



## Fluorescence-based Optical Oxygen Sensor

### GENERAL DESCRIPTION

The LuminOx Family (LOX) is a range of factory calibrated oxygen sensors which measure ambient oxygen partial pressure (ppO<sub>2</sub>) levels using the principle of fluorescence quenching by oxygen.

By default LuminOx measures ppO<sub>2</sub> (mbar) and temperature (°C). An optional pressure sensor enables LuminOx to also measure barometric pressure (mbar) and to convert the ppO<sub>2</sub> reading to an oxygen concentration (O<sub>2</sub>%).

The sensor benefits from low power operation, traditionally associated with electrochemical sensors, while providing a much longer lifetime due to the non-depleting sensing principle.

LuminOx is ppO<sub>2</sub> and temperature compensated, enabling accurate operation over a wide environmental range without the need for additional system components. Unlike other sensor technologies, LuminOx is very stable and robust, does not contain lead or any other hazardous materials and has negligible cross sensitivity to other gases.

### ELECTRICAL AND ENVIRONMENTAL SPECIFICATION

Supply Voltage (Vs)	4.5 to 5.5 Vdc
Supply Current (Is)	<7.5mA (streaming 1 sample per second), <20mA Peak
Output Type	3.3V TTL level RS232
Operating Temperature	-30°C to +60°C
Storage Temperature	-30°C to +60°C
Humidity	0-99% Rh (non-condensing)
Barometric Pressure Range	100 to 1400mbar (LOX-01) 500 to 1200mbar (LOX-02)

### PERFORMANCE SPECIFICATION\*

Oxygen Measuring Range	0-300mbar ppO <sub>2</sub> 0-25% O <sub>2</sub> (LOX-02)
Response Time	T90 <30s (Typical)
ppO <sub>2</sub> Accuracy / Resolution	<2%FS / 0.1mbar
Temperature Accuracy / Resolution	Indication Only / 0.1°C
Pressure Accuracy / Resolution	±5mbar / 1mbar (LOX-02)
O <sub>2</sub> % Accuracy / Resolution	Determined by ppO <sub>2</sub> and Pressure Accuracy / 0.1% (LOX-02)
Lifetime	>5 years

\*At ambient conditions. All performance measurements are at STP unless otherwise stated. Following extreme temperature fluctuations, re-calibration may be required.

### MECHANICAL

Connection	4 gold-plated pins (0.64mm <sup>2</sup> ) on a 2.54mm grid for PCB mounting via sockets or hand soldering with a no-clean flux (do not put the sensor through a PCB washing process)
Housing Dimensions	20mm max diameter x 12.5mm high

### CLEANING

The housing of the sensor can be cleaned using a damp cloth. The sensor should not be immersed in any cleaning media.

Full application and technical support can be provided by our knowledgeable and highly experienced engineering team if required.



### BENEFITS

- Low power
- Can also measure O<sub>2</sub>% & barometric pressure (LOX-02)
- Suitable for battery power use
- Long life
- High accuracy
- Small & compact
- Low cost
- Maintenance free
- Contains no hazardous materials
- Connects directly to microcontroller without any additional circuitry.
- Factory Calibrated

### APPLICATIONS

- Oxygen Detection
- Portable Equipment
- Breathing Apparatus
- Inerting
- Medical
- Lab Equipment
- Agriculture
- Incubation
- Fire Prevention
- Flue Gas in Condensing Boilers





## Fluorescence-based Optical Oxygen Sensor

The LuminOx range has been designed as an alternative to electrochemical sensors but with the benefits of RoHS compliance, long life and complete environmental compensation built-in.

The sensor is available with and without a built-in barometric pressure sensor. LuminOx's native measurement is partial oxygen pressure (ppO<sub>2</sub>) in mbar. By incorporating a barometric pressure sensor, LuminOx is able to measure O<sub>2</sub> vol. % in addition to ppO<sub>2</sub>

LuminOx is designed to measure ambient oxygen levels are therefore the entire sensor must be in the measurement gas for correct operation.

Unlike electrochemical sensors, LuminOx requires no additional signal conditioning circuitry and connects directly to the interfacing microcontroller via 3.3V-level RS232 link. This reduces costs and simplifies system design.

Details of the RS232 protocol and commands are given below.

### RS232 Setup:

The following setup should be used when using the RS232 interface.

Baudrate: 9600  
Flow Control: None  
Parity: None  
Stop bits: One  
Data Length: 8 bits

### RS232 Command Set:

All RS232 communication is performed using ascii characters, *Table 1* shows the legal characters for each description block. There are three modes available: Poll Mode, Stream Mode and Off Mode.

Description Block	Legal Character(s)	Hex
<Command>	"M", "O", "%", "T", "P", "A", "#", "e"	0x4D, 0x4F, 0x25, 0x54, 0x50, 0x41, 0x23, 0x65
<Argument>	"0" – "9"	0x30 – 0x39
<Separator>	" "	0x20
<Terminator>	"\r\n"	0x0D 0x0A

Table 1

### Poll Mode (M 1):

Each request is built using a combination of the description blocks. (See Table 1). A typical arrangement will be one of the following formats:

- <Command><Terminator>
- <Command>< Separator><Argument><Terminator>

Each response will be in the following format:

- <Command>< Separator><Argument><Terminator>



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Table 2 provides a description of all commands and the valid arguments that can be applied to the interface when in Poll Mode (M1). All commands are case sensitive.

