OHMEDA

THE BOC GROUP

Biox 3760 Pulse Oximeter

Operation and Maintenance Manual

L&SP No. 7234

Important

This manual is subject to periodic review, update, and revision. Customers are cautioned to verify that the manual's information applies to the software and hardware present in the equipment.

This product performs as described in this manual, and in accompanying labels and/or inserts, when assembled, operated, maintained, and repaired in accordance with the instructions provided.

This product must be cleaned and checked periodically. Do not use a defective product. Parts that are broken, missing, plainly worn, distorted, or contaminated should be replaced immediately. If repair or replacement become necessary, call or write to request service advice from the nearest Ohmeda Regional Service Center (listed on back cover). Do not repair this product or any of its parts other than in accordance with written instructions provided by Ohmeda and by Ohmeda-trained personnel.

The product must not be altered without the prior written approval of Ohmeda's Safety Department. The user of this product shall have the sole responsibility for any malfunction that results from improper use, faulty maintenance, improper repair, unauthorized service, damage, or alteration by anyone other than Ohmeda.

The safety, reliability, and performance of this device can only be assured under the following conditions:

- If the device has been used according to the accompanying operating instructions.
- If fittings, extensions, readjustments, changes, or repairs have been carried out by Ohmeda's authorized agents.
- If it is used in buildings having ground equalization wiring that complies with relevant IEC or local standards and regulations (UL, ETL, CSA, BSI, TUV, etc.).

All specifications subject to change without notice.

Text revised May 1994

1/Overview

Introduction

This manual describes the proper operation and maintenance for the Ohmeda Biox 3760 Pulse Oximeter (software Revision B). Please read this manual before using the pulse oximeter, paying attention to all details of correct operation along with precautionary measures recommended. You may perform the maintenance procedures included in this manual.

This chapter contains

- A general description of the pulse oximeter, including the theory of operation and functional components.
- An overview of the unit's features and controls.
- A list of all precautions you must follow when using the pulse oximeter.

Description

The Ohmeda Biox 3760 Pulse Oximeter is a stand-alone, non-invasive, arterial oxygen saturation monitor. It provides continuous, real-time SpO_2 and pulse rate readings.

Principles of operation

Theory

The 3760 pulse oximeter operates on the basic assumption that hemoglobin exists in the blood in two principal forms :

- **Oxygenated** (HbO_2)—with loosely bound O_2 molecules.
- **Reduced** (Hb)—with no bound O_2 molecules.

Arterial oxygen saturation (SpO_2) is defined as the ratio of oxygenated hemoglobin (HbO_2) to total hemoglobin (HbO_2 + Hb):

$$SpO_2 = \frac{HbO_2}{HbO_2 + Hb + \text{others}^*}$$

* Others = carboxyhemoglobin, methemoglobin, sulfhemoglobin, etc.; also see information about interfering substances in the A/Specifications.

Note: Because the presence of dyshemoglobins or other pigments cannot be measured by a two-wavelength instrument, the standard, internationally recognized definition for the SaO_2 read by pulse oximeters is SpO_2. The presence of appreciable amounts of these substances may result in erroneous readings. The information in this manual applies whether your unit and the messages it generates refer to SaO_2 or SpO_2.

The attenuation of light energy due to arterial blood flow can be detected and isolated. The oximeter, relying on the observation that arterial blood flow pulsates and other fluids and tissues do not, uses a patented two-wavelength, pulsatile system to differentiate between the light absorbed by hemoglobin and that absorbed by other fluid and tissue constituents. The arterial blood flow pulsation modulates light passing through the blood; nonpulsing fluids and tissues do not modulate the light.

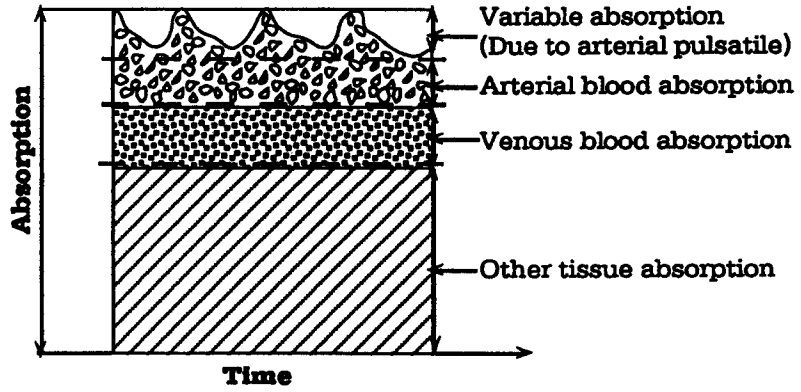


Figure 1-1. Comparative light absorption

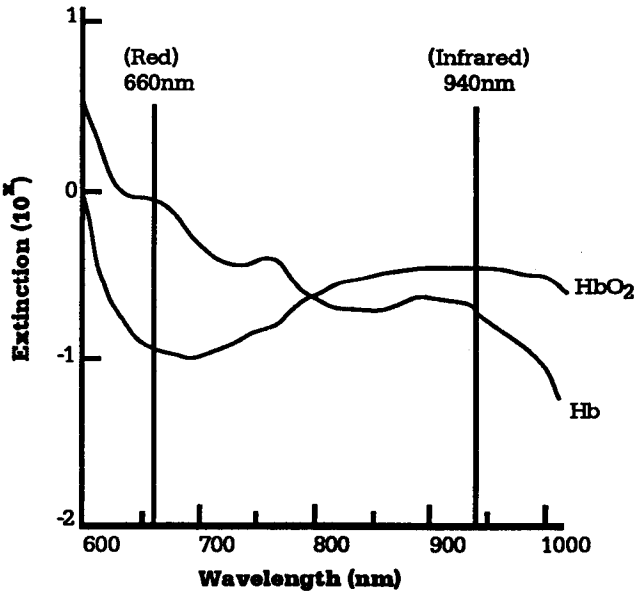


Figure 1-2. Extinction vs. wavelength graph

As shown above, HbO_2 and Hb exhibit markedly different absorption (extinction) characteristics to red light at 660 nm and infrared light at 940 nm. The oximeter measures the relative absorption by HbO_2 and Hb at these two wavelengths, and then converts this relative light intensity information into SpO_2 and pulse rate values.

