eppendorf

New Brunswick™ Galaxy® Gas Analyzer

Operating manual

6710 900.300-01/052014

Table of contents

1 Operating instructions

1.1 Using this manual

- Carefully read this operating manual before using the device for the first time.
- Also observe the operating manual enclosed with the accessories.
- The operating manual should be considered as part of the product and stored in a location that is easily accessible.
- When passing the device on to third parties, be sure to include this operating manual.
- If this manual is lost, please request another one. The latest version can be found on our website www.eppendorf.com (international) or www.eppendorfna.com (North America).

1.2 Danger symbols and danger levels

1.2.1 Hazard Symbols

 **Hazard point**	 **Burns**
 **Electric shock**	 **Material damage**

1.2.2 Degrees of Danger

The following degree levels are used in safety messages throughout this manual. Acquaint yourself with each item and the potential risk if you disregard the safety message.

DANGER	*Will* lead to severe injuries or death.
WARNING	*May* lead to severe injuries or death.
CAUTION	May lead to light to moderate injuries.
NOTICE	May lead to material damage.

1.3 Symbols used

Example		Meaning
	▸	You are requested to perform an action.
	1. 2.	Perform these actions in the sequence described.
	•	List.
		References useful information.

1.4 Abbreviations used

IAQ
Indoor Air Quality

PC
Personal Computer

ppm
Parts per million

PSI
Pounds per Square Inch

OEM
Original Equipment Manufacturer

USB
Universal Serial Bus

WEEE
Waste Electrical and Electronic Equipment

1.5 Glossary

A

Analyzer Data Manager
The Analyzer Data Manager enables the user to maximize the operation of the incubator analyzer. Instrument readings and event log data may be downloaded to a PC for further analysis and exported to other applications such as Microsoft® Excel®.

Analyzer error messages
For a list of standard error codes and for more information, please refer to Troubleshooting.

Analyzer 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 analyzer (for example, CO_2 out of calibration).

B

Battery charge
A full battery charge will take approximately three hours.

C

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 fitted internally to the analyzer at the time of manufacture.

Clean air purge
Process used to clear out gas from the inlet pipe and the analyzer's gas sensors prior to taking a new reading.

CO_2
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 background to darken, and low temperature causes the display to lighten.

D

Data logging
A mode of operation that enables the user to leave the analyzer 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 analyzer to a PC via the optional Analyzer Data Manager.

E

Event log
Record of significant events in the life of the analyzer. Used as an aid to monitoring the use of the analyzer. It can also be used as a diagnostic tool if there is a problem with the analyzer. The event log can be viewed via the Analyzer Data Manager. It cannot be viewed on the analyzer screen.

Exhaust port
The point at which the gas exits the analyzer. This is located on the top of the analyzer. 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.

F

Factory settings
Default calibration settings preset at time of factory calibration.

Firmware
Firmware is the name given to the analyzer's internal software. This can be programmed using the re-flash command on the optional Analyzer Data Manager.

G

General warnings
Displayed throughout the documentation with a warning symbol. Warning information may affect the safety of users.

I

Inlet port
Port located on the top of the analyzer to which the inlet tube is attached.

L

LCD display
Liquid Crystal Display. Fitted to the front panel of the analyzer.

M

Main screen
The main analyzer screen for normal operations and all operations are carried out from this screen.

Moisture removal tube
Device used to remove water vapor from the sample gas. This is located at the back of the analyzer and should not be covered, partially covered, or blocked in any way. This is not user-serviceable and should NOT be removed by the user.

O

O_2
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 (>>.>).

P

ppm
Parts per million.

Predetermined
Set up prior to use, either preset at the factory or set via the optional Analyzer Data Manager.

Pump
The device used to transfer a gas sample into the instrument, where that sample is not under pressure. Press the Pump key on the gas analyzer to activate the pump.

R

Regulator flow
The regulator's flow is factory-set. It only requires a few turns to open; no adjustment is available.

S

Sample tube
Tube used to transfer sample gas from the source to the analyzer. This is user-serviceable.

Span
The point at which the gas analyzer is calibrated when a known concentration of the target gas is present.

T

T^{90}
The response time required to reach 90 % of set-point.

Temperature probe(s)
Optional external device(s) to enable the instrument to read, display and record temperature.

U

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 analyzer between services. User calibration of the gas analyzer will improve the data accuracy in the range of the calibration gases used.

W

Warm-up self-test
Predetermined self-test sequence to test the analyzer functions. This takes place after the analyzer is switched on.

Z

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

2 Safety

2.1 Intended use

G100 analyzer range are specifically designed to monitor CO_2 for the verification of incubators in research and pharmaceutical markets. Each analyzer incorporates the latest technology and specification requirements to provide the user with a fast, easy-to-use and accurate laboratory instrument.

2.1.1 Applications

- IVF/Medical
- Laboratories
- Brewing
- Incubators
- Research
- IAQ (Indoor Air Quality)
- Atmosphere Control
- Gas mixing

2.2 Warnings for intended use

NOTICE! Risk of material damage

- This equipment must be operated as described in this manual.
- Please read the entire operating manual before attempting to use this equipment. If operational guidelines are not followed, equipment damage may occur.

CAUTION! Risk of personal injury

- Do not use this equipment in a hazardous atmosphere or with hazardous materials for which the equipment was not designed.
- Please read the entire operating manual before attempting to use this equipment. If operational guidelines are not followed, personal injury may occur.

3 Product description

3.1 Main illustration

G100 analyzer range is shipped with the following standard components:

1 Battery Charger

2 Gas Analyzer

3 Operating Manual

4 Battery Charger Adaptors

5 Sample Tube Kit with Filter

3.2 Delivery package

3.2.1 Inspection of Boxes

Inspect the boxes carefully for any damage that may have occurred during shipping. Report any damage to the carrier and to your local Eppendorf sales order department immediately.

3.2.2 Packing List Verification

Unpack your order, saving the packing materials for possible future use. Save the operating manual for instruction and reference. Verify against your packing list that you have received the correct materials, and that nothing is missing. If any part of your order was damaged during shipping, is missing, or fails to operate, fill out the "Customer Feedback" form, available online at: www.eppendorf.com/contact.

3.3 Introduction

This manual explains how to use the following G100 analyzer range models:

- G100 CO_2 0 - 20 %
- G1100 CO_2 0 - 100 %
- G150 CO_2 0 - 10,000 ppm

NOTICE! Risk of material damage

- Each instrument is a sensitive piece of scientific equipment, and should be handled with care.

3.4 Features

All G100 analyzer range models has the following features:

- CO_2 0 - 20 % - G100
- CO_2 0 - 100 % - G110
- CO_2 0 - 10,000 - G150
- Options for:
  - O_2 0 - 100 %
  - Dual temperature probes from 0 - 50 °C
  - Data storage and download
  - Humidity sensor 0 - 100 %
- Improved accuracy of CO_2 readings
- Quick verification of CO_2
- Time saving with dual temperature probes
- Large data storage and user friendly software
- Easy-to-read, large well-lit display
- Built-in gas moisture removal

4 Operating controls and function

4.1 Operating Controls and Function

4.1.1 Instrument Panel

This section describes the G100 analyzer range instrument panel controls and function, (see Fig. 4-1 on p. 17) and (Fig. 4-2 on p. 19).

Fig. 4-1: Instrument panel - Front view

1 **Screen**
The display and interface for the user. This is the opening and closing screen seen by the user when using the instrument.

2 **Menu key**
Press this key to go to the Main menu. This enables you to pre-set values and settings for your application of the analyzer. The Main menu also allows you to select options for viewing data and stored readings.

3 **Enter key**
Press this key to confirm and save selections you have made among various functions and operations. Also press this key to confirm and save numeric data entry.

4 **Key 2: Scroll Up**
This key enables the user to scroll up in the current screen, to display more information. It is also the numeric 2 key.

5 **Key 6: Scroll Right**
This key enables the user to scroll right in the current screen, to display more information. It is also the numeric 6 key.

6 **Key 8: Scroll Down**
This key enables the user to scroll down in the current screen, to display more information. It is also the numeric 8 key.

7 **Key 4: Scroll Left**
This key enables the user to scroll left in the current screen, to display more information. It is also the numeric 4 key.

8 **Pump key**
Press this key to turn the pump on or off.

9 **On/Off key**
Press this key to turn the instrument on or off.

10 **Soft keys**
The function of these three keys changes according to the menu options from screen to screen.

Fig. 4-2: Instrument panel - Rear view

11 Moisture removal tube
This tool removes any moisture that may be present in the sample gas.

12 Serial number
Each instrument's unique identification number. If technical support should be needed, verification of this serial number will be required.

13 Instrument stand
Pull this folding bracket out to allow the instrument to stand on a flat surface (see Fig. 4-4 on p. 21).

NOTICE! Risk of material damage

- Never attempt to remove the back cover of the analyzer, and be careful not to cover or block the moisture removal tube with your hand when you hold the analyzer to take readings.

4.1.2 Instrument Connection Points

The instrument connection points (Fig. 4-3 on p. 20) and (Fig. 4-4 on p. 21) are located at the top and back of the instrument.

Depending on the configuration of your model, certain connectors may not be present.

Fig. 4-3: Connection points - Top view

1 Temperature 1
This connector for a temperature probe measures differential temperature between, for example, an incubator chamber and the ambient temperature.

2 Temperature 2
This connector for another temperature probe also measures differential temperature between, for example, an incubator chamber and the ambient temperature.

3 Humidity Probe
Connect an optional humidity probe here.

4 Gas Outlet
This outlet port is used to exhaust gas from the sample tube.

5 Gas Inlet
This inlet port is where you attach the sample tube (and filter) in order to take the gas reading.

Temperature connectors are fitted with snap rivets to prevent dust ingress, remove before use. Grip back cap and pull upwards to release. Refit when not in use.

