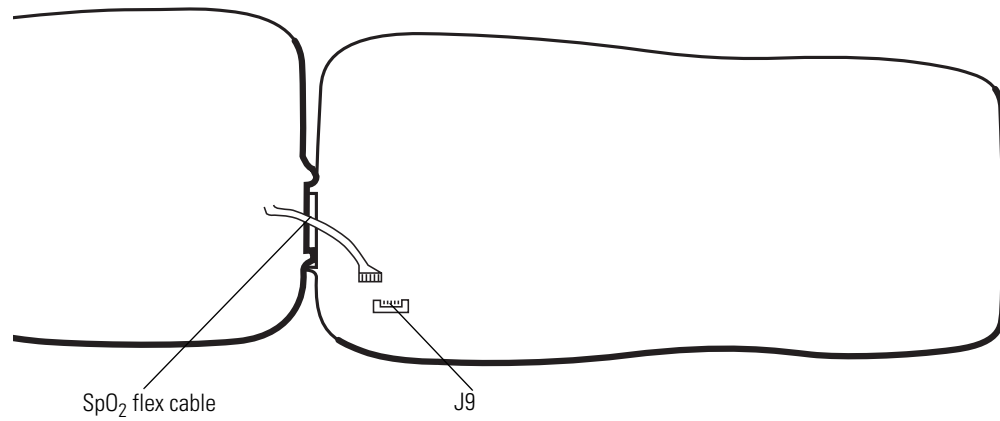


11. Insert the ECG sensor cable into the J1 connector and lock the latching piece.

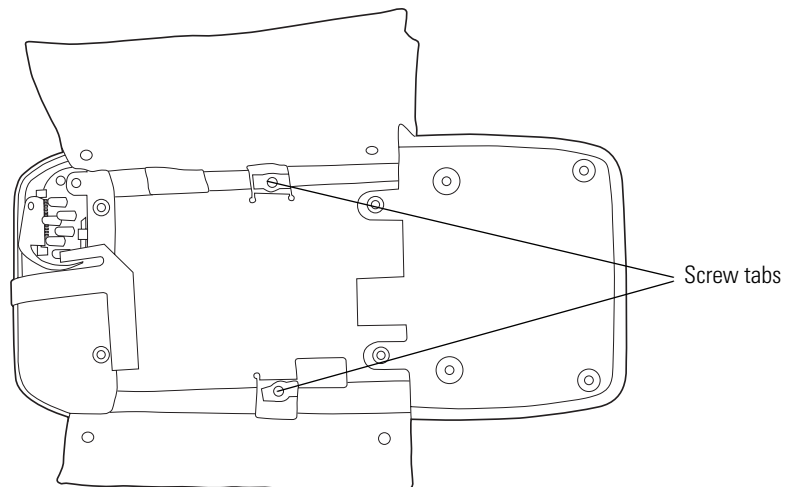


Caution Do not to bend or tilt any of the neon bulbs. They must remain vertical.

12. Insert the SpO₂ flex cable into the J9 connector and lock the latching piece.



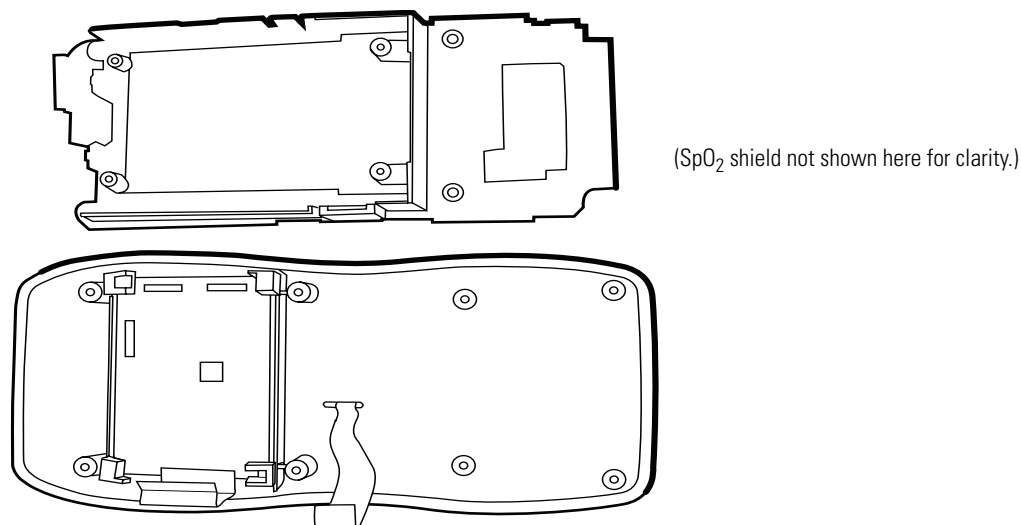
13. Install the SpO₂ shield and align the screw tabs in the center of the shield into the case screw holes.



14. For Masimo models, continue with the next section. For Nellcor models, continue with ["Installing the SpO₂ board \(Nellcor models\)"](#) on page 54.

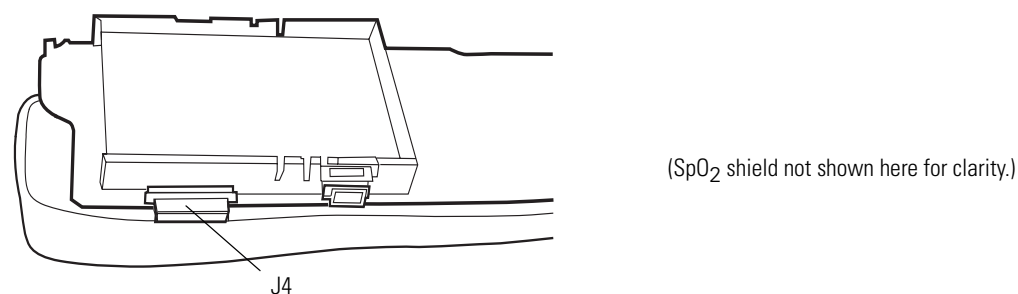
Installing the main board, subframe and radio card (2.4 GHz)

1. Install the main board, subframe and radio card as one assembly onto the front case.

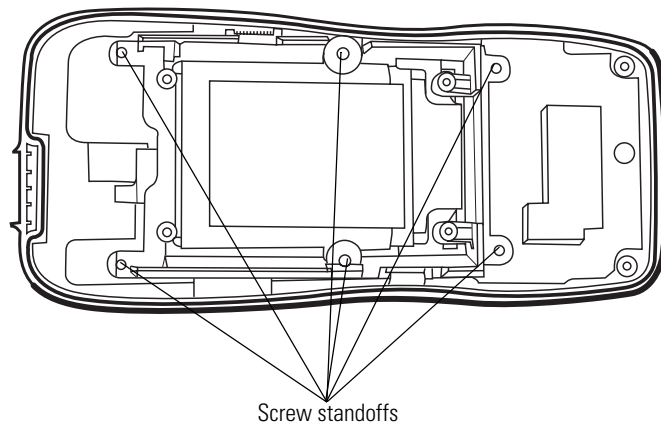


2. Connect the display cable to the J4 connector and lock the latching piece (refer to ["Zero Insertion Force \(ZIF\) connectors"](#) on page 32 for complete ZIF connector installation instructions.)

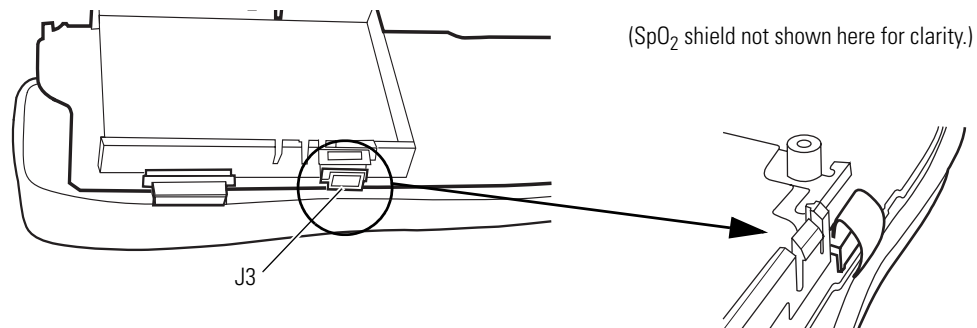
Note Tilt the assembly slightly toward the connectors, as shown, to allow insertion of the display flex cable into the J4 connector.



3. Place the main board into the front case and align the screw holes on the frame with the standoffs in the case.

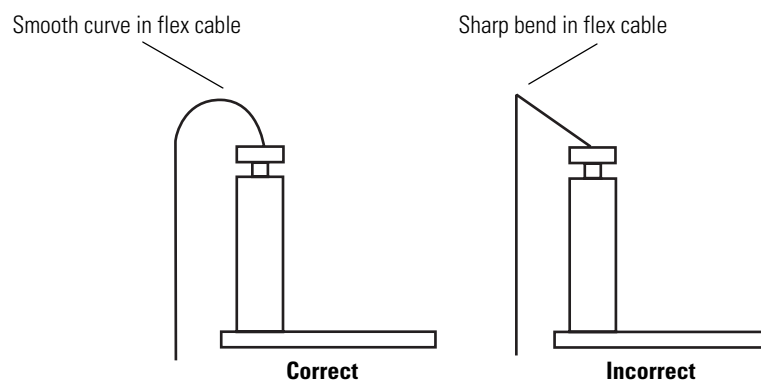


4. Insert the keyboard cable into the J3 connector and lock the latching piece.

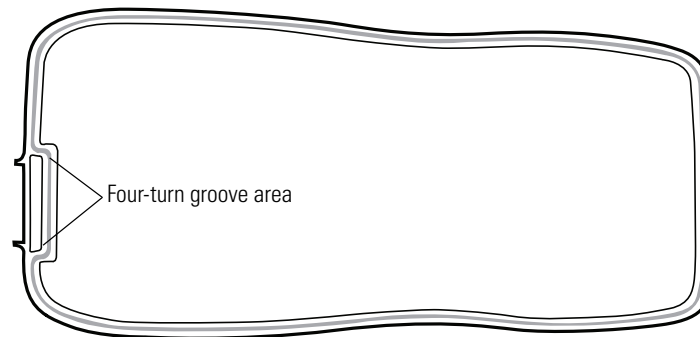


Note It may be necessary to use the round end of a small paper clip to guide the keyboard cable into the J3 connector to prevent the cable from slipping between the connector and the subframe. Make sure not to scratch the exposed circuit trace of the keyboard cable.