Functional components

The Ohmeda Biox 3760 Pulse Oximeter uses electrical components to determine SpO_2 and pulse rate values. The key elements are:

- the probe
- the processing of the probe signal
- the calculations made by the microprocessor

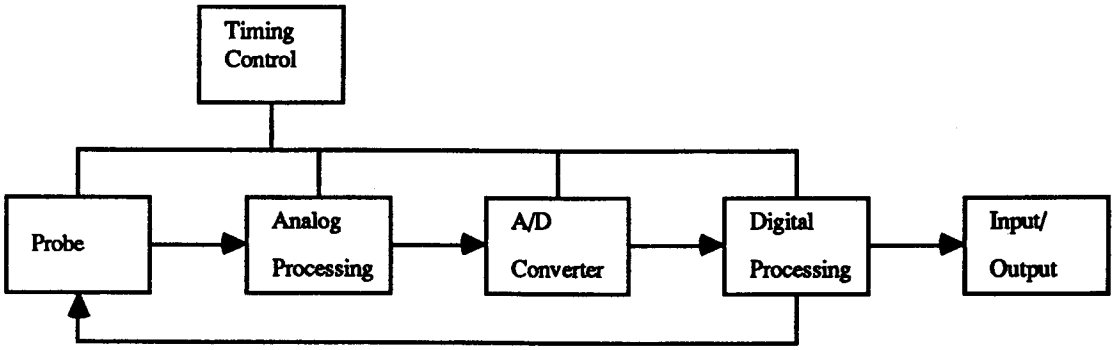


Figure 1-3. Functional components

The probe consists of:

- the light source - a red LED and an infrared LED
- the photodetector - an electronic device that produces an electrical current proportional to incident light intensity

The two wavelengths of light generated by the LEDs pass through the tissue at the probe site. This light, which is partially absorbed and modulated, is then collected by the photodetector and converted into an electronic signal. This signal is sent to the oximeter for further processing.

The electronic circuitry takes the current generated by the photodetector, processes it, and passes it to the micro-processor for calculation of the SpO_2 and pulse rate.

The calculation of SpO_2 assumes 1.6% carboxyhemoglobin, 0.4% methemoglobin, and no other pigments. Appreciable variation from these values will influence the accuracy of SpO_2. These values are based on the Ohmeda Biox 3700 Empirical Calibration Study.

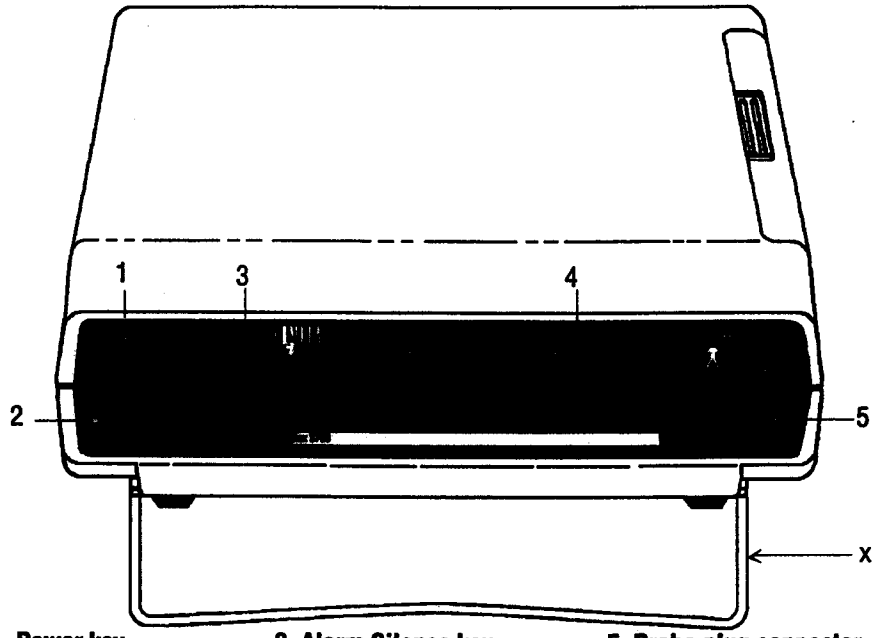
The microprocessor calculates the SpO_2 30/25 (60/50 Hz) times per second. The calculations are averaged by a running weighted average* method to determine the displayed SpO_2. The displayed average uses data over a 6 second period and is updated every 0.67 seconds (60 Hz) or 0.5 seconds (50 Hz).

* Obtained by assigning a weight (value) to each calculation based on the signal strength and the current average saturation.

The running weighted average method allows erroneous SpO_2 values to be discarded from the determination of the displayed SpO_2. Erroneous values result from probe movement, electrosurgery, and other sources of signal interference. This method of averaging provides a stable reading, with low sensitivity to interference while retaining the capability of responding quickly to saturation changes.

Features and controls

Front panel



1 Power key
2 Alarm Limit key
3 Alarm Silence key
4 Liquid crystal display
5 Probe plug connector
X Bail rod

Figure 1-4. Front panel

1 Power key
Pressing this turns the oximeter ON or OFF.

2 Alarm Limit key
Adjusts low SpO_2 alarm limit by pressing the key until desired limit is displayed and then release. (Default = 90%)

3 Alarm Silence key
Silences all audible alarms for 60 seconds, regardless if other alarms occur during this 60 second interval.

When pressed, the flashing red alarm light changes to a steady red light to indicate alarm silence. If an alarm condition still exists after the 60 second alarm silence period, the audible tone and flashing light resume.

Exception: For OFF PATIENT or NO PROBE alarms, the Alarm Silence key silences the audible alarm until either:

- The specific alarm condition is remedied or
- A different alarm condition is detected.

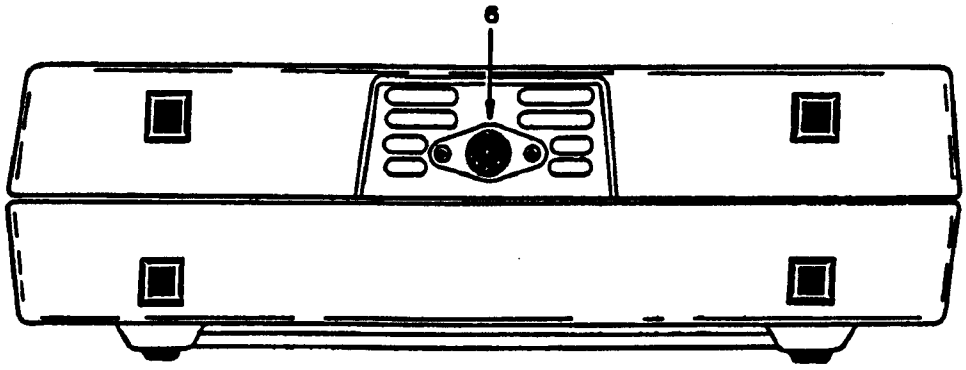
4 Liquid crystal display
Displays SpO_2, pulse rate, status messages, and alarm messages.

5 Probe plug connector
The probes supplied with this model of oximeter plug into this nine-hole connector.

X Bail rod
Folds half-way out from beneath the oximeter chassis to raise the position of the display for better viewing.

Important: Do **not** fold the rod FORWARD past the half-way stop, as damage to the chassis will occur.

Rear panel



6 Charger connector

Figure 1-5. Rear panel

6 Charger connector
Connects the oximeter to the AC charger for continuous operation and/or charging of the battery.

Precautions

Two types of precautions appear in this manual: warnings and cautions.

Warnings

A **WARNING** indicates the possibility of injury to the patient or operator.

Handle the monitor with care
Improper handling can cause damage or inaccurate results.

