G250

Dual Cell Oxygen Analyser

130-0039-6

Instruction Manual

This Manual Contains Important Health & Safety Information.

G250 Dual Cell Oxygen Analyser Operation Handbook

1.0 General Description

The G250 dual-cell oxygen analyser is a high-performance, low-cost instrument for measuring oxygen in concentrations from 25% down to 1 part per million (ppm). It is microprocessor controlled and uses galvanic oxygen cells as the primary elements. Dual cells are used to provide a very fast response from percentage concentrations down to low ppm levels: a unique feature for this type of analyser. The software has been designed very much with the user in mind, making the analyser extremely easy to operate and use while the illuminated graphical screen provides a clear unambiguous display of results and messages.

It is packaged in a portable enclosure equipped with carrying handle. Within the enclosure, in addition to the control electronics, is a sample pump, flow meter and automatic cell selection valves.

Sample conditioning equipment and take-off tubes are also available to cover a wide range of applications.

2.0 S P E C I F I C A T I O N

Display
Dot matrix illuminated LCD displaying 2 or 4 lines of alphanumeric characters depending on mode.

Display Resolution
10% to 25% (xx.x), 0.50 to 9.99% (xx.xx), 20 to 4999ppm (xxxx), 0.0 to 19.9ppm (xx.x)

Output (signal)
4 to 20mA programmable
Max load = 500 ohms
Over-range output = 20.5 to 21 mA

Outputs (alarm)
Two programmable alarms each providing a single set of normally energised volt free changeover contacts. Each alarm can be programmed to operate over the range of the analyser. The hysteresis is also programmable in the units of measurement. Each alarm can be programmed to be Off, High or Low. Relay connection rating 0.5A @ 30V ac/dc - resistive load.

Stability
Better than 2% full-scale/month

Speed of response
Less than 20s for 90% step change for oxygen in nitrogen. The dual cell model is always maintained in a purged-down condition

Sampling connections
¼" compression fittings (will accept 6mm tubing)

Sample pressure
Sample system dependant – refer to data label on rear of analyser.

Sample vent pressure
Atmospheric for optimum cell performance. The maximum vent pressure is 0.1bar above atmospheric. The cells must not be subjected to rapid pressure changes.

Sample temperature
0 to 40°C

Power supply requirements
110 to 120V or 220 to 240V ac, 50/60Hz @ 20VA selectable by switch on rear of analyser. – **ENSURE THAT THE CORRECT VOLTAGE IS SELECTED *BEFORE* APPLYING POWER.**

Ambient temperature (electronic and sensor units)
-15°C to +40°C
+55°C intermittent

Mounting
Free-standing, bench-mount

Dimensions and weight
255mm Wide x 170mm high x 260mm deep. Approximate weight 4kg.

This analyser 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 S I T I N G a n d I N S T A L L A T I O N

3.1 Unpacking and visual checking

Take all normal precautions when opening packages. In particular avoid the use of long bladed cutters.

3.2 Mounting

Chose a site where the temperature does not go above 40º C or below -15º C. Do not subject the analyser to excessive vibration or knocks and jolts.

3.3 Service requirements

A.C. mains - 220/240V AC or 110/120V AC at 20VA – voltage selectable by switch on rear panel – see Fig. 1 below.

3.4 Connections

Refer to Fig. 1

Rear panel of the analyser – Fig. 1

3.4.1 Electrical

The analyser is supplied with an I.E.C. connector which plugs into the mains input connector located on the rear of the instrument. A suitable lead must be attached.

The signal connections are as shown in Fig. 1.

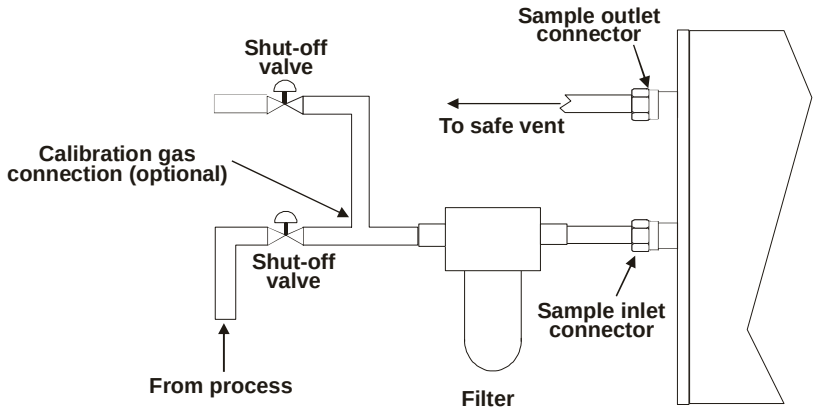
NOTE - The alarm relays are energised in the process normal condition. In all cases “Normal” (NO, NC etc) refers to the process normal condition and NOT the electrical rest position of the relay.

