



User Manual

For models

OxyLite™ Pro
OxyLite™ Pro XL

Continuous *in vivo* and *in vitro* combined
pO₂ and temperature monitoring

Product Documentation and User Manual

Revision 1.2

For the purposes of this User Manual and unless otherwise stated,
OxyLite Pro shall also mean OxyLite Pro XL

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1. SAFETY INFORMATION

This section contains important safety information related to the general use of the OxyLite Pro monitor. Other important safety information appears throughout this manual in the form of warnings and cautions.

1.1 *Intended Use*

The OxyLite Pro monitor is intended for the continuous measurement of pO₂ and temperature in tissue (i.e. *in vivo*), physiological fluids, cell cultures or other samples (i.e. *in vitro*).

OxyLite Pro is suited to the determination of tissue or cell culture hypoxia as the measurement technique is particularly sensitive at low tissue pO₂.

OxyLite Pro may be used in conjunction with OxyFlo Pro, a laser Doppler blood flow monitor that is intended for monitoring microvascular blood perfusion in tissue. The combination of these two fibre optic measurement systems provides simultaneous tissue blood flow and oxygenation data. Combined sensors are available that support simultaneous pO₂ and blood perfusion monitoring.

OxyLite Pro is not suited to the measurement of pO₂ values in excess of 200mmHg or in non-aqueous environments.

1.2 *Contra-Indications*

OxyLite Pro is purely for laboratory, industrial and research use and is NOT a medical device. OxyLite Pro does NOT possess requisite regulatory approval(s) for use with human subjects or patients.

1.3 *FCC Compliance*

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause interference, in which case the user will be required to correct the interference at his/her own expense.

1.4 EMC Compliance – EC Declaration of Conformity

This equipment meets the intent of Directive 2004/108/EC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities.

EN 61326-1:2006

EN 61326-2-1:2006

1.5 OxyLite Pro Symbols















SN	Serial number	REF	Catalogue number (product code)
	Date of manufacture		Equipment should not be disposed of in the normal waste stream
	Attention. See instructions for use.		Read instructions for use
	Alternating current		Direct current
	Digital output		Analogue outputs

Table 1: OxyLite Pro symbols







1.6 Definitions

 WARNING	A warning indicates the possibility of injury to the operator.
 CAUTION	A caution indicates a condition that may lead to equipment damage and/or malfunction.

1.7 Summary of Warnings for the OxyLite Pro Monitor

 WARNING	Do not attempt to open the OxyLite Pro. There are no user-serviceable parts inside. There is a risk of electrical shock or other injury or permanent damage to the monitor.
 WARNING	The OxyLite Pro should only be repaired or serviced by Oxford Optronix Ltd. trained service staff.
 WARNING	Use ONLY the NX-PSU universal AC adapter provided by Oxford Optronix. Failure to do so may result in irreparable damage to the OxyLite Pro monitor and may cause harm to the user.
 WARNING	To avoid the risk of electric shock or shorts, do not spray, pour or spill any liquid in or on the OxyLite Pro.

1.8 Summary of Cautions for the OxyLite Pro Monitor

 CAUTION	To avoid damage, do not use sharp objects to operate the touch screen display.
 CAUTION	To avoid damage, do not spray, pour or spill any liquid on the touch screen display.
 CAUTION	Connecting the NX-PSU universal AC adapter to the <i>DC POWER IN</i> inlet at the rear of the OxyLite Pro, having <i>already</i> powered it via its On/Off switch <i>MAY</i> trigger the surge protection circuit within the OxyLite Pro. If the OxyLite Pro does not start up, turn off the AC adapter, wait 2 - 3 minutes, then turn the AC adapter on once more.
 CAUTION	DO NOT attempt to operate the OxyLite Pro in the vicinity of imaging or therapeutic equipment that emits ionising radiation or produces a strong magnetic field as the performance of the monitor may be affected.
 CAUTION	DO NOT attempt to autoclave, pressure sterilise, or expose to radiation, any part of the monitor.
 CAUTION	Use only sensors, cables and accessories supplied by Oxford Optronix Ltd.



To ensure that the pO₂ measured by sensors in channels 2, 3 or 4 is accurate, the temperature that is recorded by the sensor in channel 1 must be representative for all sensors.



Failure to pack the OxyLite Pro monitor appropriately for repair or service is likely to result in potentially costly damage to the monitor during transit.

1.9 Summary of Cautions for OxyLite Pro Sensors



OxyLite Pro sensors should be HANDLED WITH CARE. Failure to do so may result in breakage of the internal optical fibre, loss of the oxygen sensing tip or separation of the cable from the sensor connector. REFER TO WARRANTY STATEMENTS PROVIDED AT THE END OF THIS DOCUMENT.



The tips of oxygen sensors are fragile and can be damaged by attempts to clean them without due care and attention.



For safe storage of OxyLite Pro sensors always refit the protective black cover when a sensor is not in use.



DO NOT drop, stretch or 'kink' any part of an OxyLite Pro sensor. Permanent damage may result.



DO NOT soak or immerse OxyLite Pro sensors in corrosive solution. Permanent damage may result.



DO NOT store OxyLite Pro sensors in bright sunlight.



AVOID using OxyLite Pro sensors under strong (e.g. surgical) lights.



The oxygen-sensitive tip of sensors must be isolated from atmospheric oxygen to ensure reliable *in situ* oxygen measurements.



Oxygen sensor calibration accuracy is warranted for a period of 6 months from factory calibration.



If the sensor connector has been immersed in 70% alcohol ensure that it is completely free of pockets of non-evaporated alcohol prior to use.



The effect of exposure to heat, radiation, glutaraldehyde, ETO gas or plasma on the performance and measurement accuracy of OxyLite Pro sensors has not been validated.

2. INTRODUCTION

2.1 General Description

The OxyLite Pro is an instrument capable of continuous, quantitative measurement of the partial pressure of oxygen (pO_2) and temperature in tissues, physiological fluids, cell cultures and other *in vitro* applications. pO_2 is also variously referred to as an 'oxygen tension' or as 'dissolved oxygen'.

OxyLite Pro is an optical device based upon the principle that the presence of molecular dissolved oxygen in tissues or fluids can terminate (quench) light emitted by a fluorescent compound (dye). The quenching of the fluorescent light is proportional to the pO_2 in the vicinity of the dye.

The OxyLite Pro system consists of a portable monitor and detachable, re-usable sensors. The monitor houses a green LED light source, sensitive photo-detector, a PC module and proprietary signal processing electronics. All OxyLite Pro sensors comprise a single optical fibre that conducts light from the monitor to the sensing tip. The sensing tip contains a platinum-based fluorescent dye held within a polymer matrix.

When the dye is illuminated/excited with light from the monitor, it fluoresces. The fluorescent light is returned to the monitor using the same optical fibre and the signal processor determines the fluorescent decay time. From this, the corresponding pO_2 is derived. As pO_2 in the vicinity of the sensing tip decreases, the extent of quenching decreases and the fluorescence decay time increases. The quenching process is a purely collisional dynamic where the energy from the excited fluorescent dye is transferred to the oxygen molecule during a collision, hence, reducing the emission intensity as well as the fluorescent lifetime of the dye. Thus, the oxygen content of the tissue or fluid under investigation is not changed by the measurement process.

Measured pO_2 is displayed on the monitor's display in units of either millimetres of mercury (mmHg) or kilo Pascal (kPa).

Measured pO_2 is dependent on the local temperature at the sensing tip. In general it is therefore important that pO_2 measurements are compensated for temperature. To this end, the OxyLite Pro monitor incorporates a calibrated temperature measurement system. The OxyLite Pro monitor performs automatic temperature compensation and will generate a continuous readout of temperature when a combined oxygen/temperature sensor is in use.

In order to display an accurate pO_2 value the OxyLite Pro requires calibration data. The calibration data is sensor-specific and for maximum ease of use each sensor is supplied pre-calibrated. The calibration data, as well as setup information are contained in a miniature 'EEPROM' electronic

chip integral to the sensor connector; these data are automatically read by and transferred to the OxyLite Pro monitor upon connection.

The OxyLite Pro is set up and controlled using commands issued via its touch sensitive user interface display.

Continuous pO₂ and temperature data from the OxyLite Pro can be acquired for recording, playback and analysis using a suitable data acquisition system connected via a choice of interfaces at the rear of the monitor (model dependent).

