Masimo SET® Rad-9 Pulse Oximeter
Service and Maintenance Manual

For further information about the Rad-9, LNOP® SpO_2 Sensors, LNOP® PC-Series Patient Cables or other Masimo products, contact:

Masimo, Inc.
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Possession or purchase of this device does not convey any express or implied license to use the device which would, alone, or in combination with this device, fall within the scope of one of more of the patents relating to this device.

Section 1: Preventative Maintenance

Note: The oximeter does not require calibration.

Cleaning

To clean the front panel, use a cotton swab moistened with 70% isopropyl alcohol or a 70% isopropyl alcohol wipe.

To clean the case, use a soft cloth dampened with a mild soap and water solution or diluted bleach. Do not allow liquids to enter the inside of the oximeter.

To clean reusable sensors and patient cables, refer to the Directions for Use accompanying LNOP® Oximetry Sensor and PC-Series Patient Cables.

Repair policy and procedure

All service and repairs must be performed by Masimo or a qualified Masimo service technician. Masimo will provide circuit diagrams, parts lists, and descriptions to qualified service personnel upon request. Use of Masimo service documentation and replacement parts alone does not qualify a technician. Contact Masimo for further information.

Service performed by individuals other than a qualified service technician voids the product warranty.

Packaging and return procedure

For equipment to be serviced by Masimo, obtain a Return Authorization Number and detailed shipping instructions before returning by contacting:

Masimo Corporation
2852 Kelvin Avenue
Irvine, CA 92614 USA

Phone: (949) 250-9688
Fax: (949) 250-9686

Please clean the oximeter according to the above instructions before returning it to Masimo. Ensure it is completely dry before packing. Package the oximeter securely in the original shipping container and packaging materials.

Enclose the following items:

1. A letter describing in detail the problems experienced with the oximeter. Please reference the Return Authorization Number obtained from Masimo.
2. Warranty information - a copy of the invoice or other applicable documentation.
3. Original purchase order number.
4. Shipping and billing information for returning the serviced oximeter and invoicing for any charges.
5. Personal contact information, including name, telephone/Telex/fax number, and country, to discuss any questions about the repairs.
6. A certificate stating the oximeter has been decontaminated of blood borne pathogens.

Section 2: Status Messages

Message	Potential cause	Suggested action(s)
COMM ERR	Serial communication failure.	Ref: PART *7: Product test and inspection.*
DEFECTIVE SENSOR	An incompatible or damaged sensor is connected.	Use a compatible and functional LNOP® sensor.
INSUFFICIENT LIGHT	The sensor does not have sufficient signal to accurately monitor.	Select another sensor site with less tissue thickness or that allows better light transmission. Remove nail polish or artificial nail if in use.
INTERFERENCE DETECTED	Outside signal is disrupting oximeter.	Remove outside signal source or move sensor, patient cable and oximeter away from signal source.
LOW PERFUSION	Only a very weak signal is detected.	Move the sensor to a site with better perfusion. Refer to the Directions for Use accompanying the sensor.
LOW SIGNAL IQ	Signal quality is poor due to excessive patient motion, low perfusion, or interference. SpO2 and Pulse Rate readings may be invalid.	Move the sensor to a site with better perfusion. Reduce motion or interference if possible. Check patient clinical signs to evaluate patient status.
NO SENSOR CONNECTED	No sensor is connected to the oximeter.	Connect patient cable and sensor to the oximeter.
PULSE SEARCH	Oximeter is searching for patient pulse.	If SpO_2 and pulse rate values are not displayed within 30 seconds, move the sensor to a site with better perfusion and/or light transmission.
RECHARGE BATTERY	The battery power is extremely low and insufficient to operate the oximeter.	Connect the oximeter to AC power.
SENSOR OFF PATIENT	The sensor is not properly attached to the patient.	Attach the sensor to the patient. Refer to the Directions for Use accompanying the sensor.
SPO2 LIMIT < 80%	The oximeter has been turned on with the SpO2 alarm limit set below 80%.	Confirm or adjust the alarm limit setting.
TOO MUCH AMBIENT LIGHT	High levels of external light (from daylight, examination lights, infrared heat lamps, etc.) are detected.	Cover the sensor site with dark or opaque material. Select another sensor site more protected from ambient light.
UNRECOGNIZED SENSOR	The sensor is damaged, defective or incompatible.	Use a compatible and functional LNOP® sensor.
SYSTEM FAILURE (M-XX) or (Q-XX)	System failure.	Refer to *Section 3: Troubleshooting guide* or contact Masimo for service.