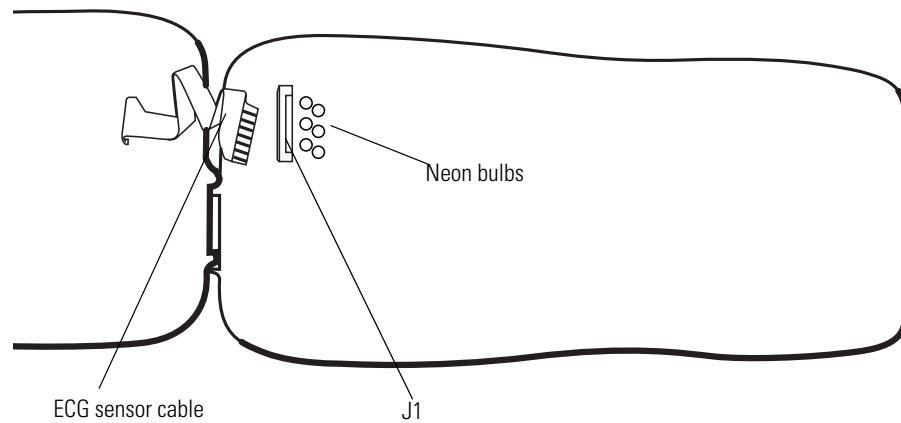
Caution When attaching the J3 connector, bend the flex cable toward the connector in a smooth radius curve (as shown below) to avoid cable damage.



5. Re-insert the rubber gasket (part of the fastener kit) into the groove in the front case. Begin inserting the gasket at the top of the rear case in the four-turn groove area. Position the rubber gasket flat in the groove of the front case.

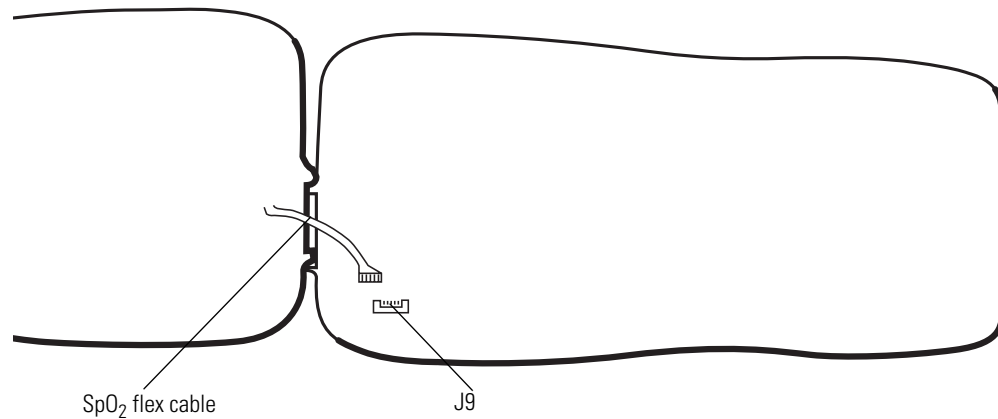


6. Insert the ECG sensor cable into the J1 connector and lock the latching piece.

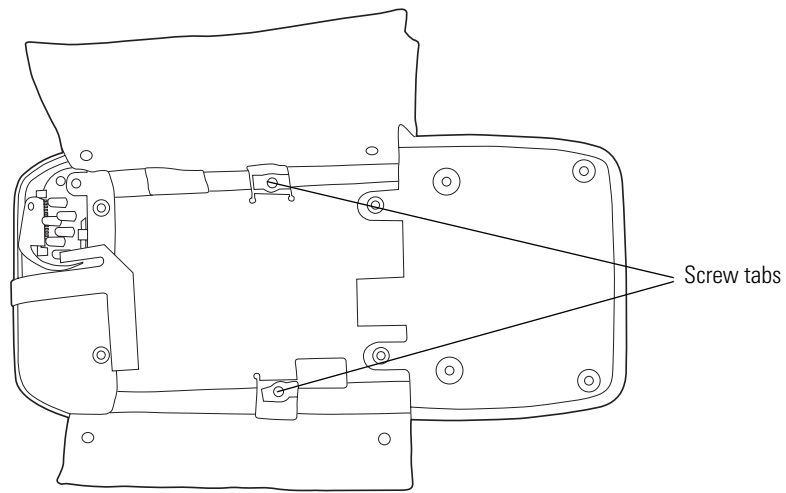


Caution Do not to bend or tilt any of the neon bulbs. They must remain vertical.

7. Insert the SpO₂ flex cable into the J9 connector and lock the latching piece.



8. Install the SpO₂ shield and align the screw tabs in the center of the shield into the case screw holes.



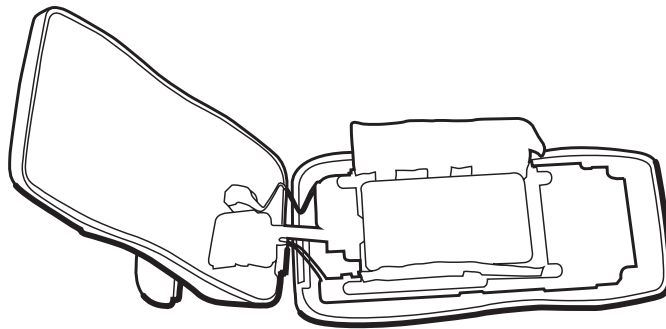
9. For Masimo models, continue with the next section. For Nellcor models, continue with ["Installing the SpO₂ board \(Nellcor models\)"](#) on page 54.

Installing the SpO₂ board (Masimo models)

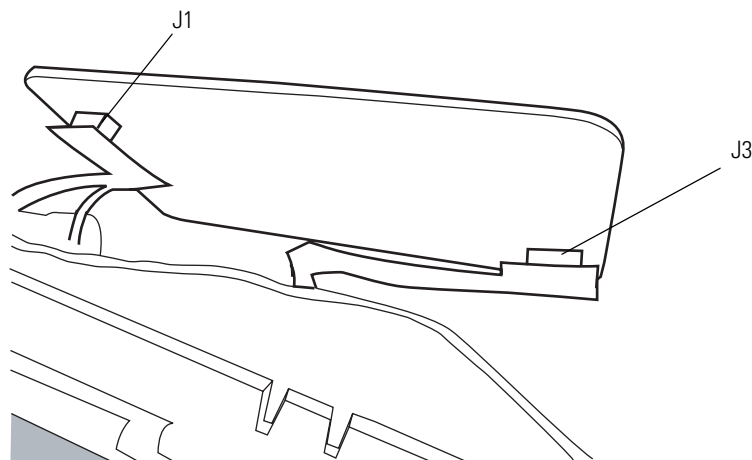
This section covers installation of the SpO₂ board on Masimo models. For Nellcor models, go to [“Installing the SpO₂ board \(Nellcor models\)”](#) on page 54.



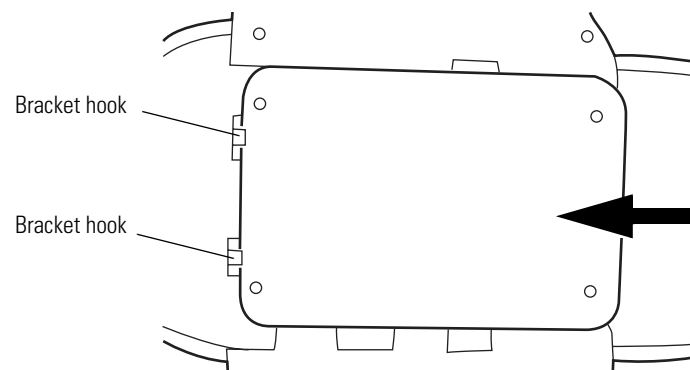
Caution When connecting the SpO₂ cable from the rear case, open the case 120 degrees and support the rear case as shown below to prevent stress on the SpO₂ flex cable.