3.4.2 Sample connections

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. Instruments applied to inert gas soldering processes must be fitted with the filter provided to remove condensed flux particles. In all cases the dew-point of the sample must be below the ambient temperature; i.e. components of the sample must not condense within the analyser.

If the analyser is to be installed permanently in a situation then the use of a high quality three way valve on the inlet side is useful in allowing easy connection of a standard gas for calibration checks.

It is particularly important that good pipe-work connections are made when low levels of oxygen are being measured. For measurements below 1000 parts per million (ppm) the pipe-work should be of all metal, or dense plastic such as Nylon, up to the sample inlet. Soft plastics such as P.V.C., P.T.F.E. etc. must be avoided. Valves etc. must be of a good grade. The cells must not be over pressurised, exposed to rapid pressure changes or a pulsating flow. Rapid pressure changes could damage the cell, while pulsations will give an erratic display.



Sample connections

Fig. 2

4.0 U S I N G

The analyser supplied as new is ready for immediate use and requires no calibration.

4.1 Normal operation

When the analyser is switched on the display will show :-

Hitech
Gas Analyser
S/W = xxxx x.x
Initialising

where xxxx is the software number and x.x is its version number.

This display will remain for a few moments while the analyser goes through its initialisation program, after which it will change to **measurement mode** and display the measured values. ***See Section 6 for details of error messages that can be displayed on start-up.***

In measurement mode the display, alarm LED, alarm relays and the 4 to 20mA outputs are continually updated with the latest measured values. If an alarm level is exceeded then the appropriate relay will be de-energised and the associated LED illuminated.

4.2 Controls & Indicators

These are all clearly labelled and self explanatory. The front panel is shown below.

Front Panel of Analyser – Fig. 3

4.3 Flowing the sample

With the instrument powered up, use the sample flow-control valve to establish a sample flow of between 0.3l/min and 1l/min. The use of the higher flows is only useful to reduce the delay of sample transport in the pipes from the process to the analyser. It is only necessary to use the built-in sample pump if the source pressure of the sample is insufficient to provide an adequate flow.

The dual cell configuration gives the analyser a much faster response rate than is usual for its type. It is able to go from air (21%) to below 10ppm in less than 60 seconds. Short time excursions to high levels of oxygen, such as may be experienced during calibration, are recovered from in a matter of a few tens of seconds.

4.4 Keyboard.

The functions of the buttons are explained in detail in the relevant sections of this manual

4.5 Alarm indicators

The two red indicators are on when the alarm is active and off when the alarm is "normal". **NOTE - In all cases "Normal" (NO, NC etc) refers to the process normal condition and NOT the electrical rest position of the relay.**

4.6 Modes

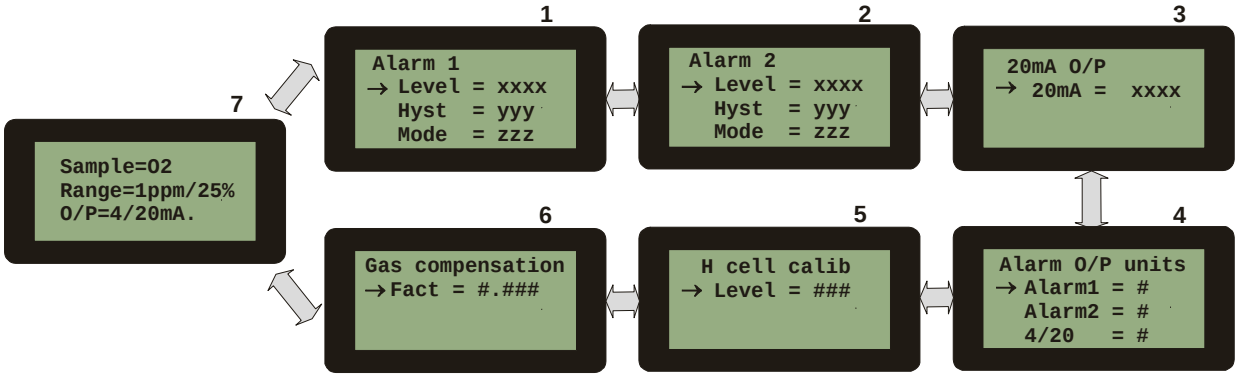
4.6.1 Measurement mode

This is the default mode of the analyser and is automatically entered when it is switched on. In this mode the results are displayed and all outputs are active.

