Rapidox 3100 OEM Oxygen Analyser

Instruction Manual

Revision 3.4

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Declaration of Conformity

Manufacturer:	Cambridge Sensotec Limited Unit 29 Stephenson Road St Ives CAMBS PE27 3WJ, England
Product Names:	Rapidox 3100 OEM oxygen analyser
Model Numbers:	RX3100 OEM

Conform to the following specifications:

EMC:	EN 61326:1998	Electrical equipment for measurement, control and laboratory use

Declaration: I declare that the above products conform to the applicable requirements of the LVD Directive 73/23/EEC and the EMC Directive 89/336/EEC and is CE marked accordingly.

Signature:	
Name:	Dr. Mark Swetnam
Title:	Managing Director
Company:	Cambridge Sensotec Limited
Date:	4th May 2009

WEEE Regulations 2006

Cambridge Sensotec takes its responsibilities under the WEEE Regulations extremely seriously and has taken steps to be compliant line with our corporate and social responsibilities. In the UK, Cambridge Sensotec has joined a registered compliance scheme "WeeeCare" (WeeeCare registration number WEE/MP3538PZ/SCH).

UK users only: If you have purchased any electronic or electrical product from Cambridge Sensotec since 2007 and would like to dispose of it correctly under the WEEE scheme, please contact us and we will be happy to either arrange the collection of the waste or have it returned to our offices for recycling. All our in-house manufactured products are scheme compliant and carry the WEEE label indicating that it is NOT allowed to be disposed of in a landfill site.

Contents

1. Introduction

The Rapidox 3100 OEM oxygen analyser allows fast and accurate oxygen analysis over the full oxygen range (10^{-20}ppm to 100% O_2) using three independent sensor channels. The Rapidox provides continuous on-line oxygen analysis, with a typical response time of less than 4 seconds for a 90% response to a step change in gas compositions.

The sensor head (three supplied) comprises a zirconia ceramic tube, which is heated up to 650°C in order for it to conduct oxygen ions. Power for the sensor heater is supplied and accurately controlled by a regulated power supply incorporated in the analyser.

The analyser is packed with features including programmable alarm circuits, programmable analogue outputs, easy calibration (user selectable gases), RS485 communications and complete communications / data logging software.

2. Features

- ✓ Three independent sensor channels
- ✓ Very fast measurement response (typically 1-4 seconds for a 90% response).
- ✓ Full measurement range available (10^{-20}ppm to 100% O_2).
- ✓ Accuracy ± 1% of the actual measured oxygen with a precision of ± 0.5%.
- ✓ Easy calibration procedure requiring any two or three gas mixtures (air is usually one).
- ✓ Simple installation, low maintenance, sensor life expectancy typically 17,500 hours.
- ✓ Bespoke software with LCD display emulator
- ✓ RS485, 0-5V and 4-20mA analogue outputs (both programmable).
- ✓ Fully programmable alarm circuits.
- ✓ Full data logging software
- ✓ Password protection

3. Specification

3.1 Rapidox 3100 OEM Dimensions

Case dimensions: W=350mm; D=263mm; H=150mm. Weight=5.5kg. Runs off any worldwide voltage of 90-260VAC 50/60Hz.

3.2 Accuracy and Precision

Sensor response time is typically 4 seconds for a 90% response involving a step change in composition. A change between 21% and 100% can be recorded in less than 4 seconds depending on flow rates. High accuracy is maintained between calibration points. Accuracy is ±1% of the actual measured oxygen content with a precision of ±0.5%. Outside the calibration range accuracy is typically ±2.5%.

3.3 Display

The OEM unit does not have a display fitted to the instrument case. The sensor readings are obtained using the bespoke software that communicates via the RS485 (connected through an Easy-Sync adapter supplied). The on-screen display shows an LCD emulator that reproduces exactly the LCD fitted to the bench analysers.

3.4 Sensor Head

The sensor head consists of a zirconia 'Nernstian' cell housed in a metal case with an 18mm 1.5mm pitch thread for tapping into pipes and flues. It operates at pressures between 10^{-4} Torr and 50 bar positive pressure. The sensor is heated to approximately 650°C using a platinum resistance heater. This temperature is controlled by the Rapidox unit which gives enhanced stability to the calibration.

Sensor body external length: 66mm.
Projection into the gas stream: 28.2mm.
Cable length: 2m.
Sensor life expectancy: typically 17,500 hours in clean gases.

3.5 Calibration

The simple and fully flexible calibration procedure requires two calibration gases (ambient air 20.95% is normally used as calibration gas no. 1 – labelled “Gas 1”). The calibration gas compositions are user-selectable and programmed into the Rapidox via the software menu. Factory pre-sets can be reloaded to allow the unit to be 'rescued' from a failed calibration.

3.6 Operating Temperature

Gas temperature must not exceed 650ºC and should ideally be kept below 350ºC for optimum performance. Sensor cables must not exceed 100ºC for extended periods, or 300ºC for more than 15 seconds. The Rapidox unit's normal operating temperature is 5-35ºC.

3.7 Outputs

The RS485 serial port outputs on demand values for oxygen (ppm),time (hh:mm:ss) and date (dd/mm/yy). This data can be downloaded and logged using the software provided.

Standard 0-5V and 4-20mA analogue outputs are available on the rear panel for O_2, as are normally-open or normally closed reed relay O_2 alarm signals. These outputs are fully user-programmable via the software provided.

4. Technical Specification

4.1 Rapidox Analyser

Property	Specification
Supply Voltage	90-260VAC, 50/60Hz
Power consumption	300W (max)
Analyser dimensions	W350mm X D263mm X H150mm
Weight	5.5 kg
Display	On-screen LCD display emulator
Warm up time	3-4 minutes at 20ºC
Operating heater voltage	13-15V
Normal operating temperature	5-35ºC
Outputs: O_2	0-5V (user-programmable) into minimum 5kΩ
O_2	4-20mA current loop (user-programmable) into maximum 500Ω
High and low alarms	Relay contacts – fully user-programmable
All data and parameters	RS485 - data streamed on demand
Calibration	Requires 2 user-selectable gas compositions (air is default plus another two) for each sensor in turn

4.2 Rapidox Sensor

Property	Specification
Cable	2-4m high temperature silicone sheathed cable, fully shielded. Nickel quick release plug
Max sustained gas temperature	650°C
Temperature of metal housing	150 to 200°C
Life expectancy	> 17,500 hours
Range of measurement	10^{-20}ppm to 100% O_2
Response time (@ gas flow rate 1l.min^{-1})	Approximately 4 secs for a 90% step change (e.g., from 21% to 100% O_2)
Accuracy	± 1% of the actual oxygen concentration
Precision of measurement	± 0.5% of the reading
Maximum working pressure	50 bar (depends on gas and temperature) 200 bar burst pressure
Minimum working pressure	Vacuum tight down to below 10^{-4} Torr

5. Precautions

Make sure you read and understand these instructions and keep them safe for later use. The unit should not be exposed to extreme temperatures < -5°C or > 60°C. Normal operating temperature is 5-35°C. Avoid direct sunlight. Do not use liquid cleaners, aerosols or solvents to clean the case. Use a damp cloth for cleaning. Do not use this equipment near water. Make sure the rear ventilation slots and the fan on the rear panel are free of obstruction.

There are no user serviceable parts in this unit. Do not attempt to repair yourself. Refer all servicing to qualified Cambridge Sensotec personnel.

6. Warning

The sensor head and metal surroundings become hot (>100°C) during use and careful consideration should be taken to avoid the risk of burn injury.

This unit is NOT designed for use in life support situations. No responsibility can be held for injury or loss of life caused by inappropriate use of this equipment.

7. Rapidox Operating Instructions

7.1 Sensor Location

The three sensor heads (see Figure 1) comprise a small tube of high purity zirconia, which becomes an oxygen conductor when heated to approximately 650ºC (see Figure 2). The ceramic can be damaged if the sensor head is knocked or dropped, so care must be taken when handling it.

Select a suitable location for each sensor bearing in mind that the temperature of the measurement gas must be less than 650°C and ideally below 350°C where the sensor tip is located. The outer part of the sensor must be in ambient air. Cambridge Sensotec can supply a selection of sensor housings (see Figure 3) to allow access in awkward situations, and if necessary a small pump can be installed to sample the gas remotely.

Figure 1: The zirconia oxygen sensor

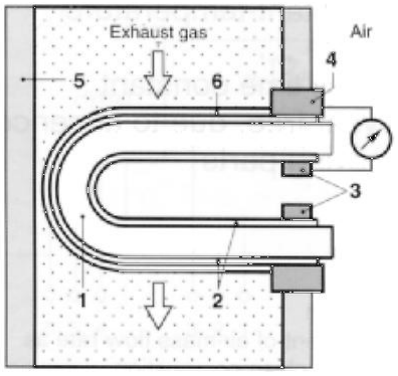

Figure 2: Oxygen sensor schematic, 1 = zirconia electrolyte, 2 = electrodes, 3 = contact, 4 = housing, 5 = sample pipe, 6 = ceramic protective coating (porous)

