ZOLL®

R Series®
Pulse Oximetry (SpO_2)

9650-0901-01 Rev. H

The issue date for the R Series Pulse Oximetry (SpO_2) guide (**REF** 9650-0901-01 Rev. H) is August, 2020.

Indication of use

The R Series system is indicated for the continuous, noninvasive monitoring of arterial oxygen saturation (SpO_2) and pulse rate during both no motion and patient motion conditions for adult patients, and no motion conditions for pediatric and neonatal patients in a hospital or prehospital environment.

Contraindications for Use

There are no known contraindications for the use of the SpO_2 monitor.

General Information

Federal (U.S.A.) law restricts this defibrillator to sale by or on the order of a physician.

Pulse Oximetry (SpO_2)

Product Description

The R Series® pulse oximeter continuously and noninvasively measures the oxygen saturation of arteriolar hemoglobin at a peripheral site (e.g., foot, toe, or finger). It is used to monitor patients at risk of developing hypoxemia. SpO_2 monitoring provides information about the circulatory and respiratory systems and supplies details of oxygen transportation in the body. This option is widely used because it is noninvasive, continuous, easily applied, and painless.

The oximeter sensor contains two emitters that transmit red and infrared light through the monitored site. This light passes through the patient's tissues and is received by a photodetector in the sensor. Because oxygen-saturated blood absorbs light differently than unsaturated blood, the amount of red and infrared light absorbed by blood flowing through the monitored site can be used to calculate the ratio of oxygenated hemoglobin to total hemoglobin in arterial blood. The monitor displays this ratio as percent SpO_2. Normal values typically range from 95% to 100% at sea level.

The quality of SpO_2 measurements depends on the correct size and application of the oximetry sensor, adequate blood flow through the sensor site, and the sensor's exposure to ambient light. For correct placement and location of the sensors, refer to the *Directions for Us*e contained in all LNCS® and RD SET™ oximetry sensor packages.

How to Use This Insert

This insert supplements your defibrillator's *R Series Operator's Guide* and describes how to set up, use, and maintain the R Series pulse oximeter. Keep this insert with your defibrillator's *R Series Operator's Guide* and all other inserts for R Series options.

Your defibrillator's *R Series Operator's Guide* provides information that users need for the safe and effective use and care of R Series products. Important safety information related to use of the R Series pulse oximeter appears in "Safety Considerations" on page 3. Additional important safety information is packaged with each oximetry sensor.

SpO_2 Intended Use

The R Series pulse oximeter, with the Masimo® SET® technology and the LNCS or RD SET series of oximeter sensors, is indicated for the continuous noninvasive monitoring of functional oxygen saturation of arterial hemoglobin (SpO_2) and pulse rate.

The R Series pulse oximeter is indicated for use with adult, pediatric, and neonatal patients during both no-motion and motion conditions, and for patients who are well or poorly perfused, in hospitals, hospital-type facilities, and mobile environments.

Oxygen saturation measurements derived from pulse oximetry are highly dependent on patient conditions and proper placement of the sensor. Patient conditions such as smoke inhalation might result in erroneous oxygen saturation readings. If the accuracy of any reading is in doubt, verify the reading using another clinically accepted method, such as arterial blood gas measurements.

The R Series Pulse Oximetry option is intended for use only with ZOLL/Masimo LNCS or RD SET sensors.

Measurement Complications

If the accuracy of any reading is suspect, first check the patient's vital signs by alternate means and then check the R Series Pulse Oximeter for proper functioning.

Inaccurate measurements may be caused by:

- Incorrect sensor application or use.
- Significant levels of dysfunctional hemoglobins (for example, carboxyhemoglobin or methemoglobin).
- Intravascular dyes, such as indocyanine green or methylene blue.
- Exposure to excessive illumination, such as surgical lamps (especially those with a xenon light source), bilirubin lamps, fluorescent lights, infrared heating lamps, or direct sunlight.
- Excessive patient movement.
- Patient conditions, such as smoke inhalation.
- Venous pulsations.
- Certain nail aberrations, nail polish, fungus, and so on.
- Placement of a sensor on a limb with restricted blood flow, a blood pressure cuff, an arterial catheter, or an intravascular line.

A weak pulse signal on the display might indicate a poorly applied sensor or a poorly chosen monitoring site. Loss of pulse signal can occur when:

- The sensor is applied too tightly.
- There is excessive illumination from light sources, such as a surgical lamp, a bilirubin lamp, or sunlight.
- A blood pressure cuff is inflated on the limb used for the oximeter sensor.
- Excessive patient movement.
- The patient has hypotension, severe vasoconstriction, or hypothermia.
- An arterial occlusion exists proximal to the sensor.
- The patient is in cardiac arrest or shock.

SPO_2 Connector and Sensors

The SpO_2 connector is located on the rear panel of the R Series unit. Use only ZOLL or Masimo accessories and sensors with the R Series Pulse Oximetry option.

Each sensor is designed for application to a specific anatomical site on patients within a certain weight range. To ensure optimal performance, use an appropriate sensor, apply it as described in the sensor's *Directions for Use*, and always observe all warnings and cautions.

Safety Considerations

Warnings

General

Carefully read your defibrillator's *R Series Operator's Guide*, these operating instructions, and the *Directions for Use* that accompany the Masimo oximeter sensors.

Only qualified personnel should operate the R Series pulse oximeter.

Do not use the pulse oximeter as an apnea monitor.

Do not immerse the R Series defibrillator, cables, or sensors in water, solvents, or cleaning solutions.