4.6.2 View Mode

This mode is entered by pressing the **View** button from **measurement mode** and gives access to the instrument's configuration screens where the parameters can be altered - see **Edit mode** section. The screens available are shown in the following diagram. xxxx, yyy, zzz and # are the changeable parameters.

Some screens have an arrow pointer on the left-hand side which indicates which line may be edited. The ↑ and ↓ buttons are used to move the arrow to the appropriate line. Scrolling downwards from the bottom line moves the display onto the next screen. Similarly scrolling upwards from the top line moves the display to the previous screen. The view mode may be exited at any time by pressing the **View** button.



4.6.3 Edit Mode

Warning - *Entering this mode causes the alarm and analogue outputs to be held at whatever value or state they were in when the mode was entered. A warning screen is displayed, and care should be taken to ensure that any external control systems will not be affected by this.*

The **Edit Mode** is used to set the user defined parameters of the analyser. The range of these parameters will depend on the particular model as detailed in the list below.

Alarm 1 & 2 - Level, Hysteresis
Alarm 1 & 2 - Units of measurement
Analogue output - 20mA concentration equivalent
Analogue output - 20mA units of concentration
Span gas (H or L cell calib) – Concentration (Level)
Gas compensation (Sample mean molecular weight) - Specialist units where the background gas is not nitrogen.

To use **edit mode** point the arrow under **view mode** at the parameter that requires changing and press the **Edit** button.

When in **Edit** button is first pressed the following screen is displayed.

Pressing **View** returns the display to the previous screen. Pressing **Edit** selects Edit mode and puts the outputs on hold. If Edit mode is entered then the screen shown in view mode is re-displayed but with a flashing block cursor over the parameter to be altered.

The ↑ and ↓ buttons increment or decrement the digit or change the parameter. Once a digit is correct the next digit is selected by pressing the **Edit** button and so on until the final digit. To skip a digit, press the edit key twice. When the **Edit** button is pressed on the final digit the display will show **"Storing Data"** momentarily and then return to view mode, displaying the new parameters. Alternatively once the entry is correct pressing the **VIEW** button will cause the value entered to be stored and return to the viewing screen. On returning to view mode, measurement mode will continue in the background so that any changes made during editing will be reflected in the outputs.

Note: The maximum hysteresis that can be set is 5% or 250ppm, depending on the units used for the alarm. It is important when setting the hysteresis to take into account the alarm level to ensure that the point at which the alarm will reset is not outside of the operating range of the analyser.

The following is a summary of the function of the buttons when in edit mode.

↑ –increments the digit under the cursor
↓ –decrements the digit " " "
View –stores value - returns to view mode
Edit –advances to the next digit, or stores the entry if the last digit has been changed. The cursor is then switched off - see above.

4.6.4 Calibration Mode - See next section

5.0 C A L I B R A T I O N

SAFETY NOTE - *Ensure that any control loops that are connected to the analyser are disabled prior to verifying or calibrating the analyser. Also ensure that the process is in a safe state and the exhaust of the standard gas is vented to a safe area.* ***The analogue output and alarm states are "frozen" while the analyser is being calibrated.***

Before proceeding with a calibration or verification it is important that this section is fully understood before proceeding.

5.1 General

It is recommended that the calibration of the analyser is verified every month against a calibration gas or gases.