Section 3: Troubleshooting Guide

The following guide is used to determine the required part or assembly needed to service a non-functional oximeter. It is assumed that the troubleshooter has at least one spare of each part or assembly listed in this manual. This will aid in exchanging components during troubleshooting to determine the suspect component.

Warning: Individuals performing service on this oximeter must be trained electrical technicians capable of safely working around 240VAC and familiar with electronic troubleshooting.

Warning: Individuals who are not trained electrical technicians must not attempt to service this product.

Warning: Hazardous voltages are present in the oximeter that may cause fire, or electrocution resulting in bodily injury up to or including death if service procedures are not strictly followed.

Caution: The oximeter warranty is void if the oximeter is disassembled by a non-qualified service technician. Use of Masimo service documentation and replacement parts alone does not make a person a qualified service technician. Please contact Masimo for more information.

Note: If this Troubleshooting Guide does not resolve the particular problem currently experienced, please contact Technical Support at Masimo for additional assistance.

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Note: Individuals performing service will need a ground continuity tester to ensure the oximeter complies with the Medical Device Safety Standard IEC 60601-1 after servicing.

Required Equipment and Tools

- Anti-static Workstation
- Screw Driver, Flat, #2
- Screw Driver, Phillips, #1
- Screw Driver, Phillips, #2
- Torque Wrench, 20 – 100 In-Oz
- Torque Wrench, 1 – 30 In-Lbs
- Nut Driver, 3/16”
- Nut Driver, 1/4"
- Nut Driver, 5/16”
- Cable Tie Tool or Wire Cutters
- DVM or DMM
- Ground Continuity Tester
- Known-good Masimo LNOP® PC08 or PC12 sensor cable
- Known-good Masimo LNOP® DCI or disposable sensor

Troubleshooting Process Overview

The process of troubleshooting is divided into eight sub-sections identified, for example, as PART 1 or PART 2 etc:

PART 1	External damage analysis
PART 2	External functional analysis
PART 3	External power system analysis
PART 4	Product disassembly
PART 5	Internal power system analysis
PART 6	Internal system PCA, MS-3 PCA and LCD module analysis
PART 7	Product test and inspection
PART 8	Product reassembly

Each of these sub-sections (PARTS) and steps should be addressed sequentially unless the process specifically states to skip to another PART.

It is highly recommended to make copies of the troubleshooting guide and document analysis on related sheets. A copy of the documented analysis will aid Masimo should Masimo need to be contacted for assistance.

Troubleshooting Process Detail

NOTE: Throughout the troubleshooting part of the manual, spare parts are listed as a reference for replacement. In some instances, there are two different part numbers for the same part description. Spare part usage is based on the design of the Rad-9 being serviced. A serial number configuration, specific to the Rad-9 design, will be implemented. For Rad-9 units with serial number configurations (QZ-XXXXXXXX) or (9XXXXX), the word "cur" (= current) will be used to distinguish spare part usage. For serial number configuration (A1XXXXX), the word "new" will be used to distinguish the spare part usage. Parts that are listed without a serial number distinction are backwards compatible.

If the failure mode of the oximeter is not known, perform PART 7: Product test and inspection to determine the failure mode. Once failure mode is determined, follow through with the appropriate steps in the manual.