Failure of operation
If the oximeter fails any part of the preoperative checkout procedures, calibration, or current leakage test, remove it from operation until qualified service personnel have corrected the situation.

The oximeter is a microprocessor-based device designed to immediately shut down if the microprocessor fails. This prevents the possible display of erroneous information. No alarms forewarn this action.

Data validity
Calibration is verified during powerup. Do **not** operate the oximeter unless it is properly calibrated or inaccurate patient readings will result.

Excessive ambient light, excessive motion, low perfusion, or electrical interference at the probe site may cause erroneous readings.

To prevent erroneous readings, do not use an inflated blood pressure cuff on the same limb as the oximeter probe.

Electrical shock hazard
This equipment must be properly grounded.

- Connect this equipment only to a three-wire, grounded, hospital-grade receptacle. The three-connector plug must be inserted into a properly wired three-wire receptacle; if a three-wire receptacle is not available, a qualified electrician must install one in accordance with the governing electrical code.
- Do not under any circumstances remove the grounding connector from the power plug.
- Do not use extension cords or adapters of any type. The power cord and plug must be intact and undamaged.
- If there is any doubt about the integrity of the protective earth conductor arrangement, operate the monitor on internal battery power until the AC power supply protective conductor is fully operational.

Do not remove the monitor cover. An operator may only perform maintenance procedures specifically described in this manual. Refer servicing to qualified service personnel trained in the repair of this equipment.

Use **only** the charger supplied for this oximeter.

Electrical shock and flammability hazard
Before cleaning the oximeter, always turn it off and disconnect the power cord from the AC power supply.

Explosion hazard
Do not use the oximeter in the presence of flammable anesthetics or other flammable substances.

Battery replacement
Unauthorized personnel should not attempt to install, connect, or replace the oximeter's battery.

- Removing the cover and/or faulty battery connections could be hazardous and will void the warranty.
- Reversing the battery connections could result in injury and will permanently damage the circuitry.
- If trained technical personnel are not available, call Ohmeda for assistance.
- For proper operation, replace only with the appropriate Ohmeda battery.

Patient safety
To prevent patient injury or equipment damage, use only oximeter probes identified for use with this monitor (see the instructions for the probe you are using).

If a probe is damaged in any way, discontinue use immediately.

Prolonged monitoring or patient condition may require periodically changing the probe test site. To reduce the risk of blistering, skin erosion, or ischemic skin necrosis, change the probe site as specified in the user instructions for the probe or sensor you are using. If any evidence of the above conditions appears before the specified time (for example, discoloration or reddening), change the probe site immediately.

To avoid any possibility of patient discomfort or injury during magnetic resonance imaging (MRI),

- Do not allow the oximeter probe cable to come in contact with the patient's body; keep the cable off of the patient or place a blanket or other insulating material between the patient and the probe cable.
- Position the oximeter probe and probe cable as far from the center of the magnetic field as possible.

The correct use of the oximeter is to measure only arterial oxygen saturation (SpO_2) and pulse rate.

- A pulse oximeter does not measure respiration and under no circumstances should be used as a substitute for an apnea monitor.
- The oximeter must not be used as the primary monitor for infants being monitored for apnea, either in the hospital or in the home setting. It measure SpO_2 and pulse rate, and only in conjunction with other appropriate monitoring techniques.
- A pulse oximeter is often used during sleep studies with adults, but must be used only to gather information regarding SpO_2 and pulse rate during these studies.
- A pulse oximeter is to be used only by or on the order of medically trained personnel.

Refer to the instructions for the probe you are using for detailed warning information with respect to probes.

Cautions

A **CAUTION** indicates a condition that may lead to equipment damage or malfunction.

Federal law in the USA and Canada restricts the sale of this device by or on the order of a licensed medical practitioner.

Always make sure the monitor is set up to operate at the AC power supply voltage present at the "wall" receptacle.

Avoid storing the oximeter and probes outside the following temperature ranges:

- Units without paper: -20° C (-4° F) to 60° C (140° F)
- Units with paper: -20° C (-4° F) to 45° C (115° F)

To prevent damage to the lead-acid battery, do not turn the monitor on after the **Recharge Battery** alert message appears without first plugging it into the AC power supply.

Do **not** operate the printer without paper. Damage to the print head may result. Paper purchased from Ohmeda has red edges to indicate the end of the paper on the roll is approaching.

Cleaning

- Do not autoclave, pressure sterilize, or gas sterilize this oximeter.
- Do not soak or immerse the monitor in any liquid.
- Use the cleaning solution sparingly. Excessive solution can flow into the monitor and cause damage to internal components.
- Do not touch, press, or rub the display panel with abrasive cleaning compounds, instruments, brushes, rough-surface materials, or bring it into contact with anything that could scratch the panel. Do not use solutions containing acetone or other harsh solvents to clean the display panel.

Detailed information for more extensive repairs is included in the service manual solely for the convenience of users having proper knowledge, tools, and test equipment, and for service representatives trained by Ohmeda.

Refer to the instructions for the probe you are using for detailed cleaning and caution information with respect to probes.

2/Operation

General operation guidelines

This chapter contains

- The preoperative checklist
- Information to help you assure validity of the pulse oximeter's data.
- Instructions for setting the oximeter's internal clock.
- Instructions for operating the printer.

WARNINGS:

Data validity—Excessive ambient light, excessive motion, low perfusion, or electrical interference at the probe site can result in the display of invalid data.

Electrical shock hazard—Use only the charger supplied for this oximeter. (CAUTION: Damage to the equipment may also result.)

Explosion hazard—Do not use in the presence of flammable anesthetics or other flammable substances.

Failure of operation—If the oximeter fails to respond as described, do not use it until the situation has been corrected by Ohmeda-trained service personnel.

Patient safety—If a probe is damaged in any way, discontinue use immediately.

CAUTIONS:

Use **only** Ohmeda probes, sensors, and interconnect cables with this oximeter. Otherwise, damage to the equipment may result.

Do not apply tension to the probe cable. Probe damage may result.

Preoperative checklist

Perform the following tests daily to assure proper operation of the oximeter and probes.

Visual inspection

1. Inspect the oximeter case for damage.
2. Ensure the display windows are clean. See 4/Maintenance and Service, Cleaning.

Functional inspection

1. Plug the charger into AC mains power and into the charging connector on the rear panel of the oximeter.

2. Check the probe.

   a. If appropriate, make sure the probe opens and closes smoothly. If there is any unevenness or variation in the closing motion, replace the probe.

   b. Ensure that there is no foreign material such as tape or cotton covering either the emitter or detector.

3. Connect an Ohmeda probe to the oximeter. Follow the application instructions carefully for the probe or sensor you are using.

   Check that the probe connector makes a firm connection with the oximeter.

   Check that the probe cable is not twisted, sliced, or frayed.

4. Attach the probe to either a finger or an ear.

5. To turn the oximeter ON, press the **Power** key. Verify that the oximeter displays:

   * POWER ON *

   then runs the self-diagnostic test and displays:

   SYSTEM CHECK ...

