G1010 OEM
Oxygen Analyser
Instruction Manual

This manual contains important Health & Safety information

SAFETY and EMC INFORMATION

Please read this section carefully before installing the instrument.

This instrument meets the requirements of the European directives specified below. However it is the responsibility of the installer to ensure the safety and EMC compliance of any particular installation

Equipment: The G1010 range of gas analysers.

Safety: These instruments comply with the European Low Voltage Directive 73/23/EEC, amended by 93/68/EEC by the application of the safety standard EN61010(93)

Installation and servicing should only be carried out by suitably qualified personnel.

Electromagnetic Compatibility: These instruments comply with the EMC directive 89/336/EMC amended by 93/68/EEC, by the application of the following standards:

EN50081 Part1: 1993 (Generic Emission Standard)
EN50082 Part1: 1995 (Generic Immunity Standard)

Installation Requirements for EMC: To ensure compliance with the European EMC directive certain installation precautions are necessary as follows:

Instrument Rear Panel Rating
The G1010 instrument is designed as a panel mounted instrument and for this reason the back panel is rated as service only. All service personnel should take electrostatic precautions before work is carried out at the rear of the instrument.

Radiated Emissions
In light industrial/domestic applications it may be necessary to suppress emissions from the power cable by fitting a ferrite choke to the mains supply lead. The mains cable should be wound twice through the choke. (This choke is available on request by quoting: Part No: 418-0045).

Routing of wires
To minimise the pick-up of electrical noise all signal wiring should be shielded and routed away from power cables.

G1010OEM OXYGEN ANALYSER HANDBOOK.

1.0 GENERAL DESCRIPTION

The G1010 is a microprocessor controlled oxygen analyser which provides a performance and a range of features without parallel for an analyser of this type and cost.

IMPORTANT NEW SENSOR IDENTIFICATION

In order to make sensor ordering easier we have renamed our galvanic sensors used in these instruments into 3 groups:

N type - (formally C/S & C/N)
L type - (formally LL or C/NLL)

This handbook reflects these changes; if you have any queries concerning sensor configuration, then please contact us with the instrument serial number, and we will be pleased to assist.

2.0 SPECIFICATION

Display
Multi digit LCD - character height 12.7mm

Display ranges
1) % version (N type sensor) - Display range 0 to 55%. Resolution: 0.1% from 10% to 25%; 0.01% below 10%

2) ppm version (L type sensor) - Display range 0ppm to 5%

Stability
Better than 2% of full-scale per month

Sensor life
Up to 18 months

Sample flow
Between 100 and 300 ml/min for optimum operation. Max. 1 l/min

Sample pressure
The pressure applied to the sensor is determined by the vent pressure which should be atmospheric for quoted accuracy.
Note: The sensor must not be subjected to rapid pressure changes.

Sample temperature
-5 to +40 °C (non condensing)

Sample connections
Inlet and outlet: captive seal compression fittings suitable for 0.25 inch (or 6mm) o/d tube

Speed of response
T90 - variable depending on sensor and concentration. Approximately 3s at % levels and 20s at ppm levels. The ppm figure assumes that the sensor is purged down.

Analogue outputs
0 to 5 volts (min. load 10kΩ) standard, 4 to 20mA (max. load 300Ω) option.

% version ≡ 0 to 5% (fixed)
PPM version user programmable to be ≡ 0/200ppm or 0/2000ppm

Alarm output
One user programmable for:
Mode - HIGH, LOW or OFF
Level - Over 0/25% for % version and 0/2000ppm for ppm version
Hysteresis - 0% to 10% of set point.
Volt free C/O contacts rated at 48v ac or dc, 0.5A, normally energised.

Ambient temperature
0 to 40 °C - continuous
-5 to + 50 °C - intermittent

Power supply
110/120 v or 220/240 v 50/60 Hz, 24v DC, ±10% including ripple and noise. Max power consumption 6VA

Mounting
Panel-mounting with two clamps

Materials
Glassfibre-reinforced Noryl to IP40 (IP54 front-panel option)

Dimensions
See Figures 1 and 5

This instrument has been designed to meet the requirements of the EMC Directive 89/336/EEC and the requirements of the Low Voltage Directive 73/23/EEC when installed in accordance with these instructions.

