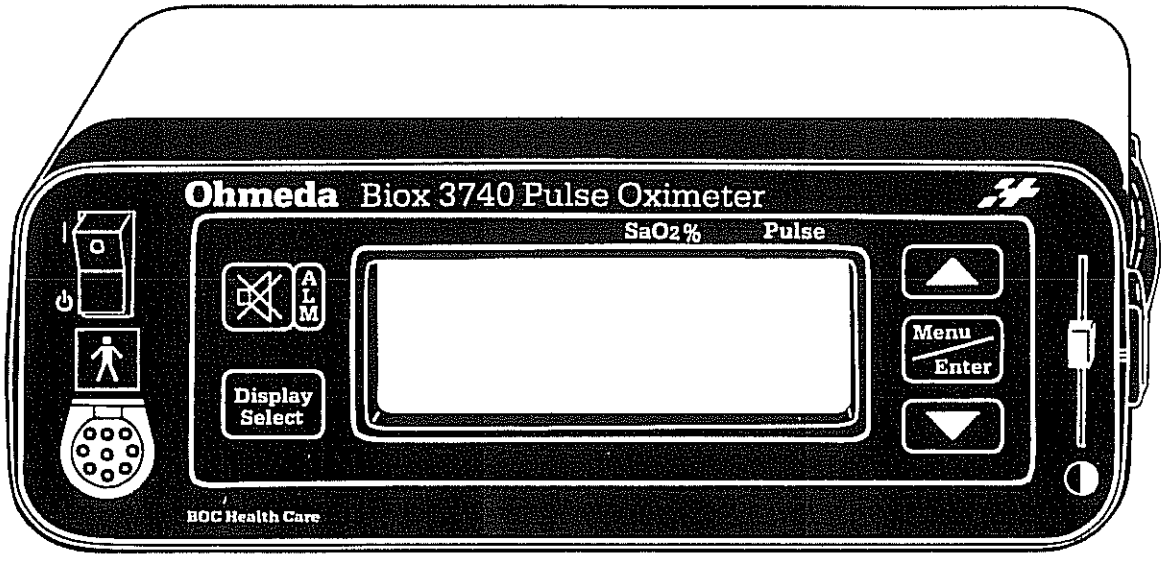
Ohmeda

Ohmeda Biox 3740 Pulse Oximeter Operating/Maintenance Manual



Ohmeda, A Division of BOC Health Care, Inc.
1315 West Century Drive
Louisville, CO 80027
303 666 7001
800 652 2469
Telex 296 445 BTI UR

0380-0900-074 (BX#1125-311)

Printed in USA

Chapter 1: How this Oximeter Operates

Introduction

This manual describes proper operation and maintenance for the Ohmeda Biox 3740 Pulse Oximeter. Please read this manual before using this product, paying attention to all details for correct operation and recommended precautionary measures. All maintenance procedures in this manual are designed for the oximeter operator.

This manual describes operation of a 3740 oximeter containing software revision F. If your oximeter displays another revision level, please consult the manual or manual addendum released with that software for more complete information.

Description of Oximeter

The Ohmeda Biox 3740 Pulse Oximeter is a standalone, noninvasive, arterial oxygen saturation monitor. It provides continuous, real-time SaO_2 and pulse rate readings. Trend information is available through both the analog and digital output ports.

How this Oximeter Operates

The Ohmeda Biox 3740 Oximeter determines a patient's arterial oxygen saturation and pulse rate by measuring the absorption of selected wavelengths of light. The, light generated in the probe, passes through the tissue and is converted into an electronic signal by the photodetector. (Some light is absorbed by the tissue.) The electronic signal passes to the oximeter and is amplified. The oximeter's circuitry processes the signal, converting the light intensity information into SaO_2 and pulse rate values. A liquid crystal display (LCD) presents patient data and oximeter status information.

Function of the Ohmeda Biox 3740 Oximeter is based on the assumption that hemoglobin exists in two principle forms in the blood: (1) Oxygenated (HbO_2)—O_2 molecules loosely bound and (2) Reduced (Hb)—no O_2 molecules bound.

To Our Customers

This manual covers operation of the 3740 oximeter containing software Revision F. If another revision level appears on your oximeter display, please consult the manual or manual addendum released with that software revison for more complete information.

User Responsibility

When operated, maintained, and repaired according to the instructions provided, this product operates as described in this manual and in any accompanying labels and/or inserts.

Do not use a defective product. Replace broken, missing, plainly worn, distorted, or damaged parts immediately.

This product and any of its components must be repaired by service personnel trained by Ohmeda. The user of this product shall have the sole responsibility for any losses incurred during unauthorized maintenance or repair as a result of improper repair, damage, or alteration.

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

Manufacturer's Liability

Ohmeda is liable for the safety, reliability, or the performance of this device only if:

- The device has been used according to the accompanying operating instructions.
- All fittings, extensions, readjustments, changes, or repairs have been done by Ohmeda's authorized agents.
- The device is used in buildings having ground equalization wiring as required by VDE 0107/IEC.

Traceability

Federal law in the USA and Canada requires traceability of certain equipment. Please fill out the self-addressed traceability registration card included with this product and return it to Ohmeda-Louisville.

NOTE: The oximeter serial number is located on the rear panel.

Product Improvement

Ohmeda reserves the right to change or improve its products and accompanying technical literature without specific notice to customers who have purchased products prior to these changes/improvements.

The technical literature accompanying your product corresponds to the product as manufactured at that time. Technical literature produced at later dates may not exactly correspond to earlier products. Manuals are revised each time a product is updated.

Ohmeda has no obligation and absolves itself from improving or retro-fitting earlier production units unless the product improvement or change directly affects the safety of the patient or proper functioning of the product.

Customers who have purchased earlier production units and wish to have them updated should contact their local Ohmeda Sales representative to determine which improvements are available.

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Arterial oxygen saturation (SaO_2) is defined as the ratio of oxygenated hemoglobin (HbO_2) to total hemoglobin [HbO_2 + Hb + others]:

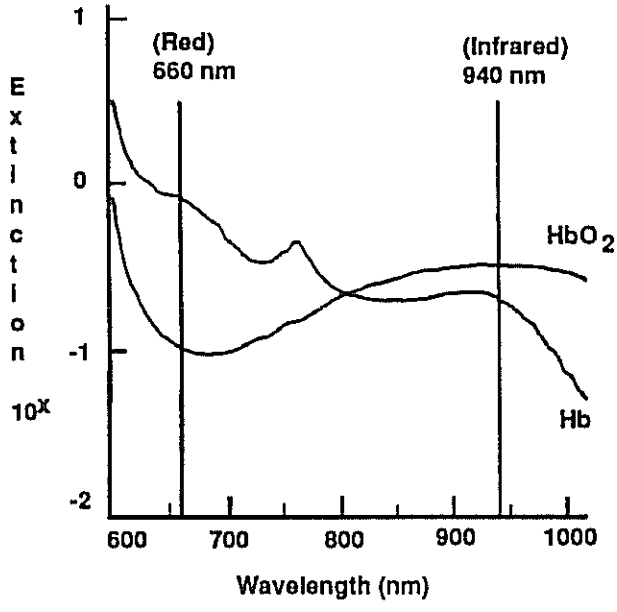
$$SaO_2 = \frac{HbO_2}{HbO_2 + Hb + others}$$

others = carboxyhemoglobin, methemoglobin, sulfhemoglobin, + ...