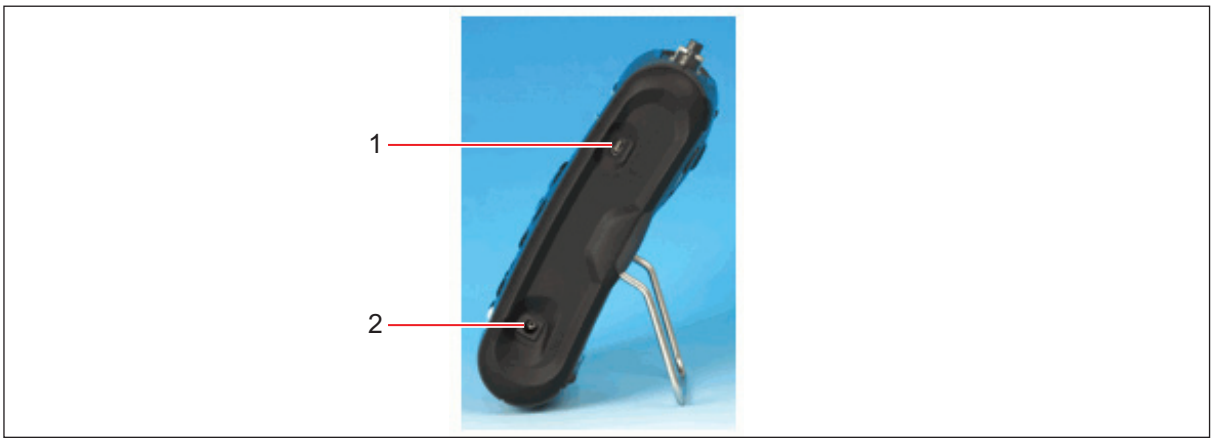


Fig. 4-4: Instrument connections

1 USB Cable
Use this connection point to connect the analyzer to a PC via a USB cable, to download data.

2 Battery Charger
Use this connection point for the battery charger, which, when plugged in to an electrical socket, will recharge the analyzer's battery.

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

5 Operation

5.1 Turning the Instrument On

Fully charge the instrument before use when the instrument is first received, or if the instrument has been in storage for six months or more.

Perform the following step to turn the instrument On:

- Press the **On/Off** key (see Fig. 4-1 on p. 17).
  - There will be a short beep and a slight pause, followed by the logo on the display.
  - The instrument will perform a short power on self-test.
  - Assuming there are no warnings to display, the instrument will display the main screen. If error codes or warnings appear, (see *Warning messages on p. 57)*.

5.2 Turning the Instrument Off

NOTICE! Risk of material damage

- Purge the gas analyzer with clean air before you turn it off to ensure that it is free of sample gas and ready for the next measurement. This is especially important to protect the oxygen sensor, as it may degrade if the sensor is contaminated with gas when you store the analyzer.

Perform the following steps to turn the instrument Off:

1. Purge the gas analyzer with fresh air by running the pump for approximately 30 seconds or until the readings have returned to normal levels.
2. Press the **On/Off** key to turn the instrument off.

If the **Auto Off** utilities setting (see *Settings on p. 30)* is set to Yes, the analyzer will turn off automatically after 10 minutes of non-use.

5.3 Main Screen

The main screen will be displayed after the analyzer has been turned on, and the power on self-test is complete.

The display will show the name/function of the three soft keys at the bottom of the screen. These functions are available while you are displaying the Main screen. The functions of the soft keys change from screen to screen. The Battery Power status icon and the Pump On icon will also be displayed.

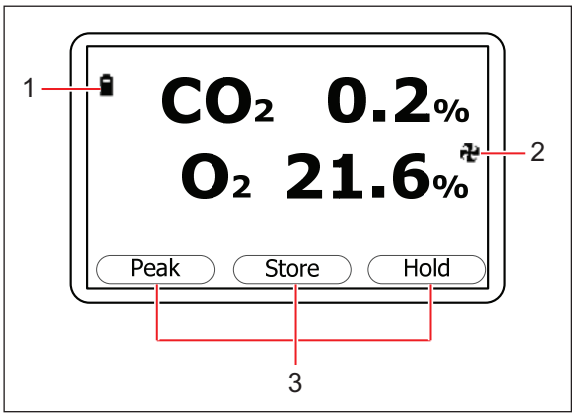


Fig. 5-1: Main screen

1 Battery power status icon

2 Pump (On) icon

3 Function of soft keys

The following describes the functions of the Main screen soft keys:

Name/Function	Description
Peak	▸ Press this key to display the peak reading (see *Peak Reading on p. 44)*.
Store	▸ Press this key to store the current reading for viewing and/or optional downloading later.
Hold	▸ Press this key to hold the current reading (see *Hold Reading on p. 45)*.

5.4 Instrument Status Icons

The following icons may be displayed on the screen during operation:

Display Icon	Meaning
	Status of battery charge (left to right, from full to empty)
(flashing)	Less than 1 hour charge remaining
(flashing)	Battery is charging
	Battery is charged
	Pump is running
(flashing)	Pump has stalled (Backlight turns red)
	Alarm is set
(flashing)	Alarm is active (Backlight turns red)

Display Icon	Meaning
	USB port is connected to a PC (icon flickers when transferring data)
	Logging mode is active (flashes when memory is nearly full)
	Temperature probe(s) is/are connected
	Humidity probe is connected
(flashing)	Instrument is due for service (every 12 months)
	Service is overdue
	Fault/Repair is needed (e.g., O_2 cell, battery or pump may need to be replaced
	Waiting

5.5 Entering Data

During normal operation, you may be prompted to enter data or information via the keypad, e.g., 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 to the left.

For example, to enter a new time of 09:25:00, type in 092500 by pressing the keys on the numeric keypad. The numbers will appear. (The boxes are to facilitate your reading on this page; they do not appear onscreen.)

		:			:		0
		:			:	0	9
		:		0	:	9	2
		:	0	9	:	2	5
	0	:	9	2	:	5	0
0	9	:	2	5	:	0	0

Fig. 5-2: Entering data

- Press the **Enter** key (see Fig. 4-1 on p. 17) to confirm/accept data entry.
  The Delete option will appear on the screen when data is being entered. Use the Delete soft key to make any corrections. Pressing the **Delete** key will delete the last character typed. Alternatively, you can retype the sequence before you press the **Enter** key; retyping will push the other numbers off the screen.

The G100 analyzer range will not accept invalid data. Delete invalid entries and begin again.

5.6 Changing Screens

By default, the instrument displays the Main screen (see Fig. 5-1 on p. 24) for gas measurement. This shows the CO_2 reading along with the optional O_2 reading. The instrument will return to this screen each time it is powered on, and when returning from the available menus.

The Scroll keys (see Fig. 4-1 on p. 17) can be used to switch to another measurement screen, e.g., Temperature or Humidity. If you continue to press the Scroll key, the instrument will return to the Main screen.

5.7 Memory

The memory should not be used as a permanent storage medium; 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.

5.8 Main Menu

The Main Menu allows the operator to select options for setting up specific parameters and performing operational tasks prior to taking sample readings or viewing data/information stored in the instrument's memory.

5.8.1 Accessing the Main Menu

To access the Main Menu from the Main screen:

Fig. 5-3: Main Menu

1. Press the **Menu** key on the instrument panel.

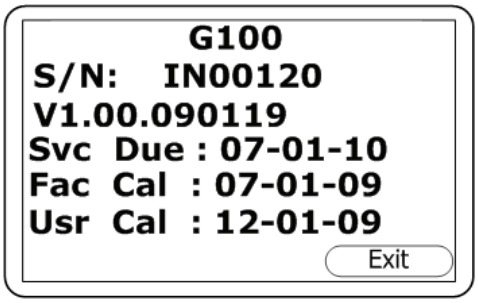
Press the right-hand soft key **Exit** at any time to exit the menu and return to the Main screen.

5.8.2 Information

The Information screen allows you to display information about your G100 analyzer range such as the instrument type (**G100** in this sample), serial number (**S/N**), current software version (**V**), service due date (**Svc Due**) and the dates of the last factory (**Fac Cal**) and user (**Usr Cal**) calibrations.

5.8.2.1 Accessing the Information Screen

To access the Information screen from the Main screen:



1. Press the **Menu** key on the instrument panel.
2. Press numeric key **1**.

Fig. 5-4: Information screen

Press the right-hand soft key **Exit** at any time to exit the menu and return to the Main screen.

5.8.3 Utilities

The Utilities Menu allows you to configure instrument readings before you begin taking readings.

5.8.3.1 Accessing the Utilities Menu

To access the Utilities Menu from the Main screen:

1. Press the **Menu** key on the instrument panel.
2. Press numeric key **2**.

Fig. 5-5: Utilities menu

Press the right-hand soft key **Exit** at any time to exit the menu and return to the Main screen.

5.8.3.2 Time and Date

The Set Time and Date screen allows you to check or reset the instrument's internal clock. The current time/date are appended to every stored reading.

1- and 2- indicate the numeric key to set each function (1 for Time, 2 for Date).

To access the Set Time and Date screen from the Main screen:

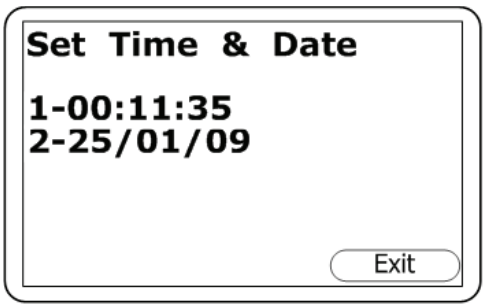


Fig. 5-6: Set Time and Date Screen

1. Press the **Menu** key on the instrument panel.
2. Press numeric key **2** to display the Utilities Menu.
3. Press numeric key **1** to display the Set Time & Date screen.

Press the right-hand soft key **Exit** at any time to exit this screen and return to the Utilities Menu.

To change the Time, press the numeric key **1**. The time is indicated in hours:minutes:seconds, and the hours are indicated in "military" time, i.e., from 00-23.

To change the Date, press the numeric key **2**. The factory default date setting is indicated in European style: day/month/year. You can use the Settings screen to change this to month/day/year.

If you take the instrument across time (or date) zones or your location changes to daylight savings time, you will need to change the instrument's time (or date) manually.

5.8.3.3 Contrast

The Adjust Contrast screen allows you to adjust the instrument's screen contrast, to compensate for changes in ambient temperature or lighting. The default setting is 0.

To access the Adjust Contrast screen from the Main screen:

Fig. 5-7: Adjust Contrast Screen

1. Press the **Menu** key on the instrument panel.
2. Press numeric key **2** to display the Utilities Menu.
3. Press numeric key **2** to display the Adjust Contrast screen:
4. To adjust the value displayed (0 in the sample screen above), press key **3** to scroll left (lower values) or key **6** to scroll right (higher values).
5. If you change your mind during the process and wish to return to the previous setting (the default 0 in the sample screen shown), press the right-hand soft key **Reject** to reject the change.
6. When the contrast displayed is suitable, press the middle soft key to Accept the change and to return to the Utilities Menu.

When you adjust and accept the Contrast setting, the instrument will retain the new setting when you turn if off and later turn it back on.

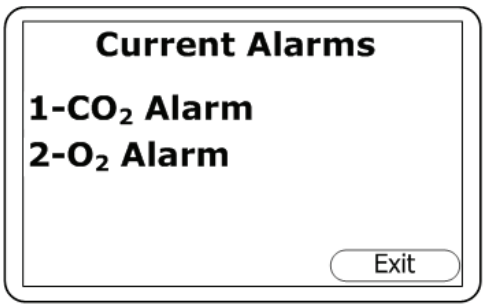
5.8.3.4 Alarms

The Current Alarms screen allows you to set High or Low alarms for the CO_2 gas channel and, if this option is present, the O_2 gas channel. The alarms for each channel can be enabled or disabled independently in this screen.