1. Attach the SpO₂ sensor cables to connectors J1 and J3.



2. Seat the SpO₂ board in place on the subframe, under the bracket hooks as shown.

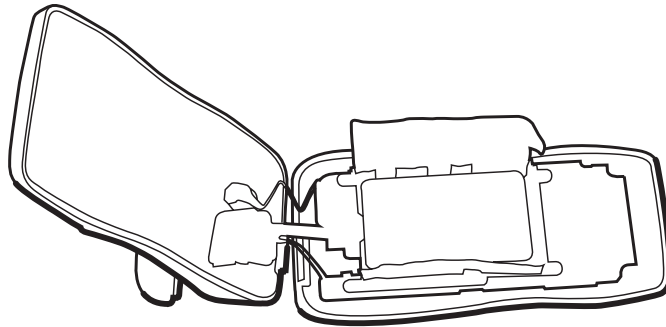


Installing the SpO₂ board (Nellcor models)

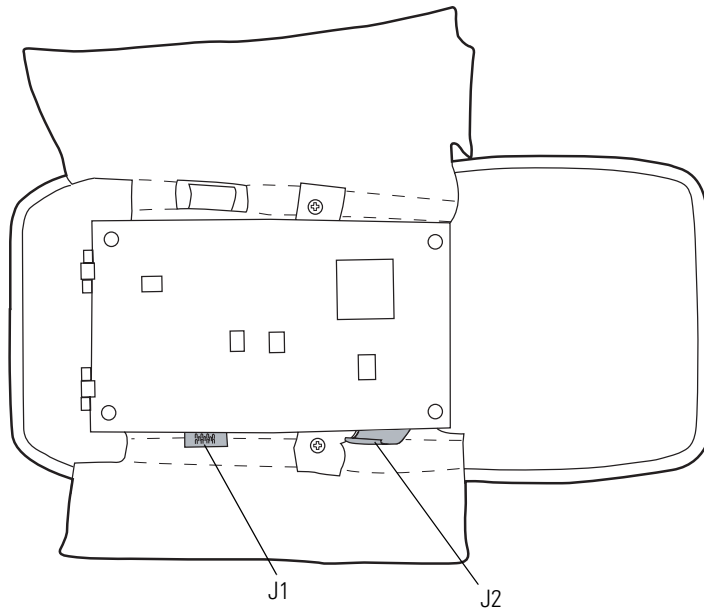
This section covers installation of the SpO₂ board on Nellcor models. For Masimo models, go to [“Installing the SpO₂ board \(Masimo models\)”](#) on page 53.



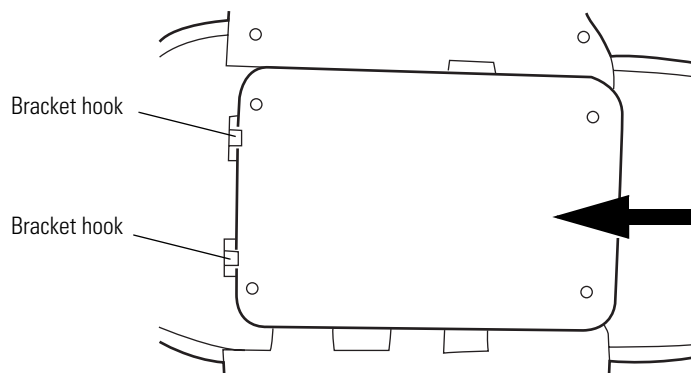
Caution When connecting the SpO₂ cable from the rear case, open the case 120 degrees and support the rear case as shown below to prevent stress on the SpO₂ flex cable.



1. Plug the SpO₂ cables into connectors J1 and J2.



2. Carefully slide the SpO₂ board under the two bracket hooks as shown.



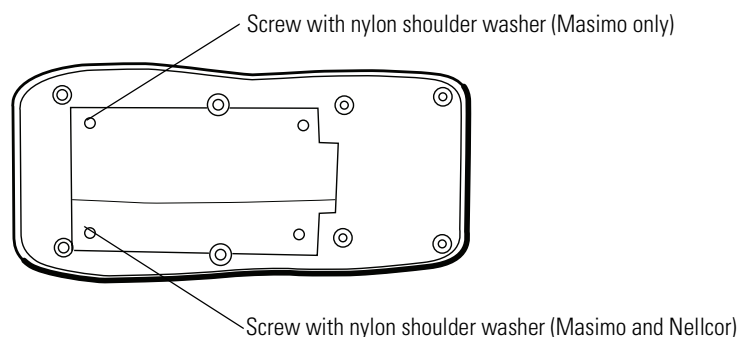
Installing the SpO₂ shield

1. Fold the SpO₂ shield closed, with the short side overlapping the long side.
2. Insert the nylon shoulder washer(s) at the location(s) shown above and fully seat in the SpO₂ shield.

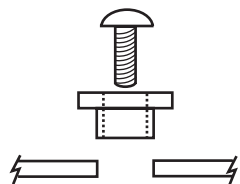


Caution Take care to place the nylon washer(s) in the correct location(s) or the system will not operate properly and may cause radio interference problems.

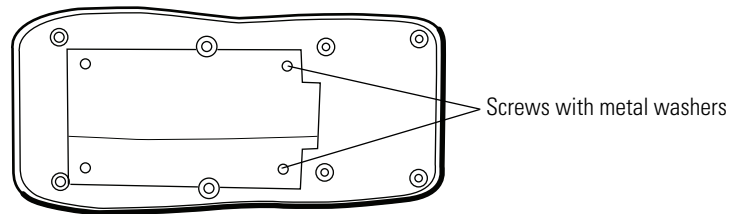
Note The Masimo version has two screws with nylon shoulder washers. The Nellcor version has only one screw with a nylon shoulder washer, as shown below.



3. Add screws after the nylon shoulder washers are seated and torque to 3 in. lbs.

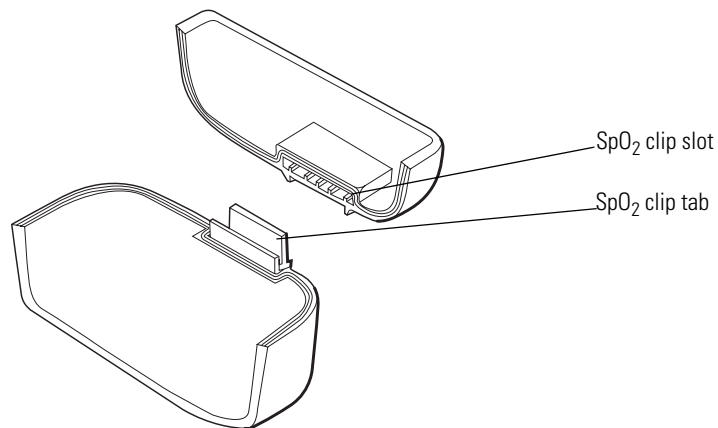


4. Place metal washers and screws in the locations shown below and torque to 3 in. lbs.



Closing the case

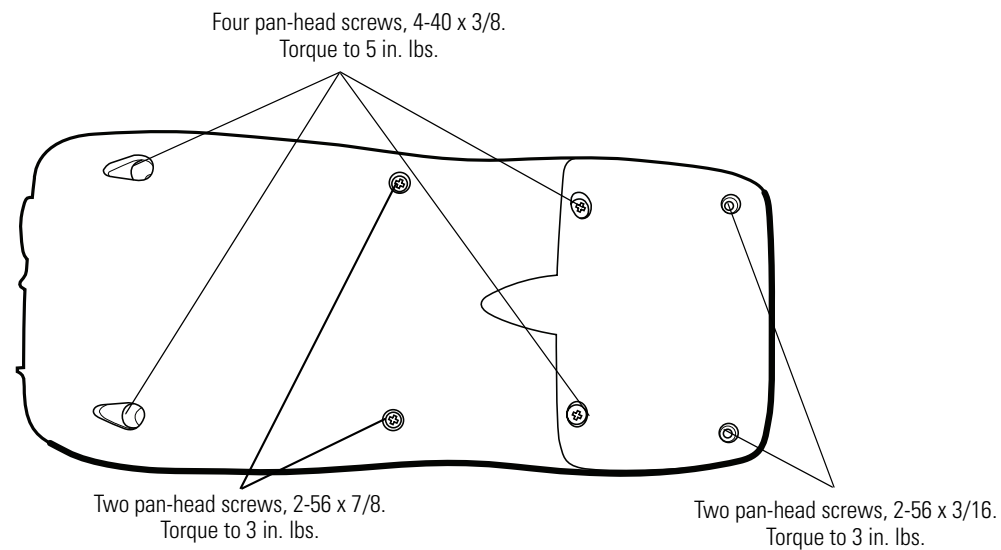
1. Align the SpO₂ clip on the rear case with the slot on the front case.



2. Make sure the rubber gasket is lying flat in the groove of the front case.
3. Make sure the screw holes on the main board assembly align with the standoffs on the front case
4. Fold the unit closed.
5. Screw the two case screws into the middle section of the monitor.
6. Attach the battery and verify that:
 - the LEDs light red, yellow and green,
 - no error messages are received,
 - the keyboard works.

7. Remove the battery.
8. Screw the rear case to the front case with the remaining screws, making sure the rubber gasket stays in its groove. Torque the screws as shown in the illustration below.

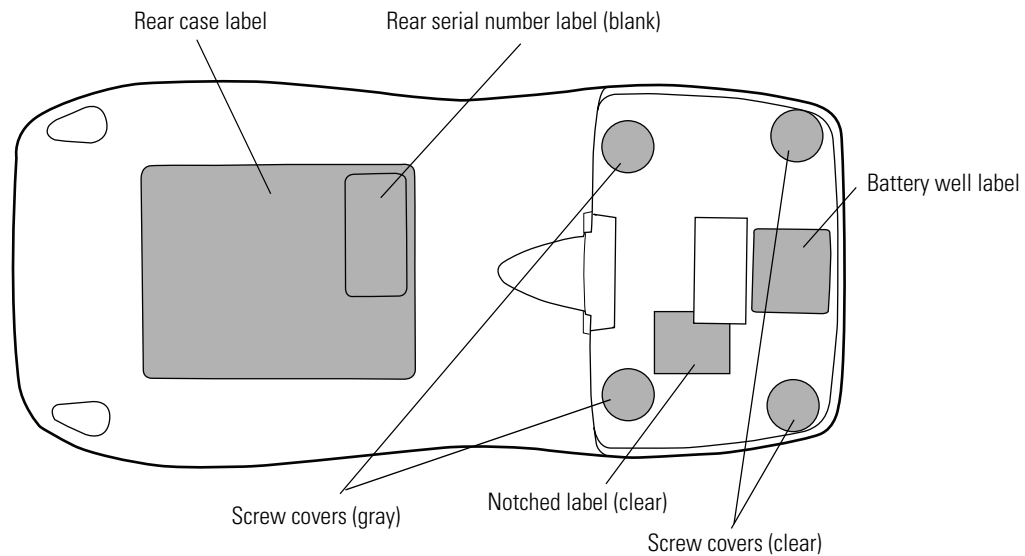
Note Use all new screws, label covers and rubber feet (supplied in the service fastener kit) when reassembling the case.



