ΩEOMEGA®

GAB-1700

GAB-1700
Benchtop Gas Analyzer

omega.com®
ΩΞOMEGA®

OMEGAnet® Online Service omega.com	Internet e-mail info@omega.com

Servicing North America:

U.S.A.:
ISO 9001 Certified
Omega Engineering, Inc., One Omega Drive, P.O. Box 4047
Stamford, CT 06907-0047 USA
Toll Free: 1-800-826-6342   TEL: (203) 359-1660
FAX: (203) 359-7700   e-mail: info@omega.com

Canada:
976 Bergar
Laval (Quebec), Canada H7L 5A1
Toll-Free: 1-800-826-6342   TEL: (514) 856-6928
FAX: (514) 856-6886   e-mail: info@omega.ca

For immediate technical or application assistance:

U.S.A. and Canada: Sales Service: 1-800-826-6342/1-800-TC-OMEGA®
Customer Service: 1-800-622-2378/1-800-622-BEST®
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Mexico:
En Español: 001 (203) 359-7803   FAX: (001) 203-359-7807
info@omega.com.mx   e-mail: espanol@omega.com

Servicing Europe:

Benelux:
Managed by the United Kingdom Office
Toll-Free: 0800 099 3344   TEL: +31 20 347 21 21
FAX: +31 20 643 46 43   e-mail: sales@omega.nl

Czech Republic:
Frystatska 184
733 01 Karviná, Czech Republic
Toll-Free: 0800-1-66342   TEL: +420-59-6311899
FAX: +420-59-6311114   e-mail: info@omegashop.cz

France:
Managed by the United Kingdom Office
Toll-Free: 0800 466 342   TEL: +33 (0) 161 37 29 00
FAX: +33 (0) 130 57 54 27   e-mail: sales@omega.fr

Germany/Austria:
Daimlerstrasse 26
D-75392 Deckenpfronn, Germany
Toll-Free: 0 800 6397678   TEL: +49 (0) 7059 9398-0
FAX: +49 (0) 7056 9398-29   e-mail: info@omega.de

United Kingdom:
ISO 9001 Certified
OMEGA Engineering Ltd.
One Omega Drive, River Bend Technology Centre, Northbank
Irlam, Manchester M44 5BD England
Toll-Free: 0800-488-488   TEL: +44 (0)161 777-6611
FAX: +44 (0)161 777-6622   e-mail: sales@omega.co.uk

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WARNING: These products are not designed for use in, and should not be used for, human applications.

Table of Contents

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1 DESCRIPTION AND DEFINITIONS

1.1 Scope of this manual

This manual provides installation, operation and routine maintenance instructions for the Omega GAB-1700 series analyzer, abbreviated to "GAB-1700" in the remainder of this manual.

1.2 Safety information

Read this manual and ensure that you fully understand its content before you attempt to install, use or maintain the GAB-1700. Important safety information is highlighted in this manual as WARNINGs and CAUTIONs, which are used as follows:

⚠	WARNING
	Warnings highlight specific hazards which, if not taken into account, may result in personal injury or death.

CAUTION

Cautions highlight hazards which, if not taken into account, can result in damage to the GAB-1700 or to other equipment or property.

This manual also incorporates 'Be aware of' information, which is used as follows:

☞   This highlights information which it is useful for you to be aware of -
For example, specific operating conditions, and so on.

1.3 Description

⚠	WARNING This analyzer is not a medical device as defined in the medical devices directive 93/42/EEC and is not intended to be used on human beings for the diagnosis, prevention, monitoring, treatment or alleviation of disease, injury or replacement or modification of the anatomy.
⚠	WARNING The GAB-1700 must not be used as personal protective equipment.

The GAB-1700 is a lightweight gas analyzer, suitable for the needs of field and laboratory analysis, and light industrial users who require fast, accurate and reliable gas analysis.

The GAB-1700 uses a paramagnetic transducer to determine the oxygen content of gas samples in concentrations up to 100%.

The GAB-1700 is simple to operate, with an intuitive user interface (see Section 4).

Gas sample measurements are shown on the GAB-1700 display, and can also be output to a serial device connected to the GAB-1700, or as optional milliamp outputs.

The GAB-1700 requires little routine maintenance (see Section 7), other than calibration (which is essential for the accuracy of sample gas measurements) and regular inspection of the inlet filter element.

1.4 Other product options

The GAB-1700 can be supplied with the following options:

- With an internal sample pump
- With a rechargeable battery
- With a milliamp output
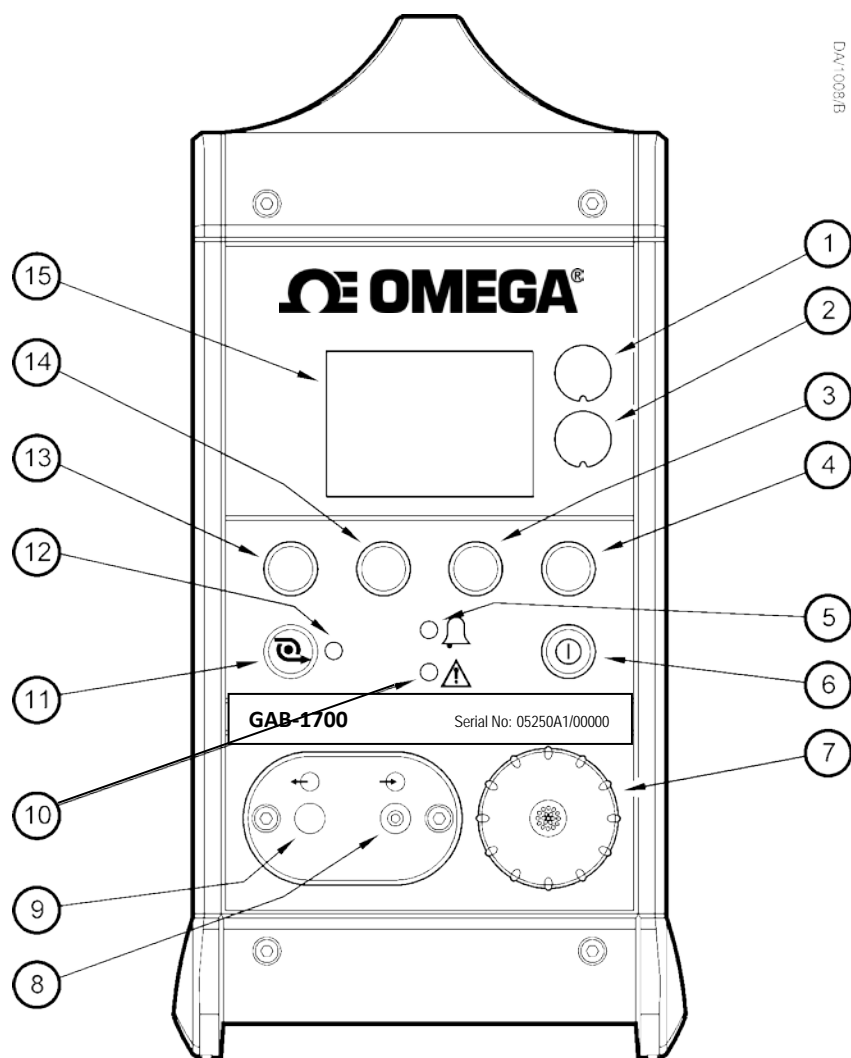
Key	Description	Key	Description
1.	Sample gas label	9.	Blank
2.	Blank	10.	Fault LED (amber) Sample
3.	Soft key 3	11.	pump key †
4.	Soft key 4	12.	Sample pump LED (green) †
5.	Alarm LED (red)	13.	Soft key 1
6.	Power On/Off key	14.	Soft key 2
7.	Filter retaining cap	15.	Display
8.	Sample gas inlet		

† Only available if the optional internal sample pump is fitted.

Figure 1 - Front of the GAB-1700

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DA/1006/B
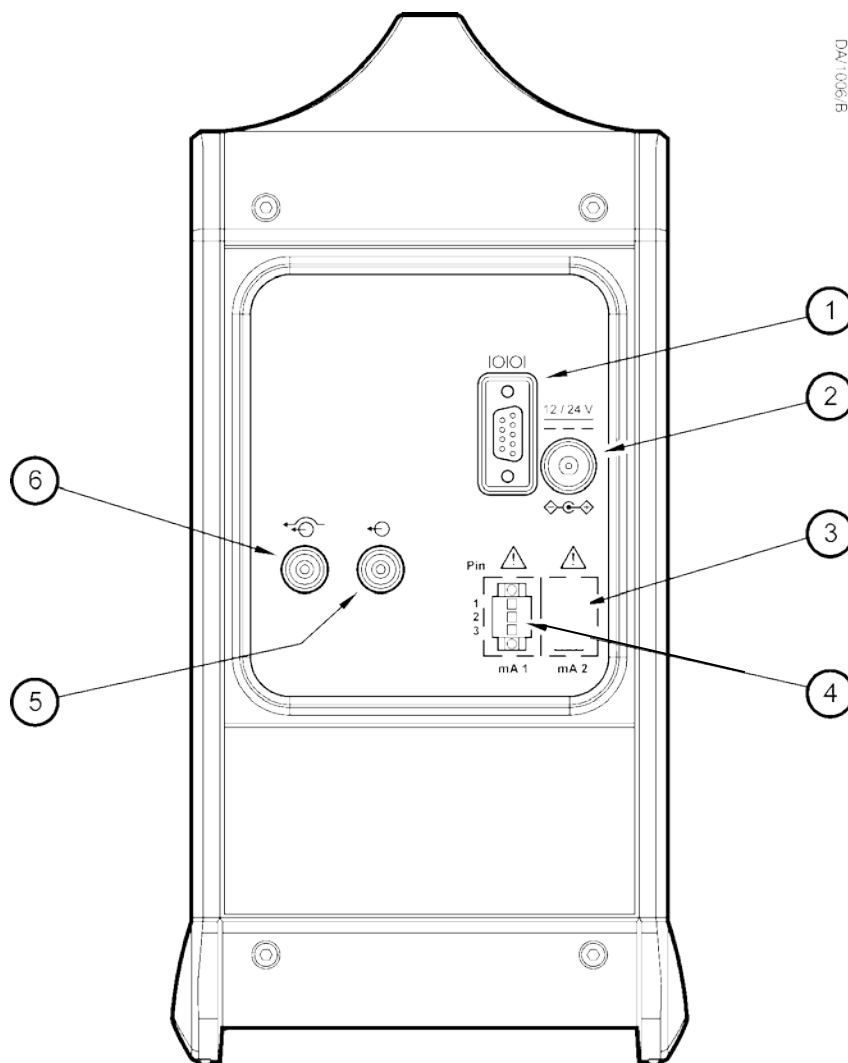
Key	Description	Key	Description
1.	Serial output port	4.	Milliamp output socket †
2.	Power inlet	5.	Sample gas outlet
3.	Blank	6.	Bypass gas outlet #

† Only fitted if the GAB-1700 includes the optional milliamp output.
# Not fitted to a GAB-1700 with an internal sample pump.