Once enabled, these alarms become active in the Main screen; this is indicated by a bell icon. If an alarm is triggered, the screen turns red and displays a flashing bell icon. The audible alarm, a beeper, sounds until the gas level has recovered beyond the set-point.

High alarms are triggered when the gas level exceeds the maximum value you set, while Low alarms are triggered when the gas level falls below the minimum value you set.

To access the Current Alarms screen from the Main screen:



1. Press the **Menu** key on the instrument panel.
2. Press numeric key **2** to display the Utilities Menu.
3. Press numeric key **3** to display the Current Alarms screen:

Fig. 5-8: Current Alarms screen

- 1- and 2- indicate the numeric key to set each function (1 for CO_2 Alarm, 2 for O_2 Alarm)
- Press the right-hand soft key **Exit** at any time to exit this screen and return to the Utilities Menu.

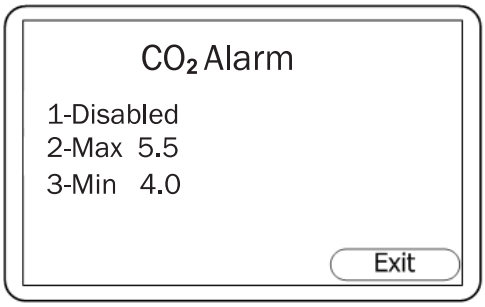


Fig. 5-9: CO_2 Alarm screen

4. Press numeric key **1** to access the CO_2 alarm (or press numeric key 2 for the O_2 alarm). The CO_2 Alarm (or O_2 Alarm) screen will allow you to disable any alarms previously set (press the numeric key **1** to do this), or to set or adjust the High (Max) and Low (Min) alarm values.
5. Press the numeric **2** key to set the Max alarm value, then use the numeric keys to enter the desired value. The decimal point is already present, so to set a value of 5.5, key in 55, then press the **Accept** (middle) soft key.
6. Press the numeric **3** key to set and accept the Min alarm value in the same way.
7. Press the right-hand **Exit** soft key to return to the Current Alarms screen.
8. If you wish to set O_2 alarms, press the numeric **2** key for the O_2 Alarm screen, then follow Steps 5 - 7.
9. Press the right-hand **Exit** soft key in the Current Alarms screen to return to the Utilities Menu.

5.8.3.5 Settings

The Settings screen allows you to setup or adjust the way information from samples and readings will be processed.

To access the Settings screen from the Main screen:

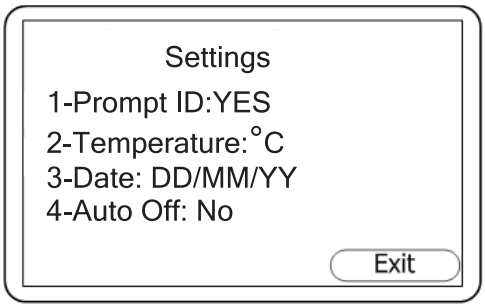


Fig. 5-10: Settings screen

1. Press the **Menu** key on the instrument panel.
2. Press numeric key **2** to display the Utilities Menu.
3. Press numeric key **4** to display the Settings screen:

- 1-, 2-, 3- and 4- indicate the numeric key for each function (i.e., press 1 for Prompt ID)
- Press the right-hand soft key **Exit** at any time to exit this screen and return to the Utilities Menu.

Prompt ID: If you want the instrument to prompt you for the ID code of the sample reading (to set an ID code(see *Logging on p. 34)*) and NO is currently displayed here, press numeric key **1** to toggle to YES. Press key **1** again to toggle back to the previous setting.

Temperature: In the sample screen, the temperature readings are taken and recorded in degrees Centigrade (°C). To change the default measurement unit from Centigrade to Fahrenheit (or vice versa), press numeric key **2**.

Date: Press key 3 to change the date format from dd/mm/yy ("European" format) to mm/dd/yy ("American" format) or vice versa.

Auto Off: If the screen says Auto Off is set to NO, press key **4** to select YES. When the Auto Off function is enabled, the instrument will automatically shut itself off when it has not been used for a period of 10 minutes. Press key **4** again if you wish to toggle back to NO.

5.8.3.6 Flow Fail

NOTICE! Risk of material damage

- If the filter has drawn in water, replace it immediately to prevent damage to the instrument. Dirty or discolored filters should also be replaced before you use the instrument again.

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.

Replace the filter, then press the Pump key to remove the flashing pump icon from the display.

If the instrument should fail during normal operation with a clean filter, the Adjust Flow Fail screen allows you to adjust the instrument's flow fail detection point.

To access the Adjust Flow Fail screen from the Main screen:

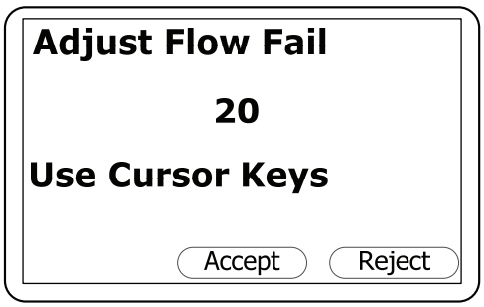


Fig. 5-11: Adjust Flow Fail Screen

1. Press the **Menu** key on the instrument panel.
2. Press numeric key **2** to display the Utilities Menu.
3. Press numeric key **5** to display the Adjust Flow Fail screen:
4. To adjust the value displayed (20 in the sample screen above), press key **3** to scroll left (lower, more sensitive Flow Fail detection values) or key **6** to scroll right (higher, less sensitive Flow Fail detection values).
5. If you change your mind during the process and wish to return to the previous setting (20 in the sample screen shown), press the right-hand soft key **Reject** to reject the change.
6. When the contrast displayed is suitable, press the middle soft key to Accept the change and then return to the Utilities Menu.

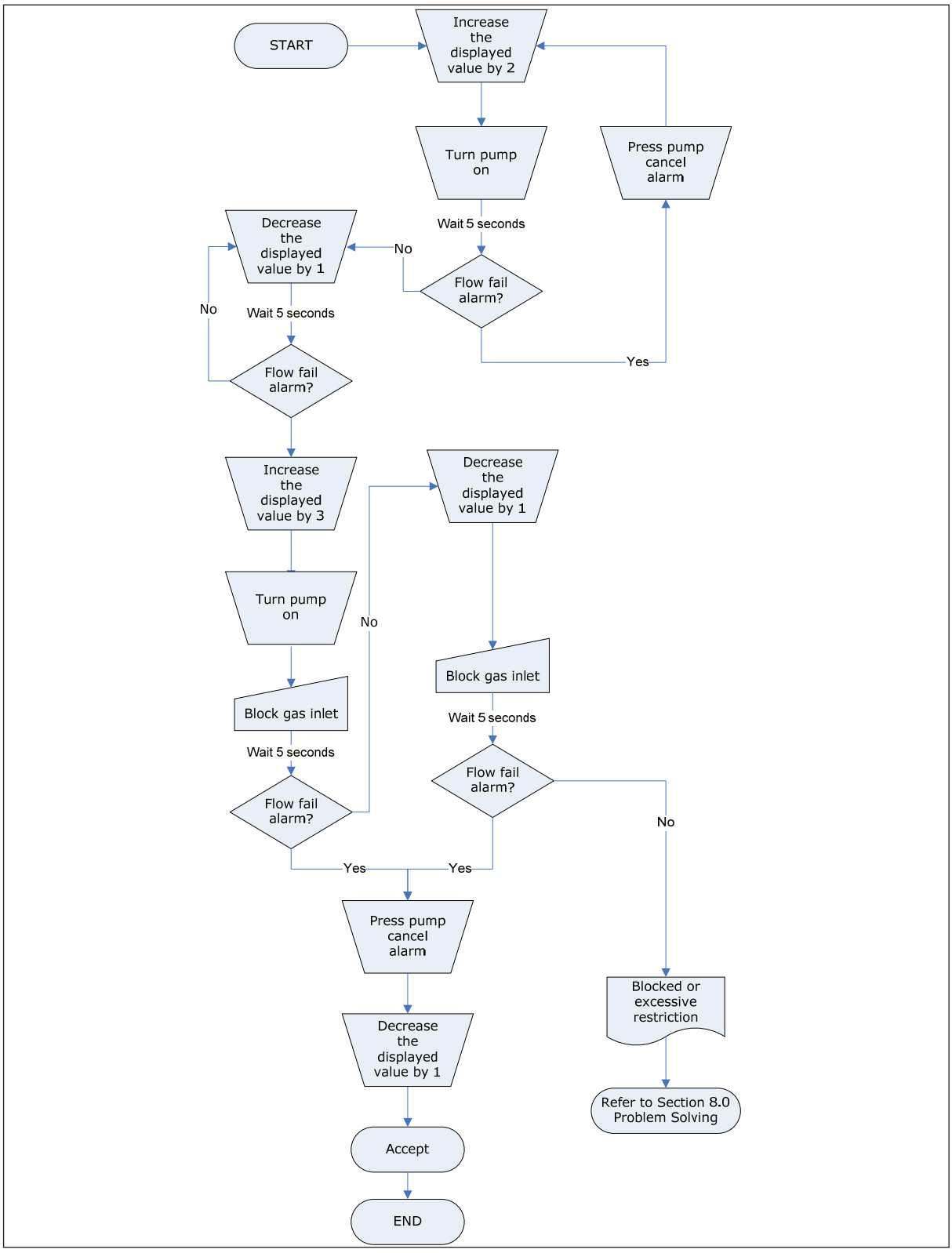


Fig. 5-12: Flow Fail set-up process – Best practice

5.8.3.7 Logging

In the Logging screen, you can start or stop data logging mode, you can set automatic data logging intervals and automatic pump operation intervals. You can also change the default 8-number ID code for data logging. When data logging mode is active, the icon is displayed in the Main screen.

To access the Logging screen from the Main screen:

1. Press the **Menu** key on the instrument panel.
2. Press numeric key **2** to display the Utilities Menu.
3. Press numeric key **6** to display the Logging screen:

Fig. 5-13: Logging Screen

- 1-, 2-, 3- and 4- indicate the numeric key for each function (i.e., press 1 to set the data logging interval)
- Press the right-hand soft key **Exit** at any time to exit this screen and return to the Utilities Menu.

Data Logging Interval (1-Every 00 mins): Press the numeric **1** key, then use the numeric keys to enter the time in minutes (01-99) for the desired interval between sample readings. When the number is in the display as desired (e.g., Every 10 mins), press the **Enter** key to save the change.