3.0 INSTALLATION

3.1 Unpacking and visual checking
Take all standard precautions when opening packages. In particular avoid the use of long bladed cutters. Search packing before discarding it and make sure that all of the components are removed. Check that all pipe connections have captive seal nuts.

3.2 Mounting

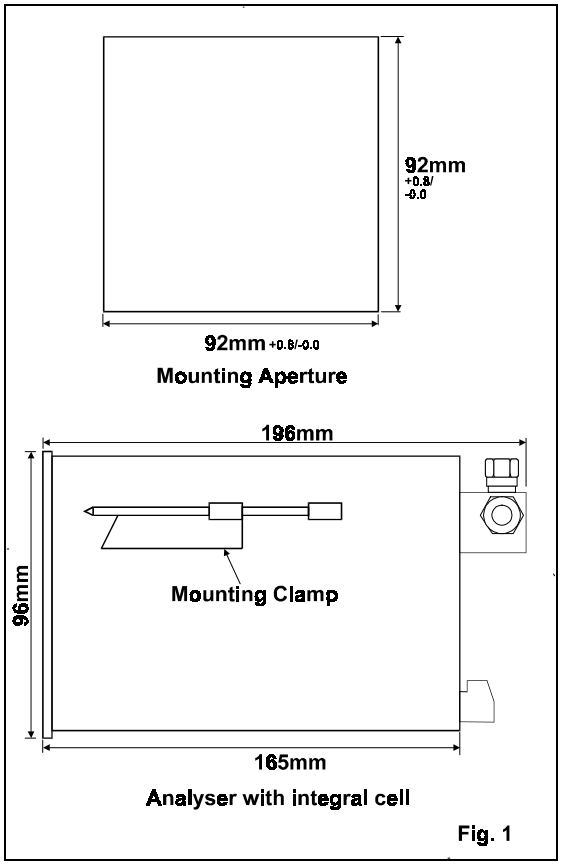


Fig. 1

Chose a site where the ambient temperature is between 0°C and 40° C. and where the analyser will not be subjected to vibration, knocks or jolts. It may be tilted etc. in any attitude.

To install the electronic control/display unit, remove the screw side-clips (if fitted) and slide the unit into the panel cut-out. Re-fit the two clips and tighten them up. Dimensional details are given in Fig. 1

3.3 Power supply
The standard options are 240V AC, or 110V AC or 24V DC. Refer to the serial number plate located on the side of the instrument for details.

3.4 Connections

The sensor, output signals and the supply should be connected as shown below. See section 3.8 for details of optional remote sensor version.

Terminal	1	Sensor +ve (red wire)
"	2	Sensor -ve (black wire)
"	3	Analogue Output +ve
"	4	" " -ve
"	5	Alarm 1 common terminal
"	6	" " N/C terminal
"	7	" " N/O terminal
"	8	Not used
"	9	" "
"	10	" "
"	11	Mains Live (or DC +ve)
"	12	Mains Neutral (or DC -ve)
"	13	Mains Earth