Figure 2 - Rear of the GAB-1700

2. SPECIFICATION

WARNING

You must install and use the GAB-1700 in accordance with the requirements of this section and subsequent sections of the manual. If you do not, the protection facilities incorporated into the design of the GAB-1700 may not operate as intended, sample gas measurements may not be accurate, or the GAB-1700 may be damaged.

2.1   General

Dimensions: height x width x depth	300 x 150 x 260 mm (12 x 6 x 10.5 in)
Mass (maximum)	2.6 to 3.9 kg (5.7 to 8.6 lbs)
Electrical supply requirements: Power supply unit GAB-1700 Analyzer	100 to 240V ac, 47 to 63 Hz (nominal) 12 to 24V dc, 20W (maximum) *
Minimum gas flow rate † GAB-1700 (with internal sample pump)	700 ml min^{-1} (0.025 ft^3 min^{-1})

*   As supplied by the power supply unit (through a center pin +ve connector).
†   Measured at the sample gas inlet.

2.2 Sample gas

<table>
<tr>
<td>⚠️</td>
<td>

WARNING

If the quantity of gas sampled by the GAB-1700 is above the short term exposure limit for the gas, the sample should be considered to be toxic. You must carry out a risk assessment before you use the GAB-1700 with such gases. The maximum inlet pressure of such toxic gases is 34.5 kPa gauge (5 psig, 0.35 bar gauge).

</td>
</tr>
</table>

Pressure range

without internal sample pump (see WARNING above)	6.9 to 68.9 kPa gauge (1 to 10 psig) (0.07 to 0.69 bar gauge)
with internal sample pump	-3.4 to 3.4 kPa gauge (max) (-0.5 to 0.5 psig) (-0.03 to 0.03 bar gauge)
Dew point	Less than (ambient temperature minus 10 ºC) Less than (ambient temperature minus 50 ºF)
Particulate size	Less than 2 μm

2.3   Calibration gases

Low calibration gas	Oxygen-free nitrogen, 99.9% pure
High calibration gas	Certified oxygen supply * or instrument quality air [†], or other supply (with > 1% oxygen)
Calibration gas flow rate (with internal sample pump fitted) Minimum	1 l min^{-1} (0.035 ft^3 min^{-1}
Maximum	2.5 l min^{-1} (0.088 ft^3 min^{-1})
Calibration gas pressure range	6.9 to 68.9 kPa gauge (1 to 10 psig, 0.07 to 0.69 bar gauge)

*   > 99.2% pure oxygen, with nitrogen balance gas.
†   The air supply must be clean and dry, and free from oil.
#   Without internal sample pump.

The industrial oxygen sensor requires at least a 1% difference in oxygen concentration between the low and high calibration gases.

2.4   Environmental limits

Ambient temperature range	
Operation (analyzer)	-10 to +50°C (14 to 122 °F)
Operation (power supply unit)	0 to +50°C (32 to 122 °F)
Battery charging	+10 to +40°C (50 to 104 °F)
Storage *	-20 to +60°C (-4 to 140 °F)
Operating ambient pressure range	1.013×10^2 kPa ±10%
	(1.013 bar ±10%)
	(14.69 psi ±10%)
Operating ambient humidity range	0 to 95% RH, non-condensing
Operating altitude range	-500 [†] to 5000 [‡] meters
	(-1640 [†] to 16400 [‡] feet)
Ingress protection	IP40

*   Storage below 21 °C (70 °F) is recommended to ensure optimum battery life.
†   Below sea level.
‡   Above sea level.

2.5   Performance of the industrial oxygen sensor

☞   The display indication given below is the default indication. You can configure the GAB-1700 to provide other display indications (see Section 6.4).

Display indication	Measured volume % oxygen
Full Scale Range	0 to 100% oxygen
Resolution	0.1% oxygen Linearity
	± 0.1% oxygen
Intrinsic error (accuracy)	± 0.1% oxygen
Zero drift per week	± 0.2% oxygen
Output fluctuation	± 0.1% oxygen
Response time [*]	
Without drying tube	15 seconds
With drying tube fitted	25 seconds
Flow effect [†]	± 0.1% oxygen
Zero temperature coefficient	± 0.2% oxygen per 10 ^{o}C (18 ^{o}F)
Span temperature coefficient	± 0.3% oxygen per 10 ^{o}C (18 ^{o}F)
Tilt effects	± 0.15% oxygen per 15° of tilt
Pressure effects	Directly proportional to ambient barometric pressure [#]

[*] T_{90} at 68.9 kPa gauge (10 psig, 0.69 bar gauge) supply pressure.
[†]   Within sample gas supply pressure range specified in Section 2.2.
[#]   A 1% change in ambient barometric pressure will result in a 1% change in sample reading.

2.6 Rechargeable battery (optional feature)

Battery type	Lithium ion Time
to charge (from empty)	4 hours *
Operating life (from fully charged)	8 to 35 hours†
Service life	Approximately 300 to 500 discharge/charge cycles (depending on ambient conditions)

* This is the charge time with the GAB-1700 switched off. With the GAB-1700 switched on, charge time depends on ambient conditions, and on the GAB-1700 configuration and usage.

† Battery operating life depends on the GAB-1700 configuration (that is, the options that are fitted), and how the GAB-1700 is used.

☞ Lithium ion batteries have no 'memory effects', so you can charge the battery, from any charge level, for any length of time and for often as you like, without affecting the battery's service life.

To ensure the optimum service life of the battery, we recommend that you charge the battery after each session of operation, and that you store the GAB-1700 when not in use in a cool environment: see Section 2.4.

2.7 Milliamp outputs (optional feature)

Maximum load resistance	1 kΩ
Minimum isolation voltage	500 V
Output range	
Normal sample measurement	0 to 20 mA or 4 to 20 mA *
Fault condition	0 mA or 21.5 mA *
Under range †	Less than 4 mA
Cable requirements	
Type	Multi-strand twisted pair with overall screen
Maximum size	1.5 mm^2 16 AWG

* User selectable: see Sections 6.6.2 and 6.6.3.
† Only available when the 4 to 20 mA output range is selected:
See Sections 6.6.2 and 6.6.3.

3   UNPACKING THE GAB-1700

1.   Remove the GAB-1700 and any other equipment from its packaging.

2.   Remove the protective plastic cover from the sample gas inlet on the front of the GAB-1700 (see Figure 1).

3.   Remove the protective plastic cover from the sample gas outlet on the rear of the GAB-1700 (see Figure 2).

4.   Remove the protective plastic cover from the bypass gas outlet (if fitted) on the rear of the GAB-1700 (see Figure 2).

5.   Inspect the GAB-1700 and the other items supplied, and check that they are not damaged. If any item is damaged, immediately contact Omega.

6.   If you do not intend to use the GAB-1700 immediately:

   • Refit the protective plastic covers to the gas inlet, the sample gas outlet and the bypass gas outlet (if fitted).

   • Place the GAB-1700 and any other equipment supplied back in its protective packaging.

   • Store the GAB-1700 as described in Section 9.1.

   Otherwise, read Section 4 (User Interface), and then continue from Section 5 onwards to install, set up, and use the GAB-1700.

☞   Retain the shipping documentation and packaging for future use (for example, return of the GAB-1700 to Omega for servicing or repair).

CAUTION

You must remove the protective plastic covers as specified in Steps 3 and 4 above before you use the GAB-1700. If you do not, you may damage the GAB-1700 when you try to pass calibration or sample gases through it.

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4   GAB-1700 USER INTERFACE

☞   Throughout this manual, reference is made to product options (such as "rechargeable battery") which must be specified at the time of purchase. Associated menus and menu options will not be available if your GAB-1700 does not have the corresponding product options.

4.1   Introduction

The GAB-1700 user interface comprises the following (shown on Figure 1):

Power On/Off key	Use this key to switch on the GAB-1700 (see Section 5.1) or to switch it off (see Section 6.8).
Display	Shows various screens: see Section 4.2 onwards.
Soft keys	The function of each of the soft keys depends on the screen currently being shown on the display: see Section 4.2.
Alarm LED	On when an alarm condition exists: see Section 6.4.
Fault LED	On when a fault condition exists: see Section 8.
Sample pump key *	Use this key to switch the sample pump on and off: See Section 5.3.6.
Sample pump LED *	Flashes when the sample pump is operating: See Section 5.3.6.

* This key and LED are only operational if an internal sample pump is fitted.

The GAB-1700 also has an audible alarm which will go on (emit a tone):

•   On initial switch-on: see Section 5.1.

•   When a measurement alarm condition is detected (if the audible measurement alarm is enabled): see Section 6.4.

•   When a fault condition is detected: see Section 8.

4.2   Start-up and measurement screens

When you first switch on the GAB-1700, a 'start-up screen' is displayed while the GAB-1700 carries out a self-test.

The start-up screen shows a 'self-test time elapsed/remaining' indicator, and messages identifying the tasks being carried out as part of the self-test:

- The screen will initially display the message "System Check".

