

Vital Signs Monitor 300 Series

Service Manual



Model 53XXX

WelchAllyn[®]

Advancing Frontline Care[™]

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1 - Safety Summary

This safety summary, and all additional specific warnings and cautions located throughout the documentation, must be read and understood by all users of the Vital Signs Monitor Series 300 monitor.



Caution

End-user software service tools used for previous models of the VSM **must not be used** with the VSM Model 300 Series. This includes the “Custom Repair Software”, part number 130S29E, and any other RS232 utility other than the Welch Allyn Monitor Service Utility (840-0676-XX). Use of any tool other than this service utility may set the monitor in an undefined and unrecoverable state.

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

General Safety Considerations

Always consider the following safety points when using the monitor:

- Place the monitor and accessories in locations where they cannot harm the patient should they fall from a shelf or mount.
- Do not connect more than one patient to a monitor.
- Do not connect more than one monitor to a patient.
- Do not use the monitor in an MRI suite or hyperbaric chamber.
- Do not autoclave the monitor.
- Accessories can be autoclaved only if the manufacturer’s instructions clearly approve it. Many accessories can be severely damaged by autoclaving.
- Inspect the power adapter cord periodically for fraying or other damage. Replace the adapter as needed. Do not operate the monitor from mains power if the adapter, the adapter cord, or the cord plug are damaged.
- Frequently check all cables, both electrically and visually.
- To avoid explosion, do not operate the monitor in the presence of flammable anesthetics.
- To ensure patient safety, use only accessories recommended or supplied by Welch Allyn. (See the *Products and Accessories Guide*, part number 810-0409-XX.) Always use accessories according to your facility’s standards and according to the manufacturer’s recommendations and instructions. Always follow the manufacturer’s directions for use.

- A monitor that has been dropped or otherwise damaged or abused must not be used until it has been tested and verified by qualified service personnel for proper operation.
- If the monitor detects an unrecoverable problem, an error code and a brief message appear in the message display. Report all such errors to Welch Allyn.
- While under warranty, the monitor must be serviced only by a Welch Allyn service technician.

Electrostatic Discharge (ESD)



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

Consider all electrical and electronic components of the monitor as static-sensitive.

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




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





- Perform all service procedures in a static-protected environment. Always use techniques and equipment designed to protect personnel and equipment from electrostatic discharge.
- Remove static-sensitive components and assemblies from their static-shielding bags only at static-safe workstations—a properly grounded table and grounded floor mat—and only when you are wearing a grounded wrist strap (with a resistor of at least 1 megohm in series) or other grounding device.





- Use only grounded tools when inserting, adjusting, or removing static-sensitive components and assemblies.
- Remove or insert static-sensitive components and assemblies only with monitor power turned off.
- Insert and seal static-sensitive components and assemblies into their original static-shielding bags before removing them from static-protected areas.
- Always test your ground strap, bench mat, conductive work surface, and ground cord before removing components and assemblies from their protective bags and before beginning any disassembly or assembly procedures.








Symbols






The symbols illustrated on the following pages appear on the monitor or in this document.



Documentation Symbols	
	Indicates important information related to the current topic of discussion.
	Caution Indicates a condition or practice which, if continued or not corrected immediately, could cause damage to the equipment.
	Warning Indicates a condition or practice which, if continued or not corrected immediately, could lead to serious illness, injury, or death.

Certification and Operation Labels			
	This device has been tested and certified by the Canadian Standards Association International to comply with applicable U.S. and Canadian medical safety standards.		Urgent alarm notification (output to Nurse Call system)
	The CE Mark and Notified Body Registration Number signify that the device meets all essential requirements of the European Medical Device Directive 93/42/EEC.		Recycle used batteries properly and in accordance with local regulations. Do not dispose of batteries in refuse containers.











	<p>Australian Registered Importer</p>		<p>Sealed lead-acid battery, 6V 4 Ah</p>
	<p>Patient connections are Type BF, and protected against defibrillation.</p>		<p>Refer to the product documentation.</p>








<p align="center">Shipping, Storing, and Environment Labels</p>			
	<p>Keep this end of the package or shipping crate up.</p>		<p>Protect the monitor from exposure to rain.</p>
	<p>Fragile contents—handle with care.</p>		<p>Do not subject the monitor to altitudes outside these limits.</p>
	<p>Do not expose the monitor to relative humidity above this limit.</p>		<p>Limit stacking to this number of units.</p>
	<p>Do not expose the monitor to temperatures outside these limits.</p>		

<p align="center">Monitor Connector Labels</p>			
	<p>Temperature Probe Cable Connector</p>	<p>SpO₂</p>	<p>SpO₂ Sensor Cable Connector</p>
	<p>RS232 Cable Connector</p>		<p>AC Power Adapter Cable Connector</p>
	<p>Nurse Call Cable Connector</p>		<p>NIBP Hose Connector</p>

<p align="center">Printer Door Label</p>			
	<p>Press to open the printer door</p>		<p>Load paper this direction</p>

The monitor front panel controls are described in more detail throughout this document.

Front Panel Controls			
	Set alarm limits		Power on/off
	Silence alarms		Print patient data
 	Scroll up/down Scroll forward/back Increase/decrease value (The scroll icon appears as these two arrows in the documentation.)		Review patient data
	Set an NIBP automatic measurement interval		Start/stop an NIBP cycle (AUTO button)
	Cycle to the next menu selections		

Front Panel Displays and Indicators			
SYS DIA SpO₂	Systolic pressure Diastolic pressure Arterial hemoglobin oxygen saturation		Temperature
 /min	Pulse rate	pulse amplitude indicator	Pulse strength
message window	MAP (mean arterial pressure)		Neonatal
°C	Degrees Celsius		Pediatric
°F	Degrees Fahrenheit		Adult
M	Monitored temperature		AC power Battery charging (flashing) Battery charged (steady)
	Battery low Battery fully discharged		

2 - Overview

Purpose and Scope

This service manual is a reference for periodic preventive maintenance and corrective service procedures for the Vital Signs Monitor 300 Series.

Corrective service is supported to the level of field-replaceable units. These include some circuit-board assemblies and some subassemblies, case parts, and other parts. (See **Replacement Parts (page 77)** for a complete list of user-replaceable service parts.)



Repair and replacement of the main board is not supported. All service work on the main board must be performed by certified and qualified service personnel at an authorized Welch Allyn service center.



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



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

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

This guide applies only to the Vital Signs Model 300 Series. For servicing the previous (52000-series) version of the Vital Signs Monitor, refer to Welch Allyn service manual 95P445E, which is available on the TechView CD (900298-1).

Technical Support Services

Welch Allyn offers the following technical support services:

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

For information on any of these services, contact Welch Allyn at the customer-service numbers listed on **page 2**.

Returning Products

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



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, including a contact name and phone number; include 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

To ship the unit, 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.
- Use the original shipping carton and packing materials, or as close an approximation as possible.
- Include a packing list.
- Write the Welch Allyn RMA number with the Welch Allyn address on the outside of the shipping carton.

United States federal regulations require that any unit received by Factory Service must be free from blood-borne pathogens before processing. All incoming products are cleaned as well as possible, but products that cannot be effectively cleaned cannot be accepted for repair. Please thoroughly clean all organic residues from the product before shipment. This will ensure safe receipt, processing and repair, and will help expedite the return of your monitor.

Product Configurations

Model numbers for the configurations are as follows:

Model Number	Monitoring Parameters	Serial Number Prefix
53000	NIBP	JA
5300P	NIBP, Printer	
530T0	NIBP, Temperature	
530TP	NIBP, Temperature, Printer	
53N00	NIBP, SpO ₂	
53N0P	NIBP, SpO ₂ , Printer	
53NT0	NIBP, SpO ₂ , Temperature	
53NTP	NIBP, SpO ₂ , Temperature, Printer	

Recommended Service Intervals

Interval or Condition	Action Recommended	Procedure	Page
Every 6 - 24 months (per hospital protocols)	Complete functional test	Functional Verification	17
Battery does not hold a charge	Check battery capacity	Functional Verification	17
	Replace battery	Disassembly Procedure	43
Monitor has been dropped or otherwise damaged	Complete functional test	Functional Verification	17
Monitor malfunctioning	Complete functional test	Functional Verification	17
Monitor does not pass Functional Verification	Troubleshooting and repair followed by functional test	Troubleshooting and Repair	37
	Return to authorized service center	Disassembly Procedure Functional Verification	43 17

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 \(page 12\)](#).



Caution Unauthorized repairs will void the product warranty.

Non-Warranty Service

Welch Allyn 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.

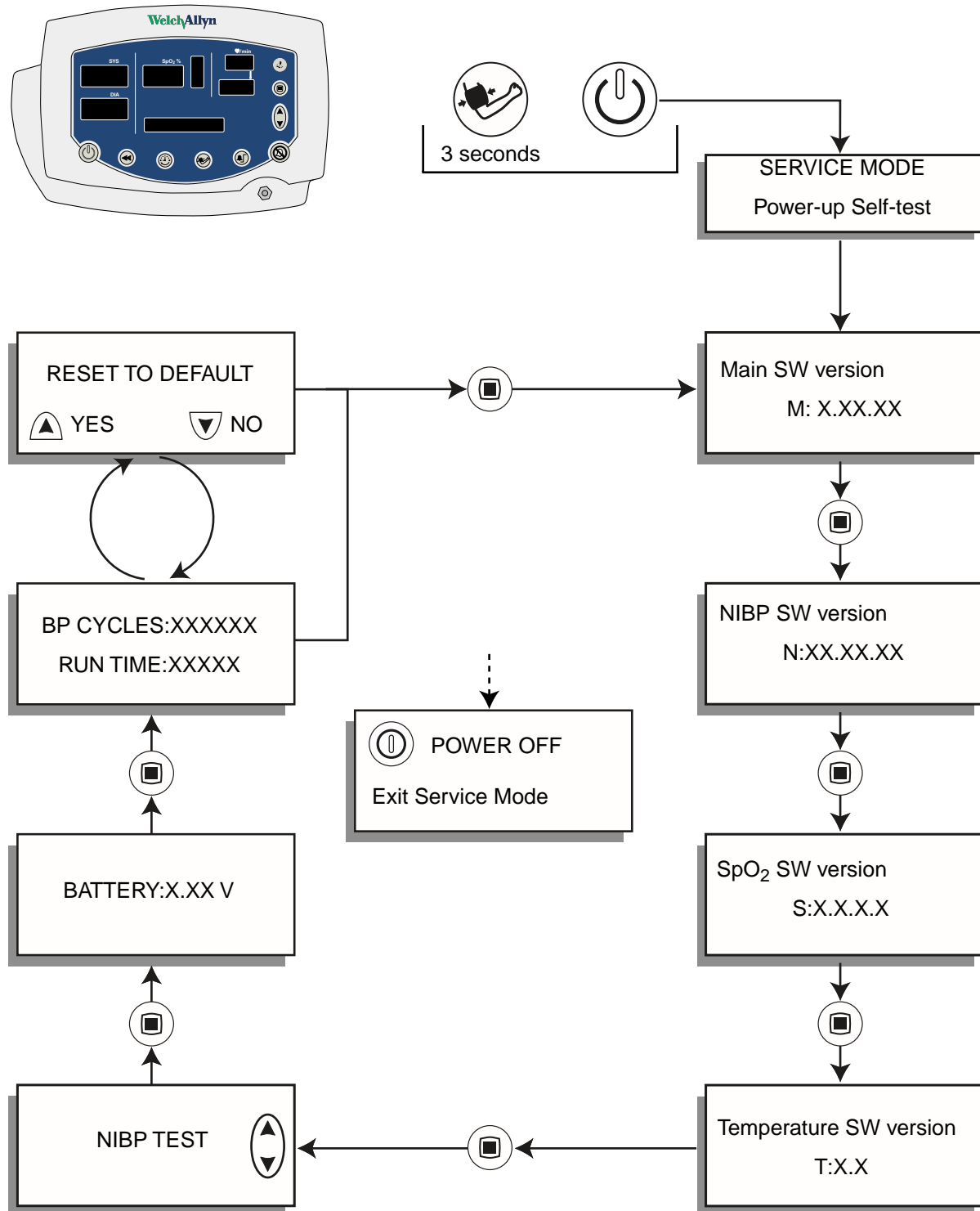
The Welch Allyn Monitor Service Utility supports certain service functions. For information, see [page 40](#).

Related Documents

Title	Part Number	Reorder Number
Vital Signs Monitor 300 Series Directions for Use (English)	810-1632-XX	810-1726-XX
Vital Signs Monitor 300 Series Directions for Use (French)	810-1716-XX	810-1727-XX
Vital Signs Monitor 300 Series Directions for Use (Spanish)	810-1715-XX	810-1729-XX
Vital Signs Monitor 300 Series Directions for Use (German)	810-1713-XX	810-1728-XX
Vital Signs Monitor 300 Series Directions for Use (Italian)	810-1712-XX	810-1725-XX
Welch Allyn Parts and Accessories Guide	810-0409-XX	810-0409-XX

Service Menu

To see the service menu, first power the monitor off. Press and hold  for 3 seconds. While  is depressed, press . The monitor displays the message **Service Mode**, runs a self-test, and then displays the main software version number (**M: 1.00.00**). Press  repeatedly to cycle to the menu selection of interest.



3 - Functional Verification

Functional Verification Overview

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

The verification includes tests for a monitor configured with the printer, temperature, and SpO₂ options. Perform only the tests applicable to the actual configuration.

A checklist of the functional tests is provided on [page 35](#). It is recommended that you print a copy of the checklist each time you perform the functional verification procedure, so that you can record and save the test results. If the monitor ever requires service, the records of test results can often facilitate troubleshooting.

Functional verification does not require opening the monitor case.

Equipment Required

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

Commercially Available General-purpose/Medical Test Equipment	
Item	Manufacturer Part Number/Specification
Power supply	Variable, 0-8 VDC, 0.75A (minimum), with voltage and current indicators (for 1mA current measurement)
Digital pressure meter	Netech Digimano 1000 or equivalent
AC withstand voltage (hi-pot) tester	Associated Research 3605 or equivalent
SpO ₂ functional tester (for testing the monitor only)	Nellcor SRC-MAX
SpO ₂ extension cable (required for SRC-MAX)	Nellcor DEC-8
SpO ₂ simulator (for testing the monitor and the SpO ₂ sensor)	Fluke (Biotek) Index2 XL/XLFE or equivalent
Syringe, 60 mL, Slip tip, Luer	BD (Becton, Dickinson) 309654 or equivalent
Hi-pot cable connectors	See page 34 .
Timer	

Welch Allyn Accessories and Test Equipment	
Temperature test key (for testing the monitor only)	06138-000
9600 Temperature calibration tester (for testing the monitor and the temperature probe)	01800-210, 110V 01800-500, 220V 01800-810, 220V UK 01800-910, 220V Australia
Neonatal cuff hose, 96"	008-0265-XX
Neonatal #1 cuff, disposable, box of 10	008-0620-XX
500 cc air volume	T112854
DC power adapter	5200-101A
Battery substitution connector (Use the female end from the cable set)	660-0237-XX
Welch Allyn Monitor Service Utility (required for NIBP repair or replacement; not required for functional testing)	840-0676-XX
Service Serial Cable (for use with the Welch Allyn Monitor Service Utility 840-0676-XX)	008-0842-XX
NIBP tubing connector, threaded	600-0021-XX
tubing, 1'	600-0179-XX
Tee, plastic	600-0043-XX



Functional Verification Procedure

System/Power

Setup


- If the monitor is configured with the temperature option, connect the temperature probe and insert it into the probe well.
- If you are using the optional Welch Allyn Model 9600 Calibration Tester (01800-200), plug it in and set it to 96.4° F (35.8° C).
- If the monitor is configured with the SpO₂ option, connect the SpO₂ sensor.


Battery Charge and Beeper

1. Disconnect the power adapter from the monitor.
2. Verify that the charge LED  is off.
3. Connect the power adapter. The monitor emits a single beep tone.
4. Verify that the charge LED  is on.