Consider a pulse oximeter an early warning device. When a trend toward patient deoxygenation is indicated, blood samples should be analyzed by a laboratory co-oximeter to completely understand the patient's condition.

If an alarm occurs while audible alarms are suspended, only visual alarm indicators are provided.

Interfering substances: Carboxyhemoglobin and methemoglobin can erroneously alter SpO_2 readings. The level of change is approximately equal to the amount of carboxyhemoglobin or methemoglobin present. Dyes or any substance containing dyes that alter arterial pigmentation might cause erroneous readings.

Do not use the R Series pulse oximeter or oximeter sensors during magnetic resonance imaging (MRI). Induced current could cause burns. The pulse oximeter might affect the MRI image and the MRI unit might interfere with the accuracy of oximetry measurements.

Carefully arrange patient cabling to reduce the possibility of patient entanglement or strangulation.

Use only the line cord supplied by ZOLL Medical Corporation for continued safety and EMC performance.

Oximeter sensors

Use only ZOLL/Masimo LNCS or RD SET oximeter sensors. Other manufacturers' sensors might not perform properly with the R Series oximeter.

Tissue damage can result from incorrect application or use of a sensor (for example, wrapping the sensor too tightly, applying supplemental tape, failing to periodically inspect the sensor site). To ensure skin integrity, correct positioning, and sensor adhesion, inspect the sensor site as directed in the *Directions for Use* provided with the sensor.

Do not use damaged sensors or cables.

Do not use a sensor with exposed optical components.

Do not sterilize a sensor by irradiation, steam, or ethylene oxide. Refer to the cleaning instructions in the Directions for Use for reusable LNCS or RD SET sensors.

Do not allow the sensor to remain on the same site for a prolonged period, especially when monitoring neonates. Check the application site at regular intervals (at least every 2 hours) and change the site if any compromise in skin quality occurs.

Do not attach the oximeter sensor to a limb being monitored with a pressure cuff or with restricted blood flow.

A poorly applied sensor might give incorrect saturation readings. A weak pulse signal on the display might indicate a poorly applied sensor or a poorly chosen monitoring site.

Choose a site with sufficient perfusion to ensure accurate oximetry values.

Certain nail aberrations, nail polish, fungus, and so on might cause inaccurate oximetry readings. Remove any nail polish or move the sensor to an unaffected digit.

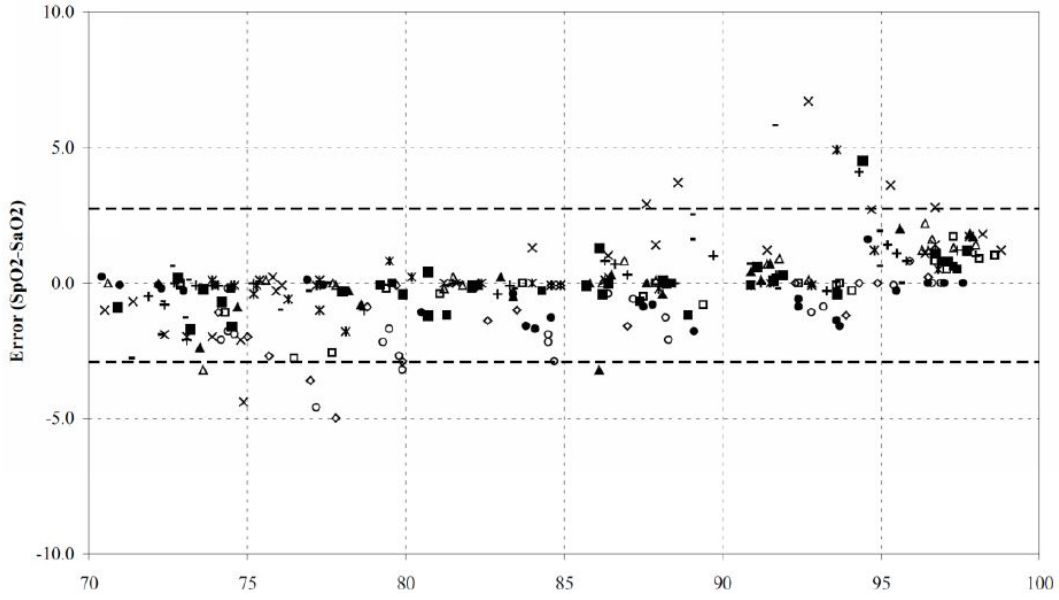
Exposure to high ambient light from surgical lamps (especially those with a xenon light source), bilirubin lamps, fluorescent lights, infrared heating lamps, or direct sunlight can affect the accuracy of oximetry readings. To prevent interference from ambient light, ensure that the sensor is properly applied. If necessary, cover the sensor with opaque material.

Do not attempt to recycle, recondition or reprocess disposable sensors or patient cables. This could damage the electrical components, leading to patient harm.

SpO_2 Accuracy Specifications

Accuracy testing for SpO_2 was performed on healthy adult subjects. The tables below provides A_{RMS} (Accuracy Root Mean Square) values measured using the Masimo Rainbow SET Technology.