The OxyLite Pro pO₂/temperature monitor is available in two configurations:

OxyLite Pro

A dual-channel monitor, capable of supporting up to two oxygen or combined oxygen/temperature sensors simultaneously;

OxyLite Pro XL

A four-channel monitor, capable of supporting up to four oxygen or combined oxygen/temperature sensors simultaneously.

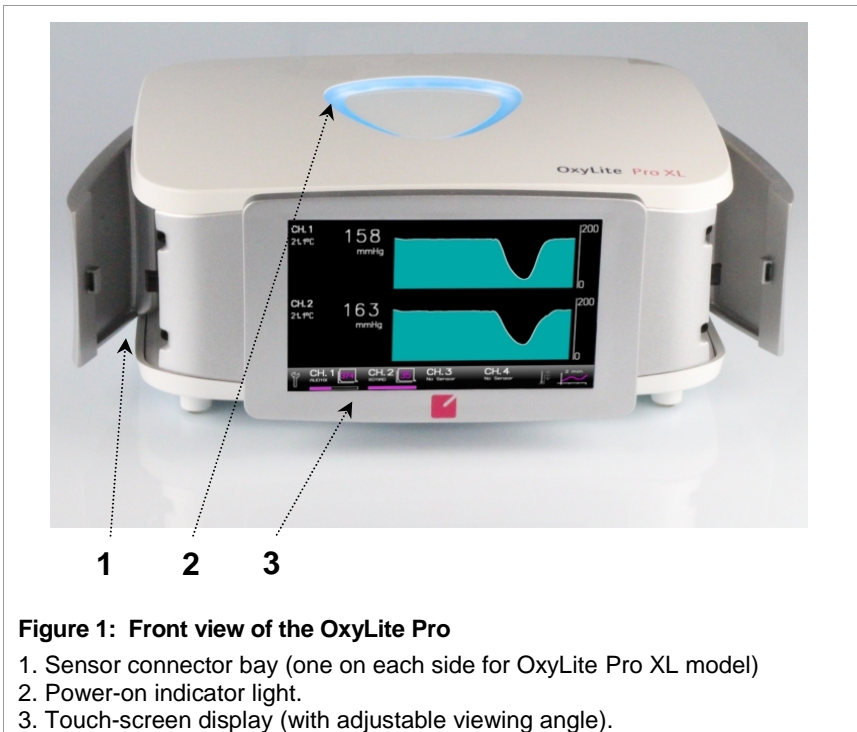
2.2 List of Key Features

- **Absolute units of dissolved oxygen**
The fluorescence-based technique employed by the OxyLite Pro type monitors provides an absolute measurement of dissolved oxygen in mmHg or kPa. For *in vivo* applications, this provides a direct readout of oxygen availability to cells and tissue, in contrast to blood oxygen saturation assessment (pulse oximetry), which merely describes the haemoglobin oxygenation status of blood.
- **Sensitivity and accuracy**
Third-generation opto-electronics provide unmatched sensitivity, stability and accuracy in the physiologically relevant pO₂ range (0 - 200mmHg) and under conditions of hypoxia (0 – 15mmHg).
- **No oxygen consumption**
Zero oxygen consumption at the point of measurement, thus innately suitable for continuous and absolute oxygen sensing, even under conditions of extreme hypoxia.
- **Microchip sensors**
'EEPROM' technology embedded within our purpose-designed connectors provides unsurpassed ease of use and user convenience by completely eliminating all calibration procedures. Simply 'plug-in and go'.
- **Touch-screen display and interface**
OxyLite Pro models feature a touch-sensitive, high-contrast, 140° viewing-angle screen, which displays real-time data in both digital and

graphical (trace) formats, and provides access to instrument/user settings.

- **Built-in temperature compensation**
Automatic temperature compensation of the pO₂ measurement through optional, integrated temperature sensors.
- **Versatility**
Full support for both *in vivo* (tissue) pO₂ applications AND measurement of dissolved oxygen *in vitro* (e.g. hypoxic cell culture, tissue constructs, bioreactors and more).
- **Minimally invasive for *in vivo* applications**
Oxygen sensor diameters range from approximately 230µm - 750µm to suit a host of tissue monitoring applications and cause minimal tissue disruption in use.
- **MRI compatible sensors**
Dedicated 8m sensors provide support and compatibility for magnetic resonance imaging.
- **Multi-channel productivity**
The OxyLite Pro is available in dual or four-channel models to suit all needs including the simultaneous monitoring of oxygen from multiple tissue sites (e.g. comparison of pathological versus control tissue sites), or multiple *in vitro* samples.
- **Upgradeable**
The OxyLite Pro dual-channel model can be factory upgraded to a 4-channel OxyLite Pro XL monitor.
- **Single-sensor multi-parameter monitoring**
Our OxyLite oxygen and temperature models are designed specifically to be used in tandem with our OxyFlo range of blood flow monitors, providing support for simultaneous measurements of tissue oxygenation, blood flow and temperature from each combined sensor.
- **USB digital output**
A dedicated USB output supports direct streaming of recordings to a PC running the popular LabChart® Pro charting software. Features automatic identification of the monitor and pre-loading of configuration and channel settings for 'plug and play' convenience.
- **Analogue outputs**
Continuous data recording to PC or Mac platforms is also supported via standard analogue data outputs offering compatibility with third party data recording solutions.
- **2-year product warranty**
Our comprehensive manufacturer's warranty covers defects in material, function or in workmanship for a period of 2 years following delivery.

2.3 The OxyLite Pro Monitor



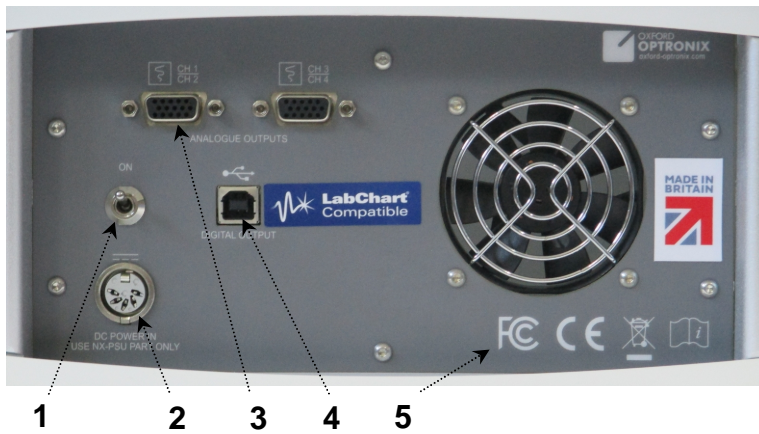


Figure 2: Rear view of the OxyLite Pro

1. On/Off switch
2. Low voltage power inlet (**use 'NX-PSU' universal AC Adapter only**)
3. Analogue output connectors:
 - Ch 1 / Ch 2 (common to all OxyLite Pro models)
 - Ch 3 / Ch 4 (OxyLite Pro XL model only)
4. USB serial output for optional *direct* data streaming to LabChart® Pro
5. Symbols applicable to OxyLite Pro

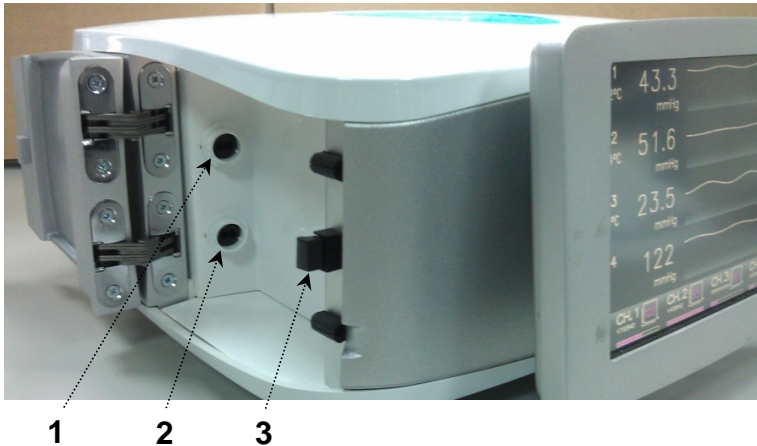


Figure 3: Side-view of OxyLite Pro, showing open sensor connector bay

1. Channel 1 sensor connector
2. Channel 2 sensor connector
3. Push-release latch opens side panel to reveal sensor connector bay

Channel 3 and Channel 4 sensor connectors (OxyLite Pro XL model only) are located inside the connector bay on the right-hand side of the monitor.