Depending on the charge level of the battery, the charge LED may be either flashing or steady.

 flashing indicates that the monitor is running on AC, the battery is charging, and the battery is charged to less than 90% capacity.

 steady indicates that the monitor is running on AC, the battery may or may not be charging, and the battery is charged to at least 90% capacity.

Battery Substitution Cable Setup

1. Disconnect the power adapter.
2. Remove the battery cover and remove and disconnect the battery.
3. Separate the connector pair (660-0237-00). Use the end that is identical to the connector on the battery as a battery substitution test cable.
4. Connect the open-ended red (+) and black (-) wires of this cable to the variable DC power supply.
5. Set the power supply to 6.0 V ± 50 mV.
6. Connect the test power cable to the battery connector on the monitor.

Monitor-Off Current

With the monitor powered down, verify that the current draw from the power supply is less than 1 mA.

Power-On Self-Test

1. Power the monitor on.



If the monitor displays error E38, power the monitor off and then power it on again.

2. Verify that the start-up tone (double beep) is audible.
3. Verify that all front-panel lights (background indicators, LCD pixels, and LED segments and periods) come on in the proper order: left, center, and right.

Initialization/Idle Mode Current






If your monitor is configured without the temperature option and without the SpO₂ option, skip these steps and proceed to **Baseline Current Draw**.

1. If the temperature option is present:
 - a. Verify that the temperature probe is in the probe well.
 - b. Set the temperature mode to MONITOR.
 - c. Remove the temperature probe from the probe well.
 - d. Verify that the temperature reading appears within 4 seconds.
 - e. Do not return the probe to the probe well.
2. If the SpO₂ option is present:
 - a. Verify that the SpO₂ sensor cable is connected to the monitor.
 - b. Verify that the current draw from the bench power supply is less than 800 mA.
3. Disconnect the SpO₂ sensor (if equipped).
4. Insert the temperature probe (if the monitor is so equipped) into the probe well.

Baseline Current Draw

1. With the monitor powered on, wait for the monitor LEDs to blank. In this state, the SpO2 % reads - -, the time of day is displayed in the message window, and the rest of the displays are blank.
2. Note and record the exact current from the power supply. (This value will be used in the NIBP and printer tests.)

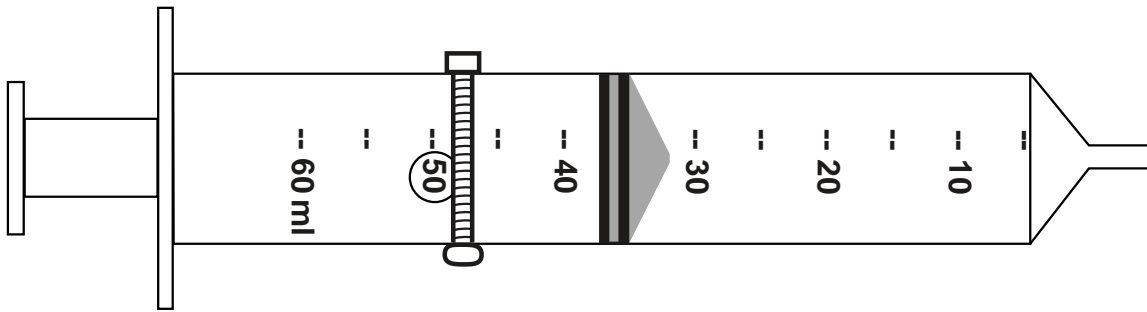
Battery Voltage





1. Power the monitor off.
2. Simultaneously press and hold  and  to bring up the monitor in SERVICE MODE. (When the monitor completes the power-on self-test in service mode, the main software version number appears in the message display.)
3. Press  repeatedly until BATTERY VOLTAGE appears in the message display.
4. Verify that the displayed battery voltage is within 0.1 volt of the DC power supply input.
5. Exit Service Mode by turning off the monitor and then turning it on again.

NIBP

Characterization Test

1. Attach a neonate hose (part 008-0265-01) to the NIBP fitting on the monitor.
2. Prepare the 60-mL syringe as follows, with reference to the illustration below:
 - a. Move the syringe plunger to the 35 mL line.
 - b. Drill a small hole (for example, 9/64") through the syringe and the plunger shaft, at a location between the plunger and the top of the syringe.
 - c. Insert a rod or bolt (for example, a 6-32 screw) through the hole so that the plunger cannot move, creating a constant volume in the syringe of 35 mL \pm 2 mL. Secure the rod or bolt so that it cannot fall out of the hole.




3. Insert the tip of the syringe into the open end of the neonate hose, and verify that the fit is tight and secure.
4. Set the monitor patient type to **Adult**, as follows:
 - a. Press  once.
 - b. If the monitor is not already in **Adult** mode, press  once or twice until **Adult** appears in the message display.
 - c. Press .
5. Press .
6. Verify that the error code **C03** appears in the message display within a few seconds.




Warning If the error code C03 does not appear, characterize NIBP according to the instructions presented on [page 41](#), and then repeat the NIBP characterization test.

Do not use the monitor if it does not pass the NIBP characterization test. If the NIBP module is not properly characterized, the monitor could overinflate a neonatal cuff, which could create a hazard for neonatal patients.

If you cannot characterize the NIBP module, remove the monitor from service immediately and return it to Welch Allyn for service. (See [Returning Products](#) on [page 12](#).)

7. Put the monitor in Service mode as follows:
 - a. Power the monitor off.
 - b. Power the monitor on while pressing .


Verification


1. Attach a #1 neonatal cuff and hose to the monitor. Wrap the cuff securely around a solid cylindrical object of circumference between 1.6 and 1.9 inches (4.1 and 4.8 cm).
2. Press  repeatedly until **NIBP TEST** appears on the LCD and **0** is displayed on the SYS and DIA LEDs.



When you first enter the NIBP test mode, give the monitor about a minute to initialize NIBP before you change the target test pressure.

When switching from one target pressure to the next, give the monitor time to fully inflate and stop before you select the next target pressure.

In the NIBP test mode, press  repeatedly to select the target NIBP test pressure. The target pressure is displayed on the DIA LEDs. The measured instantaneous pressure determined by the monitor is displayed on the SYS LEDs.

3. Press  once to select 80 mmHg (10.7 kPa). The cuff inflates to approximately 115 mmHg (15.3 kPa).



In the NIBP test mode, and especially at small test volumes, the pressure achieved can vary significantly (30-40 mmHg or 4-5.3 kPa) from the target pressure.




4. Wait 15 seconds, and note the current pressure.

5. Wait another 10 seconds, note the current pressure, and verify that it has not dropped more than 8 mmHg (1.1 kPa) below the pressure noted in **step 4**.
6. Press **▲** several times to select 0 mmHg (0 kPa). The valve opens to release pressure.
7. Disconnect the neonate cuff and replace it with the 500 cc volume test setup.






8. Press **▲** once to select 80 mmHg (10.7 kPa). The cuff quickly inflates to approximately 80 mmHg (10.7 kPa), and then settles at a slightly lower pressure level. Wait a few seconds for the pressure to stabilize.
9. Verify that the value displayed in SYS is within 3 mmHg (0.4 kPa) of the value displayed on the digital pressure meter.
10. Press **▲** to select 150 mmHg (20 kPa) target pressure. The cuff quickly inflates to approximately 150 mmHg (20 kPa), and then settles at a slightly lower pressure level. Wait a few seconds for the pressure to stabilize.
11. Verify that the value displayed in SYS is within 3 mmHg (0.4 kPa) of the value on the digital pressure meter.
12. Press **▲** to select 300 mmHg (40 kPa). The cuff quickly inflates to approximately 300 mmHg (40 kPa), and then settles at a slightly lower pressure level. Wait a few seconds for the pressure to stabilize.
13. Verify that the value displayed in SYS is within 6 mmHg (0.8 kPa) of the value on the digital pressure meter.


Valve/Pump Current

1. Press  to select 0 mmHg (0 kPa) target pressure.
2. While watching the current meter, press  to select 80 mmHg (10.7 kPa) target pressure.
3. Note the highest current reading during inflation.
4. While the pump is running, verify that the reading on the current meter is not more than 750 mA above the current level noted in **step 2** of the **Baseline Current Draw** verification test (**page 21**).
5. Press  three times to select 0 mmHg (0 kPa) target pressure.

Inflation

1. Press  once to select 80 mmHg.
2. Wait for the pump to start and stop.
3. Press  once to select 150 mmHg.
4. Wait for the pump to start and stop.
5. Bleed the pressure to 0 mmHg by disconnecting the hose from the monitor.
6. Reconnect the hose to the monitor.
7. Have a timer ready.
8. Press  once to select 300 mmHg, and immediately observe the manometer.
9. As soon as the manometer reads 5 mmHg, start the timer.
10. When the manometer reaches 250 mmHg, stop the timer.
11. Verify that the elapsed time (**step 10—step 9**) is less than 8 seconds.


Pressure Dump

1. While the pressure is still at approximately 300 mmHg (as shown by the manometer and the SYS window), press  once to select 0 mmHg, and immediately start the timer.
2. Wait 10 seconds; then verify that the manometer reads less than 15 mmHg.
3. Disconnect the hose from the monitor.



For monitors with a printer option, proceed with the Printer Test section. Otherwise, exit the Service Menu by switching the monitor power off and back on, and then proceed to **SpO2** on **page 28**.

Printer

1. Put the monitor into Service Mode.
2. Verify that the printer has paper.
3. Press . Verify that a settings report prints, and that it contains no printed anomalies and no missing or faded sections.



With a new roll of paper, the first line might be faded. This does not indicate a problem.



The settings report (as shown in the example on [page 26](#)) contains a calibration record, user record, hardware status record, and software versions record.

- The calibration record includes manufacturing configuration data: monitor serial number, set parameters, and language.
 - The user record includes user-configurable settings: alarm limits, patient type, parameter modes/units, auto interval, tone volume, and others.
 - The hardware status record shows the hardware revision number, the battery voltage level, the total number of NIBP monitoring cycles completed on the monitor, and the total number of hours of operation of the monitor.
 - The software versions record indicates the software version numbers of the main board, SpO₂ and Temperature options (if present), and NIBP.
4. After 2 seconds of printing, verify that the current draw is no more than 2.5A above the baseline current recorded in [step 2](#) of the [Baseline Current Draw](#) verification test ([page 21](#)).
 5. Exit the Service Mode.

```

Welch Allyn (R)
Vital Signs Monitor
-- Unit Settings --
13:04:21          15-Oct-2003
    
```

Calibration Record

```

-----
Serial #:          XXXXXX.XXXX
Serial # signature:  NULL
Calibration time/date
    12:00:00      01-Jan-2000
Calibration signature  NULL
Language:          ( 0) English
Configuration
    SpO2   =   1      Temp =   1
    Printer =   1
Ambient bias (K)          X.XX
SpO2 valid ver.:        X.X.X.X
Temp valid ver.:        X.X
NIBP valid ver.:      XX.XX.XX XXXXXX
    
```

User Record

Alarm Settings

```

    High Sys (0.01 mmHg):  220
    Low Sys (0.01 mmHg):   75
    High Dia (0.01 mmHg):  110
    Low Dia (0.01 mmHg):   35
    High MAP (0.01 mmHg):  120
    Low MAP (0.01 mmHg):   50
    High PR (bpm):         120
    Low PR (bpm):          50
    High O2 (%):           0
    Low O2 (%):            85
Patient type (A, P, N):   A
BP Units (mmHg, kPa):    mmHg
Target press (0.01 mmHg) 160
Auto interval:           15
MAP (On, Off):           Off
Temperature units (C, F): F
Temperature mode (P, M): P
Pulse tone volume       :   3
Clinical pause (msec)    0
Print button mode (B, S) B
    
```

H/W Status

```

-----
Hardware revision:        X
Battery voltage (mv)     XXXX
    
```

```

    Total Cycles      Total Runtime
    -----
    XXXXXXX          XXXX (hrs)
    
```

S/W Versions

```

-----
Unit:   X.XX.XX XXXXX
SpO2:  X.X.X.X
Temp:   X.X
NIBP:  XX.XX.XX XXXXXX
-----
-----
    
```

SpO₂

Perform one of the following two SpO₂ tests.

Testing the Monitor Only

Use this procedure to test only the monitor SpO₂ function.

1. Power the monitor off.
2. Connect the Nellcor SRC-MAX SpO₂ functional tester to the SpO₂ input connector through a Nellcor DEC-8 extension cable.
3. Power the monitor on.



In the following tests, if the SRC-MAX defaults are outside the monitor alarm limits, readjust the limits or silence the alarms.

4. Verify the following on the SRC-MAX:
 - At least some of the LEDs flash
 - SRC-MAX initializes to a default condition where the four test parameter LEDs are lit closest to their selector buttons
 - The default pulse rate is 60 bpm and the default SpO₂ is 75%
5. Give the monitor up to 30 seconds to stabilize, and verify a displayed pulse rate of 60 ± 3 bpm and a displayed SpO₂ of $75 \pm 3\%$.
6. Set the SRC-MAX pulse rate to 200 bpm.
7. Give the monitor up to 30 seconds to stabilize, and verify a displayed pulse rate of 200 ± 3 bpm.
8. Switch the SRC-MAX SpO₂ saturation percentage to 90.
9. Give the monitor up to 30 seconds to stabilize, and verify a displayed SpO₂ saturation level of $90 \pm 3\%$.
10. Disconnect the SRC-MAX.

Testing the Sensor with the Monitor

Use this procedure to test the monitor SpO₂ function while verifying a sensor.

1. Set the BioTek Index2 SpO₂ simulator as follows:

SpO₂ manufacturer type Nellcor (MP-506A)

% SpO ₂	94
Rate	60 (Motion Artifact not selected)

2. Connect an SpO₂ sensor to the simulator optical finger and to the monitor.
3. Wait for the monitor display to stabilize.
4. Verify an SpO₂ saturation level of 94 ± 4 .
5. Verify that the monitor displays a pulse rate of 60 ± 4 .

Temperature

Perform one of the following temperature tests.

Testing the Monitor Only

Use this procedure to test only the temperature function.

1. With the temperature probe in the well, disconnect the probe cable from the temperature input connector on the rear of the unit.
2. Connect the Welch Allyn Sure Temp Plus temperature test key (06138-000) to the temperature input connector.
3. Remove the probe from the well.
4. Verify that the displayed temperature is 97.3 ± 0.2 °F (36.3 ± 0.1 °C).

Testing the Probe with the Monitor

Use this procedure to test the temperature function while verifying the temperature probe.

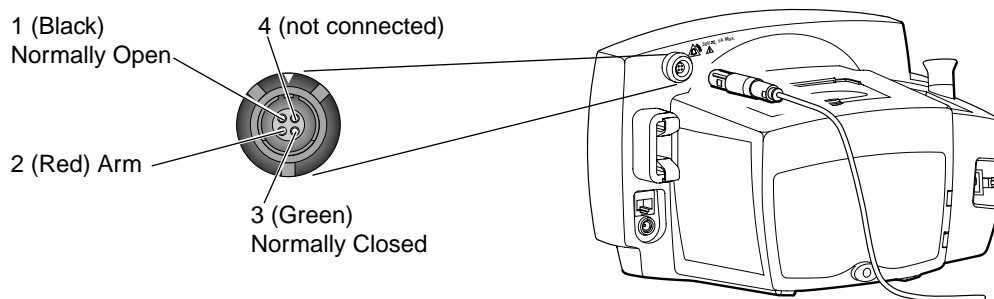
1. If the Welch Allyn 9600 Calibration Tester (01800-200) is not already warmed up, warm it up as follows:
 - a. Set the 9600 Calibration Tester temperature switch to 96.4 °F (35.8 °C).
 - b. Plug the power adapter into the 9600 Calibration Tester; wait (up to 15 minutes) until the tester 'ready' indicator light is on continuously.
2. Set the monitor temperature mode to Monitored.
3. Insert the temperature probe (without probe cover) into the small thermometer hole on the dry-heat well of the 9600 tester.
4. Wait two minutes and verify that the reading displayed on the monitor is 96.4 ± 4 °F (35.8 ± 2 °C).
5. Switch the 9600 Calibration Tester to 106.0 °F (41.1 °C) and wait about five minutes for the 'ready' indicator to light.
6. Verify that the reading displayed on the monitor is 106.0 ± 0.4 °F (41.1 ± 0.2 °C).
7. Remove the probe from the tester and replace it in the probe well.
8. Disconnect the 9600 Calibration Tester.