Pump Run Time (2-Pump 00 secs): Press the numeric **2** key to enter the length of time in seconds (01-60) that you wish the pump to run when taking a sample reading. When the number is in the display as desired (e.g., Pump 40 secs), press the **Enter** key to save the change.

The pump run time is the number of seconds the pump runs prior to storing the reading. This figure will need to take into account the sample tube length and the sample gas volume. 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.

ID Code (3-ID 00000000): Press the numeric **3** key to enter an 8-digit ID code. When the number is in the display as desired (e.g., 87654321), press the **Enter** key to save the change.

Start or Stop Data Logging (4-Start/Stop Logging): Press the numeric key **4** to begin or to end the data logging function, then press the **Enter** key to save your choice.

When you turn off the instrument, and each time you edit Logging parameters, data logging mode will automatically stop. You will therefore need to manually restart data logging in either case.

When the instrument is actively in logging mode, both the Pump and Store keys are deactivated; only logged readings can be stored.

5.8.3.8 Reset

Resetting the instrument will clear all user settings and any stored data including the optional event log. Perform the following steps to reset the instrument.

1. From the Main screen, press the **Menu** key on the instrument panel, then press the numeric **2** key to display the Utilities menu:
2. Press the numeric **7** key to select the Reset function. You will be prompted to enter a confirmation code (12345678 + Enter) to confirm that a reset is required.

Fig. 5-14: Utilities menu

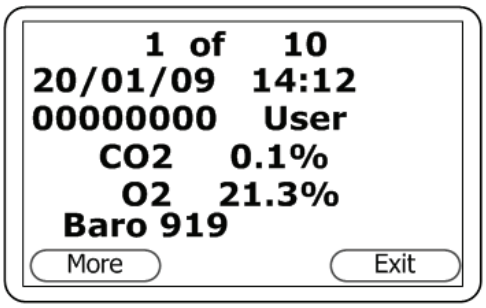
5.8.4 Calibration

The G100 analyzer range is fully calibrated at the factory and whenever it is returned for service. However, to improve accuracy between routine checks, a user/field calibration can be performed. For more information on how to use the Calibration function in the Main Menu (see *Calibration Method on p. 49)*.

5.8.5 View Data

The View Data function in the Main Menu allows you to view the stored data readings. To access this function from the Main screen:

5.8.5.1 Accessing the View Data Function



1. Press the **Menu** key on the instrument panel.
2. When the Main Menu screen opens, press the numeric **4** key to select View Data. The first part of the first View Data screen will be displayed:
3. To move through the stored data for the parameters shown on this part of the first screen (CO_2, O_2 and Baro), press the Scroll Left key (◂ 4) to scroll backward or the Scroll Right key (6 ▸) to scroll forward.

Fig. 5-15: View Data Screen 1a

The sample screen shows CO_2, O_2 and sample pressure (Baro) data read and stored on January 20, 2009 at 2:12pm, record ID code 00000000, User reading type.

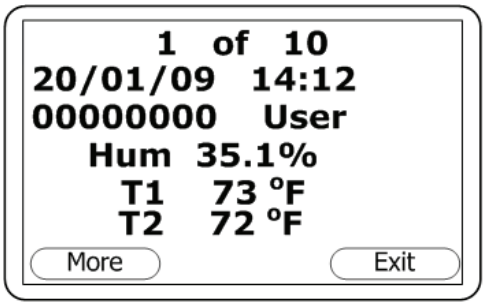


Fig. 5-16: View Data Screen 1b

4. To move to the second part of this first screen (Hum, T1 and T2), press the Scroll Down key (8/▼):
5. To return to the first part of the screen, press the Scroll Up key (▲/2).

The sample screen shows Humidity, Temperature 1 & Temperature 2 data read and stored on January 20, 2009 at 2:12pm, record ID code 00000000, User reading type.

Fig. 5-17: View Data Options Menu

6. To open the View Data Options menu, which allows you to delete, refine or filter the readings you wish to view, press the left-hand soft key (labeled More in the View Data screen):

Press the right-hand soft key **Exit** at any time to return to the View Data screen.

5.8.5.2 Delete All Data

When readings are 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.

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

The Delete All function allows you to check how many readings have previously been taken and to clear them from the memory if you so wish. Before the instrument will actually clear the memory, a caution message will appear on the display, requiring your confirmation.

To access the Delete All function from the Main screen:

1. Press the **Menu** key on the instrument panel.
2. Press the numeric **4** key to select View Data.
3. Press the left-hand **More** soft key to display the Options menu.
4. Press the numeric **1** key, then follow the prompt to confirm your wish to clear the memory of all data records.

5.8.5.3 Filter Data

Use this option to refine/filter the range of readings displayed by ID or particular date ranges.

To access the Filter screen from the Main screen:

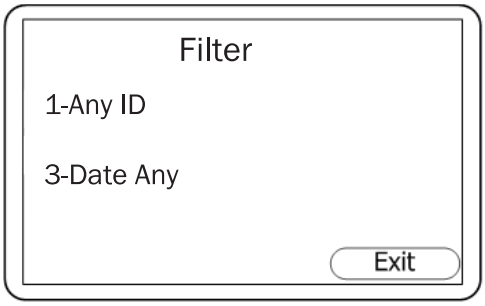


Fig. 5-18: Filter Screen

1. Press the **Menu** key on the instrument panel.
2. Press the numeric **4** key to select View Data.
3. Press the left-hand **More** soft key to display the Options menu.
4. Press the numeric **2** key to open the Filter screen:
5. Press numeric key **1** to select **Any ID** to display data saved to your ID code. You will be prompted to press numeric key **2**; the screen will then say **2-ID=00000000**. Press the numeric keys that correspond to your 8-digit ID code number, then press the middle (Accept) soft key.
6. Alternately, you may press numeric key **3** to select from a range of **Date** options:
7. Press numeric key **3**, **4** or **5** to select one of the Date options, then use the numeric keys to enter the defining date(s).
8. Press the middle **Accept** soft key each time you enter a desired date.
9. Press the right-hand **Exit** soft key to return to the Filter screen.
10. Press the **Exit** soft key again to return to the Options screen.

3-Date Between: this option allows you to enter two defining dates, a starting and ending date, to represent the range of records you wish to view.
4-Aft 00/00/00: this option allows you to enter the defining date after (later than) which you wish to view records.
5- Bfr 00/00/00: this option allows you to enter the defining date before (earlier than) which you wish to view records.

5.8.5.4 Go To Data

Use this option to jump to the first or last reading in the memory or to skip to any other reading.

To access the Go to Reading screen from the Main screen:

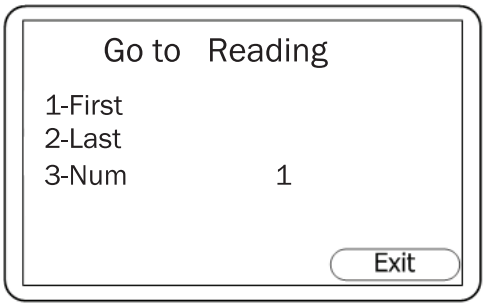


Fig. 5-19: Go to reading screen

1. Press the **Menu** key on the instrument panel.
2. Press the numeric **4** key to select View Data.
3. Press the left-hand **More** soft key to display the Options menu.
4. Press the numeric **3** key to open the Go to Reading screen:
5. **First**: Press the numeric key **1** if you wish to go to the first stored reading; use the Scroll keys to move through this record.
6. **Last**: Press the numeric key **2** if you wish to go to the last stored reading; use the Scroll keys to move through this record.
7. **Num**: If you would like to jump to one specific record, press the numeric key **3**, then enter the number of the reading you wish to see. For example, if you seek record 5 of 10, key in 5, and the instrument will display record "0005 of 0010". Use the scroll keys to move through this record.
8. Press the right-hand **Exit** soft key to return to the Options screen.

5.8.6 Diagnostics

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

This is not a function you will ordinarily need to use.

To access the Diagnostics screen from the Main screen.

- Press the **Menu** key on the instrument panel, then press the numeric **5** key to view diagnostics.

For further information, contact your equipment supplier

5.9 Warning and Error Codes

When turned on, the instrument will perform a short predetermined self-test sequence. 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, error codes or warnings may be displayed.

For error codes and warnings, (see *Warning messages on p. 57)*.

5.10 Battery/Charging

NOTICE! Risk of material damage

- Always recharge the battery using the charger provided with your G100 analyzer range. Although the instrument can be powered via its USB connector, it cannot be recharged via USB.

The G100 analyzer range uses a 2 Ah Lithium-Ion cell battery. A fully charged battery will operate for 8 - 10 hours with normal operation. Always use the battery charger provided with the instrument.

When plugged into the charger, the instrument will power on and display "Charging". A full charge will take approximately 3 hours.

When charging is complete, the display will change to show that the instrument is "Charged".

To turn the instrument on while charging, or when "Charged" is displayed, you will need to turn the instrument off and then on again.

If the instrument is already powered on when charging is initiated, the battery icon ( ) on the Main screen changes to a flashing plug symbol ( ) that will stop flashing ( ) when the charge is complete.

Instrument:	Input 5 VDC ± 0.5 V (max 1000 mA)
Mains/Power Supply:	Input 100 - 240 V ~ 60 / 50 Hz 120 mA Output 5 V ⎓ 1000 mA 5 V A
	236822 Q060580 N18371

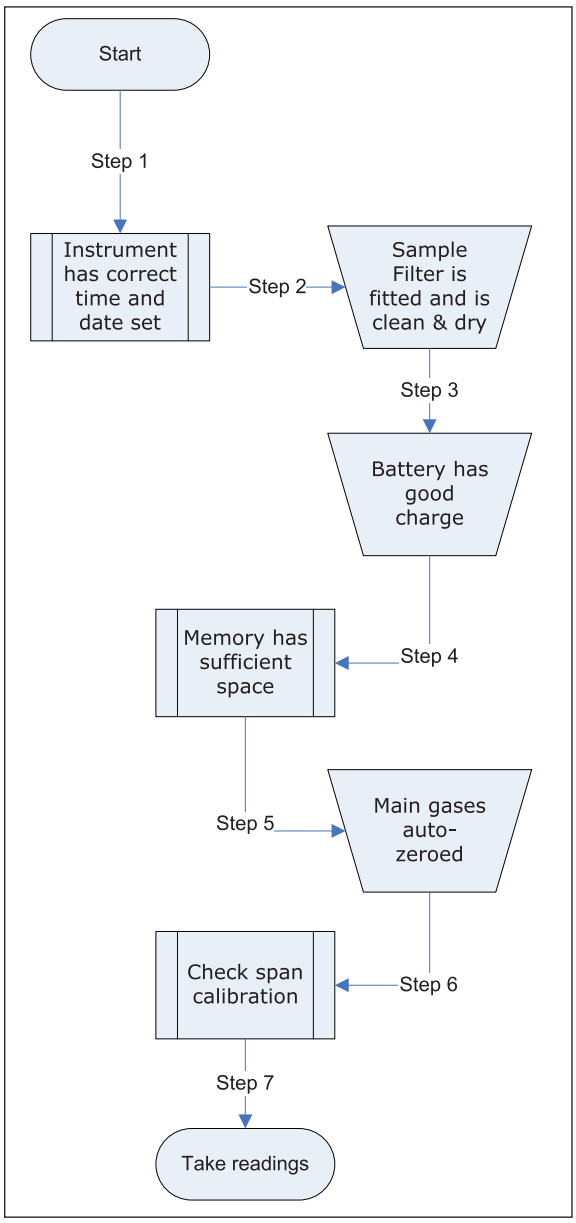
6 Taking readings

6.1 Preliminary Checks

NOTICE! Risk of material damage

- Protect the instrument from strong direct sunlight as this will quickly raise the temperature of the instrument beyond its operating range, causing the LCD display to appear almost black. In this case, the contrast cannot be adjusted.
- Always use the sample filter! If the sample filter becomes flooded, replace it and ensure all sample tubes are clean and dry before re-use.
- Don't place the instrument against anything hot: this may cause excessive internal temperatures which can lead to erroneous readings.
- Don't allow the instrument to get wet; for example, protect it from rain.

