

Thermo Fisher Scientific

G100 CO₂-O₂-Analysegerät

Operating Manual

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Manual Guidelines

Safety Related Information

Information in this manual that may affect the safety of users and others is preceded by the following symbol:



WARNING Failure to follow this information may result in physical injury which in some cases could be fatal.

Notes

Important/useful information and instructions are shown clearly throughout the manual in a note format.

For example:

Note For further information, please contact your equipment supplier.

Note Actual screenshots will vary dependent on model.

Introduction

This manual explains how to use instrument model types listed below:

- G100 CO₂ 0-20%
- G100 O₂ 0-100%

Note The instrument is a sensitive piece of scientific equipment, and should be treated as such.

The G100 analyser range is specifically designed to monitor CO₂ for the verification of incubators in research and pharmaceutical markets. This unit has been developed to incorporate the latest technology and specification requirements, which provide the user with a fast, simple-to-use and accurate piece of laboratory instrumentation.

The G100 Analyser Range

The analyser has the following features:

- CO₂ 0-20% - G100
- Improved accuracy on CO₂ readings
- Quick verification of CO₂
- O₂ 0-100% - G100
- Time saving with dual temperature probes
- Large data storage and user friendly software and download
- Easy-to-read, large well lit display
- Built-in gas moisture removal

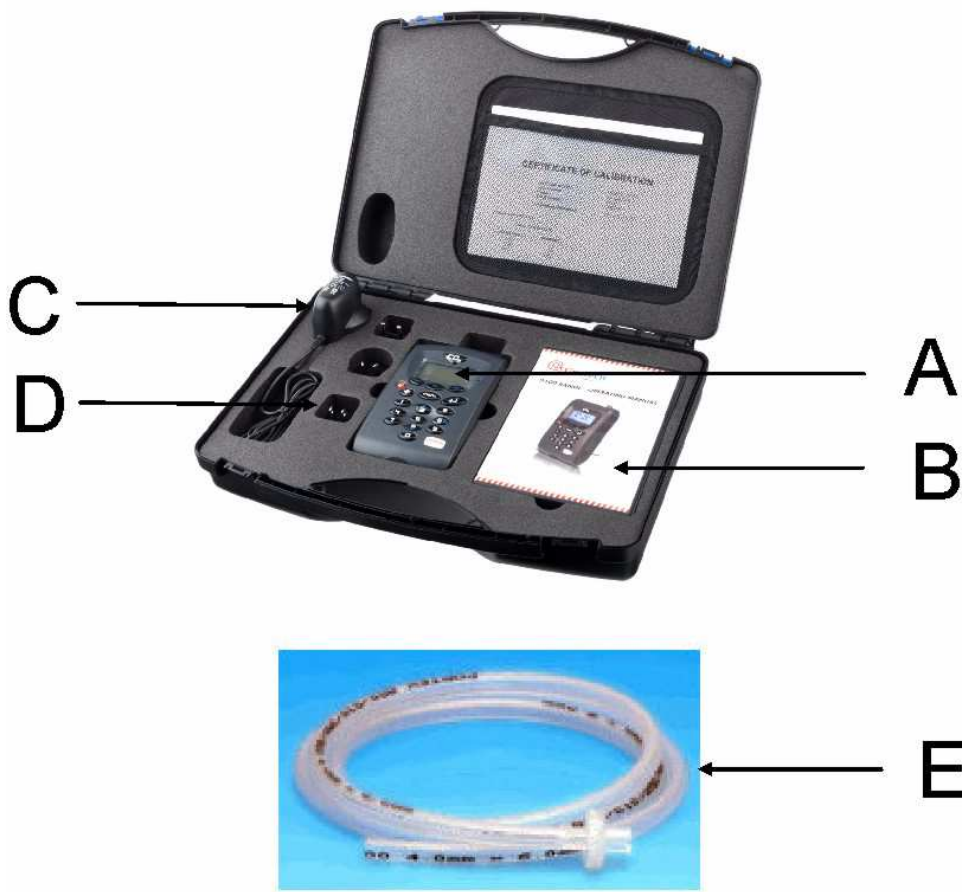
Applications:

- IVF/Medical
- Laboratories
- Brewing
- Incubators
- Research
- IAQ
- Atmosphere Control
- Gas mixing

Introduction

Instrument Components - Standard Product

Instrument Components - Standard Product



Reference:

- A Analyser
- B Operating Manual
- C Mains Battery Charger
- D Mains Battery Charger Adaptors:
 - Europe
 - US
 - Australia
- E Sample Tube Kit: (G100)
 - Sample Filter
 - Sample Tube

G100 Range Optional Products and Accessories

Optional Products

The G100 Analyser range has a number of optional products for purchase which enhance the usability and enable further analysis of data and reading information.

Note For more information on the features listed in this section please contact (Your company) on (Your telephone) or email (your email@your domain).

G100 Range – Download Software (Optional)

The G100 Range – Download Software enables the user to maximise the operation of the incubator analyser. Instrument readings and event log data may be downloaded to a PC for further analysis and exported to other applications such as MS Excel. It enables direct communication with the unit, features a simple download facility and is fully compatible with the latest Microsoft operating systems.

Event Log

The G100 instruments incorporate the facility to log significant events via the 'Event Log'. This can be used as an aid to monitoring the use of the instrument. It can also be used as a diagnostic tool if there is a problem with the instrument.

The event log can only be viewed via the optional G100 Range - Download Software. It cannot be viewed on the analyser screen. Applicable events are stored in the event log automatically. No user intervention is required.

The event log can hold approximately 270 events. If the log becomes full then it begins to over-write the older events. This can be identified by the index field which starts from event number 1. The log is cleared when the instrument is reset.

Note Please refer to section "Event Log" on page 12-1 of this operating manual for further information.

Instrument Accessory Products

Optional accessory and replacement parts may be purchased for the G100 from your equipment supplier.



Ref	Description	Mfr Order Code
B	Operating instructions	50121618
C	Spare Sample Filters (pack of 5)	50060287
J	Sample Tube Kit	03650435
L	Mains Charger inc. Worldwide Adaptors	50122292
	Software	50122293

Instrument Features

Physical Characteristics of the Instrument Panel

Front View:



Reference:

- A Main Read Screen
- B Soft-Keys
- C On/Off Key
- D Pump Key
- E Key 4 – Scroll Left
- F Key 8 – Scroll Down
- G Menu Key
- H Enter Key
- I Key 2 – Scroll Up
- J Key 6 – Scroll Right

Back View:



Reference:

- K Moisture Removal Tube
- L Serial Number
- M Instrument Stand

Panel Key Functions

Front Panel:

	Keys	Function
A	Main Read Screen	Start and end screen when using the instrument.
B	Soft Keys	The function of the three 'soft-keys' on the front of the instrument panel are determined by menu options taken. Functions vary from screen to screen.
C	On/Off Key	Press the 'On/Off' key briefly to switch the instrument on and off.
D	Pump Key	Press the 'Pump' key to start or stop the pump.
E	Scroll Left Key	Also 'Key 4'. Enables the operator to scroll left to display more information.
F	Scroll Down Key	Also 'Key 8'. Enables the operator to scroll down to display more information.
G	Menu Key	Press the 'Menu' key to go to the 'Main' menu. Enables the operator to pre-set values and settings. Select options from the 'Main' menu to also view data and readings stored or held.
H	Enter Key	The 'Enter' key accepts/confirms choices made by the operator to various functions and operations. Also, required to confirm numeric data entry.
I	Scroll Up Key	Also 'Key 2'. Press scroll up to view further information on the instrument read screen.
J	Scroll Right Key	Also 'Key 6'. Press scroll right to view further information on the instrument read screen.

