

March 2006



Product Comparison

Oxygen Monitors

UMDNS information

This Product Comparison covers the following device term and product code as listed in ECRI's Universal Medical Device Nomenclature System™ (UMDNS™):

- ✓ Monitors, Bedside, Respiration, Inspired Oxygen [20-366]
-

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The information in Product Comparisons comes from a number of sources: medical and biomedical engineering literature, correspondence and discussion with manufacturers and distributors, specifications from product literature, and ECRI's Problem Reporting System. While these data are reviewed by qualified health professionals, they have not been tested by ECRI's clinical and engineering personnel and are largely unconfirmed. The *Healthcare Product Comparison System* and ECRI are not responsible for the quality or validity of information derived from outside sources or for any adverse consequences of acting on such information.

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ECRI's focus is healthcare technology, healthcare risk and quality management, and healthcare environmental management. It provides information services and technical assistance to more than 5,000 hospitals, healthcare organizations, ministries of health, government and planning agencies, voluntary sector organizations, associations, and accrediting agencies worldwide. Its more than 30 databases, publications, information services, and technical assistance services set the standard for the healthcare community.

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March 2006

Oxygen Monitors

Scope of this Product Comparison

This Product Comparison covers dedicated oxygen monitors that use electrochemical sensors to measure oxygen concentrations in patient breathing circuits, hospital supply lines, and compressed-gas cylinders and to check and adjust equipment used to administer oxygen to patients. Continuous-controlling oxygen analyzers and oxygen monitors that are integral to ventilators or anesthesia units are excluded. For more information on oxygen monitoring, see the following Product Comparisons:

- Blood Gas/pH Analyzers
- Carbon Dioxide Monitors, Transcutaneous; Oxygen Monitors, Transcutaneous
- Oximeters, In Vitro, Multiwavelength
- Oximeters, Pulse

These units are also called: continuous-monitoring oxygen analyzers, ventilation alarms, inspired oxygen monitors, operating room monitors, OR monitors, and oxygen analyzers.

Purpose

Oxygen monitors are generally used to continuously measure and display the concentration of oxygen in the inspiratory line of a patient breathing circuit (i.e., during administration of anesthetic gases), hospital supply lines, and compressed-gas cylinders; they are also used with critical care ventilators and other oxygen administration equipment. Most units have alarms to alert clinical personnel when the oxygen concentration reaches a dangerous level. Oxygen monitors also check the accuracy of ventilator settings and the purity of compressed oxygen and air.

Principles of operation

Oxygen monitors use galvanic or polarographic cells (both electrochemical) to measure the oxygen concentration in a gas mixture. A galvanic cell is a self-energizing, oxygen-powered battery in which the electrical potential (voltage) changes with the concentration of oxygen. The cell's sensor consists of an anode and cathode surrounded by an electrolyte and has a semipermeable membrane that permits oxygen to enter but prevents electrolyte from escaping. The oxygen diffuses into the cell through the membrane and electrolyte to the cathode, where it reacts to form hydroxide ions. These ions diffuse to the anode, where they give up electrons, generating voltage. The rate at which oxygen diffuses into the cell and generates voltage is directly proportional to the oxygen concentration (partial pressure—the contribution of the constituent gas to the total pressure of the mixture of gases) of the gas outside the membrane. An electrical cable connects the sensor to the analyzer, which measures the voltage and displays it in percentage of oxygen.

A polarographic cell operates on the same principle, except that it conducts current from an external electrical source (usually a battery) in varying amounts, depending on the oxygen concentration. This current is amplified and displayed as the concentration.

Various factors affect the output and lifetime of the cells. The temperature of the oxygen affects its



diffusion through the membrane (higher temperatures increase diffusion) and therefore the output of the cell. A thermistor incorporated into the cell compensates for the effects of temperature changes. As oxygen enters the cell, the membrane permits some water from the electrolyte to diffuse out; eventually this water loss, as well as further loss through oxidation, seriously impairs continued operation. Oxygen diffusion and migration through the membrane and electrolyte are also slowed by accumulated electrolyte residues on the membrane and by oxidation of the electrode. As a result, the cell does not produce enough current to permit calibration, and its response becomes sluggish. At this point, galvanic cells must be replaced. Polarographic cells can be either replaced or renovated by adding more electrolyte gel and replacing the membrane.

Reported problems

Although mechanical and electrical problems (due mostly to poor maintenance) associated with oxygen monitors have not been common, malfunction can have very serious consequences. One unit was recalled because a transient voltage spike (which could be caused either by switching from AC power to battery or by pushing the battery test button when the battery is low) resulted in malfunction of the analyzer memory, locking the unit in calibration mode. In another case, the device's alarm warning system switched to the "visual alarm on" position rather than the "audiovisual alarm on" position when activated; a hypoxic mixture of anesthetic gases was accidentally selected, and the anesthesiologist did not notice the small, flashing warning light on the analyzer until the patient became cyanotic. Some gases, such as nitrous oxide (N₂O) and carbon dioxide (CO₂), interfere with the device's proper sensing of oxygen concentration unless the sensor is calibrated properly. Also, cleaning and disinfecting solutions may contain chemicals that could affect the sensor. Cables have also separated from plugs on some manufacturers' monitors.