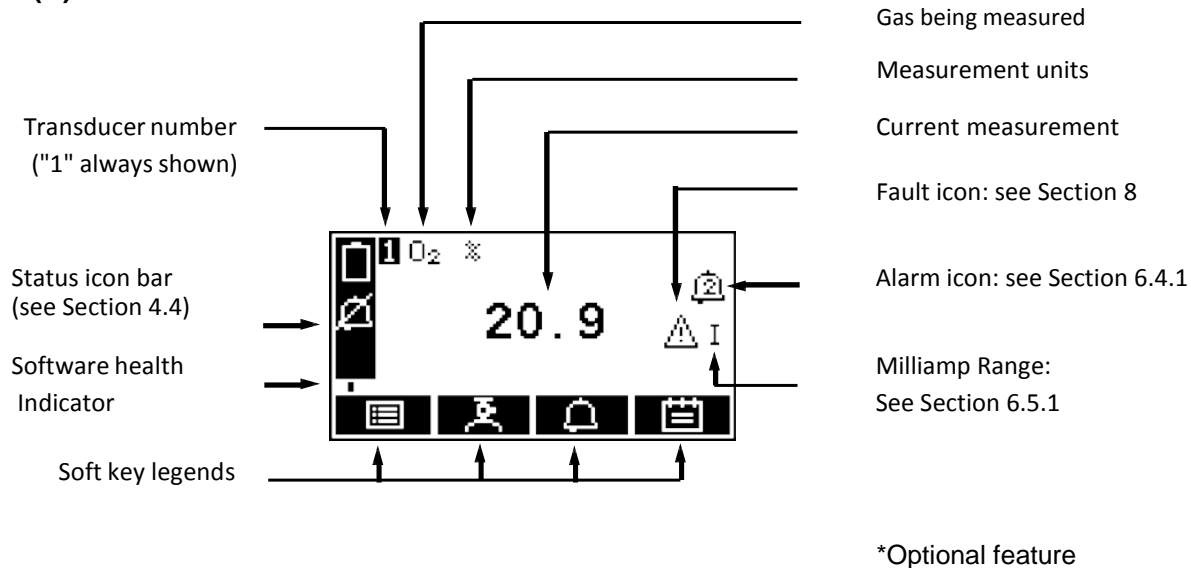- The Measurement screen is then displayed, as shown in Figure 3.

(A) 1-measurement screen:

Gas being measured

Measurement units

Transducer number
("1" always shown)

Current measurement

Fault icon: see Section 8

Status icon bar
(see Section 4.4)

Alarm icon: see Section 6.4.1

20.9

Software health
Indicator

Milliamp Range:
See Section 6.5.1

Soft key legends

*Optional feature

Figure 3 - The Measurement screen

☞ During normal GAB-1700 operation, the software health indicator continuously moves from left to right and then back again, below the status icon bar. If the indicator stops moving, this means that the GAB-1700 is not operating correctly, and you must refer to Section 8.

☞ If no soft key is pressed for 10 minutes, the Measurement screen will be automatically displayed. (You will also then have to enter the password again to access any password-protected screens: refer to Figure 4 and to Section 4.6.)

4.3   Soft key legends

The four soft key legends at the bottom of the Measurement screen (Figure 3) correspond to the four soft keys on the front of the GAB-1700. (The first legend corresponds to the function of soft key 1, the second legend corresponds to the function of soft key 2, and so on).

On the Measurement screen, the soft key functions are as follows:

Legend	Meaning	Function (when soft key pressed)
🔲	Menu	Displays the Menu screen: see Section 4.7.
🔲	Calibrate *	Displays the Calibrate screen: see Section 6.1.
🔲	Alarm *	Displays the Alarm option screen: see Section 6.4.4.
🔲	Logging †	Displays the Data logging screen: see Section 6.6.
🔲	Print †	Produces a printed sample measurement report: see Section 6.6.9.

* These soft keys are 'shortcuts' to these menus, which can also be selected by pressing the 🔲 soft key with the corresponding menu option highlighted on the Menu screen: see Section 4.7.

† If you have selected printed outputs (see Section 6.6.1), the 'Print' legend is shown instead of the 'Logging' legend.

Other soft key legends which are used on the various screens are as follows:

Legend	Meaning	Function (when soft key pressed)
✕	Back	Cancels the current screen and displays the previous screen in the menu structure.
✓	Accept	Accepts the currently selected option or data. (A new screen may be displayed accordingly.)
Edit	Edit	Allows the highlighted data to be edited.
Batch	Batch	Starts a new batch (for data logging).
△	Up	Moves the cursor up a list (or increases a digit during editing).
▽	Down	Moves the cursor down a list (or decreases a digit during editing).
◁	Left	Moves the cursor left.
▷	Right	Moves the cursor right.

4.4 Status icon bar

The status icon bar appears on all screens. The icons which can be shown and their meanings are as follows:

Icon	Meaning
⚠	Indicates that a fault has been detected by the GAB-1700 refer to Section 8.
🔇	Indicates that the audible alarm is disabled: refer to Section 6.4.5
🔋 *	Battery less than 10% full.
🔋 *	Battery 10% to 32% full.
🔋 *	Battery 33% to 65% full.
🔋 *	Battery 66% to 100% full.

*   These icons will only be shown on a GAB-1700 with the optional rechargeable battery fitted. See Section 5.2 for more information.

☞　　When the 'battery less than 10% full icon starts to flash, this indicates that the rechargeable battery is virtually empty. The GAB-1700 will automatically shut down approximately 15 seconds after the icon starts to flash.

4.5　Scroll bars

On some screens (for example, see Figure 5), there may be more options available than can be shown on the screen, and you have to scroll down the screen to view all of the options: this is identified by a scroll bar at the right-hand side of the screen.

The height of the wide part of the scroll bar gives an indication of what proportion (of all the options) are currently shown on the screen. As you scroll up or down the options (using the ▲ and ▽ soft keys), the wide part of the scroll bar will also move on the screen, indicating approximately where the currently displayed options are, within the complete list of options. For example, compare the scroll bars in Figures 5 and 13.

4.6　Menu options/screens and password protection

The menu structure of the GAB-1700 is shown in Figure 4, which shows that some of the options/screens are password protected.

When an option/screen is password protected, this means that the correct corresponding password has to be entered before the option/screen can be accessed.

Password protection operates as follows:

- The first time you try to access a password-protected option/screen, you will be prompted for the corresponding password. You must then enter the correct password (using the editing method described in Section 4.10) before the option/ screen can be displayed.

- If you have already entered the corresponding password, you will gain access to all options/screens protected by that password immediately (you do not need to enter the password again).

☞　　Once you have entered a password, it remains active until 10 minutes after the last soft key is pressed. After this, the password becomes inactive; you must re-enter the password to access password-protected options/screens again.
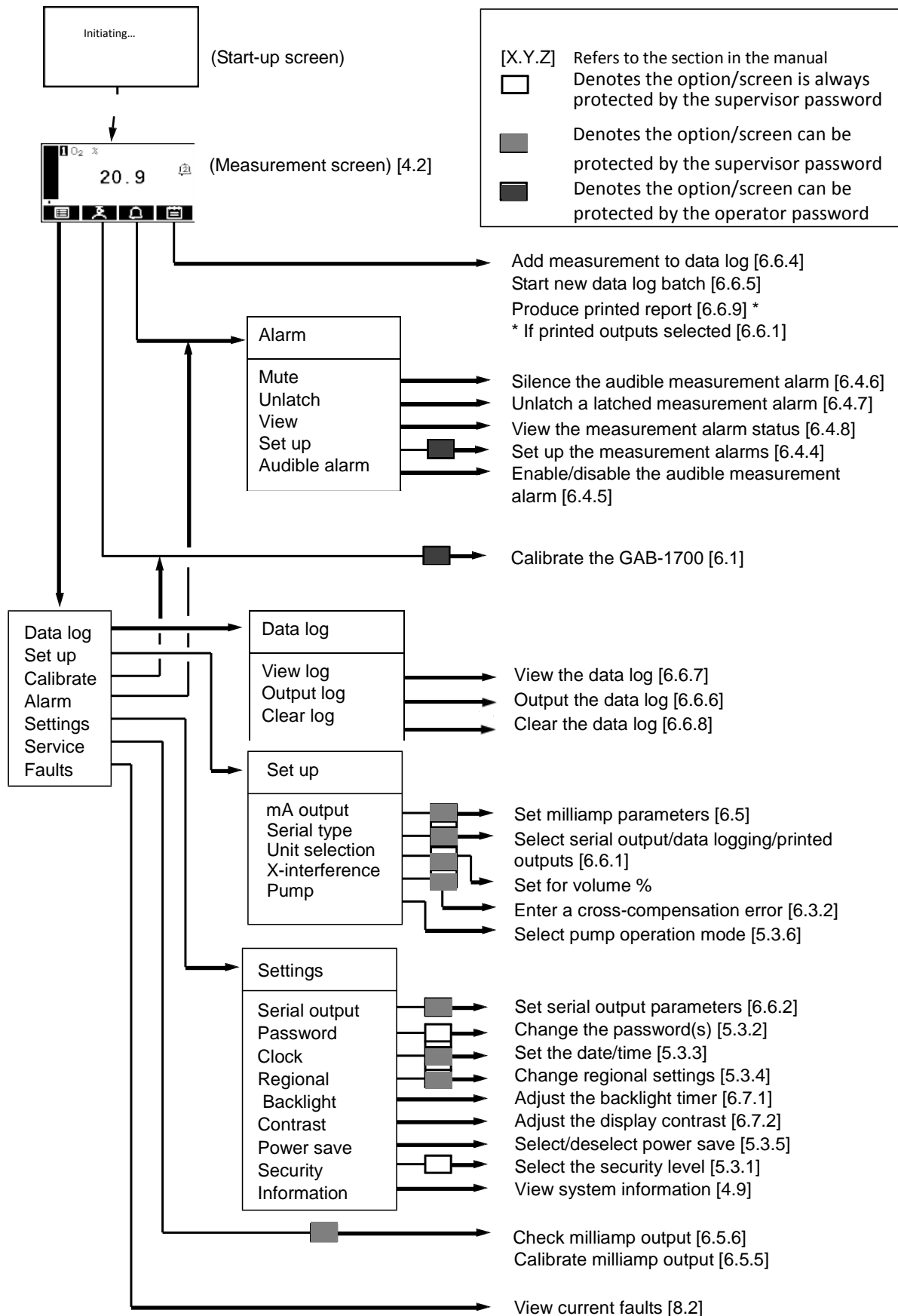
Initiating...