Part 1: External damage analysis

Step	*Investigation*	*Results*	*Notes*	*Parts/Assy's list*
1a	Is the bezel, keypad or LCD damaged?	Y ☐ N ☐		20240-Bezel ass'y w/o LCD. 20407-Bezel ass'y w/ LCD. 12651-LCD, blue
1b	Is the sensor connector damaged? Is the communication connector damaged?	Y ☐ N ☐		20375-System PCA "cur" 20399-System PCA "new"
1c	Is the case damaged?	Y ☐ N ☐		20366-Case ass'y "cur" 20427-Case ass'y "new"
1d	Are the feet and/or bail handle damaged?	Y ☐ N ☐		20366-Case ass'y "cur" 20427-Case ass'y "new"
1e	Is the rear panel damaged? Do the labels need to be replaced?	Y ☐ N ☐		30420-Rear Panel, sheet metal 12293-Label, CE 12294-Label, UL/CSA

Part 2: External functional analysis

Step	*Investigation*	*Results*	*Notes*	*Service Kit*
2a	Unplug the unit from AC and attempt to turn the unit on. Does the yellow light flash ten times? If yes, the battery charge is too low for operation. Plug the unit into AC. Verify the green LED illuminates indicating that the battery is charging and that the unit functions normally. Allow the battery to charge for two hours then re-check to see if the unit will turn on without AC. If yes, turn unit off and charge for a full 24 hours. If the battery still will not run the unit or still will not hold a charge, go to PART 4: Product disassembly.	Y ☐ N ☐		
2b	Plug the unit into AC and attempt	Y ☐		

	to turn it on. If it does not turn on, go to PART 3: External power system analysis.	N ☐		
2c	Did two tones sound and the green, yellow, and red LEDs illuminate for ~3 seconds? If no, go to PART 3: External power system analysis. If yes, but the system still does not function properly go to PART 3: External power system analysis.	Y ☐ N ☐		
2d	Attach the known-good patient cable and sensor to the unit, and place the sensor on a finger. Does the unit present reasonable SpO_2 and pulse rate values? If no, go to PART 4: Product disassembly. If yes, but the system still does not function properly go to PART 3: External power system analysis. If yes, go to PART 7: Product test and inspection.	Y ☐ N ☐		

Part 3: External power system analysis

Step	*Investigation*	*Results*	*Notes*	*Service Kit*
3a	Plug the unit into AC and attempt to turn the unit on. Does it turn on? If no, verify: • AC fuses have continuity; • AC outlet has power; • AC power cord has continuity; • AC power cord is properly plugged in at both ends. If still no, go to PART 4: Product disassembly. If yes but the green LED is not illuminated or there is another problem, go to Part 4: Product disassembly.	Y ☐ N ☐		12286-Fuse, 2A, Fast 20367-AC Harness “cur” 20408-AC Harness “new”

3b	Attach the known good patient cable and sensor to the unit, and	Y ☐		

	place the sensor on a finger. Does the unit present reasonable SpO_2 and pulse rate values, and appear, in general, to operate properly? If no, go to PART 4: Product disassembly. If yes, go to PART 7: Product test and inspection.	N ☐		

Troubleshooting Process Detail – Internal Analysis

Part 4: Product disassembly

Caution: Product warranty is void if the product is disassembled by a service representative not authorized by Masimo, Inc. Use of Masimo service documentation and replacement parts alone does not make a technician an authorized Masimo service representative.

Step	*Investigation*	*Results*	*Notes*	*Service Kit*
4a	Unplug the unit from AC.			
4b	Remove the four cap nuts with thread rods on the rear of the unit. Remove the two standoffs from the RS-232 connector on the rear panel.			12702-Rod, Threaded, SS, 6-32, with Hex Cap 12308-Stand off, Male-Female, #4-40, Threaded
4c	Cur: Tip the product up slowly towards the rear and slide the rear panel assembly about a third of the way out of the case until restricted by the DC harness. New: Set rear panel assembly aside. Remove the rear hex head button screw from the battery mounting bracket.			
4d	Disconnect the DC harness. Cur: Remove the rear panel w/battery mount assembly from the case.			
4e	Carefully remove front bezel w/system PCA out of the case. Set the case aside. New: Remove the front hex head button screw from the battery mounting bracket. Carefully remove the mounted battery assembly from the case. Set the case aside.			
4f	Place the bezel assembly (with system PCA) and rear panel assembly (with mounted battery assembly), on a high-impedance			

	anti-static mat, similar to their position inside the case. Reconnect the DC harness to the system PCA.			