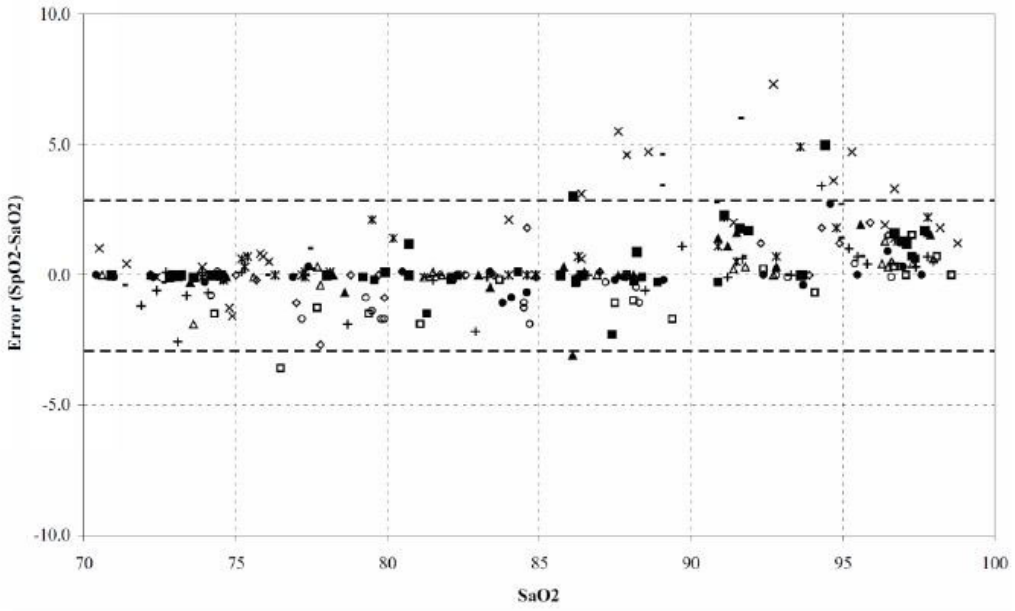
Masimo LNCS Sensors, Adult and Pediatric



MEASURED A_{RMS} VALUES	
Range	**A_{RMS}**
90-100%	1.64%
80-90%	1.07%
70-80%	1.55%

Overall Claimed Accuracy Value	
Range	**A_{RMS}**
70-100%	± 2 %

Masimo LNCS Sensors, Infant, Neonate, and Neonate (Pre-Term)

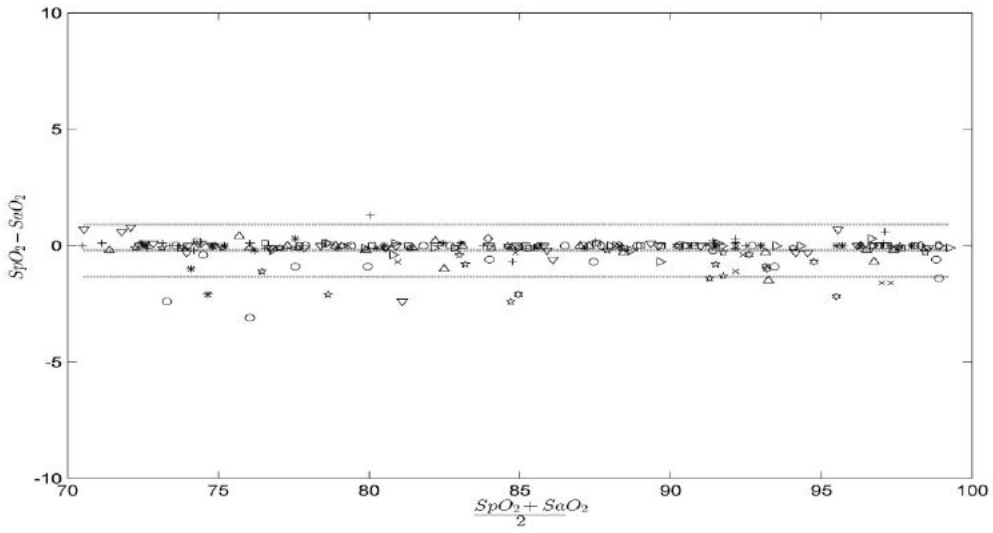


MEASURED A_{RMS} VALUES	
Range	**A_{RMS}**
90-100%	1.85%
80-90%	1.44%
70-80%	0.89%

Overall Claimed Accuracy Value			
Range	A_{RMS}		
	Inf	Neo*	Neo Pt*
70-100%	± 2%	± 2% Adult ± 3% Neonatal	± 3%

*The saturation accuracy of the Neonate and Preterm sensors were validated on adult volunteers and 1%was added to account for the properties of fetal hemoglobin.

Masimo DCI/DCIP Sensors



MEASURED A_{RMS} VALUES	
Range	A_{RMS}
90-100%	0.60%
80-90%	0.54%
70-80%	0.67%

Overall Claimed Accuracy Value	
Range	A_{RMS}
70-100%	± 2 %

Selecting a Sensor and Cable

When selecting a sensor, consider the patient's weight, the adequacy of perfusion, the available sensor sites, and the anticipated duration of monitoring. For more information, refer to the following table or contact ZOLL Medical Corporation. Select an appropriate sensor, apply it as directed, and observe all warnings and cautions presented in the *Directions for Use* accompanying the sensor.