Nurse Call

Relay Verification

With reference to the drawing and table below, use an ohmmeter to check the contact resistance at the output pins of the Nurse Call connector, while the monitor is in the alarm state and while the monitor is out of the alarm state.





When the Nurse Call verification is done, disconnect the Nurse Call cable and turn off the monitor.




Pins	Resistance (Alarm OFF)	Resistance (Alarm ON)
1-2	> 1 M Ω	< 1 Ω
2-3	< 1 Ω	> 1 M Ω



Putting the Monitor into the Alarm State


To create an alarm condition for testing the Nurse Call relay, follow these steps.

1. Press  repeatedly until **INTERVAL ST** appears in the message display.
2. Wait for the pump to charge twice (about 10 seconds), and verify that error code **C04** appears in the **SYS** display.
3. Verify that the Nurse Call circuit is shorted. (Refer to the table shown above.)
4. Press .
5. Verify that the Nurse Call circuit is open. (Refer to the table shown above.)
6. To exit the alarm state, press  repeatedly until **INTERVAL 15** appears in the message display, and then press .



Battery

1. Disconnect the battery substitution-cable connector.
2. Install and connect the battery.
3. Connect the AC power adapter to the monitor.
4. Verify that the AC mains indicator  is illuminated on the monitor front panel.

The indicator could be flashing or steady, depending on the state of the battery.  flashing indicates that the battery is charging;  steady indicates that the battery is charged to at least 90% capacity.

5. Charge the battery for a minimum of 12 hours (until  stops flashing).
6. Turn the monitor on and set it up as follows:

NIBP Auto Interval	OFF
Printer, if present	OFF (not printing)
SpO ₂ sensor (if SpO ₂ option is present)	Disconnected
Temperature probe (if temperature option is present)	Either connected or disconnected

7. Note the time and let the monitor run until **low battery** ( flashing) is indicated.
(Run time for a new, fully charged battery is at least 12 hours.)
8. Charge the battery for a minimum of 12 hours (until  stops flashing).

Patient Isolation Test

Patient Isolation Test - Overview

To verify proper patient isolation, it is important to run this test following any procedure in which the monitor is opened.



Warning Failure to run the dielectric test when indicated could cause serious injury to patients, and could lead to damage to the monitor.

The patient isolation test requires an AC Withstand Voltage (hi-pot) Tester, such as the AR 3605 or equivalent. If this equipment is not available, Welch Allyn can perform the patient isolation test for you quickly, for a nominal fee.



Warning The patient isolation test involves exposure to extremely high voltages, and is therefore extremely hazardous.

Always follow the tester manufacturer's operation instructions exactly. Failure to perform this test properly can result in serious injury or death.

This test must be performed by qualified service personnel only.

Run this test only on an insulated table top, and away from other people and equipment.



To create test cables for the patient isolation test, see [page 34](#).

Patient Isolation Test - Procedure

1. Set up the test parameters on the AC Withstand Voltage Tester as follows:



Refer to the tester manufacturer's operation manual for complete details on setup and use.

Parameter	Specification
Voltage	1500 Vac
Maximum Limit	2.50 mA
Minimum Limit	0.038 mA
Ramp Up	5.0 S
Dwell	5.0 S
Delay	0
Ramp Down	0
Arc Sense	0
Frequency	local line (50 Hz or 60 Hz)
Continuity	Off
Connect	Off



To create test cables for this procedure, see [page 34](#).

2. Connect the hi-pot DC input test cable between the HV output jack on the tester and the DC input connector of the monitor.

3. Connect the hi-pot Nurse Call test cable between the nurse call connector and the return output jack on the hi-pot tester.
4. Press the test button to run the AC withstand voltage test.
5. Verify that the monitor passed the test. (If the input current never exceeds 2.50 mA, the shielding is sufficient.)
6. Remove the Nurse Call test cable.
7. Connect the hi-pot RS232 test cable between the RS232 connector and the return output jack on the hi-pot tester.
8. Press the test button to run the AC withstand voltage test.
9. Verify that the monitor passed the test. (If the input current never exceeds 2.50 mA, the shielding is sufficient.)
10. Remove the hi-pot RS232 test cable from the RS232 connector and the hi-pot tester.
11. Connect the SpO₂ test cable between the SpO₂ connector and the return output jack on the hi-pot tester.
12. Push the test button to run the AC withstand voltage test. Verify that the monitor passed the test. (If the input current never exceeds 2.50 mA, the isolation is sufficient.)

Hi-Pot Test Connections

Cable	Monitor Connection		Hi-Pot Tester Connection	
	Connector/Cable	Connect to	Wiring	Connect to
DC Input	Switchcraft 760 0.100" ID 0.218" OD	DC Input Connector	Both wires connected together and terminated appropriately for your hi-pot tester	Return
SpO ₂	Nellcor D-connector (DEC-8 or other OXI-MAX equivalent)	SpO ₂ Input Connector	All wires connected together and terminated appropriately for your hi-pot tester	High Voltage
RS232	RJ45/standard patch cable	Communication Connector	All wires connected together and terminated appropriately for your hi-pot tester	High Voltage
Nurse Call	Welch Allyn Nurse Call cable 008-0634-XX (Uses Lemo connector PAB.MO.4GLAC397.)	Nurse Call Connector	All wires connected together and terminated appropriately for your hi-pot tester	High Voltage

Checklist and Test Results Report Form

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

✓	Test	Result	Pass (or N/A) ✓	Fail ✓
	Battery Charging			
	Power-on Self-test			
	Beeper			
	Monitor Off Current	(mA):		
	Init/Idle Current	(mA):		
	Baseline Current	(mA):		
	Battery Voltage	Monitor (V): DMM (V):		
	NIBP Characterization Test			
	NIBP Verification			
	Pressure Leakage	Before (mmHg): After (mmHg):		
	Pressure Accuracy	80 mmHg SYS: Manometer:		
		150 mmHg SYS: Manometer:		
		300 mmHg SYS: Manometer:		
	Valve/Pump Current	Valve/Pump (mA) Baseline (mA) Difference (mA)		
	Inflation	Elapsed time (sec):		
	Dump	Manometer reading (mmHg):		
	Printer Current	Peak (mA):		
	SpO ₂	Saturation (%): Pulse (bpm):		
	Temperature	° Fahrenheit: ° Celsius:		
	Nurse Call Relay	pins 1-2 Alarm (Ω) No Alarm (Ω)		
		pins 2-3 Alarm (Ω) No Alarm (Ω)		
	Battery Charge Time			
	Battery Discharge Time			

Monitor Serial #:
Tested by:
Test date:

Here is an example of verification results for a typical monitor.

✓	Test	Result	Pass (or N/A) ✓	Fail ✓
✓	Battery Charging	charge symbol lit	✓	
✓	Power-on Self-test	normal	✓	
✓	Beeper	audible	✓	
✓	Monitor Off Current	(mA): 0.00	✓	
✓	Init/Idle Current	(mA): 0.467 mA	✓	
✓	Baseline Current	(mA): 0.199 mA	✓	
✓	Battery Voltage	Monitor (V): 5.94 V DMM (V): 5.95 V	✓	
✓	NIBP Characterization Test	C03	✓	
✓	NIBP Verification		✓	
✓	Pressure Leakage	Before (mmHg): 100 After (mmHg): 99	✓	
✓	Pressure Accuracy	80 mmHg SYS: 73 Manometer: 72	✓	
		150 mmHg SYS: 142 Manometer: 140		
		300 mmHg SYS: 290 Manometer: 286		
✓	Valve/Pump Current	Valve/Pump (mA) 0.560 Baseline (mA) 0.199 Difference (mA) 0.361	✓	
✓	Inflation	Elapsed time (sec): 6	✓	
✓	Dump	Manometer reading (mmHg): 0 (3 sec)	✓	
✓	Printer Current	Peak (mA): 0.940 mA	✓	
✓	SpO ₂	Saturation (%): 90 Pulse (bpm): 200	✓	
✓	Temperature	° Fahrenheit: 105.9 ° Celsius:	✓	
✓	Nurse Call Relay	pins 1-2 Alarm (Ω) > 1M No Alarm (Ω) < 1	✓	
		pins 2-3 Alarm (Ω) < 1 No Alarm (Ω) > 1M		
✓	Battery Charge Time	12.5 h	✓	
✓	Battery Discharge Time	19 h	✓	

Monitor Serial #: 9786756453
Tested by: RJ
Test date: 12/18/2003

4 - Troubleshooting and Repair

Troubleshooting Chart

This troubleshooting chart includes error codes 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	Suggested Action
Monitor does not power up.	Power adapter not powered. Defective power adapter. Battery is fully discharged. Battery fuse open.	Verify that the power adapter is plugged into the AC source and the monitor. Replace the power adapter. Run the battery verification test; replace the battery if necessary. Replace the battery.
Battery run time is low.	Defective battery	Replace the battery.
NIBP air leak exceeds specified limits.	Leaky check valve.	Replace the check valve.
Repeated C03 error code.	NIBP internal tubing is kinked.	Route tubing properly through the monitor.
Repeated C04 error code.	NIBP internal tubing is disconnected. Faulty NIBP module.	Properly connect the NIBP tubing. Replace the NIBP module. Warning: Always characterize NIBP after replacing any NIBP component. (See page 39.)
Repeated C07 error code.	Incompatible SpO ₂ sensor. Faulty SpO ₂ sensor. Improperly connected SpO ₂ sensor. Faulty SpO ₂ board.	Use a compatible sensor. Replace the sensor. Properly connect the sensor cable. Replace the SpO ₂ board.
Repeated C20 temperature error code.	Probe well is not installed in the probe-well housing. Faulty probe. Faulty temperature board.	Install the probe well in the probe-well housing. Replace the probe. Replace the temperature board.
Error code E30	PROM is corrupt.	Return the monitor to an authorized service center for PROM programming.

Symptom	Possible Cause	Suggested Action
Error code E31	RAM test failure.	Cycle the power. If the error persists, return the monitor to an authorized service center for replacement of the main board.
Error code E32	Factory data failure.	Return the monitor to an authorized service center for replacement of the main board.
Error code E33	User data error.	Cycle the power to reset all user settings to default values.
Error code E34	A/D converter failure.	Cycle the power. If the error persists, return the monitor to an authorized service center for replacement of the main board.
Error code E35	SpO ₂ module failure.	Verify all cable connections, and then cycle the power. If the error persists, replace the SpO ₂ board.
Error code E36	Temperature module failure.	Verify all cable connections, and then cycle the power. If the error persists, replace the temperature board.
Error code E37	Printer failure.	Verify all cable connections, and then cycle the power. If the error persists, replace the printer module.
Error code E38	Error E38 always occurs when the monitor is first powered after a battery has been connected. Real-time clock failure.	Cycle the power, and then reset the date and time. Cycle the power. If the error persists, return the monitor to an authorized service center for replacement of the main board.
Error codes E40 and E41	NIBP module failure.	Verify all cable connections, and then cycle the power. If the error persists, replace the NIBP module. Warning: Always characterize NIBP after replacing any NIBP component. (See page 39.)
Error code E44	POST queue full.	Cycle the power. If the error persists, return the monitor to an authorized service center for replacement of the main board.
Missing LED display.	LED failure on the display board.	Replace the display board.
Erroneous LCD characters.	LCD partially connected.	Fully connect the LCD to the main board.
Buttons on the right side of the monitor require noticeably more pressure to actuate.	Screws attaching the display board to the front panel are loose.	Tighten the screws. Do not exceed 4 lbf/in.

Requirements for Module-level Repair and Replacement



All repairs to a monitor under warranty must be performed at an authorized Welch Allyn service center.

Activity	Recommended Action
Update the software	Return the monitor to an authorized service center.
Replace the main board	Return the monitor to an authorized service center.
Replace the NIBP module.	Replacement procedure beginning on page 43 . Perform a complete functional verification (page 17). Warning: Always characterize NIBP after replacing any NIBP component. (See page 39.)
Replace the SpO ₂ board	Replacement procedure beginning on page 43 . Perform a complete functional verification (page 17).
Replace the SpO ₂ side panel.	Replacement procedure beginning on page 43 . Perform a complete functional verification (page 17).
Replace the temperature board.	Replacement procedure beginning on page 43 . Perform a complete functional verification (page 17).
Replace the printer.	Replacement procedure beginning on page 43 . Perform a complete functional verification (page 17).
Replace the front panel.	Replacement procedure beginning on page 43 . Perform a complete functional verification (page 17).

NIBP Characterization



Warning Whenever any component of the NIBP assembly (pump, air filter, check valve, tubing, or NIBP board) is replaced, the NIBP module must be characterized before the monitor is returned to service.

If the NIBP module is not properly characterized, the NIBP cuff could overinflate, which could be hazardous to neonatal patients.

The Welch Allyn Monitor Service Utility facilitates this characterization procedure. See [page 40](#) for more information.

Welch Allyn Monitor Service Utility

Monitor Software Utility Introduction

The Welch Allyn Monitor Service Utility (840-0676-XX) is a software tool that provides the following end-user service functions:

- Download, save, and print monitor event log files.
- Characterize NIBP. Characterization sets the NIBP module for specific system pneumatic volume, and is required after replacement of any NIBP component (pump, tubing, air filter, check valve, or circuit-board assembly).



Characterization does not support the replacement of any components—including transducers—of the NIBP module. Do not attempt repair of the NIBP module; it must be replaced as an assembly.



The Welch Allyn Monitor Service Utility requires the serial cable/DB9F adapter 008-0842-XX or equivalent.

Monitor Software Utility Installation

To install the Welch Allyn Monitor Service Utility on a PC, insert the CD into the CD drive.

- If Autostart is enabled on the PC, the installation program starts automatically.
- If Autostart is not enabled on the PC, manually start the installation program as follows:

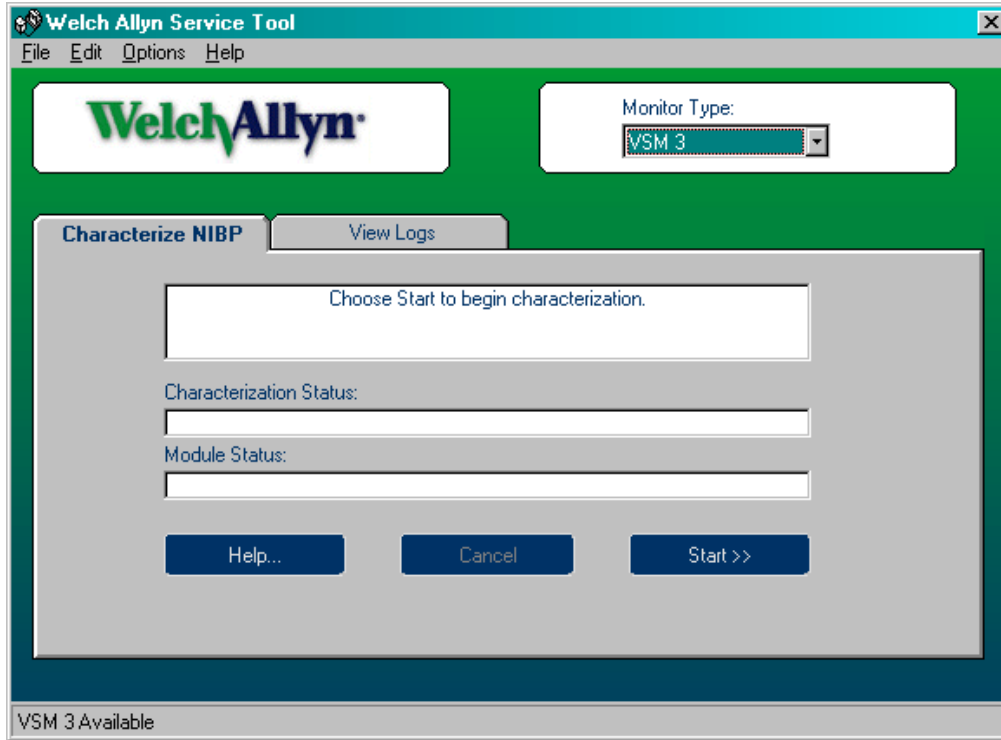
```
Start > Run N:\Setup.exe  
(where N: is your CD drive)
```

Monitor Software Utility Setup

1. Install the cable between the serial port on your PC and the RS232 port on the monitor.
2. Connect the power adapter to the monitor.
3. Turn on the monitor.