Because the operation of most oxygen monitors depends on sensing cells and batteries that have a limited life span, daily checks are essential to ensure proper accuracy and response. Some units are equipped with circuits that automatically activate visual signals when batteries or cells need to be replaced.

Purchase considerations

ECRI recommendations

Included in the accompanying comparison chart are ECRI's recommendations for minimum performance requirements for oxygen monitors. The chart covers dedicated oxygen monitors that use electrochemical sensors to measure oxygen concentrations in patient breathing circuits, hospital supply lines, and compressed-gas cylinders and to check and adjust equipment used to administer oxygen to patients.

The need for an alarm feature typically depends on the intended use of the monitor. For units intended to perform only routine oxygen spot checks or equipment maintenance, alarms may not be necessary. However, in units intended for patient monitoring (e.g., anesthesia or respiratory care settings) alarms are required.

It should be impossible to silence an audible alarm for more than two minutes since the user may forget that the alarm is disabled. An alarm-silence indicator should be provided whenever the audible alarm has been disabled. If the audible alarm can be disabled, it should be automatically reactivated within two minutes and should sound if the alarm condition persists. A visible alarm indicator should remain on until the alarm condition is corrected.

The oxygen monitor should indicate the oxygen level to within 3% oxygen. A unit for continuous monitoring should have a low alarm that cannot be set below 18% oxygen. If the oxygen monitor is to be used for anesthesia applications or infants, it should also have a high alarm. Because oxygen alarms are often used in noisy areas, audible alarms should be loud and very noticeable.

Intermittent- or alternating-tone alarms are more noticeable and are preferred over steady-tone alarms.

Oxygen monitors that will be used in anesthesia circuits over long periods should operate with acceptable accuracy in mixtures that contain 75% N₂O. Oxygen monitors should rapidly indicate changes in oxygen concentration. The response time, including alarm delay, should be within the seller-specified time but with a time constant of less than 20 seconds. A more rapid response will also make pre-use calibration checks easier and quicker to perform, thereby increasing the likelihood that checks will be done.

The effects of temperature and pressure should be minimal over normal breathing circuit conditions. Any changes should be predictable from the manufacturer's specifications so that a change in breathing circuit temperature or pressure will not require monitor recalibration.

Oxygen monitors should meet the 3% accuracy criterion when exposed to the following potentially interfering components: CO₂ (4% concentration); halothane (2% concentration); condensing water vapor (approximately 100% relative humidity); and water droplets (visible aerosol).

Sensors should be easy to disassemble, clean, and sterilize using manufacturer-specified methods. Procedures for replacement or renewal of depleted sensors should be short and easy to follow without requiring tools or special facilities.

Battery-powered units should include an automatic low-battery indicator or a manually activated battery test to permit determination of battery condition. Operation of the oxygen monitor and alarms should not be affected by the low-battery indicator or battery test. The unit should continue to function normally for at least one hour after the first indication of a low battery. If a unit with rechargeable batteries is operable from its charger, operation should be unaffected by open- or short-circuited batteries. If the battery is rechargeable, it should take no longer than 16 hours to recharge.

Units intended for spot checks or maintenance should operate for at least 12 hours on fully charged batteries; however, units employing rechargeable batteries may not need the same endurance requirements. It is essential that units intended for patient monitoring receive long-term uninterrupted power. These units should be line powered and include backup batteries capable of powering the unit for at least two hours. Alternatively, the units may be solely powered by batteries capable of providing at least 250 hours of uninterrupted use.

Other considerations

Variations in oxygen monitor list prices are primarily determined by the presence of alarm functions. On average, models equipped with such utilities cost \$325 to \$1,300, and models without such functions cost between \$225 to \$400. Monitors with dual-channel analyzers or those with anesthetic-agent monitoring are significantly more expensive.

When conducting cost comparisons, potential buyers are also advised to look beyond list prices and to account for the additional expenses that each monitor's upkeep requires. This means considering a unit's life span and warranty and estimating its battery and sensor-device upkeep costs.

Stage of development

Since the 1970s, oxygen monitoring has developed into a mature and stable technology, acquiring an integral role in patient care. Some manufacturers have recently created monitors with dual-cell units that check each other and warn of potentially faulty sensors when the two outputs differ. Also, improved galvanic and polarographic cells now last longer and are less affected by water and anesthetic gases, which can interfere with the monitoring of oxygen concentration.