Sensor	Type	Patient Weight
LNCS Adtx	Single Use	Adults > 30 kg
LNCS Pdtx	Single Use	Pediatrics and Slender Adults 10 - 50 kg
LNCS Neo-L	Single Use	Neonates < 3 kg
LNCS NeoPt-L	Single Use	Neonates < 1 kg
LNCS Inf-L	Single Use	Infant 3 - 20 kg
LNCS DCI	Reusable	Adults and Pediatrics > 30 kg
LNCS DCIP	Reusable	Pediatrics 10 - 50 kg
RD SET Adult	Single Use	Adults > 30 kg
RD SET Pediatric	Single Use	Pediatrics and Slender Adults 10 - 50 kg
RD SET Infant	Single Use	Infant 3 - 20 kg
RD SET Neonatal/Adult	Single Use	Neonatal: < 3 kg Adult: > 40 kg
RD SET Neonatal	Single Use	Neonates < 1 kg
RD SET NeoPt-500 Non-Adhesive	Single Use	Neonates < 1 kg
RD SET DCI, Adult	Reusable	Adults > 30 kg
RD SET DCIP, Pediatric	Reusable	Pediatrics and Slender Adults 10 - 50 kg

ZOLL offers four reusable patient cables for use with Masimo oximeter sensors.

ZOLL Part Number	Item
8000-0298	4 foot (1.2 m) patient cable
8000-0293	10 foot (3.0 m) patient cable
8000-001142	5 foot (1.5 m) RD SET patient cable
8000-001143	12 foot (3.5 m) RD SET patient cable

Selecting a Sensor Application Site

Choose a site that is well perfused and restricts a conscious patient's movements the least. The ring finger or middle finger of the nondominant hand is preferred.

Alternatively, you can use the other digits on the nondominant hand. Be sure the sensor's detector is fully covered by flesh. You can use the great toe or long toe (next to the great toe) on restrained patients or patients whose hands are unavailable.

To prevent interference from ambient light, ensure that the sensor is properly applied, and cover the sensor site with opaque material, if required. Failure to take this precaution in high ambient light conditions may result in inaccurate measurements.

Do not select an SpO_2 sensor site on the same arm/leg as an NIBP cuff. Inflation of the cuff will cause the SpO_2 values to read incorrectly.

Applying a Reusable DCI Sensor

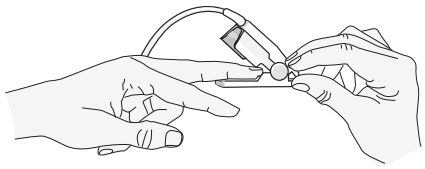
Note: These instructions describe how to apply a reusable DCI sensor. For all other reusable sensors, refer to the sensor packaging for application instructions.

Note: The reusable sensor is not intended for use on the thumb or across a child's hand or foot.

Select a monitoring site (see previous section), then apply the reusable DCI sensor as follows:

1. Place the selected digit over the sensor window, making sure that the sensor cable runs over the top of the patient's hand.

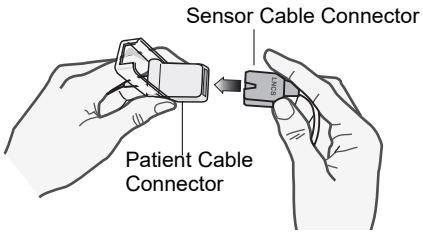
   The fleshiest part of the digit must cover the photodetector window in the lower half of the DCI sensor.



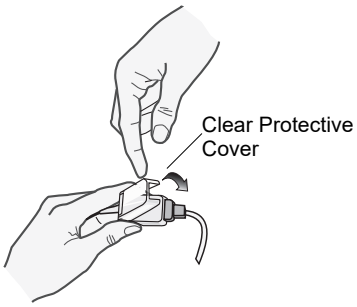
2. On finger sites, make sure the tip of the finger touches the raised digit stop inside the sensor. If the fingernail is long, it may extend over and past the finger stop.

Note: With smaller digits, the digit may not need to be pushed all the way to the stop to completely cover the detector window.

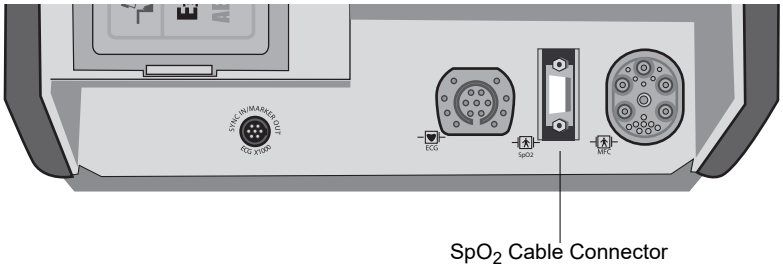
3. Check the sensor position to ensure that the top and bottom halves of the DCI sensor are parallel. To ensure accurate data, you must have complete coverage of the detector window (see previous figure).
4. Lift the clear plastic protective cover from the female end of the patient cable, then plug the sensor cable's male connector all the way into the patient cable connector (LNCS shown below).



5. Lower the clear plastic protective cover over the connection to secure it.



6. Connect the SpO_2 patient cable to the SpO2 connector on the rear panel of the R Series unit.



Applying a Single-Use Sensor

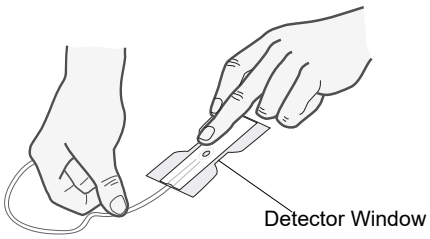
You can use a disposable LNCS or RD SET sensor for SpO_2 monitoring. Do not wrap the adhesive too tightly as this can cause venous pulsations that could lead to inaccurate saturation measurements.

You can reapply a disposable sensor to the same patient if the emitter and photodetector windows are clear and the adhesive still adheres to the skin. To rejuvenate the adhesive, wipe it with an alcohol pad and then allow the sensor to thoroughly air dry before placing it on the patient.