Characterizing NIBP

To characterize the NIBP module, start the Welch Allyn Monitor Service Utility and click on **Characterize NIBP**.



Click **Help** in the utility menu, and perform the procedure as indicated.



Warning If you cannot characterize the NIBP module, return the monitor to Welch Allyn for service. (See **Returning Products** on [page 12](#).)

Do not use the monitor if you cannot characterize the NIBP module. If the NIBP module is not properly characterized, the monitor could overinflate a neonatal cuff, which could create a hazard for neonatal patients.

5 - Disassembly Procedure

Procedures Overview

These procedures cover monitor disassembly and board removal. Unless otherwise noted, the assembly procedure is simply the reverse of the disassembly procedure.



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

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



Warning The battery can deliver currents sufficient to cause serious personal injury and to damage the monitor. When opening the monitor for any reason, always remove and disconnect the battery immediately, before proceeding with disassembly.

Screws



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

Following are recommended torque specs for all screws:

Qty	Location	Part Number	Type	Size/length	Torque
4	Battery Door	620-0399-00	Machine	#4-40, 5/16"	4 lbf/in.
3	Case	620-0399-00	Machine	#4-40, 5/16"	4 lbf/in.
5	Display Board	620-0393-00	Thread-forming	#4-20, 5/16"	4 lbf/in.
4	Main Board	620-0393-00	Thread-forming	#4-20, 5/16"	4 lbf/in.
4	NIBP Board	620-0393-00	Thread-forming	#4-20, 5/16"	4 lbf/in.
4	SpO ₂ Panel	620-0393-00	Thread-forming	#4-20, 5/16"	4 lbf/in.
2	SpO ₂ Board	620-0047-00	Machine	#6-32, 1/4"	4 lbf/in.
2	Printer	620-0165-00	Thread-forming	#2-28, 5/16"	3 lbf/in.
1	Printer Board	620-0165-00	Thread-forming	#2-28, 5/16"	3 lbf/in.
2	Printer door/roller	620-0091-00	Thread-forming	#2-32, 3/16"	3 lbf/in.
2	Temp. Module	620-0394-00	Machine	#4-40, 3/4"	4 lbf/in.
4	Temp. Panel	620-0393-00	Thread-forming	#4-20, 5/16"	4 lbf/in.
4	Temp Board	620-0393-00	Thread-forming	#4-20, 5/16"	4 lbf/in.

Connectors



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

Connector Types

The procedures described below require you to disconnect and reconnect ZIF (zero-insertion force) connectors, squeeze-release connectors, and pressure connectors.

Zero-insertion force (ZIF) Flex-cable Connectors

ZIF flex-cable connectors include J1 on the display board, CN2 on the printer board, J? on the temperature board, and J5 and J12 on the main board.

ZIF connectors use a sliding outer piece that latches and unlatches to secure and release the flex cable.

- To release a ZIF cable, slide the latching piece of the connector away from the connector body and toward the cable; the cable can then be removed without effort.
- To connect a ZIF cable, slide the latching piece of the connector body and toward the cable, insert the flex cable easily into the connector, and slide the latching piece back toward the connector body until it clicks into place.



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

Side-release Connectors

Side-release connectors include J7 and J9 on the main board, J2 on the SpO₂ board, and J? on the temperature board.

To use side-release connectors, squeeze the sides of the connectors to insert or remove the cables.

Pressure Connectors

Pressure connectors include CN1 and CN3 on the printer board and J2, J3, J4, J6, J8, J10, and J11 on the main board.

To use pressure connectors, grasp each mating connector half and pull the halves apart or insert one half into the other.



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

Main Board Connectors

For the best results when disconnecting cables from the main board, disconnect the upper cables first and work your way to the bottom of the board, in approximately the following order:

Main-board Connector (Refer to the drawing of the main board, on page 57.)	Connects With
J5	Display board – J1
J12	* Temperature board – J1
J4	Nurse call connector
J1	External RS-232
J6	LCD
J11	Speaker
J2	External DC Input
J7	* SpO ₂ board – J2
J9	NIBP board
J3	Battery
J8	* Printer data – CN3
J10	* Printer power – CN1

(* Denotes optional hardware.)

When reassembling the monitor, connect the cables in reverse order.

Display Board Connector

Connector	Connects With
J1	Main board – J5

Printer Board Connectors

Connector	Connects With
CN1	Main board – J10
CN2	Fujitsu printer
CN3	Main board – J8

SpO₂ Board Connectors

Connector	Connects With	Connector	Connects With
J1	SpO ₂ side panel	J2	Main board – J7

NIBP Board Connectors

Connector	Connects With	Connector	Connects With
J2	Main board – J7	J6	Pump

Temperature Board Connectors

Connector	Connects With	Connector	Connects With
J1	Main board – J12	J5	External Probe

Remove and Disconnect the Battery

1. Remove the four screws securing the battery door.

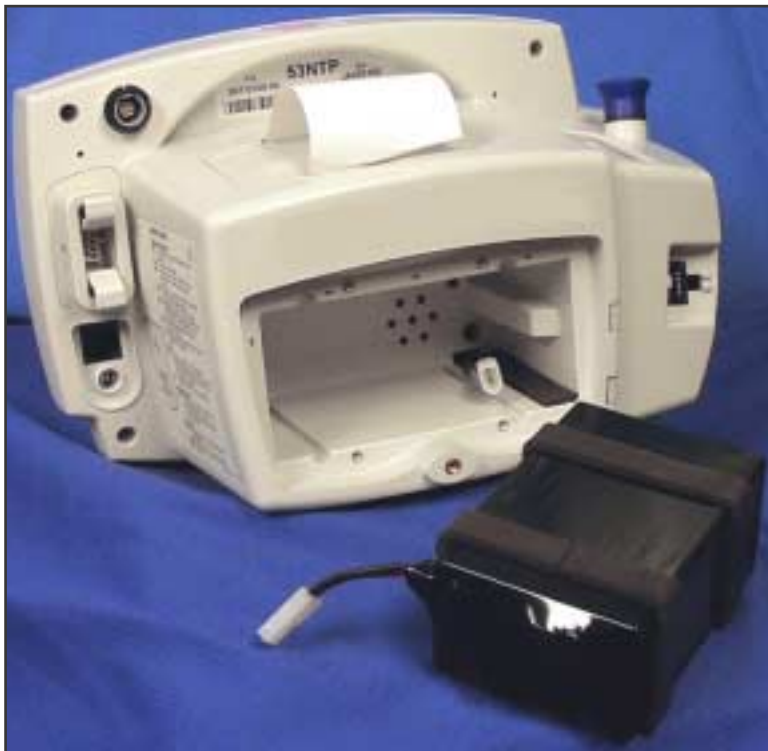
4 screws securing the battery door



2. Remove the battery door.



3. Slide the battery out of the battery compartment. This might require lightly shaking the monitor.
4. Disconnect the battery from the monitor.



Separate the Front and Rear Chassis

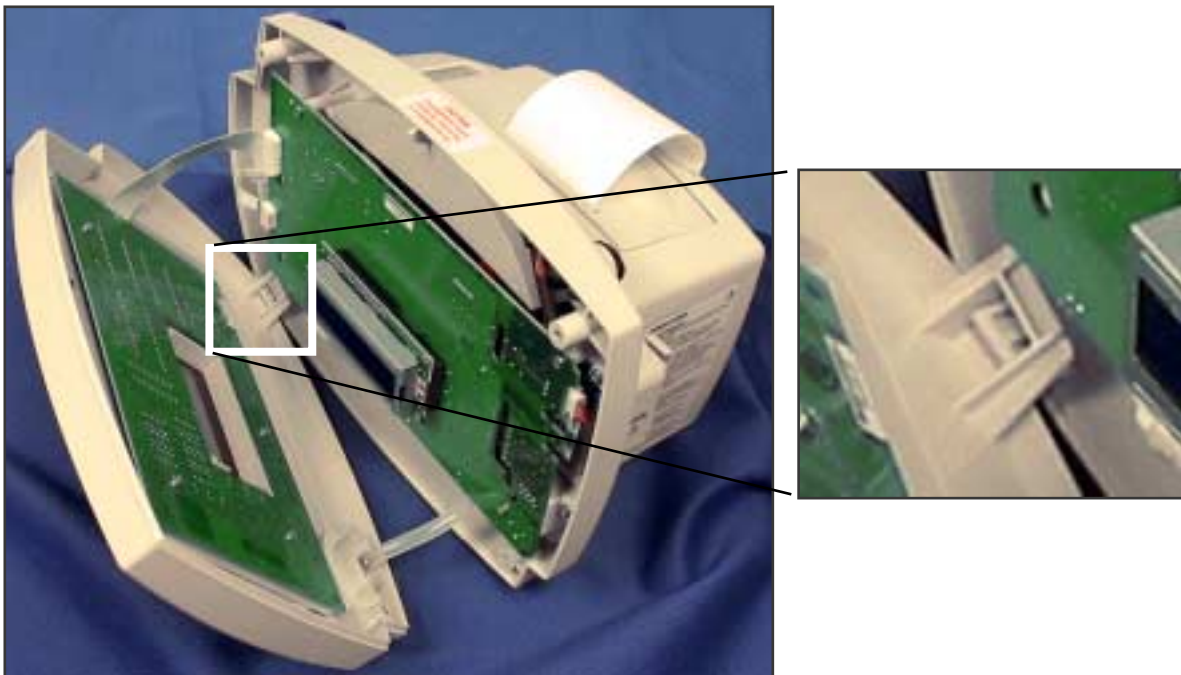
1. Remove the three screws securing the rear chassis.



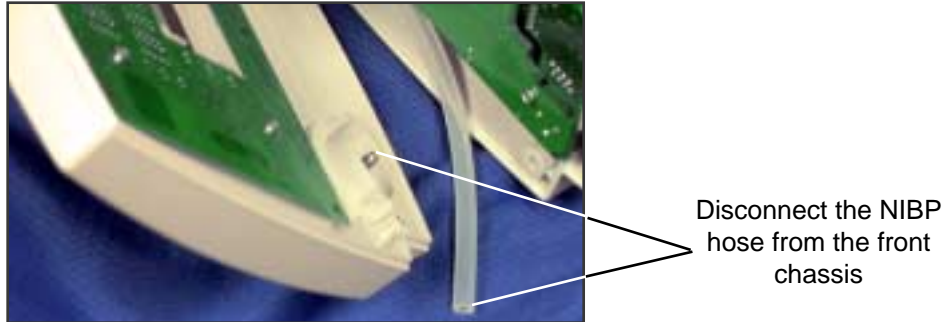
2. Place the unit upright, with the front of the unit facing you.
3. Tilt the top of the front chassis away from the rear chassis while lifting the front chassis, freeing the front chassis from the corner tab feature on the bottom left-hand corner of the rear chassis.



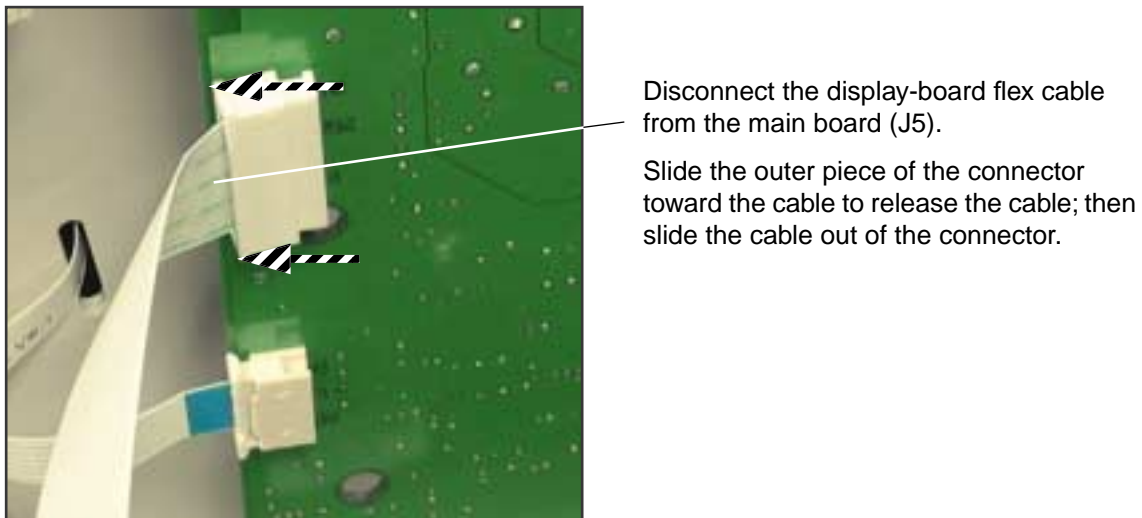
On reassembly, engage the tab and the tab receiver before attempting to align and close the chassis halves.



4. Disconnect the NIBP hose from the connector on the front chassis.



5. Disconnect the display-board flex cable (J5) from the main board.



Reassembly Notes

If you replace the front or rear chassis housing, you must affix a new ferrite bead (included with the replacement kit) to the housing before you close the monitor.

1. Remove the plastic sheet covering the adhesive on the ferrite bead.
2. Affix the ferrite bead at the location shown in the illustration below.
3. At the appropriate point in the reassembly procedure, run the flex cable through the slot in the ferrite bead.

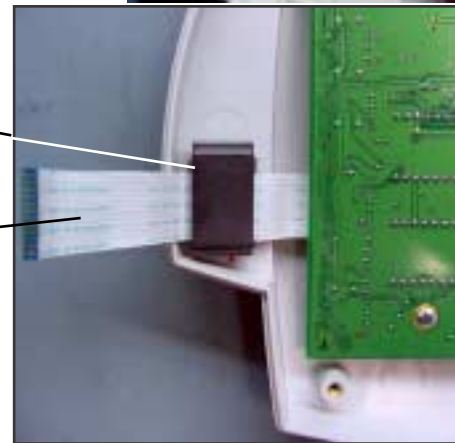
Temperature-board flex
cable (to J12 on
the main board)

Ferrite bead on
the rear chassis



Ferrite bead on
the rear chassis

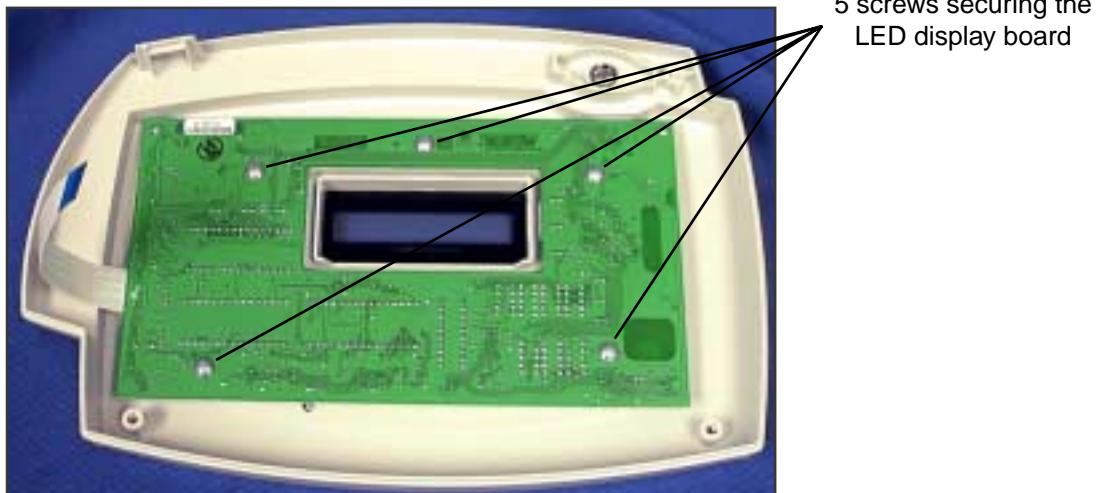
Display-board flex
cable (to J5 on
the main board)



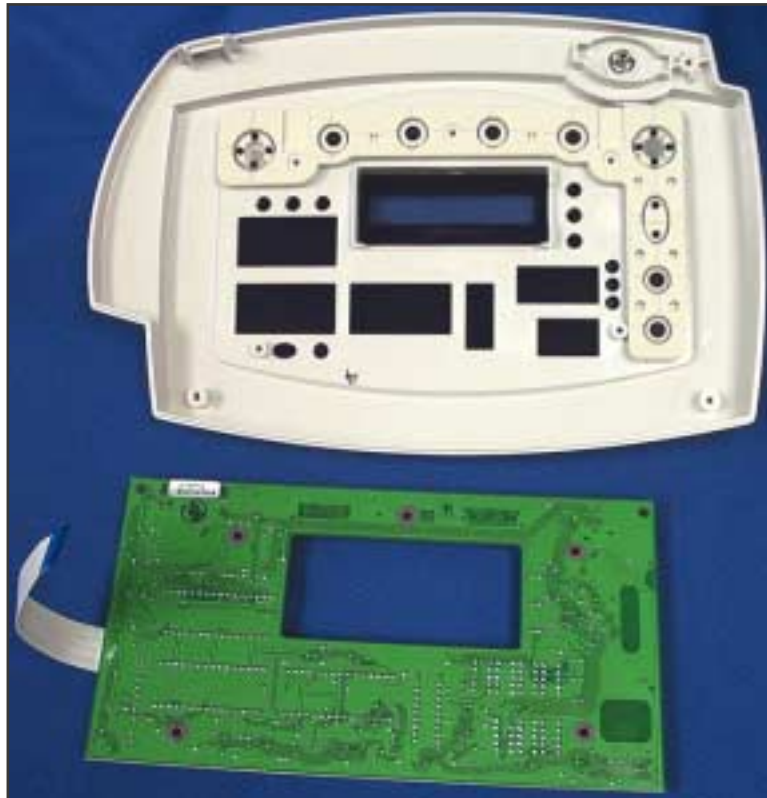
Disassemble the Front Chassis Assembly

The front chassis assembly contains the display board, keypad, and NIBP air fitting.