Prior to use, it is essential to ensure that:



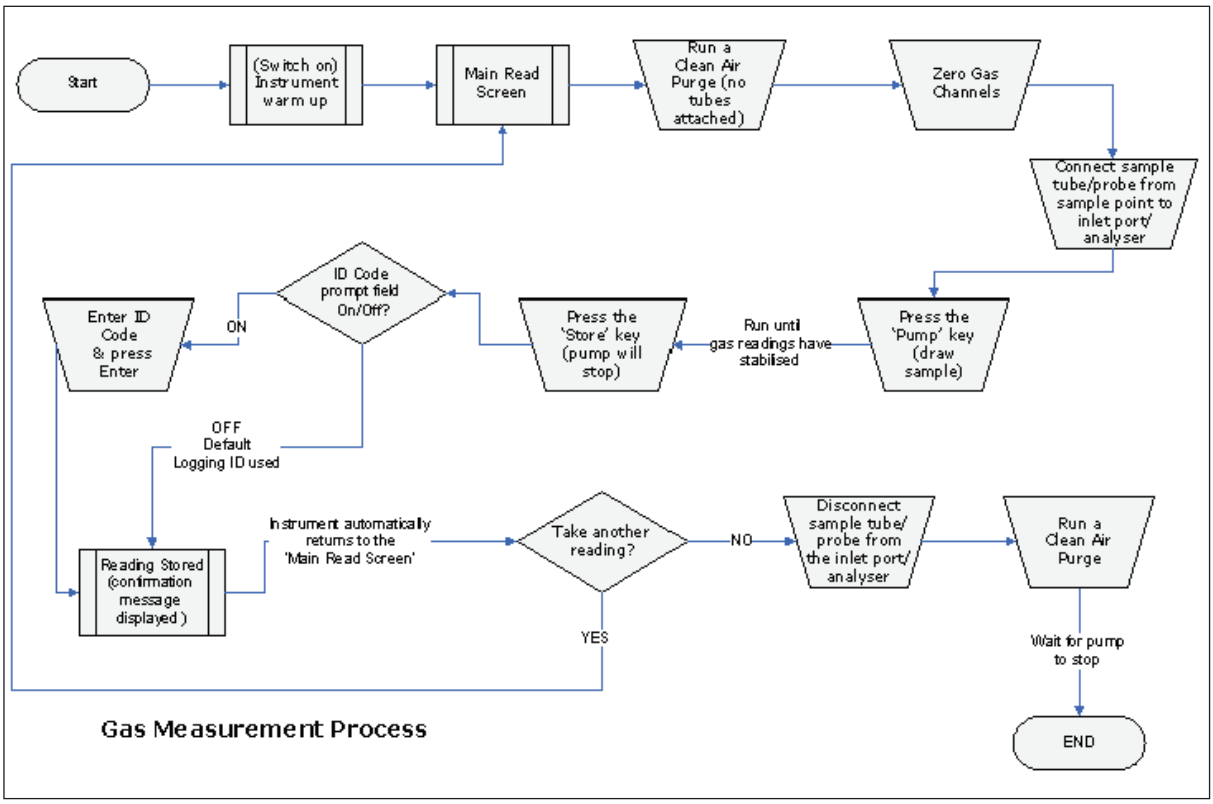
1. The instrument has the correct time and date set.
2. The sample filter is fitted and that it is clean and dry.
3. The battery has a good charge (minimum 25 % charge, even if only a few readings are required).
4. The memory has sufficient space available.
5. The main gases have been auto-zeroed, with no gas concentration present.
6. If necessary, check the span calibration with a known concentration calibration-check gas.
7. Take readings.

6.2 Gas Measurement Process

Depending on preferences, the exact measurement procedure can change. The following method, which is depicted in the flow diagram, is considered to be the best practice; if you follow it correctly, quick and consistent readings can be recorded.

1. When the instrument is first switched on, purge it with fresh air by running the pump for approximately 30 seconds, then allow it to stabilize for a few minutes.
2. Zero the CO_2 channel, following the calibration instructions (see *Setting CO_2 Channel Zero on p. 49)* for details.
3. The instrument is now ready to take the first reading. Connect the sample tube and sample filter (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.
5. Notice the main gas readings start to change. We recommend that you run the pump until the gas readings have stabilized (approximately 30 seconds), then press the **Store** soft key.
6. The pump will stop and, if the Prompt ID function is turned on, you 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 screen ("Main Read Screen" in the flow diagram shown).

   The ID code prompt can be switched on or off. This option is accessed via the Settings screen (see *Settings on p. 30)*. If the ID prompt is set to NO, the reading is stored using the default logging ID.
7. After each reading, purge the instrument with fresh air: 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 (CO_2, O_2)
- Sample pressure (for indication only)
- Temperature x 2
- Humidity

6.3 Alternative Reading Methods

There are three other methods for taking readings, each of which requires slightly different operating procedures. These alternative reading methods are:

- Logged reading (see *Logged Reading on p. 44)*
- Peak reading (see *Peak Reading on p. 44)*
- Hold reading (see *Hold Reading on p. 45)*

6.3.1 Logged Reading

Logged readings need to be configured and initiated via the Utilities menu; during configuration, you will be asked to supply an ID, reading interval and pump run time, for detailed instructions (see *Logging on p. 34)*.

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 you stop it or until the memory becomes full.

- Logging is suspended temporarily whenever you access menu options.
- When the instrument is actively in logging mode, both the Pump and Store keys are deactivated; only logged readings can be stored.

6.3.2 Peak Reading

You can toggle the reading mode between normal (current) and peak readings. In peak reading mode, the instrument will only display the peak value for each of the channels. These values can then be stored manually by pressing the **Store** key or, if logging mode is enabled, automatically at the appropriate logging interval.

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 labeled either Normal or Inverse, where inverse indicates Peak mode is active.

6.3.3 Hold Reading

The hold reading option allows you to freeze the currently displayed reading. This allows it to be manually recorded or moved away from the sample point. Hold the reading by pressing the **Hold** soft key; the readings will stay fixed until you press the **Hold** key again or you press the **Store** key to store the reading.

The current mode of operation can be identified by the status of the soft key labeled either Normal or Inverse, where inverse indicates Hold mode is active.

When the instrument is actively in Hold mode, both the Pump and Peak keys are deactivated.

6.4 Sampling on Galaxy CO_2 Incubator

1. Perform an Auto-Zero on your Galaxy incubator.
2. Turn off CO_2 gas by reprogramming setpoint for CO_2 to 0.0 % to prevent CO_2 from being injected into the chamber, which would give a false reading.
3. Use a flow rate ≤ 0.5 liters/minute to take the sample.
4. Keep the outer door closed.
5. Proceed with sampling as instructed above/below.
6. Remember to reset the CO_2 setpoint to desired level after sampling.

For detailed information on how to perform an Auto-Zero and program setpoint, refer to your Galaxy CO_2 Incubator operating manual.

7 Calibration

7.1 User Calibration

The G100 analyzer range is fully calibrated at the factory and whenever it is returned for service. However, to improve accuracy between routine checks, a user/field calibration can be performed.

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

If calibration is incorrectly performed, it may decrease the accuracy of the instrument.

Two important terms used in this section are Zero and Span:

- **Zero**: The point at which the instrument is calibrated when none of the target gas is present.
- **Span**: The point at which the instrument is calibrated when a known quantity of the target gas is present.

7.2 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. It is therefore important to select the correct calibration gas for the expected gas levels for your particular application. Only use gases with a known certified gas concentration.

CAUTION! Risk of personal injury

- Be sure to read and understand the appropriate material safety data sheet for each gas you use before proceeding: calibration gases and the use of pressure regulators can be dangerous.

7.3 Calibration Set-Up

The regulator supplied with the calibration kit is recommended for your use as its flow and pressure rates are factory-set. It only requires a few turns to open and no adjustment is necessary.

CAUTION! Risk of personal injury

- Be sure to read and understand the appropriate material safety data sheet for each gas you use before proceeding: calibration gases and the use of pressure regulators can be dangerous.

WARNING! Risk of personal injury

- When the gas analyzer is being calibrated, there are two possible exits for gas: via the exhaust port or, should the instrument be over- pressurized, via the 1/16-inch port on the pressure relief valve. We highly recommend therefore that you be sure to attach exhaust tubing—pre-tested to be leak-free—to both ports. Also ensure that this tubing's outlet is in a well-vented area.
- Always perform the calibration in a safe area, taking all necessary precautions as all pressurized gases are potentially dangerous, and some are flammable.

CAUTION!

- Do not exceed the maximum input pressure of 250 mbar (3.6 PSI).
- Do not exceed the maximum input flow rate of 250 ml per minute.