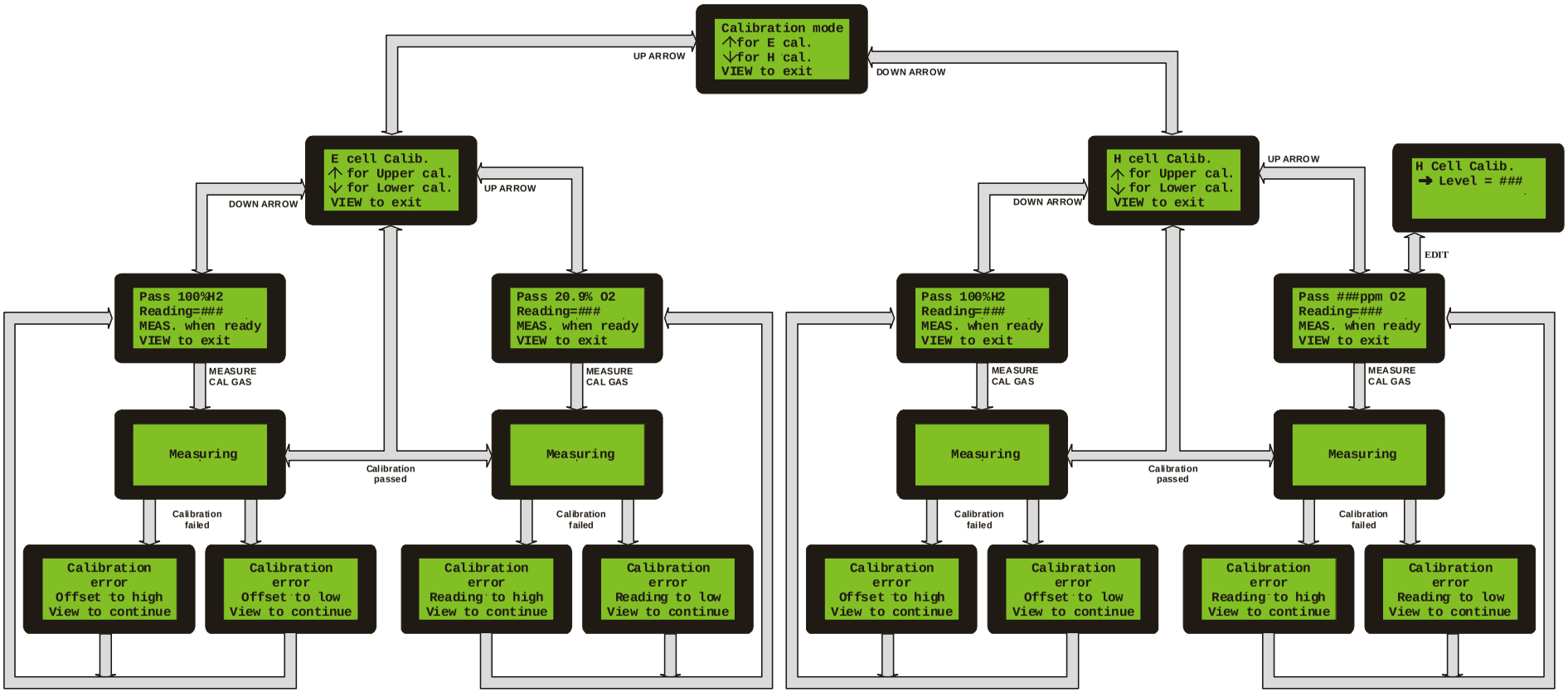
Standard models are configured for samples of oxygen in nitrogen or hydrogen and only gases of this composition will give the correct results. Certain analysers are configured for other background gases and screen 6 in **View** mode (see section 5) gives details of the background gas that the analyser is configured for. (Some specialist models allow the user to program the in the type of background gas).

The analysers have two measurement cells; one for high levels of oxygen (above approximately 2000ppm) and another for low levels of oxygen (below 2000ppm). A full gas calibration requires three calibration gases: 1) air - to span the high level cell. 2) a span gas containing between 50ppm and 1000ppm oxygen for the low level cell. 3) A zero gas for lower cal – common to both cells. The low calibration need only be performed once following a cell change. When it is necessary to perform a low calibration this should be done before the span calibration. Before a calibration is performed it is necessary to enter the span gas concentration being used. This can be done in **Edit Mode** (preferable) - see section 5, or from **Calibration Mode** - see further on in this section. Note that the air point (20.9%) used to span calibrate the high level cell is not editable.

It is important to use the correct equipment when calibrating at low levels of oxygen, particularly in the low ppm region. All pipe work must be in metal, and regulators etc. on cylinders of test gas must be of the low volume variety with metal diaphragms. Failure to observe these requirements will result in extended settling times or inaccurate calibration.

Because the outputs of some of the measurement cells are affected by the density of the gas mixture it is necessary to make allowances for that. For models designed to measure oxygen in hydrogen, it is necessary to perform a span calibration using oxygen in nitrogen mixtures because oxygen in hydrogen mixtures are much more difficult to obtain. The factor entered on configuration screen 6 is a factor which appears on the body of the ‘H’ type cell. On new analysers this factor is already entered. Only when a replacement cell is fitted need it be changed.

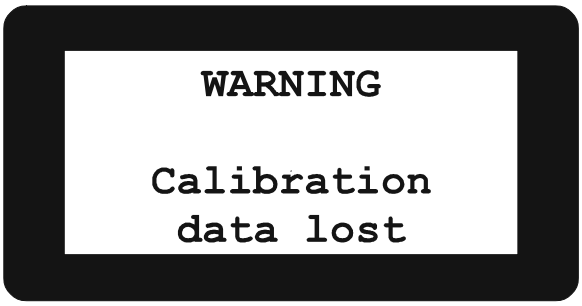
The following diagram illustrates the process for gas calibration. To enter **Calibration Mode** press the **Cal** button when in measurement mode for approximately 8 seconds. Pressing **View** returns the analyser to **Measurement Mode.**



Calibration Menu for Analysers Fitted with 'E' and 'H' Type Cells

6.0 RESETTING and ERROR MESSAGES

A high degree of self-checking is built into the instruments. If the instruments memory is corrupted, due to excessive external electrical noise etc., the following screen is displayed.