1. Remove the five screws securing the display board.



2. Lift out the display board.




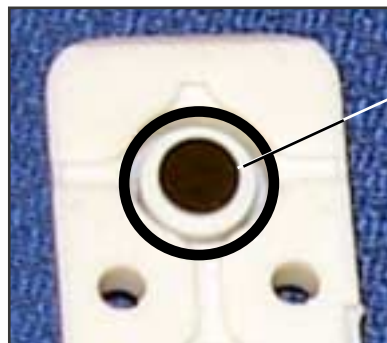
3. Remove the keypad.



Printer button

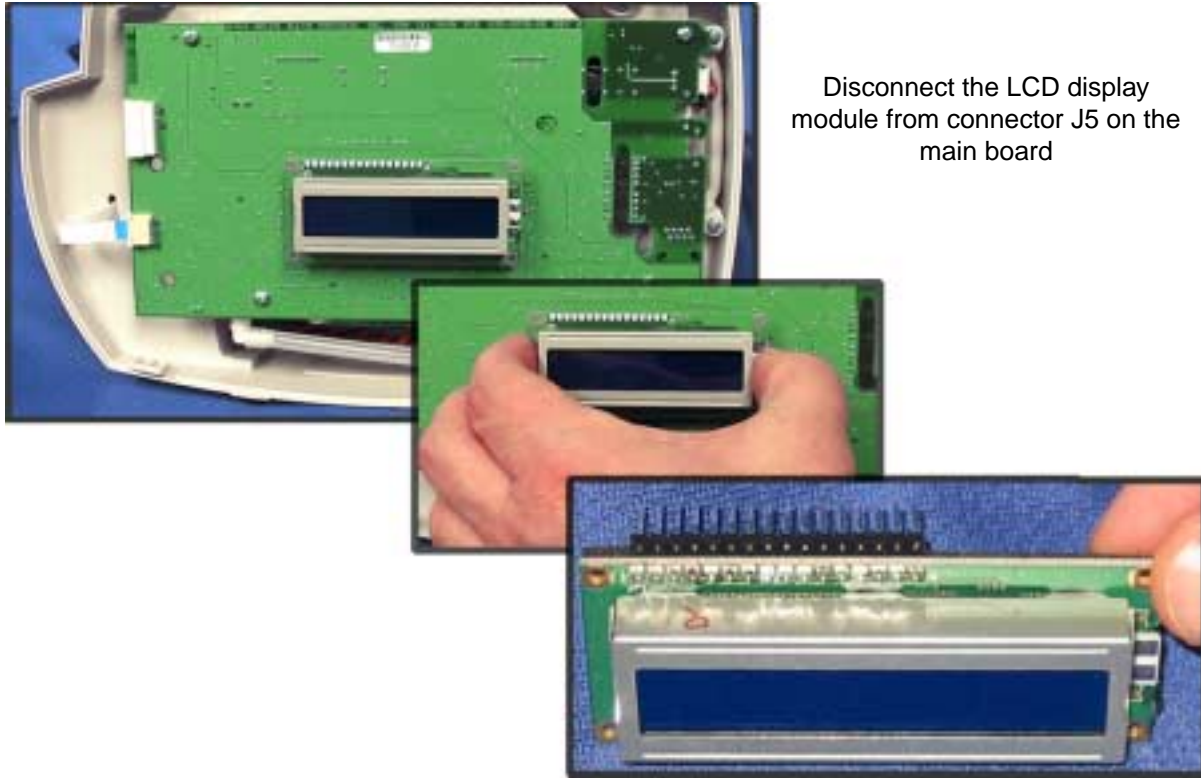
Reassembly Notes

If you are replacing the keypad and your monitor does not include the thermal printer option, the Printer button  must be removed from the keypad before you reinstall the keypad. To remove the Printer button, cut the membrane connecting the button to the keypad. (Note the circled area in the illustration.)



Printer button

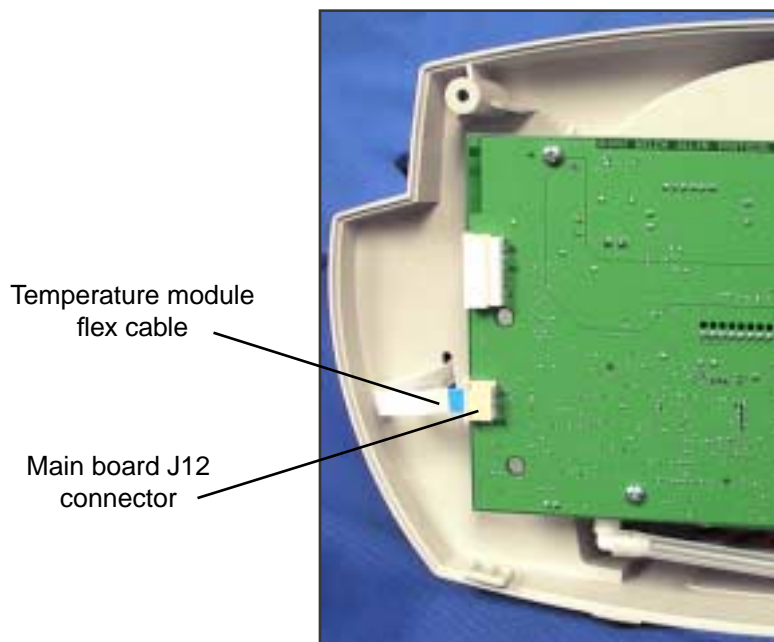
Remove the LCD Display from the Main Board

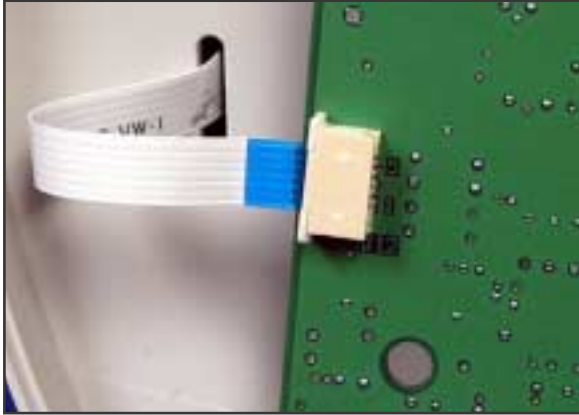


Disconnect the LCD display module from connector J5 on the main board

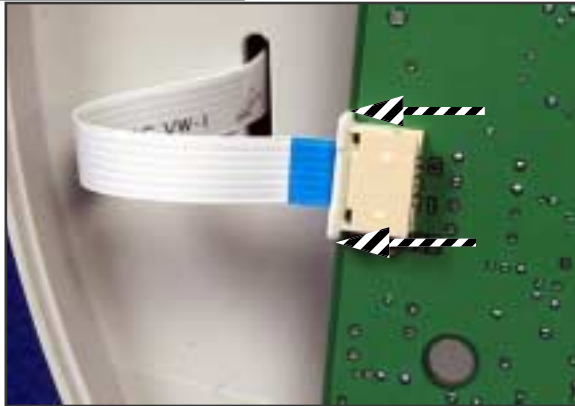
Remove the Main Board from the Rear Chassis Assembly

1. Disconnect the temperature module flex cable from J12 on the main board.

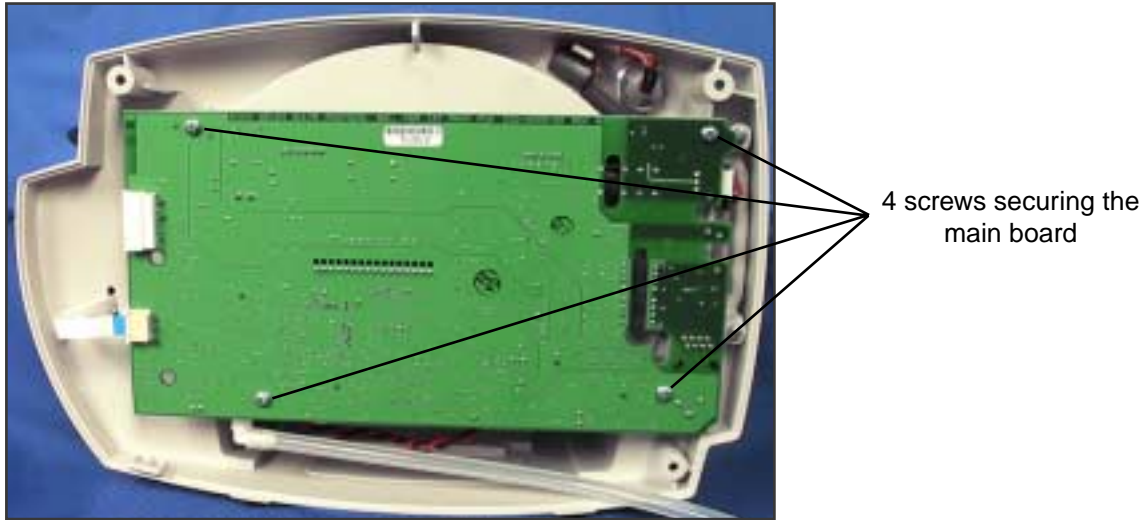




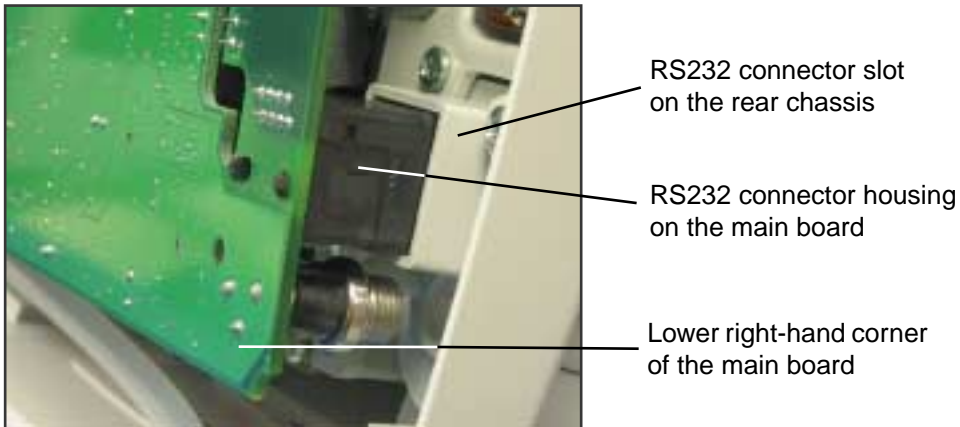
Unlatch the ZIF connector before removing or inserting the flex cable



2. Remove the four screws securing the main board to the rear chassis.



3. Pull the lower right-hand corner of the main board away from the rear chassis, just far enough to free the RS232 connector housing on the main board from the RS232 connector slot on the rear chassis.



4. Carefully tip the upper edge of the main board away from the rear chassis, far enough to access the uppermost connectors on the component side of the board.

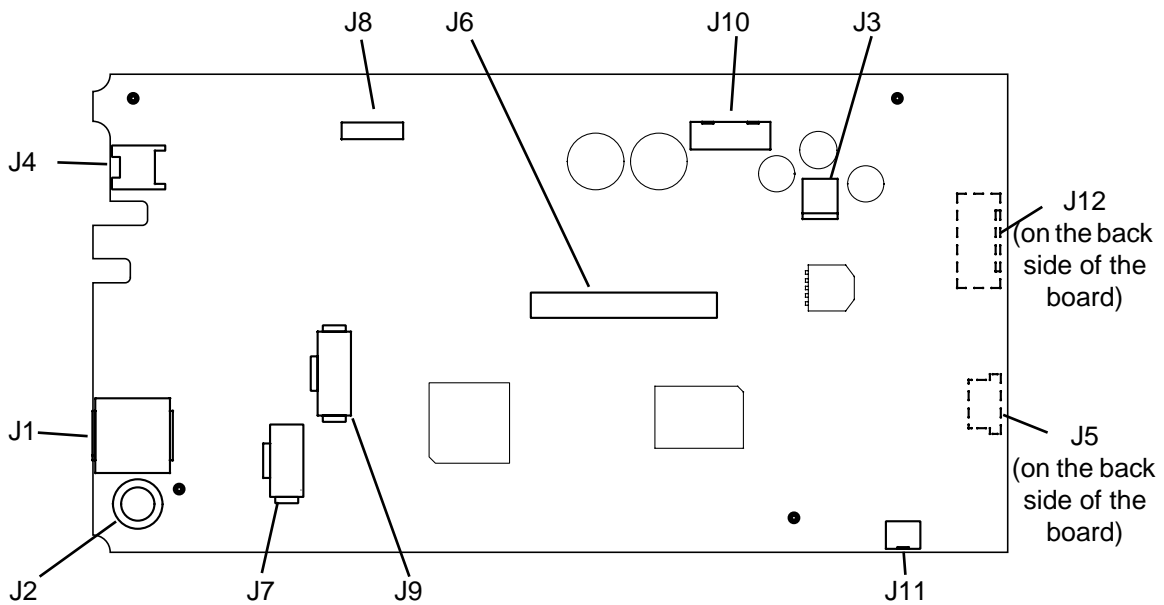


5. For best results, disconnect the uppermost cables first and work your way to the bottom of the main board. For a monitor configured with all options, the approximate order of disconnection is as follows:

Main-board Connector (Refer to the drawing of the main board, on page 57.)	Connects With
J5	Display board – J1
J12	* Temperature board – J1
J4	Nurse call connector
J1	External RS-232
J6	LCD
J11	Speaker
J2	External DC Input
J7	* SpO ₂ board – J2
J9	NIBP board
J3	Battery
J8	* Printer data – CN3
J10	* Printer power – CN1

(* Denotes optional hardware.)