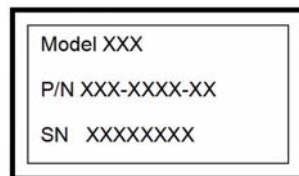
9. Push the two rubber feet and two rubber screw plugs into the rear case. For ease of installation, apply a small amount of alcohol.
10. Perform the applicable functional verification test described in ["Functional verification"](#) on page 11.

Attaching labels

The screw covers and notched labels are part of the service fastener kit. The rear case, battery well, clear serial number cover (not shown below) and the blank serial number labels are included in the rear case service kit.



1. Apply the gray screw covers over the upper screw holes in the battery area.
2. Apply the clear screw covers over the lower screws in the battery well.
3. Apply the notched label over the small recessed BDM connector next to the battery connector.
4. Apply the rear case and battery well labels.
5. Mark the blank rear serial number label with the model number, part number and serial number from the serviced unit as shown below. Use an ultrafine point permanent marker. Write small to fit in all the required information.
6. Apply the rear serial number label to the rear case label at the location shown above.



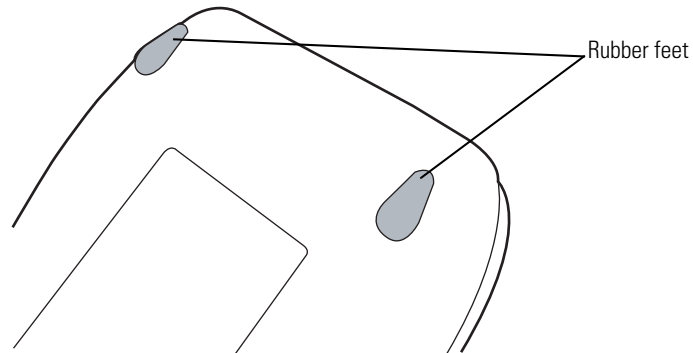
7. Apply the clear cover over the marked serial number label.
8. On the front case, apply the front ID label in the recessed area.
9. Attach the battery and verify that:
 - the LED lights red, yellow and green,
 - no error messages are received,
 - the keyboard works.

Disassembly - Model 406

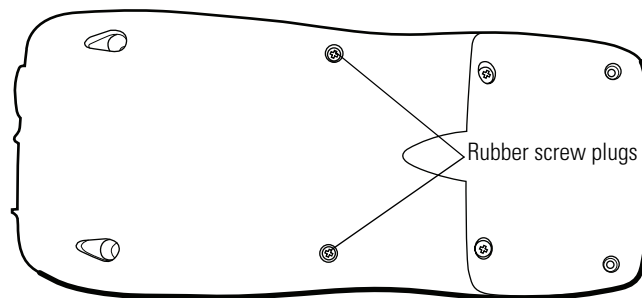
This procedure covers the Model 406 monitor with ECG only.

Opening the case

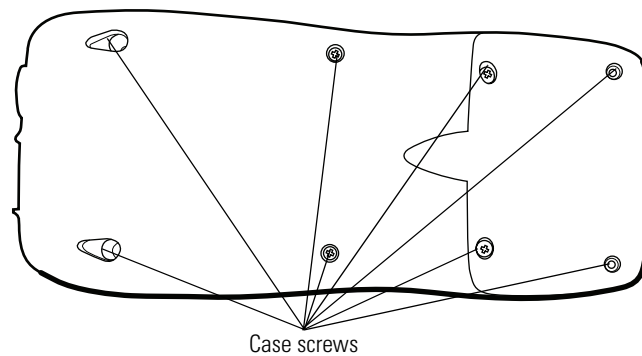
1. Remove the battery pack.
2. Remove the two rubber feet using tweezers.



3. Remove the two rubber screw plugs from the external case using a spudger or paper clip.



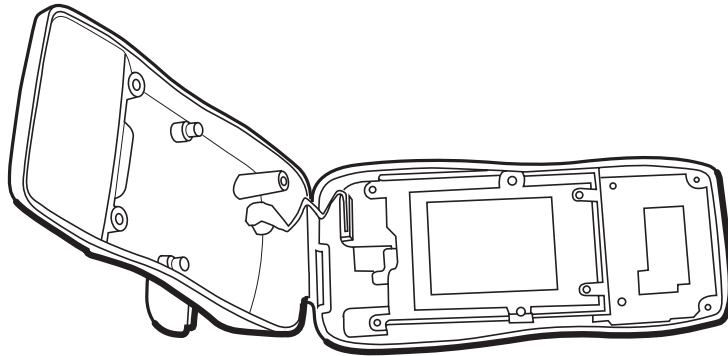
4. Remove the four screw covers in the battery compartment.
5. Remove all eight case screws.



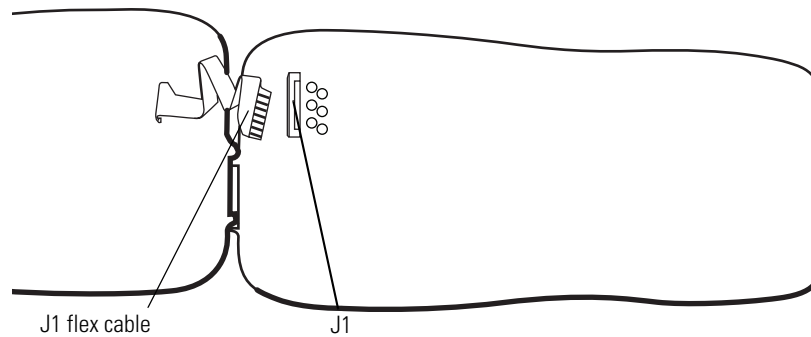
6. Place the Micropaq display-side down and carefully lift the back case away from the front case, starting at the bottom.



Caution Open the case 120 degrees and support the rear case as shown below to prevent stress on the ECG flex cable.

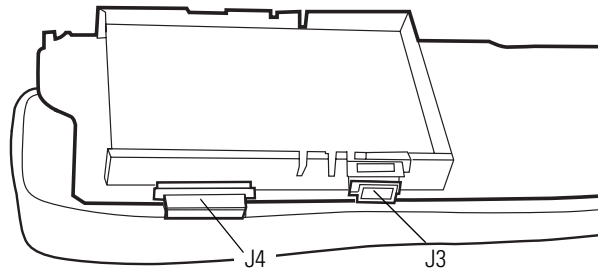


7. Remove the ECG flex cable from connector J1 on the main board. The rear case may now be replaced.

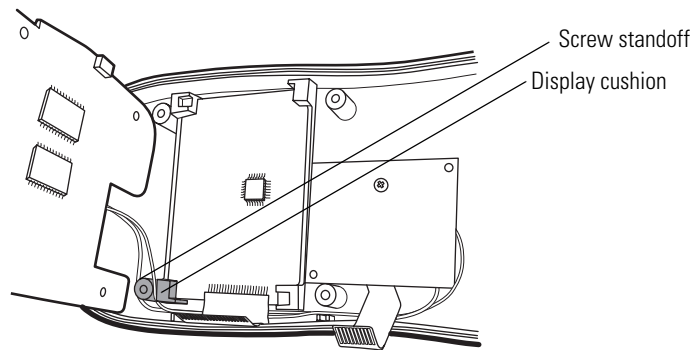


Removing the front case and/or replacing the display (5 GHz)

1. Unplug the display cable from connector J4 and keyboard cable from connector J3.



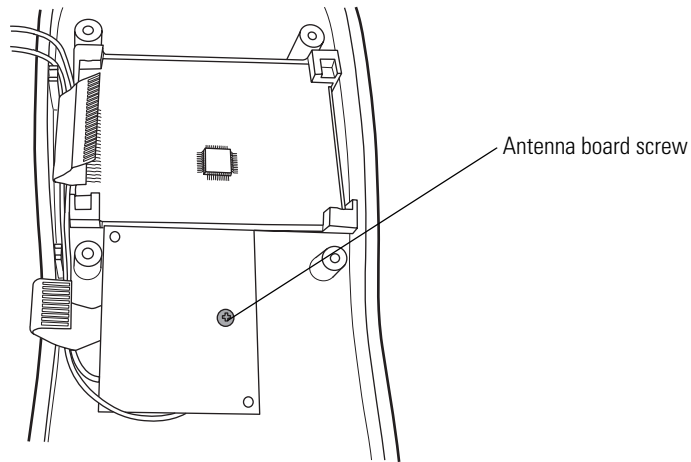
2. Lift the main board subassembly (main board, subframe and radio card) out of the front case, leaving enough room to access the antenna cables. While supporting the main board subassembly, free the antenna cables from between the display cushion and the standoff.



Caution Make sure not to stress the antenna connection cables.

3. Place the main board down next to the front case.

4. Remove the screw securing the antenna board to the front case.

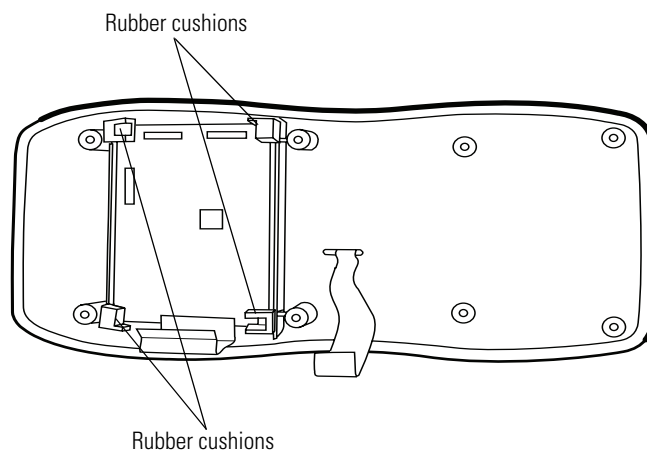


5. Remove the antenna board and the connecting cables from the front case.



Caution Do not disconnect the antenna cables from the antenna board. The connectors are easily damaged and may not be reused unless a special extractor tool is used to disconnect the cables from the board.