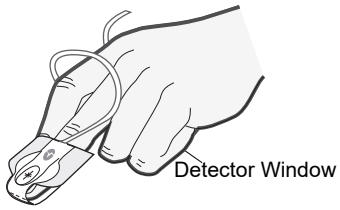
Note: LNCS Adtx sensors are not intended for use across a child's hand or foot. For instructions on proper application of neonatal sensors, refer to the *Directions for Use* included with each LNCS sensor.

1. Open the pouch and remove the sensor.
2. Holding the sensor with the tan printed side downward, bend the sensor backward and remove the backing material.

3. Orient the sensor so that the digit can be attached to the detector side of the sensor first.



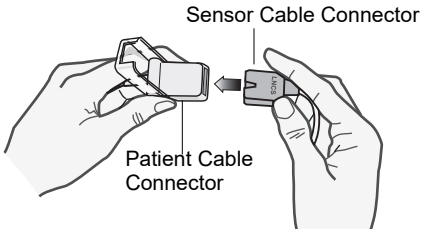
4. Press the detector onto the fleshy part of the finger near the tip of the finger. To ensure accurate data, you must have complete coverage of the detector window.
5. With the emitter positioned over the fingernail, secure the wings around the finger.



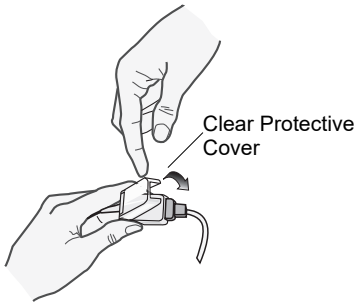
When positioned properly, the:

- emitter and photodetector are vertically aligned
- digit completely covers the photodetector window
- connector tab is located on the top side of the finger

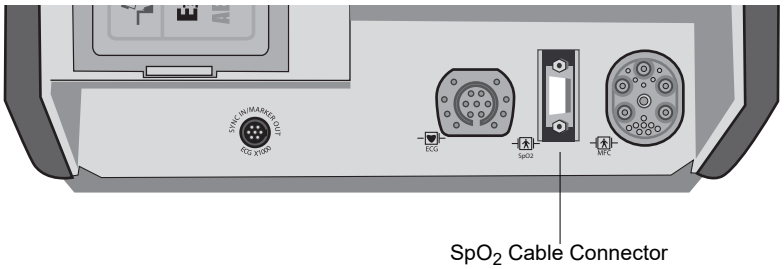
6. Lift the clear plastic protective cover from the female end of the patient cable, then plug the sensor cable's male connector all the way into the patient cable connector (LNCS shown below).



7. Lower the clear plastic protective cover over the connection to secure it.



8. Connect the SpO_2 patient cable to the SpO_2 connector on the rear panel of the R Series unit.



Cleaning and Reuse of Sensors

Reusable sensors can be cleaned as follows:

1. Disconnect the sensor from the patient cable.
2. Wipe the entire sensor clean with a 70% isopropyl alcohol moistened pad.
3. Allow the sensor to air dry before returning it to use.

Cleaning and Reuse of Patient Cables

Patient cables can be cleaned as follows:

1. Disconnect the sensor from the patient cable (if attached).
2. Disconnect the cable from the rear of the R Series unit.
3. Wipe the cable clean with a 70% isopropyl alcohol moistened pad.

Allow the cable to dry before using it.

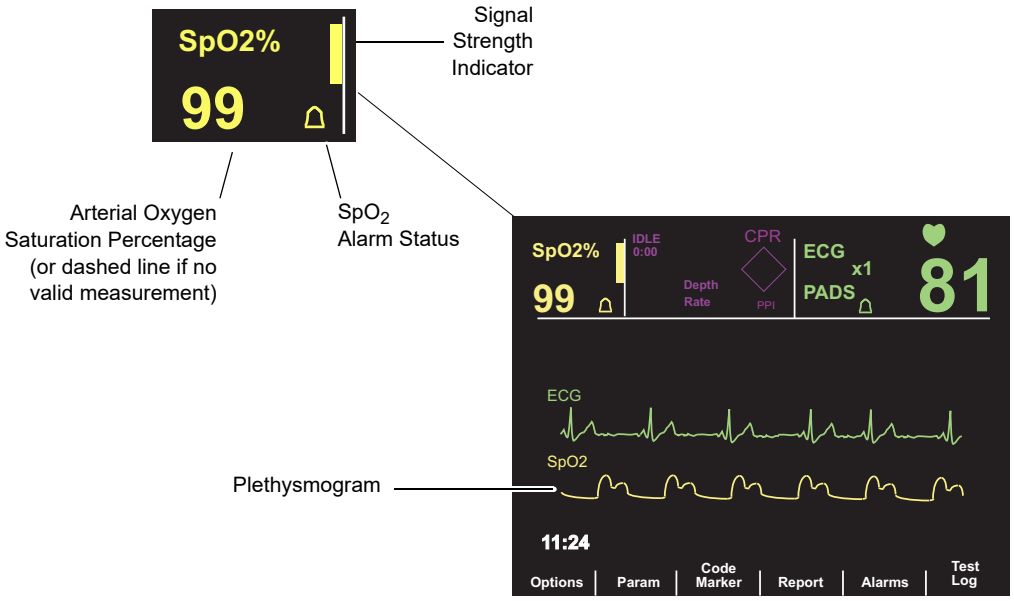
How SpO_2 Information is Displayed

The R Series pulse oximeter displays the following information in the SpO_2 area:

- SpO_2 value (arterial oxygen saturation percentage)
- SpO_2 alarm indicator
- Signal strength indicator (the bar rises and falls to indicate the relative change in the pulsatile signal)

The display optionally includes the normalized plethysmogram below the ECG trace. The R Series pulse oximeter calculates oxygen saturation and updates the display once per second.

