

Chapter 9: Service and Maintenance

The following chapter contains information about cleaning, battery operation, performance verification, service, repair, and warranty.

Cleaning

Under normal operation, no internal adjustment or recalibration is required. Safety tests and internal adjustments should be done by qualified personnel only. Safety checks should be performed at regular intervals or in accordance with local and governmental regulations. **Safety Information, Warnings, and Cautions** on page 11.

The Radical-7 Pulse CO-Oximeter is a reusable instrument. The instrument is supplied and used non-sterile.

To surface clean the Radical-7

- The outer surface of the instrument can be cleaned with a soft cloth dampened with a mild detergent and warm water solution.
- Do not allow liquids to enter the interior of the instrument.
- The outer surface of the instrument can also be wiped down using any of the following solvents:
 - Cidex Plus (3.4% glutaraldehyde)
 - 10% bleach solution
 - 70% isopropyl alcohol solution

Using the recommended cleaning solutions on the touchscreen panel will not affect the performance of the Handheld.

Battery Operation and Maintenance

The Radical-7 Handheld includes a lithium ion rechargeable battery. The Radical-7 Docking Station may include the optional 6.5 amp-hour nickel metal hydride rechargeable battery.

Before using the Radical-7 as a Handheld or as a transport monitor, the Handheld rechargeable battery and the optional Docking Station rechargeable battery must be fully charged.

To charge the Handheld rechargeable battery and the Docking Station rechargeable battery

1. Attach the Handheld to the Docking Station.
2. Connect the Docking Station to AC power.
3. Verify that the batteries are charging.
 - The Docking Station Battery Charging indicator momentarily flashes and then remains illuminated while the batteries are actively charging.
 - If the internal battery temperature exceeds recommended operating conditions for proper battery charging, the Handheld Battery Charging

indicator continuously flashes. When the temperature returns to recommended operating conditions, proper battery charging proceeds.

- The Handheld battery requires approximately 4 hours for charging. The Docking Station battery requires approximately 6 hours for charging.
- When both the Handheld Battery Charging indicator and the Docking Station Battery Charging indicator turn off, additional trickle charging may occur to complete charging.
- Memory effects of the battery may shorten run-time. When battery run time is significantly reduced, it is advisable to completely discharge and fully recharge the battery. Charging can occur while the Handheld is docked and turned on, the most efficient charge times are achieved when the Handheld is turned off.

During battery operation of the Radical-7, note that the following operating conditions affect the estimated run time of the included rechargeable batteries:

Estimated Run Times of Battery Power

The following tables outline the estimated run times of the battery-powered Radical-7. The time estimates are based on a Radical-7 with fully charged batteries. The time estimates are also based on a Radical-7 with and without the back-light illuminated.

The Radical-7 is always configured to include the Handheld battery. It may optionally be configured to include the Docking Station battery. Determine the configuration of the system before referencing the following tables.

Run Time for Handheld Only

In this configuration, the Radical-7 is configured to only include the Handheld battery (standard configuration). When running on battery power, it is advisable to operate only the Handheld. On battery power, it is possible to operate the Standalone (Handheld attached to the Docking Station with the Handheld battery providing power to the Docking Station). However, the capacity of the Handheld battery pack is not sufficient to support this mode for long periods of time.

For optimal battery run time, configure the device to automatically adjust the brightness. See **Brightness** on page 76.

Configuration	Operation Mode	Minimum run time
Handheld only	Handheld, undocked, not connected to AC power	4 hours
Handheld only	Handheld docked, not connected to AC power	1 hour

Replacing the Batteries

Before installing or removing the battery, make sure the AC power cord is removed and power to the Radical-7 is turned off.

To replace the rechargeable Handheld battery

1. Turn off the Radical-7 Handheld off and remove the patient cable connection. If docked, detach the Handheld from the Docking Station.
2. Loosen the closure screw on the battery compartment door and lift out the battery.
3. Take a new battery and place it in the compartment.
4. Tighten the closure screw.
5. Place the Handheld into Docking Station, turn on line power and charge battery.

See **Battery Operation and Maintenance** on page 123.

Replacing the Fuses

Should a power problem blow one or both of the fuses in the power entry module on the rear panel, the fuse(s) will need to be replaced. Before starting, the user will need a 5-mm or 3/16-in screwdriver.

To replace the fuse(s)

1. Disconnect instrument from AC power.
2. Remove AC power cord from the power entry module at the rear of the Docking Station.
3. Using the screwdriver, gently pry loose the fuse cover in the left portion of the power entry module, exposing the fuse holder.
4. Using the screwdriver, gently remove the fuse holder.
5. Note how the fuse(s) are placed in the fuse holder for installation of the new fuse(s).
6. To remove the fuses from the fuse holder, use the edge of the screwdriver blade to pry against the bottom of the metal portion of the fuse where it is secured to the glass portion of the fuse.
7. Place the fuse(s) (1 amp, metric, fast-acting, 5x20mm, 250V) in the fuse holder, properly orienting the fuse(s).
8. Slide the fuse holder back into the power entry module and press firmly to make sure it is completely seated.
9. Close the fuse cover and press gently until it seats completely, flush with the back of the Docking Station.
The instrument is ready to be reconnected to AC power. If the fuses blow shortly after replacement, the instrument requires service.

