G810
Oxygen Analyser

Instruction Manual

This Manual Contains Important Health & Safety Information.

G810 OXYGEN ANALYSER HANDBOOK.

1.0 GENERAL DESCRIPTION

The G810 is a truly portable microprocessor controlled oxygen analyser which provides a performance and a range of features without parallel for an analyser of this type and cost. The display autoranges over a very wide span, and a user programmable 0 to 1v analogue output is provided for recording or logging the results.

Two models are available. The version fitted with our E type cell is used for oxygen concentrations up to 100% and in mixtures containing mildly acidic gases. For measurements up to mid percentage concentrations and where superior performance in the higher ppm concentrations is required a model fitted with our N type cell is used.

2.0 SPECIFICATION

Display
Multi digit LCD - character height 12.7mm

Display ranges
1) E type cell - Display range 0.00% to 100.0%. Resolution: 0.1% from 10 to 100%; 0.01% below 10%. Suitable for samples containing mildly acidic gases. e.g. Carbon dioxide, hydrogen sulphide etc.

2) N type cell - Display range 0ppm to 50%. Resolution: 0.1% from 10% to 50%; 0.01% from 0.50% to 9.99%; 10ppm from 500ppm to 4999ppm; 1ppm from 0ppm to 499ppm Minimum usable reading 100ppm

Analogue outputs
0 to 1 volt full scale point is programmable over the following range:

E type cell version: 5% to 100%

N type cell version: 50ppm to 50%

Stability
Better than 2% of full-scale per month

Cell life
E type - up to 5 years
N type - up to 18 months

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

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

Sampling pressure
Pump off: Maximum Inlet pressure 3 bar gauge
Pump on: Minimum inlet pressure Atmospheric

Sample vent pressure
Atmospheric (for quoted accuracy) Cell must not be subjected to rapid pressure changes

Sample temperature
5 to +40 ºC (non condensing)

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 to the ppm concentration of interest.

Sensor cross-sensitivity etc.
'N' type cells:
Acid gases such as CO_2 and SO_2 will cause inaccurate readings and, if applied for more that a brief period, will damage the cell.

Ex-factory the analyser sensor is calibrated assuming a mean molecular weight in the sample gas of 28 (i.e. oxygen in nitrogen mixtures). An error approximately proportional to the inverse square root of the mean molecular weight of the sample gas will occur for other gases.

They are not affected by changes in atmospheric pressure.

'E' type cells
These cells are resistant to mildly acid gases although their concentration should be kept to low % levels.

These are partial pressure sensors, which means they are affected by changes in atmospheric pressure. For example if the analyser was calibrated when the atmospheric pressure was 1000mB, and it then changed to 1050mB it would read high by 5% of reading (e.g. an actual concentration of 20.0% would be displayed as 21.0%). Note that only in extreme situations does the atmospheric pressure vary by more than 10%

Sensor failure mode:-
All known failure modes of cell, including depletion, result in a lowering/loss of signal i.e. low oxygen reading.

Ambient temperature
0 to 40 ºC - continuous
-5 to + 55 ºC - intermittent

Power supply
Nicad rechargeable cell pack. Operating time at least 10 hours with pump off and 6 hours with pump on.

12v vehicle adaptor and mains chargers are provided on all models.

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 COMMISSIONING

3.1 Unpacking and visual checking

Take all normal precautions when opening packages. In particular avoid the use of long bladed cutters. The cell is packed separately from the analyser housing. Check that all pipe connections have captive seal nuts. Search packing if any are missing.

3.2 Service requirements

The instrument is supplied with the batteries in a charged condition. However for maximum usage time it is advised that the user charges the batteries overnight using a mains powered charger or the vehicle adaptor (supplied)

3.3 Switching on

With the analyser fully connected it may be switched on. The %/ppm indicator will illuminate and the display will show briefly the software number and issue. The instrument will then go into measurement mode and display the oxygen concentration seen by the cell. Initially on instruments fitted with a N type cell the display (and voltage output) will indicate high oxygen reading. After a few minutes the meter reading will fall and will settle at the true oxygen content of the sample being supplied to the cell. The E type cell responds immediately.

The instrument is calibrated prior to shipment and may be used immediately. If, however, you wish to check calibration go to section 4.

3.4 Programming the analogue output

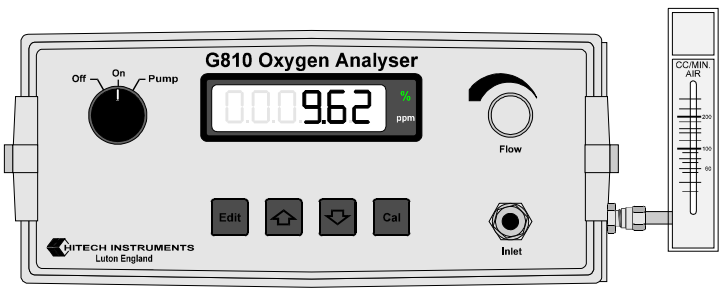
The 0 to 1volt analogue output is programmable. The concentration ranges that it can be set to represent are different for the two models as shown below.

