

Operating Manual

Infra-Red Landfill Gas Analyser (Model GA 94A)

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The information in this manual correct at the time of generating this manual. We do, however, reserve the right to alter the information without prior notice as a result of continuing development.

Important Notes

Hazardous Area Classification

The GA 94A Gas Analyser has been certified by BASEEFA to Hazardous Area Classification EEx ible IIB T3.

It is vital the instructions in this manual are followed closely.

The instrument must only be used in hazardous areas to which the classification is suited – refer British Standard BS5345.

It is the responsibility of the operator to determine the protection concept and classification required for a particular application.

Safe Area - Definition

A safe area is one where there is no requirement for Hazardous Area Certified Equipment.

Servicing

The Gas Analyser must be serviced by Geotechnical Instruments (UK) Ltd. Or approved agents, otherwise the safety Classification could be invalid.

Exhaust Port

When the Gas Analyser is in use, ensure the exhaust port is clear and unblocked at all times.

If the exhaust port is blocked while the Gas Analyser pump is running, or the analyser is being checked for accuracy with a regulated gas supply, the analyser could become over-pressurised.

Such over-pressurisation could lead to damage of internal components, which in turn might result in a build up of gas within the case of the analyser.

If this happens, the safety integrity of the analyser could become compromised.

Handling

Although the infra-red gas analyser is housed in a rugged environmentally sealed case, it must be noted that it is an advanced scientific instrument and should be treated as such.

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NOTE - Information regarding the data download function is specified in the operating instructions for the download software, not in this manual.

Introduction – General

The GA 94 Infra-Red Gas Analyser has been designed to –

- Measure and store data for concentrations of methane, carbon dioxide and oxygen
- Measure and store data for barometric pressure and the Relative Pressure in a gas extraction systems
- Measure and store data for gas temperature (via a temperature probe or manual entry)
- Store information for monitoring well water/leachate level
- Store sets of readings and provide identity codes for each set (approximately 650, dependent up on software version)
- Download readings to a PC via an interface cable
- Perform as an independent data logger
- Allow easy and quick auto-zeroing of the methane channel before reading
- Incorporate a user span calibration facility to improve accuracy of all three gas channels (this facility is covered by a separate publication)
- To be environmentally sealed and capable of use in variable weather conditions

The analyser is also fitted with an automatic power-off device in order to conserve power. Thus if no key is pressed for 15minutes the analyser will automatically switch itself off (no stored readings will be lost).

The analyser is usually supplied complete with the following accessories -

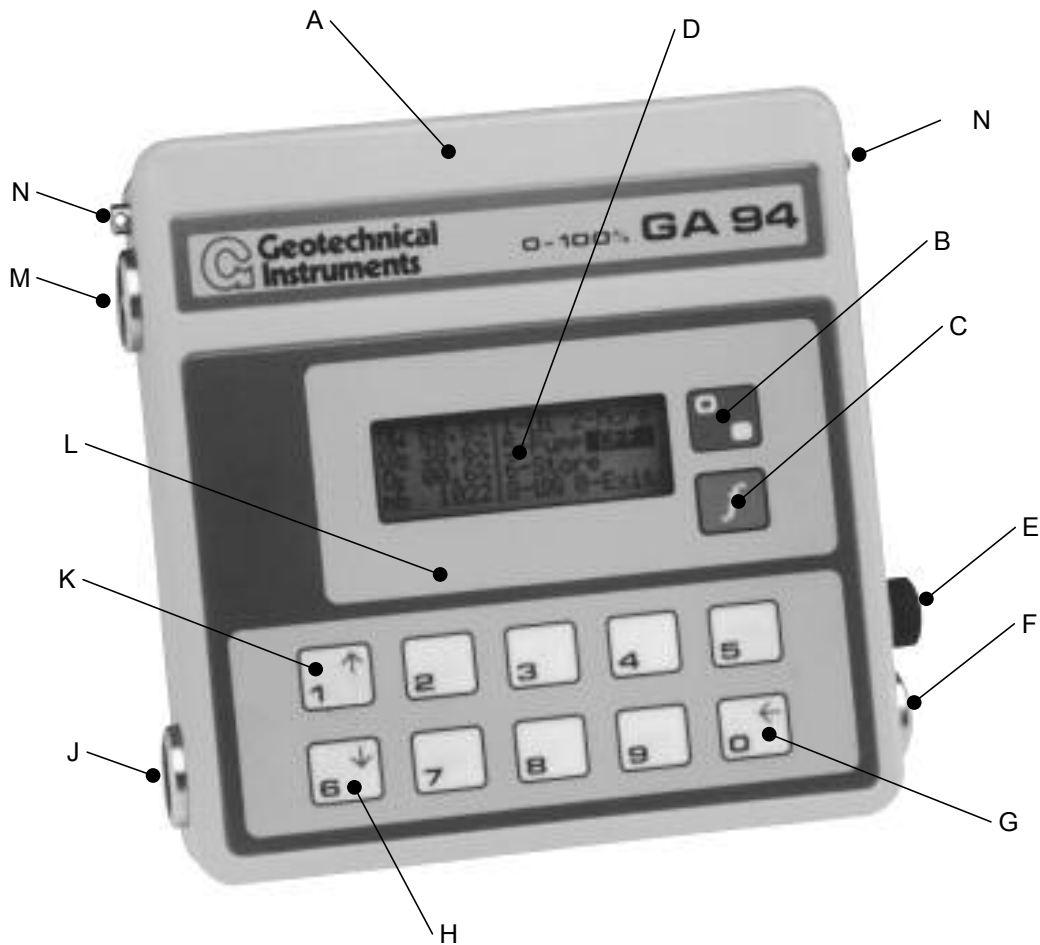
- Carrying strap
- Sampling probe
- 1m of sampling tube
- In line water trap with spare filter
- Spare inlet port filter
- Allen key - required for inlet port access
- Battery charger and lead
- Operating manual
- Calibration certificate
- Verification certificate

Optional accessories -

- | | |
|---|---------------------|
| • PC Communications software and RS232 lead | Order Code
GA2.6 |
| • Soft carrying case | GA3.1 |
| • Temperature probe | GA3.5 |
| • Check gas canisters of pre-mixed gas concentrations | GA3.2/3.3 |
| • Check gas canister control valve | GA3.4 |
| • Printer | GA2.5 |

Please contact Geotechnical Instruments (UK) Ltd., or your distributor for availability and up-to-date prices and information.