Note: See information about interfering substances in Appendix A, Product Specifications.

As shown in Figure 1-1, different amounts of light are absorbed by HbO_2 and Hb. The oximeter measures the relative absorption of red light at 660 nm and infrared light at 940 nm by HbO_2 and Hb. Because HbO_2 and Hb allow different amounts of light to pass at these wavelengths, the oximeter can convert this relative light intensity information into SaO_2 and pulse rate values.

Note: Arterial oxygen saturation readings may be displayed in some systems as SpO_2 instead of SaO_2. SpO_2 is becoming the industry standard for arterial saturation as measured by a pulse oximeter. SaO_2 is becoming the industry standard for arterial saturation as measured by a CO-oximeter.



* Oxygenated hemoglobin (HbO_2) and reduced hemoglobin (Hb) exhibit markedly different absorption (extinction) characteristics to red light at 660 nm and infrared light at 940 nm.

Figure 1-1. Extinction versus Wavelength Graph

The oximeter differentiates between light absorption of hemoglobin and other fluid and tissue constituents using a patented two-wavelength, pulsatile system. This system relies on the observation that arterial blood flow pulsates and other fluids and tissues do not. The pulsation of the arterial blood flow modulates the light passing through it. Nonpulsing fluids

and tissues do not modulate the light, but have a fixed value of absorption. Therefore, the change of light energy due to arterial blood flow can be detected and isolated. See Figure 1-2.

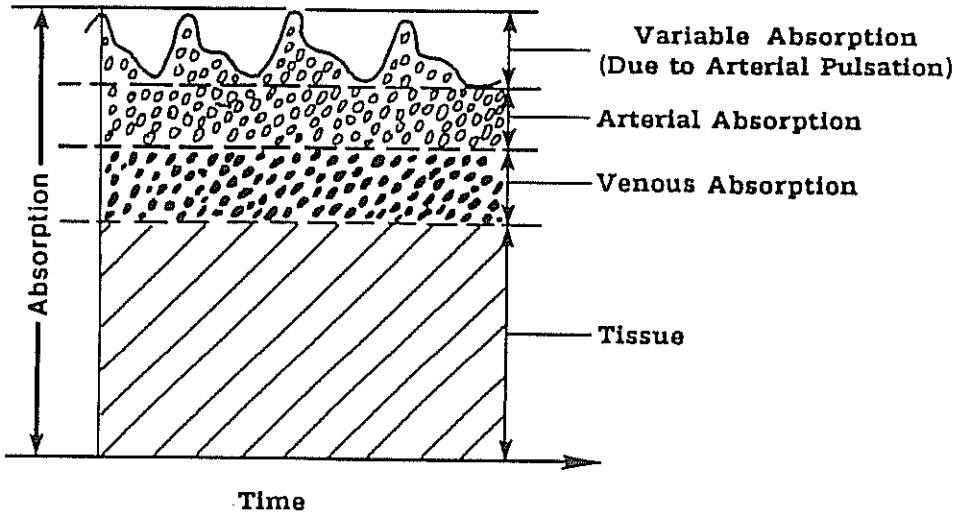


Figure 1-2. Signal Composite

Functional Components

The Ohmeda Biox 3740 uses electrical components to determine SaO_2 and pulse rate values. The key elements are the:

- Probe
- Processing of the probe signal
- Calculations made by the microprocessor

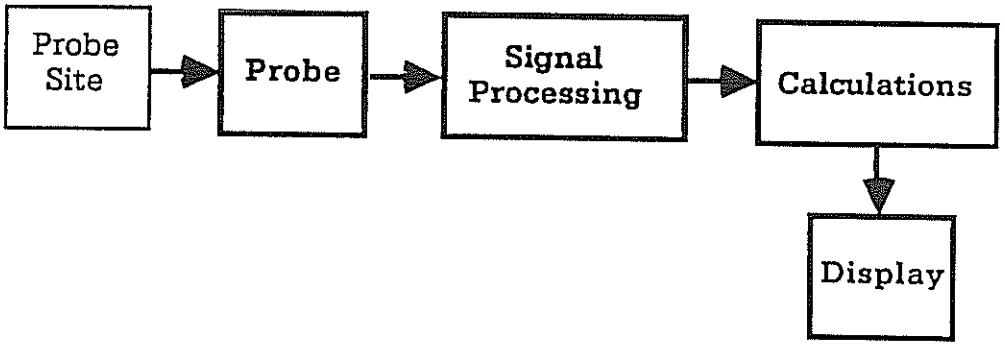


Figure 1-3. Functional Components

The probe consists of two components:

- A light source. This consists of a red and infrared LED (light emitting diode).
- A photodetector. This is an electronic device that detects light then produces an electrical current for signal processing.

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.

Signal Processing

The oximeter's electronic circuitry takes the current generated by the photodetector, processes it, and passes it to the microprocessor for calculation of the SaO_2 and pulse rate.

The microprocessor calculates the SaO_2 30/25 (60/50 Hz) times per second. These calculations are averaged by a running-weighted-average method to determine the displayed SaO_2. This method assigns a weight (value) to each calculation based on the signal strength and the current average saturation. The displayed average is based on specific time periods and is updated at specific intervals depending on the Response Mode (see Figure 1-4).

60 HZ

Response Mode	Display Data Updated	SpO_2 Averaging Time	Pulse Interval (See note)
"S" Slow	4/3 seconds	12 seconds	12 seconds
"N" Normal	2/3 seconds	6 seconds	12 seconds
"F" Fast	1/3 seconds	3 seconds	5 seconds

50 Hz

Response Mode	Display Data Updated	SpO_2 Averaging Time	Pulse Interval (See note)
"S" Slow	3/2 seconds	12 seconds	12 seconds
"N" Normal	3/4 seconds	12 seconds	12 seconds
"F" Fast	3/8 seconds	12 seconds	5 seconds

Figure 1-4. Response Mode versus Displayed Averages Tables

The running-weighted-average method allows erroneous SaO_2 values to be discarded when the displayed SaO_2 is determined. 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 ability to respond quickly to saturation changes.