6. Remove the main board.

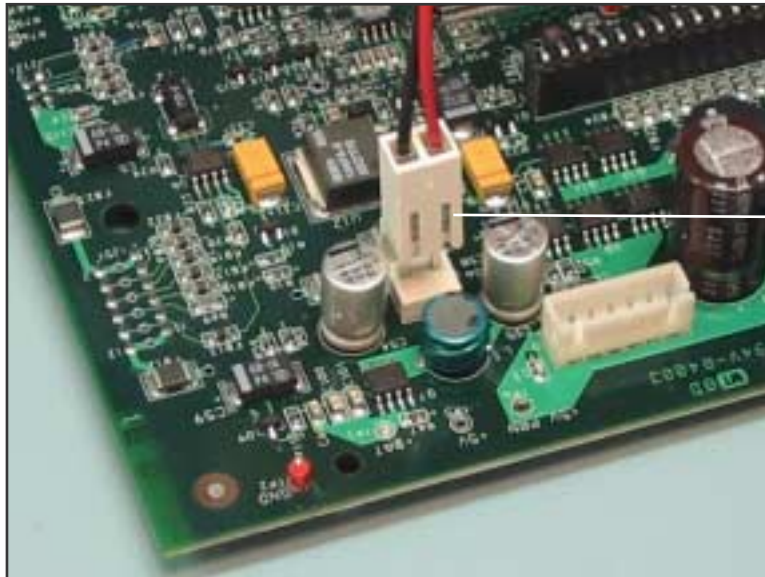


Main Board Reassembly Notes



Caution Take care when reconnecting the main board power connector (J3). If the cable connector is connected improperly, the monitor could be damaged when power is applied.

To reconnect the main board power connector (J3), be certain that the cable connector is oriented with the slotted side up...



J3 cable connector properly aligned with the J3 connector on the main board. The cable connector is slotted on the top side.

...and the flanged side down.



J3 cable connector properly aligned with the J3 connector on the main board. The cable connector has latching tabs on the bottom side.

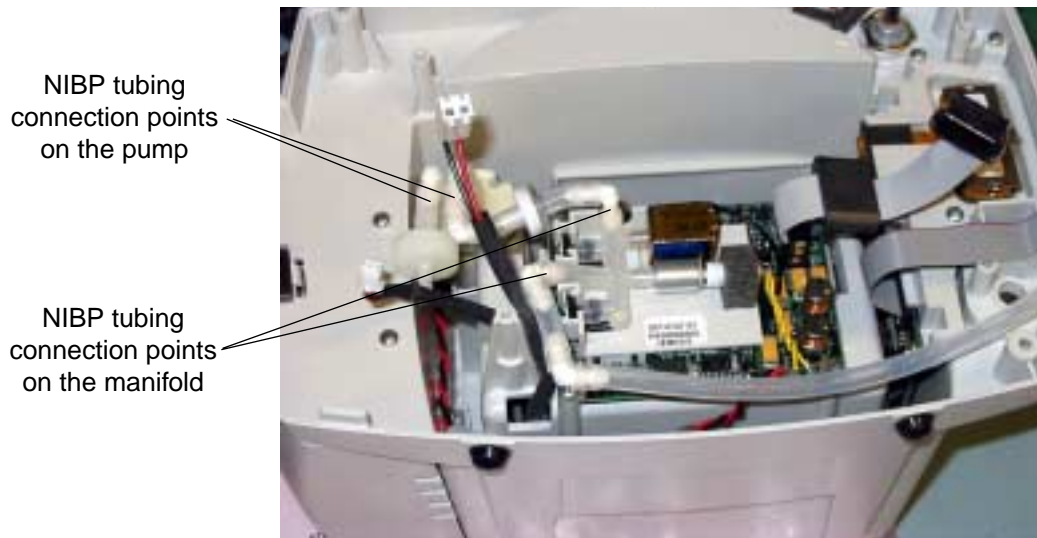
Disassemble and Remove the NIBP Assembly



Repair or replacement of the NIBP assembly is not supported. All NIBP service must be performed at an authorized Welch Allyn service center.

1. Remove the tubing and the pump.

- a. Disconnect the tubing from the manifold on the NIBP board.
- b. Disconnect the two sections of tubing from the pump.

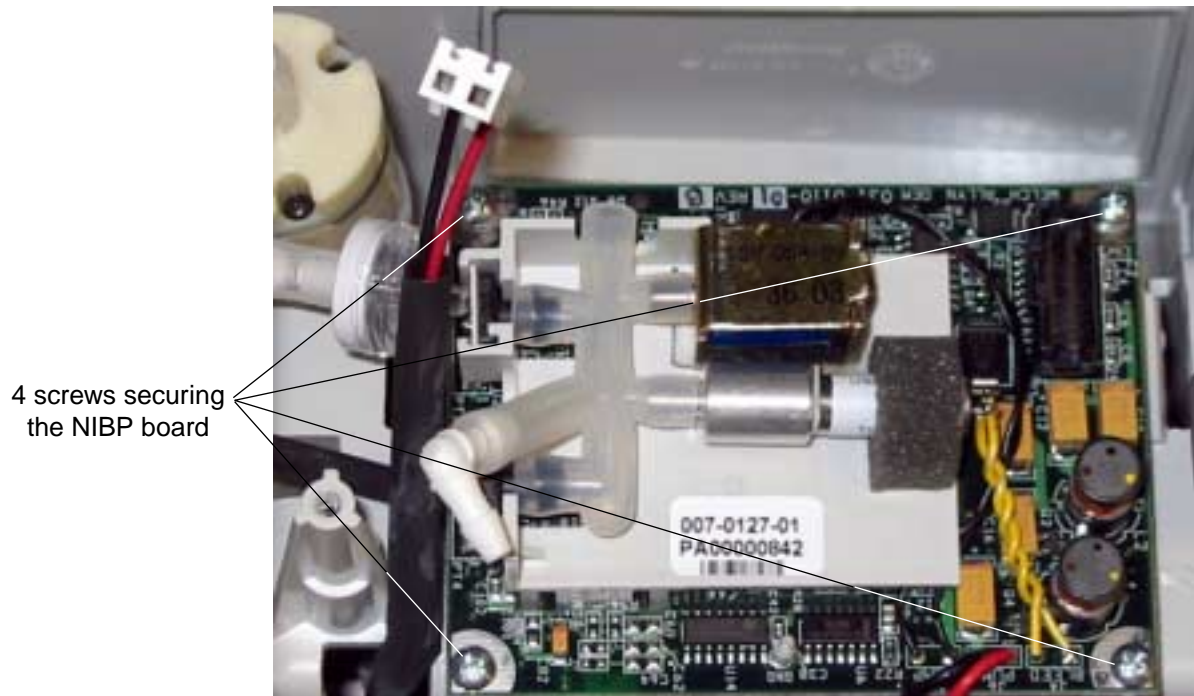


- c. Cut the tie-wrap to free the pump from the pump holder.



If your monitor has a printer, it is much easier to remove and install the NIBP pump through the printer door, after the printer assembly is removed.

2. Remove the NIBP board.
 - a. Remove the four screws securing the NIBP board to the rear chassis.



- b. Remove the NIBP board.

NIBP Reassembly Notes



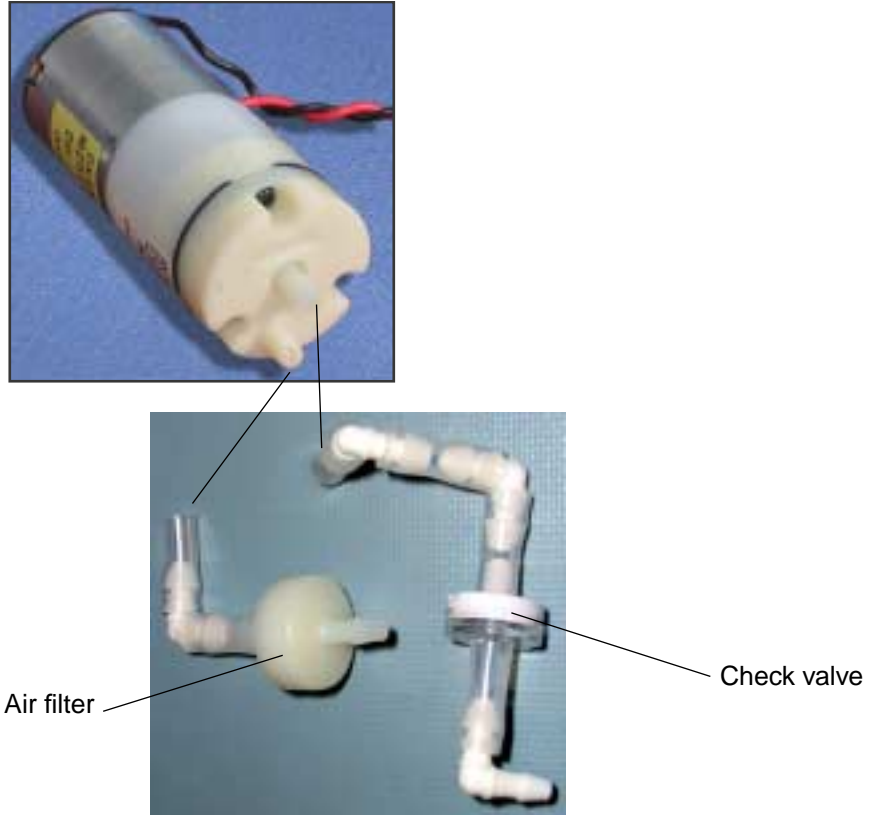
Warning You must characterize the NIBP module whenever you replace any NIBP component (pump, tubing, air filter, check valve, or NIBP module).

If the NIBP module is not properly characterized, the pump could overinflate a neonatal cuff, which could be hazardous to neonatal patients.

For information on NIBP characterization, see [page 39](#).

The shorter tubing section contains the air filter. It connects to the pump input/suction fitting on the outer edge of the front.

The longer tubing section contains the check valve. It connects to the pump pressure/output fitting in the center of the pump and to the manifold on the NIBP board.

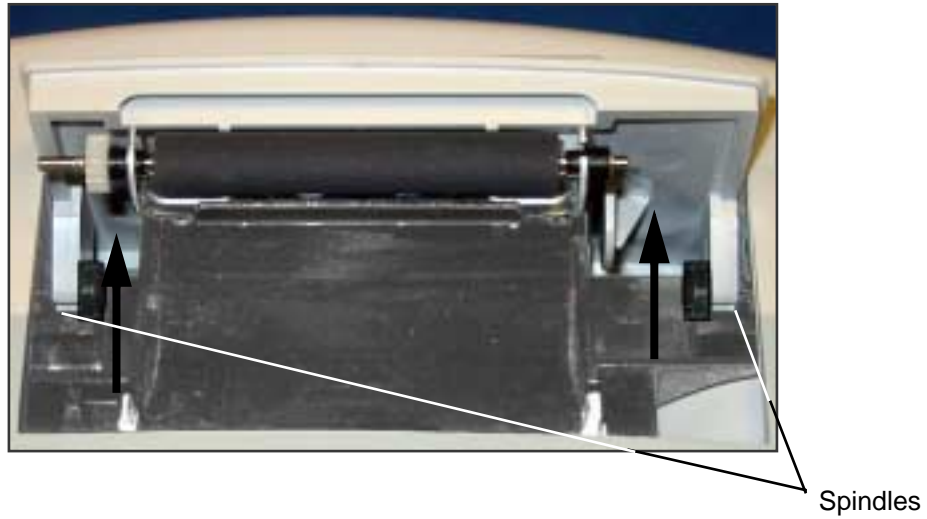


Remove and Disassemble the Printer Assembly

- 1.** Remove the printer door.
 - a.** Open the printer door and remove the roll of printer paper.

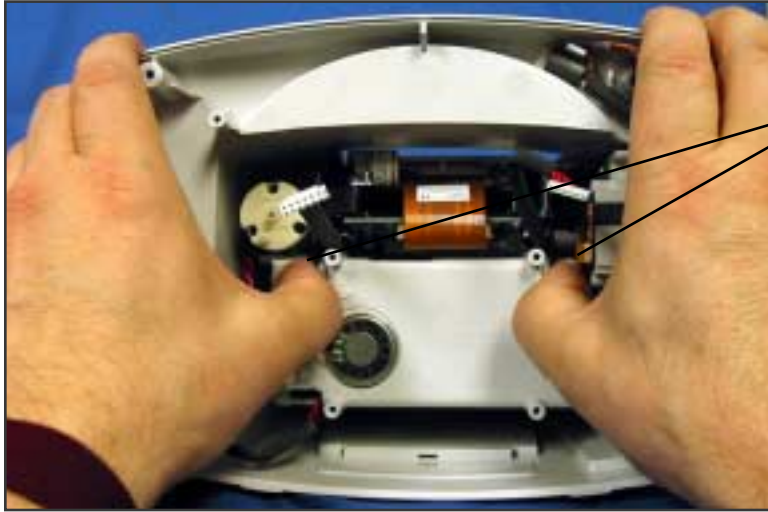


- b.** Push the printer door toward the rear of the monitor until it snaps out of the two support spindles on the printer frame.



2. Remove the printer assembly.

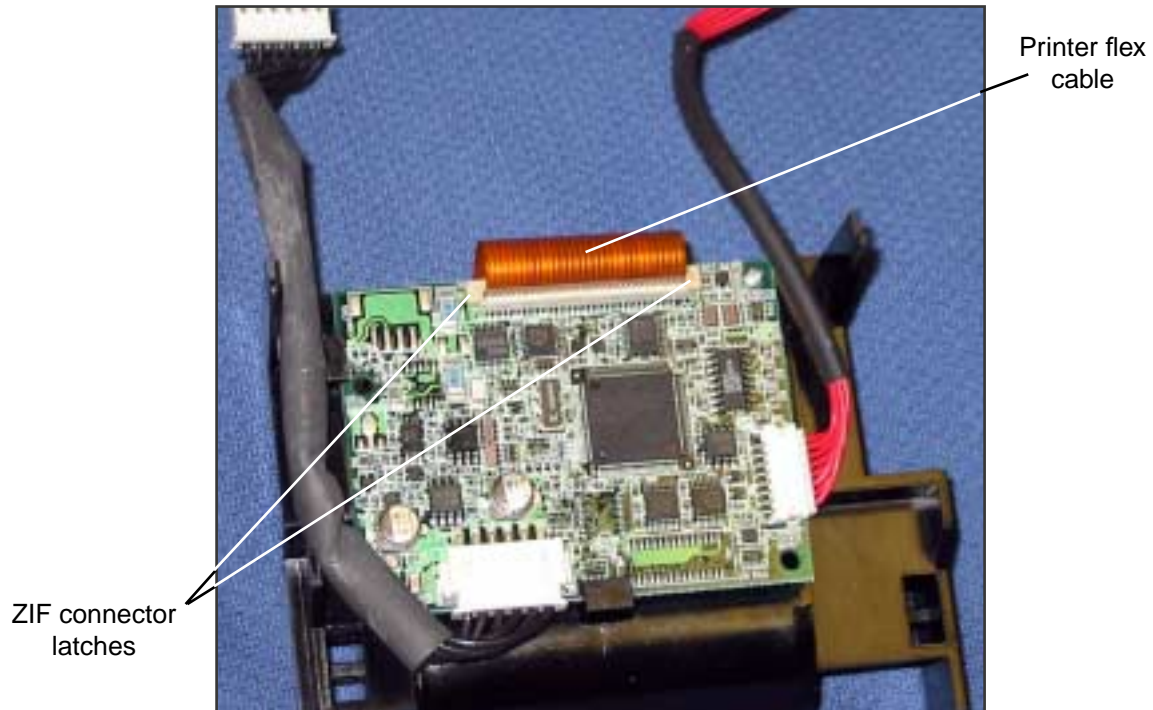
Push the plastic legs of the printer assembly outward and pull the printer assembly forward to free it from the snap-in seating of the rear chassis bulkhead.