4g	Inspect the unit and ensure that all connections are electrically and mechanically sound. If no, make connection or return unit to Masimo. Go to: PART 5: Internal power system analysis.	Y ☐ N ☐		

Part 5: Internal power system analysis

Warning: Hazardous voltages are exposed when the opened unit has AC power connected and may cause fire or electrocution, resulting in bodily injury or even death. Please exercise extreme caution!

Step	*Investigation*	*Results*	*Notes*	*Service Kit*
5a	First, verify that the wires on the system board PCA power connector pins 'batt –' and 'batt + ', and pins 'main pwr –' and 'main pwr +' are not reversed. If reversed, remove the wires and position correctly, if feasible. If not feasible, replace with a new DC power harness. Plug the unit into AC but do not turn the unit on. Measure the power supply voltage at system board PCA power connector between pins 'main pwr –' and 'main pwr +'. Is the power supply voltage less than 14.85V? If no, go to step 5e.	Y ☐ N ☐	Measured voltage: _____	20368-DC harness w/ in-line fuse. "cur" 20409-DC harness w/o in-line fuse. "new"
5b	Measure the DC output of the power supply at DC 'out –' and DC 'out +'. Is the voltage less than 14.85v? If no, go to step 5e.	Y ☐ N ☐	Measured voltage: _____	
5c	Measure the AC input voltage at the AC input connector pins (Hot and Neutral) of the power supply PCA. Is AC voltage present? If yes, replace the power supply PCA. If no, go to 5d.	Y ☐ N ☐	Measured voltage: _____	12299-Power Supply "cur" 12645-Power Supply "new"

5d	Measure the AC voltage at the power entry module between the hot and neutral blades. Is AC voltage present? If yes, replace the AC harness and re-check. Go to PART 7: Product test and inspection. If no, verify AC is coming through the power cord and visually there is no indication of damage to the power cord. If yes, replace the power entry module. Re-check and go to PART 7: Product test and inspection.	Y ☐ N ☐	Measured voltage: _____	20367-AC harness "cur" 20408-AC harness "new" 12298-Power entry module
5e	Measure the battery voltage at system PCA power connector between 'batt –' and 'batt +'. Is the battery voltage less than 12.00V? If no, go to step 5j. If the battery voltage measures zero (0v) then check the in-line fuse. If open, replace in-line fuse on DC harness or replace system PCA, depending on configuration. If the fuse is OK, replace the DC harness.	Y ☐ N ☐	Measured voltage: _____	12287- In-line fuse 20399-System PCA 20368 – DC harness w/ in-line fuse. "cur" 20409 – DC harness w/o in-line fuse. "new"
5f	Measure the battery voltage at the battery terminals. Is the voltage less than 12v? If no, go to PART 7: Product test and inspection.	Y ☐ N ☐		
5g	Check to see if the battery voltage, at the battery terminals, is rising at least a few mV/minute. Is the voltage rising? If yes, go to step 5j.	Y ☐ N ☐		

5h	Measure the voltage across system PCA resistor R49 (1Ω, ½W) [DC harness w/ in-line fuse] or R40 (1Ω, ½W) [DC harness w/o in-line fuse]. Is the voltage greater than 0.3V? If no, replace the system PCA. If yes, replace the battery and go to	Y ☐ N ☐	Measured voltage: _____	12275-Battery 20375-System PCA "cur" 20399-System PCA "new"

	PART 7: Product test and inspection.			
5j	Allow the battery to charge for a full 24 hours. After the 24-hour charge and with the unit still plugged into AC, measure the battery voltage at the battery terminals. Is the battery voltage 13.5V – 13.7V? If no, replace the battery and go to PART 7: Product test and inspection.	Y ☐ N ☐	Measured voltage: _____	
5k	Unplug the unit from AC and attempt to turn the unit on. Does it turn on? If yes, go to step 6a.	Y ☐ N ☐		

Part 6: System PCA, MS-3 PCA and LCD module analysis

Step	*Investigation*	*Results*	*Notes*	*Service Kit*
6a	Plug the unit into AC and turn on. Does it turn on? If the unit responds, test each keypad button and verify that it performs the expected function. If not, replace the bezel and recheck. If after two replacement bezels the unit still does not work, then go to step 6g. If unit works, go to PART 7: Product test and inspection. If there is no response from the unit (except for the green AC LED), replace the bezel. If this does not resolve the issue, then go to step 6g. If unit works, go to PART 7: Product test and inspection.	Y ☐ N ☐		20240-Bezel ass'y w/o LCD.