Although this report does not include monitors built into ventilators and anesthesia units, use of integrated or combination systems is popular. In an integrated system, the oxygen sensor is automatically enabled when the system is in use. Some of the built-in oxygen analyzers use paramagnetic sensors, which depend on the unusual susceptibility of oxygen molecules (as compared to other gases) to magnetic forces. A paramagnetic sensor consists of a symmetrical cell with identical chambers for the sample and the reference gas (air) joined at an interface by a differential pressure transducer. The sample and reference gases are pumped through these chambers to a

common outlet. The region just before the gases come together is surrounded by a strong magnetic field that acts on the oxygen molecules, generating a pressure difference between the two sides of the cell. The transducer reacts to this difference and generates a voltage in direct proportion to the oxygen concentration.

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- Saidman LJ, Smith NT. *Monitoring in anesthesia*. 3rd ed. Butterworth-Heinemann; 1993.

Supplier information

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Oxygen Monitors

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About the chart specifications

The following terms are used in the chart:

Accuracy: The accuracy of measurement in the display, based on the number of digits (digital meter) or graduations (analog meter).

Alarms, low oxygen: In some cases, indications are for low- and high-oxygen alarms.

Silence time, sec: Some oxygen monitors feature a push button for temporarily silencing the audible alarm after it activates.

Auxiliary outputs: Some units are equipped with outputs for a recorder or microprocessor.

Cell kit (rent/replace): The cost of either renting or replacing the cell.

Abbreviations:

The following abbreviations are used in the chart:

ABS — Acrylonitrile-butadiene-styrene, a shock-resistant plastic

AC — Alternating current

ARO — After receipt of order

CE mark — Conformance Europe mark

FDA — U.S. Food and Drug Administration

LCD — Liquid crystal display

LED — Light-emitting diode

MDD — Medical Devices Directive

MRI — Magnetic resonance imaging

NA — The specification is not applicable to this model

Ni-Cd — Nickel-cadmium

VDC — Volts of direct current

Note: The data in the charts derive from suppliers' specifications and have not been verified through independent testing by ECRI or any other agency. Because test methods vary, different products' specifications are not always comparable. Moreover, products and specifications are subject to frequent changes. ECRI is not responsible for the quality or validity of the information presented or for any adverse consequences of acting on such information.

When reading the charts, keep in mind that, unless otherwise noted, the list price does not reflect supplier discounts. And although we try to indicate which features and characteristics are standard and which are not, some may be optional, at additional cost.

For those models whose prices were supplied to us in currencies other than U.S. dollars, we have also listed the conversion to U.S. dollars *to facilitate comparison among models*. However, keep in mind that exchange rates change often.

Need to know more?

For further information about the contents of this Product Comparison, contact the *HPCS* Hotline at +1 (610) 825-6000, ext. 5265; +1 (610) 834-1275 (fax); or hpcs@ecri.org (e-mail).

Product Comparison Chart

Product Comparison Chart

MODEL	ECRI-RECOMMENDED SPECIFICATIONS ¹ Oxygen Monitor for Spot Checks	ECRI-RECOMMENDED SPECIFICATIONS ¹ Oxygen Monitor for Critical Care	ACOMA AS-25 II	DELPHIAN System 250
WHERE MARKETED			Not specified	Asia, Europe, South America, USA
FDA CLEARANCE			Not specified	Not specified
CE MARK (MDD)			Not specified	Not specified
SENSOR (CELL) TYPE	Electrochemical	Electrochemical	Galvanic	Electrochemical
Estimated life, months	≥12	≥12	>12	20
CALIBRATION CONTROL	Yes ²	Yes	Knob	Digital
OPERATING MODES	On, off	On, off	On, off	3 alarm levels
RESPONSE TIME, sec	<20	<20	<15	Not specified
DISPLAY TYPE	LCD, LED, meter	LCD, LED, meter	Meter	LED
Accuracy	3% of O ₂ concentration	3% of O ₂ concentration	3% of O ₂ concentration	1%
ALARMS				
Setting indicator	Optional No preference	Required Required, no preference for type	Yes Knob	Yes Digital
Continuously displays limits	Optional	Yes	No	Yes
Range, % O₂	15 to 100	18 to 99	18 to 25	6 to 30
Low oxygen	Preferred	Yes	Yes	Yes
Audible	Preferred	Preferred	Not specified	Not specified
Silence time, sec	60-120	60-120	NA	Not specified
Visual	Required	Required	No	Flashing LED
High oxygen	Preferred	Yes	Not specified	Yes
Audible	Preferred	Yes	Not specified	Not specified
Silence time, sec	60-120	60-120	Not specified	Not specified
Visual	Required	Required	Not specified	Flashing LED
INTERFERING GASES				
			None	None specified
AUXILIARY OUTPUTS				
			None	4-20 mA, 1-5 V
LINE POWER, VAC				
			Not specified	Not specified
BATTERIES				
Number			3	None
Type	Any common type	Any common type	AA	NA
Volts			4.5	NA
Operating time, hr	≥12	≥2 (backup)	Not specified	NA
Rechargeable	Preferred	Preferred	Not specified	NA
Recharge time, hr	16	16	Not specified	NA
Low-battery indicator	Yes	Yes	Yes	NA
Low-battery test			Knob	NA
AC POWER ADAPTER				
			No	No
H x W x D, cm (in)			9.7 x 8.5 x 5.8 (3.8 x 3.3 x 2.3)	Not specified
WEIGHT, g (oz)			550 (19.4)	Not specified