   In a few seconds, SpO_2 and pulse rate data appear.

   Important: If the oximeter fails any part of the diagnostic self-test during power up, the message SERVICE UNIT appears. Turn the oximeter off and refer to Ohmeda-trained service personnel.

6. Verify that the alarms are functional:

   - Remove the probe from the finger or ear. Ensure that the OFF PATIENT alarm message appears, the alarm tone sounds, and the red alarm light flashes.

     Note: A different OFF PATIENT message may appear when using the Flex II Probe or the SoftProbe.

   - Unplug the probe from the oximeter. Ensure that the NO PROBE alarm message appears, the alarm tone sounds, and the red alarm light flashes.

7. Turn the oximeter off. The display blanks.

Data validity

The probe must be correctly attached to the patient and the data must be reliable.

WARNING: Data validity—Excessive ambient light, excessive motion, low perfusion, or electrical interference at the probe site can result in the display of invalid data.

Factors affecting reliability of the signal and possible display of inaccurate SpO_2 readings are:

- Motion at the probe site
- Electronic noise
- Signal strength

These may be detected when the oximeter's pulse rate varies significantly from the palpated pulse rate. If you suspect that this may be the case, check the following:

- **Excessive patient movement or detector not flush with the skin:** Be sure that the probe is properly attached. If necessary, tape the probe and/or probe cable.
- **Electronic noise:** The electronic noise emitted from electrosurgery, MRI (NMR), and some electrical devices such as fans can interfere with the signal from the probe.

WARNING: Patient Safety—To avoid any possibility of patient discomfort or injury during magnetic resonance imaging,

- **Do not allowthe oximeter probe cable to come in contact with the patient's body; keep the cable off of the patient or place a blanket or other insulating material between the patient and the probe cable.**
- **Position the oximeter probe and probe cable as far from the center of the magnetic field as possible.**

- **Probe site too thick:** A large distance between the emitter (LED) and the detector can reduce the signal strength and result in a poor signal. Select a thinner site.
- **Poorly perfused site:** Select an alternate site or rub the site to increase perfusion.
- **Dark pigmentation:** Very dark pigmentation may result in low signal strength. Move the probe to a site with less pigmentation (e.g., the finger).
- **Artificial fingernails or heavy fingernail polish:** Remove polish or artificial fingernail, or select another probe site.

Clock set mode

1. Turn the oximeter on. To be sure the date and time are accurately printed, the internal clock must be set correctly.
2. Hold down the **Stop** key (for approximately 3 seconds) until the front panel displays the date and time in the following format:

   mm/dd/yy hh:mm

3. To change any of the clock settings, press the key that corresponds to the section you wish to change as shown in the following chart:

Key:	Print Slow	Print Fast	Graph Slow	Graph Fast	Pause Resume
Sets:	Month	Day	Year	Hour	Minute

- Pressing a key once changes the setting by one increment.
- Pressing a key continuously changes increments until you remove your finger from the key.

4. When you are done setting the clock, press the **Stop** key. The oximeter resumes its normal operation.

Important: If an alarm condition occurs while you are in the clock set mode, the audible alarm sounds and the red alarm light flashes, **but** the message **will not** appear on the display. (Should you want to see the alarm condition message, press the **Stop** key to exit the clock set mode.)

Printer operation

If you are using an Ohmeda Biox 3760 Pulse Oximeter with a built-in printer, read this section.

CAUTION: Do **not** operate the printer without paper. Damage to the print head may result. (Paper purchased from Ohmeda will have red edges to indicate the end of the roll.)

- The printer records the patient's SpO_2 and pulse rate readings in one of six different formats (user-selectable).
- If an alarm condition occurs, the corresponding message is printed. (If a LO BAT condition occurs, the printer automatically records the closing statistics and shuts down.)
- Thermal paper for the printer is available from Ohmeda (see "Accessories" in 4/Maintenance and Service). Use of other manufacturers' paper is **not** recommended as damage to the printer mechanism may occur.
- If long-term (more than 2 years) storage of a print-out is desired, a photocopy should be made and stored instead of the original. (Thermal paper tends to fade after 2-3 years.)
- Storage temperature range (thermal paper): -20° C (-4° F) to 45° C (115° F).

Side Panel—Printer Door

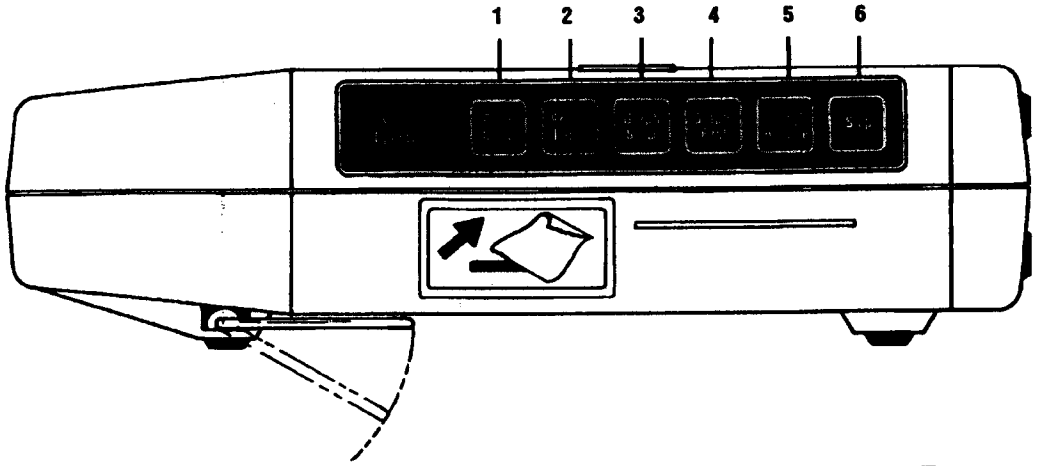


Figure 2-1. Side panel—printer door

The Ohmeda Biox 3760 Pulse Oximeter with Printer records patient SpO_2 and pulse rate in either a numeric format or graphic format.

1 through **4**: Press the key that selects the printed output format that you want, as described below.

Numeric format

Print slow

Prints the lowest SpO_2 and its corresponding pulse rate reading over a 30-second period, every 30 seconds.

(For 50 Hz Models, substitute 24 seconds for 30.)

Print fast

Prints the lowest SpO_2 and its corresponding pulse rate reading over a 6-second period, every 6 seconds.

(For 50 Hz Models, substitute 4 seconds for 6.)

```
NAME: .....
COMMENTS: .....
.....
.....
BY: .....
DATE - SEP/17/93
TIME - 10:44:07
PRINT FAST, 6 SEC./READING

SaO2%    PR     TIME
  94%    61   10:44:13
  94%    60   10:44:19
  94%    60   10:44:25
  94%    60   10:44:31
  94%    60   10:44:37
  94%    61   10:44:43
  93%    65   10:44:49
  88%    79   10:44:55
```

Figure 2-2. Numeric format

Graphic format

Graphic slow

Prints data grouped in 48-second periods (broken into eight 6-second intervals). Each line of dots represents the lowest SpO_2 per interval.