Chapter 2: Operator Features and Controls

This chapter describes the following:

- Front panel controls, indicators, and displays that you must be familiar with to operate the 3740 oximeter.
- Rear panel connectors for the external power supply and digital and analog output devices.
- Menu screens and the operating features that you can access through these screens. See Chapter 3/Operating the Oximeter, for more detailed instructions and examples for using the menu features.

Oximeter Features and Controls

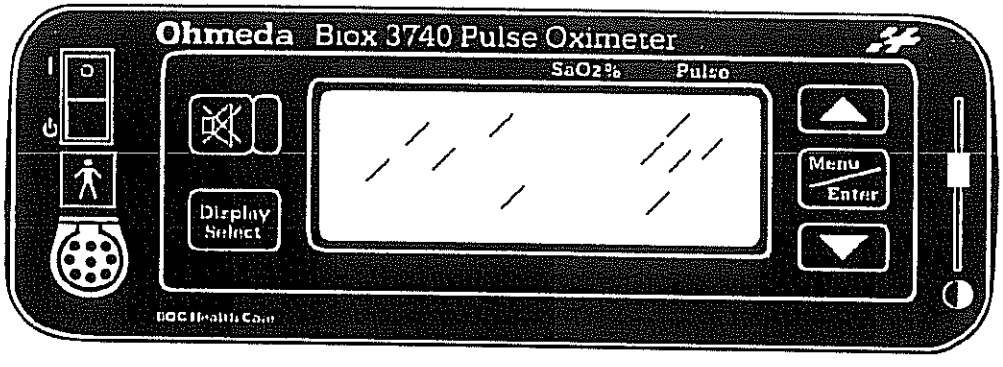
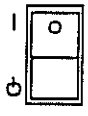


Figure 2-1. Front Panel



Power/Standby Switch: Powers the oximeter on (Operational mode) and off (Standby mode). In the Standby mode, Trend Data is maintained. The shining green LED indicates that the power supply is connected.

Symbol: Indicates the oximeter conforms with the International Electrotechnical Commission Standard 601-1 (Safety of Medical Electrical Equipment) for patient isolation-type BF devices. **Note:** Scandinavian power supplies do not have this symbol.

Probe Plug Connector: Probes, supplied with the oximeter, plug into this nine-hole connector.

WARNING: Patient Safety – For this oximeter, use only the Ohmeda probes specified in the *Ohmeda Probes Manual* (0380-0900-085, BX# 1000-304). Otherwise, patient injury or equipment damage may result.

Alarm Silence Key: Silences all audible alarms for 120 seconds. If other alarm conditions occur during this interval, the audible alarm *will not* sound.

Note: All alarms are disabled during TREND OUTPUT.

When you press this key, the flashing red alarm light changes to a steady red light to indicate alarm silence. If an alarm condition still exists after the 120-second alarm silence period, the audible tone and flashing light resume. *Exception*: For PROBE OFF or NO PROBE alarms, the alarm silence key silences the alarm tone until the specific alarm condition is remedied or a different alarm condition is detected.

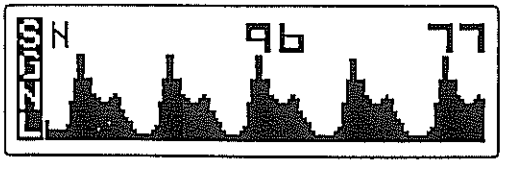
Display Select Key: Switches the display between waveform-dominant and numeric-dominant display modes. When in the menu, this key returns the display to the previously selected display mode (numeric- or waveform-dominant).

Menu/Enter Key: Enters an item from the menu. This can either access an additional menu function or enter a new operating value once selected. A description of menu functions is in the Menu Features section.

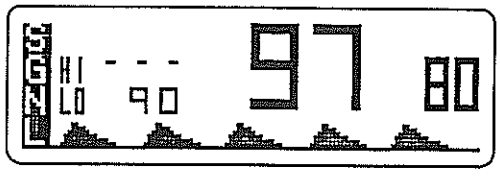
Up and Down Arrow Keys: When in either the numeric-dominant or waveform-dominant display, adjusts level of the pulse volume. When in the menu, these keys select a menu item or change an item parameter.

Contrast Adjust Lever: Adjusts the display for readability at different vertical levels. Range ≈ 50 degrees.

Waveform-Dominant Display: The photo-plethysmographic waveform (shown below) represents the blood volume change of the hemodynamic system assuming no other factors (such as motion artifact) are present. The plethysmographic waveform autoscales (automatically adjusts) according to the strength of the signal.

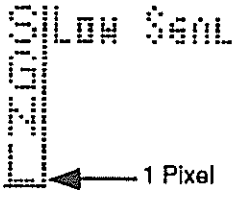


Numeric-Dominant Display: The smaller waveform (shown below) is used to confirm a good-quality signal during normal monitoring.



Signal Strength Indicator: Indicates strength of the received pulsatile signal. The higher the bar, the stronger the signal.

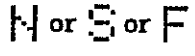
The height of the bar is determined by several factors, including tissue perfusion at the probe site and the ability of the tissue under test to pass the incident light.



Low Quality Signal Indicator: Displayed if the Signal Strength Indicator bar is continuously at 5 pixels or less for 5 seconds or more. When displayed, the SaO_2 reading on oximeter may not be accurate.

Note: When the bar shows 1 pixel or less for 5 seconds or more and/or pulse rate readings are less than or equal to 20 beats per minute (BPM) for 5 seconds or more:

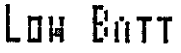
- An audible alarm sounds and alarm light flashes
- A NO PULSE message appears across the oximeter Graphic Display



Response Mode: Indicates the SaO_2 and pulse rate averaging time. (Seen only in waveform-dominant display mode.)

Response Mode	Display Data Updated	SpO_2 Averaging Time	Pulse Interval (See note)
"S" Slow	4/3 seconds	12 seconds	12 seconds
"N" Normal	2/3 seconds	6 seconds	12 seconds
"F" Fast	1/3 seconds	3 seconds	5 seconds

Note: The pulse-rate update is based on the previous 5- or-12 second interval. During each interval the oximeter measures the time between the plethysmographic waveform peaks to calculate the pulse rate. Pulse rate and SaO_2 calculations are based on independent time intervals.



Low Battery Indicator: Indicates approximately 30 minutes of operating time See Chapter 5/Maintenance and Service under Battery Alarm Messages and Recharging Periods for instructions.

Note: This message is not seen in the menu.

High SaO_2 Alarm Limit: Threshold for high SaO_2 alarm (numeric-dominant display mode only). Default = OFF, indicated by "---".

Low SaO_2 Alarm Limit: Threshold for low SaO_2 alarm (numeric-dominant display mode only). Default = 90%.