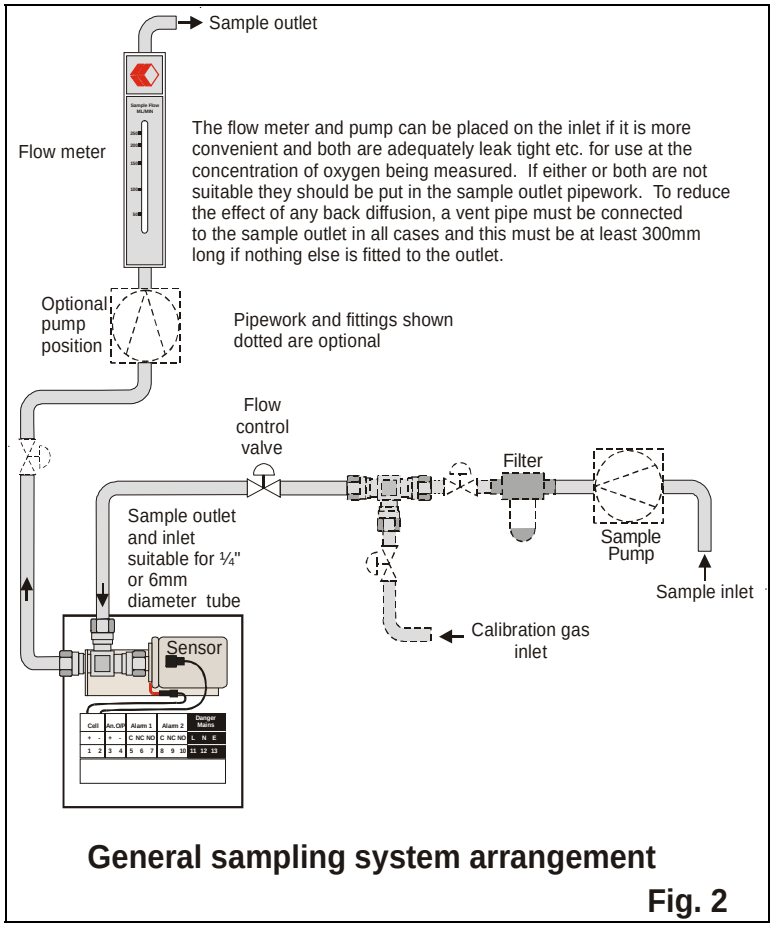
N/C= Normally closed N/O= Normally open

Note: 1) Terminal 1 is at the left-hand end of the connector when viewed from the rear. 2)"Normal" refers to the alarm status, not the electrical rest position of the relay.

3.5 Sample connections

The standard sample connections are shown in Fig. 2. It is important that the sample being supplied to the analyser is clean and non-corrosive. Filters or chemical absorbers will be necessary for those samples that contain particulate matter or corrosive components. Additionally the dew-point of the sample should not be above the ambient temperature.

If site or process conditions require that the process is isolated from the analyser when the sensor is changed then shut-off valves should be fitted to the inlet and outlet of the measuring sensor. The inclusion of a three way valve on the inlet side can also be used to allow easy connection of a standard gas for calibration checks. It is particularly important that good pipework connections are made when low levels of oxygen are being measured.



General sampling system arrangement

Fig. 2

For all parts per million (ppm) measurements the pipework should be all metal or hard plastic (Nylon, un-plasticised P.V.C. etc.) up to the inlet of the measuring sensor. Flowmeters and pumps must be suitable for handling ppm levels if placed on the inlet to the sensor; see comments on Fig. 2. Note that the sensor is shipped with its inlet tube plugged. Do not remove this plug until you are ready to fit the sensor to the instrument.

This is particularly important for instruments fitted with L sensors, irrespective of the positioning of flow meters etc.

It is important to fit a pipe of at least 300mm length to the sample vent/outlet connection to prevent back diffusion of air. It should be noted that back diffusion can occur even when the sample is flowing, and is due to the difference in oxygen partial pressure between the sample and air. The pipe should be short enough and of sufficient bore to prevent significant back pressure when the sample is flowing. Standard 6mm or ¼" tubing is ideal.

The sensor must not be pressurised beyond 0.25BAR gauge or less than (-)250mm water gauge. Rapid pressure changes could damage the sensor, and pulsation will give an erratic display.

3.6 Sensor installation

The sensors are shipped with the leads shorted and the sample tube plugged with a rubber bung. This ensures that a sensor is purged down to low levels and ready to be applied to the measurement of low levels of oxygen (less than 1000ppm) with the minimum of delay. The bung should be left in place until the system is ready for the sensor to be fitted. If it is intended to apply the sensor immediately to the measurement of low oxygen concentrations then the sample should be left flowing during the sensor change operation. **The bung should be removed from the sensor and the sensor coupled to the holder as rapidly as possible. THIS ASSUMES THAT THE SAMPLE THAT WILL INEVITABLY ESCAPE WILL NOT CONSTITUTE ANY SORT OF HAZARD. IT IS THE RESPONSIBILITY OF THE USER TO ENSURE THIS.**

To fit the sensor, first slacken the compression nut on the sensor sample tube. Remove the rubber bung from the inlet tube, and put the inlet tube into the compression fitting. Tighten the compression nut - **do not over tighten,** ½ to ¾ of a turn beyond finger tightness is adequate. Finally connect the sensor signal leads to the terminal block - see Fig. 2 and section 3.4 for details.