Introduction – Instrument Layout



Infra-Red Landfill Gas Analyser

- A – Outer Case
- B – On/Off key
- C – Function key
- D – LCD
- E – 7 pin communications, charging and temperature probe socket
- F – Exhaust port
- G – Exit key – press once. Rubout key – keep pressed
- H – Cursor down
- J – Barometric pressure and Relative Pressure reading port
- K – Cursor up
- L – Membrane panel
- M – Inlet port and replaceable filter
- N – Carrying strap attachment

Specification

Technical Specification

Electronics

Power Supply	2.8AH Nickel Cadmium rechargeable batteries
Battery Life (Full Charge)	9hours without pump running (typical) 6hours with pump running (typical)
Battery Charge Method	separate mains voltage charger
Charge Rate	225mA maximum
Battery Life	500 charge cycles minimum
Communications	RS232 via special adapter
Umax IN	18V DC
Umax OUT	6V DC
Imax IN	225mA
Imax OUT	14mA
Arithmetic Calculations	in metric units

Environment

Operating Temperature	0°C To +40°C
BASEEFA Certified Temperature	-20°C To +40°C
Relative Humidity	0-100% non condensing
Case Sealing	splash proof

Ranges

Methane	0-100%
Carbon Dioxide	0-50%
Oxygen	0-21%
Atmospheric Pressure Range	±256mbar from calibration pressure
Relative Pressure Range	±256mbar from calibration pressure *1
External Temperature	-10°C To +100°C *2
Water Depth	00.01m To 99.99m
Visual/Audible Alarms	any value 0.01% to 99.9%

*1 BASEEFA Approval for relative vacuum only

*2 BASEEFA Approval for maximum +40°C

Typical Accuracy

Gas	0 - 5% Vol.	5% - 15% Vol.	15%- FS
Methane	±0.5%	±1.0%	±3.0%
Carbon Dioxide	±0.5%	±1.0%	±3.0%
Oxygen	±1.0%	±1.0%	±1.0%

Atmospheric Pressure	±5mbar
Temperature	±0.2°C (± probe accuracy)
Water Depth	manual entry to 0.01m

Infra-red Characteristics

Residual Coefficient	0%-5%	$\pm 0.01\%$ / °C
	5%-15%	$\pm 0.03\%$ / °C
	15%-FS	$\pm 0.10\%$ / °C
	Zero Offset	$\pm 0.01\%$ / °C
Quantitisation		$\pm 0.1\%$ volume at all points
CH ₄ Gas Temperature Correction		not compensated
CO ₂ Gas Temperature Correction		coefficients calculated at 30% gas volume

Physical

Weight	2.1kg
Size (Excluding Fittings)	H 227mm, W 226mm, D 51mm
Case Material	ABS
Moisture Filter	integral fibre
Water Trap	external PTFE filter

Pump Characteristics

Typical Flow	300 cc/Minute
Flow Fail Point	100 cc/Minute (Approx.)
Flow At 200mBar Vacuum	150 cc/Minute (Typical)
Vacuum Pull	400mbar (Typical)

Cross Gas Effects**General**

The Methane and Carbon Dioxide channels are tuned to an infra-red absorption frequency relevant to the gases and the infra-red sensors will not be "poisoned" by other gases.

Methane

The Methane channel can be affected by other hydrocarbon gasses present within the sample (e.g. ethane, propane, butane, etc.), although the extent to which the reading is affected depends upon the concentration of the methane in the sample and the concentration of the other hydrocarbons. The effect is non-linear and difficult to predict.

Higher order hydrocarbon gases are not usually found on landfill sites (only a few instances have ever been reported to us).

Carbon Dioxide

The carbon dioxide channel should not be affected by any other gases usually found on landfill sites.

Note - there has been one reported instance of a high reading being obtained due to the presence of Carbon Disulphide, which has a similar absorption frequency to Carbon Dioxide.

Oxygen

The oxygen sensor is a newly developed galvanic cell type and suffers virtually no influence from CO₂, CO, H₂S, NO₂, SO₂ or H₂, unlike many other types of oxygen cell.

Maintenance

Operating Manual

Although the infra-red gas analyser is very easy to use, we strongly recommend that this operating manual is read prior to use.

Servicing

Your analyser has been electronically and functionally tested before despatch. In order to keep it in perfect working order we recommend it is returned to Geotechnical Instruments (UK) Ltd. at six monthly intervals for routine servicing, maintenance and calibration.

Cleaning

The analyser may be cleaned in a safe area using a damp cloth.

Sunlight

The analyser should not be left out in direct sunlight for long periods as this may damage the components inside.

Protective Dustcaps

Always replace the protective dustcaps in the sockets and on any leads after use.

Replaceable Filters

It is important the replaceable filters are regularly changed. They should be checked and if necessary replaced—

- If the aspirator pump has difficulty in drawing a sample gas into the analyser (indicated by an intermittent warning note and a flow fail message).
- If the filter has been allowed to become wet (also maybe indicated by an audible warning note and flow fail indicator).

The filter is changed as follows—

Inlet Port

- Remove the sampling tube from the analyser by carefully removing the inlet nozzle.
- The filter inlet nozzle is removed by using an Allen key to unscrew the inlet nozzle. When the nozzle is removed, the old filter will be attached to the rear of the nozzle. This filter can be removed by hand.
- Carefully locate a new filter onto the rear of the nozzle, ensuring it is firmly located. Carefully reposition the nozzle, ensuring the sealing O'ring is in place, in the nozzle housing and tighten using the Allen key.

Water Trap

- Remove the sampling tube from the analyser by carefully removing the inlet nozzle.
- Holding the two halves of the in-line water trap housing, one in each hand, unscrew the halves. The filter will be located in one half, remove the contaminated filter and ensuring the O'ring is in place replace with a new one - do not re-use the filters by drying out. only Geotechnical Instruments filters are to be used.
- Ensuring the housing O'ring is in place, screw the two halves together.

It is important that only Geotechnical Instruments replacement filters are used as performance and safety may be at risk.

Spare Parts

The following are user serviceable spare parts -

	Order Code
Inlet port filters - pack of 10	GA2.1
In-line water trap elements - pack of 5	GA2.2
Sampling tube	GA2.3
Sampling probe	GA2.4
Battery sticks	GAA1.2

There are not user serviceable components within the Gas Analyser.

Please contact Geotechnical Instruments (UK) Ltd., or your distributor for availability and up-to-date prices and information.

Storage

If the analyser is to be stored for a long period, the internal batteries should be fully charged prior to storage and every month during storage. **Failure to do this may cause the analyser not to switch on for several days after it is given a charge when taken from storage.**

Battery Charging

Important Notes -

The battery charging operation must only be carried out in a safe area.

It must only be charged with the Geotechnical Instruments Battery.

It is important that the battery is not overcharged, as this could result in damage to one or more of the cells.

The internal battery of the infra-red gas analyser is comprised of a series of Nickel-Cadmium cells with a maximum output of 7.2volts DC.