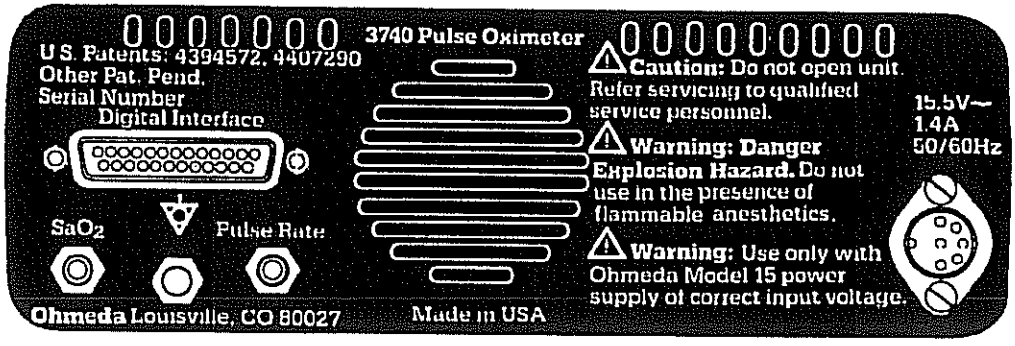


Figure 2-2. Rear Panel

WARNING: Electric Shock Hazard – Measure the leakage current whenever an external device is connected to either the analog or digital output jacks. Forward and Reverse Polarity: 100 microamperes maximum.

WARNING: Connect only equipment that complies with a relevant IEC or local country safety standard (such as ETL, CSA, BSI, and TUV) to the signal input/output jacks on the rear panel.

CAUTION: Maximum Voltage – Apply no more than ±15 volts to any analog or digital connector. Exception: Pins 11, 18, and 25 of the rear panel RS-232C connector are TTL signals. Apply only 0 to +5 volts to these pins. The oximeter will be permanently damaged if these signals are connected to RS-232C voltage levels.

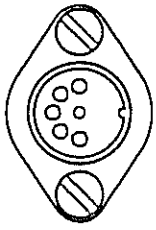
Pulse Rate Analog Output: Provides a 0-(zero) to 1-volt linear analog representation of the displayed pulse rate. A zero-volt output is equivalent to a pulse rate of zero. A 1.00 volt output is equivalent to a pulse rate of 250 Beats Per Minute (BPM).

SaO_2 Analog Output: Provides a 0 (zero)-to 1-volt linear analog representation of the displayed saturation. A zero-volt output is equivalent to a saturation of zero percent. A 1-volt output is equivalent to a saturation of 100 percent.

CAUTION: Connect only a high-impedance device (1K Ohm or higher) to the analog output jacks, otherwise improper loading will upset the correspondence between the measured voltage and the intended output voltage.

Digital Interface Connector: Provides serial digital information of the SaO_2 readings, pulse rate readings, and oximeter conditions. This 25-pin connector is compatible with most RS-232C devices capable of accepting a 1200-bits-per-second input. See chapter 7/Using the Computer Interface for more information.

Equipotentiality Connector: Complies with DIN specification 42-801 for grounding the oximeter when operating on battery, or as an auxiliary ground.



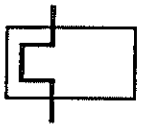
Power Supply Connector: Connects the oximeter to the power supply (charger) for charging of the battery and continuous operation.

Power Supply: Use a hospital-grade (USA) grounded receptacle only. Whenever possible, connect to AC mains power when the oximeter is operating or in storage. For long-term storage, recharge the battery every six months by plugging into AC mains power. If recharging is not possible, have battery pack removed by qualified service personnel.

WARNING: Electric Shock Hazard — Use only with Ohmeda Model 15 power supplies of correct input voltage.

CAUTION: Equipment damage may result if the incorrect power supply is used.

Symbol for "Indoor Use Only" (located on top cover of Power Supply)



Symbol for thermal fuse (located on top cover of Power Supply)

Menu Features

The menu selects and changes the oximeter's settings and features. All settings revert to the default values when the oximeter is turned off. The menu has three screens:

Screen 1	Screen 2	Screen 3
PULSE VOLUME	LOW PULSE ALARM	CALIBRATE RECORDER
ALARM VOLUME	HIGH PULSE ALARM	SET TIME hh:mm
LOW SaO2 ALARM	RESPONSE TIME	SET DATE dd/mm/yy
HIGH SaO2 ALARM	TREND OUTPUT	DIAGNOSTIC

Screen 1

- PULSE VOLUME: Volume level range: 1 to 10 and OFF. Default is 4.
- ALARM VOLUME: Volume level range: 1 to 10. Default is 4.
- LOW SaO_2 ALARM: Limit range: OFF, 50% to 100%. Default is 90%. (Displayed in the numeric-dominant display.)
- HIGH SaO_2 ALARM: Limit range: OFF, 70% to 100%. Default is OFF (Displayed in the numeric-dominant display.)

Screen 2

- LOW PULSE ALARM: Limit Range: OFF, 40 to 200 Beats Per Minute, in increments of 5. Default is OFF.
- HIGH PULSE ALARM: Limit Range: OFF, 70 to 250 Beats Per Minute in increments of 5. Default is OFF.
- RESPONSE TIME: Designates the SaO_2 and pulse rate averaging time. The response indicator is displayed in the waveform-dominant display only.

Response Mode	Display Data Updated	SpO_2 Averaging Time	Pulse Interval (See note)
"S" Slow	4/3 seconds	12 seconds	12 seconds
"N" Normal	2/3 seconds	6 seconds	12 seconds
"F" Fast	1/3 seconds	3 seconds	5 seconds

- TREND OUTPUT: Accesses trend information for output on recording devices and computers.
- CURRENT DATA: Data stored from current "power on."
- 8 HOURS OF DATA: Data stored from the last 8 hours of operation.

Screen 3

- CALIBRATE RECORDER: Supplies 0, 0.5, and 1.0 volts to the analog output jacks on the rear panel for calibrating recording devices connected to the oximeter.
- SET TIME: Sets time on real-time clock: hh:mm
- SET DATE: Sets date on real-time clock: dd/mm/yy
- DIAGNOSTICS: Verifies and calibrates the electronic circuitry of the oximeter.

Note: The time and date are displayed on the computer screen during digital TREND OUTPUT only. The time and date are displayed to the right of the SaO_2 and pulse rate values according to the date and time set when the data were collected.

Chapter 3: Operating the Oximeter

This chapter provides procedures to check the oximeter before use and steps for using the oximeter to monitor patients. Also included are examples and steps that will help you use the menu features to modify operating features. Refer to information in Chapter 2/Operator Features and Controls for more detail on oximeter controls and menu options.

Checking the Oximeter before Use

Perform the following tests daily to ensure proper operation of the oximeter.