WARNING - Do not leave an L sensor exposed to oxygen concentrations above 5% connected to the instrument for extended periods as this will cause premature depletion of the sensor. Instead, leave the sensor disconnected or apply a sample of low oxygen concentration. This applies whether the instrument is on or off. When fitting a sensor intended for immediate use at concentrations of 1000ppm or less it is advisable to:

A) have low level gas flowing through the system prior to fitting the sensor.

B) unseal and fit the sensor as fast as possible.

3.7 Alarm contacts

The contacts are rated for signal applications. Where AC voltages are to be switched, the use of suitable snubbers across the contacts is recommended to ensure reasonable contact life. Typical values are 0.047µF to 0.22µF with 47 ohms to 100 ohms in series with the capacitors. **N.B. Mains rated capacitors must be used.**

4.0 COMMISSIONING

4.1 Switching on
When the analyser is fully connected, it may be switched on. When switched on, the analyser automatically enters normal measurement mode. Depending on which sensor is fitted, the analyser may initially indicate a high oxygen reading. After a few minutes the reading will settle to a level dependent on the sample being supplied to the sensor. The analyser is calibrated prior to shipment and may be used immediately. To check calibration see section 5.

4.2 Programming
The user programmable features are accessed by pressing and holding the **Edit** button for approximately 8 seconds when the instrument is in normal measurement mode. Each subsequent momentary press of the **Edit** button scrolls the display through a sequence of adjustable parameters. The order of the sequence is as follows:

% version
Alarm Set point → Alarm Mode → Alarm Hysteresis → Return to measurement mode.

PPM version
Alarm Set point → Alarm Mode → Alarm Hysteresis → Analogue Output top scale value → Return to measurement mode.

ALARM - Set point
This is the first parameter to be displayed when the **Edit** button is pressed and held for eight seconds. The display will show “E xxxx”, and the Alarm LED will flash. “xxxx” is the value of the alarm set point and the flashing LED indicates that it is the alarm set point. To the right of the display a % or ppm symbol is displayed to indicate the units of the value displayed. To change the value of the set point, press the up/down arrows until the display shows the required value. Observe the “%” and “ppm” symbols to ensure the correct setting. When the buttons are first pressed, the value changes slowly and the least significant number can be changed by

giving the buttons a short “click”. If the button is kept depressed the rate accelerates rapidly to enable large changes in value to be achieved quickly. Once the required value is displayed, press the **Edit** button once to store the value in the analyser’s memory. Simultaneously the display will change to show “E x” and the Alarm LED will continue to flash.

ALARM - Mode
The symbol displayed in the “x” position indicates the mode of the alarm as follows;

0 - Alarm off; H - High; L - Low. Press the arrow buttons to change the mode and press the **Edit** button once to store the setting. The display will change to show “EH xx” and the Alarm 1 LED will continue to flash.

ALARM - Hysteresis
The number displayed In the “xx” position indicates the value of the hysteresis for alarm 1. The value is given in percentage of the set-point or alarm level and is variable from zero to 10%. Press the arrow buttons to set the required value and then **Edit** button to store the value. The display will then change to repeat the above sequence for **alarm 2**; indicated by the **alarm 2 LED flashing.**

ANALOGUE OUTPUT - Top scale value (PPM version only)
When the **EDIT** button is pressed following alarm hysteresis entry, the display will show “EPxxxx”, where “xxxx” is the oxygen concentration at which the analogue output (0 to 5v or 4 to 20mA) is at top scale. The alarm LED does not flash. Press the up/down arrow keys to scroll the display through the pre-set values of 200ppm and 2000ppm. Once the required value is selected, press the **Edit** button to store the value and return to measurement mode.