6. Remove the display from the front case by lifting the rubber cushions.



7. If you are installing a new display, remove and save the rubber cushions.
8. Set the display down on a clean surface with the circuit board side facing up.



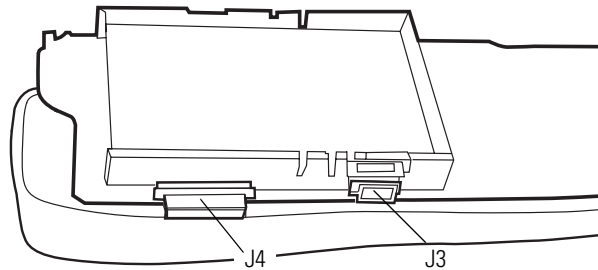
Caution Do not bend or stress the display flex cable, especially at its connection to the circuit board.



Caution Do not touch the display screen. Fingerprints are difficult to remove without damaging the display.

Removing the front case and/or replacing the display (2.4 GHz)

1. Unplug the display cable from connector J4 and keyboard cable from connector J3.

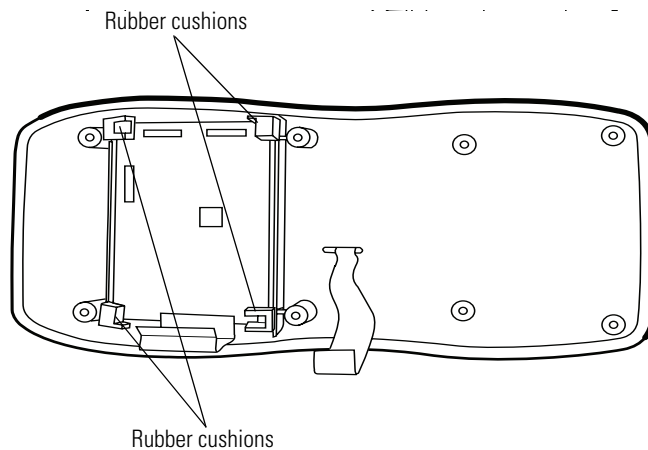


2. Remove main board, subframe, and radio card (as one assembly) from the front case.



Caution Do not separate the main board, the subframe, and the radio card. They are not serviceable. Separation will damage the single-use antenna connector, which can be replaced only at the factory.

3. Remove the display from the front case by lifting the rubber cushions.



4. If you are installing a new display, remove and save the rubber cushions.
5. Set the display down on a clean surface with the circuit board side facing up.



Caution Do not bend or stress the display flex cable, especially at its connection to the circuit board.



Caution Do not touch the display screen. Fingerprints are difficult to remove without damaging the display.

Reassembly - Model 406

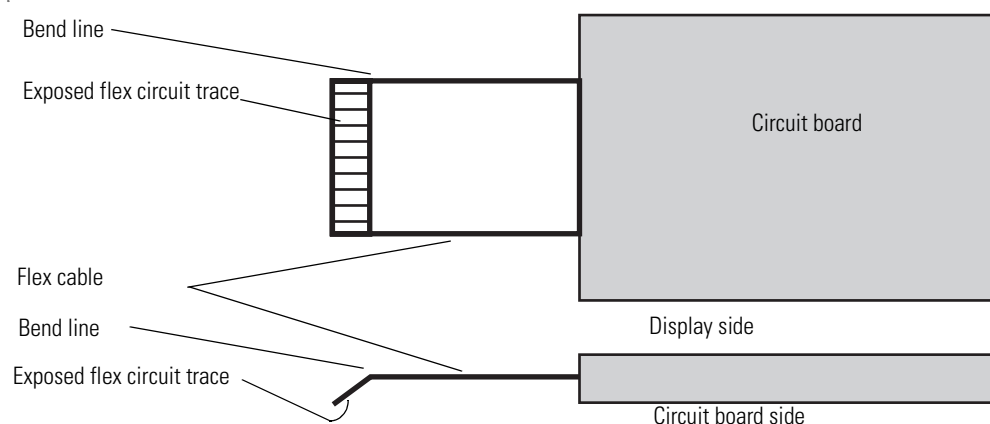
Installing the display

Note The first two steps apply only if you are installing a new display. If you are reusing a display, skip to [step 3 on page 64](#).



Caution The display flex cable is fragile. Damage may result if the flex cable is bent too sharply or if its connection with the circuit board is stressed.

Refer to the illustration.



1. Form a 45-degree bend in the end of the display cable.
 - a. With needle nose pliers, clamp the flex cable just behind the exposed flex circuit trace. You will form the bend along the edge of the pliers.
 - b. Press the end of the flex cable against a hard surface to bend it 45 degrees, toward the circuit board side, at the edge (bend line) of the exposed flex trace.

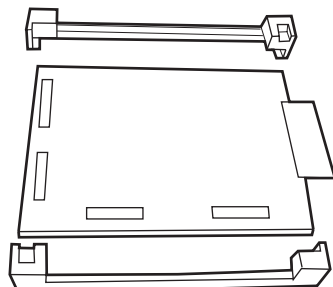


Caution The direction of the bend is toward the exposed flex circuit trace. Do not bend the cable in the opposite direction.

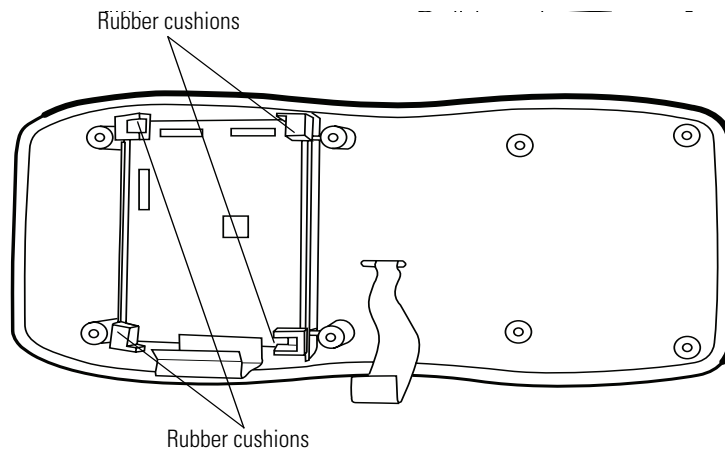
2. Peel the protective plastic liner from the front of the display.

Note Remove the protective liner before installing the display in the case.

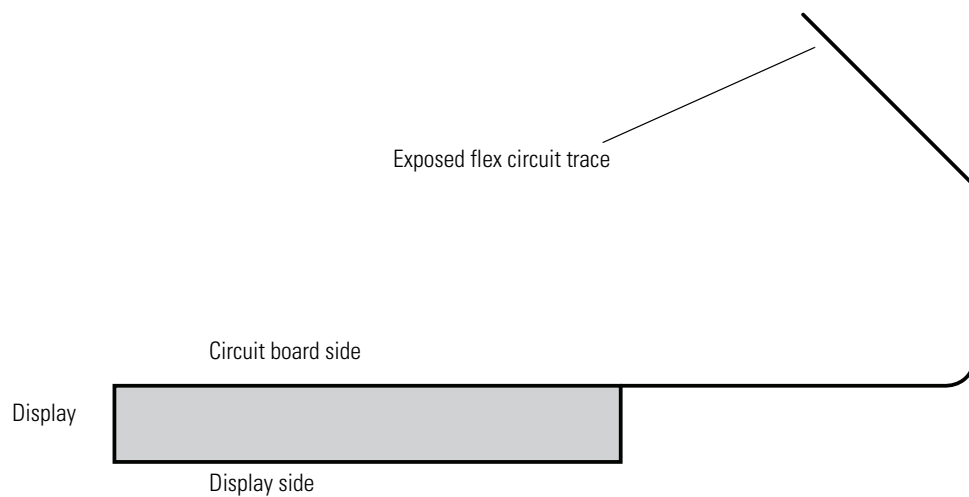
3. Press the rubber cushions onto the display, with the raised cushion corners up as shown.



4. Install the display in the front case by pressing the rubber cushions down to seat the display.



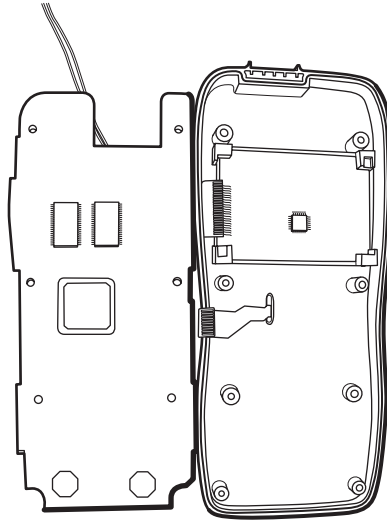
5. Carefully bend the display flex cable so that it curves back toward the circuit board, as shown in the diagram below. The curve will follow the curve of the front case.