Visual Inspection

1. Inspect the oximeter case for damage.
2. Ensure the display windows are clean. (To clean, see the Cleaning the Oximeter section of Chapter 4/Maintenance and Service.)
3. Check probes for foreign material such as tape or cotton. Remove any substances that may interfere with transmission of light between the light source and detector. (See the *Ohmeda Probes Manual* for more detail.)
4. Verify that the probe opens and closes smoothly (FingerClip, Finger Probe, and EarProbe). If there is any unevenness or variations in the closing motion, replace the probe.

Functional Inspection

1. Check that the probe is the correct model before connecting it to the oximeter.

   WARNING: Patient Safety — Use Only the Ohmeda probes specified in the Ohmeda Probes Manual (0380-0900-085, BX#1000-304) for this oximeter. Otherwise, patient injury or equipment damage may result.

2. Connect the probe to the oximeter. Make sure that the probe is firmly connected to the oximeter.
3. Check that the probe cable is not twisted or damaged.
4. Attach the probe to the patient.

5. Plug the power supply into AC mains power and the power supply connector on the oximeter rear panel.

   WARNING: Electric Shock Hazard — Use only with Ohmeda Model 15 power supplies of correct input voltage.

   CAUTION: Equipment damage may result if the incorrect power supply is used.

6. Verify that the power supply indicator light on the Power/Standby switch is illuminated.

7. Turn the oximeter on.

8. Check that the red LED in the probe is illuminated.

9. Verify that the oximeter runs the self-diagnostic test during power-up and that the following appears:

   OHMEDA-BIOX
   3740 (T125-016)
   REVISION: X
   SYS AND CAL CHECK ...

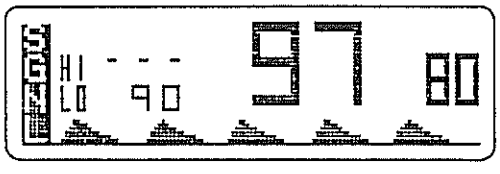
   Note: X is an alphanumeric character designating the software revision.

10. Verify that the following appears after the diagnostic self-test:

    CALIBRATION PASSED
    SYSTEM OPERATIONAL

11. Adjust the display with the View Adjust lever if necessary.

12. After a few seconds, the following appears:



Alarm Verification

1. Remove the probe from the patient. Ensure the alarm message PROBE OFF PATIENT appears, an alarm tone sounds, and the red alarm light flashes.

   Note: Other messages or a dashed display may appear with the Flex II Probe, SoftProbe, or EasyProbe.

2 Unplug the probe from the oximeter.

3. Ensure the Alarm Message NO PROBE CONNECTED TO UNIT appears on the display, an alarm tone sounds, and the red alarm light flashes.

4. Turn the oximeter off. The display should be blank.

Alarm Function During Powerup

During initial powerup, if the probe is off the patient or the probe is not connected to the oximeter, the following occurs:

- The alarm light turns on and stays on
- The appropriate alarm message, PROBE OFF PATIENT or NO PROBE CONNECTED, appears across the Graphics display
- Audible alarm is silent

When the condition that causes the alarm is cleared (probe is placed on patient or connected to the oximeter), the oximeter checks for a returning alarm condition for 30 seconds.

- If an alarm condition occurs *within* the 30 seconds (probe is removed from patient or disconnected from oximeter), the following occurs:
  - The alarm light turns on and stays on
  - PROBE OFF PATIENT or NO PROBE CONNECTED appears across the Graphics display
- If an alarm condition occurs *after* the 30 seconds, the following occurs:
  - An alarm tone sounds
  - The alarm light turns on and flashes
  - PROBE OFF PATIENT or NO PROBE CONNECTED appears across the graphics display

Preparing to Monitor the Patient

WARNING: Danger Explosion Hazard — Do not use in the presence of flammable anesthetics or other flammable substances.

WARNING: Electric Shock Hazard — Use Only with Ohmeda Model 15 power supplies of correct input voltage.

CAUTION: Equipment damage may also result if the wrong power supply is used.

1. *Optional:* Plug the power supply into AC mains power and the oximeter.
2. Turn the oximeter on.
3. Determine which probe to use. (See the *Ohmeda Probes Manual* P/N 0380-0900-085, BX#1000-304.)
4. Connect the probe to oximeter. (See the *Ohmeda Probes Manual.*)
5. Attach the probe to the patient. (See the *Ohmeda Probes Manual.*)

WARNING: Patient Safety — Prolonged monitoring or patient condition may require changing the probe test site periodically. Change the probe site at least every four hours to reduce the risk of blistering, skin erosion, or ischemic skin necrosis (especially if the site is poorly perfused.) Refer to the Ohmeda Probes Manual (0380-0900-085; BX#100-304) for complete warning information for probes.

6. *Optional:* Press the Display Select key to change the display format.

   Note: Use the Waveform-Dominant display to help place the probe and confirm signal quality. Use the numeric-dominant display for routine monitoring.

7. To determine if the probe is correctly attached to the patient and the data can be verified, see the Ohmeda Probes Manual P/N 0380-0900-085 (BX#1000-304).

Modifying Operational Settings

This section provides general steps and examples for changing operational settings. For more details on using 3740 menus, see the Menu Features section of Chapter 2/Operator Features and Controls.

General Steps

Use the following as general steps to access the oximeter's menu, select menu items, and change limits or values. See Setting the Low Pulse Rate Alarm Limit, Setting the Clock, and other examples on the following pages for details on changing a specific setting.

1. *Enter Menu*	Press the Menu/Enter key.
2. *Select Item*	Hold down an arrow key until the cursor is on the desired item, then press the Menu/Enter key. **Note:** To move more than one item at a time, continuously press the Arrow key.
3. *Change Limit or Value*	Press the Arrow keys to move the cursor to the desired limit/volume.
4. *Enter Item and* Return to Menu or Enter Item and exit Menu	Press the Menu/Enter key. Press the Display Select key.

Note: Next time the menu is entered the cursor will be at the previously selected item. The cursor is only reset to PULSE VOLUME (top of screen 1) on the next power on.

Press the Up or Down arrow keys to raise or lower the pulse volume while in either the Numeric-Dominant or Waveform-Dominant display mode.

Special Menus

- For SET TIME and SET DATE, see "Setting the Clock" in this chapter.
- For TREND OUTPUT, see Chapter 6/Using the Chart Recorder Interface or Chapter 7/Using the Computer Interface.
- For CALIBRATE RECORDER, see Chapter 6/Using the Chart Recorder Interface.

Setting the Low Pulse Rate Alarm Limit

Use the following steps to set the lower pulse rate where you want the the oximeter to alarm. **Note:** The oximeter must be on.