The time each 48-second period begins is printed to the left of the graph. The pulse rate measured at the time of the lowest SpO_2 for that same period is printed to the right of the graph.

(For 50 Hz Models, substitute 32 seconds for 48 and 4 seconds for 6.)

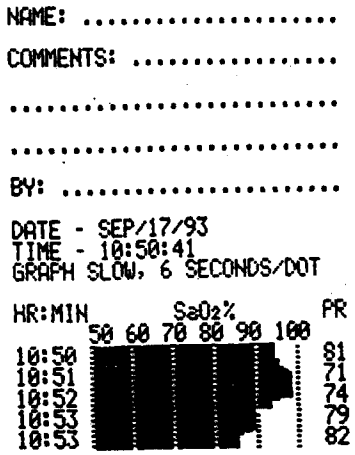


Figure 2-3. Graphic format

Graphic fast

Prints data grouped in 16-second periods (broken into eight 2-second intervals). Each line of dots represents the lowest SpO_2 per interval.

The time each 16-second period begins is printed to the left of the graph. The pulse rate measured at the time of the lowest SpO_2 for that same period is printed to the right of the graph.

(For 50 Hz Models, substitute 10.4 seconds for 16 and 1.3 seconds for 2.)

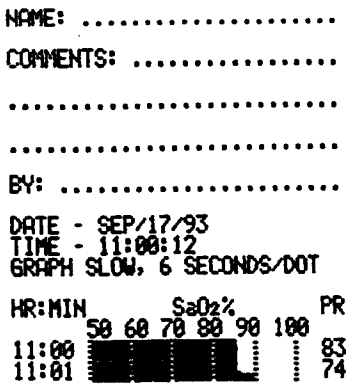


Figure 2-4. Graphic resolution print-out

Filled graph or open graph

The printer automatically prints a filled graph when either the **Graph Slow** or the **Graph Fast** key is pressed.

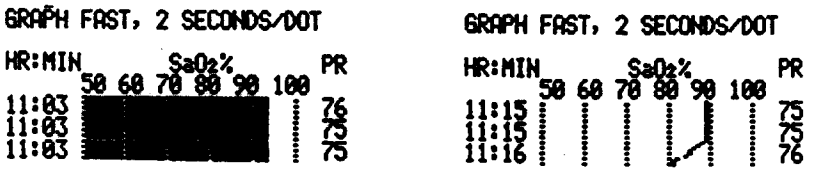


Figure 2-5. Graphic format (filled and open)

To change between a filled graph and an open graph:

1. Hold down the **Graph Fast** key (for approximately 3 seconds) until the front panel displays the status message OPEN GRAPH or FILLED GRAPH.
2. To clear that status message and return to the present patient SpO_2 and pulse rate reading, press the **Stop** key.
3. To start printing, press the desired **Graph** key.

The print-out

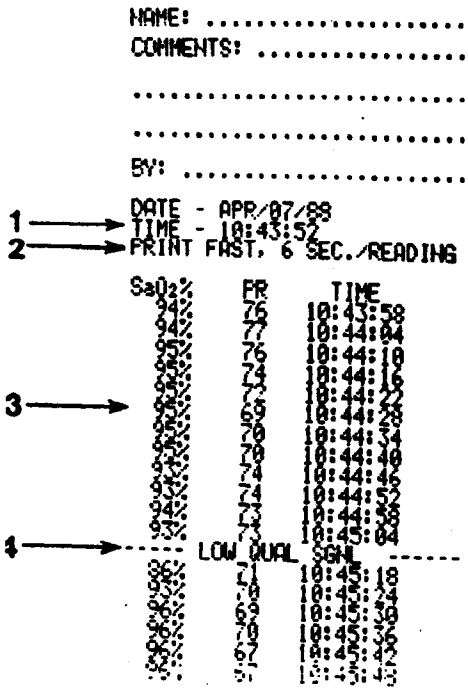


Figure 2-6. Print-out

1 Date and time the printer was turned on (set from the oximeter's internal clock).

2 Print speed and format selected, and the time frame per reading.

3 SpO_2 and corresponding pulse rate and time (shown as SpO_2 and in the numeric format).

4 Alarm messages that print as the condition occurs.

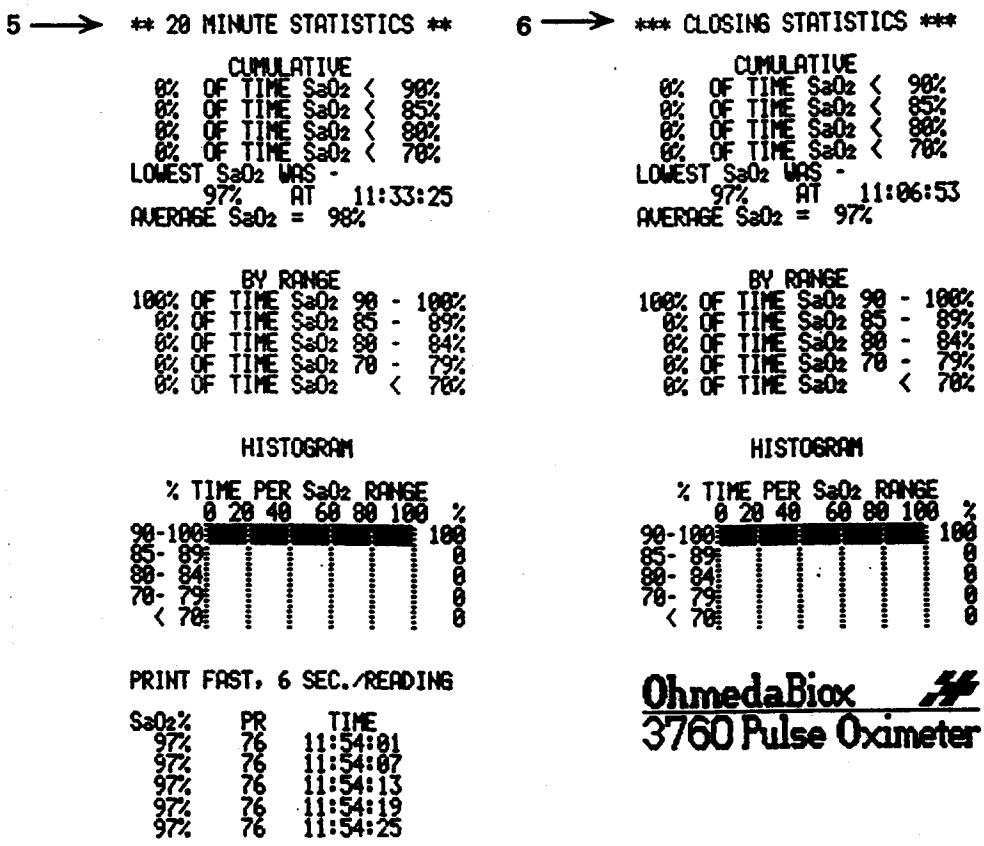


Figure 2-7. Print-out (continued)

5 Trend statistics that automatically print out during monitoring.

- Every 20 minutes (print fast or graph fast)
- Every 60 minutes (print slow or graph slow).