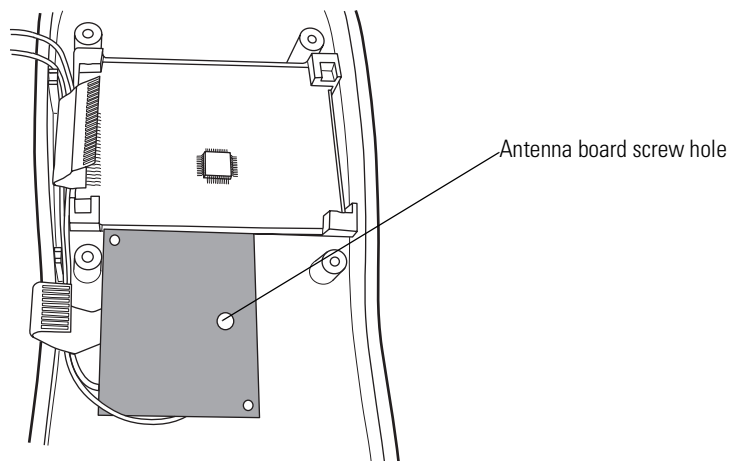
Caution The display flex cable is fragile. Damage may result if the flex cable is bent too sharply, or if its connection with the circuit board is stressed.

Installing the main board, subframe and radio card (5 GHz)

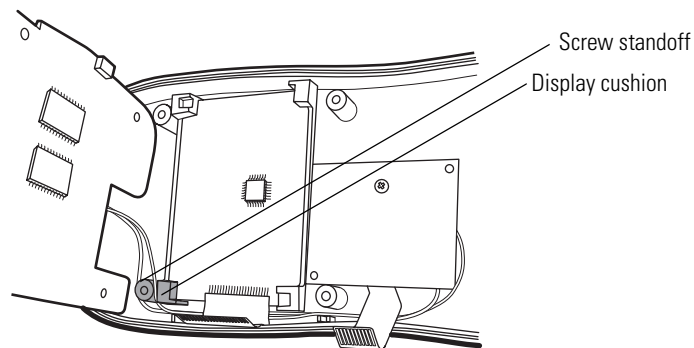
1. Place the main board subassembly (main board, subframe and radio card) with the radio-card side down to the left of the front case as shown.



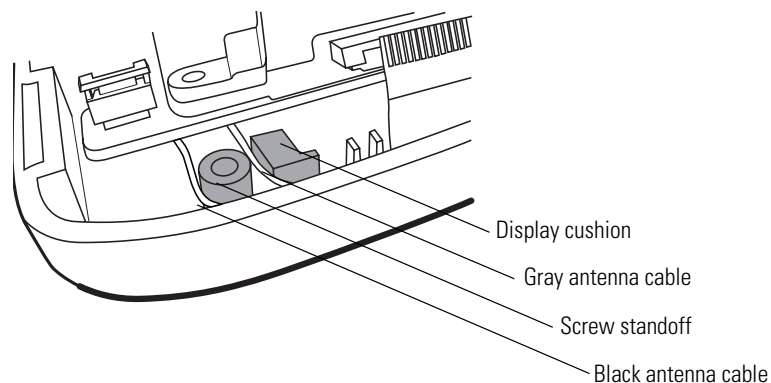
2. Place the antenna board in the front case and line up the screw hole. Route the black wire out of the side of the antenna board and the gray wire out of the bottom of the antenna board.



3. Screw the antenna on to the front case.
4. Route the cable underneath the display and keyboard cables as shown.

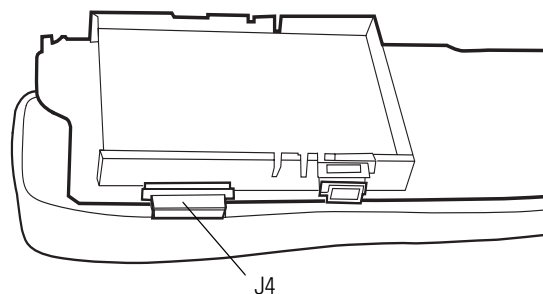


5. While supporting the main board subassembly, carefully route the shorter gray antenna cable between the screw standoff and the display cushion. Route the longer black antenna cable around the outside of the screw standoff.

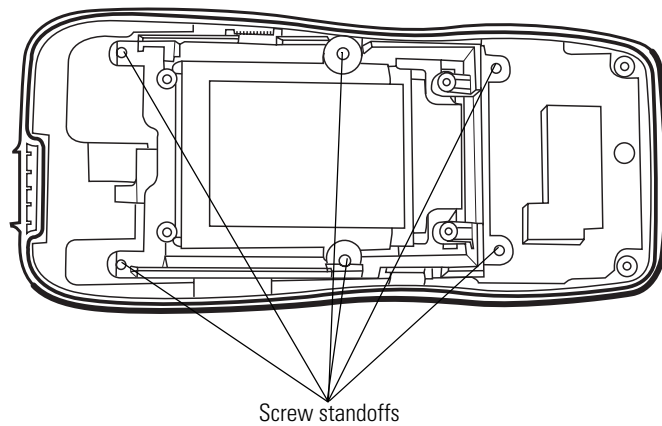


6. Seat the main board into the front case with the subframe and the radio card facing up. Make sure the antenna wires are not pinched between the board and the screw insert.
7. Connect the display cable to the J4 connector and lock the latching piece (refer to ["Zero Insertion Force \(ZIF\) connectors"](#) on page 32 for complete ZIF connector installation instructions.)

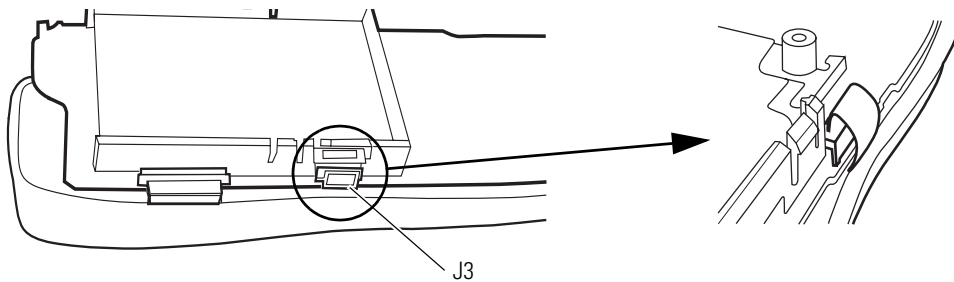
Note Tilt the assembly slightly toward the connectors, as shown, to allow insertion of the display flex cable into the J4 connector.



8. Make sure the main board screw holes align with the standoffs in the case, and the antenna cables are not pinched between the board and the screw insert.



9. Insert the keyboard cable into the J3 connector and lock the latching piece.



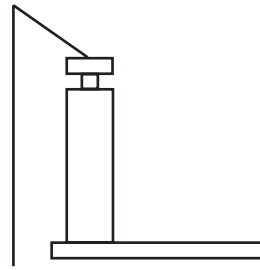
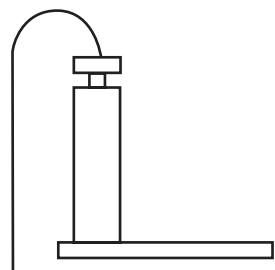
Note It may be necessary to use the round end of a small paper clip to guide the keyboard cable into the J3 connector to prevent the cable from slipping between the connector and the subframe. Make sure not to scratch the exposed circuit trace on the keyboard cable.



Caution When attaching the J3 connector, bend the flex cable toward the connector in a smooth curve (shown below at left) to avoid cable damage.

Smooth curve in flex cable

Sharp bend in flex cable



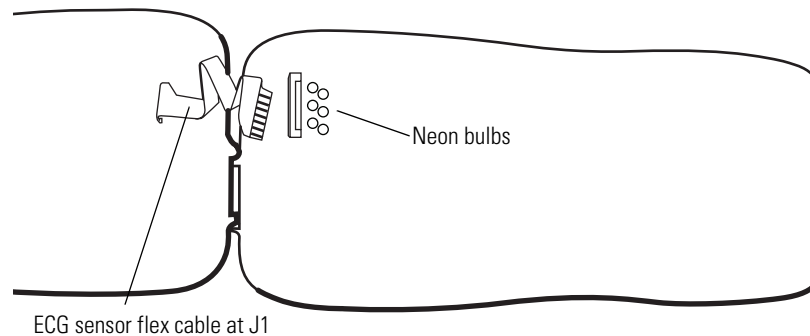
Correct

Incorrect

10. Re-insert the rubber gasket (part of the fastener kit) into the groove in the front case. Begin inserting the gasket at the top of the rear case in the four-turn groove area. Position the rubber gasket flat in the groove area of the front case.



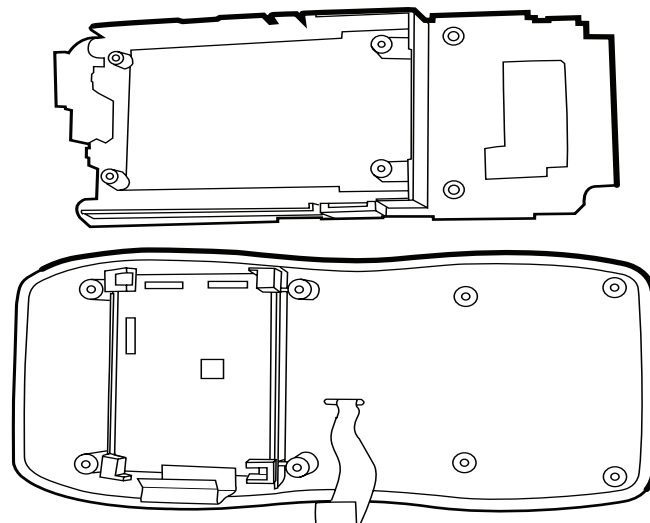
11. Insert the ECG sensor cable into the J1 connector and lock the latching piece.



Caution Do not to bend or tilt any of the neon bulbs. They must remain vertical.