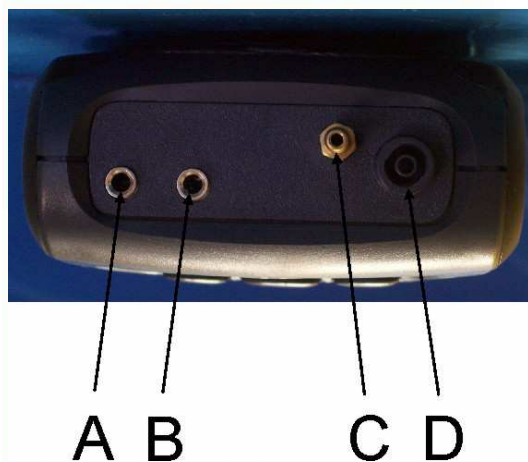
Back Panel:

K	Moisture Removal Tube	Removes the moisture from the sample gas.
L	Serial Number	Unique Identification for the instrument. Verification of the serial number will be required if Technical Support assistance is needed.
M	Instrument Stand	Instrument stand.

Note Do NOT attempt to remove the cover off the back of the analyser which houses the moisture removal tube.
Do NOT cover the moisture removal tube with your hand when holding the analyser to take readings.

Instrument Connection Points

Top View:



Side View:



Top View:

A Temperature 1

Temperature 1 connector measures differential temperature – incubator and ambient temperatures.

B Temperature 2

Temperature 2 connector measures differential temperature – incubator and ambient temperatures.

C Gas Outlet

Gas outlet port used to exhaust the gas.

D Gas Inlet

Gas inlet point used to attach the sample tube and filter in order to take the gas reading.

Side View:

F USB Cable Attachment Point

Used to connect the analyser to a PC via a USB cable to download data.

G Mains Battery Charger Point

Used to attach the mains charger to the analyser for charging.

N.B. Depending on the configuration purchased, certain connectors may not be present.

General Operational Instructions

Switching the Instrument On

1. To switch on the instrument, press the 'On/Off' key briefly. There will be a short beep and a slight pause followed by the Geotech logo.
2. The power on self-test will then commence (approximately 15 seconds) including warm-up time.
3. Assuming there are no warnings to display the instrument will continue to the 'Main Read Screen'.

Switching the Instrument Off

1. Purge with fresh air. Run the pump for approximately 30 seconds or until the readings have returned to normal levels.

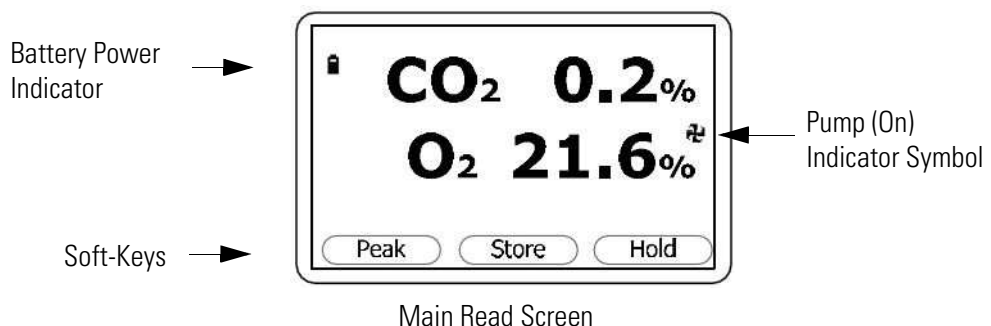
Note Before the instrument is switched off a clean air purge should be performed. This ensures that the instrument is free from gas and ready for the next measurement. This final purge is especially important for the oxygen sensor as it may degrade if stored when contaminated with gas.

2. To switch off the instrument, press the 'On/Off' key briefly.

Note If the 'Auto Off' utilities setting is set to 'Yes', the analyser will switch off automatically after 10 minutes if not in use.

Instrument Main Read Screen

After the analyser has been switched on and the warm-up self-tests completed the analyser will display the 'Main Read Screen'.



Soft-Keys:

Peak - Enables the operator to display the peak reading.

Store - Enables the operator to store the reading for viewing/download later.

Hold - Enables the operator to hold the current reading being taken.

Instrument Status Icons

The following icons may be displayed on the instrument read screens:

Icon	Description
	Battery charge state
(flashing)	< 1 hour remaining
(flashing)	Battery charging
	Charged
	Pump running
(flashing)	Pump stalled
	Alarm set
(flashing)	Alarm active
	USB connected to PC (flickers when transferring data)
	Logging mode active (flashes when memory nearly full)
(flashing)	Service due (every 12 months)
	Service overdue
	Fault/repair (i.e. battery or pump may need replacing)
	Waiting

Entering Data

During normal operation the user may be prompted to enter data or information via the keypad, i.e. entering an ID code or setting an alarm level.

When entering data into the instrument all fields are fixed format and are populated from the right. For example, to enter a new time 09:25:00 the user would type in 092500 using the numeric keypad in the following sequence:

```
* : : 0
* : : 09
* : 0: 92
* : 09: 25
* 0: 92: 50
* 09:25: 00
```

Press the 'Enter' key to confirm/accept data keyed.

Any mistakes can be corrected using the soft-key 'Delete' which will delete the last character typed. Alternatively, the sequence can be re-typed before the 'Enter' key is pressed and the existing numbers will be pushed off the screen.

Note The instrument will not allow invalid data to be entered; this should be deleted and re-entered.

Changing Between Parameters

By default, the instrument displays the 'Main Read Screen' (for gas measurement). This shows the CO₂ - along with the O₂ reading. The instrument will return to this screen after power on or when returning from the menus. Continue to press the 'Scroll' key to return to the 'Main Read Screen'.

Memory

The memory should not be used as a permanent storage medium and any important data should be transferred to a more permanent storage medium as soon as possible. The instrument should not be stored for prolonged periods with valuable data in its memory.

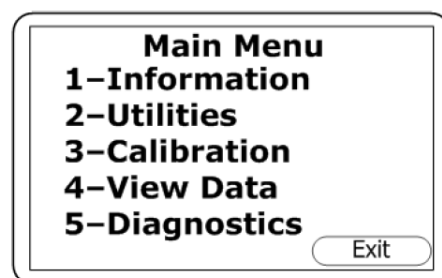
Storage

When not in use the instrument should be kept in a clean, dry and warm environment, such as an office. It should be stored flat with the stand folded away.

Main Menu

The 'Main Menu' enables the operator to select options to set up specific parameters and perform operational tasks prior to sample readings being taken or to view data/information stored in the instrument.

1. Press the 'Menu' key on the front of the instrument panel and the following screen is displayed:



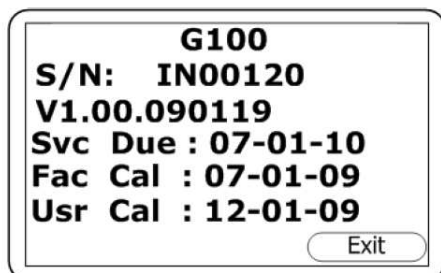
Main Menu

2. Press the soft-key 'Exit' to exit the 'Main' menu.

Information

The 'Information' option enables the operator to display information such as instrument type, serial number, current software version, service due date and the dates of the last factory and user calibrations.

1. From the 'Main Read Screen' press the 'Menu' key on the instrument panel.
2. Press 'Key 1' to display general information about the instrument.



Information Screen

Utilities

The 'Utilities' option enables the operator to configure instrument settings prior to taking readings.

1. From the 'Main Read Screen' press the 'Menu' key on the instrument panel.
2. Press 'Key 2' to display the 'Utilities' menu and the following screen is displayed:



Utilities Menu

Time & Date

The 'Time and Date' option enables the operator to check or set the instrument's internal clock. The current time/date are appended to every stored reading.

1. From the 'Main Read Screen' press the 'Menu' key on the instrument panel.
2. Press 'Key 2' to display the 'Utilities' menu.