6 Closing statistics that print when

- the **Stop** key or another print key is pressed.
- the LO BAT condition occurs.
- the oximeter memory is filled.

Switching formats/speeds while printing

To select a different print format or print speed while printing, press the key corresponding to the selection. The oximeter prints the closing statistics and starts printing in the newly selected print format or speed.

Interrupting printing

1. To make the printer pause, press the **Pause/Resume** key once. The printer finishes printing the current line (if printing) and then prints:

   -------- PAUSE --------

   The SpO_2 and pulse rate values continue to be displayed on the front panel (provided a probe is connected to the oximeter and patient). The SpO_2 and pulse rate values are not collected during this time for the closing statistics.

2. To resume printing, press the **Pause/Resume** key again. The printer prints:

   -------- RESUME -------

   and then prints in the previously selected format.

Stopping printing

To stop the printer, press the **Stop** key once. Closing statistics are printed and then the printer turns off. If you are still monitoring a patient, SpO_2 and pulse rate values continue to be displayed on the front panel.

Statistics

Closing statistics

Closing statistics are calculated from the patient SpO_2 readings taken while the printer was activated. They do **not** include patient SpO_2 readings taken when the pause/resume function was engaged. Closing statistics include:

- Cumulative—contains the percentage of time the patient's SpO_2 was below 90%, 85%, 80%, and 70%. It also contains the time and reading of the lowest SpO_2; and prints out the average SpO_2 reading.
- By range—shows the percentage of time the SpO_2 was in each of five ranges (90-100%, 85-89%, 80-84%, 70-79%, and < 70%). Due to the way the software calculates and rounds data, it is possible that the total of these percentages may be less than 100%.

  (Note: "By range" statistics are only available in Revision B software.)

- Histogram—presents the "by range" statistics in a graphic form and is always printed as a filled graph.

The closing statistics are printed when

- The **Stop** key is pressed.
- Another print format is selected.
- The alarm message LO BAT occurs.
- The oximeter's memory is filled.

Trend statistics

Trend statistics are calculated the same as closing statistics and contain the same three parts (cumulative, by range, and histogram) as described above.

They are automatically printed out every 20 minutes while in the print fast or graph fast modes, or every 60 minutes while in the print slow or graph slow modes.

Loading printer paper

CAUTION: Never pull the paper backwards through the paper feed, this may damage the feeder mechanism. To remove the paper, cut between the paper roll and the printer door; then pull the paper forward through the front of the printer door.

1. Turn the oximeter on.
2. Place the oximeter so that the printer door can open to its maximum position. To open the printer door, press down on the thumb grip (ribbed indentation) on the top of the printer door and pull back.

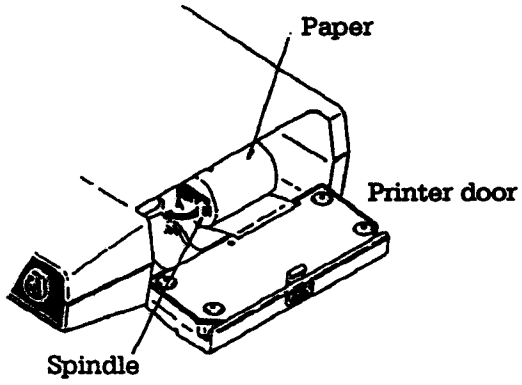


Figure 2-8. Loading printer paper

3. Unfasten the spindle cap from the paper spindle. Remove the paper roll if present.
4. Slide the new paper roll onto the spindle so that the leading edge of the paper comes out from the beneath the roll.
5. Refasten the spindle cap securely.
6. Make sure the leading end of the paper has a clean, straight edge. Feed the paper into the slot in the printer door, gently guiding it until the feeder mechanism catches it. **Do not force the paper.**
7. Close the printer door.
8. To activate the paper feed, press the **Print Fast** key for approximately 3 seconds until the front panel displays PAPER FEED.
9. When the paper is visible outside of the printer door, press the **Stop** key.

3/Messages and Troubleshooting

This chapter provides information in the event of instrument or signal problems. It is divided into four parts:

- Low SpO_2 alarm limit violation
- Probe alarm conditions
- Probe alarm messages
- Signal and device failure problems, including messages that may appear.

Low SpO_2 alarm limit violation

When the low SpO_2 alarm limit is violated:

- An alarm tone sounds.
- The red alarm light flashes.

Pressing the Alarm Silence key temporarily suppresses the audible alarm for 60 seconds and changes the flashing red Alarm light to steady red.

Probe alarm conditions

These occur when the oximeter detects conditions affecting the probe, its placement, or a probe failure. Alarms can be silenced for 60 seconds with the following exceptions:

- When OFF PATIENT or NO PROBE alarms occur:
  - An alarm tone sounds.
  - The red alarm light flashes.
  - An alarm message appears on the display.

- Pressing the Alarm Silence key during either OFF PATIENT or NO PROBE alarms silences the audible alarm and changes the red alarm light from flashing to steady until
  - The specific alarm condition is remedied.
  - A different alarm condition is detected.
  - A different message is displayed.

Probe alarm messages

MESSAGE	POSSIBLE CAUSE(S)	ACTION(S)
ID ERROR	Probe is incompatible with your unit	Use only Ohmeda probes with the correct connector.
LOW LIGHT	Dirt on probe emitter or detector, or at test site.	Clean the probe and/or test site.
	Tissue sample too thick.	Select thinner test site.
	Misaligned or poorly positioned probe.	Reposition the probe or select an alternate test site.
	Emitter light blocked by fingernail polish, artificial fingernails, or dark pigmentation.	Remove polish or artificial fingernail, or use alternate test site with less coloration.
	Detector failure.	Replace probe.
LOW QUAL SGNL	Poorly perfused site.	Rub site vigorously 20-30 seconds.
	Tissue sample too thick.	Check patient and oximeter setup.
		Select thinner site (i.e., less distance between the probe emitter and detector).
NO PROBE	Probe not plugged in or fully inserted into probe connector.	Insert probe plug fully into probe connector.
		Use only Ohmeda probes with the correct connector.
OFF PATIENT	Probe off patient.	Attach the probe to the patient.
Note: Other messages may occur with Flex II Probe, SoftProbe, or Easy Probe.	Excessive light detected.	Shield probe site from ambient light.
	Extremely thin tissue at test site.	Select an alternate test site.
PROBE/UNIT FAIL (Oximeter alarms for 2 seconds and then shuts off)	Oximeter detected probe or probe circuit failure.	Replace probe. If the oximeter still won't operate, unit requires service.