There is a linear relationship between battery capacity used and the required charging time. Reference to section 1.7, of this manual shows how to determine the available battery capacity. The following table should be used as a guide –

Available Capacity	Charging Time-to bring up to full capacity
100%	0 hours
75%	5
50%	8
25%	12
0%	16

Battery Capacity

To restore the battery to full capacity, totally discharge the battery and charge for a full 16hour period. If the analyser is repeatedly given small top-up charges, or if it is only used infrequently, the battery capacity will be reduced. This process should be carried out as often as possible.

Battery Charger

The battery charger is fitted with a single light. When this light is on it indicates that the battery charger is connected and receiving mains power.

Battery Low Indication

A small battery shaped symbol will be displayed in the top right corner of the Analyser when the battery charge level has reached a pre-determined level. When displayed the analyser must be fully charged as soon as possible.

Battery Low Shut-Off

A circuit within the gas analyser continuously monitors the battery voltage. If the battery voltage falls below a pre-determined level the analyser will automatically shut itself off in order to prevent memory loss. If the analyser shuts itself off due to the battery being very low, a full charge of 16hours is required to return the battery to its maximum level.

Automatic Power-Off

The is fitted with an automatic power-off device in order to conserve power. Thus if no key is pressed for 15minutes the analyser will automatically switch itself off. This does not apply if the analyser is in the Data Logging mode.

Battery Stick Replacement

Ensure the analyser is switched off.

With the instrument face down (on soft surface to protect fascia) unscrew and remove the three screws retaining the small compartment cover on the back of the analyser.

If fitted note the position of the small plastic half-moon sections, these must be replaced after the new sticks have been fitted. These will be located at the spring terminal end.

Using the 'ribbon' fitted to the sticks, remove the battery sticks from the analyser.

Fit the new battery sticks by way of compressing the appropriate terminal against the spring and fitting in to the compartment. Once released the spring will compress the stick against the opposite terminal. If originally fitted, re-fit the small plastic half-moon sections, these are to be located at the spring terminal end of the stick.

IMPORTANT NOTE - ENSURE THE STICK ORIENTATION IS CORRECT BEFORE FITTING

Product Assistance

If for any reason you experience known problems with your analyser you should always contact Geotechnical Instruments (UK) Ltd., or your authorised distributor.

Work should not be carried out on the analyser as this will invalidate the warranty and may negate the analysers intrinsic safety rating.

Cold Start

In cases where the memory of the analyser is corrupt, or advised by Geotechnical Instruments (UK) Ltd., or an authorised distributor a 'cold start' may rectify the instrument.

When carrying out a 'cold start' it MUST always be remembered that this WILL totally clear the memory of the analyser, including - all stored readings, all stored IDs and user calibration data. Therefore the user calibration functions may require carrying out after a 'cold start'. A 'cold start' should be carried out as follows-

Whilst pressing and holding down key 3, switch the instrument on and the following will be displayed -

Cold Start
Press 1 to continue
Any key to exit

If key 1 is pressed at this point the 'cold start' will be carried out. Once completed, taking 1-2 seconds, the instrument will return to normal operation and the main screen will be displayed.

Software Version

For assistance purposes, it may be requested that the software version installed in the analyser is advised. This may be obtained as follows-

Whilst pressing and holding down key 1 switch the instrument, the following will be displayed -

System.
Mk2c v2.41 20/02/98
Code.
IRSYS4.16 27/01/98

This information will be displayed as long as key 1 is pressed and for a few seconds if released. If key 1 is released as soon as this information is displayed, it will only be displayed for a few seconds, at which time the analyser will automatically return to normal operation.

Serial Number

If for any reason (label removed) the serial number of the analyser is not known, this may be displayed via the instrument and obtained as follows-

Whilst pressing and holding down key 7 switch the instrument, the following will be displayed -

Readout Identifier = G3217
--

This information will be displayed as long as key 7 is pressed and for a few seconds if released. If key 7 is released as soon as this information is displayed, it will only be displayed for a few seconds, at which time the analyser will automatically return to normal operation.

Starting Up

Switching On/Off

The analyser is switched on and off by briefly pressing the **red on/off** key.

The following screen will appear, informing the user the analyser is covered, or not, by the lifetime guarantee scheme offered by Geotechnical Instruments. This display will also show the next service due date, even if the analyser is not covered by the lifetime guarantee scheme.

**This Analyser has a
 Lifetime Guarantee
 Next Service Due:-
 01/08/00**

After approximately 5 seconds, this screen will be replaced by the title display –

**Geotechnical
 Instruments (UK) Ltd
 GA94A Gas Analyser
 0-Exit**

Contrast Adjustment

At this point the Display Contrast can be adjusted as follows: -

Press **↑** key to increase contrast and **↓** key to decrease contrast.

When the desired level of contrast has been selected press key 0-Exit to continue. When key 0 is pressed, the Main Menu will be displayed.

**1-General Utilities
 2-Read Gas Levels
 3-View/Print Data
 4-Download Data**

Note - The new contrast setting will not stored and therefore may require re-setting when the Analyser is next switched on.

Main Menu

The main purposes of each of the options are as follows: -

1-General Utilities

This option allows the operator to –

- Set the internal clock.
- Change the units of measurements – USA or metric.
- Set alarm levels
- Check that there is sufficient storage capacity available in memory.
- Calibration – Zero the methane and oxygen channel. Span calibrate the methane, carbon dioxide and oxygen channel. Return to the factory settings.
- View, edit, delete and enter identity codes.
- Check the charge and state of the internal battery.

With regard to the calibration options it is recommended that only trained personnel with the necessary equipment attempt these operations. The methane channel can be zeroed without equipment and this operation should be performed before taking readings at each use.

2-Read Gas Levels

Allows the operator to obtain and store readings of gas concentrations, relative pressure, temperature and borehole water depth. Also allows control of data logging functions.

3-View/Print Data

Allows scanning of all readings stored in memory and also enables hard copies to be printed (in a safe area).

4-Download Data

Enables stored readings to be downloaded to any IBM or compatible computer for archiving and processing.

General Utilities

This part of the manual describes how to enter pre-set information which will be stored in the memory of the gas analyser. It also indicates how to check the status of the battery and the memory. From the **Main Menu**

<p>1-General Utilities 2-Read Gas Levels 3-View/Print Data 4-Download Data</p>

Press key **1-General Utilities** to reveal the first part of the General Utilities Menu –

<p>1-Check Time/Date 2-USA/Metric Units 3-Gas Alarms 9-More 0-Exit</p>

Pressing key **9-More** will reveal the second part of the General Utilities Menu –

<p>4-Memory 9-Back 5-Calibration 6-ID Maintenance 7-Battery 0-Exit</p>

From this screen, pressing **9-Back** will display the first part of the menu.

Pressing **0-Exit** at any time from first part of the **General Utilities** menu, the **Main Menu** will be displayed.

Check Time/Date

The gas analyser contains a real time clock and calendar which are powered by an internal battery pack.