3. Press 'Key 1 – Time & Date' and the 'Set Time & Date' menu is displayed:



Set Time & Date

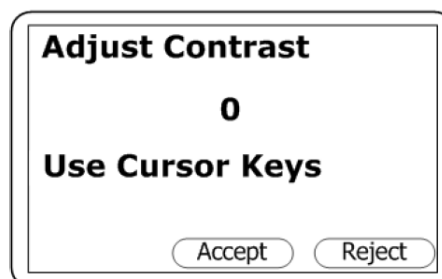
4. Press 'Key 1' to change the time or press 'Key 2' to change the date. Type the time or date using the numeric keypad followed by the 'Enter' key. The instrument will not allow invalid times or dates to be entered.

Note The clock will need to be manually adjusted to cope with daylight saving changes or changes when crossing time zones.

Contrast

The 'Contrast' option enables the operator to adjust the instrument screen contrast to compensate for changes in ambient temperature. The default setting is 0.

1. From the 'Main Read Screen' press the 'Menu' key on the instrument panel.
2. Press 'Key 2' to display the 'Utilities' menu.
3. Press 'Key 2' to select the instrument panel contrast settings and the following screen is displayed:



Adjust Contrast

4. Press 'Key 3 - Scroll Left' and 'Key 6 - Scroll Right' to adjust the value displayed.
5. Press the soft-key 'Accept' or 'Reject' accordingly to accept or reject the changes.

Note The manually set contrast setting is retained when the instrument is switched off.

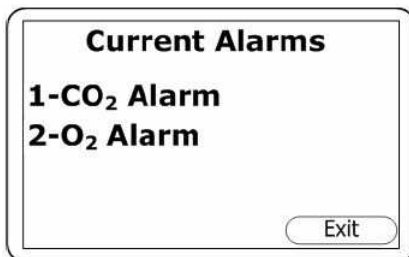
Alarms

The G100 range of instruments has the facility to set rising or falling alarms for the two main gas channels, CO₂ and O₂, if selected as an option. The alarms for each channel can be enabled or disabled independently via the 'Alarms' menu option.

Once enabled these alarms become active in the 'Main Read Screen'; this is indicated by a bell icon. If an alarm is triggered the screen turns red and a flashing bell icon is displayed. The beeper is sounded until the gas level has recovered beyond the trigger point.

- Rising alarms are triggered when the gas level exceeds the maximum value entered by the user.
- Falling alarms are triggered when the gas level falls below the minimum value entered by the user.

1. From the 'Main Read Screen' press the 'Menu' key on the instrument panel.
2. Press 'Key 2' to display the 'Utilities' menu.
3. Press 'Key 3' to select alarm settings and the following screen is displayed:



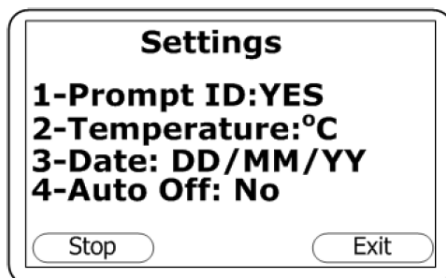
Current Alarms

4. Press 'Key 1' to maintain CO₂ alarm.
5. Press 'Key 2' to maintain O₂ alarm.

Settings

The 'Settings' option enables the operator to maintain information with regards to taking samples and readings.

1. From the 'Main Read Screen' press the 'Menu' key on the instrument panel.
2. Press 'Key 2' to display the 'Utilities' menu.
3. Press 'Key 4' to select settings and the following screen is displayed:



Settings

4. The following instrument settings may be maintained:
 - 1-Prompt ID: - Press 'Key 1' to prompt for ID code for each sample reading, answer Yes or No accordingly.
 - 3-Date: - Press 'Key 3' to switch the date format between dd/mm/yy and mm/dd/yy formats.
 - 4-Auto Off: - Press 'Key 4' to auto switch off the instrument when not in use. Toggle between Auto Off: Yes or No. If set to Yes, the instrument will switch off after 10 minutes if not in use.

Flow Fail

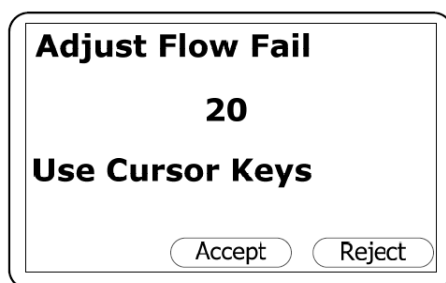
The 'Flow Fail' option enables the operator to adjust the instrument flow fail detection point should it fail in normal operation with a clean filter.

The instrument's internal pump can be stalled when pulling against a vacuum or through a blocked filter. This is indicated by a flashing pump icon; to prevent damage to the pump, the pump will switch off after a few seconds.

Press the 'Pump' key again to remove the flashing pump icon.

Note Dirty or discoloured filters should be changed before use. Filters that have drawn in water should be changed immediately to prevent damage to the instrument.

1. From the 'Main Read Screen' press the 'Menu' key on the instrument panel.
2. Press 'Key 2' to display the 'Utilities' menu.
3. Press 'Key' 5 to select flow fail and the following screen is displayed:



Adjust Flow Fail


Use the 'Scroll' keys to adjust the value displayed. The larger the value, the less sensitive the flow fail detection is.

4. Press soft-key 'Accept' or 'Reject' accordingly.

Logging

Data logging mode can be started or stopped via 'Key 6 - Logging' accessed from the 'Utilities' menu. Press 'Key 4 - Start/Stop Logging' to start and stop data logging.

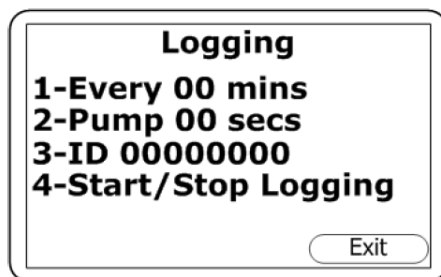
Whilst in data logging mode the instrument will automatically record data at the pre-set intervals including running the pump for a preset time.

Active logging mode is indicated on the 'Main Read Screen' by the  icon.

The operator is able to edit the default ID, pump run-time, interval and start/stop logging.

1. From the 'Main Read Screen' press the 'Menu' key on the instrument panel.

2. Press 'Key 6' to display the 'Logging' menu and the following screen is displayed:



Logging Menu

3. Select the desired option by pressing 'Keys 1 to 4'. Then enter the appropriate setting using the keypad followed by the 'Enter' key.

- 1-Every 00 mins. - Press 'Key 1' to enter the time in minutes for the timeframe between sample readings. The interval controls the reading frequency in minutes, i.e. every 10 minutes.
- 2-Pump 00 secs. - Press 'Key 2' to enter the time in seconds for the length of time you wish the pump to run when taking a sample reading. The pump run-time is the time in seconds for which the pump runs prior to the reading being stored. This figure will also need to take into account the length of sample tube and the volume of the sample gas. For example, there is little point setting a pump run-time of 10 seconds if it takes 30 seconds to draw in a new sample.
- 3-ID 00000000 - Press 'Key 3' to create an 8-digit numeric ID Code.
- 4-Start/Stop Logging - Press 'Key 4' to start and stop data logging.

Note Data logging mode is automatically stopped when the instrument is switched off or if the logging parameters are edited.

Reset

The instrument can be reset by pressing 'Key 7 - Reset' accessed via the 'Utilities' menu. Selecting this option will clear all user settings and any stored data including the event log.

A confirmation code (12345678) must be entered to confirm that a reset is really required.

Calibration

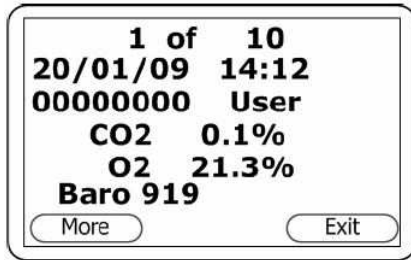
The G100 range of instruments is fully calibrated during manufacture and when returned for service. However, to improve accuracy between services a user/field calibration can be performed.

Note For further information please refer to section "Calibration" on page 7-1 of this manual.

View Data

The 'View Data' option enables the operator to view the stored readings.