Figure 4: The NX-PSU universal AC adapter

NOTE: Use **ONLY** the universal AC adapter provided by Oxford Optronix. Failure to do so may result in irreparable damage to the OxyLite Pro monitor and may cause harm to the user.

2.4 OxyLite Pro Sensors

Introduction

A range of pO₂ sensors are available for use with the OxyLite Pro monitor. In addition, there are sensors available for the simultaneous measurement of microvascular blood perfusion when OxyLite Pro is used in conjunction with its counterpart, OxyFlo Pro.

All OxyLite Pro sensors comprise a 230µm diameter bare optical fibre, which is used to direct light to and from the sensing tip. The fibres terminate at one end of the sensor in the sensing tip (protected beneath a removable black tubular protective cover) and at the other end in a connector plug that attaches to the OxyLite Pro. The connector plug is colour-coded with a **blue** band.

A durable white polyurethane sleeving serves to protect the optical fibre(s) along the 2.5m length of the sensor.

The oxygen sensing tip comprises a platinum-based dye held within a matrix of silicone. A polymer layer encapsulates the tip and the fibre, giving an overall tip diameter of approximately 250µm (bare-fibre sensors only).

Since measured pO₂ is dependent on the local tissue temperature, some OxyLite Pro oxygen sensors are available with integrated temperature sensors. These monitor temperature from the site of oxygen measurement and provide automatic temperature compensation of the oxygen measurement. The temperature sensors are polyurethane-coated T-type thermocouples that have a diameter of approx. 100µm.

A comprehensive list and detailed description of available sensor types can be found on our website (www.oxford-optronix.com).

The number of plugs on a sensor is dependent on the number of parameters being measured. Oxygen and dual-parameter oxygen/temperature sensors feature a single plug, while triple-parameter sensors, also incorporating laser Doppler blood flow support feature two connector plugs. The optional temperature parameter is supported by additional pins integral to the oxygen connector plug, i.e. no additional connector plug is required.

In the case of combined sensors the connector plug carrying the laser Doppler signal is colour-coded with a **red** band.

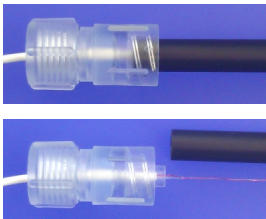
Sensor presentation



OxyLite Pro sensors consist of an optical fibre used to direct light to and from the sensing tip.

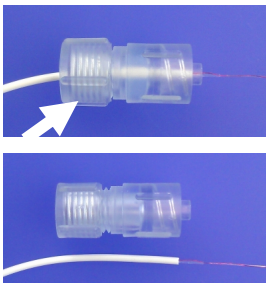
The fibres terminate at one end in the sensing tip (protected beneath a black protective cover) and at the other end in a connector plug that attaches to the OxyLite Pro.

A durable white polyurethane sleeving serves to protect the optical fibre(s) along the 2.5m length of the sensor.



The removable protective cover is push-fitted into the Tuohy Borst / Luer adapter.

The protective cover serves to protect the delicate optical fibres and should be refitted following sensor use and for sensor storage.



The Tuohy Borst / Luer adapter is intended to accommodate the protective cover (above) and can also serve to accept a catheter or needle introducer (refer to section 3.8 below).

The adapter grips the white sensor sleeving internally but can itself be removed by twisting the threaded rear section of the adapter (arrow) in an *anticlockwise* direction.

NOTE: When replacing the adapter and in order to achieve a secure 'grip' on the sleeving, ensure that the threaded rear section is twisted tightly.

Figure 5: An OxyLite Pro sensor ('NX-BF/OT' type depicted)

Sensor calibration







All OxyLite Pro sensors are individually factory pre-calibrated prior to dispatch. Sensor calibration data is stored within integrated 'EEPROM' electronic chips to provide true 'plug and play' convenience. The electronic chip contains detailed, sensor-specific calibration information which is read and loaded automatically by the monitor upon connection.

Each sensor is uniquely identified with an alphanumeric code of the following general format 'XXnnnX', for example 'MR007S'.

The sensor ID is printed at the connector (plug) end of each sensor and is also found on the sensor packaging.

It is not possible for the user to calibrate OxyLite Pro sensors.

SENSOR-RELATED CAUTIONS:

	<p>OxyLite Pro sensors should be HANDLED WITH CARE. Failure to do so may result in breakage of the internal optical fibre, loss of the oxygen sensing tip or separation of the cable from the sensor connector.</p> <p>REFER TO WARRANTY STATEMENTS PROVIDED AT THE END OF THIS DOCUMENT.</p>
	<p>DO NOT drop, stretch or 'kink' any part of an OxyLite Pro sensor. Permanent damage may result.</p>
	<p>DO NOT soak or immerse OxyLite Pro sensors in any corrosive solution. Permanent damage may result.</p>
	<p>DO NOT store OxyLite Pro sensors in bright sunlight.</p>
	<p>AVOID using OxyLite Pro sensors under strong (e.g. surgical) lights.</p>
	<p>For safe storage of OxyLite Pro sensors always refit the protective black cover when a sensor is not in use.</p>

2.5 Accessories

The following, non sensor-related accessories are available from Oxford Optronix Ltd. for use with the OxyLite Pro:

Product Code	Product Description
NX-BNC	High-density 15-pin D-connector to 4 BNC data adapter cable for OxyLite Pro or OxyFlo Pro (1m)
LABCHART_PRO	LabChart® Pro software (PC/Windows® only), incl. 1 user license and 5 years free updates
VALUE ADC	12 channel analogue output data recorder and PC software, by Dataq Inc.
POWERLAB	A range of analogue output data recorders and associated PC or Mac software, by AD Instruments
NX-PSU	Universal voltage input AC adapter (including integral power On/Off switch)

Table 2: Optional accessories for OxyLite Pro

3. MONITOR SETUP AND USE

3.1 *Unpacking and Inspection*

Immediately notify Oxford Optronix Ltd. or your local distributor if the outer packaging or carton is wet or damaged in any way. Unpack the OxyLite Pro and its components, ensuring that all items listed on the enclosed packing list / dispatch note are present. If anything is missing or damaged please contact Oxford Optronix Ltd. or your local distributor.

NOTE: We recommend that the original shipping carton and shock-absorbing inserts be stored in a safe place rather than discarded, since these will be required for any warranty returns and/or for shipping the OxyLite Pro safely scheduled servicing.

3.2 *List of Standard Components*

- OxyLite Pro Monitor
- NX-PSU universal voltage input AC adapter (including integral power On/Off switch)
- Country-specific IEC power cable
- User Manual (this document)

3.3 *Connecting and Powering-up the Monitor*

1. Position the unit on a flat and stable surface. Note that the standard sensor cable length is 2.5 metres (approx. 8 feet).
2. Ensure that the integral power On/Off switch on the universal voltage AC adapter is set to the OFF (0) position.



Use **ONLY** the NX-PSU universal AC adapter provided by Oxford Optronix. Failure to do so may result in irreparable damage to the OxyLite Pro monitor and may cause harm to the User.

3. Plug the male connector end of the NX-PSU universal AC adapter into the mains power inlet labelled *DC POWER IN* at the rear of the monitor.
4. Plug the IEC power cable into the NX-PSU AC adapter and then into a wall mains supply.

5. Power up the monitor via the power On/Off switch on the NX-PSU AC adapter. The AC adapter will automatically detect the local mains voltage (110/120V or 220/240V supported). The blue, ring-shaped power-on indicator light on top of the monitor will illuminate and the monitor will generate an audible 'beep'. While the monitor runs its internal boot sequence and start-up checks (approx. 15 seconds) the display will initially remain blank. There will be two further audible 'beeps' approx. 5 seconds apart, at which point the Oxford Optronix logo will be briefly displayed before the screen launches into its 'default' view (below).
6. The monitor is now ready for sensor connection and use (see section 3.5).