(Start-up screen)

[X.Y.Z]　Refers to the section in the manual
☐　Denotes the option/screen is always protected by the supervisor password

▨　Denotes the option/screen can be protected by the supervisor password

▨　Denotes the option/screen can be protected by the operator password

O₂　%

20.9

(Measurement screen) [4.2]

Add measurement to data log [6.6.4]
Start new data log batch [6.6.5]
Produce printed report [6.6.9] *
* If printed outputs selected [6.6.1]

Alarm

Mute
Unlatch
View
Set up
Audible alarm

Silence the audible measurement alarm [6.4.6]
Unlatch a latched measurement alarm [6.4.7]
View the measurement alarm status [6.4.8]
Set up the measurement alarms [6.4.4]
Enable/disable the audible measurement alarm [6.4.5]

Calibrate the GAB-1700 [6.1]

Data log
Set up
Calibrate
Alarm
Settings
Service
Faults

Data log

View log
Output log
Clear log

View the data log [6.6.7]
Output the data log [6.6.6]
Clear the data log [6.6.8]

Set up

mA output
Serial type
Unit selection
X-interference
Pump

Set milliamp parameters [6.5]
Select serial output/data logging/printed outputs [6.6.1]
Set for volume %
Enter a cross-compensation error [6.3.2]
Select pump operation mode [5.3.6]

Settings

Serial output
Password
Clock
Regional
Backlight
Contrast
Power save
Security
Information

Set serial output parameters [6.6.2]
Change the password(s) [5.3.2]
Set the date/time [5.3.3]
Change regional settings [5.3.4]
Adjust the backlight timer [6.7.1]
Adjust the display contrast [6.7.2]
Select/deselect power save [5.3.5]
Select the security level [5.3.1]
View system information [4.9]

Check milliamp output [6.5.6]
Calibrate milliamp output [6.5.5]

View current faults [8.2]

Figure 4 - The GAB-1700 menu structure

4.7 The Menu screen

☞ Some of the menu screens referenced below may not be available: refer to the note at the start of Section 4.

The Menu screen (see Figure 5) provides access to other screens in the menu structure, and is displayed by pressing the 🔲 soft key when the Measurement screen is displayed.
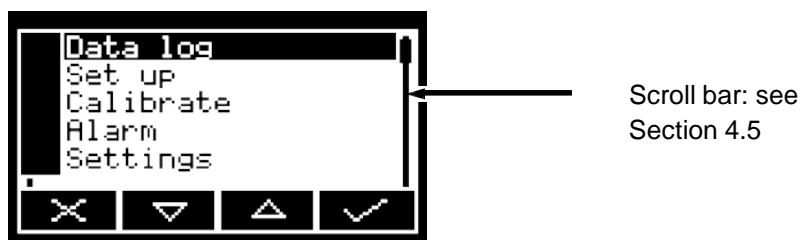

Scroll bar: see Section 4.5

Figure 5 - The Menu screen

Use the 🔺 and 🔻 soft keys to highlight the required screen option, then press the ✔ soft key to display the selected screen:

Screen	Use	Section
Data Log	Select this screen to view, output or clear the data log.	6.6.6 to 6.6.8
Set up	Select this screen to configure the (optional) milliamp output, select serial output, data logging or printed outputs, or introduce a cross- interference correction.	6.5.3, 6.6.1, 6.3.2
Calibrate	Select this screen to calibrate the GAB-1700.	6.1
Alarm	Select this screen to set up the measurement alarms, or to silence (mute) the audible measurement alarm.	6.4.4
Settings	Select this screen to change GAB-1700 settings (password, display language and so on).	4.8
Service	Select this screen to calibrate or check the (optional) milliamp output.	6.5.5, 6.5.6
Faults	Select this screen to view current faults.	8.2

Alternatively, press the ✖ soft key to display the Measurement screen again.

4.8   The Settings screen

The Settings screen is shown in Figure 6. Use the △ and ▽ soft keys to highlight the required screen option, then press the ✓ soft key to display the selected screen, as shown below.
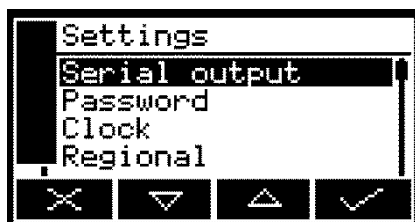


```
Settings
Serial output
Password
Clock
Regional
 ✕    ▽    △    ✓
```

Figure 6 – The Settings screen

Screen	Use	Section
Serial output	Configuring the serial output parameters	6.6.2
Password	Changing the password.	5.3.2
Clock	Setting the clock time and/or date.	5.3.3
Regional	Changing regional settings (language and so on).	5.3.4
Backlight	Adjusting the backlight timer duration.	6.7.1
Contrast	Adjusting the contrast of the screen.	6.7.2
Power save *	Selecting/deselecting 'power save' operation.	5.3.5
Security	Selecting the security level.	5.3.1
Information	Viewing GAB-1700 system information.	4.9

* Only available on a GAB-1700 with the optional rechargeable battery fitted.

Alternatively, press the ✕ soft key to display the Menu screen again.

4.9   The Information screen

The content on the information screen (such as the GAB-1700 serial number and the version of the operating software) may be useful to the Omega support team.


```
Information

    05000A1/00001
Software version
    05000-cu0_0d8.6
 ✕
```
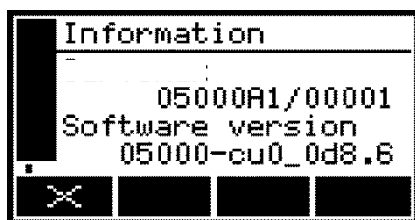
Figure 7 – Typical information screen

After viewing (and if necessary recording) the information shown on the screen, press the ✖ soft key to display the Settings screen again, or press and hold the ✖ soft key to show the Measurement screen again.

☞ You may be asked to provide the information from this screen to the Omega support team; for example, to aid fault diagnosis.

4.10 Editing on-screen data

A common method is used for editing data shown on all of the different screens.

When you press the ✎ soft key to edit an item of data, the screen changes to show the corresponding edit screen, with the first digit highlighted; a typical edit screen is shown in Figure 8:

Figure 8 - A typical edit screen

When the first digit is highlighted, press the ✖ soft key to exit the menu without changing the data.

Alternatively, use the soft keys to edit the data as follows:

Soft key	Function
△	Increases the highlighted digit by 1.
▽	Decreases the highlighted digit by 1
◁	Moves the cursor left to the previous digit.
▷	Moves the cursor right to the next digit.

Note that the figures above and below the highlighted digit show the digits above and below the currently highlighted value.

When the last digit is highlighted, press the ✔ soft key to enter the new data.

☞ When editing numerical values, the decimal point appears between digits "9" and "0".

5   INSTALLATION AND SET-UP

5.1   Installation and switch-on

⚠	**WARNING** Ensure that the cables and tubes that you connect to the GAB-1700 are routed so that they do not present a trip hazard to people.
⚠	**WARNING** Ensure that the electrical installation of the GAB-1700 and the power supply unit conforms with all applicable local and national electrical safety requirements.
⚠	**WARNING** Sample and calibration gases may be toxic or asphyxiant. Ensure that the external connections are leak free at full operating pressure before you use sample or calibration gases.
⚠	**WARNING** Sample and calibration gases may be toxic or asphyxiant. Ensure that the GAB-1700 sample, bypass gas and calibration 'T' piece (if used) outlets are vented to an area where they will not be a hazard to people.
⚠	**WARNING** Sample and calibration gases may be toxic or asphyxiant. To prevent the build-up of such gases, ensure that the GAB-1700 is only used in a well-ventilated environment.

CAUTION
Do not use the GAB-1700 in an area subject to high levels of vibration or sudden jolts. If you do, sample measurements may not be accurate, or the GAB-1700 may be damaged.

1.   Place the GAB-1700 in a suitable operating location, within easy reach of a suitable electrical supply outlet.

2.   If necessary (if sample or calibration gases are toxic or asphyxiant) or if required:

   • Use quick-connect fittings to connect a suitable sized tube to the sample gas outlet (on the rear of the GAB-1700: see Figure 2).

   • Use quick-connect fittings to connect a suitable sized tube to the bypass gas outlet (if fitted, on the rear of the GAB-1700: see Figure 2).

3. If you have fitted tubes to the sample gas outlet and/or bypass gas outlet, route the ends of the tubes so that they can freely vent to atmosphere.

    ☞ The two outlets can be left to vent to local atmosphere. However if you do fit a tube to one or both of the outlets, the tube(s) must be suitably sized so that the gases can vent from the GAB-1700 without over-pressuring the GAB-1700 or the tubes.

4. You may connect a PC (personal computer) or other device to the serial connector, refer to Appendix A4.

5. If your GAB-1700 is configured to provide an optional milliamp output:

    • Connect the wires in your cable to the screw terminals on the milliamp interface connector supplied: refer to Section 2.7 for the cable requirements, and refer to Figure 9 below for the connection requirements.

    • Fit the interface connector to the corresponding milliamp output connector on the rear of the GAB-1700 (see Figure 2), and secure with the two captive screws on the interface connector.

Pin	Use
1	+ve
2	-ve
3	screen
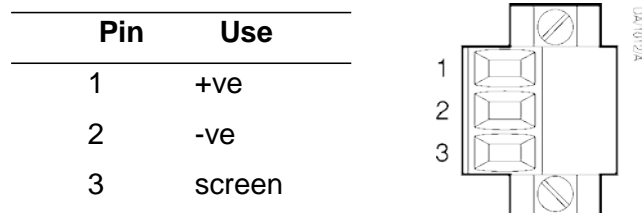
Figure 9 - milliamp interface connector

6. Fit the power outlet on the power supply unit to the power socket on the rear of the GAB-1700.

7. Fit the power supply unit plug to a suitable electrical supply outlet.

8. Press and hold the Power On/Off key on the front of the GAB-1700 for at least 2 seconds to switch the GAB-1700 on.

    ☞ When the GAB-1700 is switched on, the Alarm LED, the Fault LED and the audible alarm will all go on for 1 second to demonstrate that they are functioning correctly, and will then go off again.