1. From the 'Main Read Screen' press the 'Menu' key on the instrument panel.
2. Press 'Key 4' to view stored data readings and the following screens are displayed:
Press 'Key 8 - Scroll Down'



View Data – Screen 1

3. Press 'Key 4 - Scroll Left' and 'Key 6 - Scroll Right' to move through the stored readings either forwards or backwards. Press 'Key 2 - Scroll Up' and 'Key 8 - Scroll Down' to switch between the first (CO₂, O₂ & Baro) and second (T1, T2 & humidity) group of reading parameters.
4. Press the soft-key 'More' to refine or filter the readings to view.



View Data – Soft-key 'More'

- | | | |
|--------------|---|---|
| 1-Delete All | - | Enables the operator to delete all the readings stored, (see below). |
| 2-Filter | - | Used to refine/filter the range of readings displayed by ID or date ranges.
Press between two dates, after a date, before a date or all dates. |
| 3-Go to | - | Enables the operator to jump to the first or last reading in the memory or any other reading. |

Clear Reading Memory

The 'Clear Reading Memory' function enables the user to check how many readings have previously been taken and clear them if necessary.

Note Before readings are actually deleted a caution message is displayed; once readings have been deleted they cannot be recovered.

The instrument can store up to 1000 readings. The reading structure is fixed and may contain optional parameters not activated for your particular instrument configuration, i.e. oxygen, temperature and humidity.

Once the reading memory is full it is not possible to store any more readings. When full and the 'Store' key is pressed or data logging is activated the instrument will show a brief message stating that the memory is full and that no further data will be recorded.

1. From the 'Main Read Screen' press the 'Menu' key on the instrument panel.
2. Press 'Key 4' to view data.
3. To clear the readings press the soft-key 'More' followed by 'Key 1 - Delete all'.

Diagnostics

The 'Diagnostics' option enables remote technical support to identify and resolve issues with the instrument and readings. If required, the operator may be asked to confirm the diagnostics displayed.

1. From the 'Main Read Screen' press the 'Menu' key on the instrument panel.
2. Press 'Key 5' to view diagnostics.

Note For further information contact your equipment supplier.

Warning and Error Codes

When switched on the instrument will perform a predetermined self-test sequence taking approximately 10 seconds. During this time many of the instrument's working parameters and settings are checked. If any operational parameters are out of specification or if the pre-programmed recommended calibration/service date has passed, errors or warnings may be displayed.

Note For further information please refer to section "Problem Solving" on page 8-1 of this manual.

Battery/Charging

The battery used in the instrument is 2.6 Ah Lithium-Ion cell. The instrument must be charged using the power supply supplied with your instrument.

Note The instrument cannot be powered or charged via USB connector.

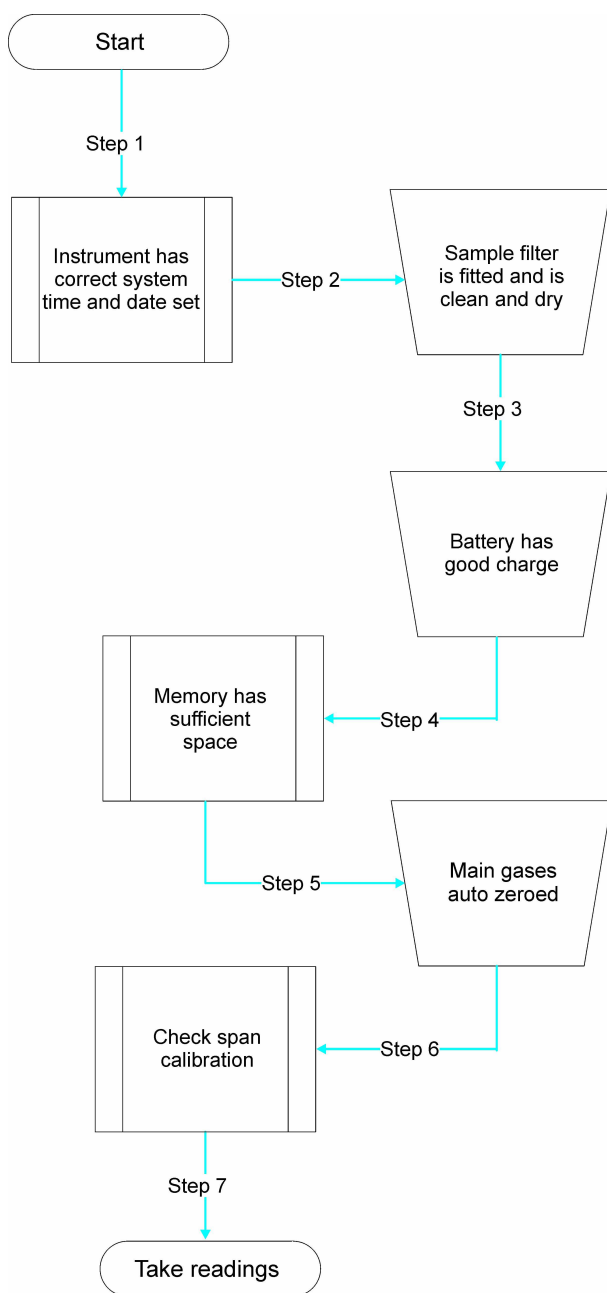
When plugged into the charger the instrument will power on and display charging. When complete the display will change to show that the instrument is charged. To switch the instrument ON whilst charging or charged is displayed the operator will need to press and hold the power key briefly.

Note A full charge will take approximately 4 hours. Typically, a fully charged battery will last 10-12 hours.

When the instrument is already powered on, the operation is slightly different as the battery icon changes to a flashing plug symbol. This will stop flashing when the charge is complete.

Taking Readings

Preliminary Checks - Best Practice



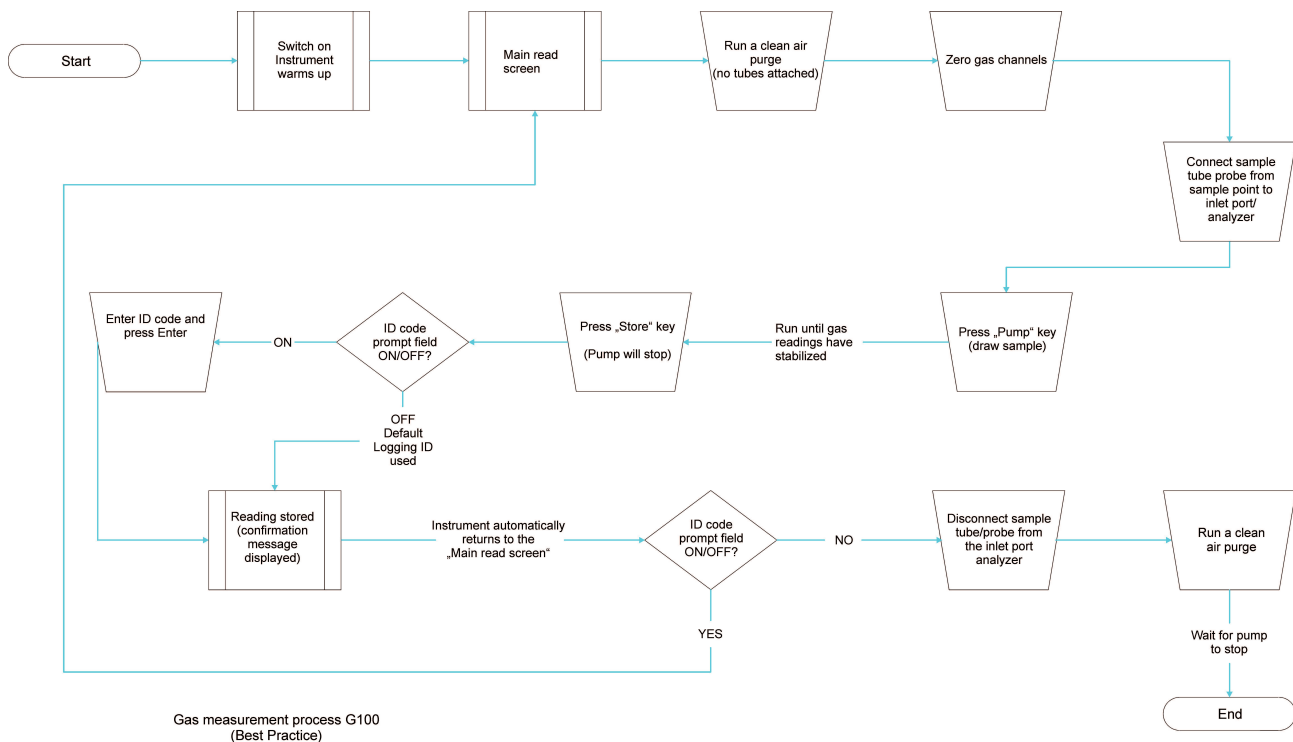
Preliminary Checks
(Best Practice)