The time and date will be automatically with each reading stored. Both clock and calendar are pre-set to UK time during manufacture. It is advisable to check the settings prior to use to ensure they correspond with local time. To do this –

From the first part of the **General Utilities Menu**, press **1-Check Time/Date**. The current time and date will be displayed–

```

16:44.34 20/08/00

1-Set Time/Date
0-Exit
    
```

If the time and date are correct pressing **0-Exit** to return the General Utilities menu.

If they require setting, press key **1-Set Time/Date**. The following screen will appear

```

?h:mm.ss dd/mm/yy

Enter New Time/Date
    
```

The new time and date should now be entered - **Hours:Minutes.Seconds Days/Months/Year** - Use two digits for each part of the entry (e.g. **08=August**) and make use of the **rubout key (depress and hold key 0)** to correct any errors.

When the correct time/date has been entered, the message **0-Exit** will appear on the screen -

```

17:44.00 20/08/00

Enter New Time/Date
0-Exit
    
```

Now press key **0-Exit** and the message **Time/Date Set OK!** will briefly be displayed, prior to the first part of the **General Utilities Menu** being redisplayed.

If an attempt is made to enter an impossible time/date, it will not be accepted and the complete entry must be re-started.

USA/Metric Units

This facility allows the operator to change the units of atmospheric pressure measurement, displayed by the gas analyser.

From the first part of the menu, select **2-USA/Metric Units**. The following screen will be displayed–

<p>Measurement Units Set to Metric 1-Change to USA Std 0-Exit</p>
--

This screen displays the current units of measurements used by the gas analyser - in this case metric. By pressing **1-Change to USA Std** the units of measurement are changed to USA standard units and the following screen will be displayed–

<p>Measurement Units Set to USA Std 1-Change to Metric 0-Exit</p>
--

This table shows the different units of measurement available for the UK and USA settings –

	Metric	USA Std
Barometric Pressure	mbar	“Hg
Relative Pressure	mbar	“H ₂ O
Temperature	Centigrade	Fahrenheit
Depth	Meters	Feet

Note - when the measurement units are set to metric both barometric and relative readings are in millibar.

Pressing **1-Change to Metric** will change the units of measurement back to metric units.

To return to the first part of the menu, press **0-Exit**.

Gas Alarms

The gas analyser can warn the operator if a gas sample contains concentrations of Methane or Carbon Dioxide **above** preset levels, or Oxygen **below** preset levels.

Selecting **3-Gas Alarms** from the first part of the **General Utilities Menu** the following will be displayed –

1-Methane	00.5%
2-CarbonDioxide	00.5%
3-Oxygen	18.0%
1/2/3-Change	0-Exit

This screen displays the present gas alarm levels. If a gas sample contains a concentration of Methane or Carbon Dioxide above, or Oxygen below any of these values an intermittent warning note will be emitted and the relevant gas abbreviation display will flash in Read Gas Levels mode. The warning note will cease when concentrations fall outside alarm levels. If the alarm levels are satisfactory, pressing **0-Exit** will return the operator to the general utilities menu.

To change any of the existing alarm levels –

Select **1-Methane**, **2-CarbonDioxide** or **3-Oxygen**. For example, **1-Mathane** is selected, the following screen will appear.

CH4 Level is 00.5%
Level Required ? . %
Enter Level

Enter the new level required as prompted by the question mark. The rubout key may be used to correct any mistakes. The new level must be entered in the format required.

When the new level has been correctly entered, the screen will change to –

CH4 Level is 00.5%
Level Required 01.0%
Enter Level 0-Exit

Press **0-Exit** to return gas alarm selection listing.

Any of the alarm levels may be altered at in this manner.

Memory - Status and Clearing

This section describes how to check the available free space in the memory and also how to clear the memory, thus allowing new readings and IDs to be stored. It also allows the operator to clear the memory of identity code (ID) information.

From the first part of the general utilities menu, press **9-more**, then **4-memory**. The following screen will be displayed-

<p>0529 Free Readings 1-Clear Readings 2-Clear ID Info. 0-Exit</p>

To return to the second part of the general utilities menu without clearing the memory press key **0-Exit**.

If the memory is to be cleared of readings, press **1-clear readings**. The following screen will be displayed in order to prevent unintentional memory clearance.

<p>CAUTION! DATA WILL BE LOST ENTER 0102 TO CLEAR ?---</p>

The code 0102 should now be entered as prompted by the question mark.

If an incorrect code is entered the memory screen will be displayed again.

If the correct code is entered the message **Clearing Memory!** will briefly appear, prior to returning to the memory screen.

The total capacity of the memory is approximately 650 readings (this will vary according to the software version installed in the analyser).

The memory capacity of the gas analyser will be reduced by the entry of ID codes as well as data. Approximately one memory reading space will be taken for every two ID codes entered.

The procedure for clearing the memory of ID information follows the same pattern except the selection of **2-Clear ID Info**.

Calibration (User)

The gas analyser incorporates a number of user calibration features to help improve reading accuracy. The user calibration facilities include the following options –

Gas Reading Channel	Zero	Calibrate Span
CH ₄	Yes	Yes
CO ₂	No	Yes
O ₂	Yes	Yes

The factory calibration settings have been designed to give the best possible results over a wide range of conditions.

The accuracy of the instrument can be improved in specific operating ranges by performing a user calibration. If required, the gas analyser can be rest back to the factory settings at any time. This will clear the analyser of **ALL** user calibration settings and restores the last factory calibration.

It is very important to check the methane channel is zeroed at regular intervals, particularly before commencing reading.

Full details on the calibration procedures are available in a separate manual. This manual is supplied with the calibration equipment available from Geotechnical Instruments (UK) Ltd.

All calibration operations must be carried out in a safe area.

ID Maintenance

An identity code (ID) is an eight character alphanumeric series which can be entered before any readings are taken. The code system helps in the identification of readings during processing and assessment. The read gas level operation provides the option of recording the data with or without pre-entered ID code. A pre entered ID code can be tagged with a “reminder” that a relative pressure reading is required at the same time as the gas reading. Pre-entered ID codes allow the recording of both the prevailing barometric pressure and the relative pressure of a gas extraction system.

From the second part of the general utilities menu, select **6-ID Maintenance**. The following screen will appear -

ID MAINTENANCE	
1-View/Edit/Delete	
2-Enter New ID	
0-Exit	

View/Edit/Delete

Pressing **1-View/Edit/Delete** allows the user to view, edit or delete ID information.