Signal and device failure problems

SYMPTOM/MESSAGE	POSSIBLE CAUSE(S)	ACTION(S)
CHECKSUM ERROR	Printer EPROM error.	Unit requires service.
FIFO OVERFLOW	Buffer overflow.	Turn the oximeter off and back on. If the message persists, unit requires service.
	Paper jammed in printer mechanism (printer motor not running).	Try pulling paper out through the front of the printer door. **Do not pull backwards.**
INTERFERENCE	Strong radio frequency interference; electro-cautery.	Operate from battery power or plug charger into a different wall outlet (AC mains power).
LO BAT	Battery is getting low.	Recharge the battery or operate from AC mains power. (**Note:** LO BAT message replaces the pulse rate reading.)
SERVICE UNIT	An internal component has failed.	Turn the unit off; unit requires service.
SYSTEM ERROR X (X = alphanumeric value)	Internal hardware failure.	Note error code and turn oximeter off; unit requires service.
RECHARGE BATT	Battery is unable to supply proper operating voltage.	Recharge the battery or operate from AC mains power. (**Note:** The unit turns off approximately 10 seconds after RECHARGE BATT message appears.)
Display blank or difficult to read	Display contrast requires adjustment.	Unit requires service.
	Power off.	Press power switch to turn unit on.
	Battery needs recharging or replacement.	Plug oximeter into charger and AC mains power. If the battery won't recharge, unit requires service.
	Blown fuse or internal circuit failure.	Plug oximeter into AC mains power. If the oximeter still will not operate, unit requires service.
Non-correlating or erratic pulse	Excessive patient motion.	Select alternate probe site, or tape probe cable to patient.
Non-correlating SpO_2	Comparison vs. calculated SpO_2.	Compare with a co-oximeter.
(i.e., oximeter reading does not correspond with co-oximeter reading)	Excessive ambient light.	Shield probe from ambient light.
	High concentration of carboxyhemoglobin or other dysfunctional hemoglobin.	Use oximeter only to monitor SpO_2 trends, not values.

Notes

4/Maintenance and Service

This chapter contains the following information:

- How to clean the oximeter and probes
- How to recharge the battery
- How to obtain service and repairs
- A list of accessories you can order for your unit

On a routine basis, you must:

- Clean the exterior surface of the monitor—at least weekly.
- Clean reusable probes—after each patient use.
- Recharge the battery—whenever the LO BAT or RECHARGE BATT message appears and whenever the oximeter is not in use.

Cleaning

Oximeter

WARNING: Electrical shock and flammability hazard—Always turn the oximeter off and disconnect it from AC mains power before cleaning it.

CAUTION:

Cleaning

- Do not autoclave, pressure sterilize, or gas sterilize this oximeter.
- Do not soak or immerse the monitor in any liquid.
- Use the cleaning solution sparingly. Excessive solution can flow into the monitor and cause damage to internal components.
- Do not touch, press, or rub the display panel with abrasive cleaning compounds, instruments, brushes, rough-surface materials, or bring it into contact with anything that could scratch the panel. Do not use solutions containing acetone or other harsh solvents to clean the display panel.

1. Clean the outer surface of the oximeter with a soft cloth dampened in a mild soap and water solution or isopropyl alcohol (70%).
2. Allow the unit to dry completely before using it.

Probes

Important: Follow the cleaning instructions on the user instructions shipped with the probe or sensor you are using.

In general, you may clean **reusable** probes **after each patient use**, as follows:

1. Disconnect the probe from the patient and the oximeter.
2. Clean with a soft cloth using a mild soap and water solution, or an isopropyl alcohol (70%) swab.
3. Allow the probe to dry completely before returning it to operation.

Recharging the battery

WARNING: Electrical shock hazard—Use only the charger supplied for this oximeter. Damage to the equipment may also result.

CAUTION: Do **not** turn the oximeter on after the RECHARGE BATT alarm message has been displayed without first connecting it to the charger which is plugged into AC mains power. Operating the oximeter on battery power during a RECHARGE BATT alarm condition may permanently damage the lead-acid battery.

To recharge the battery, plug the charger into AC mains power and into the charging connector on the rear panel of the oximeter. Under normal conditions, the battery lasts for several hundred "charge-discharge" cycles. To obtain maximum battery life, recharge the battery pack whenever it is not in use. The battery will not overcharge.

Note: During the recharging process, the oximeter may be operated when it is plugged into AC mains power.

Alarm messages

LO BAT appears when battery capacity is below 50%. Recharge the battery promptly when this message appears. **Note:** This message replaces pulse rate data readings on the display.

RECHARGE BATT appears for approximately 10 seconds, the audible alarm sounds, and the oximeter automatically shuts off. Immediately connect the charger into the oximeter and into AC mains power.

Repair policy and procedure

Warranty repair and service must be performed by an Ohmeda Service Representative or at the Ohmeda Service and Distribution Center. To contact an Ohmeda Service Representative, call the nearest Ohmeda Regional Service Office listed on the back cover.

Do **not** use malfunctioning equipment. Make all necessary repairs or have the equipment repaired by an Ohmeda Service Representative. Parts listed in the service manual for this product may be repaired or replaced by a competent, trained person who has experience in repairing devices of this nature. After repair, test the equipment to verify that it complies with the published specifications.

WARNING: Do not remove the cover of the monitor. An operator may only perform maintenance procedures specifically described in this manual. Refer servicing to qualified service personnel trained in the repair of this equipment.

CAUTION: Detailed information for extensive repairs is included in the *Ohmeda 3760 Pulse Oximeter Service Manual* solely for the convenience of users who have proper knowledge, tools, and test equipment, and for service personnel trained by Ohmeda.

Obtaining service

Contact the nearest Ohmeda Regional Service Office or Ohmeda representative listed on the back cover of this manual.

Packaging and return procedure

If returning equipment to Ohmeda:

Everyone:

Please clean contaminated/dirty equipment before returning.

Package the equipment securely—in the original shipping container if possible—and enclose the following items:

1. A letter describing in detail any difficulties experienced with the Oximeter.
2. Warranty information--a copy of the invoice or other applicable documentation must be included.
3. Purchase order number to cover repair if the oximeter is not under warranty.
4. Ship-to and bill-to information.
5. Person (name, telephone/Telex/fax number, and country) to contact for any questions about the repairs.

When Ohmeda's warranty is not applicable, repairs are made at Ohmeda's current list price for replacement part(s) plus a reasonable labor charge.

Inside the USA:

First, call the Ohmeda Service and Distribution Center (800 999 6277) for instructions on your specific product and then ship it prepaid to the following address:

Ohmeda Service and Distribution Center
7750 The Bluffs NW
Austell, GA 30001
Attention: Service Center

Outside the USA:

Send to your local authorized service office as shown on the back cover of this manual.

Accessories

For a current list of Ohmeda probes, sensors, and their accessories, contact your Ohmeda representative.