Prior to use, it is good practice to ensure that:

- Step 1** The instrument has the correct time and date set.
- Step 2** The sample filter is fitted and that it is clean and dry.
- Step 3** The battery has a good charge (minimum 25% charge, even if only a few readings are required).
- Step 4** The memory has sufficient space available.
- Step 5** The main gases have been auto-zeroed, without gas concentration present.
- Step 6** If necessary check the span calibration with a known concentration calibration check gas.
- Step 7** Take readings.

- Do protect the instrument from strong direct sunlight which will quickly raise the temperature of the instrument beyond its operating range and the LCD display will appear almost black. The contrast setting cannot then alter the contrast.
- Do remember to always use the sample filter! If the sample filter becomes flooded, change it and ensure all sample tubes are clean and dry before re-use.
- Don't place the instrument against anything hot as this may cause excessive internal temperatures which can lead to erroneous readings.
- Don't get the instrument wet, for example exposure to rain.

Gas Measurement Process – Best Practice



Depending on preferences the exact reading procedure can change.

The following method is considered best practice and when followed correctly will allow quick and consistent readings to be recorded.

1. When the instrument is first switched on it should be purged with fresh air and allowed to stabilise for a few minutes.
2. At this point it is good practice to zero the CO₂ channel. This option is available via the 'Calibration' menu.
The instrument is now ready to take the first reading.
3. Connect the sample tube, if relevant (always use the sample filter) from the sample point to the inlet port of the instrument, ensuring the filter is seated correctly.
4. Press the 'Pump' key to draw a sample into the instrument.
Notice the main gas readings start to change. It is recommended to run the pump until the gas readings have stabilised (approx. 30 seconds) then press the soft-key 'Store'.
5. The pump will stop and the operator will be prompted to enter an ID code to identify the reading. A "reading stored" confirmation message will be displayed briefly before returning to the 'Main Read Screen'.

Note The ID code prompt can be switched on or off. This option is accessed via the 'Settings' menu, then press 'Key 1 - Prompt for ID: Yes or No'. If the ID prompt is set to 'No' the reading is stored using the default logging ID.

6. After each reading the instrument should be purged with fresh air.

7. Disconnect the sample tube from the instrument. Then, run the pump for a minimum of 30 seconds. The gas readings should return to nominal values for fresh air.

Regardless of the instrument configuration the following data will be stored for each reading:-

- ID code (8 characters)
- Reading Type (0=User, 1=Auto, 2=peak, 3=hold)
- Current time/date
- Gas readings (CO₂ and O₂)
- Sample pressure (for indication only)

Alternative Reading Methods

There are three other reading types or methods which each require slightly different operating procedures.

- Logged reading
- Peak reading
- Hold reading

Logged Reading

Logged readings need to be configured and initiated via the 'Utilities' menu by pressing 'Key 6 - Logging'. During configuration the user will be asked to supply an ID, reading interval and pump run-time.

These parameters are used to control the reading frequency in logging mode. Once logging mode is activated the instrument will automatically record a reading at every interval until stopped by the operator or the memory becomes full. Logging is also suspended temporarily whilst the user is accessing the menu options.

Whilst the logging mode is active both the 'Pump' and 'Store' key will be deactivated, only logged readings can be stored.

Peak Reading

The operator can toggle the reading mode between normal (current) and peak readings. Whilst in peak reading mode the instrument will only display peak values for each of the channels. These values can then be stored by pressing the 'Store' key or automatically at the appropriate logging interval (if logging is enabled).

The peak value is reset after a reading is stored or by exiting the peak mode using the appropriate soft-key. The current mode of operation can be identified by the status of the soft-key, either 'Normal' or 'Inverse', where inverse indicates peak mode is active.

Hold Reading

The 'Hold Reading' option allows the user to freeze the currently displayed reading. This allows it to be manually recorded or moved away from the sample point. Once activated, press the soft-key 'Hold' and the readings are fixed until the 'Hold' key is pressed again or by storing the reading.

The current mode of operation can be identified by the status of the soft-key which is inverted whilst in the hold phase. When hold is active the 'Pump' and 'Peak' keys are disabled.

Calibration

User Calibration

The G100 range of instruments is fully calibrated during manufacture and when returned for service. However, to improve accuracy between services a user/field calibration can be performed.

This section sets out the correct procedures to achieve an accurate user calibration.

Note If the calibration is completed incorrectly it may decrease the accuracy of the instrument.

Two important terms that are used within this section are “Zero” and “Span”.

Zero: The point at which the instrument is calibrated when there is none of the target gas present.

Span: The point at which the instrument is calibrated when a known quantity of the target gas is present.

Calibration Gases

User calibration of the instrument will improve the data accuracy in the range of the calibration gases used. However, it may cause less accurate readings of concentrations outside this calibrated range. Users should select the correct calibration gas for the expected gas levels on their particular application. Only use gases with a known certified gas concentration.

Note Certified calibration gases can be supplied by Geotechnical Instruments (UK) Limited.



WARNING For each gas used the appropriate material safety data sheet must be read and understood before proceeding. Calibration gases and the use of pressure regulators can be dangerous.

Calibration Set-up

The regulator supplied with the calibration kit has been configured to deliver a fixed flow. It only requires a few turns to open and no adjustment is necessary.



WARNING Exhaust Port

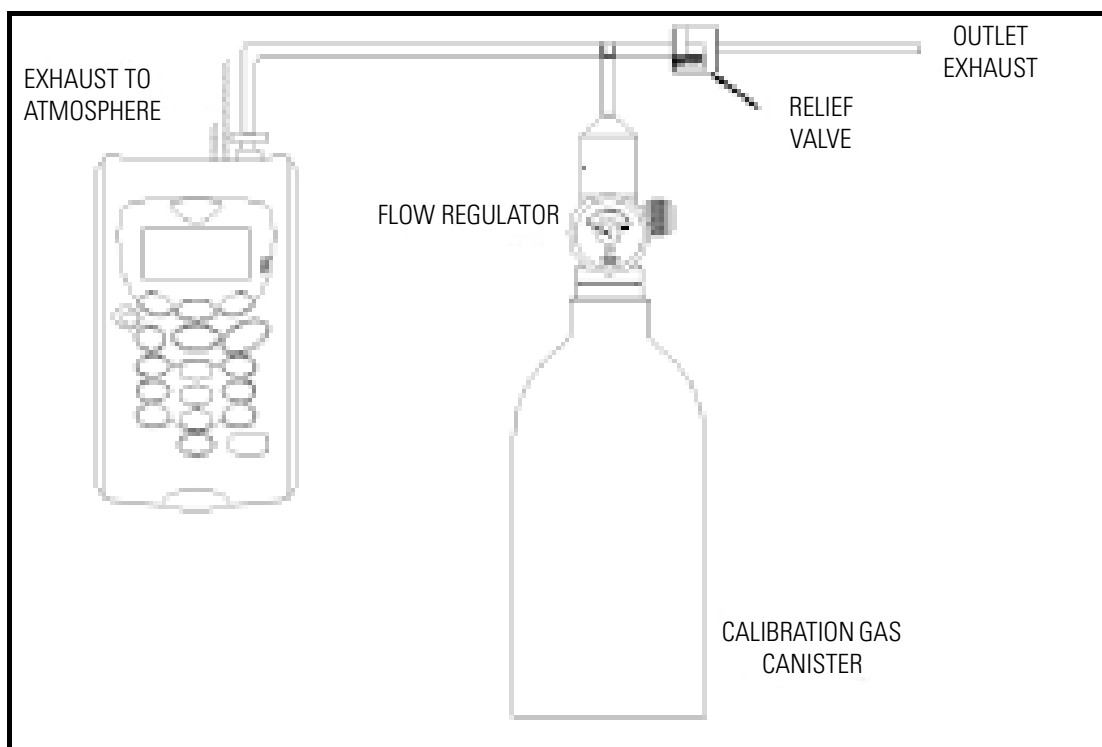
When the instrument is being calibrated, there are two possible exits for the gas; via the usual manner out of the exhaust port of the instrument or in cases of over-pressurisation the 1/16" port on the pressure relief valve.