This is the first of two pages covering the above model(s). These specifications continue onto the next page.

Product Comparison Chart

MODEL	ECRI-RECOMMENDED SPECIFICATIONS¹	ECRI-RECOMMENDED SPECIFICATIONS¹	ACOMA	DELPHIAN
	Oxygen Monitor for Spot Checks	Oxygen Monitor for Critical Care	AS-25 II	System 250
PURCHASE INFORMATION				
List prices				
Unit			Y200,00 (US\$1,663)	Not specified
Cell kit (rent/replace)			Not specified	Not specified
Gel for polar unit			Not specified	Not specified
Warranty				
Unit			Not specified	Not specified
Sensor			Not specified	Not specified
Delivery time, ARO			Not specified	Not specified
Year first sold			Not specified	Not specified
Number installed				
USA/worldwide			Not specified	Not specified
Fiscal year			May to April	Not specified
OTHER SPECIFICATIONS		Critical care units should be line powered with battery backup.	None specified.	None specified.
LAST UPDATED			March 2006	March 2006
Supplier Footnotes	¹ These recommendations are the opinions of ECRI's technology experts. ECRI assumes no liability for decisions made based on this data.	¹ These recommendations are the opinions of ECRI's technology experts. ECRI assumes no liability for decisions made based on this data.		
Model Footnotes				
Data Footnotes	² Optional 100% calibration features automated sensor technology to advise user of impending expiration within 200 hr.			

Product Comparison Chart

MODEL	ENMET ISA-60M/MRI-5175	ENMET MedAir 2200	ENMET SDS-1100-97D	ENMET SPECTRUM, O2
WHERE MARKETED	Worldwide	Worldwide	Worldwide	Worldwide
FDA CLEARANCE	Not specified	Not specified	Not specified	Not specified
CE MARK (MDD)	Not specified	Not specified	Not specified	Not specified
SENSOR (CELL) TYPE	Electrochemical	Electrochemical	Plug-in electrochemical	Electrochemical
Estimated life, months	18	18	18	18
CALIBRATION CONTROL	Push button	Push button	Push button	Push button
OPERATING MODES	On, off, maintenance	On, off, maintenance	On, off	On, off, maintenance
RESPONSE TIME, sec	<10 (90%)	<10 (90%)	<10 (90%)	<10 (90%)
DISPLAY TYPE	LCD	LCD	LCD	LCD
Accuracy	0.1%	0.1%	0.1%	0.1%
ALARMS	Yes	Yes	Yes	Yes
Setting indicator	No	No	No	No
Continuously displays limits	Yes	No	No	No
Range, % O2	0 to 30	0 to 25	0 to 30	0 to 25
Low oxygen	Yes	Yes	Yes	Yes
Audible	95 dB at 2 ft	Steady tone	Not specified	Yes
Silence time, sec	NA	NA	NA	NA
Visual	Red LED	Red LED	Not specified	Red LED
High oxygen	Available	Yes	Not specified	Yes
Audible	Yes	Yes	Not specified	Yes
Silence time, sec	Not specified	NA	Not specified	Not specified
Visual	Red LED	Red LED	Red LED	Red LED
INTERFERING GASES	None specified	None specified	None specified	None specified
AUXILIARY OUTPUTS	4-20 mA	4-20 mA (latching or nonlatching relay terminal)	4-20 mA	None
LINE POWER, VAC	100-240	100-240	Not specified	Not specified
BATTERIES				
Number	Optional backup	Optional backup	Not specified	1
Type	Lead acid	Lead acid	Not specified	Alkaline or Ni-Cd
Volts	12	12	24	9
Operating time, hr	3-24	3-24	Continuous	400
Rechargeable	Yes	Yes	NA	No
Recharge time, hr	6-24	6-24	NA	NA
Low-battery indicator	Yes	Yes	Not specified	Yes
Low-battery test	No	No	Not specified	Yes
AC POWER ADAPTER	Line	Line	Not specified	No
H x W x D, cm (in)	27 x 21.5 x 14.5 (10.8 x 8.5 x 5.8)	27 x 21.5 x 14.5 (10.8 x 8.5 x 5.8) control panel	6.6 x 12 x 4.7 (2.6 x 4.7 x 1.9)	6 x 11 x 3 (2.4 x 4.3 x 1.2)
WEIGHT, g (oz)	3,624 (128) control panel	3,624 (128) control panel	454 (16)	340 (12)

This is the first of two pages covering the above model(s). These specifications continue onto the next page.