4.3 Applying the sample
Establish a sample flow of between 100 and 300ml/min. The analyser will respond immediately and move towards displaying the concentration of oxygen in the sample. The speed of response

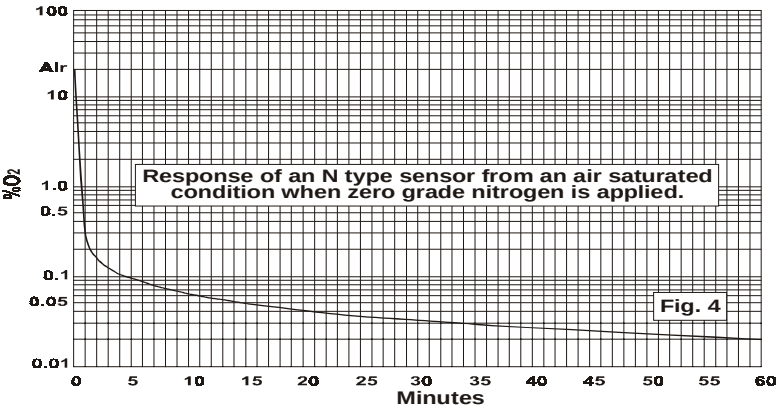
varies according to how far the oxygen concentration in the sample is from the gas in contact with the sensor at start up (usually air). Figs 4 & 5 show the typical response time from an air condition for N and L type sensors. Once the sensor is purged down, it responds in a few seconds to large changes of oxygen concentration within the instrument's span. Short time excursions to high levels of oxygen, such as may be experienced during calibration, are recovered from in a matter of a few minutes.

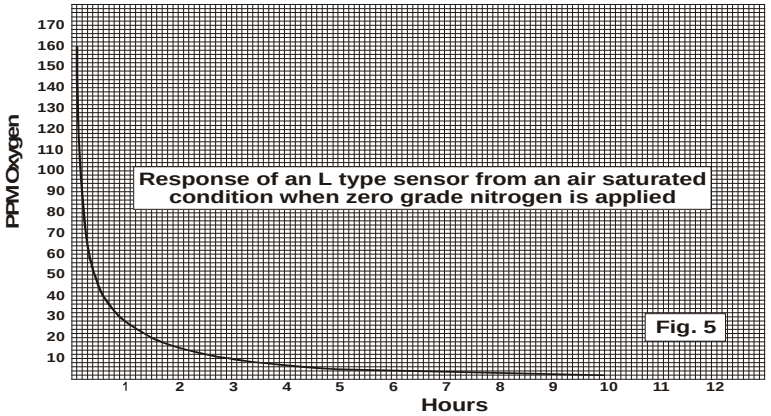
4.4 Sensor failure detection

All types of sensor used on the G1010 fail to a low output or concentration reading.

5.0 MAINTENANCE AND CALIBRATION CHECKS

CAUTION: VARIOUS PROCEDURES ASSOCIATED WITH MAINTENANCE AND CALIBRATION AFFECT THE OUTPUTS OF THE ANALYSER. ANY OF THESE OUTPUTS THAT ARE BEING





USED FOR CONTROL, OR THE ASSOCIATED CONTROL LOOP SHOULD BE DISABLED BEFORE COMMENCING.

5.1 Sensor life

The N sensors have a life of 100,000 oxygen % hours or 18 months - whichever is the sooner; and the L type a life of 16,000 oxygen % hours or 18 months whichever is the sooner. Each sensor is date labelled (see the Storage of the Measuring Sensor section 6.2 for the code) when supplied. This date should be used to establish the expiry date.

5.1.1 Sensor failure modes

All known sensor failure modes result in a loss or lowering of output. Thus applications that look for oxygen depletion are automatically fail safe and vice-versa.

5.2 Calibration interval

It is recommended that the calibration is verified every month. This frequency of verification is for typical industrial applications. When the application is critical, the frequency of verification should be increased in line with local safety standards.

5.3 Calibration gas level

The level of oxygen in the calibration gas depends on the particular model and in particular the type of sensor fitted. In general, for optimum accuracy, it best to calibrate with a gas with the same composition and oxygen concentration as the normal sample. If you calibrate on air, the response time for the sensor to stabilise back to its normal working level after being exposed to air should be taken into account.

Moreover if an air calibration is performed, it should be borne in mind that most air taken from the atmosphere is moist. The normal figure of 20.95% for the oxygen content of air is for dry air. Ambient air contains nearer 20.7% because of dilution effect of the

moisture. It is this figure that should be used when calibrating in this way.