Note: If you are using the Plus or BLS models, you will see the SpO_2 value, the alarm indicator, and the signal strength indicator whwile in AED or Manual mode. To see the normalized plethysmogram, the unit must be in Manual mode.



Monitoring a Patient

To set up the pulse oximeter:

1. Attach the sensor to the patient, and plug the sensor cable into the patient cable (refer to "Applying a Reusable DCI Sensor" on page 8 or "Applying a Single-Use Sensor" on page 9.)
2. Ensure the patient cable is connected to the unit.
3. Turn the Mode Selector to the following:
   - MONITOR for ALS models.
   - ON for Plus or BLS models. Press the **Manual Mode** softkey, and then the **Confirm** softkey to enter the Manual mode of operation.

   When the unit obtains measurements for arterial oxygen saturation, numeric values replace the dashed lines on the display.
4. If the pulse indicator shows a weak signal, check the oximeter sensor or apply it to a more appropriate site.

   If necessary, enable SpO_2 alarms and adjust the alarm limits. Refer to "Setting SpO2 Alarms" on page 15.

Note: If ECG leads are not attached to the patient, the unit uses SpO_2 pulse measurements for displaying the heart rate (HR) in the ECG area. In this case, the heartbeat indicator does not flash.

Note: If the unit displays the message *SPO2 COMM ERROR* shortly after powering on, the SpO_2 monitoring subsystem has failed. Contact ZOLL Technical Service.

Adjustable SpO_2 Settings

The pulse oximeter includes several settings which you can adjust when the unit is in clinical mode:

- Sensitivity level
- Measurement averaging period
- Plethysmogram display
- SpO_2 alarm state and limits (SpO_2 and pulse rate)

Any change you make to one of these settings remains in effect until changed again or until the unit is turned off for at least 10 seconds. When restarted, the unit reinstates its configured default settings, which can differ from the factory defaults. (For the factory default values, refer to "Default Settings for the SpO_2 Option" on page 16.)

To access the SpO_2 monitoring functions:

1. Turn the Mode Selector to the following:
   - MONITOR for ALS models.
   - ON for Plus or BLS models. Press the **Manual Mode** softkey, and then the **Confirm** softkey to enter the Manual mode of operation.
2. Press the **Param** softkey.

   Softkey labels for the SpO_2 functions appear: **Sens** (used to adjust the SpO_2 sensitivity), and **Average** (used to adjust the SpO_2 averaging period). Follow instructions in the two subsequent sections.

Setting the SpO_2 Sensitivity

The **Sens** softkey allows you to select either Normal or High sensitivity for SpO_2 monitoring. Normal sensitivity is recommended for most patients.

Under very low perfusion conditions, such as severe hypotension or shock, high sensitivity might provide more accurate measurements.

Note: With high sensitivity, SpO_2 measurements are more easily contaminated by artifact; carefully and continuously observe the patient.

To set the SpO_2 sensitivity level:

1. Press the **Sens** softkey.

   The **Normal** and **High** softkeys appear.
2. Press the softkey for the preferred SpO_2 sensitivity, then press the **Return** softkey.

Setting the SpO_2 Averaging Period

The R Series provides three different time periods over which SpO_2 values are averaged:

- 4 seconds
- 8 seconds (factory default)
- 16 seconds

The averaging period is rarely changed from the 8-second default setting. For high-risk patients with rapidly changing SpO_2 conditions, use 4-second averaging. The 16 second setting should be used only when the 8-second setting (default) is inadequate due to extremely high artifact conditions.

To set the SpO_2 averaging period:

1. Press the **Average** key.

   The following softkeys appear: **4 secs**, **8 secs**, **16 secs**.
2. Press the softkey for the preferred averaging period, then press the **Return** softkey.

Displaying the Plethysmogram

When pulse oximetry is in use, the unit can display a plethysmogram below the ECG in either the second or third trace position in MONITOR and DEFIB mode (for ALS models) or ON mode (for Plus and BLS models), or in the second trace position in PACER mode (for all models).

The amplitude of the plethysmogram remains constant for all saturation levels (see the *R Series Operator's Guide* for instruction on how to adjust the amplitude of the waveform using the SIZE button). The shape of the waveform itself is variable.

To display or remove the plethysmogram:

1. From one of the following modes:
   - MONITOR, DEFIB or PACER mode for ALS models
   - ON or PACER mode for Plus or BLS models
2. Press the **Options** softkey.
3. Press **Traces**.
4. Press **Trace 2** in PACER mode, or press either **Trace 2** or **Trace 3** in DEFIB or MONITOR mode (for ALS models) or ON mode (for Plus or BLS models) to select the position.
5. To display the plethysmogram in the selected position, press **SpO_2**. To remove the trace from the display, press **Off**.
6. When you are finished, press **Return** twice to return to the main menu.

The third waveform disappears in DEFIB mode (for ALS models) or ON mode (for Plus or BLS models) under the following conditions:

- When the **CHARGE** button is pressed
- When the **ANALYZE** button is pressed
- When the **ENERGY SELECT** button is pressed
- While synchronization is enabled

Setting SpO_2 Alarms

The R Series pulse oximeter provides operator-programmable alarms for arterial oxygen saturation and pulse rate. These are high-priority alarms, indicated visually by flashing the associated bell symbol and parameter values and audibly by a continuous tone.