E type cell instruments – between 0/5% and 0/100%

N type cell instruments – between 0/50ppm and 0/50%

To program the output press the **EDIT** button for 8 seconds when in measurement mode (normal mode from switching on) to enter edit mode. Press the **EDIT** key repeatedly until the display shows '**EP**' and the analogue output setting. Alter the value with the **UP** and **DOWN** keys. Once the required value is selected, press the **EDIT** button to store the value and return to measurement mode.

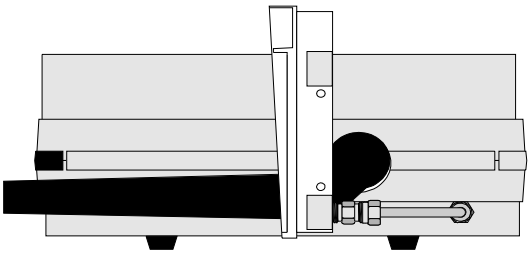
3.5 Sample connections



Flow meter mounting (Front view)

The sample inlet connection is via a captive seal compression connector mounted on the front panel - see illustration. The sample outlet is located on the right hand side of the instrument. A flow meter and connecting tube are supplied for checking the sample flowrate and this should be attached as shown in the illustration.

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.



Flow meter mounting (Side view)

It is particularly important that good pipework connections are made when low levels of oxygen are being measured.

The cell should not be pressurised, nor should it be exposed to rapid pressure changes or a pulsating flow. Rapid pressure changes could damage the cell, while pulsations will give an erratic display.

Connect the sample flow meter as shown in the diagram.

3.6 Turning on the sample

Establish a sample flow of between 100 and 300ml/min by adjusting the flow control valve. If the pressure of the sample is insufficient to provide an adequate flow, then the pump must be switched on. **DO NOT RUN THE PUMP IF THE SAMPLE'S OWN PRESSURE PROVIDES AN ADEQUATE FLOW.** Once the sample flows the instrument should respond immediately and display the concentration of oxygen in the sample after an appropriate response time has elapsed. 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) and the purge volumes of interconnecting pipe work etc..

4.0 MAINTENANCE AND CALIBRATION CHECKS

CAUTION: VARIOUS PROCEDURES ASSOCIATED WITH MAINTENANCE AND CALIBRATION AFFECT THE OUTPUTS OF THE INSTRUMENT. ANY OF THESE OUTPUTS THAT ARE BEING USED FOR CONTROL, OR THE ASSOCIATED CONTROL LOOP SHOULD BE DISABLED BEFORE COMMENCING.

4.1 Cell life

The E type cell has a life expectancy of up to 5 years in ideal conditions - (moist inert gas at 15°C). Typically 2 to 3 years can be expected as a minimum. The N type cells have a life expectancy of 100,000 oxygen % hours or 18 months - whichever is the sooner. Each cell is date labelled (see the Storage of the Measuring Cell section 5.2 for the code) when supplied and it is this date that should be used when establishing expiry date.

4.2 Calibration interval

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

4.3 Calibration gas level

For optimum accuracy it is best to calibrate with a gas the same composition and oxygen concentration as the normal sample, as cylinders of calibration gas can be expensive and inconvenient, it is frequently easier to calibrate on air. If the analyser is fitted with an 'N' type cell (refer to data label of analyser if unsure) then it is important to calibrate on a gas mixture of a similar composition to the sample. This is because of the effect that the mean molecular weight of the sample has on the sensor – see Specification - Cross Sensitivity. If an air calibration is performed then it should be borne in mind that most air taken from the atmosphere is moist. Use the table below to establish the oxygen content of the ambient air and use this figure when calibrating in this way.

Temp °C	20% RH	40% RH	60% RH	80% RH	100% RH
0	20.9% O_2	20.9% O_2	20.9% O_2	20.8% O_2	20.8% O_2
10	20.9% O_2	20.8% O_2	20.8% O_2	20.7% O_2	20.7 % O_2
20	20.9% O_2	20.8% O_2	20.7% O_2	20.6% O_2	20.5% O_2
30	20.8% O_2	20.6% O_2	20.4% O_2	20.2% O_2	20.1% O_2
40	20.6% O_2	20.3% O_2	20.0% O_2	19.7% O_2	19.4% O_2

The rate of flow of the gas should be the same as the flow rate of the sample from the process.

4.4 Calibration method

The calibration method varies slightly depending on the model.

A full calibration for an instrument fitted with a E type cell requires two calibration points referred to as higher and lower, although the lower point can be omitted except when replacing a cell. An instrument fitted with a N type cell only requires a single (higher)

calibration point. Safeguards are built into the instrument to prevent the calibration being set outside of the cell's operational limits.