5.4 Calibration of a percent range instrument.

(See section 5.5 for instruments scaled in PPM)

5.4.1 Piping

The piping carrying the calibration gas must not have any leaks, and should have an outlet pipe at least 300mm long to reduce any effect of back diffusion. The flow rate of the gas must be controlled and should be the same as the flow rate of the sample from the process. Also, the pressure at the sample outlet must be the same as that when the analyser is measuring the sample. This avoids any errors due to the pressure at the sensor. Refer to Fig 2 for details of a typical installation.

5.4.2 Calibration method

Isolate the analyser from the process gas and pass the calibration gas through it. A full calibration requires two calibration points referred to as upper and lower, although the lower point can be omitted except when replacing a sensor. Safeguards are built into the instrument to prevent the calibration being set outside of the sensor's operational limits.

It should be noted that it will take time for the calibration gas to flush the previous gas out of any filters etc. upstream of the analyser. This means that the reading will take time to stabilise. Refer to the response graphs (Fig. 5) for guidance on this. When the reading is stable, press and hold the **Calibrate** button for approximately 8 seconds. The display will go blank for a moment and then show "H xxxx"; where H indicates that the high calibration point is selected. Use the up/down arrow buttons to set the reading to that of the calibration gas, and then press the **Edit** button momentarily to reset the calibration. The display will now show "H xxxx", where xxxx is the correct concentration of the test gas. Unless a low level calibration is required, normally done only when a new sensor is fitted, press the **Calibrate** button momentarily to return to measurement mode. To access the low calibration mode, press and hold the **Calibrate** button for 8 seconds. The display will now show "Lxxxx" where "L" indicates that the low

calibration point is selected and "XXXX" is the measured value of the calibration gas. Lower point calibration is performed in the same way as the high calibration, however it may be necessary to allow a longer time for the reading to stabilise.

5.5 Calibration of a ppm range instrument

Piping
See section 3.5 for advice on pipe work etc. If there are regulators in the gas stream they should have a low volume and a metal diaphragm. Most pressure gauges etc. contain cavities that entrain air/oxygen and can take several hours to purge down. For this reason they should be avoided.

Calibration gas level for L sensors
Ideally the calibration gas level should be as near to the normal working concentration as possible. However it is possible to use concentrations up to 5% oxygen in nitrogen. Beyond 5% the sensor begins to deviate from its standard output equation. **N.B. Air may be used for convenience if nothing else is available. In this case, to correct for the deviation from the standard equation, the reading should be set to read 19.4% - NOT 20.9%.**

Calibration method
Isolate the analyser from the process gas and pass the calibration gas through it. It should be noted that it will take time for the calibration gas to flush the previous gas out of any filters etc. upstream of the analyser, which will increase the time taken to stabilise.

WARNING: Care must be taken not to expose a L type sensor to ambient air for more than a few minutes while changing pipes etc. The time taken to purge the sensor down to low ppm levels depends on how much oxygen the sensor has absorbed. If the sensor has only been exposed briefly to air, the purge time will be quite short. If, however, the sensor has been exposed to air for several hours, the purge time may become far longer. See Fig. 5.

5.6 Sensor replacement - overview
Before proceeding identify which sensor is to be replaced, then read and fully understand the following appropriate procedure.

For best accuracy it is necessary to re-calibrate the instrument following a sensor change. The calibration procedure depends on the type of sensor fitted to the instrument. *See sections 5.3 to 5.5 for additional information on calibration before proceeding*.

Each instrument is built to accept a particular type of sensor and for the most part cannot be used with one of a different type.

For instruments fitted with L type sensors it is necessary to reset the sensor zero offset before replacing the sensor as detailed in the following sections. For instruments fitted with N sensors proceed to section 5.7.