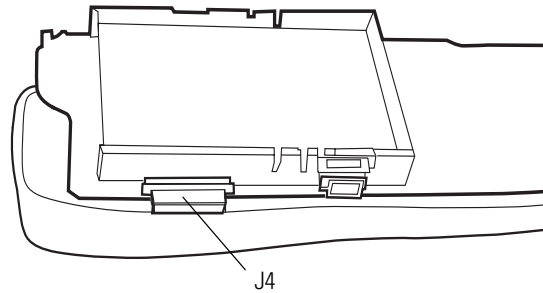
Installing the main board, subframe and radio card (2.4 GHz)

1. Install the main board, subframe and radio card as one assembly onto the front case.

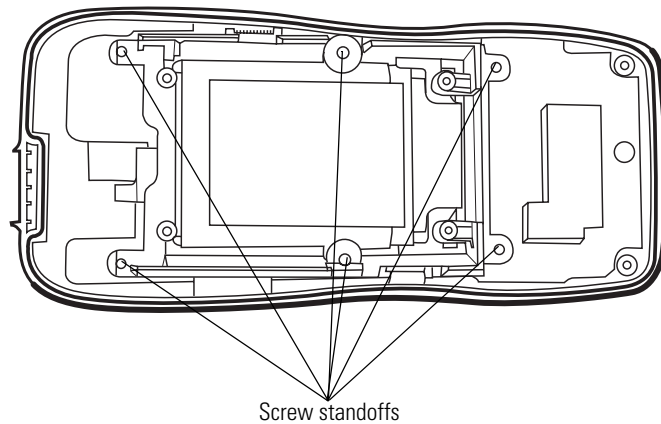


2. Connect the display cable to the J4 connector and lock the latching piece (refer to ["Zero Insertion Force \(ZIF\) connectors"](#) on page 32 for complete ZIF connector installation instructions.)

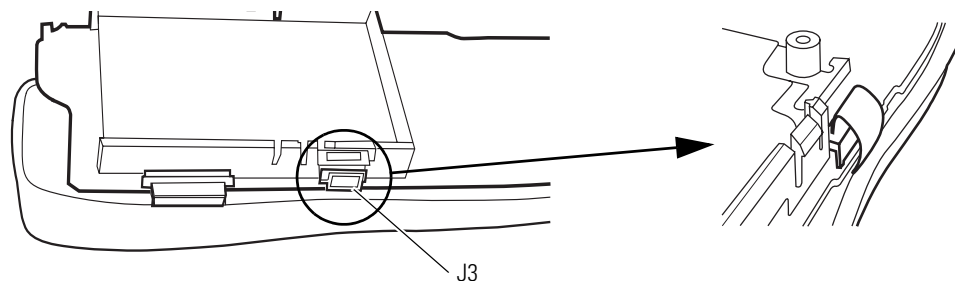
Note Tilt the assembly slightly toward the connectors, as shown, to allow insertion of the display flex cable into the J4 connector.



3. Place the main board into the front case and align the screw holes on the frame with the standoffs in the case.



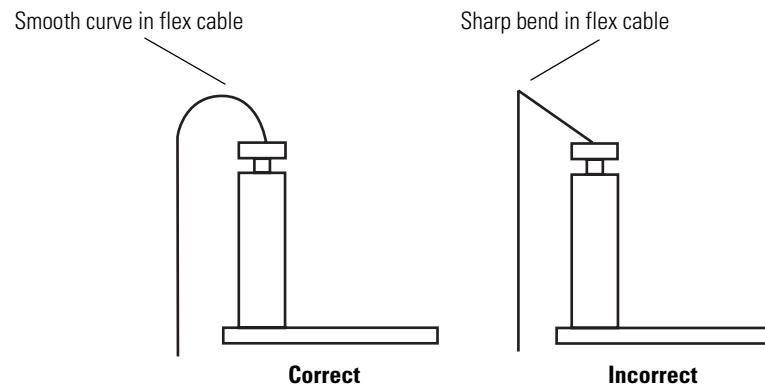
4. Insert the keyboard cable into the J3 connector and lock the latching piece.



Note It may be necessary to use the round end of a small paper clip to guide the keyboard cable into the J3 connector to prevent the cable from slipping between the connector and the subframe. Make sure not to scratch the exposed circuit trace on the keyboard cable.



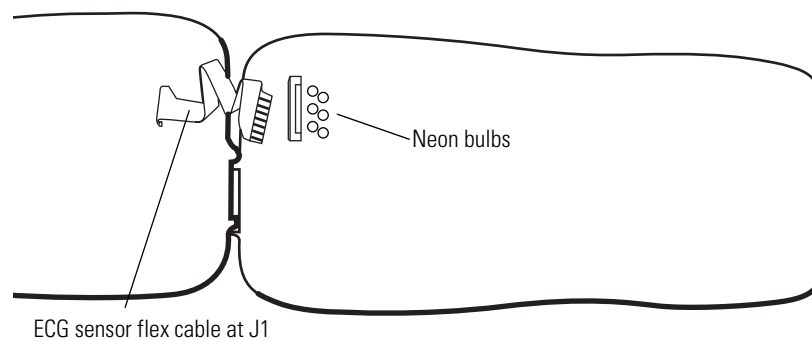
Caution When attaching the J3 connector, bend the flex cable toward the connector in a smooth curve (shown below at left) to avoid cable damage.



5. Re-insert the rubber gasket (part of the fastener kit) into the groove in the front case. Begin inserting the gasket at the top of the rear case in the four-turn groove area. Position the rubber gasket flat in the groove area of the front case.



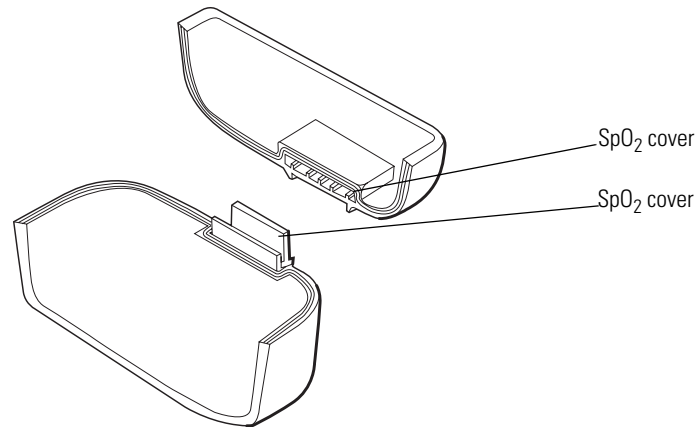
6. Insert the ECG sensor cable into the J1 connector and lock the latching piece.



Caution Do not to bend or tilt any of the neon bulbs. They must remain vertical.

Closing the case

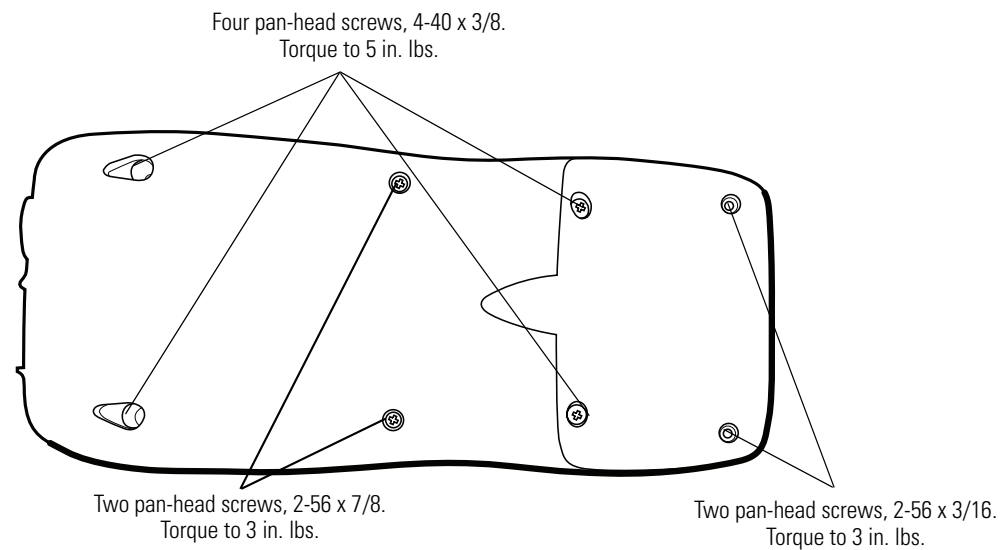
1. Align the SpO₂ clip on the rear case with the slot on the front case.



2. Make sure the rubber gasket is lying flat in the groove of the front case.
3. Make sure the screw holes on the main board assembly align with the standoffs on the front case
4. Fold the unit closed.
5. Screw the two case screws into the middle section of the monitor.
6. Attach the battery and verify that:
 - the LEDs light red, yellow and green,
 - no error messages are received,
 - the keyboard works.

7. Remove the battery.
8. Screw the rear case to the front case with the remaining screws, making sure the rubber gasket stays in its groove. Torque the screws as shown in the illustration below.

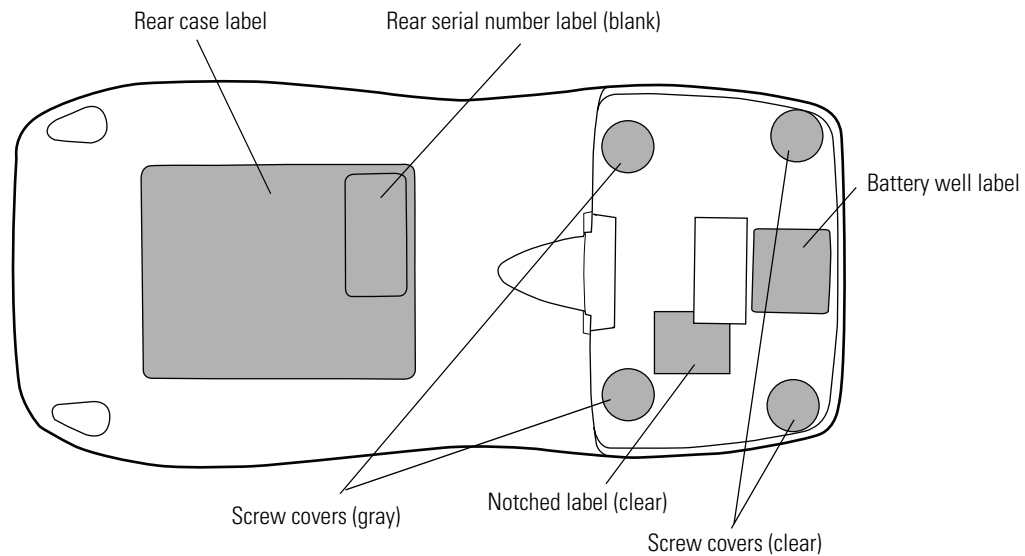
Note Use all new screws, label covers and rubber feet (supplied in the service fastener kit) when reassembling the case.