6b	Do the three LEDs illuminate for approximately 3 seconds on power up? If this does not resolve the problem, go to 6g. If yes, go to PART 7: Product test and inspection.	Y ☐ N ☐		
6c	Is there an audible response from	Y ☐		

	the unit? If no, replace the bezel and go to PART 7: Product test and inspection. If this does not resolve the problem, go to 6g.	N ☐		
6d	Does the unit turn on but have a blank display or other display problem? If yes, replace the LCD module and recheck. If this does not resolve the problem, go to 6g. Otherwise, go to PART 7: Product test and inspection.	Y ☐ N ☐		12651-LCD, blue
6e	Does the unit exhibit a "SYSTEM FAILURE" message during power up? If yes, replace the MS-3 PCA and recheck. If this does not resolve the problem, go to 6g. Otherwise, go to PART 7: Product test and inspection.	Y ☐ N ☐		1331-MS-3 PCA
6f	Attach the known good patient cable and sensor to the unit, and place the sensor on a finger. Does the unit exhibit a "No Sensor Connected" message even with a sensor attached? If yes, replace the MS-3 PCA and recheck. If this does not resolve the problem, go to 6g. Otherwise, go to PART 7: Product test and inspection.	Y ☐ N ☐		1331-MS-3 PCA

6g	If the unit still does not function, replace the system PCA and recheck. Go to PART 7: Product test and inspection.			20375-System PCA "cur" 20399-System PCA "new"

Part 7: Product test and inspection, Rad-9

Tools

- Calibrated Digital Voltage Meter (DVM) or Digital Multimeter (DMM)
- Known-good Masimo LNOP® sensor and cable
- Computer with RS-232 cable and communication program (Terminal)
- Leakage current tester

Procedure

Note: Perform service at an electrostatic discharge (ESD) workstation. Always use ESD precautions when handling PCAs.

Note: Verify that all items (materials, equipment and procedures) are available.

7.1 Ground continuity testing

7.1.1 With the power cord connected only to the unit, measure the resistance from the plug ground prong to all exposed metal on the chassis. The measured resistance must not exceed 0.2Ω.

7.2 Leakage current testing

7.2.1 Measure the unit leakage current following the instructions supplied with the leakage current tester. The leakage current must not exceed 100μA.

7.3 Functional testing

7.3.1 Connect a computer with an RS-232 cable and RS-232 communication software (such as Terminal). Set up the software for input from the pulse oximeter at 9600 baud, 8 data bits, 1 stop bit and no parity. Connect to the unit.

7.3.2 Turn on the unit. Verify that the speaker sounds two tones, the backlight turns on, the three LEDs illuminate for approximately three seconds and that the unit comes up with the “NO SENSOR CONNECTED” message at the top of the display.

7.3.3 Turn the unit off.

7.3.4 Plug a sensor into the unit and turn it on. Put a finger into the sensor, keep the hand still, and wait (less than 10 seconds) for waveform and saturation data to be displayed. Saturation values should be between 90 and 100%, pulse rate should be displayed, and a clean plethysmographic waveform should be visible in the graphics portion of the display.

7.3.5 Verify that the computer is displaying data from the unit approximately every 2 seconds in the following format: MM/DD/YYYY HH:MM:SS XXX ZZZ where “XXX” is the SpO2 value and “ZZZ” is the pulse rate value.

7.3.6 Remove the finger from the sensor and verify that the unit alarms with a flashing red alarm light, a repeating three tone-two tone sequence, and that the message area of the display reads “SENSOR OFF PATIENT”.