It is recommended that both ports have exhaust tubing attached. The exhaust tubing must emerge in a well-vented area. Ensure there are no leaks in the tubing and connections.

The calibration should always be carried out in a safe area with all necessary precautions taken as all pressurised gases are potentially dangerous.

Calibration Equipment

The diagram below displays the regulator and tubing equipment for user calibration:

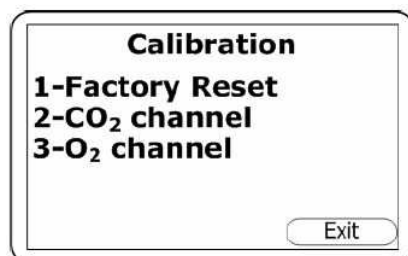


- Contact your equipment supplier for further information.
- The regulator supplied with the calibration kit is recommended as flow and pressure rates are factory set.

Calibration Method

Before you begin ensure the unit is stabilised at its working temperature before performing any of the calibration operations.

To achieve the processes set out in this section, press 'Key 3 – Calibration' from the 'Main' menu. The first screen displayed provides the option to select the gas that requires calibration.



Calibration

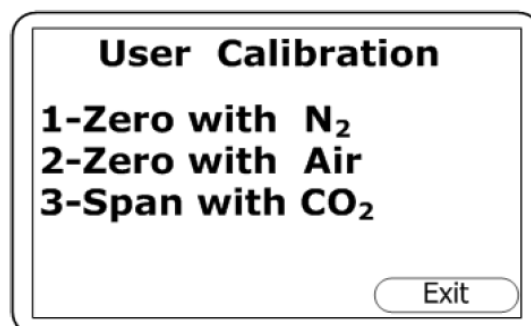
The exact calibration method can vary depending on the gases used.

Zero CO₂ Channel:

For maximum accuracy it is recommended that the CO₂ Channel is zeroed using bottled gas (certified 100% N₂). However, if nitrogen gas is not available the optional soda lime filter kit can be fitted to the gas inlet. This allows the user to perform a zero using normal air as the soda lime filter will absorb virtually all CO₂ from the sample air. For both these options select 'Key 1-Zero with N₂' from the user calibration menu.

If neither of the recommended methods is available the user can select the option to perform an air calibration. This option assumes that the user has access to fresh air at around 390ppm. Generally, this can be found outside or in a well ventilated corridor (typically, an office or lab would have a higher CO₂ concentration).

1. From the 'Calibration' Menu, press 'Key 2 - CO₂ channel'.



User Calibration

2. Press either 'Key 1 - Zero with N₂' (recommended) or 'Key 2 - Zero with Air' from the menu. Then, either attach the 100% N₂ or sample pipe to allow access to fresh air.
3. Press the 'Start' key. The instrument will now wait (approximately 60 seconds) for the gas reading to stabilize at the correct level. If zeroing with air press the 'Pump' key to draw in fresh air.

4. The instrument will then indicate a successful zero has been completed. Press the soft-key 'Accept' to confirm the calibration and 'Store' the new user offset. Alternatively, soft-key 'Reject' to exit without change.

Note If the calibration failed then purge and try again or select a different air source.

Note If using G110 – very high concentrations of CO₂ may take up to 30 minutes to purge completely.

Span CO₂ Channel:

It is recommended that the instrument is spanned to target the desired reading range (e.g. 5%); ideally this should not be a low level close to zero.

1. If not already preset, enter the **span target**, i.e. certified concentration of your calibration gas. Press 'Key 1' and enter the new value. Then attach the gas and open regulator valve to allow the gas to flow.
2. Press the 'Start' key and wait for the reading to stabilise. This can take a couple of minutes. Press the 'Pump' key to draw sample gas.
3. Once a stable reading is shown press the soft-key 'Accept'. A successful span calibration message will then be displayed. Press the soft-key 'Accept' again to confirm the calibration and 'Store' the new user span. Alternatively, press soft-key 'Reject' to exit without change.

Note If the calibration failed then try again using a longer purge time or different target gas.

Zero O₂ Channel:

It is not required to zero the O₂ channel. A span calibration corrects the reading across the whole range.

Span O₂ Channel:

It is recommended that the O₂ channel is spanned in fresh air with a target concentration of 20.8%, although other target concentrations can be used if required.

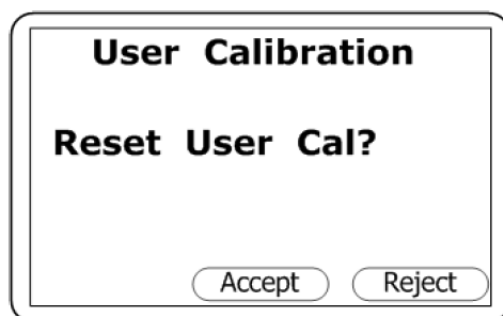
1. If not already preset, enter the **span target**, i.e. certified concentration of your calibration gas.
2. Press the 'Start' key and wait for the reading to stabilize. Press the 'Pump' key to draw in fresh air. This can take a couple of minutes.
3. Once a stable reading is shown press the soft-key 'Accept'. A successful span calibration message will then be displayed. Press the soft-key 'Accept' again to confirm the calibration and 'Store' the new user span. Alternatively, press soft-key 'Reject' to exit without change.

Note If the calibration failed then try again using a longer purge time or different target gas.

Reset Factory Settings

This option will reset the instrument to its factory programmed calibration characteristics and will clear the user calibration points for both gas channels.

1. To reset to factory settings, press 'Key 1 - Factory Reset' from the 'Calibration' menu.



User Calibration - Reset

2. To prevent the user calibration data being accidentally erased the user must confirm the action by pressing the soft-key 'Accept', or soft-key 'Reject' to exit without change.

Last Field Calibration

This data can be found in the 'Information' screen accessed via the 'Utilities' menu. This option displays the date that the last field calibration was performed on the instrument.

Calibration Record

The G100 instruments have the facility to log user calibrations via the 'Event Log'. This can be used as an aid in ensuring that gas measurements are valid and accurate.

During calibration the instrument will record the following in the event log. For each entry the time and date will be stored.

Event	Data recorded
Successful user zero CO ₂	Type (N ₂ or Air) and Readings before and after
Successful user span CO ₂	Target Value, Readings before and after
Successful user span O ₂	Target Value, Readings before and after
Failed user zero CO ₂	Type (N ₂ or Air) and Reading
Failed user span CO ₂	Target Value, Gas Reading
Failed user span O ₂	Target Value, Gas Reading
Return to factory settings	

Note If the calibration failed, then try again using a longer purge time or different target gas. This event log can only be downloaded and viewed via the optional G100 Range - Download Software. It cannot be viewed on the analyzer screen.

Problem Solving

This section outlines various warning and error messages which the operator may receive during general operation of the instrument. For further assistance please contact your equipment supplier.

Warnings and Errors

When switched on the instrument will perform a predetermined self-test sequence taking approximately 15 seconds. During this time many of the instrument's working parameters and settings are checked.