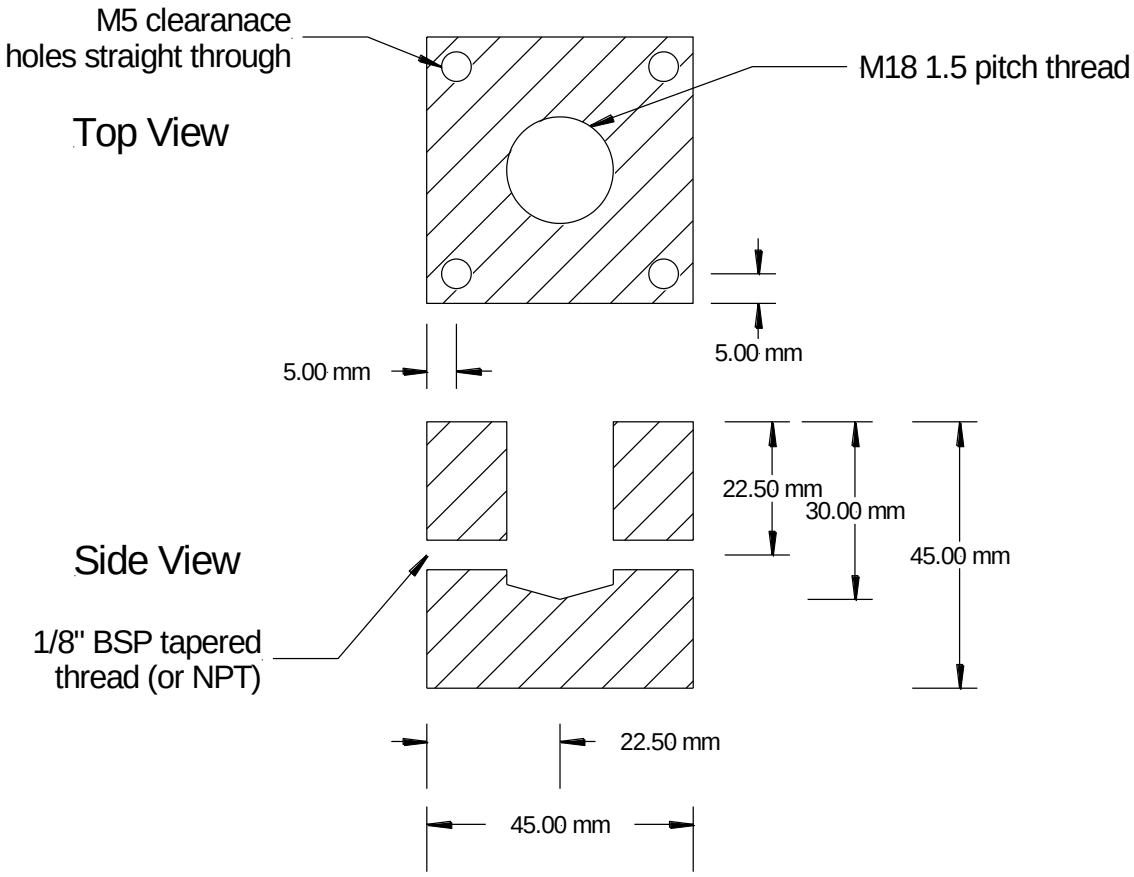

Figure 3: Schematic showing sensor attached to gas pipe adapter (supplied). Gas flows across the sensor via pipes attached to the nipple fittings.

As with all electronic devices, the Rapidox sensor signal may be affected by strong electromagnetic noise interference although this has been minimised by careful shielding. Please ensure that wherever possible, the sensor head and analyser are kept away from sources of electrical noise. Ensure that the sensor cable is not touching any hot surfaces and is kept away from areas that are generating electrical noise. The cable is designed to withstand temperatures of up to 150°C for short periods (<15 seconds).

The sensor is threaded with an 18mm 1.5mm pitch thread, which is a standard tap size for automotive spark-plugs. Ensure that the sensor is tightened down securely so that no gas can escape around the thread. A selection of gaskets is available for different applications (e.g. working above pressures of 1 bar or under vacuum conditions).

The sample chamber is tapped with a 1/8" BSP tapered thread. NPT fittings will also fit this tap.

7.2 The Rapidox Analyser - Front and Rear Panels

Figure 4: Rapidox 3100 OEM front panel. Numbers are referred to in the text.

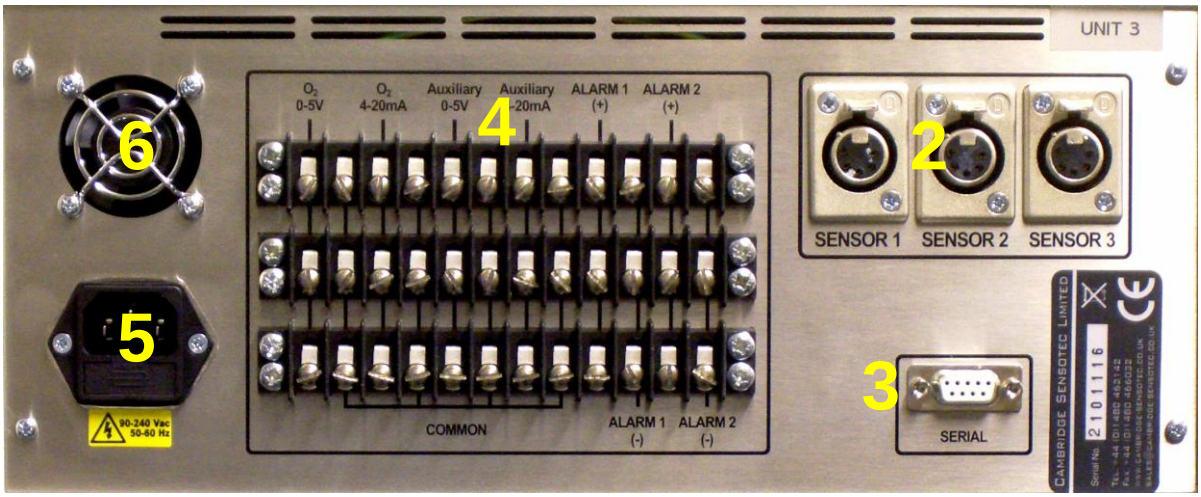

Figure 5: Rapidox 3100 OEM rear panel. Numbers are referred to in the text

8. Getting Started

Ensure that the Rapidox OEM analyser is located away from extreme heat and dirt environments. Plug the unit in to a suitable supply (noting the information on the serial sticker and using the power cable supplied) using the rear power socket (5). Make sure that the cooling fan (6) is not obstructed during operation. Connect the three sensor plugs to the rear of the Rapidox using the 5-way Cannon type socket (2). Note that the sensors are factory calibrated to a particular channel and labelled accordingly. Connect the easy-Sync unit to the rear serial socket (3) and make sure the OEM software is correctly installed and the communications cable is attached to a USB port.

Turn the unit on using the red power switch on the front (1). At this point start

the OEM software (see section 9 for a full description) and establish communications with the unit. The on-screen LCD is available from the "Utilities" menu and should be enabled. The display will display the firmware version and serial number followed by the message "HEATING SENSOR". The three sensors will take approximately four minutes to come up to temperature, after which the Rapidox will begin to take measurements. The progress of the sensor heater is shown in the form of a bar graph on the LCD display. Once at temperature the LCD display will show the oxygen readings of all three sensors at once. The lower right hand corner of the LCD will display the range selected (H=high, M=Medium & L=Low). The symbol ALARM may appear to the bottom right of the LCD if the alarm system is enabled and an alarm condition applies.

Allow thirty minutes for the box to stabilise fully. This allows the components of the analyser to reach a stable working temperature. During this warm-up period it is common for the baseline oxygen to drift by a small amount, which may be corrected by re-calibrating.

8.1 Menu Access / Passwords

The analyser has an option to set a password that will restrict access to the software menus. The password menu is disabled by default in the factory. If you wish to password protect the analyser follow the software instructions in section 9.

If the password has been forgotten please contact Cambridge Sensotec who will advise you on how to recover it.

8.2 Rapidox Calibration

The Rapidox OEM is calibrated using the software supplied. Please see section 9.7 for details of the calibration procedure. Below are some guidelines for performing a successful calibration.

Care must be taken to calibrate the analyser so that, whenever possible, the range of measurement lies between the two calibration points. For example, if you are working at 10ppm but have calibrated the analyser between 21% and 100% then the analyser will be inaccurate. You would need to calibrate at, say, 1ppm and 21% to be sure of good accuracy. The procedure is as follows:

1) Bearing in mind the points made above decide which two gases you are going to use for calibration. If you are constantly working at a particular range of compositions then it would be wise to obtain small cylinders of calibration gas with analysis certificates. You may need to programme the analyser and tell it which two gases you are using. This procedure is necessary only when you change calibration gases and the cal gas values are entered into the appropriate boxes on the config 2 page of the software.

2) The sensor needs to be exposed to the first calibration gas from a cylinder (or exposed to ambient air, 20.95% if this is the calibration gas of choice). Allow several minutes to pass to flush the sensor chamber properly and make sure that the flow rate over the sensor is the same as when it is in use (0.5-4 litres per minute is recommended). Wait for the top line of the on-screen LCD display to become stable. To complete the calibration click on the button labelled "Calibrate O_2 with gas 1". The display will now correctly read the value of the first calibration gas.

4) To calibrate against the second calibration gas, repeat the procedure from 2 but this time flush the sensor chamber with the second calibration gas allowing several minutes for the new gas to flush through, and as before, use the same flow rate as in use (0.5-4 litres per minute is recommended). Wait for the display to become stable before clicking on the button labelled "Calibrate O_2 with gas 2". The analyser will then recalibrate and then return to normal run mode. The display will now correctly read the value of the second calibration gas.

5) The analyser is now correctly calibrated and will read accurately between these two calibration points. Note that this procedure must be performed for each separate channel in turn.

6) If at any time, you encounter difficulties and wish to restore the machine to its factory set calibration, use the configuration software provided and load the default settings. Each machine and channel is provided with a unique file that contains the factory settings. This is located on the CD-Rom provided and is copied onto your PC during the installation process.

NB You must always perform a FULL calibration to achieve good accuracy.

8.3 Cleaning the Sensor

You can clean each of the three sensors at any time by using the software described in section 9.7. Note that only the selected channel is cleaned. The procedure takes approximately five seconds and the on-screen LCD display shows the progress of the operation. Once finished, the analyser will take a few seconds to re-stabilise. The sensor is cleaned each time the unit is switched on prior to operation. If you are operating in gases with large amounts of soot, there is a risk that the sensor surfaces will become contaminated with particulates, which will impair performance if allowed to build up. The cleaning operation pumps oxygen through the zirconia tube, which burns the particulates away from the sensor surface.

8.4 Oxygen Range

The Rapidox 3100 OEM has three oxygen measurement ranges which can be programmed using the software provided (section 9.5.1). Always select the most appropriate range in order to achieve maximum resolution from the analyser. The

three ranges are labelled HIGH, MEDIUM & LOW.

1. ***High*** from 0.1% to 100% oxygen
2. ***Medium*** from 1ppm to 100% oxygen
3. ***Low*** from 10^{-20}ppm to 100% oxygen

The range currently in use is displayed in the bottom right hand corner of the LCD display by the character L, M or H. To change the range select option 3 "Set O_2 Range" and press ENT. Use the UP & DOWN arrows to select the required range and press ENT to finish. If the measurement is out of range then please select a different range to continue operating.

8.5 Alarms

The Rapidox is fitted with two independent and fully programmable alarm relay outputs, whose set-points can be programmed as well as enabling the alarm relay circuits, enabling an audible buzzer and enabling a visual warning on the screen.