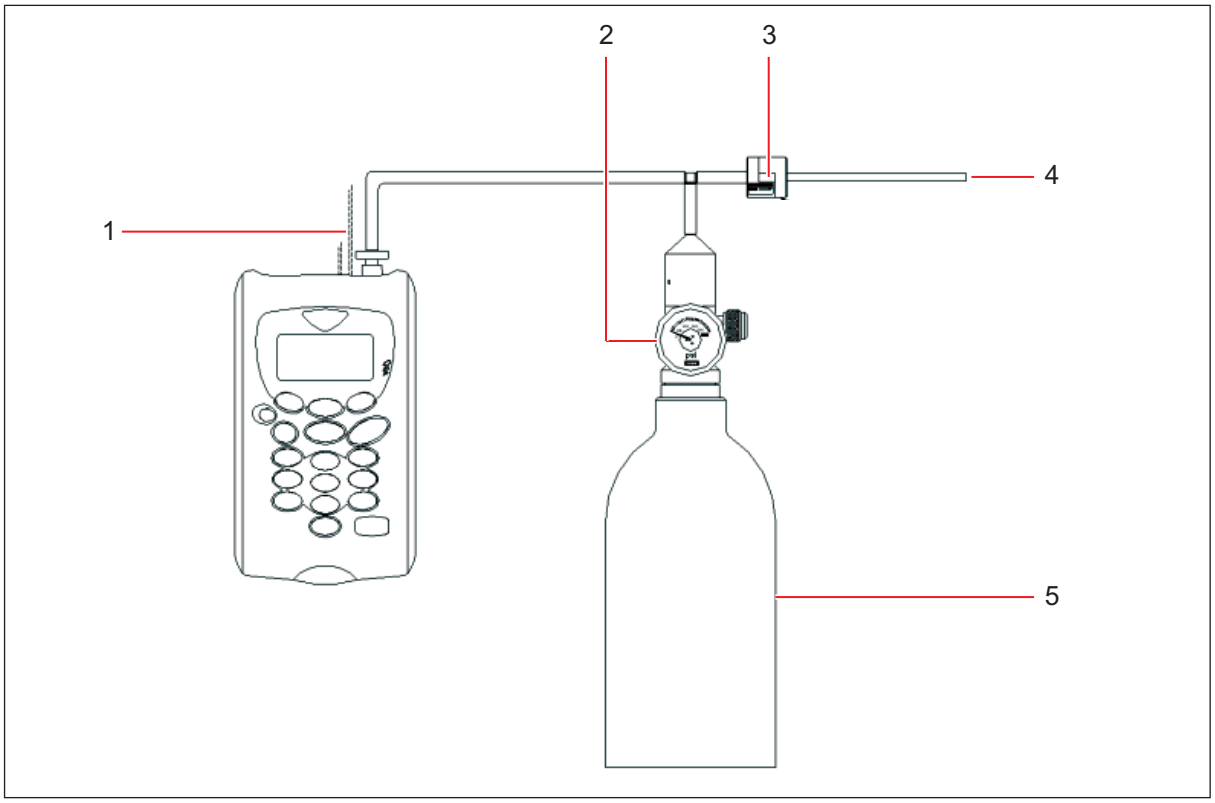


Fig. 7-1: Calibration Set-Up

1 Exhaust to Atmosphere

2 Flow regulator

3 Relief valve

4 Outlet exhaust

5 Calibration gas canister

7.4 Calibration Method

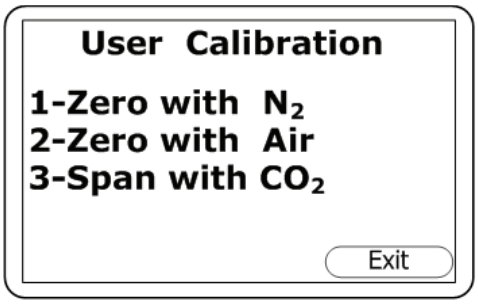
Before you begin any calibration operations, ensure that the instrument is stabilized at its working temperature.

To access the Calibration screen from the Main screen:

1. Press the **Menu** key on the instrument panel to open the Main Menu.
2. Press the numeric **3** key to select Calibration. This screen allows you to select the gas you wish to calibrate:

Fig. 7-2: Calibration Screen

For details about option 1, Factory Reset (see *Reset factory settings on p. 52)*.



3. Press the numeric **2** key to calibrate the CO_2 gas. This will bring you to the User Calibration screen for the CO_2 channel.
4. Proceed with the instructions (see *Setting CO_2 Channel Zero on p. 49)* and (see *Setting CO_2 Channel Span on p. 51)* to set the Zero and Span for the CO_2 channel.

Fig. 7-3: User Calibration (CO_2) Screen

To calibrate the O_2 channel, (see *Setting O_2 Channel Zero on p. 51)* and (see *Setting O_2 Channel Span on p. 52)*.

7.4.1 Setting CO_2 Channel Zero

For maximum accuracy, we recommend the use of certified 100 % N_2 bottled gas. However, if nitrogen gas is not available, the optional soda lime filter kit can be fitted to the gas inlet, allowing you to use normal air; the soda lime filter will absorb virtually all CO_2 from the sample air.

If neither of the recommended methods is available, you can perform an air calibration. This option assumes that you have access to fresh air at around 390 ppm. Generally, this can be found outside or in a well-ventilated corridor (an office or lab typically has a higher CO_2 concentration, which is not desirable for this operation).

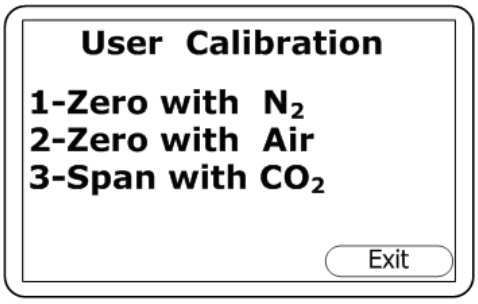


Fig. 7-4: User Calibration (CO_2) Screen

1. If you need to perform the Zero with air, skip to Step 2. To perform the Zero as recommended with N_2 or the soda lime filter kit, press the numeric **1** key (1-Zero with N_2), and attach the 100 % N_2 to the instrument's gas inlet (see Fig. 4-3 on p. 20) and (Fig. 7-1 on p. 48).
2. To perform the Zero with air, press the numeric **2** key (2-Zero with Air), and attach the sample pipe to the instrument's gas inlet (see Fig. 4-3 on p. 20) to allow access to fresh air.
3. Press the **Start** key. The instrument will wait approximately 60 seconds for the gas reading to stabilize at the correct level. If you are zeroing with air, you will need to press the Pump key to draw in fresh air.
4. The instrument will indicate when a successful Zero has been completed. Press the **Accept** soft key to confirm the calibration and press the Store key to save the new user offset. Alternatively, you can press the **Reject** soft key to exit without change.

CAUTION!

- Do not exceed the maximum input pressure of 250 mbar (3.6 PSI).
- Do not exceed the maximum input flow rate of 250 ml per minute.

5. To perform the Zero with air, press the numeric **2** key (2-Zero with Air), and attach the sample pipe to the instrument's gas inlet (see Fig. 4-3 on p. 20) to allow access to fresh air.

If the calibration fails, purge the instrument then try again. If you are zeroing with air, select a different air source.

7.4.2 Setting CO_2 Channel Span

We recommend that you set the span to target the desired reading range (e.g., 5 %); ideally this should not be a level close to zero.

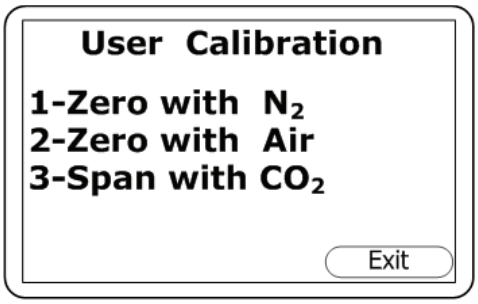


Fig. 7-5: User Calibration (CO_2) Screen

1. In the User Calibration screen, press the numeric **3** key (3-Span with CO_2).
2. If not already preset, enter the span target (i.e., the certified concentration of your calibration gas) by pressing the numeric **1** key and entering the new value.
3. Attach the CO_2 gas and open the regulator valve to allow the gas to flow.
4. Press the **Start** key and wait for the reading to stabilize. This can take a couple of minutes.
5. Once a stable reading is shown, press the **Accept** soft key. A successful span calibration message should then be displayed. Press the **Accept** soft key again to confirm the calibration and press the **Store** key to retain the new user span. Alternatively, you may press the **Reject** soft key to exit without change.

CAUTION!

- Do not exceed the maximum input pressure of 250 mbar (3.6 PSI).
- Do not exceed the maximum input flow rate of 250 ml per minute.

6. Attach the CO_2 gas and open the regulator valve to allow the gas to flow.

If the calibration fails, try again using a longer purge time or a different target gas.

7.4.3 Setting O_2 Channel Zero

It is not necessary to zero the O_2 channel. A span calibration should correct the reading across the whole range.

7.4.4 Setting O_2 Channel Span

We recommend that you use fresh air with a target concentration of 20.8 % oxygen to set the span of the O_2 channel, although other gases and target concentrations can be used if required.

1. If not already preset, enter the span target (i.e., the certified concentration of your calibration gas) by pressing the numeric **1** key and entering the new value.
2. Press the **Start** soft key and wait for the reading to stabilize (this can take a few minutes). Press the **Pump** key to draw in fresh air.
3. Once a stable reading is displayed, press the **Accept** soft key. A successful span calibration message should then be displayed. Press the **Accept** soft key again to confirm the calibration and press the **Store** key to retain the new user span. Alternatively, you may press the **Reject** soft key to exit without change.

If the calibration fails, try again using a longer purge time or a different target gas.

7.4.5 Reset factory settings

The Factory Reset option will reset the instrument to its factory programmed calibration characteristics, thereby clearing any user calibration points stored for both gas channels.

To reset to factory settings from the Main screen:

Fig. 7-6: Calibration Screen

1. Press the **Menu** key on the instrument panel.
2. Press the numeric **3** key to select Calibration.
3. Press the numeric **1** key .

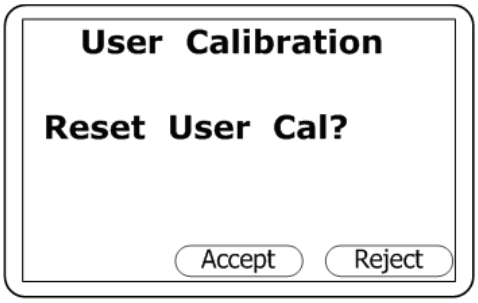


Fig. 7-7: Reset Confirmation Prompt

4. You will be prompted for a confirmation, to prevent unintentional deletion of user calibration data:
5. Press the middle soft key to **Accept** the deletion, or the right-hand soft key to **Reject** and exit without change.

7.5 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 perfomed on the instrument.

7.6 Calibration Record

The G100 analyzer range have the ability 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:

This event log can only be downloaded and viewed via the the Data Manager. It cannot be viewed on the gas analyzer's screen.

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	

8 Maintenance

8.1 Introduction

The G100 analyzer range should be regularly serviced to ensure correct operation and accurate readings.

Depending on usage, the O_2 cell should be replaced by the manufacturer every 2 - 3 years.

8.2 Replacement Parts

NOTICE! Risk of material damage

- There are no user-servicable parts inside the instrument. Do not attempt to open the gas analyzer, as this may invalidate the warranty.