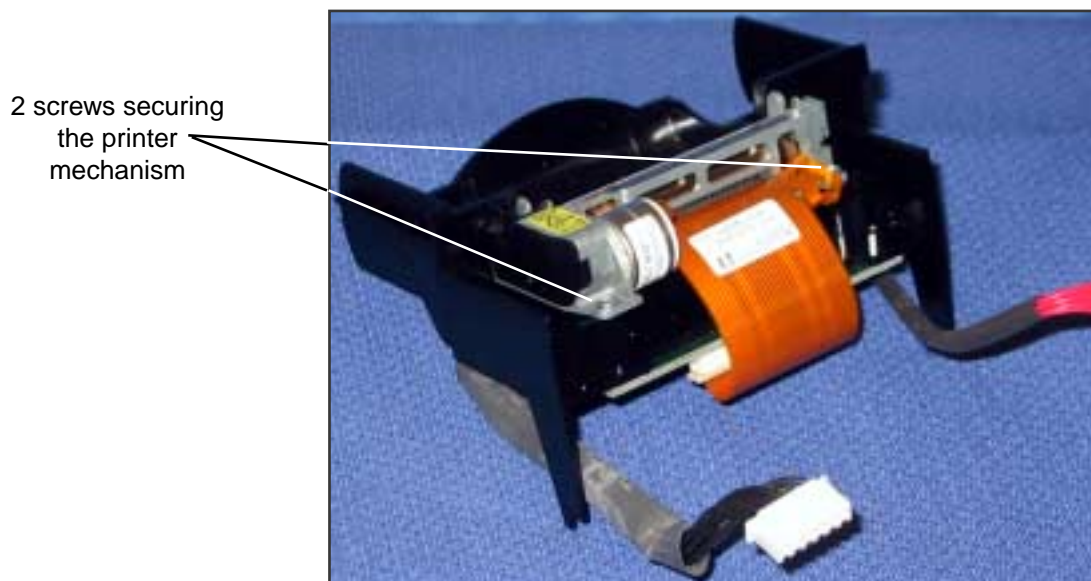
Push the printer legs very slightly outward while pulling them toward you.



3. Remove the printer mechanism and the printer board.
 - a. Turn the printer assembly upside-down, and release the ZIF connector latches (CN2) on the printer board.



- b. Disconnect the printer flex cable from CN2 on the printer board.
 - c. Turn the printer assembly upright, remove the two screws securing the printer mechanism, and remove the printer mechanism.



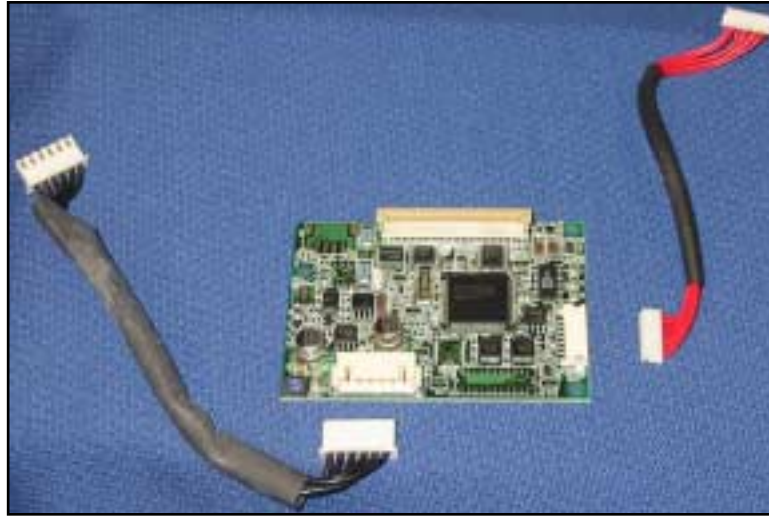


- d. Remove the screw securing the printer board to the printer assembly.

One screw securing the printer board

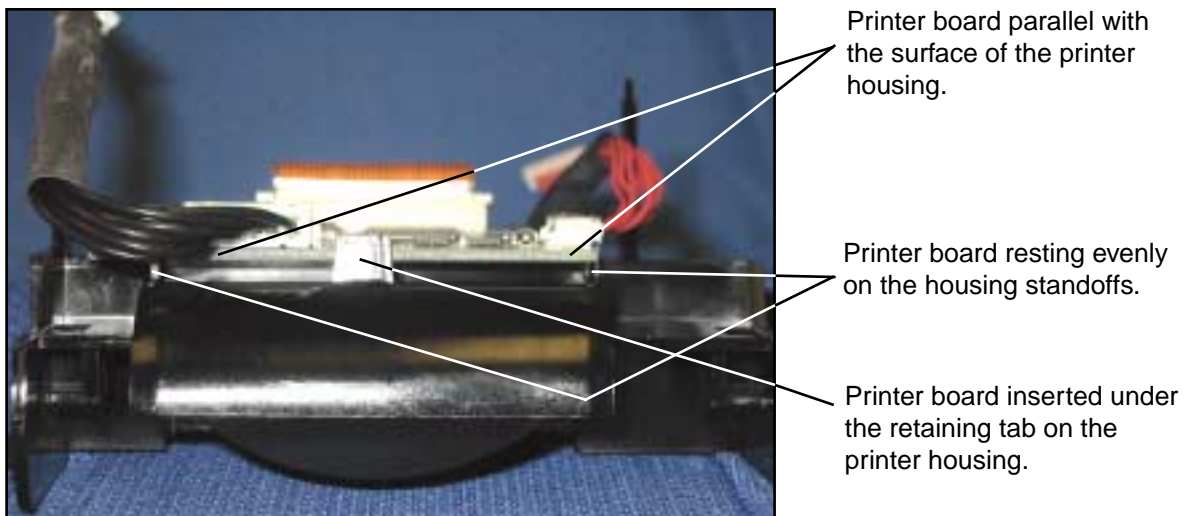


- e. If you are replacing the printer board, remove the cables from connectors CN1 and CN3 for use on the replacement board.



Printer Reassembly Notes

- a. When connecting the printer assembly board to the plastic printer housing, be sure the printer board is seated flat on the housing, within the guide rails on either side of the housing, and with the front of the board secured under the tab on the front of the housing.



- b. To install the printer assembly into the cavity in the monitor, orient the printer assembly so that the side rails of the plastic frame are on the left and right and the two

printer-frame “piano” legs are toward the front, extending downward from the assembly.



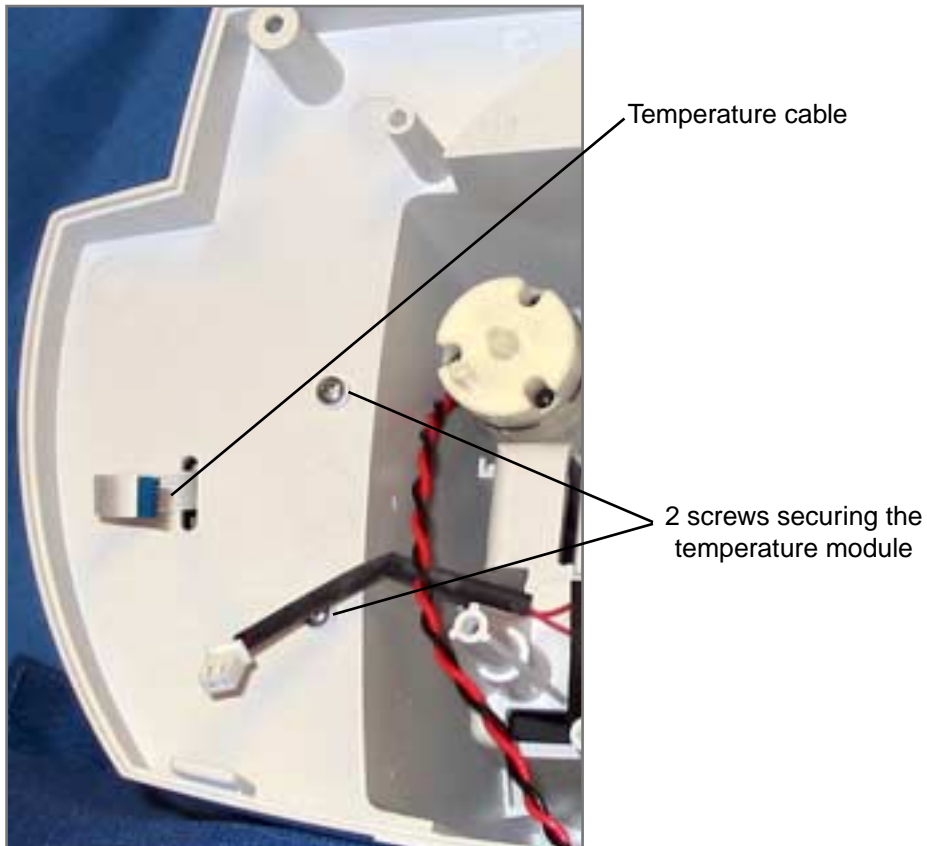
- c. Partially insert the printer frame assembly into the printer well in the rear chassis, aligning the rear side rails for insertion between the two slotted side latches on the top of the printer well of the rear chassis.
- d. Align the bottom of the two printer frame legs toward the top of the vertical bulkhead slots.
- e. Fully insert the printer assembly into the printer well until the side rails engage in the slotted side latches and the legs click into the vertical slots. Be sure that the white plastic shield on the housing rests on the top of the SpO₂ board.
- f. Install the printer door by inserting it in the printer slot, tilted slightly forward, and snapping the latches onto the printer frame spindles.

Disassemble the Temperature Module

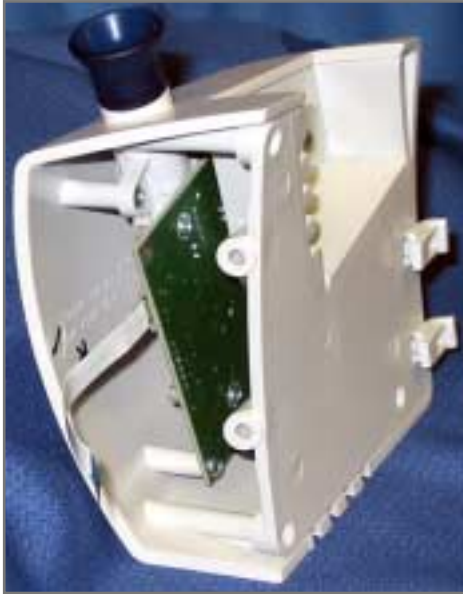


Disassembly of the temperature module does NOT require removal of the main board.

1. Remove the temperature module from the monitor.
 - a. Remove the two screws (located on the left side, inside the rear chassis) securing the module to the slots on the left side of the rear chassis. To prevent the module from dropping, hold it as you remove the screws.

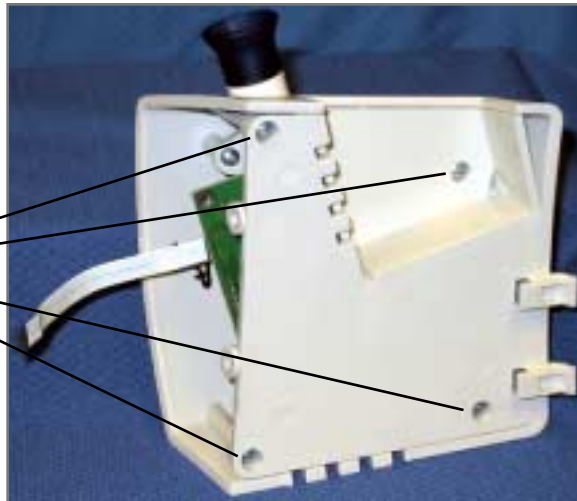


- b. Separate the temperature module from the rear chassis and pull the temperature cable through the slot in the rear chassis.

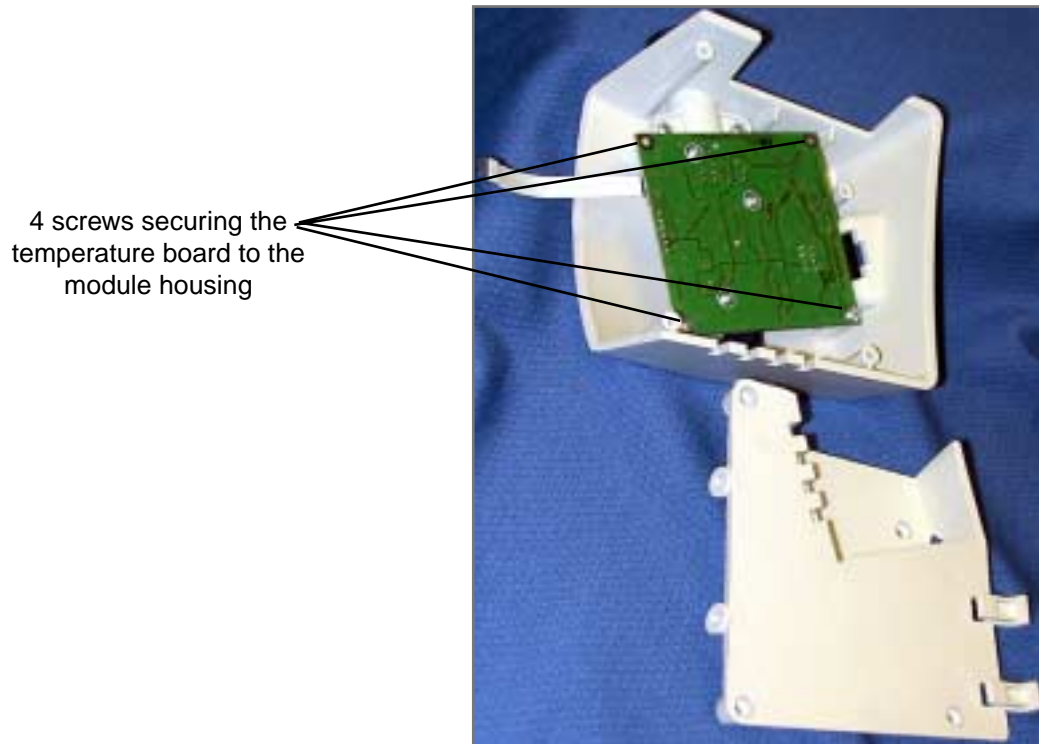


2. Remove the temperature-board assembly from the SureTemp Plus module as follows:
 - a. Remove the four screws securing the inside panel to the module housing.