Connecting the NX-PSU universal AC adapter to the *DC POWER IN* inlet at the rear of the OxyLite Pro, having *already* powered it via its On/Off switch MAY trigger the surge protection circuit within the OxyLite Pro. If the OxyLite Pro does not start up, turn off the AC adapter, wait 2 - 3 minutes, then turn the AC adapter on once more.

3.4 Connecting / Disconnecting Sensors

The OxyLite Pro supports pre-calibrated sensors featuring integrated 'EEPROM' electronic chips to provide true plug and play convenience. The electronic chip contains sensor-specific calibration information which is read and loaded by the monitor upon connection.

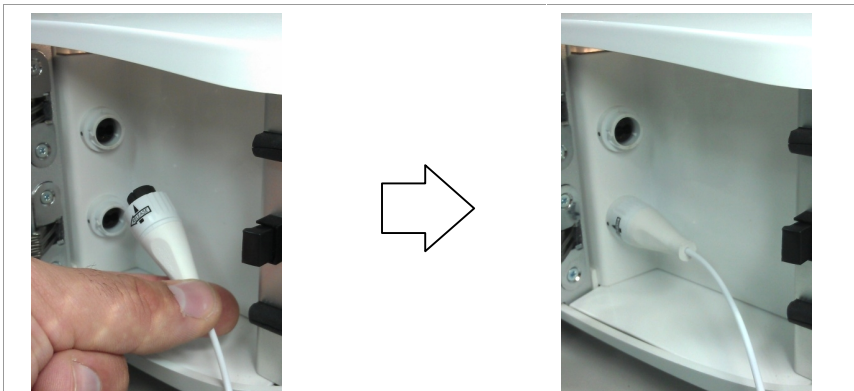


Figure 6: Connecting and disconnecting a sensor

Align the sensor connector such that the arrow is aligned with the black dot on the instrument connector surround and simply push. The connector will snap into position and calibration and other sensor information will be read automatically by the monitor.

Disconnect by twisting the front portion of the sensor connector anti-clockwise in the direction of the 'Release' arrow printed on the connector.

3.5 The Touch-Screen Display

The following pages provide an introduction to the touch-screen display.

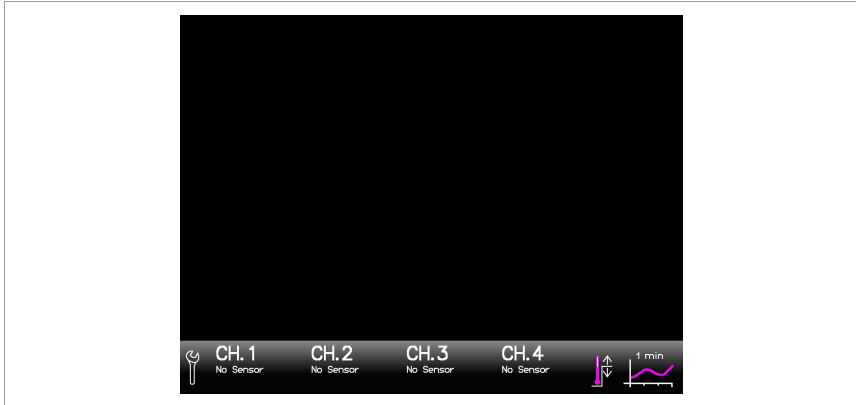


Figure 7: The touch screen display with no sensors connected

Following monitor start up the display will initially show the default screen (OxyLite Pro XL model in this example).



Figure 8: The touch screen display with 2 sensors connected

The screen will concurrently display a trace and a numerical value of pO₂ for each sensor connected.

Description of icons:




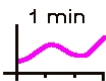
	<p>The toolbar displays sensor summary information per channel in use, including the 6-digit sensor ID, days remaining until 'recommended use-by date' (35 in this example), and a graphical representation of accumulated sensor longevity remaining (bar). Touch to display the sensor status dialogue (figure 9).</p>
	<p>Touch to display the settings toolbar (see figure 8).</p>
	<p>Touch to display the manual temperature selection screen (unavailable/greyed out where sensor in channel 1 is a combined oxygen/temperature sensor).</p>
	<p>Touch to toggle x-axis compression. Press and hold to display the x-axis compression selection screen.</p>

Table 3: Touch screen default toolbar icons

Useful functionality:

- Press and hold on any of the numerical digits to hide trace(s) and display digits in large text.
- Press and hold 'mmHg' to toggle to 'kPa' units (and vice versa).
- Press and hold the y-axis (for any channel) to display the y-axis scale selection screen.

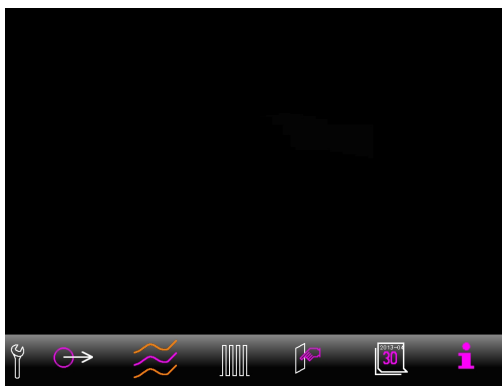






Figure 9: The touch screen settings toolbar

Touching the 'spanner' icon displays the settings toolbar on which numerous display parameters and instrument settings can be defined (see below). Touch it again to return to the default screen. The settings toolbar will automatically revert to the default screen after 20s of inactivity.

Description of icons on the settings toolbar:

	<p>Touch to display the analogue output scaling screen. This allows the user to specify the analogue data output range for the oxygen parameter (default is 5V = 200mmHg).</p> <p>Changes to this function are saved and will apply the next time the OxyLite Pro is powered up.</p>
	<p>Touch once to display the trace-selection screen; touch a second time to display the trace-fill options screen.</p> <p>Changes to this function are saved and will apply the next time the OxyLite Pro is powered up.</p>
	<p>Displays the pulse rate (sampling rate) options screen.</p> <p>Changes to this function are NOT saved and will return to sensor defaults the next time the OxyLite Pro is powered up.</p>
	<p>Displays the screen 'swipe' sensitivity controls, used to set the sensitivity of the touch screen to swipe motions for controlling x-axis and y-axis scaling.</p> <p>Changes to this function are saved and will apply the next time the OxyLite Pro is powered up.</p>



	<p>Displays the system date for optional adjustment. Changes to this function are saved and will apply the next time the OxyLite Pro is powered up.</p>
	<p>Displays software/firmware version information.</p>

Table 4: Touch screen settings toolbar icons

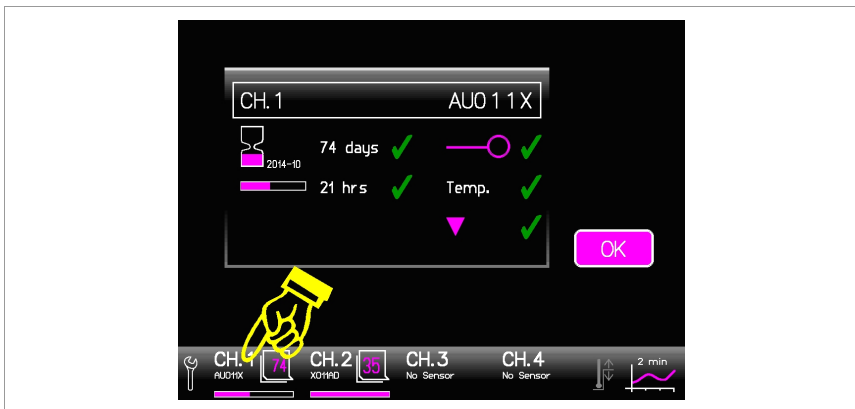



Figure 10: The touch screen sensor status dialogue

Sensor status and calibration/lifetime information is displayed by selecting the appropriate channel/sensor from the toolbar.

Refer to the table below and Troubleshooting for sensor warnings and errors.