5.6.1 Setting zero offset on instruments fitted with an L sensor
The label on the L sensor is marked with the sensor's offset at zero oxygen concentration. The offset figure is given in units of parts per million (PPM) oxygen and is negative; for example (-)3.5PPM. To set the zero offset proceed as follows:

a) Disconnect the signal leads of the old sensor from terminals 1 and 2 of the instrument's terminal block and leave the input open circuit, i.e. with nothing connected to terminals 1 and 2.

b) Apply power to the instrument if it has been disconnected, and allow 2 minutes, or until the reading is steady, for the electronics to stabilise.

c) Press the **Calibrate** button for approximately 8 seconds until the display shows "H xxxx" . Release the button and then press it for another 8 seconds approximately until the display shows "L xxxx". "L" indicates that the lower concentration calibration is selected and xxxx is an oxygen concentration figure; note it probably will have a negative sign in front of it. Next use the up/down arrow buttons to set the display to read the sensor oxygen concentration offset figure

given on the new sensor - note that this a negative figure and it is important that the display is set accordingly. When the correct figure has been set on the display, press the **Edit** button once for approximately 2 seconds and release. This puts the figure into the instrument's memory and the "L" will disappear and instrument will return to ordinary measurement mode. Refer to section 5.7 for details of how to replace and connect the sensor.

5.7 Replacing/Connecting the sensor
Read section 5.6 before proceeding
Before replacing/connecting a sensor please note:

a) **SOME OF THESE PROCESSES ASSUME THAT THE SAMPLE WILL NOT CONSTITUTE ANY SORT OF HAZARD, ASPHYXIATION ETC., IF IT ESCAPES INTO THE ATMOSPHERE. IT IS THE RESPONSIBILITY OF THE USER TO ENSURE THIS. IF A HAZARD WILL RESULT THEN THE METHOD SHOULD BE MODIFIED ACCORDINGLY. CONSULT HITECH OR THEIR REPRESENTATIVES FOR ADVICE IF IN DOUBT.**

b) **That any control loop using the outputs from the unit is disabled.**

5.7.1 General points when replacing a sensor
Disconnect the old sensor's signal leads from terminals 1 and 2 of the connector on the rear of the instrument. Slacken the compression nut on the sensor sample tube and withdraw the old sensor. ***See warning 5.7 a).*** Replacement is the reverse of removal; refer to the following instructions for details of each type of sensor. The instrument does not have to be turned off during this operation, although care should be taken to ensure that any control equipment that is attached is disabled.

5.7.2 Replacing and connecting N and L sensors - N and L sensors are shipped with the leads shorted and the sample tube plugged with a rubber bung. This ensures that the sensor is purged down to low levels and ready to be applied to the measurement of low levels of oxygen (less than 1000ppm) with the minimum of delay. The bung should be left in place until the system is ready

for the sensor to be fitted. If the sensor is to be immediately applied to the measurement of low oxygen concentrations, the sample should be left flowing during the sensor change operation. **The bung should be removed from the sensor and the sensor coupled to the holder as quickly as possible.**

5.8 Gas calibration following replacement
Refer to sections 5.3 to 5.5 for method of calibrating the sensor at higher levels (span).

5.9 Safety and Disposal of old sensors
The sensors contain a 4-molar potassium acetate solution which is corrosive. Normally this solution only leaks out as a result of mechanical damage (crushing or piercing) or by electrical misuse; e.g. by attempting to input an electrical charge. The sensors also contain small amounts of lead, lead oxide, platinum, silver, carbon

and antimony, some of which are toxic and/or mutagenic. If the contents of the sensors come into contact with the skin or other parts of the body, the affected area should be washed with copious amounts of water and medical advice sought.

As the sensors contain some toxic compounds, they must be disposed of according to local waste management requirements and environmental legislation, irrespective of their physical condition. They must not be burnt as they will evolve toxic fumes.

6.0 SPARES AND REPAIRS

6.1 Ordering parts

The replacement sensor is the only user serviceable part. All other parts are designed for a MTBF of 100,000 hours. Should any failure occur, the instrument should be returned to Hitech Instruments Ltd or their local representative for repair. When ordering spare sensors or raising queries on the instrument, it is important that the serial number or job number, is quoted. These numbers are found on the data label on the right-hand side of the instrument.

6.2 Storage of measuring sensor

The oxygen sensors type N and L have a maximum storage life of 6 months if the full usable life is to be realised. Each sensor is dated in manufacture and "storage" starts from that time. The first two digits give the month and the second two the year. i.e. 1086 is October 1986. Ideally the sensor should be stored in a refrigerator and the seal over the sample connector should be intact and undamaged. It is advisable, when the projected replacement date can be anticipated, to order a new sensor from Hitech or their agents one month prior to this date. This ensures that a fresh sensor is available at replacement time.