If any operational parameters are out of specification or if the pre-programmed recommended calibration/service date has passed, errors or warnings may be displayed.

Use the 'Scroll Up' and 'Scroll Down' keys to move through the list if required.

There are two types of warning that may be displayed:

- General warnings that may not affect the instrument's function and those where the self-test has detected a function that is outside the usual operating criteria, e.g. battery charge low, memory nearly full.
- Operational parameters that could affect the performance of the instrument, e.g. CO₂ out of calibration.

The most likely reason for these errors is either an incorrect user calibration, or may indicate sensor failure. If an incorrect user calibration has caused the warning it should be correctable by way of returning the instrument to factory settings, zeroing or carrying out a user calibration as necessary for the relevant function.

Under and Over Range Codes

If a reading is over range (i.e. above the maximum allowed reading) it will be displayed with more than chevrons (>>.>). This can occur if a channel has been incorrectly calibrated or the sample gas has exceeded its specified range (e.g. CO₂ > 20%).





If a reading is under range (i.e. below zero) it will be displayed with less than chevrons (<<. <). Refer to section "Calibration" on [page 7-1](#) of this manual to remedy under-range by performing a user zero.


A number displayed as asterisks (**.*) indicates an error, usually where the instrument has been unable to complete a particular calculation. Typically, this will be the first indication of a fault condition.

Where no data is available dashes (--.) are displayed. This usually occurs when a particular reading or parameter has been skipped by the user, or where an optional accessory is not fitted correctly, i.e. a temperature probe.

Self-test Warning Messages

The following warnings may be displayed during the self-test period when the instrument is switched ON.

Warning		Description
CheckMemory		The instrument only has space to store less than 50 readings before it is full. The exact number can be checked using the 'View Readings' option.
Memory Full		There is no more space in memory to store readings. Both the store and log options will be disabled until the memory is cleared. The readings should be downloaded to PC using the optional download software before memory is cleared.
Battery Low		The instrument does not have enough power to operate for a full day. The instrument should be recharged or connected to an external power supply.
Service Due		It has been 12 months (or more) since your instrument was returned to the manufacturer for a service. The performance and accuracy of the instrument may be impaired.
Low Flow		The instrument's gas inlet (or outlet) may be blocked. This warning is most commonly caused by a water-logged or dirty sample filter. Change the sample filter and check for obvious blockages in the sample tubes. Alternatively, a small amount of adjustment can be made to the low flow detection point to compensate for minor changes in the performance of the pump fitted to the instrument.
Check CO ₂ Cal.		This warning is most commonly caused by an incorrect user calibration. Try recalibrating the sensor or press 'Return to factory settings'. If the warning persists it may be caused by dirt or damage to the infrared sensor. The instrument will need to be returned to the manufacturer for service/repair.
Ref. Fault		This may be caused by dirt or damage to the infrared sensor in the instrument. The instrument will need to be returned to the manufacturer for service/repair.
*Invalid Config.		The instrument has detected a problem with the configuration parameters. The instrument will need to be returned to the manufacturer for service/repair. Most likely to be caused after firmware update.
Change O ₂ Cell		The oxygen cell has not been changed for at least 2 years; its performance and accuracy may be impaired. The instrument will need to be returned to the manufacturer for service.
Change Pump		The pump has exceeded its recommended run-time and should be changed. The instrument will need to be returned to the manufacturer for service.

Warning	Description
Change Battery	 <p>The Lithium Ion battery has exceeded its recommended life-time or number of charge cycles and should be changed. The instrument will need to be returned to the manufacturer for service.</p>
User Cal. Due	It has been over a month since the instrument was last user calibrated. For optimal performance and accuracy it is recommended that the instrument is user calibrated each time it is used.
Invalid Time	The instrument has an invalid time. This is most likely to occur after a reset. The correct time should be entered using the set 'Time & Date' option via the 'Utilities' menu.
Invalid Date	The instrument has an invalid date. This is most likely to occur after a reset. The correct date should be entered using the set 'Time & Date' option via the 'Utilities' menu.
Baro. Fault	The instrument has detected a fault with the barometric sensor or its calibration. This will have an effect on the accuracy of the readings as they are pressure compensated. The instrument will need to be returned to the manufacturer for service.

Note *Certain configuration problems can be corrected remotely. Using the G100 Range - Download Software, it is possible to export the current configuration and e-mail it to the manufacturer's Technical Support or Service Department. Depending on the type of error it may be possible to correct the configuration file and import it back into the instrument.

Problem Solving

User Calibration Trouble Shooting.

User Calibration Trouble Shooting.

Error	Remedy
User Zero failed	A possible reason for this is because the instrument is trying to zero to a level which is outside the predetermined range set when the unit was calibrated at the factory. To rectify this, first ensure the unit contains absolutely none of the gas which is being zeroed by flushing thoroughly with nitrogen. If it will not zero, then refer to the instructions given in the Reset Factory Settings section. If the instrument continues to fail to zero then the unit must be returned to the manufacturer for investigation.
Calibration failed	Check the span target is set to the correct value, if not, correct and retry spanning the channel. Repeat the entire procedure, including zeroing the channel and then calibrate the span. Ensure the reading is stable before spanning the channel.

Cross-Gas Effects

Carbon dioxide is measured by infrared absorption at a wavelength specific to carbon dioxide. Therefore, the carbon dioxide reading will not be affected by any other gases. The oxygen sensor is a galvanic cell type and suffers virtually no influence from CO₂, CO, H₂S, NO₂, SO₂ or H₂, unlike many other types of oxygen cell.

Hardware Reset

If for any reason the instrument 'locks up' and will not switch off, or the instrument appears off and will not turn, it is possible to force an emergency power off. Press and hold the ON-OFF key for 10 seconds will power off the instrument. Once this time has elapsed, the instrument can be powered on as normal.

Note Performing a hardware reset may cause loss or corruption of currently stored data including the time/date.

Service

The G100 instrument should be regularly serviced to ensure correct operation and accurate readings. The manufacturer recommends a full service and recalibration **every 12 months**.

Depending on usage the O₂ cell should be replaced every 2-3 years.

User Serviceable Parts

Note There are no user serviceable parts inside the instrument. Please do not attempt any repair as this may invalidate any warranty supplied with your instrument.

The following parts are supplied by your instrument manufacturer and can be user serviced:

Sample Filter	This should be regularly inspected for damage or discolouration and changed if needed. The instrument should never be operated without the sample filter as this may result in water or dust entering the instrument. The filter should be changed immediately if water can be seen. Failure to do so can damage the instrument.
Sample Tubing	Always ensure that sample tubes are not contaminated or damaged.

Warranty Policy

The warranty against defects in materials and workmanship is subject to our General Terms and Conditions.

During this period covers repair or replacement of defective parts on an exchange basis.

The decision to repair or replace will be determined by your equipment supplier.

To maintain this warranty, the purchaser must perform maintenance and calibration as prescribed in the operating manual.

Normal wear and tear, and parts damaged by abuse, misuse, negligence or accidents are specifically excluded from the warranty.

Note Please contact your equipment supplier for further information.