Access the Menu

1. Press the Menu/Enter key.

   - If you *have not* changed a setting since the last time you powered off and on, screen 1 (as shown on the following table) appears with the cursor at PULSE VOLUME.
   - If you *have* changed a setting since the last time you powered off and on, the screen appears (screen 1, 2, or 3) where you last changed settings. The cursor will be at the menu item where you last changed settings.

Screen 1	Screen 2	Screen 3
PULSE VOLUME	LOW PULSE ALARM	CALIBRATE RECORDER
ALARM VOLUME	HIGH PULSE ALARM	SET TIME hh:mm
LOW SaO_2 ALARM	RESPONSE TIME	SET DATE dd/mm/yy
HIGH SaO_2 ALARM	TREND OUTPUT	DIAGNOSTIC

   Note: hh:mm and mm/dd/yy are the time and date stored in memory.

2. Select LOW PULSE ALARM using one or all of these steps:

   a. If screen 2 appears, step through each menu item on the screen using the Up or Down arrow key to select LOW PULSE ALARM.

   b. If screen 2 does not appear, do one of the following:

      — Press the Down arrow key when the cursor is on the last item of a menu screen to display the next menu screen. For example, pressing the Down arrow key when the cursor is on HIGH $Sa0_2$ ALARM displays screen 2.

      — Press the Up arrow key when the cursor is on the first item of a menu screen to display the previous menu screen. For example, pressing the Up arrow key when the cursor is on PULSE VOLUME displays Screen 3. Pressing the Up arrow key while the cursor is on CALIBRATE RECORDER displays screen 2.

3. When you select LOW PULSE VOLUME, press the Menu/Enter key.

The following screen appears:

LOW PULSE ALARM

(OFF, 40 - 200)
** OFF **

4. Press the Up arrow key once.

   The following screen appears to show that the pulse rate limit is at 40:

   LOW PULSE ALARM

   (OFF, 40 - 200)
   ** 40 **

   Note: You can change the low pulse rate limit in increments of 5.

5. Press the Down arrow key once. The pulse rate limit changes to OFF.

6. Press the Down arrow key again. The pulse rate limit changes to 200.

7. Continuously press the Down arrow Key. The limit continuously changes. Set the limit to your desired value.

8. To save changes and return to either the menu screen or the existing monitoring display (the numeric- or waveform-dominant) use one of the following steps:

   - To enter the item and return to the monitoring display, press the Display Select key.

   Note: Next time the menu appears, the cursor appears at LOW PULSE ALARM. The cursor is only reset to PULSE VOLUME (top of screen 1) on the next power up.

   - To enter the item and return to the menu, press the Menu/Enter key.

Setting the Clock

The clock is provided to mark data during digital trend output.

Setting the Time

If you do not know how to use the menu, please read the Modifying Operational Settings section of this chapter.

Note: The oximeter must be on and the power-on self check must be completed before the menu can be entered.

1. Press the Menu/Enter key.

   - If you *have not* changed a setting since the last time you powered off and on, screen 1 (as shown on the following table) appears with the cursor at PULSE VOLUME.

- If you *have* changed a setting since the last time you powered off and on, the screen appears (screen 1, 2, or 3) where you last changed settings. The cursor will be at the menu item where you last changed settings.

Screen 1	Screen 2	Screen 3
PULSE VOLUME	LOW PULSE ALARM	CALIBRATE RECORDER
ALARM VOLUME	HIGH PULSE ALARM	SET TIME hh:mm
LOW SaO_2 ALARM	RESPONSE TIME	SET DATE dd/mm/yy
HIGH SaO_2 ALARM	TREND OUTPUT	DIAGNOSTIC

3. Select SET TIME using the Arrow keys (changing screens as necessary)

4. Press the Menu/Enter key.

   The following appears:

   MINUTE
   HOUR

5. Move the cursor to the desired item using an Arrow key.

6. Press the Menu/Enter key.

   One of the following screens appear, depending on what item you select:

   ARROW KEY ADJUST,
   ANY OTHER EXITS
   MINUTE
   ** xx **

   ARROW KEY ADJUST,
   ANY OTHER EXITS
   HOUR
   ** xx **

   Note: xx = minutes or hours (24-hour clock)

7. Press either Arrow key to adjust to current time.

   Note: To move more than one number at a time, continually press the Arrow key.

8. Press the Menu/Enter key. The new time is entered and the following appears:

   MINUTE
   HOUR

9. Press the Display Select key. The following appears:

   CALIBRATE RECORDER
   SET TIME hh:mm
   SET DATE dd/mm/yy
   DIAGNOSTICS

Setting the Date

1. If you are not at a menu screen, press the Menu/Enter key.
2. Move cursor to screen 3 (if necessary) and select SET DATE using an Arrow key.
3. Press the Menu/Enter key. The following appears:

   MONTH
   DATE
   YEAR

4. Move the cursor to the desired item using an Arrow key.
5. Press the Menu/Enter key.

   One of the following screens should appear, depending on the item you select:

ARROW KEY ADJUST, ANY OTHER EXITS MONTH ** xx **	ARROW KEY ADJUST, ANY OTHER EXITS DATE ** xx **	ARROW KEY ADJUST, ANY OTHER EXITS YEAR ** xx **

   Note: xx = month, day, or year

6. Press either Arrow key to adjust to current date.

   Note: To move more than one number at a time, continually press the Arrow key.

7. Press the Menu/Enter key.

   The new date is entered and the following appears:

   MONTH
   DATE
   YEAR

8. Press the Display Select key.

   The following appears:

   CALIBRATE RECORDER
   SET TIME hh:mm
   SET DATE dd/mm/yy
   DIAGNOSTICS

Chapter 4: Troubleshooting

This chapter provides instructions to follow in the event of instrument or signal problems. It is divided into five parts:

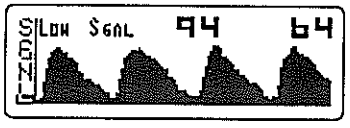
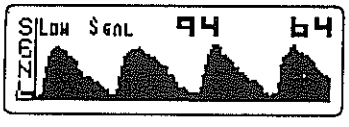
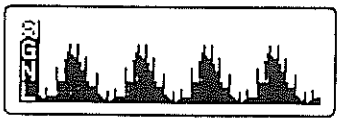
- Patient Alarm Limit Violations
- Signal and User Correctable Problems
- Staged Alarm System
- Probe Alarm Messages
- Device Failure Messages

Patient Alarm Limit Violations

Patient Alarm Messages appear on the display alerting you to conditions needing immediate attention. Check the patient and the oximeter whenever any alarm condition occurs. You can silence the alarm for 120 seconds by pressing the alarm silence key. When patient alarm limit conditions occur, some or all of the following occur:

- An alarm tone sounds
- The red alarm light flashes
- The violated alarm limit flashes (if displayed)
- The out-of-range SaO_2 or pulse rate reading flashes on the display

Signal and User Correctable Problems

Problem or Display Message	Possible Causes	Action
 Low Quality Signal	1. Poorly perfused site 2. Tissue sample too thick 3. Tape securing probe wrapped too tightly 4. Alarm stage 1 5. Bar graph on graphic display is a five pixels or less continuously for 5 seconds or more	1, Rub site vigorously for 20 to 30 seconds 2. Select thinner application site (decrease distance between probe's light source and detector) 3. Loosen tape 4. See the Staged Alarm System section of this chapter 5. Check patient and oximeter setup
 Low Quality Signal (alarm tone sounds and alarm light flashes)	Alarm stage 2	See the Staged Alarm System section of this chapter
CHECK PROBE SITE Inadequate Signal (alarm tone sounds and alarm light flashes)	Alarm stage 3	See the Staged Alarm System section of this chapter
 Electronic Interference	Electrosurgery, MRI (NMR), or other electrical/electronic devices	Data questionable during this period. Move the unit and probe cable away from other electrical devices. Operate unit on battery or try plugging power supply into a different electrical outlet (AC Mains Power).

Signal and User Correctable Problems (cont.)

Problem or Display Message	Possible Causes	Action
 Probe Motion	1. Probe detector not flush with tissue 2. Patient movement	1. Tape probe and/or cable 2. Select another probe site
NO PULSE Inadequate Signal (alarm tone sounds and alarm light flashes)	1. Signal strength at one pixel or less for five seconds or more 2. Perfusion at probe site insufficient for valid readings 3. Pulse rate of 20 BPM or less for five seconds or more	1. Check patient and oximeter setup 2. Check patient and oximeter setup 3. Check patient and oximeter setup
Display blank or difficult to read	1. Display contrast requires adjustment 2. Power switch off 3. Battery needs recharged or replaced 4. Blown fuse or internal circuit failure	1. Adjust display with view adjust lever 2. Turn power switch on 3. Plug oximeter into power supply 4. Plug oximeter into power supply. If LED on Power/Standby switch isn't illuminated, have unit serviced.
Oximeter alarms and then shuts off (A failure message is displayed for 2 seconds before unit shuts off)	Oximeter detected probe or circuit failure and automatically shut off	See the possible causes and action in this table under the following message: PROBE OR CIRCUIT FAILURE, REPLACE PROBE OR SERVICE UNIT
±X.X ADJUST POT AT BOTTOM HOLE TO VALUE = 0±.1 HIT DISP SEL TO END	Oximeter out of calibration	Calibrate oximeter. (See the Calibrating the Oximeter section in Chapter 6/Maintenance and Service.)

Signal and User Correctable Problems (cont.)

Problem or Display Message	Possible Causes	Action
Digital readings on display dash. Waveform and signal strenth bar both good.	Motion artifact	Select another probe site
INSUFFICIENT LIGHT DETECTED CHECK PROBE SITE	1. Dirt on probe's light source, probe detector, or test site 2. Tissue sample too thick 3. Misaligned or malpositioned probe 4. Light source blocked by fingernail polish 5. Light source blocked by dark pigmentation 6. Detector failure failure 7. Light source blocked by tape	1. Clean probe and/or test site 2. Select thinner test site 3. Reposition probe or select an alternate test site 4. Use an alternate test site 5. Use an alternate test site with less coloration 6. Replace Probe 7. Reapply probe or move tape (For the CHECK PROBE SITE message, also see information under the Staged Alarm System section in this chapter)
INTERFERENCE SaO_2 & PULSE RATE MAY BE INVALID **Note:** Data is not collected when interference is detected	1. Strong electromagnetic interference 2. Electrocautery	1. See Interference Present next page 2. See Interference Present next page

Signal and User Correctable Problems (cont.)

<table>
<tr><th>Problem or Display Message</th><th>Possible Causes</th><th>Action</th></tr>
<tr><td>INTERFERENCE
SaO_2 & PULSE RATE
MAY BE INVALID

Note: Data is not collected when interference is detected</td><td colspan="2">Interference Present

When strong interference is detected by the oximeter, the SaO_2 and pulse rate readings do not change. If interference persists beyond the time periods indicated below, the INTERFERENCE DETECTED message is displayed. After the interference has stopped, the oximeter begins collecting data again. The SaO_2 and pulse rate readings return to the display in approximately 2 seconds.

Response Mode — Time period before display of the INTERFERENCE DETECTED message
Slow — 24 seconds
Normal — 24 seconds
Fast — 12 seconds</td></tr>
<tr><td>LOW BATT</td><td>Battery is getting low</td><td>Recharge battery or operate from AC mains power</td></tr>
<tr><td>Noncorrelating SaO_2 (Oximeter readings do not correspond to co-oximeter readings)</td><td>1. Excessive ambient light

2. High concentration of carboxyhemoglobin or other dysfunctional hemoglobin</td><td>1. Shield probe from ambient light

2. For dyshemoglobins > 3%, see Appendix A, Specifications. Use oximeter only to monitor SaO_2 trends.</td></tr>
<tr><td>Noncorrelating or erratic pulse</td><td>Excessive patient motion</td><td>Select alternate probe site, or tape probe and/or probe cable</td></tr>
<tr><td>Power/Standby Switch on, but oximeter off</td><td>1. Oximeter turned off and back on too quickly

2. Oximeter detected probe or circuit failure and automatically shut off

3. Battery failure</td><td>1. Turn Power/Standby switch off. Wait 2 seconds and turn oximeter back on.

2. See the following alarm message in this table:

PROBE OR CIRCUIT FAILURE, REPLACE PROBE OR SERVICE UNIT

3. Have oximeter serviced</td></tr>
</table>

Signal and User Correctable Problems (cont.)

Problem or Display Message	Possible Causes	Action
PLEASE CONNECT POWER SUPPLY TO DETERMINE LINE FREQUENCY	Oximeter has lost battery-backed RAM	Plug power supply into oximeter
PLEASE CONNECT POWER SUPPLY TO RECHARGE BATTERY	Battery needs recharging (oximeter alarms continuously and automatically shuts off in approximately 10 seconds)	Recharge battery (see Recharging the Battery in Chapter 6/Maintenance and Service) or operate from AC mains
PROBE OR CIRCUIT FAILURE, REPLACE PROBE OR SERVICE UNIT	Oximeter detected probe or circuit failure (oximeter alarms continuously and automatically shuts off in approximately 2 seconds)	Turn Power/Standby switch off Remove probe from patient and disconnect from oximeter • Turn oximeter on. If oximeter shuts off, have it serviced • Connect probe to oximeter. If oximeter shuts off, replace it
RAM DATA INVALID RE-INITIALIZING	Oximeter memory has been erased. Trend Data lost.	Oximeter automatically reintializes and is ready for use

Staged Alarm System

The staged alarm system warns you that data might be unreliable and that you may need to check the probe site or how the probe is applied to the patient. The heart of this system is an algorithm that checks signal quality from the probe site. This algorithm notes a low quality signal "event" when the signal quality deteriorates due to motion of the probe site, poor probe placement, electrical noise, or other factors. The oximeter initiates messages, then increases alarm/message severity according to the number of these events that occur over a period of time.