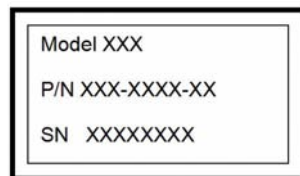
9. Push the two rubber feet and two rubber screw plugs into the rear case. For ease of installation, apply a small amount of alcohol.
10. Perform the applicable functional verification test described in ["Functional verification"](#) on page 11.

Attaching labels

The screw covers and notched labels are part of the service fastener kit. The rear case, battery well, clear serial number cover (not shown below) and the blank serial number labels are included in the rear case service kit.



1. Apply the gray screw covers over the upper screw holes in the battery area.
2. Apply the clear screw covers over the lower screws in the battery well.
3. Apply the notched label over the small recessed BDM connector next to the battery connector.
4. Apply the rear case and battery well labels.
5. Mark the blank rear serial number label with the model number, part number and serial number from the serviced unit as shown below. Use an ultrafine point permanent marker. Write small to fit in all the required information.
6. Apply the rear serial number label to the rear case label at the location shown above.




7. Apply the clear cover over the marked serial number label.
8. On the front case, apply the front ID label in the recessed area.
9. Attach the battery and verify that:
 - the LED lights red, yellow and green,
 - no error messages are received,
 - the keyboard works.

6

Technical overview

Feature summary

The monitor is a patient-worn vital signs monitor for use by adult or pediatric ambulatory patients.

- One or two ECG channels displayed
- Up to 2 ECG leads displayed at the monitor: I, II, III, V, aV_R, aV_L, or aV_F with 5-lead cable
- Up to 7 ECG leads displayed at Acuity: I, II, III, V, aV_R, aV_L, or aV_F with 5-lead cable
- One ECG lead displayed at the monitor and at Acuity: Fixed lead II with 3-lead cable, or 5-lead cable with only RA, LA and LL electrodes attached.
- Pulse oximetry (SpO₂) monitoring (Model 408 only)
- Two-way wireless communication within Welch Allyn's FlexNet network
- LCD for display of ECG waveforms, SpO₂ and heart rate/pulse rate data, and messages from Acuity
- Standalone operation with patient alarms when out of range of the network
- Patient alarm limits that can be set at the monitor or at Acuity
- Configurable formats for single- or dual-waveform ECG display
- Internal antenna
-  Snapshot key
- Lightweight (less than two pounds with battery)
- Rugged and tolerant of brief water exposure
- Rechargeable battery
- Sleep mode to extend battery life
- Your model may be shipped with an attached identification number on the front of the monitor.



Micropaq 406

ECG monitoring

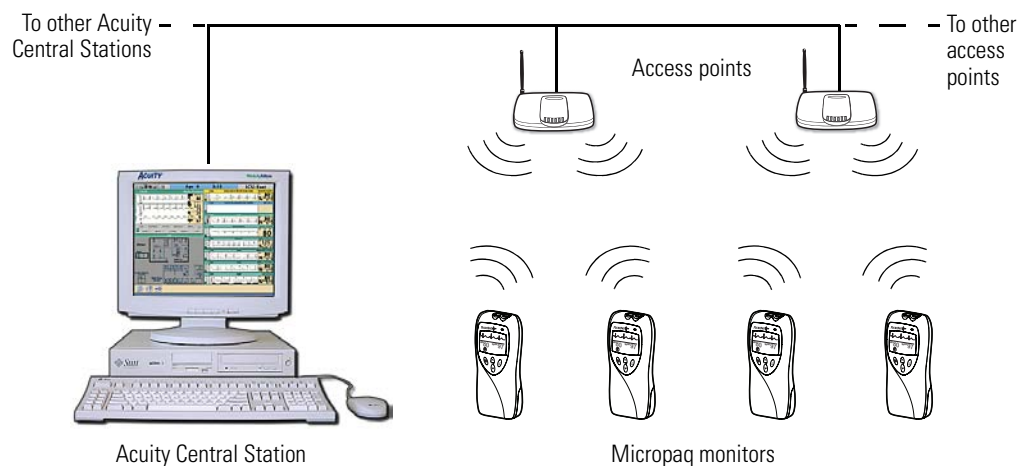
Micropaq 408

ECG monitoring and either of two pulse oximetry (SpO₂) monitoring options:

- SpO₂ with Masimo SET technology
- SpO₂ with Nellcor OxiMax technology

Understanding Micropaq and the FlexNet Network

The monitor is intended to operate with an Acuity Central Station as part of Welch Allyn's FlexNet network. FlexNet allows multiple devices to communicate through hardwired Ethernet networks and Wireless Local Area Networks (WLANs). The Acuity Central Station provides the primary display and entry of patient data for a patient connected to the monitor.



Each patient-worn monitor supports two-way communication with an Acuity Central Station through an access point in the FlexNet network. The access point is a digital radio transceiver that connects to the FlexNet network. During monitoring, the monitor sends the patient data to Acuity. Acuity and the monitor continuously analyze the data. Acuity provides appropriate alarm or alert messages at the Central Station and other network devices such as a hallway message panel and the monitor itself. Acuity also stores the patient data for viewing or report printing.

If the monitor is moved out of range or loses communication with the FlexNet network and Acuity, it continues to monitor the patient and display patient data. While not communicating with Acuity, the monitor continues to generate local patient alarms or alert messages. Patient data is not stored and Acuity does not perform waveform analysis or generate arrhythmia messages while the monitor is not communicating with Acuity.

When the monitor is returned to within range of the FlexNet network, it automatically reconnects to Acuity.

7

Field Replaceable Units

This list includes field-replaceable service parts only. Product accessories are listed separately in Welch Allyn *Products and Accessories* (810-0409-XX), which is available from Welch Allyn Customer Service.

The following table lists service kits and the included parts for the Micropaq monitor.

Table 1. Service parts list

| Order Number | Item Description | Model |
|--------------|--|----------------------------|
| 640-1128-XX | Label, Rear/Battery Well, Sheet, Nellcor, Micropaq HD (2.4 GHz) | 408 with Nellcor |
| 640-1129-XX | Label, Rear/Battery Well, Sheet, ECG Only, Micropaq HD (2.4 GHz) | 406 ECG only |
| 640-1132-XX | Label, Rear/Battery Well, Sheet, Masimo, Micropaq HD (2.4 GHz) | 408 with Masimo, PPO+ |
| 640-1186-XX | Label, Rear/Battery Well, Sheet, Masimo, Micropaq HD (5 GHz) | 408 with Masimo, PPO+ |
| 640-1187-XX | Label, Rear/Battery Well, Sheet, Nellcor, Micropaq HD (5 GHz) | 408 with Nellcor |
| 640-1191-XX | Label, Rear/Battery Well, Sheet, ECG Only, Micropaq HD (5 GHz) | 406 ECG only |
| 500-0040-00 | Display, LCD, 320 x 200 | All |
| 630-0168-00 | Display Cushion | All |
| 020-0693-XX | Service Kit, Front Case Subassembly, 406 Contains: Upper housing with plastic window and keyboard Blank ID label (.75" x .25") | 406 ECG only |
| 020-0694-XX | Service Kit, Rear Case Subassembly Contains: Blank serial number label, serial number clear cover Lower housing with ECG flex cable | 406 ECG Only |
| 020-0695-XX | Service Kit, Front Case Subassembly, 408 Contains: Upper housing with plastic window and keyboard Blank ID label (.75" x .25") | 408 with Masimo or Nellcor |
| 020-0696-XX | Service Kit, Rear Case Subassembly Contains: Blank serial number label, serial number clear cover Lower housing with ECG and SpO ₂ flex cable | 408 Masimo or PPO+ |
| 020-0697-XX | Service Kit, Rear Case Subassembly Contains: Blank serial number label, serial number clear cover Lower housing with ECG and SpO ₂ flex cable | 408 with Nellcor |

Table 1. Service parts list

| Order Number | Item Description | Model |
|---------------------|--|--------------|
| 020-0698-XX | Service Kit, Front Case Subassembly Contains: Upper housing with plastic window and keyboard Blank ID label (.75" x .25") | 408 PPO+ |
| 020-0699-XX | Service Kit, Fasteners, Micropaq HD Contains: Main gasket (1) Teardrop screw covers (2) Rubber screw plugs(2) 4-40 x 3/8 panhead screws (4) 2-56 x 3/16 panhead screws (3) 2-56 x 7/8 panhead screws (2) Polyester screw cover (.62 ID) (2) Clear screw cover (.468 ID) (2) Clear BDM cover (1) | All |
| 020-0700-00 | Service Kit, SpO ₂ Connector Clip, Cover, and Screws Contains: 2-56 x 3/16 panhead screw DB9 SpO ₂ connector clip DB9 connector cover | All 408 |
| 020-0703-00 | Service Kit, Plastic, SpO ₂ Connector Cover and Screw Contains: SpO ₂ connector cover 2-56 x 3/16 panhead screw | 406 ECG only |

A

Micropaq exploded view