Note: Once the arterial oxygen saturation reaches the high or low limit, there is a 4 second delay until the alarm occurs.

For the low and high alarm limit ranges and factory default values, refer to "Specifications" on page A-1 of your defibrillator's *R Series Operator's Guide*.

Note: When monitoring heart rate via pulse oximetry rather than ECG electrodes, the tachycardia alarm limit is automatically lowered to 235 if it was previously set to a higher value. The unit restores the higher setting when ECG monitoring resumes.

SpO_2 Automated Alarm Limits

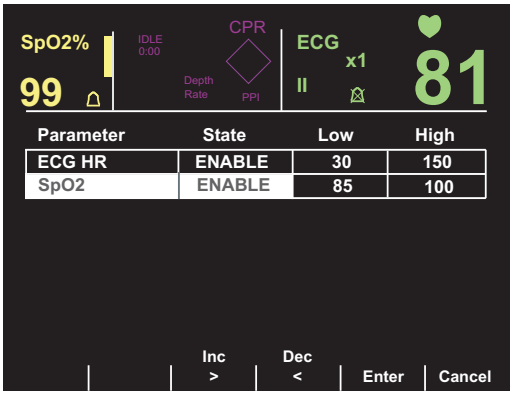
When the SpO_2 alarm state is set to AUTO, the unit calculates the low and high limits for arterial oxygen saturation as follows:

SpO_2 Alarm Limit (AUTO State)	Calculation
Low	95% of the patient's current saturation measurement
High	105% of the patient's current saturation measurement (up to 100%)

To use AUTO alarm limits, ensure that the unit is making valid SpO_2 measurements from the patient.

To set SpO_2 alarm limits:

1. Using the procedure "Setting Alarms for Monitored Parameters" in your defibrillator's *R Series Operator's Guide*, select the parameter SpO_2.



2. Follow procedures in the Alarm section of your defibrillator's *R Series Operator's Guide* to enable or disable processing and/or set alarm limits.

For information on configuring different alarm default va'lues, refer to the *R Series Configuration Guide.*

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Weekly Test Procedure

Perform the following procedure weekly to ensure that the pulse oximeter is functioning properly.

Use a reusable oximeter sensor for this procedure and test the pulse oximeter as follows:

1. Attach a reusable SpO_2 sensor to your finger and connect the patient cable to the SpO_2 connector.
2. Turn the Mode Selector to the following:
   - MONITOR for ALS models.
   - ON for Plus or BLS models. Press the **Manual Mode** softkey, and then the **Confirm** softkey to enter the Manual mode of operation.

   The monitor displays the pulse signal indicator and the arterial oxygen saturation percentage.
3. Manually measure your pulse and compare it with the displayed pulse rate.

   The displayed pulse rate should be comparable to your measured pulse.
4. Observe the plethysmogram and verify that the wave repeats at the pulse rate.

   If the unit is not displaying the waveform, refer to “Displaying the Plethysmogram” on page 14.
5. With SpO_2 alarms enabled, raise the low SpO_2 limit to generate an alarm, suspend the alarm tone, and then reset the low limit. (For instructions, refer to “Setting SpO2 Alarms” on page 15.)

   When the alarm occurs, the unit emits a continuous alarm tone, highlights the SpO_2 value, and flashes the associated bell symbol.
6. Lower the high SpO_2 limit to generate an alarm, suspend the alarm tone, and then reset the high limit. (For instructions, refer to “Setting SpO2 Alarms” on page 15.)

   When the alarm occurs, the unit emits a continuous alarm tone, highlights the SpO_2 value, and flashes the associated bell symbol.
7. Remove the sensor from your finger without disconnecting the patient cable.

   The unit emits two beeps and displays the message: *CHECK SPO2 SENSOR*.
8. Replace the sensor on your finger and wait for the SpO_2 value to reappear.
9. Unplug the patient cable from the unit.

   The unit emits two beeps and displays the message: *CHECK SPO2 SENSOR*.

Default Settings for the SpO_2 Option

The table below lists the factory default settings for SpO_2 monitoring and the range of values available for each parameter. Unless changed by the user, these default settings will always

appear after the unit is powered-up. See the *R Series Configuration Guide* for instructions on changing power-up defaults.

Parameter	Factory Default Setting	Possible Values
Averaging period	8 seconds	• 4 seconds • 8 seconds • 16 seconds
Sensitivity level	Normal	• Normal • High
SpO_2 low saturation limit	85%	50% to 100% or OFF
SpO_2 high saturation limit	OFF (appears as: ---)	50% to 100% or OFF
Low Heart Rate Alarm Limit	30 beats per minute	20 to 100 beats per minute
High Heart Rate Alarm Limit	150 beats per minute	60 to 280 beats per minute (ECG) 60 to 235 beats per minute (SpO_2)

SpO_2 Accessories

The following table describes each of the SpO_2 accessories.