Description	Part number
3760 Pulse Oximeter Operation and Maintenance Manual	6050-0002-840
3760 Pulse Oximeter Service Manual	6050-0002-853
Thermal printer paper	
Single:	0380-1500-034
Box of 5:	0380-1500-021

A/Specifications

Note: All specifications are nominal and subject to change without notice.

SpO_2 accuracy (1 standard deviation)

SpO_2 range	Accuracy	Number of data points
60% – 100%	2.4%	616
90% – 100%	1.5%	183
80% – 89.9%	2.1%	197
Below 60%	Unspecified	

These accuracy measurements are statistically derived and correlated to simultaneous oxygen averaging readings measured on an Ohmeda Biox 3700 Pulse Oximeter.

Interfering substances

Carboxyhemoglobin may erroneously increase readings. The increase is approximately equal to the amount of carboxyhemoglobin present.

Dyes, or any substances containing dyes that change usual arterial pigmentation may cause erroneous readings.

See references at the end of this appendix.

Pulse rate accuracy (1 standard deviation)

± 1.7% of current reading (assuming a constant pulse rate)

SpO_2 range

0% to 100%

Pulse rate range

40 to 235 beats per minute

Alarm limits

Low SpO_2 = 80, 85, 90 (default), OFF

Oximeter

Height:	8.1 cm	(3.2 in)
Width:	26.1 cm	(10.3 in)
Depth:	27.4 cm	(10.8 in)
Weight:	2.8 kg	(6.0 lb) without Printer
	3.2 kg	(7.0 lb) with Printer

Battery

Sealed lead-acid, 12 volt, 1.9 Ampere-Hours

Charge Time (unit not operating, from a 25% charge capacity):

- 80% capacity in 4 hours
- 100% capacity in 4.5 hours

Operation time (from a fully charged battery to automatic shut-off at 25% capacity):

- Without Printer: approx. 7 hours
- With Printer: approx. 3.5 hours

Low battery indicator

LO BAT message appears when battery capacity is below 50%

Electrical requirements

Oximeter input power maximum: 15.5 volts AC ±5%, 50 or 60 Hz (non-interchangeable) at 1.4 A

100V charger

Input (AC mains): 100 VAC ±10% (217 mA max. current draw)

Output: 15.5 VAC at 1.4 A, 50/60 Hz

120V charger

Input (AC mains): 120 VAC ±10% (180 mA max. current draw)

Output: 15.5 VAC at 1.4 A, 60 Hz

220/240V charger

Input (AC mains): 220/240 VAC ±10% (100 mA max. current draw)

Output: 15.5 VAC at 1.4 A, 50 Hz

Environmental tolerances

Operating temperature:	10° – 45° C	(50° – 115° F)
Storage temperature (without paper):	-20° – 60° C	(-4° – 140° F)
Storage temperature (with paper):	-20° – 45° C	(-4° – 115° F)
Altitude:	to 3048 m	(10,000 ft)
Humidity:	5% to 80% non-condensing	

Note: At temperature extremes, the LCD read-out may exhibit reduced contrast, ghosting or darkening. When returning from temperature extremes, allow the oximeter to return to room temperature before use.

International Electrotechnical Commission classifications

Type of protection against electric shock: Class I/Internal electrical power source.

Degree of protection against electric shock: Type BF

Degree of protection against ingress of liquids: Ordinary

Mode of operation: Continuous

Recommended methods of sterilization or disinfection: See 4/Maintenance and Service in this manual and appropriate section in the instructions shipped with your probes for recommended procedures for cleaning this equipment.

Degree of safety of application in the presence of a flammable anesthetic mixed with air or with oxygen or nitrous oxide: Equipment not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.

Printer

Printer head life expectancy: approximately 500,000 lines

Paper (thermal-type) approximate dimensions:

Width:	5.7 cm	(2.25 in)
Roll diameter:	3.8 cm	(1.5 in)
Roll length:	15.8 cm	(52 ft)

One full roll of paper lasts approximately:

	60 Hz	50 Hz
Graph fast	22 hrs	17 hrs
Graph slow	67 hrs	62 hrs
Print fast	10 hrs	8 hrs
Print slow	45 hrs	44 hrs

References

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Scheller, MS, M.D., Unger, RJ, M.D. "The Influence of Intravenously Administered Dyes on Pulse Oximetry Readings" Anesthesiology, Vol 65:A161, 1986.

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Sidi, A, Rush, WR, Paulus, DA, M.D.; Gravenstein, N, M.D.; Davis, RF, M.D. "Effect of Fluorescein Indocyanine Green, and Methylene Blue on the Measurement of Oxygen Saturation by Pulse Oximetry" Anesthesiology, Vol 65:A132, 1986.

Warranty

The Ohmeda 3760 Pulse Oximeter is sold by Ohmeda only under the warranties set forth in the following paragraphs. Such warranties are extended only with respect to the purchase of this product directly from Ohmeda's Authorized Dealers as new merchandise and are extended to the first Buyer thereof, other than for resale.

Limited warranty

Ohmeda warrants that the Ohmeda 3760 Pulse Oximeter meets its published specifications at the time of shipment from the factory. Ohmeda further warrants that this product was calibrated at the factory prior to shipment [using standard gravimetrically determined calibration gases. The calibration gases used to calibrate the instrument are warranted by Ohmeda.]

Products not under warranty

The following items are not covered under this warranty: disposable items, service kits, and replacement parts. These items may be covered under a separate warranty. Consult Ohmeda for details.

Duration

This product, other than its expendable parts, is warranted against functional defects in materials and workmanship for a period of twelve (12) months from the date of delivery to the user (in no event for a period of more than twelve (12) months from the date of original delivery by Ohmeda to an Ohmeda Authorized Dealer). If any part of this product proves defective under proper and normal use within the warranty period, and the proper planned maintenance procedures have been followed, as the purchaser's exclusive remedy, Ohmeda will repair or replace, at its sole discretion, the product or any defective part provided it is returned to Ohmeda Service within 30 days.

Limitation

Ohmeda may at any time discharge its warranty obligation by repairing and returning the product to original factory performance. This may be accomplished by installing new or remanufactured assemblies or other repairs deemed appropriate by Ohmeda. Ohmeda's choice of repair or replacement shall be the sole remedy of the buyer or user.

Conditions

This warranty is valid only when Ohmeda-trained personnel have performed installation and service on the product and all recommended planned maintenance procedures have been completed during the warranty period. Damage caused by the abuse or misuse of the product is not covered by this warranty. Ohmeda shall not be liable for damage resulting from the improper installation or the misuse of the product.

Exclusion of warranties

Oral statements about the product do not constitute warranties, shall not be relied on by the buyer or user, and are not part of any warranty extended by Ohmeda.

Except as set forth in this limited warranty, Ohmeda makes no warranties, expressed or implied, including the implied warranty of merchantability and the implied warranty of fitness for a particular purpose. Except for the obligations under this limited warranty, Ohmeda shall not have any obligation or liability for any incidental or consequential damages (including those from commercial loss) or other loss, damage, or injury resulting directly or indirectly for the product.

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