Product Comparison Chart

MODEL	ENMET ISA-60M/MRI-5175	ENMET MedAir 2200	ENMET SDS-1100-97D	ENMET SPECTRUM, O2
PURCHASE INFORMATION				
List prices				
Unit	\$1,895	\$2,295	\$895	\$495
Cell kit (rent/replace)	\$395	\$195	\$225	\$195
Gel for polar unit	NA	NA	NA	NA
Warranty				
Unit	1 year	1 year	1 year	1 year
Sensor	1 year	1 year	1 year	1 year
Delivery time, ARO	2 weeks	2 weeks	2 weeks	1 week
Year first sold	2005	2005	2000	1996
Number installed				
USA/worldwide	Not specified	Not specified	Not specified	Not specified
Fiscal year	January to December	January to December	January to December	January to December
OTHER SPECIFICATIONS	None specified.	Additional gases available.	Sensor/transmitter; available for a wide range of toxic gases and hydrogen.	Handheld; portable; monitors other gases.
LAST UPDATED	March 2006	March 2006	March 2006	March 2006
Supplier Footnotes				
Model Footnotes				
Data Footnotes				

Product Comparison Chart

MODEL	HUDSON 5800	HUDSON 5801	HUDSON 5802	HUDSON 5810
WHERE MARKETED	Worldwide	Worldwide	Worldwide	Worldwide
FDA CLEARANCE	Yes	Yes	Yes	Yes
CE MARK (MDD)	Yes	Yes	Yes	Yes
SENSOR (CELL) TYPE	Galvanic, intelligent, patented intelligent sensor technology gives 200 hr advance notice of sensor expiration	Galvanic, intelligent, patented intelligent sensor technology gives 200 hr advance notice of sensor expiration	Galvanic, intelligent, patented intelligent sensor technology gives 200 hr advance notice of sensor expiration	Galvanic
Estimated life, months	18	18	18	18
CALIBRATION CONTROL	Automatic at 21% O2 concentration and semiautomatic at 100%	Automatic at 21% O2 concentration and semiautomatic at 100%	Automatic at 21% O2 concentration and semiautomatic at 100%	Manual potentiometer
OPERATING MODES	On, off	On, off	On, off	On, off
RESPONSE TIME, sec	10 (97%)	10 (97%)	10 (97%)	10 (97%)
DISPLAY TYPE	LCD	LCD	LCD	LCD
Accuracy	1%	1%	1%	2%
ALARMS	Yes	No	No	No
Setting indicator	Keypad	NA	NA	NA
Continuously displays limits	Yes	NA	NA	NA
Range, % O2	16 to 100, preset low at 18	NA	NA	NA
Low oxygen	Yes	NA	NA	NA
Audible	Beeping 2,300 Hz	NA	NA	NA
Silence time, sec	90	NA	NA	NA
Visual	Flashing red LED	NA	NA	NA
High oxygen	Yes	NA	NA	NA
Audible	Beeping 2,300 Hz	NA	NA	NA
Silence time, sec	30	NA	NA	NA
Visual	Flashing red LED	NA	NA	NA
INTERFERING GASES	None specified	None specified	None specified	None specified
AUXILIARY OUTPUTS	None	None	None	None
LINE POWER, VAC	Not specified	Not specified	Not specified	Not specified
BATTERIES				
Number	2	2	2	1
Type	Alkaline, AA	Alkaline, AA	Alkaline, AA	Alkaline, 9 V
Volts	2 x 1.5	2 x 1.5	2 x 1.5	1 x 9
Operating time, hr	Not specified	Not specified	Not specified	Not specified
Rechargeable	Not specified	Not specified	Not specified	Not specified
Recharge time, hr	Not specified	Not specified	Not specified	Not specified
Low-battery indicator	Yes	Yes	Yes	Yes
Low-battery test	Yes	Yes	Yes	Yes
AC POWER ADAPTER	No	No	No	No
H x W x D, cm (in)	14.2 x 9.1 x 3.8 (5.6 x 3.6 x 1.5)	14.2 x 9.1 x 3.8 (5.6 x 3.6 x 1.5)	14.2 x 9.1 x 3.8 (5.6 x 3.6 x 1.5)	11.7 x 6.4 x 3.6 (4.6 x 2.5 x 1.4)
WEIGHT, g (oz)	215 (7.6)	215 (7.6)	215 (7.6)	200 (7.1)

This is the first of two pages covering the above model(s). These specifications continue onto the next page.