5.2   Charging the battery (optional rechargeable battery)

The first time you use a GAB-1700 with the optional rechargeable battery, you should leave the GAB-1700 connected to the electrical supply for at least 4 hours to fully charge the battery.

When the battery is fully charged, you can leave the GAB-1700 connected to the electrical supply, or you can disconnect the electrical supply and continue to use the GAB-1700 powered by the battery.

☞   We recommend that you charge the battery as soon as possible after the 'battery less than 10% full ' icon is displayed.

During normal use, the battery icon on the status icon bar of the display will identify the level of charge within the battery (see Section 4.4).

You can charge the battery as and when required during normal use. To charge the battery, simply connect the GAB-1700 to an external electrical supply outlet.

☞   While charging the status icon bar will continually show the 'battery less than 10% full', 'battery 10 to 32% full', 'battery 33 to 65% full' and 'battery 66 to 100% full' icons in sequence.

☞   You can charge the battery with the GAB-1700 switched on or off. However, charging will take longer when the GAB-1700 is switched on.

5.3   GAB-1700 set-up

When you switch on the GAB-1700, a 'start-up screen' is first displayed (see Section 4.2), then the Measurement screen (Figure 3) is displayed.

When the Measurement screen is displayed, you can set up the GAB-1700 as described below.

5.3.1 Selecting the security level

You can configure the GAB-1700 to provide any of three levels of security:

Security level	Function
Low	None of the options/screens are password protected *.
Standard	Some of the options/screens are protected by a supervisor password.
High	Some of the options/screens are protected by a supervisor password and some of the options/screens are protected by an operator password [†].

*   Except for the 'change the password(s)' and 'select the security level' options/screens: see below.

†   The supervisor password can also be used to access options/screens protected by the operator password: see notes below.

☞   The 'change the password(s)' and 'select the security level' screens/options are always protected by the supervisor password, regardless of the security level selected. This is to ensure that unauthorized personnel cannot change the security level and password(s) and so lock out the GAB-1700 from other users.

☞   The supervisor password provides access to all password protected options/ screens. That is, if you have selected the 'high' security level and are prompted to enter the operator password, you can also access the option/ screen by entering the supervisor password.

☞   Password protection can be used to prevent adjustment of the clock by unauthorized persons, so ensuring the validity of measurement times and the 'time since last calibration' history.

Refer to Figure 4 to see the options/screens which can be password-protected within the menu structure.

☞   As supplied, the security level is set to 'high', the supervisor password is set to "2000" and the operator password is set to "1000". We recommend that you select your required security level and change the password(s) as described below to provide additional protection.

Before the GAB-1700 is used for sample measurement, we recommend that you select the security level (low, standard or high: see Section 4.6) most suitable for the way in which the GAB-1700 will be used by you and/or your personnel.

Use the following procedure to select the required security level:

1.   With the Settings screen displayed, use the [△] and [▽] soft keys to highlight the "Security" menu option, then press the [✓] soft key. The Security level screen will then be displayed showing the currently selected level: see Figure 10.

Figure 10 - The Security level screen

2.   To change the security level, press the [✎] soft key. You will then be prompted to enter the supervisor password.

3.   Once the supervisor password has been entered correctly, the Security select screen will be displayed (see Figure 11), with the currently selected security level highlighted.

Figure 11 - The Security select screen

4.   To change the security level, use the [△] and [▽] soft keys to highlight the required level, then press the [✓] soft key. The Security level screen will then be displayed again, showing the newly selected security level.

5.   Press the [✗] soft key twice to display the Menus screen again.

5.3.2 Changing passwords

☞ If you change a password, ensure that you record the new password and store it somewhere safe. Otherwise, if you cannot recall the new password, you will have to contact Omega for assistance.

Use the following procedure to change the supervisor and operator passwords:

1. With the Measurement screen displayed, press the ▣ soft key to display the Menu screen, use the △ and ▽ soft keys to highlight the "Settings" menu option, then press the ✓ soft key. The Settings screen will then be displayed (see Figure 6).

2. Use the △ and ▽ soft keys to highlight the "Password" menu option, then press the ✓ soft key. The Edit supervisor password screen will then be displayed with the supervisor password shown, as shown in Figure 12.

```
┌─────────────────────────┐
│█ Edit Password          │
│█ Supervisor           ▐ │
│█                      ▐ │
│█               ****   ▐ │
│▪                        │
│  ✕  │  ▽  │  △  │  �   │
└─────────────────────────┘
```

Figure 12 - The Edit supervisor password screen

3. To change the supervisor password, press the ✏ soft key, then enter the new password: use the editing method described in Section 4.10.

4. When you enter the last digit, the ▷ soft key changes to the ✓ soft key. Press the ✓ soft key to enter the new supervisor password value.

5. To change the operator password, press the ▽ soft key to display the edit operator password screen, press the ✏ soft key, then enter the new password: use the editing method described in Section 4.10.

6. When you enter the last digit, the ▷ soft key changes to the ✓ soft key. Press the ✓ soft key to enter the new operator password value.

7. Press the ✕ soft key to display the Settings screen again.

5.3.3 Setting the clock

Use the following procedure to set the date and time:

1.   Press the ▦ soft key to display the Menu screen, use the △ and ▽ soft keys to highlight the "Settings" menu option, then press the ✓ soft key. The Settings screen will then be displayed.

2.   Use the △ and ▽ soft keys to highlight the "Clock" menu option, then press the ✓ soft key. The Clock (time) screen will then be displayed, as shown in Figure 13.

☞   Time is always shown in 24-hour format.

Figure 13 - The Clock (time) screen

3.   Press the 🖉 soft key, then edit the displayed time as described in Section 4.10. When you change the last digit, the ▷ soft key changes to the ✓ soft key. Press the ✓ soft key to show the Clock (time) screen again.

4.   Press the ▽ soft key to show the Clock (date) screen, as shown in Figure 14.

☞   You can change this format from day/month/ year to month/day/year: refer to Section 5.3.3.

Figure 14 - The Clock (date) screen

5.   To change the date, press the 🖉 soft key, then edit the displayed date as described in Section 4.10. When you change the last digit, the ▷ soft key changes to the ✓ soft key. Press the ✓ soft key to show the Clock (date) screen again.

6.   Press the ✕ soft key twice to display the Menus screen.

☞   The date format can be set to your regional preference ('day/month/year' or month/day/year' format): refer to Section 5.3.3.

☞   On a GAB-1700 without an optional rechargeable battery: once set, date and time will remain set until approximately 1 week after the GAB-1700 has been disconnected from the electrical supply. If the GAB-1700 is left connected to the electrical supply, date and time will remain set indefinitely, even if the GAB-1700 is switched off.

5.3.4 Changing regional settings

You can configure the following GAB-1700 regional settings so that the information shown on the various screens is better suited to your local conventions:

Setting	Options available
Language	Various languages are supported.
Date format	Day/Month/Year * or Month/Day/Year.
Decimal format	Use of "." (full stop) or "," (comma) as the decimal point.

* Default option.

To change the regional settings:

1. With the Settings screen displayed, use the ▲ and ▼ soft keys to highlight the "Regional" menu option, then press the ✓ soft key. The first Regional settings option screen will then be displayed, as shown in Figure 15.

Figure 15 - The Regional settings (language) option screen

2. This screen shows the first regional option (Language). If necessary, press the ✎ soft key, use the ▲ and ▼ soft keys to highlight the required display language, then press the ✓ soft key.

3. If required, for each of the other two selectable options (date format and decimal format):

    • Use the ▲ and ▼ soft keys to select the corresponding option screen.

    • Press the ✎ soft key.

    • Use the ▲ and ▼ soft keys to highlight the required option, then press the ✓ soft key.

5.3.5 Selecting power save mode (for optional rechargeable battery)

If the GAB-1700 has the optional rechargeable battery, you can select the 'power save' mode of operation, to conserve battery power. When power save mode is selected, the GAB-1700 will automatically switch off after 30 minutes has elapsed during which no key has been pressed.

To select/deselect power save mode:

1.   With the Settings screen displayed, use the ▲ and ▼ soft keys to highlight the "Power save" menu option, then press the ✓ soft key. The Power save option screen will then be displayed, as shown in Figure 16.
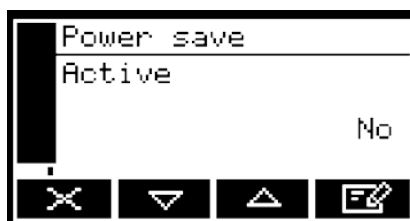
Figure 16 - The Power save option screen

2.   "No" or "Yes" on this screen identifies whether power save is selected or not. If necessary, press the 📝 soft key to select the alternative setting, then press the ✓ soft key.

☞   Power save mode is automatically disabled when the GAB-1700 is connected (through the power supply unit) to the electrical supply.

5.3.6 Selecting pump operation (for optional internal sample pump)

If your GAB-1700 has an internal sample pump fitted, you must select how you want to operate the pump before you start to make sample measurements. The pump can be operated using one of two methods:

Method	Pump operation
Manual	When you press the Pump key on the front of the GAB-1700 (see Figure 1), the sample pump will start. You must then press the key again, to stop the pump.
Timed	When you press the Pump key on the front of the GAB-1700 (see Figure 1), the sample pump will start, operate for a preset time, and then stop. If you select this mode, you must also specify the time for which the pump should operate.

To select the required method of sample pump operation:

1. With the Settings screen displayed, use the ▲ and ▼ soft keys to highlight the "Set up" menu option, then press the ✓ soft key. The Set up screen will then be displayed, as shown in Figure 17.
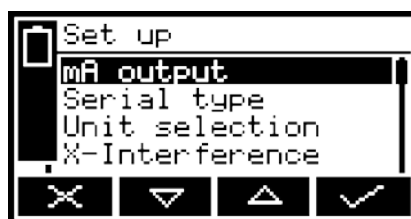
Figure 17 - The Set up screen

2. Use the ▲ and ▼ soft keys to highlight the "Pump" menu option, then press the ✓ soft key. The Pump mode screen will then be displayed, as shown in Figure 18 (which shows manual pump operation selected).