Performance Verification

Under normal operation, no internal adjustment or recalibration is required. Safety tests and internal adjustments should be done by qualified personnel only. Safety checks should be performed at regular intervals or in accordance with local and governmental regulations.

To test the performance of the Radical-7 following repairs or during routine maintenance, follow the procedure outlined in this chapter. If the Radical-7 fails any of the described tests, discontinue its use and correct the problem before returning the instrument back to the user.

Before performing the following tests, do the following:

- Place the Handheld into the Docking Station.
- Connect the Docking Station to AC power and fully charge the Handheld battery.
- Disconnect any patient cables or pulse oximetry probes.
- Disconnect any SatShare, serial or analog output cables from the instrument.
- Set the Radical-7 to Normal operating mode by going to the Main menu and the Home Use feature to *No*.

Power-On Self Test

To conduct a Power-On Self Test

1. Connect the monitor to the AC power and verify that the AC Power indicator is illuminated.
2. Turn on the monitor. Within 5 seconds, all available indicators illuminate, the instrument emits a tone and the Masimo logo displays.
3. The Docking Station indicator continuously illuminates and the Radical-7 begins normal operation.

Alarm Limit Test

To conduct an Alarm Limit Test

1. Change the High SpO2 Alarm parameter to a value two points below the currently selected value. See Alarms for SpO2.
2. Verify that the newly set parameter is shown on the *Display* screen.
3. Return the parameter to its original setting.
4. Repeat steps 1 to 3 for all active parameters.
5. Reset the alarm limits again to the original settings.

Testing with the optional Masimo SET Tester

To conduct a test with the optional Masimo SET Tester

1. Turn off and then turn on the Radical-7.
2. Use the Patient Cable connector on the Radical-7 to connect the Masimo SET Tester to the Radical-7.
3. See the directions for use that were provided with the Masimo SET Tester.

Nurse Call Test

To conduct a Nurse Call test

1. Disconnect any patient cables, sensors, or accessories from the Radical-7. Turn off the Radical-7 and then turn on again.
2. Ensure that there are no audible alarms and that the Audible Alarm feature is not set to silenced.
3. Verify the Nurse Call polarity is set to normal (default).
4. Connect the common lead of a digital multi-meter to the pin 12 (Nurse Call Common) of the Analog Output connector on the Radical-7. Connect the positive lead of the multi-meter to pin 6 (Nurse Call - Normally Open) of the Analog Output connector and measure that the resistance is greater than 1 MW (open circuit).
5. Trigger an alarm on the monitor (for example, by disconnecting a sensor after it was measuring data). Verify that the resistance is less than 35 ohms.

Analog Output Test

To conduct an Analog Output test

1. Disconnect any patient cables, sensors, or accessories from the Radical-7. Turn off the Radical-7 and then turn on again.
2. Connect the common lead of a digital voltmeter to the pin 2 (Ground) of the analog output connector on the Radical-7. Connect the positive lead of the voltmeter to pin 9 (Analog 1) of the analog output connector.
3. On the *device output* screen, on the *analog 1* option, select **0V Output**. See **Device Output** on page 76.
4. Verify that the voltmeter measures a voltage of approximately 0V.
5. Change the *analog 1* option to **1V Output**.
6. Verify that the voltmeter measures a voltage of approximately 1.0V.
7. Repeat steps 5 and 6, with the positive lead of the voltmeter connected to pin 15 (*analog 2*). See **Serial Interface Specifications** on page 115.
8. Connect a patient cable and sensor and verify that the voltage on pins 9 and 15 are between 0V and 1.0V while measuring a saturation and pulse rate.

Battery Test

To conduct a Battery test

1. Fully charge the Radical-7 by placing the Handheld into the Docking Station and then connect the AC power.
2. Verify that the Handheld Battery Charging indicator is illuminated.
3. When the Radical-7 is fully charged, the Handheld Battery Charging indicator turns off.
4. Turn on the Radical-7 on and verify that the Battery indicator shows a full charge.

Repair Policy

Masimo or an authorized Service Department must perform warranty repair and service. Do not use malfunctioning equipment. Have the instrument repaired.

Clean contaminated and/or dirty equipment before returning, following the cleaning procedure described in *Cleaning*. Make sure the equipment is fully dry before packing.

To return the instrument for service, see *Return Procedure on page 128*.

Return Procedure

Clean contaminated/dirty equipment before returning, following instructions in *Cleaning* on page 123. Make sure the equipment is fully dry before packing. Call Masimo at 800-326-4890 and ask for Technical Support. Ask for an RMA number. Package the equipment securely, in the original shipping container if possible, and enclose or include the following information and items:

- A letter describing in detail any difficulties experienced with the Radical-7. Include the RMA number in the letter.
- Warranty information, a copy of the invoice or other applicable documentation must be included.
- Purchase order number to cover repair if the Radical-7 is not under warranty, or for tracking purposes if it is.
- Ship-to and bill-to information.
- Person (name, telephone/Telex/fax number, and country) to contact for any questions about the repairs.
- A certificate stating the Radical-7 has been decontaminated for bloodborne pathogens.
- Return the Radical-7 to the shipping address listed in *Contacting Masimo* on page 129.