Apply the span gas and adjust the flow to between 100 and 300ml/min. To calibrate on ambient air, leave the sample inlet unconnected and run the pump. **DO NOT RUN THE PUMP IF THE SPAN GAS IS BEING SUPPLIED FROM A PRESSURE SOURCE SUCH AS A CYLINDER.** When the reading is stable, press and hold the **Calibrate** button for approximately 8 seconds. The display will 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 span gas (20.7% to 20.9% for ambient air depending on its dryness), then press the **Edit** button momentarily to reset the calibration. The display will now show "H xxxx", where xxxx is the concentration set. Unless a low level calibration is required, normally done only when a new cell is fitted, press the **Calibrate** button momentarily to return to measurement mode, shown by the "H" disappearing.

To access the low calibration mode, press and hold the **Calibrate** button for another 8 seconds when in high calibration mode. 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. Introduce a gas of low concentration, typically 1% or less, and allow the reading to stabilise; this can take several minutes depending on the concentration of the gas. Use the up/down arrow keys to set the correct reading then press the **Edit** button momentarily to reset the calibration. The instrument automatically returns to ordinary measurement mode following this key press.

4.5 Cell failure modes

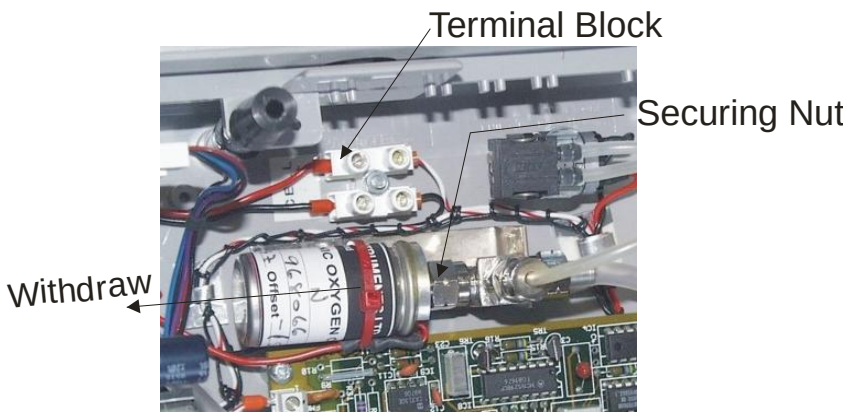
All known cell failure modes result in a loss or lowering of output. Thus applications that look for oxygen depletion are automatically fail safe and vice-versa.

4.6 Cell replacement

'N' type cells are shipped with the leads shorted and the sample tube plugged with a rubber bung. This ensures that the cell is purged down to low levels and ready to be applied to the measurement of low levels of oxygen with the minimum of delay. The bung should be left in place until the system is ready for the cell to be fitted. The cell is mounted inside the case.

Ensure that the analyser is switched off before opening the case. Also disconnect the charger if attached.

Turn the case upside down remove the four fixing bolts. Carefully turn the case the right way up and remove the top half.



Refer to Fig.1 for details of the cell mounting. Remove the leads from the terminal block. Slacken the cell securing nut and withdraw the cell.

Fit the replacement cell and tighten the pipe nut.

Fig. 1

If the new cell is an 'E' type then continue to next section otherwise go to section 4.8

4.7 Calibration following an installation of a new 'E' type cell

Each spare E type cell is supplied with a label that indicates the cell's offset and a short length of wire, the use of which is described later. The offset figure is given in units of percent and is negative; for example (-)0.35%. To set the zero offset, do not connect the cell's leads but connect the length of wire, supplied with the cell, across the cell terminals to form a shorting link on the terminal block. Switch the instrument on and allow 30 seconds for the electronics to stabilise. Press **Calibrate** approximately 8 seconds; the display will change to show an "H" at the left hand side. Release and then press **Calibrate** for another 8 seconds; the display will now show "L xxxx", where 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 cell oxygen concentration offset figure given on the new cell - 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 momentarily to put the figure into the instrument's memory. Press the **Calibrate** button for 1 second and release to return the instrument to ordinary measurement mode.

4.8 Connecting the cell and reassembling the case

Remove any shorting links and connect the cell signal wires to the terminal block. Re-assemble the case.

Note that the analyser must be span calibrated after the cell has been changed. Refer to the calibration section for details.

4.9 Battery Charging

If the battery becomes fully discharged ensure it is re-charged as soon as possible. Two devices are provided for charging the battery. One is suitable for plugging into a vehicle 'cigarette lighter' socket (12v only). The other is suitable for an AC supply of between 100 to 250v at 50/60Hz. The output lead in both cases must be plugged into the 'charging' socket on the rear left side of the instrument. The instrument may be used during charging, but for fastest charging the instrument should be turned 'OFF'.

A completely exhausted battery will take 14 to 16 hours to become fully charged.

5.0 SPARES AND REPAIRS

5.1 Ordering parts

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

5.2 Storage of measuring cell

The E type cells have a maximum useful life of 5 years including any storage time. The oxygen cells N type and L type have a maximum storage life of 6 months if the full usable life is to be realised. Each cell 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 cell should be stored in a refrigerator and the seal over the sample connector should be intact and undamaged. It is advisable, when the replacement date is predictable, to order a new cell from Hitech or their agents one month prior to this date. This ensures that a fresh cell is available at replacement time.

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