7.3.7 Press the alarm silence key. Verify that the alarm is audibly and visually silenced.

7.3.8 Plug the unit into AC line power and assure that the green Mains Power/Battery Charging LED illuminates. Press the following keys: [LIMITS], [NEXT], [EXIT], [SETUP], [EXIT]. Verify each key press operates accordingly. Turn the back light on and off by pressing [LIGHT] twice. Press the up arrow two times and verify that the volume increases. Press the down arrow two times and verify that the volume decreases. Press and hold the Contrast button [◑] to cycle through all possible settings. Ensure that the unit performs as expected to each key press.

7.3.9 Press [SETUP]. Press [MORE] until you see "Diagnostics" in the menu. Press [NEXT] until you have highlighted [Options]. Press [▼] to "Test Memory" and select "Yes". [Confirm] to test the unit's memory. The test takes approximately 60 seconds. Verify that "Passed" is displayed on the LCD next to the "Test Memory" label. Press [Exit] twice.

7.3.10 Press [SETUP]. Press [MORE] and search for [Time] in the menu. Using [▲] and [▼], set the time. Press [NEXT] and verify that the time is counting up in seconds. Using [▲] and [▼], set the date. Press [EXIT].

7.3.11 Press [SETUP]. Search for [Analog Signal]. Press [NEXT] until [Data] is highlighted. Using [▲], set the signal to "High". Using a DVM or DMM, verify the signal on connector (ANALOG OUTPUT PORT) at pin ANALOG OUT 1 and pin to ground, and ANALOG OUT 2 and pin to ground is 1.0V ± 0.1.

7.3.12 Using [▲], set the signal to "1/2". Using a DVM or DMM, verify the signal on connector (ANALOG OUTPUT PORT) at pin ANALOG OUT 1 and pin to ground, and ANALOG OUT 2 and pin to ground is 0.5V ± 0.1.

7.3.13 Using [▲], set the signal to "Low". Using a DVM or DMM, verify the signal on connector (ANALOG OUTPUT PORT) at pin ANALOG OUT 1 and pin to ground, and ANALOG OUT 2 and pin to ground is 0.0V ± 0.1. Press [EXIT].

7.3.14 Press [SETUP]. Press [MORE] and search for [Nurse Call]. Press [NEXT] and highlight [Nurse Call] selections. Using [▲], set the signal to "High". Using a DVM or DMM, verify the signal on connector (ANALOG OUTPUT PORT) between pin NURSE CALL OUT and pin to ground is 5V ± 0.25V.

7.3.15 Using [▲], set the signal to "Low". Using a DVM or DMM, verify the signal on connector (ANALOG OUTPUT PORT) between pin NURSE CALL OUT and pin to ground is 5V ± 0.25V. Press [EXIT].

7.3.16 Press [SETUP]. Press [MORE]. Search for [Reset Defaults]. Highlight [Reset Defaults] selection. Using [▲], select [YES] and [CONFIRM]. After the unit completes the self-test, set any settings specific to your institution such as language, user alarms limits, etc.

7.3.17 Turn off the unit. Disconnect all cables and cords.

7.4 Inspection

7.4.1 Visually inspect the unit for any cosmetic defects.

7.4.2 Visually inspect the case and the bezel for dents or marks.

7.4.3 Visually inspect the rear panel. Verify there are four threaded rods with hex cap (torque to 96 in oz), one on each corner, two screws in the power entry module (torque to 60 in oz), two Phillips head screws in the back panel (torque to 96 in oz) and two hex standoffs on the RS-232 connector (torque to 60 in oz).

7.4.4 Verify there is a gray UL label and a gray CE label on the back panel.

7.4.5 Visually inspect the front panel. Verify there are no fingerprints on the display window and little or no visible dust or dirt inside the display window. Clean the display with a soft cloth as necessary.

7.4.6 Verify there are two screws in the sensor connector and torque.

7.4.7 Visually inspect the bottom of the unit. Verify there are four feet, a bale, and a sheath on the bale. Move the bale up and back down to ensure it moves smoothly.

7.5 Documentation

7.5.1 If the unit does not pass test and final inspection, then go to the beginning of the Rad-9 Service Manual and troubleshoot.