Item	Description	REF
LNCS Adtx	Single use sensor for Adult patients > 30 kg	8000-0320
LNCS Pdtx	Single use sensor for Pediatrics and Slender Adults 10 - 50 kg	8000-0321
LNCS Inf-L	Single use sensor for Infants 3 - 20 kg	8000-0322
LNCS Neo-L	Single use sensor for Neonates < 3 kg	8000-0323
LNCS NeoPt-L	Single use sensor for Neonates < 1 kg (Pre-term)	8000-0324
LNCS DCI	Reusable sensor for Adults and Pediatrics > 30 kg	8000-0294
LNCS DCIP	Reusable sensor for Pediatrics 10 - 50 kg	8000-0295
LNC-4	4' Reusable Patient Cable	8000-0298
LNC-10	10’ Reusable Patient Cable	8000-0293
MD14-05	RD SET 5’ Reusable Patient Cable	8000-001142
MD14-12	RD SET 12’ Reusable Patient Cable	8000-001143
LNC Ext	LNC Extension Cable, DB-9 Termination, 4ft	8000-0325
LNCS-to-LNOP	Adapter Cable, LNCS Sensor to LNOP Patient Cable	8000-0327
LNOP DC-12	LNOP Adult Reusable Direct Connect 12’ Cable	8000-0296
RD SET Adt	Single use sensor for Adult patients > 30 kg	8000-001877
RD SET Pdt	Single use sensor for Pediatrics and Slender Adults 10 - 50 kg	8000-001878
RD SET Inf	Single use sensor for Infants 3 - 20 kg	8000-001879
RD SET Neo	Single use sensor for Neonates < 3 kg and Adults > 40 kg	8000-001880
RD SET NeoPT	Single use sensor for Neonates < 1 kg (Pre-term)	8000-001108
RD SET NeoPt-500	Single use non-adhesive sensor for Neonates < 1 kg (Pre-term)	8000-001107
RD SET DCI	Reusable sensor for Adults and Pediatrics > 30 kg	8000-001814
RD SET DCI-P	Reusable sensor for Pediatrics and Slender Adults 10 - 50 kg	8000-001815

Messages and Troubleshooting

Message or Symptom	Possible Causes	Recommended Action
SPO2 AMBIENT LIGHT	Excessive ambient light	Relocate the sensor, reduce the ambient light, or shield the sensor from the light.
SPO2 PULSE SEARCH	Sensor cannot detect a pulse.	Normal behavior immediately after applying the sensor. If this message persists beyond 10 seconds, reposition or relocate the sensor, or increase perfusion.
CHECK SPO2 SITE	Insufficient perfusion at the sensor site	Reposition or relocate the sensor, or increase perfusion.
CHECK SPO2 SENSOR	An inappropriate sensor site, poor application of the sensor, no patient cable plugged in, or motion is causing invalid SpO_2 readings.	Reposition or relocate the sensor, or increase perfusion. Ensure that the cable is plugged into the unit. Cease motion.
Dashes appear in place of the SpO_2 saturation percentage.	Excessive ambient light, inadequate perfusion, high signal artifact, or a defective or disconnected sensor or patient cable	Reposition or relocate the sensor, reduce the ambient light, shield the sensor from the light, or increase perfusion. Check the cable and sensor.
Message: *SPO2 COMM ERROR*	The pulse oximeter subsystem is not communicating with the defibrillator.	Turn unit off and then back on to see if message clears. If message persists, contact ZOLL Technical Service.

Specifications

The following specifications apply to the R Series pulse oximeter only. For information about the R Series defibrillator and batteries, refer to your defibrillator's *R Series Operator's Guide*.

General	
Saturation range (%SpO_2)	1% to 100%
Saturation resolution	1%
Saturation accuracy * **Note:** R Series defibrillators are designed to work with the Masimo LNCS or RD SET series of sensors and are dependent on their specifications. Refer to Masimo LNCS or RD SET sensor labeling for accuracy information.	<u>During no-motion conditions</u> Adults/pediatrics: 70% to 100%, ±2% 0% to 69%, unspecified Neonates: 70% to 100%, ±3% 0% to 69%, unspecified <u>During motion conditions</u> All patients: 70% to 100%, ±3% 0% to 69%, unspecified

Saturation alarm limits	On/Off displayed on monitor; operator-selectable. Low limit: 70% to 98% High limit: 72% to 100%
SpO_2 Wavelength * **Note:** Information about wavelength range can be especially useful to clinicians.	Nominal Red LED Wavelength: 660 nanometers Nominal Infrared LED Wavelength: 905 nanometers
Energies (Radiant Power) of light for LNCS Sensors at 50 mA pulsed	Minimum: 0.13 mW Maximum: 0.79 mW
Pulse rate range	25 to 240 beats per minute
Pulse rate resolution	1 beat per minute
Pulse rate accuracy	During no-motion conditions 25 to 240 beats per minute, ±3 beats per minute During motion conditions 25 to 240 beats per minute, ±5 beats per minute
Pulse rate alarm limits	On/Off displayed on monitor; operator-selectable. Low limit: 20 to 100 beats per minute High limit: 60 to 235 beats per minute
Biocompatibility	Patient-contacting material meets requirements of ISO 10993-1, Biological Evaluation of Medical Device, Part I, for external surfaces, intact surfaces, and short-term exposure.
Environmental	
Temperature	Operating: 0°C to 40°C Storage and shipping: –20°C to 60°C **Note:** The defibrillator might not perform to specifications if stored at the upper or lower temperature extreme and then put to immediate use.
Electromagnetic immunity	EN60601-2-4; IEC 1000-4-3 to 18 V/m
Software Hazards	Minimized by compliance with EN14971

Note: The Pulse Oximetry Option is calibrated for functional saturation.

Note: Because R Series pulse oximeter measurements are statistically distributed, only about 68% of these measurements can be expected to fall within plus or minus one standard deviation of the value measured by a CO-oximeter.

* The accuracy of the R Series pulse oximeter can only be verified by comparing its measurements to those obtained with a CO-oximeter. Pulse oximeter functional testers cannot be used to verify the accuracy of the oximeter or its sensors.

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