Figure 18 - The Pump mode screen

3.   If you want to change the method of sample pump operation, press the ▣ soft key, use the ▲ and ▼ soft keys to highlight the alternative menu option, then press the ✓ soft key.

If you have selected Timed pump operation, you must then continue at Step 4 below to set the pump operation time.

4.   With the Pump mode screen displayed (as described above), and with "Timed" operation selected, press the ▲ or ▼ soft key so that the Pump duration screen is displayed, as shown in Figure 19.

This screen shows the currently selected duration (that is, the time for which the pump will operate when you press the Pump key).

```
Pump
Duration (Seconds)

              30
 ✕    ▽    △   ▣
```

Figure 19 - The Pump duration screen

5.   If you want to change the duration, press the ▣ soft key then edit the displayed duration as described in Section 4.10.

☞   Pump duration can be set in the range 1 to 999 seconds.

6   GENERAL OPERATION

⚠	WARNING This gas analyzer may be used with sample and/or calibration gases that present a toxic hazard, where the local gas concentrations may exceed short- or long-term exposure limits (and very high dilution rates may be needed to safely vent the gases used). You must therefore ensure that you are fully aware of the potential hazards of the gases used, carry out your own risk assessment and create suitable safe working practices based on these hazards, and ensure that these working practices are complied with whenever the analyzer is used. If in doubt about the potential hazards of the gases to be used with the analyzer, seek expert advice from appropriate specialists/safety consultants.

CAUTION **Sample and calibration gases must be as specified in Sections 2.2 and 2.3. If your sample or calibration gas pressures and/or flow rates are above those specified in Sections 2.2 and 2.3, you must regulate the gases externally, before they enter the GAB-1700.**

6.1   Calibrating the GAB-1700

☞   The pressure of your calibration gas supply must be the same as the pressure of the gases to be sampled. If the pressures are different, sample gas measurements may not be accurate.

☞   If you do not allow calibration gas to pass through the GAB-1700 for 3 to 5 minutes before you start the calibration procedure, the measurement system in the GAB-1700 may not be fully purged of other residual gases, and the calibration may not be accurate.

☞   Do not knock or move the GAB-1700 during calibration. If you do, the calibration measurements may be affected.

☞   For a standard GAB-1700 with a sample pump, the following calibration procedure assumes that you have selected manual pump operation. If you have selected timed pump operation, you must ensure that the pump operation time is set correctly to allow calibration gas to pass through the GAB-1700 for sufficient time: refer to Section 5.3.6 for more information.

You must calibrate the GAB-1700 as part of the initial set-up (see Section 5.3), and whenever the GAB-1700 has been moved to a different environment. We also recommend that you calibrate the GAB-1700 at each power up, to avoid measurement errors due to changes in ambient conditions. Calibrate the GAB-1700 as follows:

1. If you have a GAB-1700 without a sample pump:

    • Connect your calibration gas supply to the sample gas inlet on the front of the GAB-1700 (see Figure 1). Ensure that the calibration gas pressure is as specified in Section 2.3.

    • Allow the calibration gas to pass through the GAB-1700 for 3 to 5 minutes, then continue at Step 3.

2. If you have a GAB-1700 with a sample pump:

    • Connect the branch on the calibration 'T' piece to the sample gas inlet on the front of the GAB-1700 (see Figure 1)

    • Connect a suitable vent pipeline to one end of the calibration 'T' piece; alternatively, if it is safe to do so, leave the end of the 'T' piece open to vent to the local atmosphere.

    • Connect your calibration gas supply to the other end of the 'T' piece.

    • Switch on the sample pump (see Section 5.3.6), allow the calibration gas to pass through the GAB-1700 for 3 to 5 minutes, then continue at Step 3.

3. Press the ▨ soft key on the Measurement screen (or select the "Calibrate" option from the Menu screen) to display the Calibrate screen (see Figure 20).
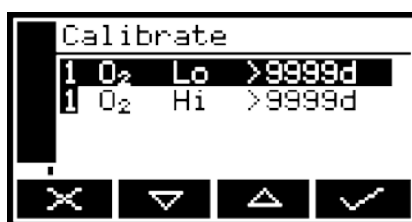
Figure 18 - The Pump mode screen

Note that the "9999d" field of the screen shown in Figure 20 will identify the period of time that has elapsed since the last calibration, and can be in any of the following forms:

• 9999d specifying days	• 9999h specifying hours
• 9999m specifying minutes	• Any combination of these.

4. Use the ▲ and ▼ soft keys to select the required calibration, that is:

    • 'Lo' (low calibration gas: for example, nitrogen for the oxygen sensor).

    • 'Hi' (high calibration gas: for example, oxygen for the oxygen sensor).

5.   Press the [✓] soft key. The Calibrate target value screen will then be shown (see Figure 21), identifying the target value and the current reading.

```
┌─────────────────────────┐
│█Calibrate Low           │
│█ 1 O₂         Target     │
│█            0.0000       │
│█           Reading       │
│█              21.1       │
│ ▪                       │
│  ╳    │    │ ⊟✎ │  ✓   │
└─────────────────────────┘
```
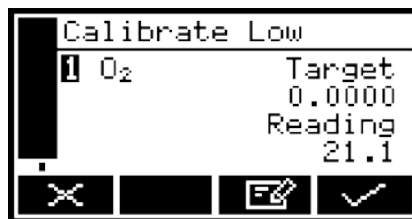
Figure 21 - The Calibrate target
value screen

6.   If the target value is not that for the calibration gas which you are using, change the target value to the required value: use the edit method in Section 4.10.

☞   Refer to Sections 2.2 and 2.3 for the required pressures, flow rates (if applicable) and concentrations of the calibration gases.

7.   When the current reading is stable, press the [✓] soft key. The GAB-1700 will then carry out the specified calibration.

8.   If you have a standard GAB-1700 with a sample pump, switch the pump off (if necessary: see Section 5.3.6).

9.   Disconnect the calibration gas supply from the sample gas inlet or the calibration 'T' piece.

10. Repeat Steps 1 to 9 of this section for the second calibration for the specific sample gas.

11. On a GAB-1700 with the optional sample pump: disconnect your vent pipeline (if fitted) from the calibration 'T' piece, then disconnect the 'T' piece from the sample gas inlet.

12. Press the [╳] soft key to display the Measurement screen again.

6.2   Taking sample readings

☞   Depending on how you have configured the measurement alarms, and on
         how you connect the sample gases to the GAB-1700, a measurement alarm
         may occur when you change sample gases as described below.

☞   Unless your sample gases are known to be dry, you must connect the drying
         tube (supplied with the GAB-1700) to the sample gas inlet on the GAB-
         1700, and then connect your sample gas supply to the drying tube.

1.   If necessary, calibrate the GAB-1700: see Section 6.1.

2.   Ensure that the Measurement screen is displayed: see Section 4.

3.   Use the quick-connect fitting supplied to connect the sample gas supply to the
       sample gas inlet on the front of the GAB-1700 (see Figure 1).

4.   If your GAB-1700 has a sample pump, start the sample pump: see
       Section 5.3.6.

5.   Wait until the measurement shown on the screen has stabilized, then take note of
       the reading.

6.   If your GAB-1700 has a sample pump and you have selected manual pump
       operation, stop the sample pump: see Section 5.3.6.

7.   Turn off the sample gas supply, or disconnect it from the sample gas inlet on the
       front of the GAB-1700.

Repeat Steps 3 to 7 as necessary, for different gas samples to be measured.

6.3 Correcting oxygen measurement for different background gases

☞ If you are measuring oxygen in a background of nitrogen or air, you do not need to correct the measurements.

6.3.1 Overview of measurement errors

For an oxygen sensor, the composition of any typical background gas in the gas sample will have a negligible effect on the GAB-1700 measurement. For a GAB-1700 which has been 'Lo' calibrated with nitrogen and 'Hi' calibrated with oxygen, the cross-interference errors (that is, oxygen measurement errors) in gases which contain 100% of a specific background gas will be as shown below:

Background gas	Error	Background gas	Error
Argon	-0.22%	Krypton	-0.49%
Carbon dioxide	-0.26%	Neon	-0.15%
Halothane	-1.93%	Nitrous oxide	-0.20%
Helium	-0.29%	Xenon	-0.92%

Note that the error is directly proportional to the concentration of the background gas in the sample being measured, and in most cases can be ignored.

If you cannot ignore the error, you can use the procedure in Section 6.3.2 to enter a compensation to correct for the error.

6.3.2 Entering a cross-interference compensation

☞ Cross-interference compensation is disabled during calibration, and is not applied to the values shown in Figure 21. All other outputs (that is, serial or milliamp outputs) remain compensated.

Use the following procedure to enter a compensation to correct for an oxygen measurement error:

1. Press the ▦ soft key to display the Menu screen, use the △ and ▽ soft keys to highlight the "Set up" menu option, then press the ✓ soft key. The Set up screen will then be displayed (see Figure 17).

2. Use the ▲ and ▼ soft keys to highlight the "X-Interference" menu option, then press the ✓ soft key:

- The X- Interference offset screen is then displayed as shown in Figure 23.
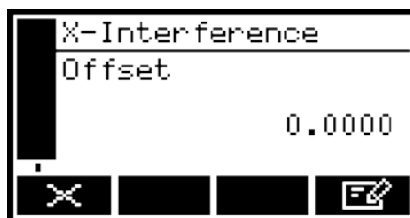
Figure 23 - The X-Interference offset screen

4. The offset value shown on the X-Interference offset screen is the correction which will be applied to oxygen sample measurements before they are displayed (or output).

If you want to change the offset value, press the ✎ soft key, then edit the displayed offset as described in Section 4.10.