The alarm circuit relays are accessed via the terminal blocks (4) on the rear panel and are clearly labelled. Alarm High is assigned to the terminals labelled "Alarm 1" and Alarm Low is assigned to the terminals labelled "Alarm 2". The relay circuit is rated at 24V 0.5amps maximum.

The alarm limits for oxygen are set to a minimum of 10^{-20}ppm and a maximum of 1000%. At any time, should a sensor become disconnected so there is a fault condition then the Rapidox will set the alarm channel to OFF to prevent false alarms.

8.6 Analogue Outputs

The Rapidox analyser provides various analogue outputs. The standard industrial analogue outputs (0-5V and 4-20mA) for oxygen are accessible via the terminal blocks (4) on the rear panel. These outputs have a 12 bit resolution (approximately 1 in 4000) and the lower and upper values are fully user-programmable using the software provided (section 9). Three output mode options are provided for setting the outputs, in order to give the user maximum flexibility:

1. ***LIN (ppm):*** The linear oxygen output mode setting produces an output that is scaled linearly between 0 and 5V (or 4 and 20mA). So, for example, if the scale is set 0V = 0% O_2 and 5V = 100% O_2 then 2.5V would indicate an oxygen reading of 50% O_2. The scaling of this example is shown in the following plot, from which other intermediate values can also be read. This setting is more suitable for medium to high ranges of oxygen, or where the user wishes to monitor oxygen over a narrow range.

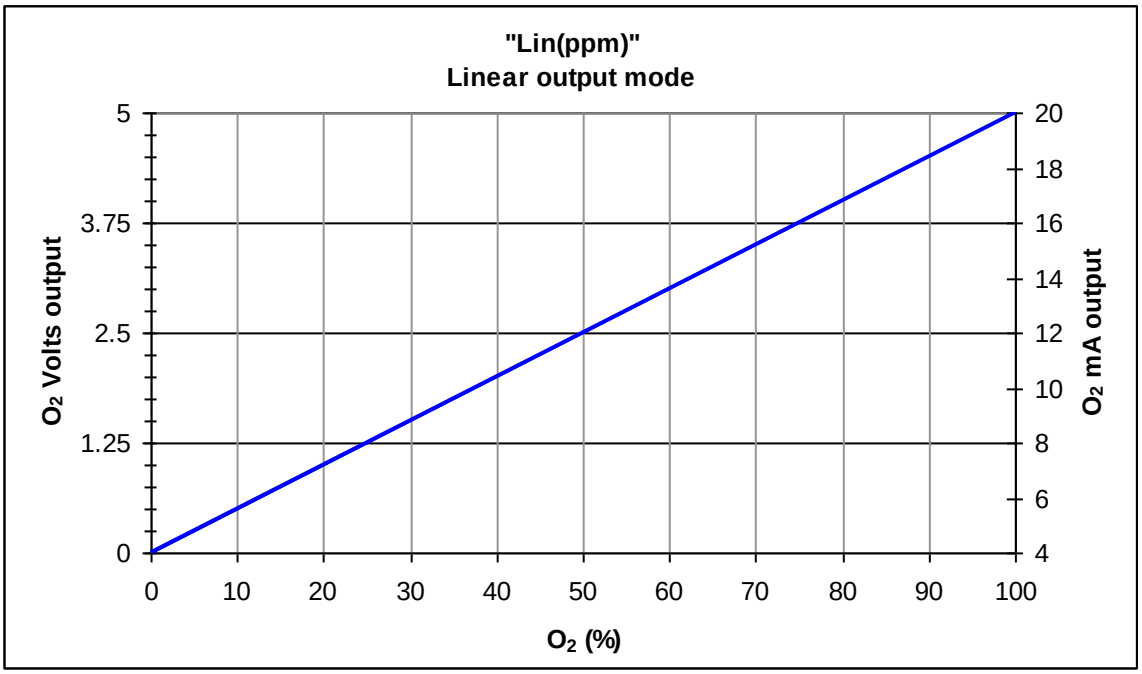

Figure 6: Graph showing the linear output mode option for oxygen

The following general formulae can be used to calculate the oxygen from the voltage or current outputs when set to the linear output mode:

Output type	Formula for calculating oxygen from analogue output signal
0-5V	$O_2 = V_{out} / 5 * (O_{2H} - O_{2L}) + O_{2L}$
4-20mA	$O_2 = (mA_{out} - 4) / 16 * (O_{2H} - O_{2L}) + O_{2L}$

Where: O_{2L} = user setting of oxygen for 0V or 4mA output [1]
O_{2H} = user setting of oxygen for 5V or 20mA output [1]
V_{out} = the measured voltage output in volts
mA_{out} = the measured current output in mA

[1] O_2, O_{2L} and O_{2H} must all be in the same units.

2. ***LOG (ppm):*** This setting produces an output that is scaled logarithmically between 0V and 5V (or 4 and 20mA). So, for example, if the scale is set to 0V = 0.0001% (1 ppm) and 5V = 100% (1000000 ppm) then 2.5V would indicate an oxygen reading of 0.1% (1000 ppm). This scale is more suitable for large ranges of oxygen down to very low ppm levels. Note that because the scaling is logarithmic 0V cannot be set to 0% oxygen since log(0) is -∞! The lowest permitted setting is 0V = 10^{-20} ppm (or 10^{-24} %) O_2. The scaling of this example is shown in the blue line in following plot, from which other intermediate values can also be read. For comparison, the red line shows the limitations of using the linear oxygen output mode over the same range.

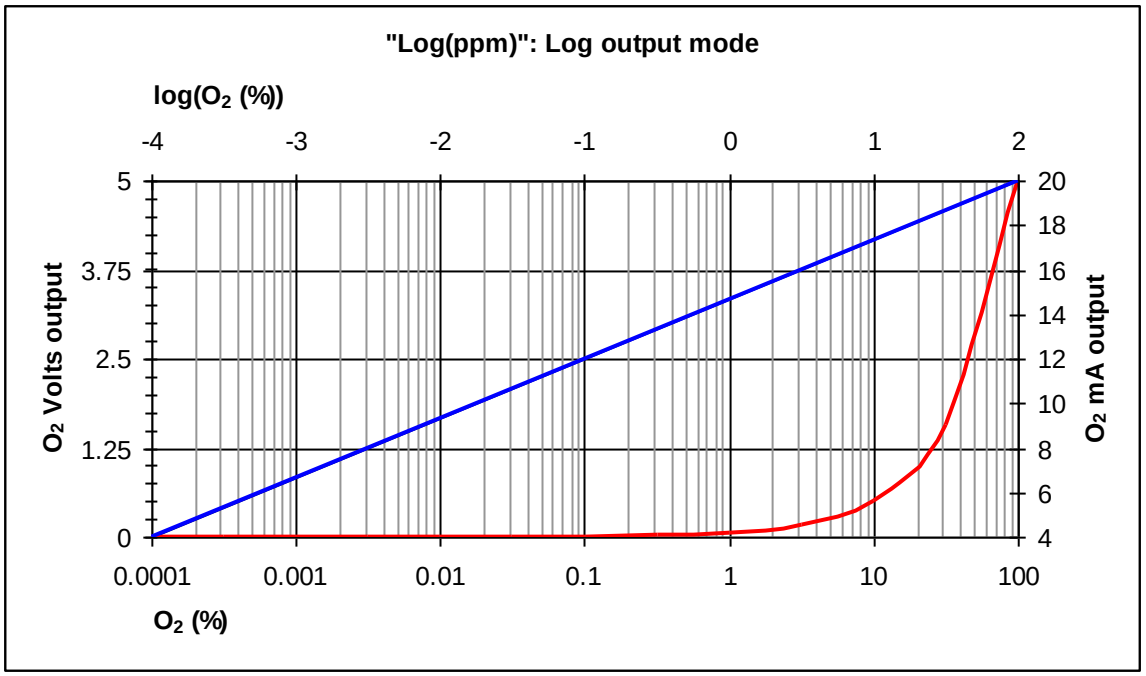

Figure 7: Graph showing the logarithmic output mode option for oxygen (blue) compared with linear mode (red).

The following general formulae can be used to calculate the oxygen from the voltage or current outputs when set to the log output mode:

Output type	Formula for calculating $\log_{10}(O_2)$ from analogue output signal
0-5V	$\log_{10}(O_2) = V_{out} / 5 * \log_{10}(O_{2H} / O_{2L}) + \log_{10}(O_{2L})$
4-20mA	$\log_{10}(O_2) = (mA_{out} - 4) / 16 * \log_{10}(O_{2H} / O_{2L}) + \log_{10}(O_{2L})$

Where: O_{2L} = user setting of oxygen for 0V or 4mA output [2]
O_{2H} = user setting of oxygen for 5V or 20mA output [2]
V_{out} = the measured voltage output in volts
mA_{out} = the measured current output in mA

[2] O_2, O_{2L} and O_{2H} must all be in the same units.

Note: $O_2 = 10^{\log(O2)}$

3. ***RAW (mV)***: This setting is for certain customers who like to monitor the raw sensor EMF signal. The signal from a sensor goes from approximately -50mV at 100% O_2 through zero at approx 5% O_2 and to +1000mV at extremely low O_2 levels. So, for example, if the scale is set to 0V (output) = -50mV (sensor voltage at approximately 100% O_2) and 5V (output) = 250mV (sensor voltage at approximately 1ppm O_2) then 2.5V would indicate a sensor voltage of 100mV. The scaling of this example is shown in the following plot, from which other intermediate values can also be read.