Description of sensor status dialogue icons:

	<p>Days remaining until 'recommended use-by date' (year-month of use-by date also shown).</p> <p>'✓' indicates that the sensor remains within its calibration accuracy period ('use-by date'), with the number of days remaining indicated.</p> <p>'⚠' indicates that the sensor is outside its calibration accuracy period ('use-by date' exceeded). A negative number indicates by how many days it has been exceeded. See further details below.</p>
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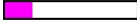


	<p>Accumulated sensor longevity remaining (hours).</p> <p>‘✓’ indicates that the sensor remains within its accumulated longevity limits.</p> <p>‘X’ indicates that sensor longevity has been exceeded.</p> <p>See further details below.</p>
	<p>Indicator for presence/integrity of sensor oxygen-sensitive ‘tip’.</p> <p>‘✓’ indicates that the sensor tip is present and functional.</p> <p>‘↓’ indicates low return signal from the sensor tip chemistry and possible damage, or a sensor approaching the limit of its useful life, and/or oxygen readings that are approaching the maximum of the supported dynamic range.</p> <p>‘↑’ indicates excessive return signal from the sensor tip chemistry, resulting in saturation of monitor detection circuitry. This may be due to interference by ambient light.</p> <p>‘X’ indicates sensor tip chemistry is absent or has been damaged.</p>
<p>Temp</p>	<p>Indicator for integrity of temperature sensor (only displayed where a combined oxygen/temperature sensor is in use).</p> <p>‘✓’ indicates that the temperature thermocouple sensor is functional.</p> <p>‘X’ indicates that the temperature thermocouple sensor has malfunctioned.</p> <p>‘↓’ indicates that the temperature has dropped <i>below</i> the validated temperature compensation limit (presently 10°C, see section 3.8).</p> <p>‘↑’ indicates that the temperature has risen <i>above</i> the validated temperature compensation limit (presently 45°C, see section 3.8).</p>
	<p>Sensor calibration / calibration integrity indicator.</p> <p>‘✓’ indicates that sensor calibration data has been read and interpreted successfully.</p> <p>‘X’ indicates that sensor calibration data has not been read or interpreted successfully.</p>

Table 5: Sensor status dialogue icons

3.6 Sensor Shelf Life and Accumulated Longevity

The usable lifetime of all oxygen sensors is defined by,

- a warranted calibration accuracy period (6 months),
- a total used or unused shelf life limit (2 years),
- a maximum accumulated usage limit (48 hours at default sampling rate).

Calibration Accuracy Period and Total Shelf Life

Oxygen sensors are provided with a 2-year shelf life.

Total shelf life is defined as the time from factory calibration until sensor expiry and is independent of sensor usage. The OxyLite Pro will not accept a sensor that has exceeded its 2-year shelf life.

Oxford Optronix warrants the **calibration accuracy** of OxyLite Pro sensors for the first 6 months of the 2-year shelf life (refer to Sensor Warranty statement towards the end of this document).

The 6 month point is referred to as the 'Recommended use-by date' and is printed on the sensor packaging. The toolbar sensor icon and the sensor status dialogue (see figure 9) display the number of days remaining until the 'Recommended use-by date'.

When a sensor reaches its 'recommended use-by date' (at 6 months from factory calibration) the instrument will display a toolbar warning (refer to Troubleshooting section).

The use of sensors beyond this point is not disabled but entirely at the discretion and own risk of the user.

The maximum delay between factory calibration and sensor delivery will typically be 2 weeks. Thus, the warranted calibration accuracy period from *receipt* of a sensor may be slightly short than 6 months.

The 2-year shelf life and the 6-month warranted calibration accuracy period should be considered when establishing sensor inventories.

Accumulated Longevity

Sensor longevity is also limited by usage, an effect that relates to the total (accumulated) time that the sensor has been 'exposed' to the light source within the instrument.

At the default sampling rate, the total (accumulated) time before a sensor expires is **48 hours**. This excludes a 2-hour 'grace' period.

The sampling rate can be reduced, thereby directly extending the theoretical accumulated usage expiry (refer to the touch-screen user interface section of the support site).

The accumulated longevity status of a sensor is displayed schematically on the display toolbar and can be called up via the sensor status dialogue (see above).

Upon reaching an accumulated usage of 48 hours, a warning is displayed on the touch screen display to alert the user that a further 2 hours of 'grace' usage remain.

At approximately 50 hours of accumulated usage the monitor will reject the sensor and the measurement will cease.

Oxygen sensors will expire due to the total shelf life limit OR due to the accumulated longevity limit, whichever occurs first.

IN SUMMARY:

- Oxygen sensors have a maximum used or unused shelf life of 2 years from factory calibration.
- Oxygen sensor calibration accuracy is warranted for a period of 6 months from factory calibration.
- Oxygen sensors have a maximum accumulated longevity of 48 hours (at default sampling rate, excluding 2 hour 'grace' usage).
- Oxygen sensors will expire due to shelf life expiry OR due to the accumulated longevity limit, whichever occurs first.

3.7 Placement of Sensors *in Vivo* or *in Vitro*

Please note that detailed guidelines for the use of sensors in a variety of tissue monitoring applications are maintained on our dedicated support site:

http://www.oxford-optronix.com/support/supp_oxylite.htm

In summary:

Depending on sensor type, the oxygen-sensitive region is found either at the very tip ('bare-fibre' sensors), or slightly posterior to the tip ('NP/O' and 'LAS' sensor types).



The oxygen-sensitive region of sensors must be isolated from atmospheric oxygen to ensure reliable *in situ* oxygen measurements.

For *in vitro* environments (e.g. cell culture) the placement of sensors generally simply requires the direct exposure of the sensor tip to the fluid of interest. Brief measurements can be carried out by hand; a miniature clamping apparatus or any other type of jig can be used for longer term measurements.

The optimum approach for introducing sensors into biological tissues (*in vivo* use) will depend on the sensor type, the tissue to be studied, the size of the animal model, the nature of the application and the personal preferences of the user. In general we recommend the use of suitable catheter introducers as the majority of sensor types are insufficiently robust for direct tissue insertion.

3.8 Temperature Compensation

The luminescence-based oxygen monitoring technology employed by the OxyLite Pro is sensitive to temperature.

The error in the pO₂ reading due to a discrepancy between the temperature at the site of measurement and the temperature at which the sensor was calibrated (37°C) is dependent upon:

- The temperature range in question,
- The current pO₂ reading.

It can be approximated as follows.

For measurements in the range 30 - 45°C, the error in mmHg will be (1.2%) x (temperature discrepancy (i.e. temp error), in °C) x (displayed pO₂ reading in mmHg).

For example, if the site of measurement is at 42°C, with the instrument set to 37 °C and for a displayed reading of 50 mmHg of pO₂, the *actual* pO₂ reading will be approximately,

$$(50 \text{ mmHg}) - (1.2\% \times 5 \times 50 \text{ mmHg}) = 50 \text{ mmHg} - 3 \text{ mmHg} = 47 \text{ mmHg.}$$

i.e. in this instance the OxyLite will *over read* by 3 mmHg.

For measurements in the range 20 - 30°C, the error in mmHg will be (1.5%) x (temperature discrepancy (i.e. temp error) in °C) x (displayed pO₂ reading in mmHg).

For example, if the site of measurement is at 27°C, with the instrument set to 37°C and for a displayed reading of 140 mmHg of pO₂, the *actual* pO₂ reading will be approximately,

$$(140 \text{ mmHg}) + (1.5\% \times 10 \times 140) = 140 \text{ mmHg} + 21 \text{ mmHg} = 161 \text{ mmHg.}$$

i.e. in this instance the OxyLite will *under read* by 21 mmHg.

To overcome this limitation, the OxyLite Pro is capable of real-time temperature compensation across a limited temperature range.

Automatic temperature compensation requires a continuous temperature measurement from the tissue or sample under investigation and this is achieved by using combined OxyLite Pro sensors that incorporate a fine

thermocouple sensor ensuring that a temperature reading is obtained from the precise site of oxygen monitoring.

NOTE: While the thermocouple temperature sensors will accurately measure temperature in the range 0 – 50°C, temperature compensation has been validated within the range 10 – 45°C only. Oxygen measurements can be made outside of these limits (note: combined oxygen/temperature sensor required), however compensation accuracy has not been determined outside of these limits.

Independent temperature compensation per channel

All OxyLite Pro channels feature an integrated temperature input. The measured oxygen value is automatically and continuously compensated where the channel is occupied by a combined oxygen/temperature sensor using the temperature measured by the integrated sensor thermocouple. This permits independent temperature compensation for each channel/sensor.

Temperature compensation using input from channel 1

The temperature measured in channel 1 can be used to compensate oxygen measurements in all other channels, provided these are occupied by oxygen-only sensors.