The following parts are supplied by the manufacturer for your use with the G100 analyzer range:

Part	Used
Sample Filter	▸ Regularly inspect the sample filter, and replace it when you find signs of damage or discoloration. ▸ Never operate the instrument without the sample filter, as this may result in water or dust entering the gas analyzer. ▸ Replace the filter immediately if water is seen; failure to do so can damage the instrument.
Sample Tubing	▸ Always inspect the sample tubes to be sure they are not contaminated or damaged. Replace them as needed.

8.3 Cleaning

The instrument and accessories (including battery charger) can be wiped clean using a non-fibrous damp cloth.

NOTICE! Risk of material damage

- Do not apply pressure to the LCD display as this can cause damage.
- Do not apply any moisture to the moisture removal tube on the rear of the instrument as this may damage.
- Do not use solvents or any other chemical cleaners.

9 Troubleshooting

9.1 Introduction

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 local Eppendorf sales office or distributor.

9.2 Warning messages

When turned on, the instrument will perform a short pre-determined self-test sequence. 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., CO_2 out of calibration.

The most likely reason for these errors is an incorrect user calibration; it may also 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. If none of these interventions solves the problem, contact your Eppendorf representative for service.

9.2.1 Under- and Over-Range Codes

Warning message	Icon	Probable explanation
Over-range	>>.>	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., $CO_2 > 20$ %).
Under-range	<<.<	If a reading is under-range (i.e., below zero) it will be displayed with less than chevrons (<<.<). To remedy under-range perform a user zero (see *Calibration on p. 47)*.
Numbers displayed as asterisks	**.*	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.
No data available	--.-	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 (such as a temperature probe) is not fitted correctly.

9.2.2 Flow Fail Warning

A common error is a premature flow fail. This is caused by a blocked or flooded inlet filter. However, new instruments can go into flow fail prematurely as the pump loosens up over the first few days of use. For further information (see *Flow Fail on p. 31)*.

9.2.3 Self-Test Warning Messages

For warnings that may be displayed during the self-test period when the instrument is first turned ON (see Tab. on p. 58):

Tab. 9-1: Self-Test Warning Messages

Warning message	Icon	Probable explanation
Check Memory		The instrument only has enough space to store < 50 readings before the memory will be full. The exact number remaining can be checked using the View Readings option.
Memory Full		There is no space left in the memory to store new readings. Both the Store and the Logging options will be disabled until the memory has been cleared. The stored readings should be downloaded to your PC using the optional Analyzer Data Manager before you clear the memory.
Battery Low		The instrument does not have enough battery power to operate for a full day. Recharge the instrument or connect it to an external power supply.
Service Due		It has been 12 months or more since your instrument was returned for service. Its performance and accuracy may be impaired: service it now.

Warning message	Icon	Probable explanation
Flow Fail		The instrument's gas inlet or outlet may be blocked. This warning is most often caused by a dirty or water-logged sample filter. Replace the sample filter and check for blockage(s) in the sample tubes. Alternatively, a small adjustment may be made to the low flow detection point to compensate for minor changes in the performance of the instrument's pump; consult your Eppendorf service technician.
Check CO_2 Cal.		This warning is most often caused by an incorrect user calibration. Recalibrate the sensor or press Return to Factory Settings. If the warning remains, the infrared sensor may be dirty or damaged; return the instrument to the manufacturer for service or repair.
Check O_2 Cal.		This warning is most often caused by an incorrect user calibration. Recalibrate the sensor or press Return to Factory Settings. If the warning remains, the sensor may be damaged or faulty; return the instrument to the manufacturer for service or repair.
Ref. Fault		This warning possibly means the infrared sensor is dirty or damaged; return the instrument to the manufacturer for service or repair.
Invalid Config. *		The instrument has detected a problem with the configuration parameters, most likely after a software update. Return the instrument to the manufacturer for service or repair.
Change O_2 Cell		If the oxygen cell has not been replaced for at least 2 years, its performance and accuracy may be impaired. Return the instrument to the manufacturer for service.
Change Pump		The pump has exceeded its recommended run time and should be replaced. Return the instrument to the manufacturer for service.
Change Battery		The lithium ion battery has exceeded its recommended lifetime (or number of charge cycles) and needs to be replaced. Return the instrument to the manufacturer for service.
User Cal. Due		More than a month has passed since the last user calibration. For optimum performance and accuracy, run the user calibration each time you use the instrument.
Invalid Time		This is most likely to occur after you Reset the instrument. Enter the correct time using the Time & Date option from the Utilities menu.
Invalid Date		This is most likely to occur after you Reset the instrument. Enter the correct date using the Time & Date option from the Utilities menu.
Baro. Fault		The instrument has detected a fault with the barometric sensor or its calibration, which will affect the accuracy of readings because they are pressure-sensitive. Return the instrument to the manufacturer for service.

* Certain configuration problems can be corrected remotely. Using the optional Analyzer Data Manager, it is possible to export the current configuration, then 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, then import it back into the instrument.

9.3 User Calibration Troubleshooting

For error messages that may be displayed during a user calibration procedure (see Tab. on p. 60):

Tab. 9-2: User calibration error messages

Error	Probable Remedy
User Zero failed	It is quite possible the instrument is trying to zero to a level that is outside the predetermined range set at the factory when the instrument was calibrated. To rectify such a problem, first ensure that the instrument contains none of the gas you were zeroing: flush it thoroughly with nitrogen. Calibrate the zero again, and if it still fails, refer to the Reset Factory Settings instructions (see *Reset factory settings on p. 52)*. If the instrument fails to zero yet again, return it to the manufacturer for service.
Calibration failed	Make sure the span target has been correctly set; if not, correct the setting. Repeat the entire procedure, including zeroing the channel and then calibrating the span-make sure the reading is stable before you span the channel.

9.3.1 User Calibration Explained

User calibration is used for optimizing the performance of the instrument to the current operating conditions, such as ambient temperature and pressure; as well as correcting for instrument drift caused by lamp and filter settling.

In general, the instrument should not require calibration more than once a month, but we do recommend verifying the instruments operation each day.

Zero calibration and Span calibration may be performed individually; however, for a complete user calibration both must be completed.

(Fig. 9-1 on p. 61) shows the user calibration curves for factory, zero, and span calibrations.

9.3.1.1 Factory Calibration (Curve 1)

The G100 analyzer range is factory 'Factory' calibrated and stable.

9.3.1.2 Zero Calibration (Curve 2)

This corrects the entire curve for lamp and filter variations caused by aging and user induced drift due to dirt etc. If done correctly there is often no need to complete a span calibration. However a poor calibration **[A]** will result in a span error as shown with the zero indicating a small error **[B]** but a significant span error **[C]**.

The Zero calibration is very sensitive and even 100 % instruments will detect in the 0 to 100 ppm range even though they do not display to this resolution (see Fig. 9-2 on p. 62).

9.3.1.3 Span Calibration (Curve 3)

This optimizes the instrument at the span calibration concentration **[D]** for the current operational conditions and variations in user calibration gasses. It corrects the span point leaving the zero unadjusted and should be done at the concentration of normal operation.

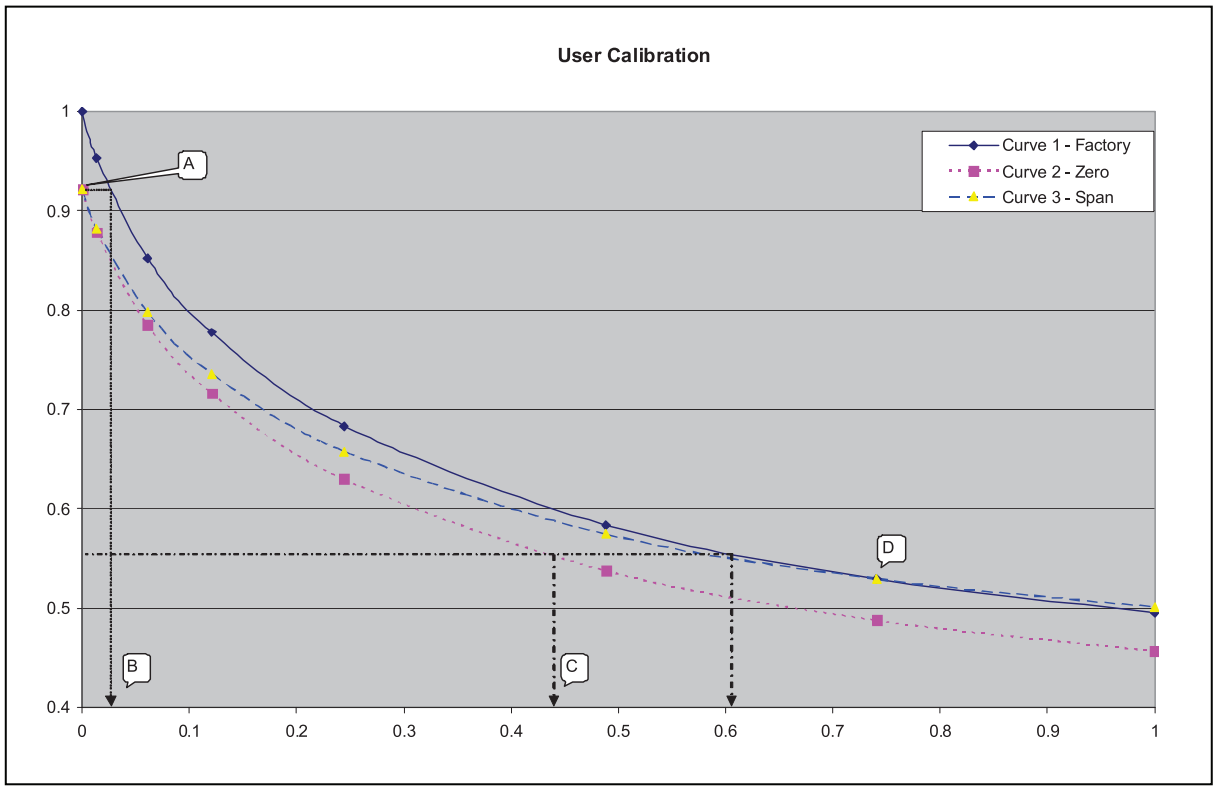


Fig. 9-1: User Calibration Curve

9.3.2 Zero Calibration Purge Time

Typical zero calibration reading less than 0.01 needs to be given time to settle. Start the calibration at least five minutes after the display concentration stabilizes is recommended (see Fig. 9-2 on p. 62).

Very high concentrations of CO_2 may take up to 30 minutes to purge completely.