7.5.2 Maintain a record of all service performed on the unit. This will aid in future troubleshooting.

7.5.3 If available, plug the unit into AC power to maintain battery charge while waiting for use.

Part 8: Product reassembly

Step	*Investigation*	*Results*	*Notes*	*Service Kit*
8a	Unplug the unit from AC.			
8b	Disconnect the DC harness from the system PCA. New: Slide mounted battery assembly into case. Attach to front and rear battery mounts using hex head button screws. Slide the bezel assembly with system PCA into the case. Ensure that the notch in the middle vertical wall of the case is to the rear of the unit.			
8c	Cur: Slide the rear panel assembly into the case until it is possible to reattach the DC harness to the system PCA. Reattach the DC harness.			
8d	Secure the rear panel assembly to the case using the threaded rods with cap nuts into each of the four holes. Tighten each rod to 96 in-			

	oz using a torque wrench.			
8e	Place the RS-232 standoffs into the holes on either side of the RS-232 connector and tighten each screw to 60 in-oz with a torque wrench.			
8f	Go to Part 7: Test and final inspection, Rad-9 Does the unit pass? If no, go to the beginning of the troubleshooting guide.	Y ☐ N ☐		

Section 4: Typical Signs and Symptoms

Other abnormal conditions may occur that are not associated with one or the system status messages.

Problem	Potential cause	Suggested action(s)
Oximeter does not power on.	Battery is too low to operate oximeter.	Connect oximeter to AC power to operate. Leave connected for at least 12 hours before using the oximeter on battery.
	Battery needs replacement.	Contact Masimo for service.
	Fuses need replacement.	Replace fuses. See the *Section 2: Maintenance and service.*
The  indicator flashes several times when [] is pressed. No other response from oximeter.	Battery power is too low to operate the oximeter.	Connect oximeter to AC power to operate. Leave connected for at least 12 hours before using the oximeter on battery.
		If condition persists, contact Masimo for service.
Oximeter powers on, but display is blank.	[] is not set correctly.	Press [] until the display is visible.
		If condition persists, contact Masimo for service.
Power cord is connected but the  indicator is not illuminated.	AC power source is not active.	Check AC power source, circuit breakers, etc.
	System failure.	Contact Masimo for service.
No response from oximeter when keys are pressed.	System failure.	Contact Masimo for service.
No speaker sound.	Pulse beep volume is set to OFF, and no alarm conditions are active.	Press [] to increase pulse beep volume.
	System failure.	Contact Masimo for service.
Continuous speaker sound.	System failure.	Contact Masimo for service.
	Communication failure.	Cycle power on both the Agilent CMS and oximeter, and verify that the baud rate is 9600 or 19200.
	SpO2 Limit <80%	Press [CONFIRM] or [CANCEL].
Oximeter displays readings while sensor is not applied to patient.	Sensitivity is set to HIGH.	Set sensitivity to normal.
	Sensor is open to ambient lighting.	Disconnect sensor from oximeter, or turn sensor detector away from ambient light source.
Erratic SpO_2 values, and intermittent "LOW PERFUSION" and "SENSOR OFF PATIENT" messages.	Open detector cathode circuit on sensor.	Use a compatible and functional LNOP® sensor.
	System failure.	Contact Masimo for service.

Appendix A: Warranty, Exclusions and End User License Agreement

WARRANTY

Masimo warrants to the initial purchaser that each new pulse oximeter will be free from defects in workmanship or materials for a period of three (3) years from the date of purchase. Masimo's sole obligation under this warranty is to repair or replace any product that Masimo deems to be covered under warranty with a repaired or a replacement pulse oximeter.

To request a replacement under warranty, contact the licensed manufacturer or Masimo for a returned goods authorization. If the licensed manufacturer or Masimo determines that a product must be replaced under warranty, it will be replaced and the cost of shipment covered. All other shipping costs shall be the responsibility of the purchaser.

EXCLUSIONS

This warranty does not extend to any product that has been subject to misuse, neglect or accident; that has been damaged by causes external to the product; that has been used in violation of the operating instructions supplied with the product. The warranty does not extend to the product that has been connected to an unlicensed instrument system, modified accessories or any unit that has been disassembled or reassembled by anyone but an authorized Masimo agent.

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