If the combined oxygen/temperature sensor is disconnected from channel 1, all other sensors will revert to their default calibration temperature (typically 37°C). The monitor will continue to use this temperature value until the temperature is adjusted manually (via the now available toolbar icon, see section 3.4) or until a combined oxygen/temperature sensor is reconnected to channel 1.

NOTE: When a temperature sensor is connected to channel 1 this disables access to ('greys out') the toolbar temperature control icon.

NOTE: When a temperature sensor is connected to channel 1 this overrides the manual temperature setting in all channels.



To ensure that the pO₂ measured by sensors in channels 2, 3 or 4 is accurate, the temperature that is recorded by the sensor in channel 1 must be representative for all sensors.

Manual temperature correction

Temperature compensation can also be achieved by manual temperature entry via the touch screen display (see section 3.4). This functionality allows the use of less costly oxygen-only sensors in certain circumstances. Manual temperature control may suffice in situations where the temperature of the monitoring site or fluid is stable and known to within $\pm 2 - 3^{\circ}\text{C}$.

By default a manual temperature setting is simultaneously applied to all channels which are not receiving an independent temperature reading. As soon as a combined oxygen/temperature sensor is connected to a given channel, the manually set temperature for that channel is overridden by the temperature measurement received from the sensor.

Any manual temperature setting is lost when the monitor is turned off. On start up, in the absence of a combined oxygen/temperature sensor in channel 1, the instrument will default to 37°C.

NOTE: Manual temperature compensation assumes that the temperature at the site of pO₂ monitoring is known to within a few degrees and unlikely to fluctuate excessively. Inaccurate temperature compensation will result in erroneous pO₂ readings.

3.9 Digital (USB) Data Output

Our monitors now offer compatibility with the highly acclaimed LabChart® Pro data recording and analysis software by ADInstruments.



LabChart supports direct streaming of real-time recordings to a PC, via the dedicated USB output at the rear of the monitor.

Compatibility requires a dedicated and free software Add-on for LabChart (the 'Device Enabler'*), which supports automatic recognition of the Oxford Optronix monitor, the use of multiple Oxford Optronix monitors simultaneously and provides a choice of pre-loaded configuration settings specifically tailored to our monitors.

The Add-on also supports the simultaneous recording of data from an existing AD Instruments PowerLab® module.

A single LabChart Pro user license, inclusive of 5 years of free updates is available to order.

The Oxford Optronix Device Enabler can be downloaded via the 'Feature Manager' utility integral to LabChart.

Alternatively the Oxford Optronix Device Enabler is available for download from the 'Downloads' section of the ADInstruments website.

Dedicated instructions for setting up LabChart Pro for recording from OxyLite Pro monitors can be found on our support site (www.oxford-optronix.com/support/supp_oxylite.htm).

*Notes: PC/Windows platforms supported only at this time; LabChart 8.0.4 or later required.

3.10 Analogue Data Outputs

Oxygen and temperature measurements can be recorded continuously to a PC or Macintosh computer via analogue outputs located at the rear of the OxyLite Pro (see figure 2).

Analogue output ports consist of a 15-pin female D-type connector (one per pair of channels).

Data recording requires a third-party data acquisition module and accompanying software (optionally available from Oxford Optronix), which will accept analogue input in the range -5V to +5V.

A dedicated data adapter cable (product code 'NX-BNC'), terminating in standard BNC connectors, provides compatibility with the vast majority of data acquisition systems.

The dual-channel OxyLite Pro requires one such cable (carrying data for channels 1 and 2), while the 4-channel OxyLite Pro XL model requires two such cables (carrying data for channels 1 and 2, and 3 and 4, respectively).

The data adapter cable terminates in 4 colour-coded BNC connectors, which carry oxygen and temperature data in the following order:

Output labelled 'Ch1 / Ch2'

Cable colour	Parameter
Red cable	Channel 1 oxygen
Green cable	Channel 1 temperature
Blue cable	Channel 2 oxygen
White cable	Channel 2 temperature

Output labelled 'Ch3 / Ch4' (OxyLite Pro XL only)

Cable colour	Parameter
Red cable	Channel 3 oxygen
Green cable	Channel 3 temperature
Blue cable	Channel 4 oxygen
White cable	Channel 4 temperature

Table 6: OxyLite Pro analogue data cable colour codes

OxyLite Pro User Manual

The following table summarizes the unit conversion parameters required for data acquisition via the analogue outputs at the rear of the OxyLite Pro monitor when using third-party data recorders (factory defaults shown):

Parameter	pO ₂	Temperature
Output voltage range	0 – 5V	0 – 5V
Zero output (0V)	0mmHg	0°C
Full scale output (5V)	200mmHg	50°C
Output resolution	40mmHg/V	10°C/V

Table 7: OxyLite Pro analogue output unit conversion

The following table summarizes potentially diagnostic analogue output voltages during instrument boot-up and/or during error states:

Scenario	pO ₂ output channel	Temp output channel
Initial boot	0V (typically)	0V (typically)
Instrument start-up	2.5V then 0V	2.5V then 0V
No Sensor	-2.5V	-2.5V
Negative measurement	Negative voltage	Negative voltage
Sensor expired	-1V	-1V
Sensor fault	-4V	-4V
Sensor error	-4V	-4V

Table 8: Summary of diagnostic analogue output voltages

4. CARE OF OXYLITE PRO

4.1 Use of OxyLite Pro

OxyLite Pro should only be operated on a secure, flat, horizontal surface and in ambient temperatures of 15°C to 30°C.

4.2 Cleaning and Storage of OxyLite Pro

The monitor enclosure may be surface-cleaned by wiping lightly using a soft cloth dampened with a commercial, nonabrasive cleaner.

The monitor enclosure may be disinfected by wiping the surface with a soft cloth dampened with a solution of 70% alcohol in water.



To avoid the risk of electric shock or shorts, do not spray, pour or spill any liquid in or on the OxyLite Pro.

The OxyLite Pro monitor should be stored between 10°C to 40°C. If returning from extremes of temperature, the unit should be allowed to acclimatise at room temperature for 30 minutes before use.

4.3 Handling and Cleaning of the Touch Screen



To avoid damage, do not use sharp objects to operate the touch screen display.



To avoid damage, do not spray, pour or spill any liquid on the touch screen display.

The touch screen display should be operated using a finger, fingernail, or optionally a dedicated touch screen pen.

The touch screen may be gently surface-cleaned using dedicated 'screen clean' wipes.

4.4 Handling and Storage of Sensors

The optical fibres employed within OxyLite Pro sensors consist of glass, with a diameter of 230µm. The fibres are flexible and can be bent. However, it is recommended that they are not subjected to bends with a radius less than 30mm.



OxyLite Pro sensors should be HANDLED WITH CARE.

Failure to do so may result in breakage of the internal optical fibre, loss of the oxygen sensing tip or separation of the cable from the sensor connector.

Sensor connectors must be kept clean and free from dust. Connectors should be inspected before use. Dust can be removed from the connectors using a good quality 'air-duster'.

OxyLite Pro sensors should be stored, with the sensor cable carefully coiled to avoid 'kinks', in the pouch in which they are provided and, ideally, in the dark (e.g. inside the closed cardboard container in which they are supplied), at or below room temperature.



DO NOT store OxyLite Pro sensors in bright sunlight.

OxyLite sensors have a limited used or unused total shelf life and a recommended use-by date (printed on the sensor packaging). Both should be considered when establishing sensor inventories. Refer to section 3.7 for further information.

4.5 Cleaning, Disinfection and Sterilization of Sensors

Cleaning

OxyLite Pro sensors are manufactured and packed in a controlled (clean) environment. The tips of OxyLite Pro sensors can be cleaned after use by gentle wiping with water, or saline-soaked cotton wool / cotton gauze.



The oxygen sensing tips are fragile and can be damaged by attempts to clean them without due care and attention.

Disinfection

OxyLite Pro sensors can be safely (and repeatedly) disinfected using 70% alcohol (industrial methylated spirit, IMS or isopropyl alcohol IPA) in water.

The sensor tip (beyond the Luer fitting) can be safely immersed in 70% alcohol while the white sleeving is best wiped with a non-linting cloth immersed in 70% alcohol.

Optionally, disinfection can be achieved by immersion of the complete sensor in 70% alcohol, although it is important to ensure that residual alcohol that may have become trapped within the sensor sleeving is allowed to fully drain away.