Product Comparison Chart

MODEL	HUDSON 5800	HUDSON 5801	HUDSON 5802	HUDSON 5810
PURCHASE INFORMATION				
List prices				
Unit	Not specified	Not specified	Not specified	Not specified
Cell kit (rent/replace)	Not specified	Not specified	Not specified	Not specified
Gel for polar unit	NA	NA	NA	NA
Warranty				
Unit	2 years, limited	2 years, limited	2 years, limited	2 years, limited
Sensor	1 year, limited	1 year, limited	1 year, limited	1 year, limited
Delivery time, ARO	Not specified	Not specified	Not specified	Not specified
Year first sold	Not specified	Not specified	Not specified	Not specified
Number installed USA/worldwide	Not specified	Not specified	Not specified	Not specified
Fiscal year	Not specified	Not specified	Not specified	Not specified
OTHER SPECIFICATIONS	Microprocessor-based self-diagnostic program; onscreen calibration menu; various mounting options; automatic alarm test (high and low); mute status indicator; low alarm can be set to 16%; high alarm disable for 100%.	Microprocessor-based self-diagnostic program; onscreen calibration menu; various mounting options; optional 100% calibration.	Microprocessor-based self-diagnostic program; onscreen calibration menu; internally mounted sensor for easy spot check of concentrators.	Simple digital analyzer designed for durability and ruggedness; internally mounted sensor for easy spot checking of concentrators.
LAST UPDATED	March 2006	March 2006	March 2006	March 2006
Supplier Footnotes				
Model Footnotes				
Data Footnotes				

Product Comparison Chart

MODEL	MAXTEC OM-25ME	MSA MiniOX 3000	OXIGEL 0950 : 0951-Alarms	SIERRA MONITOR 4101-03
WHERE MARKETED	Worldwide	Worldwide	Latin America	Worldwide, except USA
FDA CLEARANCE	Yes	Yes	No	No
CE MARK (MDD)	Yes	Yes	No	No
SENSOR (CELL) TYPE	Galvanic	Galvanic	Galvanic	Electrochemical
Estimated life, months	36	12 to 24	18	24
CALIBRATION CONTROL	Push button, semiautomatic	Automatic push button	Knob	Screwdriver (side)
OPERATING MODES	On, off	On, off	On, off	Not specified
RESPONSE TIME, sec	<15 (90%) at room temperature	8 (90%)	8 (90%)	10 (90%)
DISPLAY TYPE	LCD	LCD	LCD	4-20 mA output
Accuracy	0.1% of O ₂ concentration	0.1% of O ₂ concentration	To within 0.1% of O ₂ concentration	0.1% of O ₂ concentration
ALARMS	Yes	Yes	No : Yes	Yes
Setting indicator	LCD	Push to indicate	No : Yes	Screwdriver
Continuously displays limits	Yes	Yes	No : Yes	Not specified
Range, % O ₂	18 to 99	15 to 99	0 to 100	0 to 25
Low oxygen	Yes	Yes	No : Yes	Yes
Audible	Pulsating tone	Pulsating tone	No : Yes	Not specified
Silence time, sec	120	30, 60, 90	No : 90	Not specified
Visual	Flashing red LED	Flashing red LED	No : Red LED	Not specified
High oxygen	Yes	Yes	No : Yes	Not specified
Audible	Pulsating tone	Pulse tone	No : Yes	Not specified
Silence time, sec	120	30, 60, 90	No : 90	Not specified
Visual	Flashing red LED	Flashing red LED	No : Red LED	Not specified
INTERFERING GASES	No gases present in typical anesthesia and respiratory applications	Methoxyflurane at 4%: 2.3 vol% O ₂ ; diethyl ether at 20%: 1.5 vol% O ₂ ; halothane at 5%: 0.9 vol% O ₂ ; nitrous oxide at 80%: 0.8 vol% O ₂ ; enflurane at 4%: 0.5 vol% O ₂	None specified	None
AUXILIARY OUTPUTS	None	None specified	Probe	Not specified
LINE POWER, VAC	Not specified	Not specified	Not specified	24 VDC
BATTERIES				
Number	2	1	1	Not specified
Type	Alkaline, AA	Alkaline	Alkaline	Not specified
Volts	1.5	9	9	Not specified
Operating time, hr	Not specified	Not specified	Not specified	Not specified
Rechargeable	Not specified	Not specified	Not specified	Not specified
Recharge time, hr	Not specified	Not specified	Not specified	Not specified
Low-battery indicator	Yes	Yes	No : Yes	Not specified
Low-battery test	Automatic	Yes	No : Yes	Not specified
AC POWER ADAPTER	No	No	No : No	Not specified
H x W x D, cm (in)	14 x 8.9 x 3.8 (5.5 x 3.5 x 1.5)	15.2 x 8.4 x 3.4 (6 x 3.3 x 1.3)	4 x 14 x 8 (6.3 x 5.5 x 3.1) : 8 x 18 x 19 (3.1 x 7.1 x 7.5)	21.6 x 10.2 x 10.2 (8.5 x 4 x 4)
WEIGHT, g (oz)	317.5 (11.2)	260 (9.2) without sensor	100 (3.5) : 300 (10.6)	1,000 (35.3)

This is the first of two pages covering the above model(s). These specifications continue onto the next page.