Under these circumstances the analyser does not enter measurement mode but goes immediately to **view mode** (Alarm 1 screen) so that the parameters can be set as appropriate. On leaving **view mode** the analyser goes straight to **calibration mode** as a prompt to re-calibrate the analyser. Calibration should be performed, but if for any reason this is not possible, then **calibration mode** can be exited and the analyser will operate using the built-in default values. From this point the analyser will continue to use the default calibration values, without any warning, until it is re-calibrated.

7.0 S E R V I C I N G

7.1 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 analyser should be returned to Hitech Instruments Ltd or their local agents for repair. When ordering spare cells, or raising queries on the analyser, it is important that the serial number is quoted. This number may be found on the data label on the case of the analyser.

7.2 Storage of measuring cell

It is advisable not to store the N, L and H types of oxygen cell for more than 6 months if the full service 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. 1005 is October 2005. Ideally all cells 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.

7.3 Cell life

In situations where high oxygen content constitutes a hazardous condition, then the cell should be replaced every twelve months, whether it calibrates or not.

7.4 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.

7.5 Cell replacement

7.5.1 Overview

Remove the analyser's top cover by unscrewing the four retaining screws and carefully lifting it off.

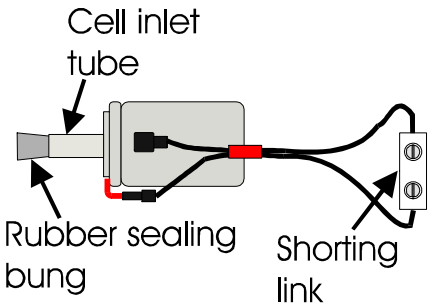
Inside rear panel (Cover removed) Fig. 4

Before proceeding with changing a cell, identify which one is being replaced, then read and fully understand the appropriate procedure given in the sections that follow.

For best accuracy it is necessary to re-calibrate the instrument following a cell change.

7.5.2 Cell installation

The illustration shows how 'N', 'L' and 'H' type cells are supplied as spares They are shipped with their 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 (less than 1000ppm) with the minimum of delay. The bung should be left in place until the system is ready for the cell to be fitted. . 'E' type cells are supplied unplugged and with their leads open circuit and must be kept that way.



Cell before installation

To shorten the purge time following the fitting of a low level cell it is strongly recommended that zero grade nitrogen is flowing through the analyser during cell installation. **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.**

Prior to removing the old cell, disconnect its signal leads and establish a 0.5l/min (minimum) flow of nitrogen. Allow the gas to flow for approximately 60 seconds to ensure the analyser is purged.

Slacken the cell coupling nut and with a spanner and withdraw the old cell. ***This next operation should be carried out as rapidly as possible*.** Remove the rubber bung from the cell's inlet tube and couple the cell to the holder immediately by putting the inlet tube into the compression fitting and tightening the compression nut - do not over tighten, ½ to ¾ of a turn beyond finger tightness is all that is required. Finally connect the cell signal leads to the appropriate terminal block; the red leads to the terminals marked "+" and the black leads to the terminal marked "-". Note this will cause the measured reading to fluctuate and possibly show high values for about 5 minutes until the cells stabilise.

Following the fitting of a new low level cell, reliable measurements below 100ppm can only be made after the cell has been allowed to purge down for several hours. This is best done by turning the instrument off and allowing the cell to self purge overnight (approximately 12 hours). Alternatively, passing zero grade nitrogen through the instrument will decrease the time to approximately 4 hours. The flow of the nitrogen purge can be 0.2l/min or less.

Once the low level cell is purged down to low levels its exposure to high levels of concentration is automatically prevented; measurements from air down to sub 10ppm of oxygen may be made in less than 60 seconds.

Replacement of the high level cell does not require nitrogen to be flowed.

7.6 Gas calibration following replacement

The analyser must always be calibrated following cell replacement. Refer to section 5.

Contact Hitech direct at the address below or your local agent with any queries.

HITECH INSTRUMENTS LTD, 20 TITAN COURT, LAPORTE WAY, LUTON, BEDS, ENGLAND, LU4 8EF
Telephone: (+44) (0)1582 456900 Telefax: (+44) (0)1582 400901