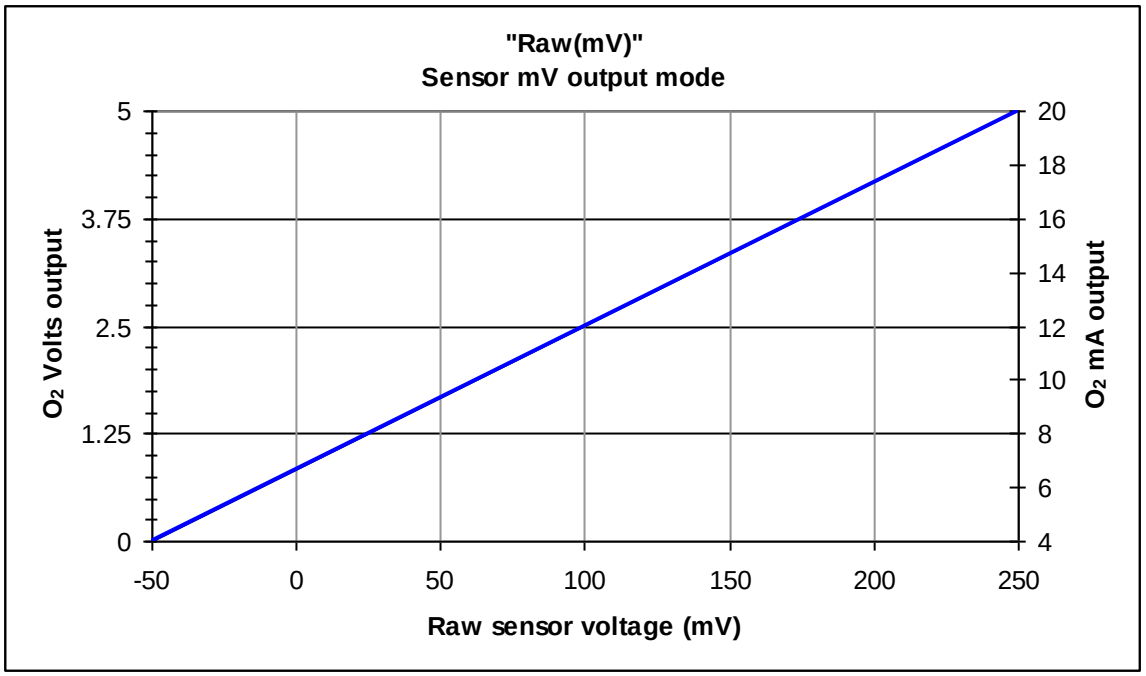

Figure 8: Graph showing the raw sensor mV output mode option for oxygen

The following general formulae can be used to calculate the oxygen sensor raw voltage (O_{2mV}) from the voltage or current outputs when set to the raw sensor voltage output mode:

Output type	Formula for calculating sensor mV from analogue output signal
0-5V	$O_{2mV} = V_{out} / 5 * (O_{2mVH} - O_{2mVL}) + O_{2mVL}$
4-20mA	$O_{2mV} = (mA_{out} - 4) / 16 * (O_{2mVH} - O_{2mVL}) + O_{2mVL}$

Where: O_{2mVL} = user setting of oxygen mV for 0V or 4mA output
O_{2mVH} = user setting of oxygen mV for 5V or 20mA output
V_{out} = the measured voltage output in volts
mA_{out} = the measured current output in mA

Note that the terminals labelled “Auxilary” on the rear panel (4) are NOT connected in the OEM version and should be ignored.

Note that the voltage (0 to 5V) and current (4 to 20mA) outputs are locked together, so that these outputs cannot be set independently of each other. In normal operation therefore, 0V output always corresponds to 4mA and 5V always corresponds to 20mA output.

During initial warm up of the Rapidox when the display reads “Sensor Heating” the output sent to the rear terminal for oxygen will stay at 2mA (0.628V) which is the standby signal. The output for the temperature or pressure sensor will begin to work after the initial boot up screen.

If at any stage a sensor becomes disconnected (externally or internally) or the signal exceeds the measurable range for that sensor, then the display will indicate

there is a fault and the outputs will change to 1mA (0.313V) which is the sensor fault signal. This will recover as soon as the sensor is reconnected and the fault cleared.

8.7 Display Units

The notation used by the display is fully programmable to suit your needs using the software provided. The oxygen reading can be displayed in percent (e.g. 20.95%), ppm (e.g. 0.01ppm) or scientific (e.g. 2.095E+05ppm). If percent is selected the Rapidox will display oxygen as a percentage down to 0.1% and ppm below this value. At values less than 1ppm the display switches to scientific notation for the remainder of the range. There is also an option to display the oxygen reading in terms of a pressure.

8.8 LCD Refresh rate

The user can select the LCD refresh rate using the the software provided. The frequency of the display update can be selected from 0.1 to 1.5 seconds.

8.9 Setting Date & Time

The date and time can be programmed using the software “Utilities” menu and selecting “Set Date & Time”. Note that if you re-programme the date & time it will use the current date and time of the PC.

Note that the exact date format will depend on the country you are in and the language and local settings of the PC which you have used to connect to the analyser. So for example in the USA you would now see the date as mm/dd/yy. The local date format will be stored along with the date and time in the Rapidox.

8.10 RS485 Port

The serial port (3) on the rear of the OEM unit has been factory set to RS485. Data from each of the sensors is sent in turn, on demand to the socket on the rear panel and can be read using a simple terminal programme such as 'HyperTerminal' in Windows, or with the user's own custom software. However the OEM analyser has been designed to run exclusively with the software included. This includes a simple and convenient data logger programme and is described in section 10 below.

8.11 Load Defaults

If you make a mistake programming the Rapidox it is possible to restore the machine back to its factory settings by loading the unique default configuration that is supplied on your software CD-ROM. The default set-up can only be

accessed using the software provided. Please see section 9.4 for further details.

9. Rapidox Software Instructions

9.1 Software Installation

It is possible to the Rapidox OEM using an RS485 link with a PC running MS-Windows (all versions) and the supplied Rapidox OEM software. The software is installed automatically by inserting the Rapidox CD into the CD-ROM drive. If auto-installation does not start then you can click the Windows START button and select RUN. Type X:\setup.exe where X is the drive letter of your CD. Alternatively access the CD from Windows Explorer or the 'My Computer' icon on your desktop, and double-click on the 'Setup.exe' programme. Follow the on-screen instructions to install the programme onto the hard drive. Once installed, you can access the programme by clicking START - PROGRAMS – Rapidox Software.

The software has been tested successfully on most language machines including Chinese, Korean & Japanese and all current versions of Windows operating system. We do not recommend the use of Vista as connecting devices to this operating system can be problematical at best.

Note that software is 'regionally aware' and will therefore accept and display data using the decimal separator that is set in the PC's Regional Settings in the Control Panel. For example, in the UK or US, you might enter the value 2.5 - in continental Europe this would normally be entered as 2,5 assuming the PC's Regional Settings have been set up to use ',' as the decimal separator.

9.2 Getting Started

Please note that you MUST use the "Easy Snc Adapter" provided or the software will not work correctly!

Make sure that the Rapidox is connected to a free serial port on the rear of your computer. These will nearly always be COM1 or COM2 but the software will scan through the ports until it finds the Rapidox. The analyser must be switched on for this to succeed and while you are communicating with it. On start up the software will locate the Rapidox and display the following page. The values displayed in the columns of boxes above the 'Read' and 'Write' buttons may differ from those shown. NOT ALL features are available with this model.

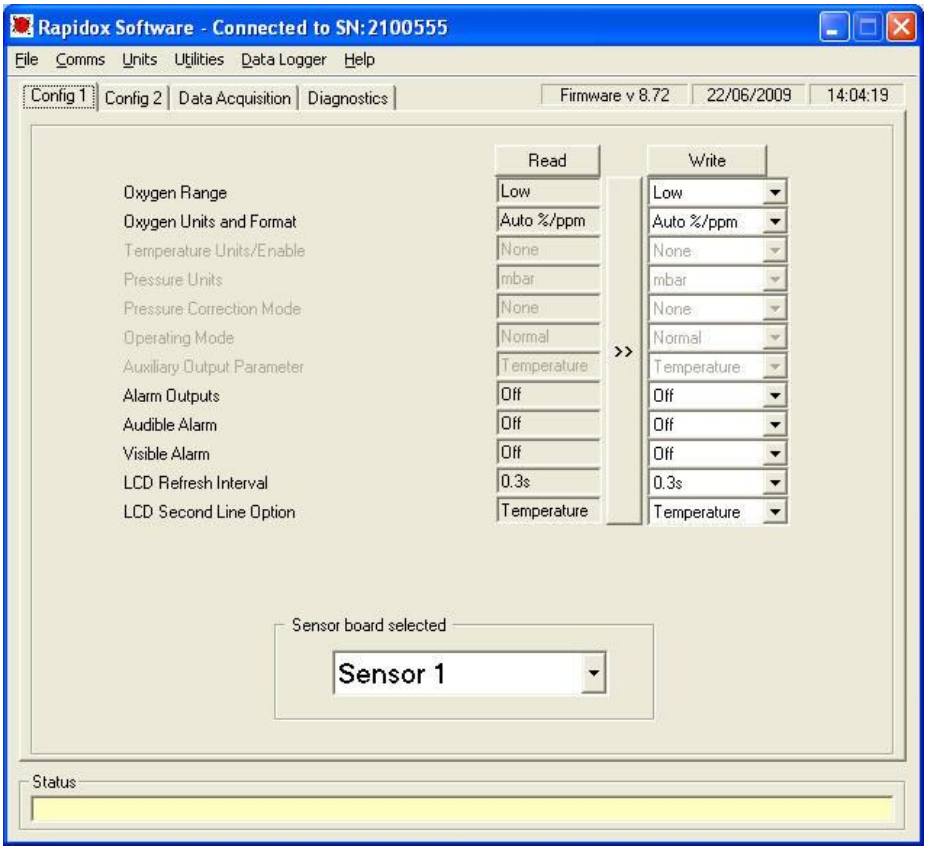

Figure 9: Configuration 1 page. Note the actual values used may differ from those shown above.

The yellow status box at the bottom will display confirmation that the Rapidox was found and the result of the last action, or any error messages if there is a problem with communication. If you experience problems check that your serial cable (supplied) is correctly fitted to a valid USB port, and that you do not have another application open that may be using the same port. There are several types of serial cable available. You must use the cable and Easy-Sync adapter as supplied as other cable formats will not work. Also check the status of your COM port settings in Device Manager accessed by clicking START – Settings - Control Panel.

9.3 On-Screen Help

You can access the on-screen help facility at any time by clicking on the 'Help' menu on the menu bar and select the 'Help' option or press F1.

9.4 Configuration Pages

The configuration page is split into two (see figures 11 & 12) and you can toggle by clicking on the folder tabs labelled “config 1” and “config 2” page allows the user to reprogram an array of variables used by the Rapidox. Once written to the Rapidox, the new variables remain permanent until overwritten.

As this is a multi-channel analyser the channel of choice must be selected first using the drop-down box at the bottom of the window labelled "Sensor board selected" (see figure 11). In this example Sensor 1 is selected and all the parameters on config 1 & 2 pages now refer to this sensor only. Note that the label "Sensor 1" can be edited by the user in the LCD display window.