If the sensor connector has been immersed in 70% alcohol ensure that it is completely free of pockets of non-evaporated alcohol prior to use.

Sterilization

OxyLite Pro sensors are NOT supplied pre-sterilized.

OxyLite Pro sensors are NOT capable of withstanding sterilisation by dry or moist heat (autoclaving).

The materials and components used in OxyLite Pro sensors may be compatible with exposure to ETO (ethylene oxide) gas.



The effect of exposure to heat, radiation, glutaraldehyde, ETO gas or plasma on the performance and measurement accuracy of OxyLite Pro sensors has not been validated.

4.6 Disposal of Sensors

After use, failure and/or expiry, please dispose of sensors carefully and in accordance with local and national biohazard regulations and guidelines.

5. TROUBLESHOOTING AND MAINTENANCE

5.1 Troubleshooting

If you experience a problem using the OxyLite Pro that you are unable to correct by reconnecting the sensor(s) and/or turning off and turning back on the monitor, please contact Oxford Optronix technical support (see p2 of this document).



Do not attempt to open the OxyLite Pro. There are no user-serviceable parts inside. There is a risk of electrical shock or other injury or permanent damage to the monitor.

The following is a list of possible monitor errors / failure modes and suggestions for correcting them.

The monitor does not seem to power up

Check that the NX-PSU universal AC adapter itself is receiving power from the wall socket (i.e. that the wall socket is live) by confirming that the integral LED is lit.

Check that the male connector of the NX-PSU universal AC adapter is securely seated in the *DC POWER IN* inlet at the rear of the monitor.

Check that the monitor isn't in a 'surge prevented mode' by turning off the AC adapter, waiting 2-3 minutes, then turning the AC adapter back on.



Connecting the NX PSU AC adapter to the *DC POWER IN* inlet at the rear of the OxyLite Pro, having *already* powered it up via its On/Off switch MAY trigger the surge protection circuit within the OxyLite Pro. If the OxyLite Pro does not start up, turn off the AC adapter, wait 2 - 3 minutes, then turn the AC adapter on once more.

If the problem persists please contact technical support.

The monitor is receiving power (the blue power-on indicator light is on) but is not booting to the usual 'default' screen

Turn off the universal AC adapter, wait 2-3 minutes and try again. If the problem persists there is likely to be an electronic fault, in which case please contact technical support.

The monitor boots into the usual 'default' screen but does not respond to the connection of a sensor

Try power-cycling the monitor by turning off the AC adapter, waiting 2-3 minutes and turning the AC adapter (i.e. the monitor) back on. If available try another sensor and/or try switching channels. If the problem persists there is likely to be a fault, in which case please contact technical support.

The monitor boots into the usual 'default' screen but the display does not respond to any touch inputs

Try power-cycling the monitor by turning off the AC adapter, waiting 2-3 minutes and turning the AC adapter (i.e. the monitor) back on. Try connecting a sensor in one or more channels. If the problem persists there is likely to be a fault, in which case please contact technical support.

The monitor re-starts repeatedly mid-recording

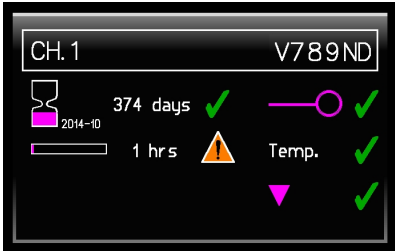
Confirm that, a) you are operating within the recommended operating temperature and humidity limits for the monitor (see Specifications towards the back of this document), b) that the mains supply is stable and c) that the connection of the universal AC adapter at the rear of the monitor is securely seated. Try turning off the monitor for a period of 30 minutes and then turning it back on. If the problem persists there is likely to be a fault, in which case please contact technical support.

The analogue output signal is zero

There may be a cable problem. Check that the cable(s) attached to the analogue output connector(s) is/are securely seated and correctly configured at the data acquisition module end. Check that the correct data channels are being viewed on the software package provided by the data acquisition module supplier. Check that the analogue output settings are correctly configured by selecting the appropriate icon from the display settings toolbar.

A sensor displays a toolbar warning triangle

Call up the sensor status dialogue by touching the warning triangle on the toolbar to determine the problem (referring to description of sensor status icons in section 3.5).



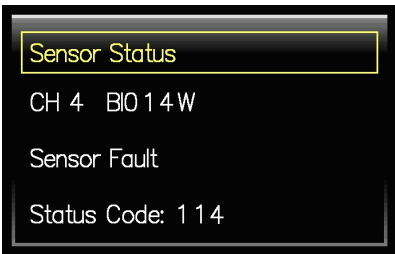
Example sensor warning

Sensor-related warnings are indicated on the toolbar by a warning triangle against the relevant channel/sensor.

The sensor status dialogue allows identification of the parameter that is in a fault condition (sensor longevity warning in the example shown).

Note: the toolbar warning triangle turns grey once the fault state has been previewed via the above sensor status dialogue.

To obtain a diagnostic sensor fault code, press the warning triangle on the above sensor status dialogue, e.g.,



Sensor fault code

A diagnostic sensor fault code can be obtained by pressing the warning triangle on the above sensor status dialogue.

Common faults and their likely interpretation are shown in the table below.

Fault	Description / Interpretation
113	Low signal. Indicates that the sensor is not properly connected and/or that the oxygen-sensitive chemistry has become partially detached or photo-bleached. The sensor may be damaged and may need to be replaced. However it may still function in low oxygen environments (for example below 100 mmHg).
114	High signal. Indicates excessive ambient light conditions. Turn off any surgical light sources or cover the measurement area and wait a short while to see if the error disappears.

- 240 Error calculating pO₂. May indicate that ambient light conditions are fluctuating more rapidly than the monitor can compensate for them. Ensure excessive ambient light is either excluded or at least are not fluctuating near the site of oxygen measurement.
-

Table 9: Common sensor fault codes

Unexpectedly low oxygen readings

Sensors are subjected to strict quality control procedures prior to dispatch. Generally speaking, unexpectedly low oxygen readings have a physiological root cause (where used *in vivo*).

For example, the force exerted by the tip of an OxyLite Pro sensor can easily exceed capillary closing pressure. Low pO₂ readings will result if this is the case. To overcome this situation, support the sensor cable and sensor tip area as neutrally as possible in such a way that the sensor is not exerting forward or lateral forces on the tissue. Withdrawing the sensor slightly, so that the tip is not at the end of the track created during placement, can reduce the pressure on the tissue.

Sensor placement is also commonly accompanied by a short-lived trauma response. Resultant vasoconstriction may generate low pO₂ readings for several minutes dependent on the tissue being examined. It is advisable to wait until the tissue has adjusted to the trauma and a steady pO₂ reading is obtained.

Another possible source for unexpectedly low oxygen measurements is inappropriate temperature compensation (refer to section 3.8 above). If the compensated temperature is greater than the actual temperature at the measurement site then the reported oxygen reading will be less than the true pO₂.

Unexpectedly high oxygen measurement

Sensors are subjected to strict quality control procedures prior to dispatch. Generally speaking, unexpectedly high oxygen readings have a physiological root cause (where used *in vivo*).

If a sensor is positioned very near the surface of a tissue, without sufficient tissue surrounding it to generate an effective seal, atmospheric oxygen may track along the sensor to the measurement area, resulting in high pO₂ readings. A better oxygen seal can be achieved by using a 'purse stitch' around the point of introduction or by positioning the sensor a little further into the tissue.

When a sensor is partially withdrawn from tissue or adjusted, the insertion point may open briefly allowing atmospheric oxygen to track to the measurement site. This may cause a transient in oxygen readings. Once

the tissue re-closes around the sensor, the surplus oxygen will be consumed and normal readings will resume thereafter.

If the subject is being artificially respired using pure oxygen, the tissue pO_2 can exceed normal levels. Under these circumstances, it is possible that tissue pO_2 will exceed the range supported by the OxyLite (i.e. 200mmHg). With very high pO_2 the OxyLite Pro may no longer report an oxygen value and show an on-screen error state.

Another possible source for unexpectedly high oxygen measurements is inappropriate temperature compensation (refer to section 3.8 above). If the compensated temperature is less than the actual temperature at the measurement site then the reported oxygen reading will be greater than the true pO_2 .