6.4   Configuring the measurement alarms

6.4.1 Alarm modes and levels

Two separate measurement alarms are available, which can be configured to operate in one of three modes:

Alarm mode	Operation
None	The alarm is not used (that is, an alarm condition will not be activated under any circumstances).
Low alarm	An alarm condition will be activated when a sample measurement is lower than the preset alarm level.
High alarm	An alarm condition will be activated when a sample measurement is higher than the preset alarm level.

While a measurement alarm condition is activated:

- An 'alarm' icon is shown on the measurement screen (see Section 4.2). The number ("1" or "2") in the icon will identify the alarm which has been triggered.

- If the audible measurement alarm is enabled (see Section 6.4.5), the audible alarm goes on.

- The alarm LED on the front of the GAB-1700 (see Figure 1) flashes on and off.

- You can view the details of the activated alarm: see Section 6.4.8.

6.4.2 Latching/non-latching alarms

You can configure each of the two measurement alarms to be either latching or not latching:

Alarm setting	Meaning
Latching	Once the alarm condition has been activated, the alarm condition remains activated (even if subsequent sample measurements would not trigger the alarm) until the alarm is manually unlatched: see Section 6.4.7.
Not latching	Once the alarm condition has been activated, the alarm condition remains activated only until a subsequent sample measurement which would not trigger the alarm is made. The alarm condition is then deactivated.

6.4.3 Hysteresis levels

The hysteresis level associated with a measurement alarm determines when an alarm condition (once activated) is deactivated, and this depends on the alarm mode, as follows:

Alarm mode	Effect of hysteresis
Low alarm	Once the low alarm condition has been activated, the alarm condition will not be deactivated until a sample measurement is above (alarm level + hysteresis level).
High alarm	Once the high alarm condition has been activated, the alarm condition will not be deactivated until a sample measurement is below (alarm level - hysteresis level).

For example:

• If a 'low' alarm has an alarm level of 18% and a hysteresis level of 1%, the alarm will be activated when a sample measurement is < 18%, and the alarm will not be deactivated until a sample measurement is > 19%.

• If a 'high' alarm has an alarm level of 20% and a hysteresis level of 2%, the alarm will be activated when a sample measurement is > 20%, and the alarm will not be deactivated until a sample measurement is < 18%.

6.4.4 Setting the measurement alarm levels and modes

☞ Ensure that the measurement alarm and hysteresis levels are not too close to the expected sample measurements. (If they are, minor – and acceptable - variations in your sample gas concentrations will result in spurious alarms.)

☞ If you configure one measurement alarm as 'low' and configure the other alarm as 'high', ensure that the 'high' alarm and hysteresis levels are higher than the 'low' alarm and hysteresis levels. (If you do not, the GAB-1700 can be permanently in an alarm condition, until you correct the levels.)

Before you start to take sample readings, you must ensure that the measurement alarms are correctly configured for your sample gases.

1. On the Measurement screen, press the 🔔 soft key. The Alarm option screen will then be displayed, as shown in Figure 27.

2. Highlight the "Set up" menu option, then press the ✓ soft key. The Alarm set up screen will then be displayed, as shown in Figure 28.

3. Use the △ and ▽ soft keys to highlight the required alarm, then press the ✓ soft key. The Alarm mode screen will then be displayed, as shown in Figure 29.

4 . If the alarm mode is not the required mode, press the 📝 soft key, use the △

5. On the Alarm mode screen, use the △ and ▽ soft keys to highlight each of the following alarm options, and select the required option (using the method in Step 4 above) or enter the appropriate levels (using the method described in Section 4.10):

    • Latching
    • Level
    • Hysteresis.

Figure 27 - The Alarm option screen

Figure 28 - The Alarm set up screen

Figure 29 - The Alarm mode screen

6.4.5 Enabling/disabling the audible measurement alarm

☞ The audible measurement alarm options are "Yes" (for enable) and "No" (for disable).

1. With the Alarms option screen displayed (see Section 6.4.4), use the ▲ and ▽ soft keys to highlight the "Audible alarm" option, then press the ✓ soft key.

2. If the displayed alarm setting is not the required setting, press the ✎ soft key. The Audible alarm option screen will then be displayed: see Figure 30.

Figure 30 - The Audible alarm option screen

3. Use the ▲ and ▽ soft keys to select the required option ("Yes" or "No"), then press the ✓ soft key.

6.5.6 Silencing (muting) the audible measurement alarm

☞ The audible alarm will only go on when a measurement is made which triggers a measurement alarm condition **and** the audible measurement alarm has been enabled (see Section 6.4.5).

When the audible alarm is on because of a measurement alarm condition, you can temporarily silence (mute) the audible alarm, as follows:

1. On the Measurement screen, press the 🔔 soft key; the Alarm option screen (Figure 27) will then be displayed.

2. With the "Mute" option highlighted, press the ✓ soft key. The audible alarm will then go off and the Measurement screen will be displayed again.

☞ Once silenced, the audible alarm will go on again:

• If a new measurement alarm condition is activated.

• If the measurement alarm condition which caused the audible alarm to go on is deactivated and is then re-activated.

You will then need to silence the audible measurement alarm again.

6.4.7 Unlatching measurement alarms

When necessary, use the following procedure to unlatch any 'latched' measurement alarm(s) (see Section 6.4.2):

1. On the Measurement screen, press the 🔔 soft key; the Alarm option screen (Figure 27) will then be displayed.

2. With the "Unlatch" option highlighted, press the ✓ soft key. All latched alarms will then be unlatched and the Measurement screen will be displayed again.

6.4.8 Viewing the measurement alarm status

1. On the Measurement screen, press the 🔔 soft key; the Alarm option screen (see Figure 27) will then be displayed.

2. With the "View" option highlighted, press the ✓ soft key. The Alarm status screen will then be displayed (see Figure 31).
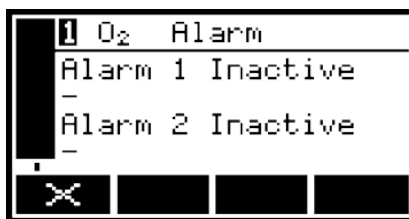
Figure 31 - The Alarm status screen

In the Alarm status screen shown in Figure 31, both measurement alarms are shown as "Inactive"; that is, either the mode of each alarm is set to 'none', or no alarm condition currently exists.

If a measurement alarm condition exists when you view this screen, the screen will show:

•   The alarm number ("1" or "2").

•   The sample reading which triggered the alarm condition.

•   The alarm mode (where "<" indicates a low alarm and ">" indicates a high alarm).

•   The alarm level.

6.5   Configuring and using the optional milliamp output

6.5.1 Overview

The GAB-1700 can be supplied with a milliamp output to provide a constantly updated output (from the connector on the rear of the GAB-1700, see Figure 2), in which the current represents the value of gas sample measurement.

The GAB-1700 allows you to specify two separate output configurations for the milliamp output: Range 1 and Range 2. The Range with which a measurement is currently associated is shown on the Measurement screen (see Figure 3):

I   is shown if Range 1 is selected.

II   is shown if Range 2 is selected.

The milliamp output provides one of the following selectable output current ranges, for gas sample measurements:

- 0 to 20 mA, where 0 mA represents a sample measurement of 0 (zero) and 20 mA represents a user selected highest sample measurement (the span).

- 4 to 20 mA, where 4 mA represents a sample measurement of 0 (zero) and 20 mA represents a user selected highest sample measurement (the span).

In addition to the above, you can specify how the milliamp output will operate during calibration, during a fault condition, and during under-range conditions.

Details of the output parameters for the milliamp output are given in Section 6.5.2. Set up, configure, check, calibrate and use the milliamp output as described in Sections 6.5.3 to 6.5.6.

6.5.2 Introduction to the milliamp output parameters

The milliamp output parameters that you must set up are as follows:

Parameter	Values/options
Range 1 high level	The Range 1 highest sample measurement (span) *.
Range 2 high level	The Range 2 highest sample measurement (span) *.
During calibration	The selected option determines how the milliamp output will operate during calibration:
	Freeze — As soon as the calibration screen is displayed, the milliamp output will 'freeze' at its last output value. The output will only be updated to reflect subsequent measurements when calibration has been completed.
	Follow — The milliamp output value will reflect the measurement value, even during calibration.
Jam condition	The selected option determines how the milliamp output will operate during a fault condition:
	High — The output value will be held at 21.5 mA.
	Low — The output value will be held at 0 mA.
	None — The output values will continue to be derived from the sample gas measurements, even though these output values may be erroneous.
mA output range	0-20 mA or 4-20 mA *, configurable as follows:
	0-1% to 0-100% O_2 industrial oxygen sensor
Under-range	Any value below 4 mA #

* See Section 6.5.1.

\# Only available if the 4-20 mA output range is selected; this sets the lowest out- put current during normal operation, and allows negative gas concentrations to be monitored through the milliamp outputs. For example, with an under- range setting of 3.8 mA, the milliamp outputs can be less than 4 mA (which indicates a zero gas concentration), down to a minimum of 3.8 mA, where an output between 3.8 mA and 4 mA indicates a negative gas concentration.

6.5.3 Set up the milliamp output parameters

Use the following procedure to set up the milliamp output parameters:

1.   Press the ▣ soft key to display the Menu screen, use the △ and ▽ soft keys to highlight the "Set up" menu option, then press the ✓ soft key. The Set up screen will then be displayed (see Figure 17).

2.   Use the △ and ▽ soft keys to highlight the "mA output" menu option, then press the ✓ soft key: the mA configuration screen is then shown (see Figure 32).
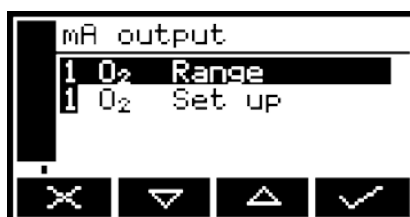
Figure 32 - The mA configuration screen

3.   Use the △ and ▽ soft keys to highlight the required "Set up" option, then press the ✓ soft key: the corresponding mA output high level screen will then be shown: see Figure 33.

Figure 33 - The mA output high level screen

4.   If necessary, change the displayed parameter using the edit method described in Section 4.10.

5.   For each of the other milliamp parameters (see Section 6.5.2):

•   Use the △ and ▽ soft keys to select the corresponding parameter screen.