To read the current configuration for the selected board stored in your Rapidox select ‘Read Analyser Configuration’ from the file menu. Note that the edit boxes on the RHS will turn red if the value is different to that just read and a red asterisk will appear next to the ‘Write’ button to warn you that a change has been made. The left-hand set of grey text fields (‘read fields’) will be updated with the current configuration data. To save this information (e.g. if several people share the same instrument) press the long copy button to transfer the data into the edit boxes, select ‘Save Configuration as’ from the file menu and choose a filename. This data set can be subsequently be reloaded at any time by selecting ‘Load Configuration File’ button and selecting the directory where the configuration files have been stored.

If at any time you wish to restore the machine to its factory default settings select ‘Default Configuration’ from the file menu to load these values. The software will search for a unique rxc file that is loaded onto the PC during the software installation. The filename is 2100***.rxc where *** is the last three digits of the serial number located on the rear of the machine. This file is also located on the CD-Rom that came with the machine. Normally this file is located in the main Rapidox directory but if the software can not locate it then it will ask you for the serial number to help it search. With the correct rxc file loaded simply press COPY to transfer the defaults into the edit boxes and then select WRITE to load them back into the Rapidox.

The right-hand set of white editable text fields (‘write fields’) is used to enter new values to be programmed into the Rapidox. The values in these fields can either be entered manually, or copied across from the ‘read fields’ by clicking the vertical ‘Copy’ button, and then edited as required. Alternatively, you can load saved configuration data by selecting ‘Load Configuration’ from the file menu and selecting the required file. In order to programme the analyser select ‘Write configuration to the analyser’ from the file menu.

9.5 Reconfiguring the Analyser

The on-screen edit boxes contain variables that can be reprogrammed into the Rapidox. For a full description please refer to the relevant section in this manual.

The user can choose whether to use ppm or percent notation to edit the text boxes by selecting the UNITS menu and clicking on percent or ppm. To access a field, either click inside it or use the TAB key to scroll through them. Note that some parameters are greyed out - these options are NOT applicable for the OEM version of the Rapidox. The field parameters are as follows:

9.5.1 Config 1 Screen

1) ***Oxygen Range:***

The Rapidox OEM is fitted with three ranges of oxygen which can be programmed using the software provided. Always select the most appropriate range to work with to achieve maximum resolution from the analyser. The three ranges are labelled LOW, MEDIUM & HIGH. Note that if you operate the machine below the minimum value of a particular range the display will 'bottom out' and you need to select a lower range to continue measuring.

High	from 0.1% to 100% oxygen
Medium	from 0.001% to 100% oxygen
Low	from 10^{-20}ppm to 100% oxygen

The range currently in use is displayed in the bottom right hand corner of the LCD display by the character L, M or H.

2) ***Oxygen Units:*** Use the drop down box to select PPM EXPONENTIAL, PPM MIXED, AUTO%/PPM or PRESSURE. The default setting is AUTO%/PPM. The oxygen reading can be displayed in percent (e.g. 20.95%), ppm (e.g. 0.01ppm) or scientific (e.g. 2.095E+05ppm). There is also an option to display the oxygen reading in terms of a pressure in mbar. If percent is selected the Rapidox will display oxygen as a percentage down to 0.1% and ppm below this value. At values less than 1ppm the display switches to scientific notation for the remainder of the range

3) ***Temperature Units:*** Not available for the OEM version

4) ***Pressure Units:*** Not available for the OEM version

5) ***Pressure Correction Mode:*** Not available for the OEM version

6) ***Operating Mode:*** Not available for the OEM version

7) ***Auxiliary Output Parameter:*** Not available for the OEM version

8) ***Alarm Outputs:*** Use the drop down menu to select OFF or ON. When set to ON the alarm circuits on the rear are activated. The default setting is OFF. The Rapidox is fitted with fully programmable alarms. There are two independent alarm circuits for low and high oxygen conditions. These are relay circuits which are open if there is no alarm and closed when an alarm condition occurs. You have the option of enabling the alarm circuits, enabling an audible buzzer and enabling a visual warning on the screen. Note that the alarm circuit relays are accessed via the terminal block on the rear panel and are clearly labelled. The relay circuit is rated at 24V 0.5amps maximum.

9) ***Audible Alarm:*** Use the drop down menu to select OFF or ON. When set to ON the buzzer will sound when an alarm is activated. The default setting is OFF.

10) ***Visible Alarm:*** Use the drop down menu to select OFF or ON. When set to ON the on-screen LCD display will show the word ALARM (flashing) when an alarm is activated. The default setting is OFF.

11) ***LCD Refresh interval:*** Use the drop down menu to select a refresh rate for the on-screen LCD (min 0.1, max 1.5 sec). The default is 0.3 seconds.

12) ***Oxygen Analogue Output Mode:*** The Rapidox analyser provides three analogue outputs for oxygen: LIN, LOG & RAW. Please see section 3.7 for a complete description. The standard industrial analogue outputs (0-5V and 4-20mA) are accessible via the terminal block (4) on the rear panel. These outputs have a 12 bit resolution (approximately 1 in 4000) and the lower and upper values are fully user-programmable.

13) ***Password option:*** The analyser has an option to set a password that will restrict access to the menus. The password menu is disabled by default in the factory. If you wish to password protect the analyser select "enable" from the drop down menu. Click the "write" button to activate. The software will ask you for the default password which is “0000” as shown in figure 5:

Figure 10: Password entry screen. Please note that the factory default is 0000

Once the password has been entered successfully the Rapidox will be programmed with your command. The same procedure applies if you want to disable the password function. The other option is to RESET the password to a new value. The password must be 4 digits long and can be any combination of numbers from 0000-9999. Make sure that the new password is noted down! If the password function has been enabled then in the future each time the software is accessed then the password prompt

will display. After the correct password is entered then all the software functions become accessible. If the password has been forgotten please contact Cambridge Sensotec who will advise you on how to recover it. Note that you will be prompted to enter the original password if you wish to make changes to the password or its status.

9.5.2 Config 2 Screen

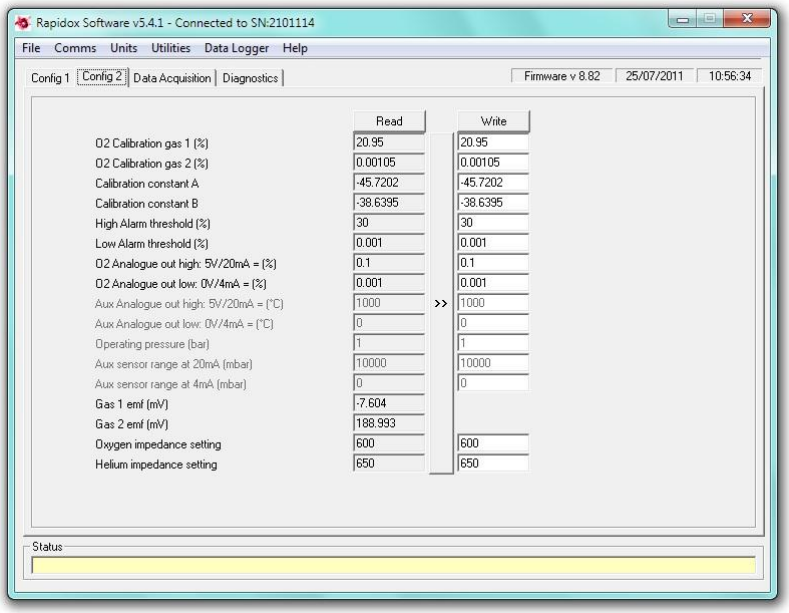

Figure 11: Configuration 2 screen. Note the actual values used may differ from those shown above.

14) ***Calibration Gas 1:*** Use this box to enter a new value for the first cal gas. The value can be entered either in % or ppm depending on the units selected. The default is %. Enter a value such as 10.1 for 10.1%The default value for cal gas 1 is 20.95%

15) ***Calibration Gas 2:*** Use this box to enter a new value for the second cal gas. The value can be entered either in % or ppm depending on the units selected. The default is %. Enter a value such as 0.1 for 0.1% The default value for cal gas 2 is 0.001% (10ppm).

16) ***Calibration Constant A & B:*** These boxes contain the calibration constants that the Rapidox calculates automatically when you perform a calibration. You will see that they change each time you perform a new calibration. It is possible to manually edit these but this should only be attempted after consulting with Cambridge Sensotec. Normally they are just provided for information and should be left untouched. The default settings are A= -46.482 and B= -38.845. Note that the values are always negative as this follows the convention of the Nernst equation.

17) ***High & Low Alarm Thresholds:*** Use these two boxes to enter new values for the alarm trigger points. The alarm High value must always be greater than the alarm low value. The value can be entered either in % or ppm

depending on the units selected. The default is %. Enter a value such as 10.1 for 10.1%. The default values are 25% for Alarm High and 0.001% for Alarm Low.

18) ***Analogue Output (0V/4mA & 5V/20mA):*** Use these four boxes to set the High and Low oxygen for the analogue outputs on the rear panel of the analyser. For example if you want 4mA to represent 1% and 20mA to represent 21% then enter these two values into the appropriate boxes. The value can be entered either in % or ppm depending on the units selected. The default is %. The default values are 25% for the high setting and 0.001% for the low setting.

19) ***Gas 1 & Gas 2 emf (mV):*** These values are for information purposes only and cannot be adjusted. They represent the voltage that the Rapidox measured on the sensor at the point of calibration. These values are used in the calculation of the A & B values derived from the Nernst equation. As a guide the emf in air is around -8mV and the value at 10ppm is around +190mV. Exact values depend entirely on the individual sensor.

20) ***Oxygen and helium impedance setting:*** These values are for information purposes only and can not be adjusted. They control the temperature of the heater for the two modes of operation by setting the impedance of the zirconia cell to a pre-determined value.

Once you have finished editing the parameters, select 'Write Configuration to Analyser' from the file menu or click the 'Write' button on any configuration page and the new data set will be written to the Rapidox. The Rapidox is reprogrammed using the new configuration. The software then reads the new settings back from the Rapidox and displays them in the boxes on the left-hand side confirming that the configuration was successful.

9.6 On-Screen LCD

It is possible to display an LCD emulator on the desktop of your PC. This shows ALL THREE channels on the OEM unit together. The top line of each display shows the oxygen value and the second line is reserved for showing the ALARM status and oxygen range (L, M or H). To activate the LCD select the utilities menu and select the LCD on option. This will display a small window showing the LCD that can be positioned independently anywhere on the desktop.