ID ABCD1234	2-Edit
Pressure	3-Delete
Reading	↑↓-Scan
required	0-Exit

The ID code will appear at the top left. Use the **↑** and **↓** arrow keys to scan through the available ID codes. If there is only one ID code in the memory the scan facility will not be displayed. The screen also indicates the ID code will require a relative pressure reading to be stored with the gas reading. The right hand side of the screen displays the available options for ID code maintenance

Edit ID

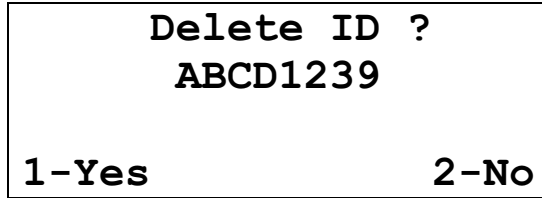
When **2-Edit** is selected the following screen will be displayed –

Does this ID require	
a pressure reading	
with each reading?	
1-Yes	0-No

If a relative pressure is no longer required for this ID code press **0-No**. The message indicating a 'Pressure reading required' will disappear. The requirement for a relative pressure reading can be restored at any time with this option.

Delete ID

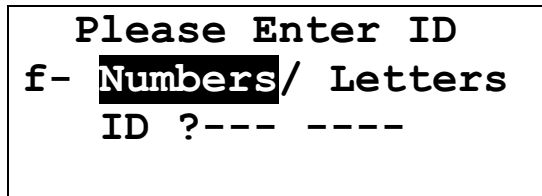
This option will delete from the memory the currently displayed ID code. If the ID to be deleted is not displayed use the up and down keys to scan through the available ID codes. When **3-Delete** is selected the following screen will be displayed-



Press **1-Yes** to delete the ID or **0-No** to return to the previous screen.

Enter New ID

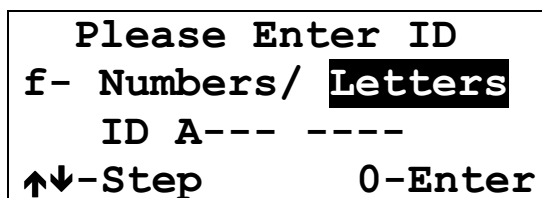
This option allows the operator to input new ID codes into the gas analysers memory. When key **2-Enter New ID** is pressed the following screen will appear –



You are now prompted to enter an eight digit alphanumeric code (in 2 blocks, of 4 characters) which will identify the set of readings.

Any number between 0-9 or letter can be entered at a location. When an entry has been made, the question mark will automatically move to the next space.

Only numbers can be entered when the question mark is displayed. To change from numbers to letters, press the Function Key **f** - the word Letters will be highlighted, the letter "A" displayed and the **↑↓** arrow keys to scan through the alphabet. Any letter of the alphabet may be selected and when **0-Enter** is selected the next letter (or number) may be entered. Pressing the function key to change back to numbers at any time.



The rubout key may be used to correct any errors. A space is automatically inserted between the first four characters and the second four.

When an eight character code has been entered, the message **0-Cont** will appear.

```

Please Enter ID
f- Numbers/ Letters
ID TEST 1001
0-Cont

```

When **0-Cont** is pressed the new ID is stored. If the ID already exists the option of overwriting the existing ID given-

```

ID TEST1001 Already
Exists, overwrite ?
1-Yes                2-No

```

Press the appropriate key as required. If **2-No** the main ID Maintenance menu will be displayed. If **1-Yes** is selected and the new ID code is accepted, the procedure continues with the following screen –

```

Does this ID require
a pressure reading
with each reading?
1-Yes                0-No

```

Each ID code can be stored with a relative pressure reading “reminder” incorporated. This reminder will appear when the gas levels have been read. More instructions on the relative pressure reading are given in the Read Gas Levels section. If either **1-Yes** or **0-No** is selected the following will be displayed -

```

ID Stored OK

```

Default Selection of last ID Code Entered

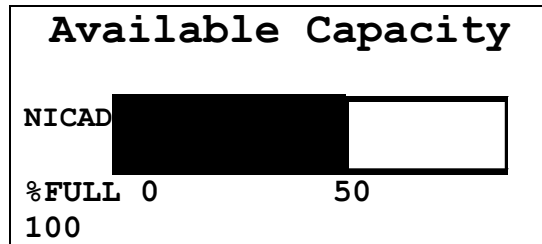
When the next new ID is to be entered, the first four characters of the last ID entered will automatically be display. If the default selection of the last code is not required, the characters may be deleted by using the rubout key.

Battery

Note: the Battery Changing operation must be performed in a safe area.

From the second part of the **General Utilities Menu**, select **7- Battery**.

If the unit has been switched on for less than 30 seconds, the flashing message **Waiting For Reading** will be displayed. Otherwise the following will be displayed -




The Gas Analyser is powered by an internal rechargeable 7.2volt Nickel-Cadmium battery pack. This is sufficient to provide power for approximately: -

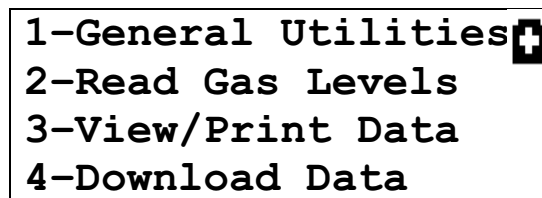
- 9.0 hours without use of the pump
- 6.0 hours if the pump is used normally

A voltage measuring circuit monitors the charge state of the battery and interprets this information to give an estimate of the available battery capacity, which is indicated by the dark area on the Available Capacity graph.

Pressing key **0** will return the analyser to the General Utilities Menu.

When the available battery capacity is very low, a battery low symbol  will be displayed in the top right hand corner of the screen, irrespective of the display at that time.

For example, if the Main Menu was being displayed the screen would change to-



When this symbol appears it is important that the battery is recharged as soon as possible (in a safe area).

The analyser is charged via a 7 pin socket on the right hand side of the case. Only the battery charger supplied by Geotechnical Instruments should be used with the analyser.

Read Gas Levels

Warning - Exhaust port (item F on diagram page 5)

- When the Gas analyser is in use, ensure that the exhaust port is **clear and unblocked** at all times. If necessary tubing may be attached to vent the exhaust away from the user. If the exhaust port is blocked during operation, the analyser could become over-pressurised and cause erroneous readings to be obtained.
- Such over-pressurisation could also lead to damage of internal components, which in turn might result in a build up of gas within the case of the analyser. If this happens a subsequent explosion could occur.

From the **Main Menu**, press **2-Read Gas Levels**, the following screen will appear-

```

Read using ID?

1-Yes  2-No  0-Exit
    
```

Readings can be taken with a pre-entered ID, or simply taken and stored. The advantage of using the pre-entered ID is that the gas levels are recorded quickly and may include relative pressure data. The procedure for entering IDs is described in **ID Maintenance** section.

Manual Operation

Read Using ID

If **1-Yes** is pressed from the above screen, the following screen will appear-

```

Manually enter ID or
Scroll through?

1-Scroll  2-Manual
    
```

There are two procedures for selecting the required ID. Either scroll through all IDs available, or manually enter the ID.