Warranty Policy

Technical Specification

G100 Range CO₂ Analyser TECHNICAL SPECIFICATION	
POWER SUPPLY	
Battery type	Li Ion
Battery life	10 Hours (8 hours with pump)
Battery lifetime	> 300 Cycles
Battery charger	5v DC external power supply and internal charging circuit
Charge time	3 Hours
Alternative power	USB connector DC power supply

GAS RANGES		
Gases Measured	CO ₂	By custom dual wavelength infra-red cell with reference channel
Oxygen cell lifetime	Approximately 3 years in air	
Range	CO ₂ (G100)	0-20%
Measurement Accuracy	Gas	
	CO ₂	Accuracy: ±(1% of range+2% of reading) at reference conditions ¹ Temperature dependence: ± 0.2% reading /°C (typical at 5% CO ₂) Pressure dependence: ±0.02% of reading/hPa (typical at 5% CO ₂)
Response time, T₉₀	CO ₂	≤ 20 seconds ≤ 60 seconds

¹ Conditions during factory calibration, typically 20°C, 1000mBar

FACILITIES	
Barometric pressure	800 - 1200 mbar
Visual and audible alarm	User selectable CO ₂ alarm level
Communications	USB type B mini-connector, HID device class
Data Storage	1000 reading sets

PUMP	
Flow	100cc/min typically

ENVIRONMENTAL CONDITIONS	
Operating temperature range	5°C – 40°C
Relative humidity	0 - 95% non condensing (RH Probe 0-100% non condensing)
Barometric pressure	±200 mbar from calibration pressure

PHYSICAL	
Weight	495 grams
Size	L 165mm, W100mm, D55mm
Case Material	ABS / Polypropylene with Silicone Rubber Inserts
Keys	17 Resin capped Silicone rubber keys
Display	Liquid crystal display, 128 x 64 pixel With RGB LED back-light
Gas sample filters	Built-in gas dryer tube to remove moisture User replaceable PTFE water trap filter

Note Due to a continuous programme of improvement, this specification is subject to change without prior notice.

Event Log

The following events are recorded in the instrument's event log. The event log can only be downloaded using the additional G100 Range - Download Software. Please refer to the G100 Range – Download Software manual for further details.

Event	Data
Cold Start/Reset	Type of start (MCUSR, boot_key)
Firmware Version	Description
Set time	Before and After
Set date	Before and After
Re-flash requested	Type
Restore to factory settings	Type
Comms clear memory	Type 0=Readings, 1=Event Log
Change contrast	Before and After
Change flow fail current limit	Before and After
Battery less than critical voltage	Critical, Actual
RTC date/time invalid	None
Factory calibration invalid or overdue	Date, difference
Service invalid or overdue	Date, difference
Power on self-test, sensor out of range	Channel, reading, limit
User calibration set zero OK	Before, After
User calibration set span OK	Target, Before, After
User calibration set zero failed	Target, Reading
User calibration set span failed	Target, Reading
Attempt to store when readings memory full	Max
Readings memory nearly full	Limit, Actual
Change logging mode	Status, Interval, Pump time
Change logging mode ID	ID
Flow fail current limit exceeded	Limit, Actual

Event Log

Sample Certificate of Calibration

This is a sample certificate of calibration supplied at the time of purchase and updated when the instrument is serviced.

CERTIFICATE OF CALIBRATION

Certificate number: IN00588_3/4705
Date of calibration: 27 November 2009
Product: G100
Serial number: IN00588
Calibration checked at: 19.9°C to 29.3°C

Primary Gas Channels

Carbon Dioxide (CO ₂)	
Certified Gas (%)	Reading (%)
9.85	9.9
2.46	2.4
5.02	4.9

Barometer	
Certified (mb)	Reading (mb)
989	990

Approved by: _____ (Name)

_____ (Signature)

All gases are traceable to certified National Standards

This unit must be serviced at regular 12 monthly intervals by a Thermo Fisher approved service facility.

Sample Certificate of Calibration

Important Notice to All Customers

WEEE COMPLIANT



The wheeled bin symbol now displayed on equipment supplied signifies that the apparatus must not be disposed of through the normal municipal waste stream but through a registered recycling scheme.

The Waste Electrical and Electronic Equipment directive (WEEE) makes producers responsible from July 1st 2007 in meeting their obligations, with the fundamental aim of reducing the environmental impact of electrical and electronic equipment at the end of its life.

The OEM is now registered as a producer and has joined a recycling scheme provider who will manage and report on our electrical waste on our behalf.

Producer Registration Number: see thermo.com/WEEERoHs

So when your instrument is at the end of its life, please contact your equipment supplier who will advise you on the next step in order to help us meet our obligations.

Important Notice to All Customers
WEEE COMPLIANT

Glossary of Terms - G100 Range

Analyser error messages	For a list of standard error codes and for more information, please refer to section “ Problem Solving ” on page 8-1 of the operating manual.
Analyser warnings	There are two types of warning messages displayed; general warnings that may not necessarily affect the instrument’s function, for example battery power low, and operational parameters that could affect the performance of the analyser, for example CO ₂ out of calibration.
Battery charge	A full battery charge will take approximately 4 hours.
Calibration	The process that an instrument will undergo to enable it to measure and display the various parameters in accordance with the manufacturer’s specification.
Chemical cell	Type of gas detector which can be fitted internally to the analyser at the time of manufacture.
Clean air purge	Process used to clear out gas from the inlet pipe and the analyser’s gas sensors prior to taking a new reading.
CO₂	Carbon dioxide gas.
Contrast adjustment	Adjustable setting which darkens or lightens the text displayed on the screen. Typically, this is used to compensate for different environmental temperatures. High temperature causes the display to darken and low temperature causes the display to lighten.
Data logging	A mode of operation that enables the user to leave the analyser unattended to take readings automatically at predetermined times. The reading interval and pump run-time may be adjusted prior to commencing the logging cycle.
Download	Terminology used to describe the transfer of data from the analyser to a PC via the G100 Range – Download Software.

Event log	Record of significant events in the life of the analyser. Used as an aid to monitoring the use of the analyser. It can also be used as a diagnostic tool if there is a problem with the analyser. The event log can be viewed via the G100 Range - Download Software. It cannot be viewed on the analyser screen.
Exhaust port	The point at which the gas exits the analyser. This is located on the top of the analyser. It is threaded to take an M5 hose-barb to allow an exhaust tube to be attached if required.
Exhaust tube	Clear plastic tubing used to route gases from the exhaust port.
Factory settings	Default calibration settings preset at time of factory calibration.
Firmware	Firmware is the name given to the analyser's internal software. This can be programmed using the re-flash command on the G100 Range – Download Software. The latest software release can be downloaded from the Geotech website. It is also automatically updated when the analyser is returned for servicing.
G100 Range – Download Software	The G100 Range – Download Software enables the user to maximise the operation of the incubator analyser. Instrument readings and event log data may be downloaded to a PC for further analysis and exported to other applications such as MS Excel.
General warnings	Displayed throughout the documentation with a warning symbol. Warning information may affect the safety of users.
Inlet port	Port located on the top of the analyser to which the inlet tube is attached.
LCD display	Liquid Crystal Display. Fitted to the front panel of the analyser.
Main Read Screen	The main analyser screen for normal operations and all operations are carried out from this screen.
Memory	The analyser memory should not be used as a permanent storage medium and data collected should be transferred using the G100 Range – Download Software.
Moisture removal tube	Device used to remove water vapour from the sample gas. This is located at the back of the analyser and should not be covered or partially covered. This is not user serviceable and should NOT be removed by the user.

O₂	Oxygen gas typically 20.9% in air, measured via electro-chemical cell.
Over range codes	Over range codes are errors above the maximum allowed reading and will be displayed with more than chevrons (>>.>)
ppm	Parts per million
Predetermined	Set up prior to use via G100 Range – Download Software.
Pump	The device used to transfer a gas sample into the instrument where that sample is not under pressure. Select the 'Pump' key on the analyser to activate.
Regulator flow	The regulator's flow is factory set. It only requires a few turns to open, no adjustment is available.
Sample tube	Tube used to transfer sample gas from the source to the analyser.
Span	The point at which the gas analyser is calibrated when a known concentration of the target gas is present.
Temperature probe	External device to enable the instrument to display data and record the temperature readings. This is an optional feature.
Under range codes	Under range codes are errors below zero and will be displayed with less than chevrons (<<.<)
User calibration	Users have the facility to calibrate the analyser between services. User calibration of the gas analyser will improve the data accuracy in the range of the calibration gases used.
Warm-up self test	Predetermined self-test sequence to test the analyser functions which takes place after the analyser is switched on and lasts approximately 30-40 seconds.
Warranty	The instrument is guaranteed against defect in materials and workmanship for a period of 12 months from the date of shipment to the user and is subject to the recommended service and recalibration requirements.
Zero	The point at which the gas analyser is calibrated when there is none of the target gas present.