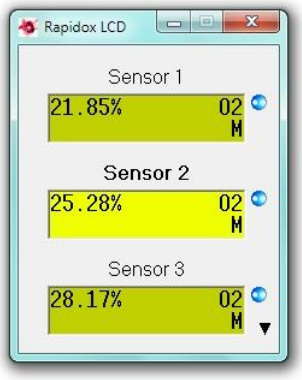

Figure 12: On-screen LCD. Values shown are for illustrative purposes only.

The blue LED indicator will flash to show that the display is updating. To close the LCD either click its window close button, or click the 'Utilities' menu on the main programme window and select the 'Hide LCD' option.

The active channel (set on the config 1 page) is shown slightly highlighted as in Figure 9 (channel 2 is shown active). To change the active channel you can double click on the LCD with the mouse and it will update itself. You can also rename each channel if required. For example click on the text labelled "Sensor 1" and change to "Hot Zone". The new channel label is stored when the software is closed and also updates both on the config 1 page and the graph legend (see section on data-logging).

9.7 Remote Calibrating

With the on-screen LCD display active it is possible to remotely calibrate the analyser and clean the sensor. Click on the down arrow icon in the bottom right-hand corner of the LCD display to expand the window:

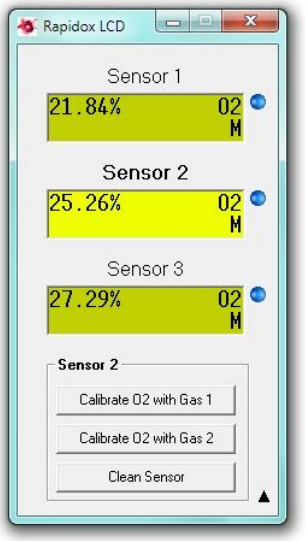

Figure 13: Remote calibration and clean function. Values shown are for illustrative purposes only.

Use the three buttons to calibrate or clean the sensor directly from the PC. Before calibrating the analyser with gas, make sure that you know the exact O_2 concentration in your gas bottle AND you have a calibration certificate from the gas supplier confirming the concentration. You can calibrate the analyser in any order but remember that the gas value for O_2 Gas 1 must be greater than the gas value for O_2 Gas 2. Allow sufficient time for the calibration gas to pass over the sensor and let the reading on the LCD stabilise. This is extremely important to perform a successful and accurate calibration.

The software uses the two calibration gas values already stored in the Rapidox as a starting point (see config 2 page instructions for changing the cal gas values). These are typically High = 20.95%, and Low = 0.001% as set in the factory but may be different if the user has recalibrated with other gas values in the past. Either way you are given an option to change the cal gas value before proceeding to the actual calibration.

Assuming you are using fresh air (20.95%) to calibrate O_2 High then simply click on the button labelled “Calibrate O_2 with gas 1” to see the following:

Figure 14: Calibration Gas Confirmation Screen.

If the current stored value is correct and matches your cal gas value then simply click “Yes” to proceed. If you are using a different value to the one you see on the screen then click “No” to return to the main menu and change it as described in 9.5.2.

This is your final chance to change your mind before committing to a calibration. Check carefully that the gas value on the screen actually matches the value of your calibration gas before clicking on “Yes” to complete the calibration. At this point you should observe that the LCD display will reset itself to the correct calibration. You can now proceed with the rest of the calibration process by selecting the gas 2 in the same manner.

9.8 Cleaning the Sensors

You can clean the sensors at any time by pressing the button labelled "Clean Sensor". The procedure takes approximately five seconds and the LCD display shows the progress of the operation. Once finished the analyser will take a moment to re-stabilise. The sensors are cleaned each time the unit is switched on prior to operation. If you are operating in gases with large amounts of soot, there is a risk that the sensor surfaces will become contaminated with particulates, which will impair performance if allowed to build up. The cleaning operation

pumps oxygen through the zirconia tube, which burns the particulates away from the sensor surface.

9.9 Software Utilities

The utilities menu is located on the main file menu as shown below:

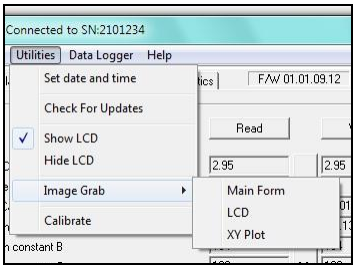

Figure 15: Software Utilities Menu

9.9.1 Setting Analyser Date and Time

The current date and time of your PC are displayed on the configuration screen and can be loaded into the Rapidox by selecting the Utilities menu and clicking the 'Set date and time' option. This information is used in the RS232 data string for data logging purposes. Make sure that your PC clock is set correctly before using this function, as you cannot edit the date and time shown by the Rapidox software. The date and time formats displayed are those set in the PC's Regional Settings.

9.9.2 Check for Updates

This function will check online and advise you if any software updates are available for your machine. This function is not automatic. To update the software you need to visit www.cambridge-sensotec.co.uk and select the support page where a list of downloads are provided.

9.9.3 Image Grabber

This is a simple function to allow the user to copy the software screens into the Windows clipboard. This is useful for diagnosing problems; allowing a quick and simple way of sending the Sensotec technicians actual screen shots of the software. To recover the images simply press CTL+V to paste.

10. Rapidox Data Logging Software

10.1 Introduction

The Rapidox software includes a full data logging facility which logs data from ALL THREE channels simultaneously. Data can be saved to a file automatically at regular intervals and the format is compatible with modern spreadsheet programmes such as MS-Excel. A live-time graphing facility is also included which has many powerful features. Note that the data logging facility will only function if the analyser is in NORMAL run mode.

10.2 Setting up the Data Logger

Click on the tab labelled 'Data Acquisition' to display the following page:

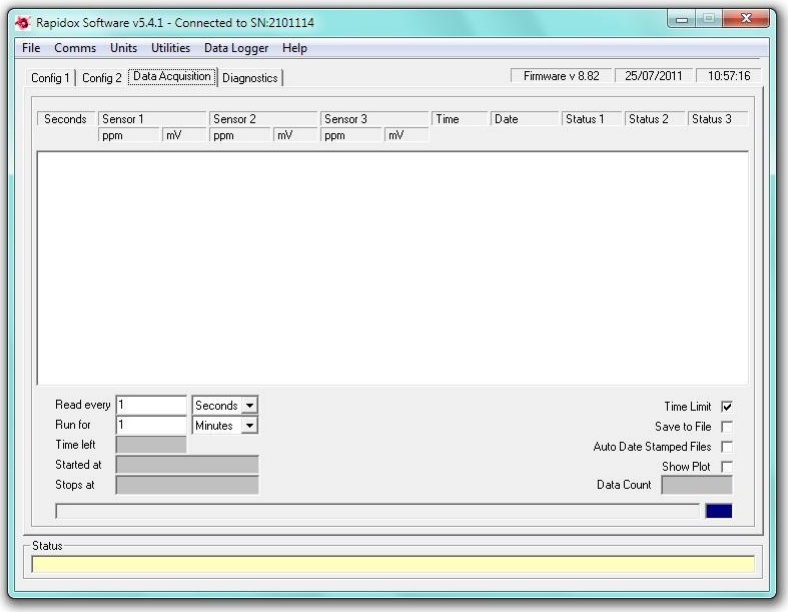

Figure 16: Data Logging page

During logging, data from the analyser is shown in the central area of this page. The data is displayed in the following columns: time (in seconds), channel 1 O_2 value (in ppm and mV), channel 2 O_2 value (in ppm and mV), channel 3 O_2 value (in ppm and mV), time (H:M:S), date (dd/mm/yyyy), status of channels 1,2,&3 (L=Low, M=Medium, H=High, Alarm),

To start data logging select the frequency of measurement by entering a time and selecting a unit from the drop down list. For example if you wish to log data once every minute type 1 in the box and select 'Minutes' from the drop down menu. The fastest speed the three channel OEM analyser can log at is 1 second.

You can open the notes window at any time by selecting NOTES from the 'Data Logger' drop down menu. A small text box appears in which you can type a text message. This note is then saved as a header in the data file set and can be viewed along with the data.

You can either choose to have data logged continuously until 'Stop' is selected from the Data Logger menu, or you can choose to set a time limit for data logging by checking the box labelled 'Time Limit', setting the duration in the 'Run For' box and selecting units with the drop down list. For example if you wish to log data for thirty minutes type '30' in the box and select 'Minutes' from the drop down list.

10.3 Running the Data Logger

If you wish to save the data into a file for later use, check the 'Save to File' box before selecting 'Run' from the 'Data Logger' menu. You will be prompted for a file name and location before data logging commences. The file and path information will appear in the box at the top of the page labelled 'Data File Name'. If you forget to select file saving before starting a run, you will nevertheless be prompted at the end as to whether you wish to save the run data.

The blue progress bar displays the state of completion of the run, and the blue box to the right of it displays the same information as a percentage. You can stop the run at any time by selecting 'Stop' from the 'Data Logger' menu. The yellow Status bar at the bottom of the page gives information about the data logging operation.

Once data logging is complete you may open the text format data file using any compatible spreadsheet programme such as MS-Excel, and use the data to generate plots and reports. You can save files with a ".txt" extension (the factory default) or a ".csv" extension, and whichever was last used will become the new default. See section 10.20 "Working with Spreadsheets" for more on this topic.

You can pause the data logger at any time by selecting 'Data logger' and 'Pause'. Click 'Data logger', 'Resume' to continue logging from where you left off, noting that the clock keeps ticking during the pause period.

10.4 Auto Date Stamped Files

If you are planning to run the data logger for extended periods of time then you should consider checking the 'Auto date stamped file' option. This feature will save the data at midnight for the previous twenty four hours and so on until the data logging is complete OR the user interrupts it. The data file is stored with a date suffix in brackets in yy-mm-dd format.

This feature ensures that data is saved periodically in sensible sized files. This will prevent the computer from crashing and will also ensure that the data is small enough to fit into an MS-Excel spreadsheet

As an example, the user wishes to run the data logger for seven days recording every minute starting at lunchtime on 12th November 2005. He starts the data logger with the auto-date stamp function enabled. When prompted he gives the filename as "test1.txt". In this situation the data logger will run from lunchtime to midnight and then save the first file as "test1 (2005-11-12).txt". The data logger then clears and continues for another twenty four hours until midnight the following day. The data is then stored as "test1 (2005-11-13).txt". This will continue for seven days when the data logger will finish.

After this the user will have a sequence of files:

test1 (2005-11-12).txt
test1 (2005-11-13).txt
test1 (2005-11-14).txt

And so on. Combined together they represent all the data over the last seven days. Note that the Rapidox uses the computer clock and date to perform this action, so make sure that they are correct before starting a run.