Scroll Through

If **1-Scroll** is pressed, the following screen will appear-

```

1)          TEST1001

↑↓-Scroll
 2-Select          0-Exit
    
```

At the top of the screen is an ID; the scroll process always starts with the first ID.

By using the **↑** and **↓** keys the other available IDs can be viewed. When the required ID appears on the screen press **2-Select** and the following screen will appear -

ID TEST1001	1-Read
Pressure	2-Retry
Reading	3-Edit
Required	0-Abort

On the top left hand side of is the selected identity code. If the ID has been tagged with a reminder to take a relative pressure reading the message "Pressure reading required" will appear on the left hand side. The options on the right hand side of the screen are-

1-Read

This is explained in **Read Gas Levels** section.

2-Retry

If the operator decides the selected ID is wrong, this option allows a return to the selection screen. Select another ID before proceeding to read gas levels.

3-Edit

The edit function only allows the user to set whether the reading will require a relative pressure reading or not, it does not allow the user to edit the actual ID, the following will be displayed at this stage-

Does this ID require	
a pressure reading	
with each reading?	
1-Yes	0-No

Select the required option **1-Yes** or **0-No**.

When the selection has been made, the ID selection screen will be displayed.

0-Abort

If this key is pressed the entire read gas level procedure is cancelled and the operator is returned to the main menu.

Manual (manual entry of ID code)

When **2-Manual** is selected the operator can enter character by character the required ID. The following screen will appear-

<p>Please enter ID f- Numbers/ Letters ?--- ----</p>
--

The procedure for entering an ID is described in section **Enter New ID**.

When the correct ID has been entered, press **0-Cont**. If the ID entered is not currently stored, the following will be displayed-

<p>No reading for ID TEST1001 1-Enter 2-Retry 0-Abort</p>
--

The options available are-

1- Enter

This provides the opportunity to store the eight letters/ numbers entered as a new ID. If **1-Enter** pressed, the procedure will continue as per section.

2- Retry

This will return the operator to the manual entry screen. This provides the opportunity to start the identity code selection again.

0- Abort

When this option is chosen, the operator is returned to the Main Menu.

When the identity code selection is completed, the Read Gas levels operation can continue, select **1-Read**

<p>ID TEST1001 Pressure Reading Required</p>	<p>1-Read 2-Retry 3-Edit 0-Abort</p>
---	---

Read - Pressure Reading

Pressure Reading Required

If the ID is tagged with a reminder to take a relative pressure reading, the Gas Analyser will provide a series of instructions. The next screen to appear will be- (If a relative pressure reading is not required, on pressing **1-Read** the **Normal Read Gas Levels** screen)

**This ID requires a
Pressure reading do
You wish to zero?
1-Yes 2-No**

The pressure transducer in the Gas Analyser can be zeroed to the prevailing atmospheric pressure. It is vital to perform this operation prior to taking a relative pressure reading.

The relative pressure reading to be taken will usually be the pressure in a gas extraction system relative to the atmospheric pressure. Both the atmospheric and relative reading are displayed with the associated gas levels in the option **3-View/Print data** from the main menu. The relative pressure will be identified with the letter "R". It will be expressed as a positive value for an increase in pressure or a negative value for a decrease in pressure, relative to the zeroed value (atmospheric pressure).

Note: If the analyser is subjected to a pressure/vacuum change outside its range a row of chevrons will be displayed. This indicates the reading is "over range" and cannot be measured and may damage to the analyser may occur.

Press 1-Zero and the following will be displayed-

**WARNING: Disconnect
All hoses before
Zeroing transducer
Press Any Key**

Disconnect all hoses from the Gas Analyser. This ensures the pressure transducer is only open to the prevailing atmospheric pressure and not any pressure/vacuum in the pipe work. After disconnecting any hoses, **press any key** and the following screen will be displayed-

+0000.9_{mb}
1-Zero 0-Exit

This shows the current relative reading, which should be close to zero. By pressing **1-Zero**, the transducer will be zeroed to the prevailing atmospheric pressure and the message **Transducer Zeroed** will be briefly displayed. To proceed press **0-Exit** and the following will be displayed

**Connect Pressure
transducer to well**

Press Any Key

At this point connect the sample tubing between the pressure transducer port and the well monitoring point. The connection must be airtight.

After securing the connection to the well, press any key and the following screen will be displayed-

-0023.9_{mb}
1-Store 0-Exit

The current well reading will be displayed, press **1-Store** and the message **Reading Stored!** will be displayed briefly, before returning to the above screen.

The relative reading can be taken more than once, if required, by pressing **1-Store**, but only the last reading taken will actually be stored.

To proceed, press **0-Exit** and the following screen will be displayed-

**Disconnect from the
Pressure and connect
To the sample port**
Press Any Key

Read Gas Levels

The relative reading procedure is now completed and the Gas Analyser is providing instructions for taking the gas level readings.

Disconnect the sampling tubing from the pressure port (item 1, see diagram on page 5). And Press any key to proceed. The following screen will be displayed-

Normal Read Gas Levels screen.

CH ₄ 00.0%	1-LEL 2-More
CO ₂ 00.0%	5-Pump OFF
O ₂ 00.0%	6-Store
Mb 1006	8-IOG 0-Exit

Note: the pump will be in the OFF position and the readings shown on the display will not represent the true gas concentrations until a sample has been drawn into the analyser. For the first 30seconds after switching on a row of asterisk characters will be displayed. If the asterisk characters remain at the CH₄ location after the initial 30seconds the analyser may require auto zeroing.

The left side of the display shows the current gas concentrations and atmospheric pressure. The following sections explain the controls and information on the right hand side.

1-LEL

Press **1-LEL**, the concentration of methane both in terms of percentage **by volume** and percentage of the **Lower Explosive Limit (LEL)**.

02.5	CH ₄ %Gas	5-Pump OFF
050.	CH ₄ %LEL	6-Store 0-Back

The **Lower Explosive Limit** of Methane is equal to 5% concentration of Methane by volume in air (percentage by volume is termed here as %gas). Thus the following relationships are derived-

- For Methane-** 1.0% gas = 020. % LEL
- 2.0% gas = 040. % LEL
- 3.0% gas = 060. % LEL
- 4.0% gas = 080. % LEL
- 5.0% gas = 100. % LEL

Fore example, if the display shows **2.5% gas this equals 50% LEL**. If key **0-Exit** is pressed, the display will revert to that shown at the beginning of this paragraph.

2-More

When **2-More** is pressed two options will be displayed-

18.0°C	1-Enter Temp
>>.>>m	2-EnterDepth
	6-Store
	0-Back

Temperature Probe Connected

The temperature reading displayed on the screen will vary until the temperature probe has been placed as required for a few seconds. When the reading on the screen has stabilised it can be stored along with the current gas level and pressure readings.