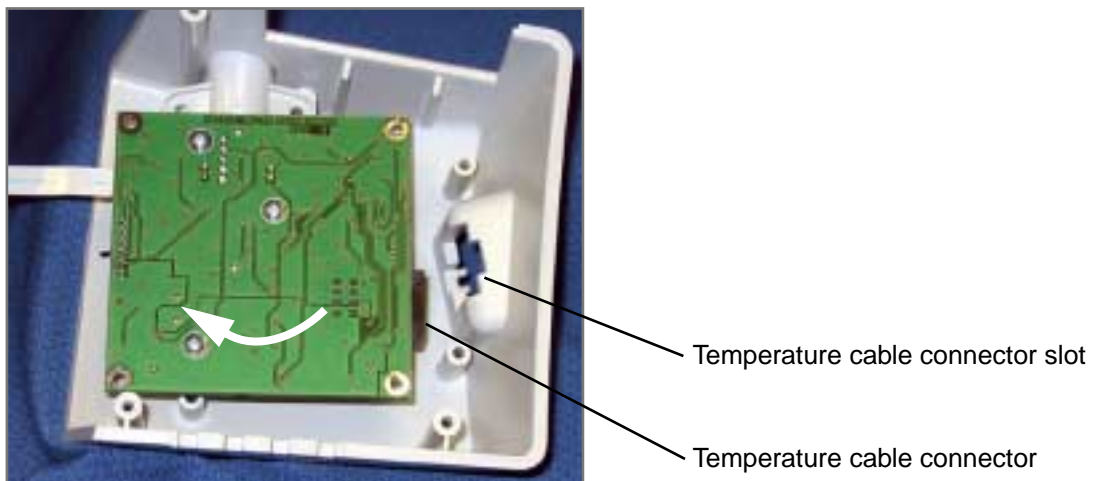
4 screws securing the inside panel to the module housing



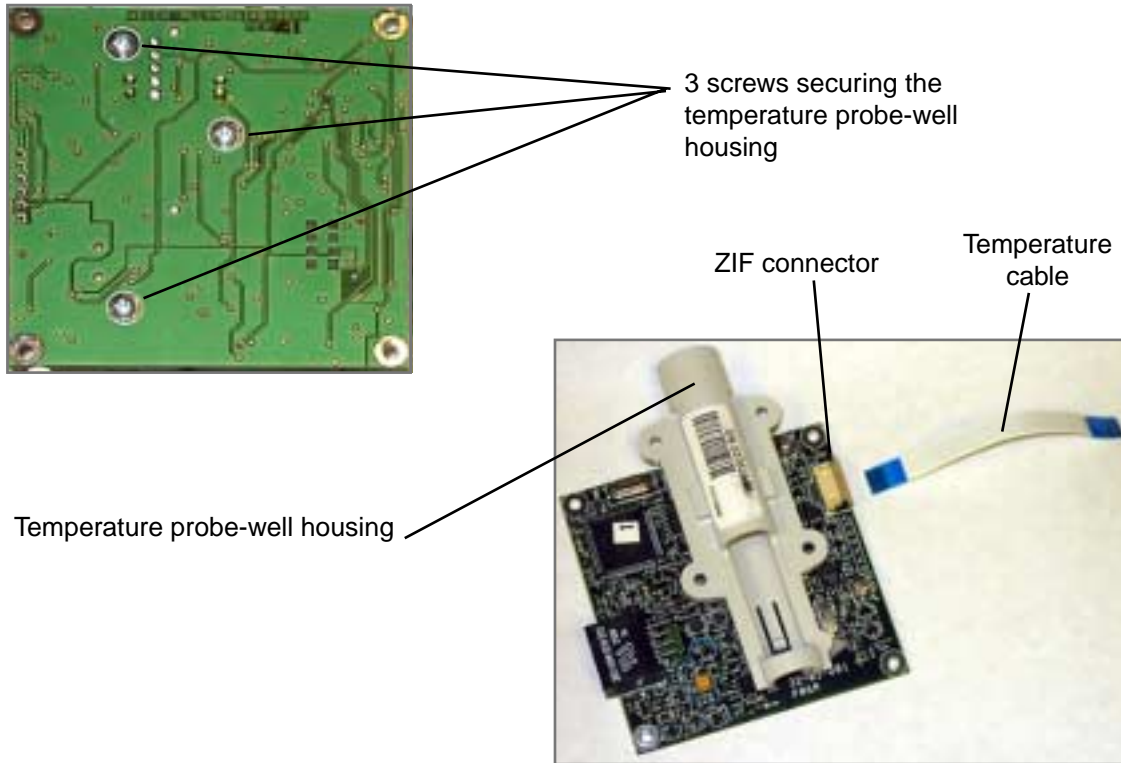
- b. Remove the four screws securing the temperature board to the module housing.



- c. Tilt the temperature board and rotate it clockwise to free the cable connector from the connector slot (J5) in the housing; then lift the board out of the housing.



- d. Remove the 3 screws securing the temperature probe-well housing, and remove the probe well from the temperature module.
- e. Release the ZIF latches (J1) and disconnect the temperature cable.



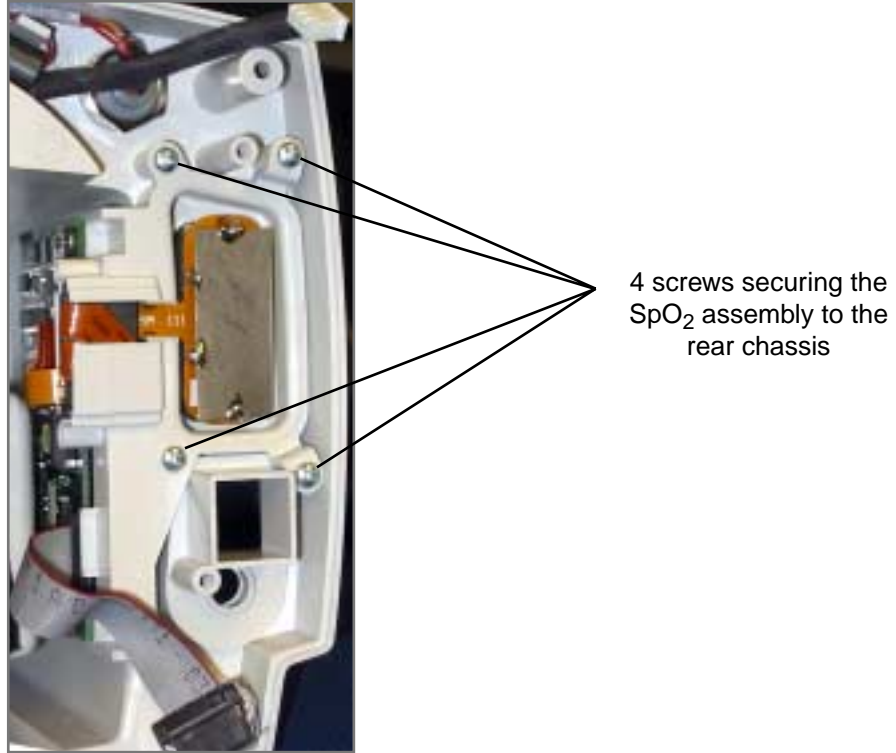
Temperature Module Reassembly Notes

To install the temperature board in the module housing:

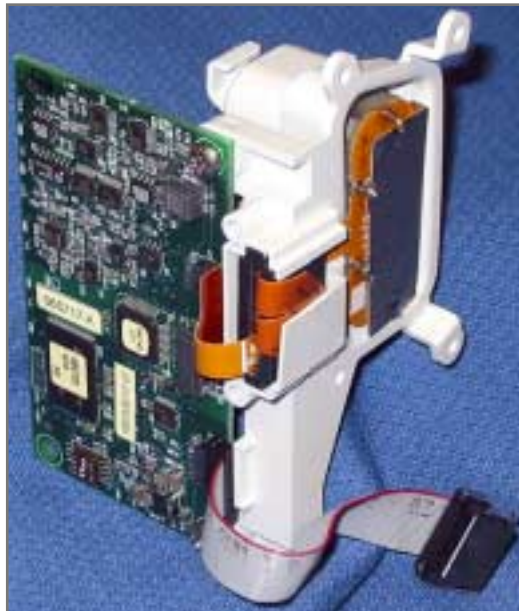
1. Square the circuit board in the housing to fit the probe-well receiver into the top of the outside housing.
2. Tilt the board and rotate it counterclockwise so that the temperature cable connector (J5) fits down into the connector slot in the housing.

Disassemble the SpO₂ Assembly

1. Remove the SpO₂ assembly from the rear chassis and disassemble it as follows:
 - a. Remove the four screws (located on the inside of the rear chassis on the right side) securing the SpO₂ assembly to the rear chassis.

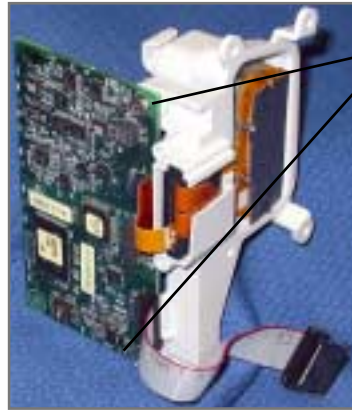


- b.** Remove the side panel and board assembly from the rear chassis.



- 2.** Remove the SpO₂ board.

- a.** Remove the two screws securing the board to the side panel.



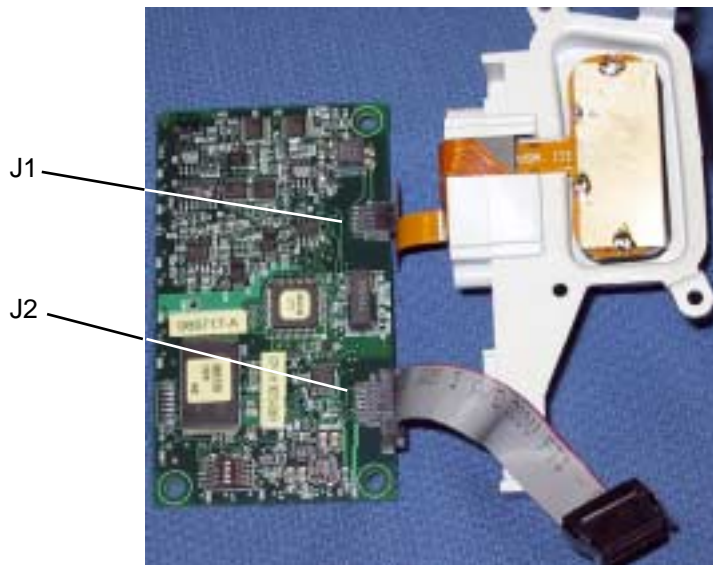
2 screws securing the SpO₂ board to the SpO₂ assembly



b. Disconnect J1 and J2.

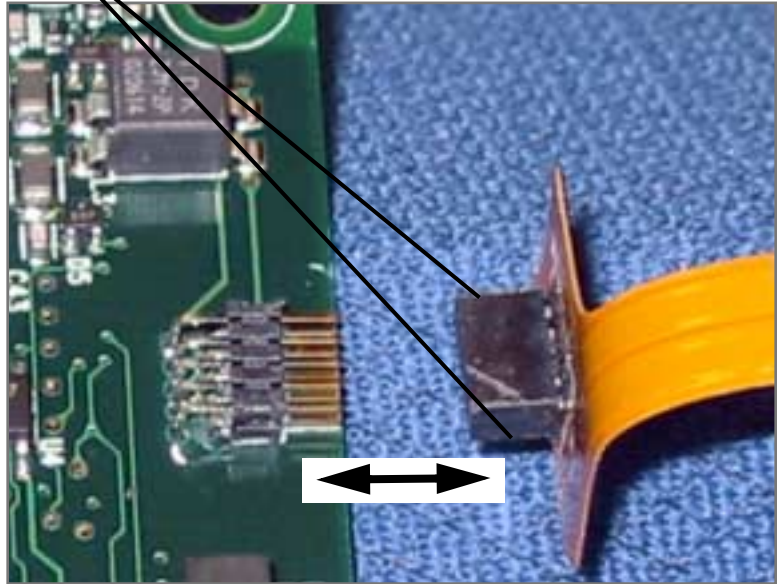


Caution To avoid stressing and damaging the J1 flex cable, disconnect the cable by gripping the J1 flex-cable connector with pliers and separating the connector halves without stressing or otherwise putting any pressure on the flex cable itself.



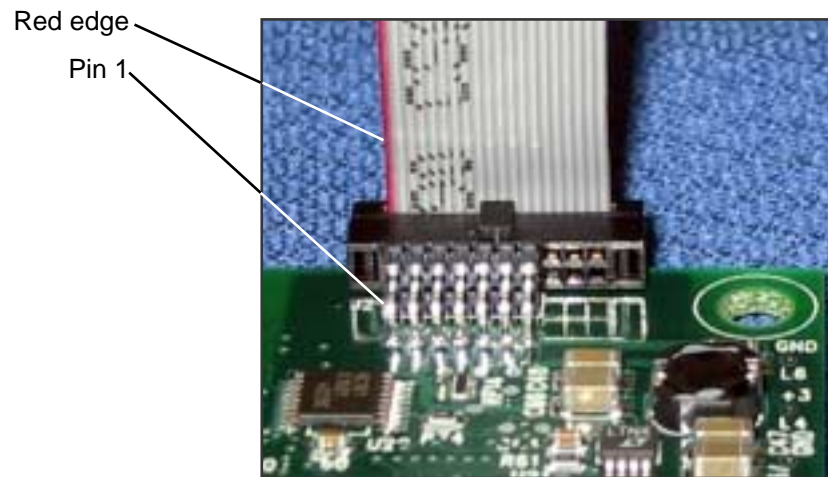
Grip with pliers here, and separate the J1 connector halves.

Never pull directly on the cable itself.



SpO₂ Reassembly Notes

The J2 connector halves are keyed to prevent incorrect connection. However, to facilitate the connection, align the red line on the edge of the ribbon cable with pin 1 of the connector on the SpO₂ board.



6 - Replacement Parts

This list includes field-replaceable service parts only. Product accessories, including patient sensors, probes, cables, batteries, probe covers, printer paper and other consumable items, are listed separately in the Welch Allyn Products and Accessories Guide (810-0409-00), which is available from Welch Allyn Customer Service.

Order Number	Description
Board Assemblies & Modules (Standard Configuration)	
031-0151-XX	Display Board, LED
500-0044-XX	Display Module, LCD
020-0621-XX	NIBP Module
Front Case (Standard Configuration)	
630-0216-XX	Case, Front
600-0495-XX	Fitting, NIBP (order with 630-0216-XX)
620-0392-XX	Retainer, NIBP Fitting (order with 630-0216-XX)
010-0239-XX	Ferrite Bead with Adhesive, Front Case (for monitors with the temperature option only; order with 630-0216-XX)
680-0072-XX	Keypad, Elastomeric
Rear Case (Standard Configuration)	
630-0217-XX	Case, Rear
660-0231-XX	Speaker Assembly (order with 630-0217-XX)
600-0518-XX	Gasket, Speaker (order with 630-0217-XX)
010-0240-XX	Ferrite Bead with Adhesive, Rear Case (for monitors with the temperature option only; order with 630-0217-XX)
501-0015-XX	Battery Assembly
630-0215-XX	Battery Door
600-0517-XX	Feet, Adhesive
020-0622-XX	NIBP pump and tubing assembly
600-0179-XX	Tubing, 1', 0.125" diameter
600-0520-XX	Filter, NIBP
020-0064-XX	Check valve, NIBP
600-0043-XX	Fitting, tee, 1/8"
600-0178-XX	Fitting, elbow, 1/8"
620-0396-XX	Mount, Cable Tie
630-0236-XX	Cover, No-printer Option
600-0524-XX	Gasket (order with 630-0236-XX)
660-0154-XX	Connector Assembly, Nurse Call
660-0232-XX	Cable Assembly, Power
620-0047-XX	Screw, #6-32, 1/4", Machine
620-0394-XX	Screw, #4-40, 3/4", Machine
620-0399-XX	Screw, #4-40, 5/16", Machine
620-0393-XX	Screw, #4-20, 5/16", Thread-forming
620-0091-XX	Screw, #2-32, 3/16", Thread-forming
620-0165-XX	Screw, #2-28, 5/16", Thread-forming

SpO₂ Option	
010-0232-XX	Side-panel Assembly, SpO ₂ , MP-506
031-0139-XX	Board, SpO ₂ , Nellcor MP-506
660-0233-XX	Cable Assembly, SpO ₂ Main Interface
Temperature Option	
21327-000	PCB, Temperature Module
630-0211-XX	Outside Housing, Temperature Module
630-0238-XX	Inside Panel, Temperature Module
660-0230-XX	Cable, Flex, Temperature Main Board
Printer Option	
532012-000	PCB, Printer
532013-000	Printer, with Roller
630-0214-XX	Frame, Printer Assembly
630-0213-XX	Printer Door Assembly
660-0228-XX	Cable, Printer Power
660-0229-XX	Cable, Printer Data
Labels	
680-0085-XX	Overlay, Front Panel, 53000, International
680-0079-XX	Overlay, Front Panel, 5300P, International
680-0082-XX	Overlay, Front Panel, 530T0, International
680-0083-XX	Overlay, Front Panel, 530TP, International
680-0080-XX	Overlay, Front Panel, 53N00, International
680-0081-XX	Overlay, Front Panel, 53N0P, International
680-0084-XX	Overlay, Front Panel, 53NT0, International
680-0071-XX	Overlay, Front Panel, 53NTP, International
680-0093-XX	Overlay, Front Panel, 53000, USA
680-0087-XX	Overlay, Front Panel, 5300P, USA
680-0090-XX	Overlay, Front Panel, 530T0, USA
680-0091-XX	Overlay, Front Panel, 530TP, USA
680-0088-XX	Overlay, Front Panel, 53N00, USA
680-0089-XX	Overlay, Front Panel, 53N0P, USA
680-0092-XX	Overlay, Front Panel, 53NT0, USA
680-0086-XX	Overlay, Front Panel, 53NTP, USA
640-0610-XX	Label, Error Codes, English
640-0641-XX	Label, Error Codes, Italian
640-0642-XX	Label, Error Codes, French
640-0643-XX	Label, Error Codes, German
640-0644-XX	Label, Error Codes, Spanish
640-0611-XX	Label, Icon Reference, USA Only
640-0612-XX	Label, Safety Agency