To view the data in its entirety the user would need to load each file in turn back into e.g., MS-Excel to combine them.

10.5 Live-Time Graphing Screen

The Rapidox data logging package includes a live-time graphing facility that allows you to monitor the progress of your data in a graphical format (see Figure 17). To access the graph check the box labelled 'Show Graph'. The graph will appear in a new window, and can be accessed at any time without disturbing a run that is already in progress. You can select 'Run' and 'Stop' from the 'Data Logger' menu in the graphing window to begin and end data logging, and the window can be minimised to (and restored from) the task bar while logging data.

To close the window and return to the main data logging page select 'Close Plot' from the 'File' menu or click on the close window button.

The features of the graph window are described below:

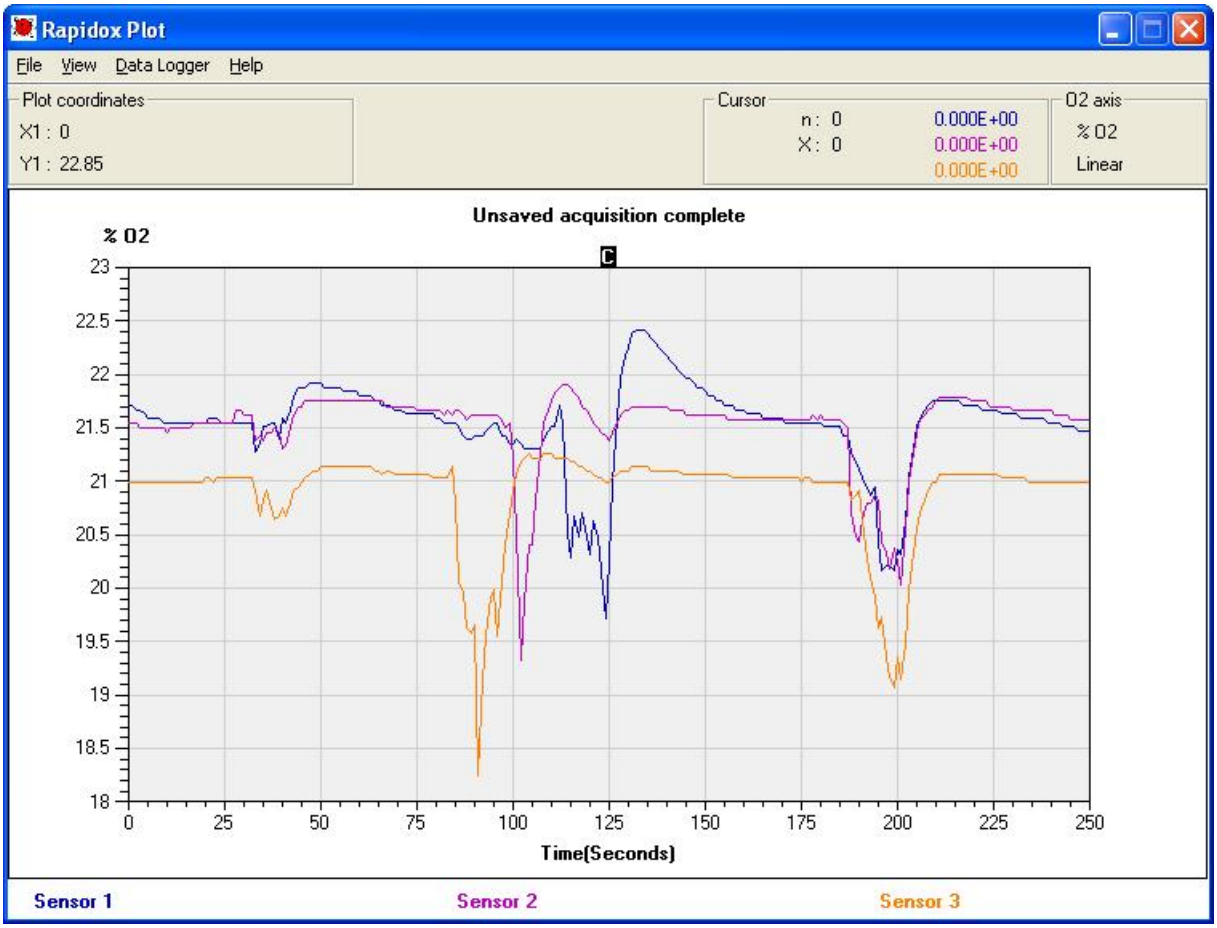

Figure 17: Live-time graphing screen

10.6 Main Graph Window

The graph is an XY plot, with time plotted on the X-axis and the three oxygen channels plotted on the Y-axis. The X-axis is auto-scale during data logging so that all data points are shown on the graph at all times.

10.7 Plot Colours

The default colours used on the graph are set to blue for sensor 1, red for sensor 2 and green for sensor 3. To change the colours double-click on the coloured label at the bottom of the graph window. A colour palette window will appear (see Figure 18) and a new colour can either be chosen from a colour box, or for more variety, by clicking the 'Define Custom Colors >>' button. Click on 'OK' to select the new colour or 'Cancel' to return to the graph without change.

Figure 18: Plot colour palette menu accessed by double-clicking on the axes titles.

10.8 Graph Titles and Labels

If you want to change the text of the graph axis labels, place the mouse pointer over the text and do a single left click to enter edit mode. The text can then be modified. Similarly, to change the title of the graph, place the mouse pointer over the title and click once to edit. If you choose not to enter a title the graph will display the path and filename of the run as the new title once the run has finished. Note that these changes are only temporary and will be overwritten by the defaults if a new run is started or the graph window is closed and reopened. They are provided so that the plot may be printed with alternative labels.

10.9 Plot Co-ordinates

The box labelled 'Plot co-ordinates' to the upper left of the graph window displays the actual plot co-ordinate value at the mouse pointer. This can be used to get a quick oxygen value from the graph. Simply place the mouse pointer at a place of interest and read the corresponding X1 and Y1 values in the box.

10.10 Last data point

During data acquisition, the box labelled 'Last data point' will appear at the upper middle of the graph window. It displays the last data values read from the analyser.

10.11 Using the Cursor

Clicking and holding the left mouse button with the pointer over the 'C' at the top of the plot area activates the cursor, which appears as a vertical dashed line on the plot. While keeping the mouse button pressed, you can now move the pointer anywhere in the plot area or on the 'C' in order to move the cursor. The box labelled 'Cursor' to the upper right of the graph window will display actual values for oxygen, time and the data point number (n) at or immediately to the left of the cursor position. The cursor can be used to investigate actual data values at specific points of interest on the graph.

10.12 Zooming

You can zoom in to any part of the oxygen plot by simply placing the mouse pointer on the new graph start position and then clicking and dragging a new box to re-size the graph. The label on the box to the upper left of the graph window will change to 'Zoom box co-ordinates', and an extra set of co-ordinates, labelled X2 and Y2, will appear, showing the co-ordinates in X and Y units of the second corner of the zoom rectangle as you drag the mouse pointer. The plot will zoom and auto-scale when you release the mouse button. This can be repeated if you wish to zoom in even further. To zoom back to the original size select 'Zoom Full' from the 'View' menu.

Note that although you can use the zoom facility during a live run, the graph will auto-scale to full size with each new data point.

10.13 Y-Axis Graph Units

You can toggle the Y1 oxygen units at any time from percent to ppm and vice versa. Select 'O_2 Units' from the 'View' menu and choose either percent or ppm. The current selection is then displayed in the top right box labelled 'O_2 Axis'.

10.14 Oxygen Scale

You can display the Y1 oxygen axis in linear or logarithmic format at any time by selecting 'O_2 Scale' from the 'View' menu. The current selection is then displayed in the top right box labelled 'O_2 Axis'. Note that the zoom function is disabled when you are viewing on a log scale.

10.15 Loading an Old Run

A previously logged data file can be loaded and viewed by selecting 'Open Data File' from the 'File' menu and selecting the appropriate TXT or CSV file. A progress bar is displayed while the data is being imported. Note that very large data files may take several seconds to load. The data is re-graphed and you can zoom, label axes, change colours etc., before printing the graph.

10.16 Printing Graphs

You can print the graph at any time by selecting 'Print Plot' from the 'File' menu. This will bring up the printer dialogue box for your specific printer where you can choose various printing options. Make sure that the printer page is set to landscape to obtain a full size print out.

10.17 Data Logging in the Background

It is possible to begin data logging and then minimise the windows in order to continue working with another application. To minimise the graph simply click on the minimise button on the blue title bar at the top of the window. You can then use the ALT + TAB keys to take you to other programmes already running. To return to the graph simply maximise from the start menu bar or press ALT + TAB again. If the graph does not redraw immediately select 'Zoom Full' from the 'View' menu to redraw.

10.18 Pausing the Data Logging

You can pause the data logging at any time during the run by selecting the 'Data Logger' menu and selecting 'Pause'. Repeat the action to continue, noting that the live graph will draw a straight line between the paused points to keep continuity of the axes. The clock keeps ticking during the pause period.

If you decide to access the menu of the Rapidox using the front keypad during data logging, then the software will pause automatically. A message appears on the screen informing the user that the unit is being accessed from the keypad. Once the menu has been exited, the software will continue data logging from where it left off. The clock keeps ticking during the pause period.

10.19 Changing the Data Logging Parameters Mid-run

Once the data logging has begun it is not possible to modify the original total length of time that the data logging will run for, but you may change the sample interval time by pausing the data logger and then entering a new value for the time interval. The data logger can then be resumed with the new values in place. Note that you can not change units (e.g. seconds to hours) once logging has started. If you originally selected seconds then you may change the current value to a new value between 1 and 3600 seconds, if you originally selected minutes then you may change between 0.02 and 360 and if you selected hours you may change between 0.01 and 6 hours. You can of course stop the run at any time using the 'Data Logger', 'Stop' menu option.

10.20 Working with Spreadsheets

The data logger saves data files in a standard comma separated ASCII text format which can be readily imported into spreadsheet programmes such as MS-Excel, in order to produce plots and reports as desired. For specific information on how to import text files into your spreadsheet programme please refer to the help guide supplied with the programme.

Data is saved in comma separated value format, with a '.txt' file extension as the

initial programme default. However, when entering the file name, you can instead select a '.csv' extension: the programme will register the last used file extension as the new default. The '.csv' extension is recognised by MS-Excel, so that opening the file will automatically run MS-Excel, and this may be of benefit if your regional decimal separator is period '.' rather than comma ','. However, if your decimal separator is comma, you should continue to use the '.txt' extension and open the file explicitly from within your spreadsheet programme, defining the field delimiter as 'comma' where appropriate.