Manual Entry of Temperature

If a temperature probe is not available, a temperature reading can be entered by pressing **1-Enter Temp**. The following screen will appear-

Enter Temperature

? . °C

Enter the temperature reading as prompted. The rubout key may be used to correct mistakes. The reading must be entered in the format XX.X. If the units of measurement are set to USA standard, the temperature units will be in °F. When the final numeral has been entered **0-Exit** will be displayed and should be selected, the reading will now be stored.

Enter Depth Reading

Information about the water level in the monitoring point can be entered and stored with the gas levels reading. This reading is usually taken with a Dipmeter (water level indicator), which can be supplied by Geotechnical Instruments (UK) Ltd. If the total depth of the monitoring point is known the depth of the water from the bottom can be calculated by subtracting the Dipmeter measurement.

Note: The Dipmeter must only be used in safe areas.

To enter a Depth reading, press **2-Enter depth**, the following screen will be displayed-

Enter Depth Reading

? . m

Enter the depth reading as prompted. The rubout key may be used to correct any mistakes. The reading must be entered in the format XX.XX. If the units of measurement are set to USA standard the depth reading should be entered in feet and inches, e.g. a depth of 5ft 2inches would be entered as 05.02. After the final digit is entered, **0-Exit** will be displayed and should be selected, the reading will now be stored.

5-Pump.

When the sampling tube is connected to the monitoring point or the probe is at the required location, pressing **5-Pump** will draw a gas sample into the analyser. After approximately 30seconds the readings will stabilise to represent the gas concentrations.

To stop the pump press **5-Pump**. When the pump is on, an on-screen counter shows the number of seconds the pump has been turned on.

The pump may be operated in this manner whenever the option is displayed.

Note: the Gas Analyser compensates the gas readings for atmospheric pressure. While the pump is running the measuring chamber may not be at atmospheric pressure. For the most accurate results, switch the pump off and let the readings stabilise for a few seconds before storing a reading.

6-Store

Irrespective of which screen is displayed, when this option is displayed the reading may be stored. Although if the option is selected from the Read Gas Levels screen the reading will be stored without a temperature or depth being entered.

If **6-Store** is pressed, readings of all gasses and ancillary readings (if entered) will be stored. The readings stored are those as displayed and are compensated for barometric pressure.

When **6-Store** is pressed, the message **Readings Stored** will be briefly displayed before the analyser returns to the pervious screen, to take another reading.

Further readings with the same ID may be stored if required, each reading stored will be identified with the time and date.

8-Log

This will be described in detail under **Section 2.2 Automatic Operation (Data Logging)**.

Read Without Using ID

If readings are required without a pre- entered ID code, key **2-No** should be selected after entering **Read Gas Levels-**

Read using ID?		
1-Yes	2-No	0-Exit

Using this function the Read Gas Level screen will be displayed immediately and it does not have the facility to record relative pressure reading. Only the atmospheric pressure will recorded with the gas levels.

This reading procedure will require the entry of an eight character code to identify the readings, but it is entered at the end of the Read Gas Level operation. Each time a reading is stored, an identity code must be entered.

When key **2- No** is pressed the following screen will be displayed-

CH₄ 00.0%	1-IEL 2-More
CO₂ 00.0%	5-Pump OFF
O₂ 00.0%	6-Store
Mb 1006	8-IOG 0-Exit

The controls and information for this operation are the same as those described in the **Read Using ID** section.

When key **6-Store** is pressed the following screen will be displayed-

Please enter ID
f- Numbers/ Letters
?--- ----

The procedure for entering an identity code is described in section **Enter New ID**. When entered, press **0-Cont** and the message **Reading Stored!** will briefly displayed, before returning to the **Read Gas Levels**.

If key **0-Exit** is pressed, the operator will be returned to the Main Menu. If the aspirator pump is running it will automatically shut down.

NOTE - After any readings have been taken it is advisable to view the data to ensure all relevant readings have been stored.

Automatic Operation (Data Logging)

This section of the manual explains how to obtain and store readings using the automatic Data Logging function of the Analyser. Prior to commencing any logging operation it is imperative that alarm levels have been correctly set and the battery life is sufficient for operation throughout the required logging duration.

During a Data Logging operation the 15-minute "auto power off" facility is inhibited and current data will be displayed for as long as data logging is aloud to continue.

Starting and stopping of the pump will be carried out automatically and under the control of the Gas Analyser, as per the interval and running time entered during the process.

If available, the temperature probe may also be connected during the Data Logging operation as these readings will also be stored.

From the **Main Menu** select **2-Read Gas Levels-**

<p>Read using ID?</p> <p>1-Yes 2-No 0-Exit</p>
--

The Data Logged readings will require the use of an ID. This can be entered by selecting the ID from the pre-entered list **1-Yes** - an ID code selection be required before entering the read screen, or by entering the ID at the time of logging **2-No** - individual ID code entered at time of logging. For selection and entry of the ID codes refer to the sections **Read Using ID**, or **Read Without Using ID** respectively. After selection (and ID entry if required) the Read Gas Levels screen will be displayed-

CH₄ 00.0%	1-IEL 2-More
CO₂ 00.0%	5-Pump OFF
O₂ 00.0%	6-Store
Mb 1006	8-LOG 0-Exit

Select **8-Log** to enter the logging function (this does not start the operation automatically). If 2-No was selected at the Read Using ID stage, the ID entry screen will be displayed at this point. The screen will change to-

<p>Enter Required</p> <p>Logging Interval</p> <p>Min 05, Max 60 Mins</p> <p>Interval = ?</p>
--

The operator should now enter the **time between each reading (interval)**, and within the parameters as indicated. If an invalid interval is entered, the operator will be returned to this screen after the message **Invalid Duration Please Enter Again** is displayed briefly. When entered correctly, press key **0-Exit** to continue and the following will be displayed-

<p>Select Running Time For pump in seconds 00,15,30,45,60,90 Time = ?</p>
--

Enter the required pump running time prior to each reading be obtained from the selection given. If the entered incorrectly the message **Invalid Pump Time Please Enter Again** will be briefly displayed. When entered correctly, press key **0-Exit** to continue.

At this point the Data Logging operation will be initiated and the following will be displayed-

CH₄	00.0%	LOGGING
CO₂	00.0%	1-LEL%
O₂	00.0%	2-More
Mb	1006	0-Stop Log

The following options are available to the user during the Data Logging operation: -

1-LEL%

The operator may view concentrations of Methane expressed as a percentage LEL without disturbing the logging sequence by pressing 1-LEL%-

02.5	CH₄	LOGGING
	%Gas	
050.	CH₄	
	%LEL	0-Exit

2-More

This will enable the operator to view the auxiliary readings, although the Depth Reading can not be recorded or entered, only temperature. 0-Exit should be pressed to return to the main logging screen-

18.0°C	LOGGING
>>.>>m	
	0-Exit

0-Stop Logging

To Stop the logging operation press **0-Stop Logging**. When this has been stopped the main Read Gas Levels screen will be displayed and normal operation commence.