Erratic oxygen readings

Erratic readings, cessation of operation or other incorrect functioning may be evidence of electro-magnetic interference to the monitor (for example from a mobile phone). If this occurs, the place of use should be surveyed to determine if there may be a source for the disruption and actions should be taken to eliminate it, such as:

- 1) Turn equipment off in the vicinity of the monitor to isolate the equipment that may be generating the electro-magnetic interference.
- 2) Relocate the other device(s).
- 3) Increase the separation between the potentially interfering equipment and the OxyLite monitor.

5.2 Simple Sensor Functionality / Calibration Check

Sensors suspected of having failed or having sustained damage may be tested in a low-oxygen environment *in vitro*. The following section describes three recommended low or zero oxygen test conditions:

1. Pre-warmed (25 - 40°C) can of freshly opened soda (Cola, carbonated water, etc.).
2. Pre-warmed (25 - 40°C) water or saline in a glass conical flask continuously bubbled with nitrogen gas. Allow at least 5 minutes of continuous bubbling prior to introducing the sensor(s).
3. Freshly prepared 3% (w/v) solution of sodium sulphite (i.e. 3 grams of Na_2SO_3 in 100ml of water) in a glass vial (25 - 40°C). Stir well.

The above conditions should produce a stable measurement of oxygen in the 0 - 5mmHg range. Failure to produce a reading after 1 - 2 minutes and

continued display of an error state on the sensor status dialogue (see above) would indicate terminal damage to the sensor.

5.3 **Obtaining Technical Assistance**

Contact information for obtaining technical assistance is provided on p2 of this manual and on the Oxford Optronix website.

When contacting Oxford Optronix technical support or your local distributor please provide the serial number of your monitor (found at the rear of the unit), the 6-digit alphanumeric sensor ID and details of the problem or error message(s) encountered.

5.4 **Maintenance and Servicing**



The OxyLite Pro should only be repaired or serviced by Oxford Optronix Ltd. trained service staff.



Do not attempt to open the OxyLite Pro. There are no user-serviceable parts inside. There is a risk of electrical shock or other injury or permanent damage to the monitor.

The monitor should be inspected regularly for signs of wear and tear.

The OxyLite Pro monitor is supplied with a 2 year warranty. Please refer to the Terms and Conditions of the Warranty at the end of this user manual for further details.

Like all specialist laboratory equipment the OxyLite Pro will benefit from regular servicing. The recommended service interval for OxyLite Pro is every 2 years.

Servicing is strongly recommended to ensure continued optimal performance and operational reliability. Our maintenance service provides not only a complete technical/mechanical overhaul, update and recalibration but also ensures that your monitor receives the latest applicable software/firmware upgrades introduced as a result of our continuing R&D and product enhancement programmes.

Please contact technical support for detailed service schedules and pricing.

5.5 *Returning the OxyLite Pro Monitor*

Contact Oxford Optronix or your local distributor for shipping instructions.

A **Returned Materials Authorisation (RMA)** number and completed **Decontamination Declaration form** **MUST** be obtained prior to shipping the equipment.

Pack the OxyLite in its original shipping carton where available. If the original carton is not available, pack the OxyLite in a suitably sized **STURDY** cardboard box ensuring that it is surrounded on **ALL** sides by at least 10 cm (4") of tightly packed polystyrene chips, bubble wrap, foam or other suitable protective packing material.

Particular attention should be paid to protecting the touch-screen.

For a small fee, Oxford Optronix can provide new original shipping cartons and foam inserts that will ensure safe transportation.



Failure to pack the OxyLite Pro monitor appropriately for repair or service may result in potentially costly damage to the monitor during transit.

Sensors for return should be wrapped in protective material and packed in a suitably-sized strong box. Where accompanying a monitor for return these may be included within the larger carton for the monitor.

Use a recognized international courier company for the return of product to Oxford Optronix (e.g. UPS, FedEx, DHL etc).

Oxford Optronix will not accept responsibility for any loss or damage to goods shipped to us, howsoever caused.

6. TECHNICAL SPECIFICATIONS

Physical

Dimensions	150mm (H) x 310mm (W) x 280mm (D)
Weight	4Kg / 9lbs
Operating temperature	10 - 30°C
Operating humidity	0 – 70% (non-condensing)
Power requirements	40W max.
Number of sensors supported/ Number of channels	OxyLite Pro 2 OxyLite Pro XL 4
Display	High contrast 800 x 480 full colour LCD touch-screen
User configuration	Via touch-screen display
Analogue voltage outputs	2 x 15-pin D type, 4 outputs (Pro) or 8 outputs (Pro XL)
LED excitation wavelength	525nm
Luminescence wavelength	650nm

Performance

Mode of operation	Luminescence decay lifetime (pO ₂) / T-type thermocouple or manual user input (temperature)
Measurement units (displayed)	mmHg or kPa / °C
Measurement range	0 – 200mmHg; 0 – 26.6kPa / 0 – 50°C
Measurement resolution	0.1mmHg / 0.1°C
Measurement accuracy	Oxygen: ±0.7mmHg (0 – 7mmHg) ±10% of reading (7 – 150mmHg) ±15% of reading (150 – 200mmHg) Temp: ±0.2°C
Measurement T90 response time	< 20s (bare-fibre oxygen sensor) / < 2s (temperature)
Measurement sampling rate	1Hz, user definable
Measurement acquisition time	1s
Measurement averaging	5s (rolling)
Display update time (numerical)	2s
Validated temp compensation range	10°C – 45°C
Sensor identification	Automatic; integrated connector EEPROM

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Sensor calibration	Factory pre-calibration (unique per sensor); valid 6 months
Sensor shelf-life	2 years from factory calibration (used or unused)
Sensor longevity	48 hours accumulated usage at default sampling rate
Analogue data output range	0 – 5V (0 – 200mmHg / 0 – 50°C) (default)
Analogue data output rate	1Hz

Table 10: OxyLite Pro technical specifications

7. WARRANTIES

7.1 *Sensor Warranty*

Oxford Optronix Ltd. warrants its sensors against defects in material or workmanship, when used in accordance with issued operating instructions.

Sensors are warranted for a single use only.

Oxford Optronix Ltd. is not liable under this warranty for defects arising from more than one insertion (or use) *in vivo*, and/or for continuous/accumulated operation in excess of 48 hours at the default sampling rate, and/or for operation in excess of 6 months from factory calibration.

Any re-use of sensors is carried out at the end-user's own risk and under the end-user's sole responsibility.

Oxford Optronix Ltd. specifically disclaims any other express or implied warranty, including warranties of merchantability and of fitness for use.

7.2 *Monitor Warranty*

Oxford Optronix Ltd. warrants its Products against defects in material or in workmanship, when used under appropriate conditions and in accordance with the appropriate Operating or User Instructions for a period of **24 months** from the date of purchase.

Oxford Optronix Ltd's sole obligation shall be to repair or to replace at Oxford Optronix' option, FOB its factory, without charge, any part(s) that prove defective within the warranty period. Software programs are supplied on the strict understanding that we do not warrant their functions to be free from defects, errors or bugs.

Any claim under the warranty must be made in writing. The Products to which the claim refers must be returned to us within 2 months from the date the claim was made, suitably packaged, using our Returned Materials Authorisation (RMA) procedure and our courier (e.g. FedEx) account reference. No returned Products will be accepted without prior written authorisation and an RMA number.

Oxford Optronix Ltd. is not liable under this warranty:

- for any defect arising from fair wear and tear, wilful damage, negligence, misuse, repair of the Products without our written approval; or
- any use of or dealing with the Products in conjunction with any other item where such item causes or gives rise to the alleged defect; or
- any use of the Products which is not in accordance with the Operating or

User Instructions or from any failure to service or maintain the Products in accordance with such instructions.

Oxford Optronix Ltd. specifically disclaims any other express or implied warranty, including warranties of merchantability and of fitness for use. To the full extent permitted by law, we shall not be liable in any way whatsoever whether in contract, in tort, in misrepresentation or under statute or common law or otherwise (whether caused by our negligence or otherwise) in respect of defects in the Products or failure to correspond to specification or for any injury, damage or loss resulting from such defects or failure. In no event shall any breach of contract on our part or tort (including negligence) or failure of any kind on our part give rise to any liability for loss of revenue or loss of profits or any other consequential or indirect loss or damage arising from any cause whatsoever.