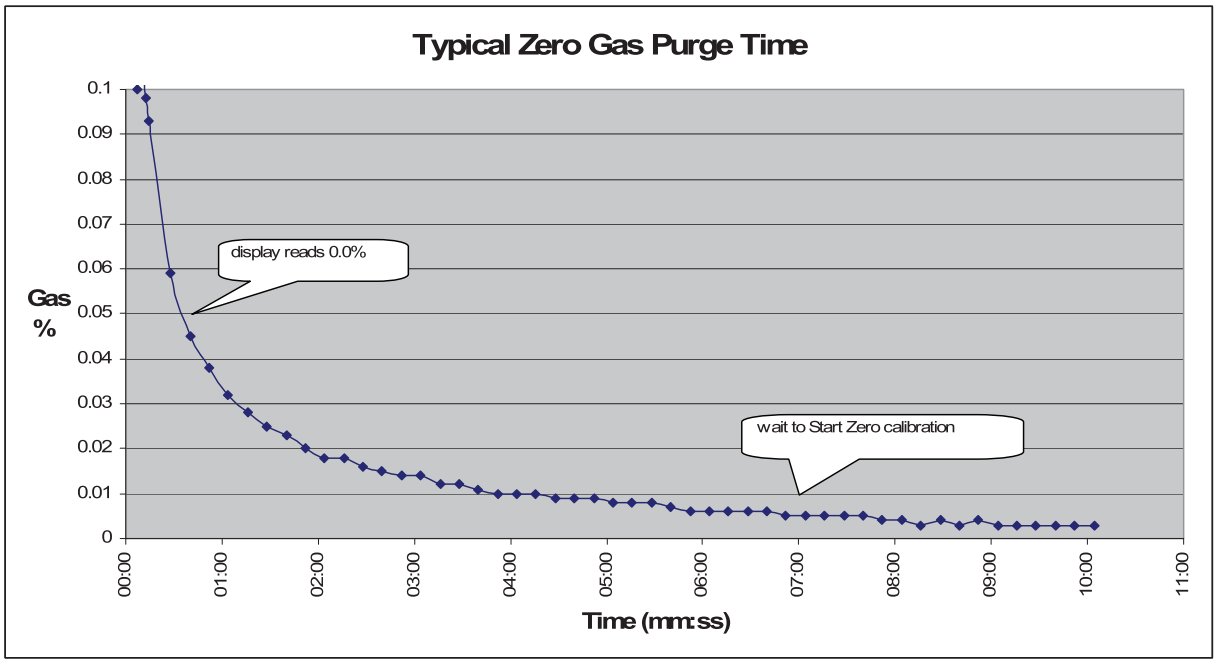


Fig. 9-2: Typical Zero Gas Purge Time

9.4 No Cross-Gas Effects

Carbon dioxide is measured by infrared absorption at a wavelength specific to that gas. Therefore, the carbon dioxide reading will not be affected by any other gases.

The oxygen sensor is a galvanic cell type and experiences virtually no influence from CO_2, CO, H_2S, NO_2, SO_2 or H_2, unlike many other types of oxygen cells.

9.5 Hardware Reset

IIf for any reason the instrument locks up and will not turn off, it is possible to force a hardware reset:

1. Press and hold the **On/Off** key for 10 seconds; wait at least 15 seconds, and the instrument should restart automatically.

Performing a hardware reset may cause loss or corruption of currently stored data, including the time/date. If this happens, be sure to reset the time and date.

10 Technical data

10.1 Specifications

For specifications on G100 analyzer range, contact your Eppendorf representative.

Galaxy Gas Analyzer Specifications		
Mains/Power Supply		
Battery Type	Lithium ion	
Battery Life before recharge	10 hours (8 hours with pump working)	
Battery Lifetime	> 300 cycles	
Battery Charger	5 V DC external mains/power supply and internal charging circuit	
Charge Time	3 hours	
Alternative Power	USB connector Mains/DC power supply	
Gases		
Gases Measured	CO_2	By custom dual wavelength infrared cell with reference channel
	O_2 (optional)	By internal electrochemical cell
Oxygen Cell Lifetime	Approximately 3 years in air environment	
Range	CO_2	0 to 20 %
	O_2 (optional)	0 to100 %
Measurement Accuracy*	CO_2	Accurate to ± 1 % range after calibration
	O_2 (optional)	Accurate to ± 1 % range after calibration
Response Time, T^{90}	CO_2	≤ 20 seconds
	O_2 (optional)	≤ 60 seconds
Other Features		
Temperature (optional)	Two temperature probes available, range 0 °C to +50 °C	
Temperature Accuracy	Typically, ± 0.1 °C from 32 to 44 °C, ± 0.2 °C over the remaining range	
Barometric Pressure	800 to 1200 mbar	
RH Measurement (opt.)	RH probe available, 0 to 100 % RH non-condensing	
RH Accuracy	± 1.5 % RH across the range	
Visual & Audible Alarm	User-selectable CO_2 and O_2 alarm levels	
Communications	USB type B mini-connector, HID device class	
Data Storage	1000 reading sets + 270 events	
Pump		
Flow	Typically, 100 cc/min	
Environmental Conditions		
Operating Temperature Range	0 °C to 50 °C	

Galaxy Gas Analyzer Specifications	
Relative Humidity Range	0 to 95 % non-condensing (RH Probe 0 to 100 % non-condensing)
Barometric Pressure	± 500 mbar from calibration pressure
IP Rating	IP40
Physical Characteristics	
Weight	495 grams (17.5 oz)
Dimensions	Length: 165 mm (6.5 in) Width: 100 mm (3.9 in) Depth: 55 mm (2.2 in)
Case Material	ABS / Polypropylene with silicone rubber inserts
Keypad	17 resin-capped silicone rubber keys
Display	Liquid crystal display (LCD), 128 x 64 pixels with RGB LED backlight
Gas Sample Filters	Built-in gas dryer tube to remove moisture User-replaceable PTFE water trap filter

*Plus accuracy of calibration gas used.

These specifications are subject to change without prior notice.

11 Ordering information

11.1 Accessories

This section explains the optional products available for purchase, which will enhance the usability of the G100 analyzer range, and enable further analysis of data and reading information.

For more information on the products listed in this section, contact your Eppendorf representative.

11.1.1 Analyzer Data Manager

The G100 analyzer range optional Analyzer Data Manager software enables the user to maximize the potential of the incubator analyzer. Instrument readings and event log data may be downloaded to a PC for further analysis and exported to other applications such as Microsoft® Excel®. It enables direct communication with the G100 analyzer range, features a simple download capability, and is fully compatible with the latest Microsoft operating systems.

11.1.2 Event Log

The G100 analyzer range incorporate the ability to log significant events via the Event Log feature. This can be used as an aid to monitoring the use of the instrument. It can also be used as a diagnostic tool if a problem should occur with the instrument.

The event log can only be viewed via the optional Analyzer Data Manager. It cannot be viewed on the analyzer 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, it begins to overwrite 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. For more information on this feature, (see *Optional Event Log on p. 71)*.

11.1.3 Temperature Probes

The G100 analyzer range has the ability to read and display two temperature readings via optional temperature probes. When a temperature probe is fitted to one of the two temperature ports on the top of the instrument, the display will automatically show the current reading and a temperature probe icon will be shown.

The display can also be changed to show a $T_1 - T_2$ calculation by pressing the appropriate key. Pressing the scroll up or scroll down key in certain screens can allow you to toggle between the gas reading and the temperature reading.

The $T_1 - T_2$ result is not stored as part of the reading.

The operator can also choose to display the temperature reading in either Centigrade or Fahrenheit (see *Settings on p. 30)*.

11.1.4 Humidity Probe

The instrument has the optional ability to use a humidity probe (specified at the time of purchase). This allows the instrument to read and display humidity readings from the optional probe.

When a humidity probe is fitted, the display will change automatically to show the current reading and a humidity probe icon will be shown. The Scroll keys on the instrument panel are used to switch between the reading screens.

The humidity kit contains the humidity lead and the humidity sensor. If you have purchased and received the optional humidity sensor, connect by plugging the humidity sensor onto its mating connector on the transmitter or connection cable. Make sure that the catches are aligned correctly, then finger-tighten the knurled nut.

Refer to the instruction leaflet included with the humidity sensor packaging for the Humidity Standards.

11.1.5 Oxygen Reading

The instrument has the optional facility to use an internal oxygen cell (specified at the time of manufacture). This allows the instrument to read and display oxygen readings along with CO_2.

Oxygen sensor stability; as the sensor is a partial pressure sensor its output will be affected by changes in relative humidity. Although the percentage of O_2 in the air is relatively constant, the relative humidity in air is variable. A unit calibrated with dry air could cause the readout to read low by up to 0.5 % by volume.

11.2 Spare parts

11.2.1 Accessory parts

The optional accessory and replacement parts for the G100 analyzer range on the following page may be purchased from your equipment supplier:

Item	Description
A	USB Lead
B	Spare Inlet Filters (pack of 5)
C	Sample Tube with Filter
D	Hard Carrying Case
E	Temperature Probe (100 mm tip)
F	Temperature Probe (5 mm tip)
 G H I	Humidity Kit: Probe (4 mm stainless steel tip) with Cable Humidity Lead and Sensor Humidity Sensor Only
J	Moisture Trap (pack of 2)
K	Spare Calibration Gas, 5 % CO_2
L	Mains/Power Charger including Worldwide Adaptors
M	Soft Carry Case
N	Soda Lime Filter Kit
O	Analyzer Data Manager Software
P	Regulator and Tubing for Calibration Gas

12 Transport, storage and disposal

12.1 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; this helps prolong the life of the O_2 cell.

Fully charge the instrument before use if the instrument has been in storage for six months or more.

12.2 Disposal

In case the product is to be disposed of, the relevant legal regulations are to be observed.

Information on the disposal of electrical and electronic devices in the European Community:

Within the European Community, the disposal of electrical devices is regulated by national regulations based on EU Directive 2012/19/EU pertaining to waste electrical and electronic equipment (WEEE).

According to these regulations, any devices supplied after August 13, 2005, in the business-to-business sphere, to which this product is assigned, may no longer be disposed of in municipal or domestic waste. To document this, they have been marked with the following identification:

Because disposal regulations may differ from one country to another within the EU, please contact your supplier if necessary.

In Germany, this is mandatory from March 23, 2006. From this date, the manufacturer has to offer a suitable method of return for all devices supplied after August 13, 2005. For all devices supplied before August 13, 2005, the last user is responsible for the correct disposal.

13 Optional Event Log

The following events are recorded in the instrument's event log. The event log can only be downloaded using the optional Analyzer Data Manager (please refer to the Analyzer Data Manager manual for further details).

Event	Data
Cold Start/Restart	Type of start (MCUSR, boot_key)
Software Version	Description
Set Time	Before and After
Set Date	Before and After
Re-flash requested	None
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

Index

Evaluate your manual

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