All data gathered during data logging will have been automatically stored in the memory of the Gas Analyser.

If the Gas Analyser battery is allowed to totally discharge during a logging operation the readings should not be lost, but the analyser **MUST** be recharged as soon as possible. In such instances it is advisable to ignore the last four readings taken. It can be assumed that the battery will have fallen below the required operating level at this stage.

Note: If a flow fail occurs during a logging operation, there will be no indication of this event in the stored data.

NOTE - After any readings have been taken it is advisable to view the data to ensure all relevant readings have been stored.

View/ Print Data

This section of the manual describes how to view or obtain a hard copy of data which is stored in the memory of the Gas Analyser.

All data viewed will be displayed in chronological order.

From the Main Menu select **3-View/ Print Data**. The following will be displayed-

```

Please select
1-View Data
2-Print Data
0-Main Menu
    
```

If no data is available in the analysers memory the following message will be briefly displayed and the analyser return to the main menu-

```

NO DATA
AVAILABLE
    
```

View Data

Select **1- View Data**. The following screen will be displayed-

```

View Data

1-With specific ID
2-All data
    
```

The operator can select to viewing only data with a specific ID, or scan through all stored data. Although if specific ID is known, this facility can be used to avoid scanning through irrelevant data if.

1-With Specific ID

Select **1-With Specific ID** to view data that has been stored with a specific identification code, the following will be displayed-

```

Manually enter ID or
Scroll through?

1-Scroll      2-Manual
    
```

There are two procedures for selecting the required ID. Scroll through all IDs available, or manually enter the ID.

1-Scroll Through

When selected the following will be displayed -

```

1)          TEST1001

↑↓-Scroll
2-Select      0-Exit
    
```

At the top of this screen is the ID, the scroll process always starts with the first code entered.

By using the ↑ and ↓ keys all IDs available can be scrolled through. When the required ID is displayed, press **2-Select** and the main View Data menu will be displayed.

2-Manual

If this option is selected the following will be displayed-

```

Please enter ID
f- Numbers/ Letters
?--- ----
    
```

The ID required must be entered manually, refer to the section **Read Gas Levels - Using ID - Manual** for instruction on entering an ID code.

2-All Data

If this option is selected the initial view data screen and available options will be displayed immediately.

Viewing The Data/Options

Once an appropriate ID code has been entered the following will be displayed-

```

Use:↑↓-Scroll 0-Exit
2-Go First 7-Go Last
5-Change data screen
Any key to continue
    
```

The various facilities described in this screen will not be functional until data is being viewed, press any key to continue and a screen layout similar to the following will be displayed.

Press any key to continue and view the data.

CH₄ 58.5%	ID TEST1001
CO₂ 39.3%	At 15:30.45
O₂ 02.2%	On 01/04/01
Mb 1006	RP -009.3mb

The various gas concentrations (in terms of percentage gas), barometric pressure, ID, time and date of reading and relative pressure (if taken) are displayed.

Note: If USA units of measurement are used the relevant units of measurement will be displayed.

The data can be scanned through as per the initial instructions given: -

- Press **↓** (Key 6) to view the next reading.
- Press **↑** (Key 1) to view the previous reading.
- Press **2** to view the first reading stored.
- Press **7** to view the last reading stored.

By pressing **5-Change Data Screen** the following information will be displayed for the current reading-

18.0°C	ID TEST1001
05.05m	At 15:30.45
	On 01/04/01
	RP -009.3mb

This screen shows the temperature and depth reading stored with the gas data. To return to the previous screen **5-Change Data Screen** again.

When all required data has been viewed, press 0-Exit, this will return the analyser to the main View/Print Data screen.

Print Data

Note: Printing must be performed in a safe area.

For successful printing the following conditions must be satisfied: -

- A printer with a serial interface e.g. **Diconix Model 150** must be connected correctly to the communications port of the Gas Analyser.
- Printer Settings - the printer must be set to these readings-
 Baud Rate 2400
 Handshake RTS/ CTS
 Parity None
 Data bits 8
 Stop bits 1
 For additional information please consult the manual supplied with the printer.
- RS232 Printer Lead - the lead used to connect the Gas Analyser to the printer must be the type supplied by Geotechnical Instruments (UK) Ltd. For this an RS232 download lead with an adaptor will be required.
- Sufficient supply of continuous fan fold paper must be available and correctly fitted in the printer.

From the View/ Print Menu select 2-Print Data-

Please select
1-View Data
2-Print Data
0-Main Menu

The following will be displayed-

Print Data
1-With Specific ID
5-All Data

This allows the operator to select stored data with a specific which has been or to print all stored data.

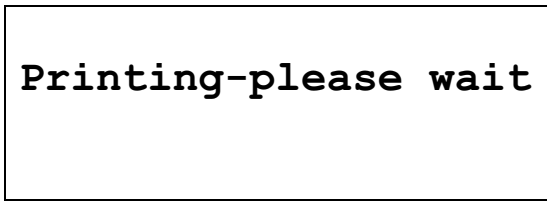
1-With Specific ID

Select **1-With Specific ID** to print data that has been stored with a specific identification code, the following will be displayed-

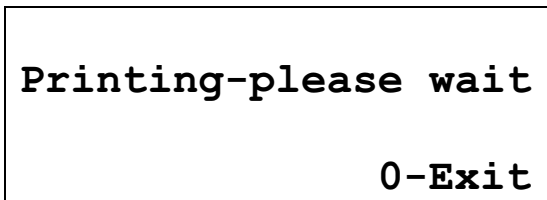
Manually enter ID or
Scroll through?
1-Scroll 2-Manual

The selection of such data may be obtained in the same manner as the for viewing data with a specific ID, refer section **Viewing Data**.

When the required code has been entered the following screen will be displayed-



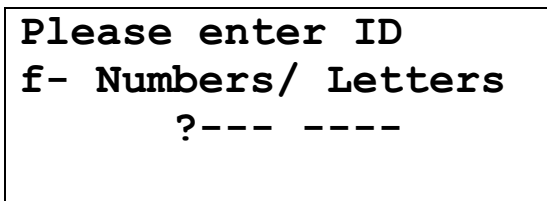
This indicates that data with the chosen identity code is being printed. The message will remain on the display until all available data is printed, the following screen will then be displayed-



To return to the **View/ Print Data** menu, press **0-Exit**.

2-Manual

If this option is selected the following will be displayed-



The ID required must be entered manually, refer to the section **Read Gas Levels - Using ID - Manual** for instruction on entering an ID code.

When the appropriate ID has been entered printing will be carried out as explained in the previous section.

5-All Data

If this option is selected printing will automatically commence until all stored has been printed.



Thank you for reading this data sheet.

For pricing or for further information, please contact us at our UK Office, using the details below.



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The user is responsible for determining the suitability of this product.