The following tables provide an overview of the staged alarm system. They list alarms and messages output by the oximeter and a computer interface (if used) during the alarm stages.

Oximeter Alarms and Messages

Stage	Oximeter Display and Alarms
1	• LOW SGNL appears on Graphic Display (see Low Quality Signal under "Problem or Display Message" in the Signal and User Correctable Problems section of this chapter) • SaO_2 and Pulse Rate readings continue on Graphic Display
2	• LOW SGNL appears on Graphic Display • Audible alarm sounds and alarm light flashes • SaO_2 and Pulse Rate readings continue
3	• CHECK PROBE SITE appears across the Graphic Display • Audible alarm sounds and alarm light flashes • SaO_2 and Pulse Rate analog output on graph of chart recorder, polygraph, or other recording equipment read zero volts

Computer Interface Display and Message

Stage	Computer Interface Modes		
	Auto Output	Trend Output	Slave and Waveform
1	• LOW QUALITY SIGNAL message appears	• LQ message appears	• 14 (error code) appears
	• SaO_2 and PR readings continue	• SaO_2 and PR readings appear	• SaO_2 and PR readings continue
2	• LOW QUALITY SIGNAL message appears • SaO_2 and PR readings continue	• LQ message appears • SaO_2 and PR readings appear	• 14 (error code) appears • SaO_2 and PR readings continue
3	• CHECK PROBE SITE message appears • SaO_2 and PR readings dashed	• CK message appears • SaO_2 and PR readings dashed	• 09 (error code) appears • SaO_2 and PR readings dashed

As shown in the preceding tables, the type of messages, displays, and alarms indicate the severity of signal deterioration from the probe site. When signal quality improves to acceptable levels, alarms and warning messages cease, and displays return to normal.

Warning Remedies

To alleviate the warning condition, try these techniques in sequence until alarms, messages, and other warnings cease.

1. Check attachment and placement of the probe model you are using against instructions in the *Ohmeda Probes Manual* (0380-0900-085, BX#1000-304). Make sure that the probe is used according to instructions.
2. Have the patient remain as motionless as possible.
3. Massage probe site and reapply the probe.
4. Select another probe site, if possible.
5. Try using another probe.

Probe Alarm Messages

Probe Alarm Messages occur when the oximeter detects conditions affecting the probe. The alarm can be silenced for 120 seconds by pressing the alarm silence key.

When PROBE OFF or NO PROBE alarms occur:

- An alarm tone sounds.
- The red alarm light flashes.
- PROBE OFF PATIENT or NO PROBE CONNECTED appears on the display.
- The **Alarm Silence** key silences the audible alarm until:
  - The specific alarm condition is remedied.
  - A different alarm condition is detected.
  - A different message is displayed.

Alarm Function During Powerup

During initial powerup, if the probe is off the patient or the probe is not connected to the oximeter, the following occurs:

- The alarm light turns on and stays on.
- The appropriate alarm message, PROBE OFF PATIENT or NO PROBE CONNECTED, appears across the Graphics display.
- Audible alarm is silent.

When the condition that causes the alarm is cleared (probe is placed on patient or connected to the oximeter), the oximeter checks for a returning alarm condition for 30 seconds.

- If an alarm condition occurs *within* the 30 seconds (probe is removed from patient or disconnected from oximeter), the following occurs:
  - The alarm light turns on and stays on
  - PROBE OFF PATIENT or NO PROBE CONNECTED appears across the Graphics display.
- If an alarm condition occurs *after* the 30 seconds, the following occurs:
  - An alarm tone sounds.
  - The alarm light turns on and flashes.
  - PROBE OFF PATIENT or NO PROBE CONNECTED appears across the graphics display.

Display Message	Possible Causes	Action
NO PROBE CONNECTED TO UNIT	1. Incorrect probe or probe not plugged in or fully inserted into probe connector. 2. Probe failure	1. Use only the probes specified in the Ohmeda Probes Manual (0380-0900-085, BX# 1000-304) for this oximeter. Insert all probe cable plugs fully into probe connector. 2. Replace probe
CANNOT IDENTIFY PROBE (SEE MANUAL)	Oximeter unable to identify probe	Use only probes specified in the Ohmeda Probes Manual for this oximeter. Replace probe.
PROBE OFF PATIENT (Other messages may occur with the Flex II Probe, SoftProbe, or EasyProbe)	1. Probe off patient 2. Excessive light detected by probe detector 3. Extremely thin tissue at test site	1. Attach probe to patient 2. Shield probe site from ambient light 3. Select an alternate test site

Device Failure Messages

Whenever any of the following messages appear, you should:

1. Note the message and turn the unit off.
2. Have the unit serviced by qualified service personnel. See the Repair Policy section of Chapter 6/Maintenance and Service.

A/D CONVERTER FAILURE, SERVICE UNIT (Unit alarms continuously and then automatically shuts off in ≈ 2 seconds)	RAM CHECK ERROR, SERVICE UNIT RAM TEST ERROR HIGH BYTE, SERVICE UNIT	ROM TEST ERROR LOW BYTE, SERVICE UNIT
ANALOG SYNCHRONIZATION ERROR, SERVICE UNIT	RAM TEST ERROR HIGH & LOW BYTES, SERVICE UNIT	STACK ERROR PLEASE NOTE CONDITIONS AND SERVICE UNIT
CHARGING CIRCUIT FAILURE, SERVICE UNIT	RAM TEST ERROR LOW BYTE, SERVICE UNIT	SYSTEM ERROR ----X, PLEASE NOTE ERROR CODE AND SERVICE UNIT (Note: X represents an alphanumeric value)
MICRO-PROCESSOR ERROR, SERVICE UNIT	RAM TEST ERROR TREND CHECKSUM, SERVICE UNIT	TEST SIGNAL DC REFERENCE ERROR, SERVICE UNIT
MICRO-PROCESSOR INTERRUPT ERROR, SERVICE UNIT	ROM TEST ERROR HIGH BYTE, SERVICE UNIT	VOLTAGE REFERENCE FAILURE, SERVICE UNIT
POWER SUPPLY FAILURE, SERVICE UNIT	ROM TEST ERROR HIGH & LOW BYTES, SERVICE UNIT	