Product Comparison Chart

MODEL	MAXTEC	MSA	OXIGEL	SIERRA MONITOR
	OM-25ME	MiniOX 3000	0950 : 0951-Alarms	4101-03
PURCHASE INFORMATION				
List prices				
Unit	\$585	\$575, \$625	\$300 : \$420	\$795
Cell kit (rent/replace)	\$95	\$75	\$80	Not specified
Gel for polar unit	NA	NA	Not specified	Not specified
Warranty				
Unit	2 years	1 year, unconditional	1 year	2 years
Sensor	2 years	1 year, unconditional	3 weeks	2 years
Delivery time, ARO	1 week	Not specified	Not specified	2 weeks
Year first sold	Not specified	1997	1986	1984
Number installed				
USA/worldwide	Not specified	Not specified	Not specified	NA/not specified
Fiscal year				
	January to December	January to December	January to December	January to December
OTHER SPECIFICATIONS				
	Sensor electrolyte nonreactive to nitrous oxide and other acid gases; surface-mount electronics; quick-calibration feature; DuraCase protection; adapter T-piece accessory.	Portable unit; ABS case; microprocessor-controlled (2 backup systems operate to retain the program).	None specified.	None specified.
LAST UPDATED				
	March 2006	March 2006	March 2006	March 2006
Supplier Footnotes				
Model Footnotes				
Data Footnotes				

Product Comparison Chart

MODEL	SIERRA MONITOR	TELEDYNE	TELEDYNE	VASCULAR TECHNOLOGY VTI OXYGEN ANALYZER
	5100-03	AX300	MX300	
WHERE MARKETED	Worldwide, except USA	Worldwide	Worldwide	Worldwide
FDA CLEARANCE	No	Yes	Yes	Yes
CE MARK (MDD)	No	Yes	Yes	No
SENSOR (CELL) TYPE	Electrochemical	Galvanic	Galvanic	Galvanic or polarographic ¹
Estimated life, months	24	36 in air	36 in air	12 to 36
CALIBRATION CONTROL	Through controller	Manual/automatic	Manual/automatic	Knob
OPERATING MODES	Not specified	On, off	On, off	On, off
RESPONSE TIME, sec	10 (90%)	<6 (90%)	<6 (90%)	<20 (90%)
DISPLAY TYPE	Digital signal	LCD	LCD	LCD
Accuracy	0.1% of O ₂ concentration	2% of O ₂ concentration at constant temperature	2% of O ₂ concentration at constant temperature	0.1% of O ₂ concentration
ALARMS	Yes	Yes	Yes	No
Setting indicator	Screwdriver	No	Digital	NA
Continuously displays limits	Not specified	No	Yes	NA
Range, % O₂	0 to 25	0 to 100	0 to 100	NA
Low oxygen	Yes	Yes	Yes	NA
Audible	Not specified	Pulsating tone	Pulsating tone	NA
Silence time, sec	Not specified	NA	120	NA
Visual	Not specified	Yes	Red LED	NA
High oxygen	Not specified	NA	Yes	NA
Audible	Not specified	NA	Yes	NA
Silence time, sec	Not specified	NA	120	NA
Visual	Not specified	NA	Yes	NA
INTERFERING GASES	None	None	None	Interference from mixtures containing the following gases and vapors mixed with oxygen is ≤2% O ₂ : 80 vol% N ₂ O, 80 vol% He, 10 vol% CO ₂ , 3 vol% water vapor, 6 vol% halothane, 5 vol% enflurane, 5 vol% isoflurane, 1 vol% methoxyflurane
AUXILIARY OUTPUTS	Not specified	0-1 VDC; optional RS232	0-1 VDC; optional RS232	None
LINE POWER, VAC	24 VDC	Not specified	Not specified	Not specified
BATTERIES				
Number	Not specified	3	3	1
Type	Not specified	Alkaline AA	Alkaline AA	Alkaline
Volts	Not specified	1.5	1.5	9
Operating time, hr	Not specified	2,000	2,000	2,200
Rechargeable	Not specified	Not specified	Not specified	Not specified
Recharge time, hr	Not specified	Not specified	Not specified	Not specified
Low-battery indicator	Not specified	Yes	Yes	Yes
Low-battery test	Not specified	No	Yes	Automatic
AC POWER ADAPTER	Not specified	No	No	No
H x W x D, cm (in)	21.6 x 10.2 x 10.2 (8.5 x 4 x 4)	14 x 8.8 x 7.6 (5.5 x 3.5 x 3)	14 x 8.8 x 7.6 (5.5 x 3.5 x 3)	14.4 x 8.3 x 4 (5.7 x 3.3 x 1.6)
WEIGHT, g (oz)	1,000 (35.3)	454 (16)	454 (16)	238 (8.4)

This is the first of two pages covering the above model(s). These specifications continue onto the next page.