Command	Description	Arguments	Response
"M"	Output Mode	0 = Stream 1 = Poll 2 = Off	"M xx\r\n" Where xx equals the Argument of the command.
"O"	Request current ppO <sub>2</sub> value	N/a	"O xxxx.x\r\n" Where xxxx.x equals the ppO <sub>2</sub> in mBar
"%"	Request current O <sub>2</sub> value (only valid for sensors fitted with barometric pressure sensor. Otherwise returns "-----")	N/a	"% xxx.xx\r\n" Where xxx.xx equals the O <sub>2</sub> in percent %
"T"	Request current temperature inside sensor	N/a	"T yxx.x\r\n" Where y equals the sign '-' or '+' and xx.x equals the temperature in °C
"P"	Request current barometric pressure (only valid for sensors fitted with barometric pressure sensor. Otherwise returns "----")	N/a	"P xxxx\r\n" Where xxxx equals the pressure in mBar
"e"	Sensor Status	N/a	"e 0000\r\n" = Sensor Status Good "e xxxx\r\n" = Any other response contact SST Sensing for advice.
"A"	Request all values (see above: O, T, P, % and e)	N/a	See Stream Mode (M 0), Page 4.
"#"	Sensor Information	0 = Date of manufacture 1 = Serial Number 2 = Software Revision	"# YYYYY DDDDD\r\n" "# xxxxx xxxxx\r\n" "# xxxxx\r\n"

Table 2

### Example 1:

Request (What is the current oxygen partial pressure?):

- "O\r\n" "0x4F 0x0D 0x0A"

Response (210.3mbar):

- "O 0210.3\r\n" "0x4F 0x20 0x30 0x32 0x31 0x30 0x2E 0x33 0x0D 0x0A"

### Example 2:

Request (Put LuminOx into streaming mode):

- "M 0\r\n" "0x4D 0x20 0x30 0x0D 0x0A"

Response (LuminOx is now in streaming mode):

- "M 00\r\n" "0x4D 0x20 0x30 0x30 0x0D 0x0A"



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### Error Codes

When a request has been unsuccessfully received, an error code may appear in a response format. Table 3 provides more information on possible causes and actions.

Response:	Description:	Possible Cause:	Action
"E 00\r\n"	RS232 Receiver Overflow	No <Terminator> received before overflow.	Check RS232 Setup, Confirm correct termination.
"E 01\r\n"	Invalid Command	Unrecognised <Command> received.	Check command is valid Check command is upper Case "M" instead of "m"
"E 02\r\n"	Invalid Frame	Incorrect character in frame < Separator>.	Check correct separator is used.
"E 03\r\n"	Invalid Argument	<Argument> not allowed or in limits.	Check Argument is no longer than 6 characters long. Check Argument is within limits Check Argument is available for command.

Table 3

### Stream Mode (M 0):

By default stream mode is initiated on sensor power-up and will supply an output string approximately once every second. This provides the data for ppO<sub>2</sub>, Temperature, Pressure, O<sub>2</sub> and Sensor Status. The format is provided below, for more details on the format see Table 2.

- "O xxxx.x T yxx.x P xxxx % xxx.xx e xxxx\r\n"

or the equivalent block description:

- <Command>< Separator><Argument>< Separator><Command>< Separator><Argument>< Separator><Command>< Separator><Argument>< Separator><Command>< Separator><Argument>< Terminator>

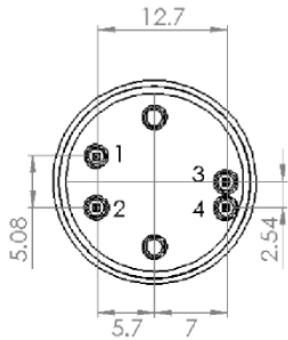
### Off Mode (M 2):

In this mode, LuminOx stops taking measurements and current consumption reduces to less than 6mA constantly.

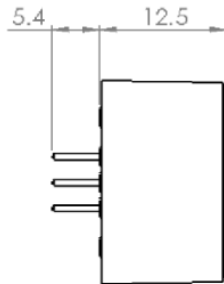


## Fluorescence-based Optical Oxygen Sensor

### PRODUCT DIMENSIONS (All dimensions in mm)



Bottom view



Side view



Top view

### PINOUT:

Pin 1: Vs (+5V)  
Pin 2: GND (0V)  
Pin 3: 3.3V RS232 Sensor Transmit  
Pin 4: 3.3V RS232 Sensor Receive

### NOTES:

Always apply power to the sensor pins 1 and 2 before attempting to communicate on pins 3 and 4.

The sensor should be treated as an electronic component and handled using the correct ESD handling precautions.

### PART NUMBERING SYSTEM

LOX - XX

#### Type

01: Measures 0-300 mbar ppO<sub>2</sub> and temperature (°C)  
02: Measures 0-300 mbar ppO<sub>2</sub>, 0-25% O<sub>2</sub>, temperature (°C) and 500-1200mbar barometric pressure

For additional information or help in choosing the most suitable sensor for your application, please contact us. We can provide full application and technical support on all products.

#### WARNING

All SST Sensing Ltd products are tested under nominal operating conditions during the production process. Applications for our products are varied and, as these are outside our control, specification information provided is given without legal responsibility. Customers should test under their own conditions, to ensure that the sensors are suitable for their intended application.

#### CAUTION

Do not exceed maximum ratings.  
Carefully follow all wiring instructions, incorrect wiring can cause permanent damage to the device.  
Do not use chemical cleaning agents.

**Failure to comply with these instructions may result in product damage.**

**General Note:** SST Sensing Ltd reserves the right to make changes in product specifications without notice or liability. All information is subject to SST's own data and considered accurate at time of going to print.