10.21 Disaster Recovery

To prevent catastrophic loss of important data during a computer crash or power failure, the data is automatically saved point by point in a temporary file called 'Rapidox temporary data file 2100xxx.txt', where 2100xxx is the serial number of your Rapidox. This file is located in the same directory as the main Rapidox programme itself and can be renamed or copied to recover data that would otherwise be lost. Note that this file is overwritten each time 'Run' is selected from the 'Data Logger' menu so make sure all data is recovered successfully before starting another run.

Note that during a run using the 'auto date stamped' feature, the temporary data file is wiped clean as soon as the previous data set has been saved successfully. In the case of a crash the temporary data file should be used to recover the last day's worth of data that was not saved to the hard disc.

10.22 Diagnostics

The Rapidox software includes a diagnostics page that is accessed from the tab labelled 'Diagnostics'. This screen will display various values and settings that are operating inside your machine. There is no editing possible on this page – it is purely for information and to enable technical support help you should you experience difficulties with your machine. You may be asked to record values from this page if trouble shooting is required.

Note that the information found on the diagnostics page refers to the active channel only. To view diagnostic data from a different channel go to the LCD display and click on the channel of interest to activate it. The display will appear brighter than the non-active other two.

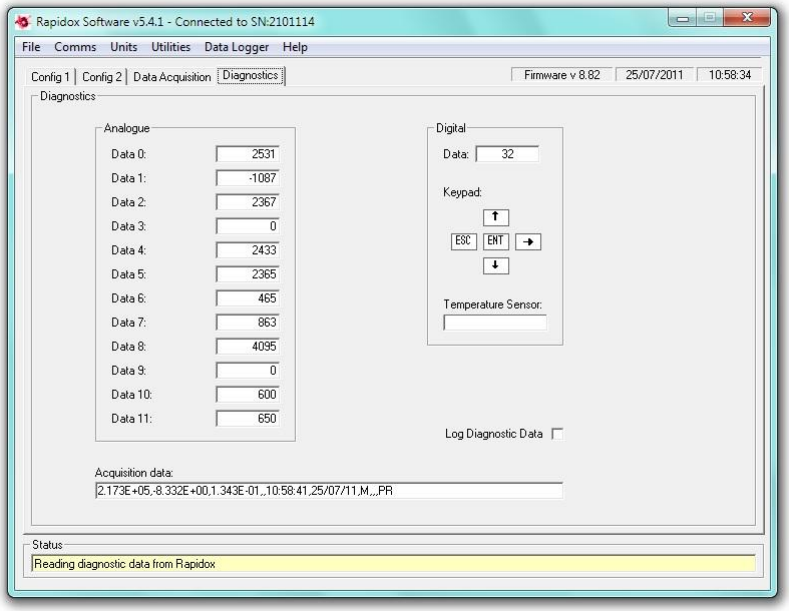

Figure 19: Rapidox Diagnostics Page

1. ***Analogue****:* The live analogue values displayed in this pane are voltage measurements coming directly from the computer chip inside the analyser. They are for information purposes only but are a useful diagnostics tool for Sensotec staff, as unusual values can indicate a particular fault. To help Sensotec diagnose a fault please capture this window as shown above using the screen capture function described in section 9.9 above and e-mail it to support@cambridge-sensotec.co.uk

2. ***Sensor State:*** These boxes should all indicate "OK" on a healthy analyser. Note that the Rapidox 1100Z does not have a temperature sensor fitted so all references to temperature on this screen are not relevant. The possible messages are "OK" "High" "Low" or "Fault". The High and Low messages indicate that the sensor is out off normal range. The fault message will only display if the sensor is disconnected or has failed in some way.

3. ***Digital:*** The digital signals coming directly from the computer chip inside the analyser can be monitored here. To test the keypad is working correctly try pushing the buttons and watching the panel. A correctly functioning key will turn the box red on the screen and the digital value for that particular key will show in the data box. If the analyser has an external thermocouple correctly fitted (2100 and 3100 series only) then this will display a signal in the "Temperature Sensor" box.

4. ***Log Diagnostic Data:*** Checking this box will allow the software to log the diagnostic data which can then be e-mailed to Sensotec for analysis. Do not switch to a different tab while logging diagnostic data – the data is only logged while the "Diagnostics" tab is still selected. The software will log diagnostic to a file named "Rapidox diagnostics file 210xxxx.txt" (where "xxxx" is the serial number of the analyser) in the folder shown in the yellow "Status" box at the bottom of the screen. Data is logged every 6

seconds, so the software should be left to run for at least 1 minute to gather a few data points. In order to stop logging, simply uncheck the “Log Diagnostic Data” tick box. Note that diagnostic data is always saved to the same file, and will automatically overwrite any existing file without prompting the user, so if you want to save existing data you must either rename it or copy (or move) it to a different folder, before checking the “Log Diagnostic Data” tick box again. If you are logging diagnostic data during the analyser’s warm up period, the “Acquisition data:” box will display the current sensor heating message, and will only display acquisition data once the oxygen sensor has reached its operating temperature.

Once completed please e-mail this file to support@cambridge-sensotec.co.uk for analysis.

11. Troubleshooting

Q: One of the channels says 'sensor heating' but won't begin measuring.
A: Check to see if the particular sensor is getting hot. If it is then make sure the cable plug is located firmly in the socket (2). If you are still having problems contact Cambridge Sensotec for advice. If the sensor stays cool then the internal heater has failed and the sensor needs replacing. This problem can also occur if you are using helium gas without selecting the helium mode in the menu.

Q: The Rapidox won't power up at all.
A: There are fuses located on the power socket on both live and neutral lines. These are standard 20mm slow blow 3A fuses available from a supplier such as RS Components.

Q: One or more of the sensors gives strange readings that are way off the expected values.
A: Check to make sure which three calibration gases are selected. Are they the same as the actual gases you used to perform the calibration? If not you can change their values using the software. Also check to see that the pressure sensor is working correctly and is measuring the same pressure as the oxygen sensor is being exposed to, if the pressure correction mode is set to ‘Auto’.

Q: The sensor does not read 20.9 - 21.0% in air (actual value is 20.95%).
A: If the room air is very humid, it will slightly affect the observed measurement or the sensor may have drifted slightly because of natural ageing. If you are using air as a calibration point then simply do a quick re-calibration in the air to compensate for this.

Q: I messed up the calibration procedure and the analyser is not working properly.
A: Return the box to the factory defaults using the communications software, by selecting ‘Default Configuration’ followed by ‘Write Configuration to Analyser’ from the ‘File’ menu. Now try re-calibrating the Rapidox.

Q: The date and time information on the RS232 is incorrect.
A: The date, time and other features are user-programmable via the configuration software, or via the front panel using the built-in configuration menu. If using the software, make sure that the time and date are correct on the PC you are using before attempting to reprogramme the Rapidox. Also, the date format must be set via the software, and uses the setting from the PC that was last used to set the date and time. The factory default date format is DD/MM/YY.

Q: The software will not talk to the Rapidox.
A: Make sure that you are using the correct cable and easy-sync unit as supplied as other cables will not work. Make sure that your COM ports are recognised by your computer. Check in your Windows device manager to see if there are any conflicts. If you have an internal modem fixed to your PC you may experience difficulties using this software. Contact Cambridge Sensotec for further advice.

Q: I selected 'Write Configuration to Analyser' and now the Rapidox is way off calibration.
A: Only select 'Write Configuration to Analyser' once all the values are correctly entered in the boxes on the right. The best procedure is to 'Read Analyser Configuration' and then press 'Copy' so the values in the boxes are the same as those stored in the Rapidox memory. You can then edit these values and then select 'Write Configuration to Analyser' when finished.

Q: How do I get back to the factory calibration for my instrument.
A: Select 'Load Configuration File' from the 'File' menu and look for the "2100xxx.rxc" file on your CD, where "2100xxx" is the serial number of your unit. Select this file and then select 'Write to the Analyser'. This will load the factory calibration back into the Rapidox. Alternatively you can use 'Default Configuration' on the 'File' menu which will automatically try to load "2100xxx.rxc".

12. Warranty

The Rapidox analyser has been carefully tested and inspected before shipment and is guaranteed to be free from defective materials and workmanship for a period of twelve months from date of purchase and delivery. The sensor head is replaceable and has a life expectancy in excess of 17,500 hours. However, if the analysis gas contains corrosive gases or large quantities of particulates, sensor life may be shortened. In the case of the latter, it is normally possible to insert a filter prior to the sensor head to remove the particulate material.

12.1 Conditions of Warranty:

1) This warranty is in addition to and does not affect any statutory rights of

consumer purchasers. This warranty is valid worldwide on a “back to base basis”.

2) This warranty covers breakdowns due to design or manufacturing faults; it does not apply to damage, however caused, wear and tear, neglect, unauthorised adjustment or repair, or any items of limited natural life.

3) In the event of failure, please take the following action:

a] Refer to the “Troubleshooting” section of your instruction manual to identify and possibly correct the problem.

b] If the fault cannot be resolved, please contact the Cambridge Sensotec service and repair centre at the address given on the cover of the manual.

4) The warranty period applicable shall be 12 months from the date of delivery provided that:

a] Notice in writing of the defects complained of shall be given to Cambridge Sensotec (The Seller) upon their appearance, and

b] such defects shall be found to have arisen from the Seller's faulty design, workmanship or materials, and

c] The defective goods shall be returned to the Seller's premises at the Purchaser's expense if so requested by the Seller.

d] Any repaired or replaced goods shall be redelivered by the Seller free of charge to the original point of delivery but otherwise in accordance with and subject to these Conditions of Sale.

e] Alternatively the Seller shall be entitled at its absolute discretion to refund the price of the defective goods in the event that such price shall already have been paid by the Purchaser to the Seller, or, if such price has not been so paid, to relieve the Purchaser of all obligation to pay the same by the issue of a credit note in favour of the Purchaser in the amount of such price.

Rapidox CERTIFICATE of CALIBRATION

Date: ……..

Rapidox Serial number: ……

Calibration Constant A ……

Calibration Constant B ……

Calibration Gas 1 ……

Calibration Gas 2 ……

Configuration Filename ……

Calibrated by: ……

Signed: ……..

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Cambridge Sensotec Rapidox 3100 OEM Oxygen Analyser Instruction Manual