Product Comparison Chart

MODEL	SIERRA MONITOR	TELEDYNE	TELEDYNE	VASCULAR TECHNOLOGY
	5100-03	AX300	MX300	VTI OXYGEN ANALYZER
PURCHASE INFORMATION				
List prices				
Unit	\$795	\$549	\$735	\$315-355
Cell kit (rent/replace)	Not specified	NA	NA	\$79-97
Gel for polar unit	Not specified	NA	NA	NA ¹
Warranty				
Unit	2 years	2 years	2 years	Lifetime, limited
Sensor	2 years	2 years, limited	2 years	1 year
Delivery time, ARO	2 weeks	2-4 days	2-4 days	Stock
Year first sold	1984	2004	2004	1992
Number installed				
USA/worldwide	NA/not specified	1,200 total	1,500 total	Not specified
Fiscal year	January to December	Not specified	Not specified	October to September
OTHER				
SPECIFICATIONS	None specified.	Large LCD; autocalibration; stand with suction cups; 3 mounting options; long-life sensor; rugged construction; autodiagnosics with fail alarm; optional digital output.	Large LCD; autocalibration; stand with suction cups; 3 mounting options; long-life sensor; rugged construction; autodiagnosics with fail alarm; high and low alarms; optional digital output.	Portable; ABS case; operates on galvanic or polarographic sensors.
LAST UPDATED				
	March 2006	March 2006	March 2006	March 2006
Supplier Footnotes				
Model Footnotes				
Data Footnotes				
				¹ Polarographic sensor is maintenance free.

Product Comparison Chart

MODEL	VASCULAR TECHNOLOGY VTI OXYGEN MONITOR
WHERE MARKETED	Worldwide
FDA CLEARANCE	Yes
CE MARK (MDD)	No
SENSOR (CELL) TYPE	Galvanic or polarographic ¹
Estimated life, months	12 to 36
CALIBRATION CONTROL	Knob
OPERATING MODES	On, off
RESPONSE TIME, sec	<20 (90%)
DISPLAY TYPE	LCD
Accuracy	0.1% of O ₂ concentration
ALARMS	Yes
Setting indicator	Dial, push to display
Continuously displays limits	Yes
Range, % O₂	18 to 106
Low oxygen	Yes
Audible	Continuous tone
Silence time, sec	None
Visual	Red LED
High oxygen	Yes
Audible	Continuous tone
Silence time, sec	Not specified
Visual	Red LED
INTERFERING GASES	Interference from mixtures containing the following gases and vapors mixed with oxygen is $\leq 2\%$ O ₂ : 80 vol% N ₂ O, 80 vol% He, 10 vol% CO ₂ , 3 vol% water vapor, 6 vol% halothane, 5 vol% enflurane, 5 vol% isoflurane, 1 vol% methoxyflurane
AUXILIARY OUTPUTS	Optional (0-100 mV)
LINE POWER, VAC	Not specified
BATTERIES	
Number	1
Type	Alkaline
Volts	9
Operating time, hr	2,200
Rechargeable	Not specified
Recharge time, hr	Not specified
Low-battery indicator	Yes
Low-battery test	Automatic
AC POWER ADAPTER	No
H x W x D, cm (in)	14.4 x 8.3 x 4 (5.7 x 3.3 x 1.6)
WEIGHT, g (oz)	240 (8.5)

This is the first of two pages covering the above model(s). These specifications continue onto the next page.

Product Comparison Chart

MODEL	VASCULAR TECHNOLOGY VTI OXYGEN MONITOR
PURCHASE INFORMATION	
List prices	
Unit	\$522-562
Cell kit (rent/replace)	\$79-97
Gel for polar unit	NA ¹
Warranty	
Unit	Lifetime, limited
Sensor	1 year
Delivery time, ARO	Stock
Year first sold	1989
Number installed	
USA/worldwide	Not specified
Fiscal year	October to September
OTHER SPECIFICATIONS	Portable; ABS case; pole-mountable; adjustable high and low alarms.
LAST UPDATED	March 2006
Supplier Footnotes	
Model Footnotes	
Data Footnotes	¹ Polarographic sensor is maintenance free.