•   Change the parameter as necessary: press the ▨ soft key then use the △ and ▽ soft keys to select the required option, or edit the data as described in Section 4.10.

☞   You cannot enter a high level (span) value higher than the maximum measurement that the corresponding gas sensor can determine (refer to Sections 2.5 to 2.8).

6.5.4 Select the Range associated with a measurement

Use the following procedure at any time during sampling to change the Range (see Section 6.5.1) associated with a gas measurement:

1. Press the [icon] soft key to display the Menu screen, use the [icon] and [icon] soft keys to highlight the "Set up" menu option, then press the [icon] soft key. The Set up screen will then be displayed (see Figure 17).

2. Use the [icon] and [icon] soft keys to highlight the "mA output" menu option, then press the [icon] soft key: the mA configuration screen is then shown (see Figure 32).

3. Use the [icon] and [icon] soft keys to highlight the required gas Range option, then press the [icon] soft key: the mA range screen will then be displayed, as shown in Figure 34.

```
┌──────────────────────────┐
│█ mA output               │
│█ Range                   │
│█                         │
│█         Range 1         │
│█                         │
│▪                         │
│  ✕             ▣         │
└──────────────────────────┘
```
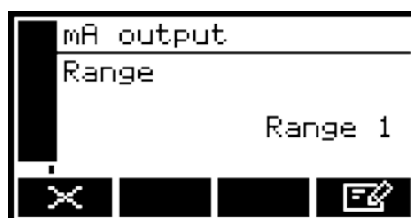
Figure 34 - The mA range screen

4. To change the selected Range:

    • Press the [icon] soft key, then use the [icon] and [icon] soft keys to highlight the alternative Range option (Range 1 or Range 2).

Press the [icon] soft key: the mA Range screen will then be displayed again, with the new Range shown.

6.5.5 Calibrate a milliamp output

Use the following procedure to calibrate a milliamp output:

1. Press the ▣ soft key to display the Menu screen, use the ▲ and ▽ soft keys to highlight the "Service" menu option, then press the ✓ soft key. The mA output service screen will then be displayed: see Figure 36.

2. Select the required 'Calibrate' option, then press the ✓ soft key. The mA output calibrate screen will then be displayed, as shown in Figure 35.

```
mA output
Calibrate

            20.000

        ▽    △    ✓
```
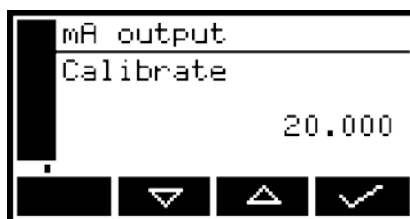
Figure 35 - The mA output calibrate screen

3. As soon as the mA output calibrate screen is shown, the nominal milliamp output value is set to 20 mA:

    •   Use your equipment (connected to the milliamp connector on the rear of the GAB-1700) to monitor the actual output value.

    •   Use the ▲ and ▽ soft keys to increase or decrease the actual output value until your equipment indicates 20 mA output.

4. When the milliamp output has been correctly calibrated, press the ✓ soft key: the mA output service screen (Figure 36) will then be displayed again.

☞   The actual milliamp output value is controlled from the mA output calibrate screen as long as the screen is displayed. As soon as the mA service screen is displayed, the milliamp output value will be updated to reflect the corresponding gas measurement.

6.5.6 Check a milliamp output

If required, use the following procedure at any time to perform a check on a milliamp output:

1. Press the [▤] soft key to display the Menu screen, use the [△] and [▽] soft keys to highlight the "Service" menu option, then press the [✓] soft key. The mA output service screen will then be displayed: see Figure 36.


```
mA output
1 O₂  Override
1 O₂  Calibrate


  ✕    ▽    △    ✓
```
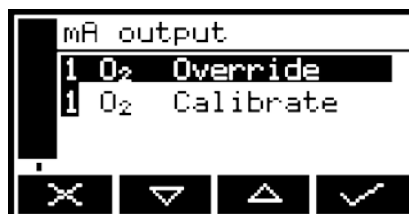
Figure 36 - The mA output service screen

2. Select the required 'Override' option, then press the [✓] soft key. The mA output override screen will then be displayed, as shown in Figure 37.


```
mA output
Override value

         12.000

  ✕    ▽         ⧆
```
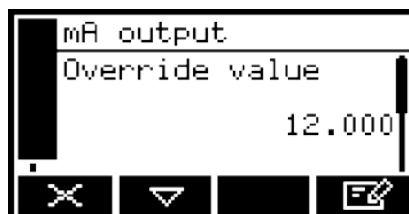
Figure 37 - The mA output override screen

3. Edit the displayed override value as described in Section 4.10.

4. Press the [▽] soft key: an acceptance screen showing "No" will then be displayed.

5. To apply the override, press the [⧆] soft key: an 'Override' screen will then be shown. Use the [△] and [▽] soft keys to highlight the "Yes" option, then press the [✓] soft key.

   The milliamp output will now be set to the override value you have selected. Use your equipment (connected to the milliamp connector on the rear of the GAB-1700) to check that the output is correct.

6. If required, repeat Steps 3 to 5 above to check for other milliamp output values, or press the [✕] soft key to display the mA output service screen again.

☞ The milliamp output freezes at the override value as long as the 'Override' screen is displayed. As soon as another screen is displayed, the milliamp output value will be updated to reflect the corresponding gas measurement.

6.6   Data logging, serial outputs and printed outputs

6.6.1 Selecting data logging/serial output/printed outputs

You can configure the GAB-1700 to provide data logging, to provide serial outputs, or to provide a report to a printer.

• When serial output is selected, data is continuously output to your PC (or other device) connected to the serial output port on the rear of the GAB-1700.

• When data logging is selected, measurement information is stored in GAB-1700 memory (see Section 6.6.3). You must manually initiate output of the stored data log to a connected device, as described in Section 6.6.6.

• When printer (printed output) is selected, you must manually initiate the printing of a sample measurement report to the printer, as described in Section 6.6.9.

Use the following procedure to select the required option:

1.   With the Menus screen displayed, use the ⬛△⬛ and ⬛▽⬛ soft keys to highlight the "Set up" menu option, then press the ⬛✓⬛ soft key. The Serial type screen will then be displayed, as shown in Figure 38.
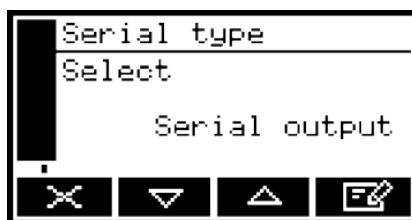
Figure 38 - The Serial type screen

2.   If the option shown on the Serial type screen is not the required option, press the ⬛🖉⬛ soft key; the Serial type select screen will then be displayed (see Figure 39).
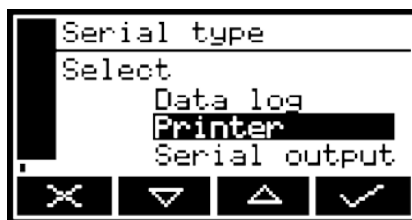
Figure 39 - The Serial type select screen

3.   Use the ⬛△⬛ and ⬛▽⬛ soft keys to select the required option, then press the ⬛✓⬛ soft key.

4.   Press the ⬛✕⬛ soft key to display the Menu screen.

6.6.2 Configuring the serial output parameters

☞ The serial output parameters apply to both the data logging and serial output options (see Section 6.6.1).

If you have selected data logging or serial outputs, you must configure the GAB-1700 serial output parameters to suit the requirements of the PC (or other device) which you have connected to the serial output port on the rear of the GAB-1700. The output parameters which you can configure are listed below:

Parameter	Valid settings
Period *	0 to 999 seconds.
Baud rate	2400, 4800, 9600, 19200 and 38400 are all supported.
Stop bits	1 or 2.
Data bits	7 or 8.
Parity	None, odd parity, or even parity.

* Time between updates: not applicable to data logging.

To configure the parameters:

1. From the Settings screen, use the ▲ and ▼ soft keys to highlight the "Serial output" menu option, then press the ✓ soft key. The first parameter screen will then be displayed: if you have selected serial outputs, the RS232 period screen will be shown (see Figure 40); if you have selected data logging, the RS232 baud rate screen will be shown (see Figure 41).
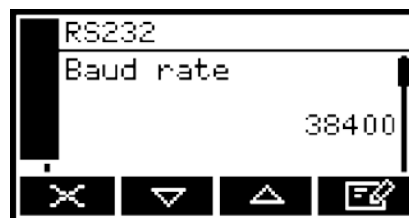
Figure 40 - The RS232 period screen   Figure 41 - The RS232 baud rate screen

2. If necessary, change the displayed parameter using the edit method described in Section 4.10.

3. For each of the other configurable parameters (see above):

    • Use the ▲ and ▼ soft keys to select the corresponding parameter screen.

    • Change the parameter as necessary: use the ▲ and ▼ soft keys to highlight the required option, or edit the data as described in Section 4.10.

6.6.3 Introduction to data logging

The GAB-1700 allows you to maintain a data log of sample measurements made within the internal memory. The data log consists of one or more 'batches' of measurements, and a total of 200 measurements can be stored.

Each sample measurement entered in the log has:

• an associated batch number
• a sequence number of the sample measurement within the batch
• the date and time that the measurement was made
• an alarm indication (if the measurement caused a measurement alarm to be raised)
• a fault indication (if a fault existed at the time of the measurement).

You must manually transfer measurements into the data log, specify when a new batch is to start within the data log, and clear the data log when necessary.

At any time, you can view the currently stored data log on the GAB-1700 display, or you can output it to a device (such as a PC) connected to the GAB-1700 serial output port.

☞   The GAB-1700 cannot be configured to automatically log data over specified periods of time. If you require such a facility, we recommend that you select serial outputs (instead of data logging) and connect the serial output to a PC or a data logger.

6.6.4 Entering measurement data into the data log

When you want to enter the sample measurement(s) from the Measurement screen into the data log:

1.   Press the [icon] soft key. When you press the soft key, the current sample measurement at the time of the key press is 'captured' (stored in internal memory), and the Data logging screen will then be displayed (see Figure 42).
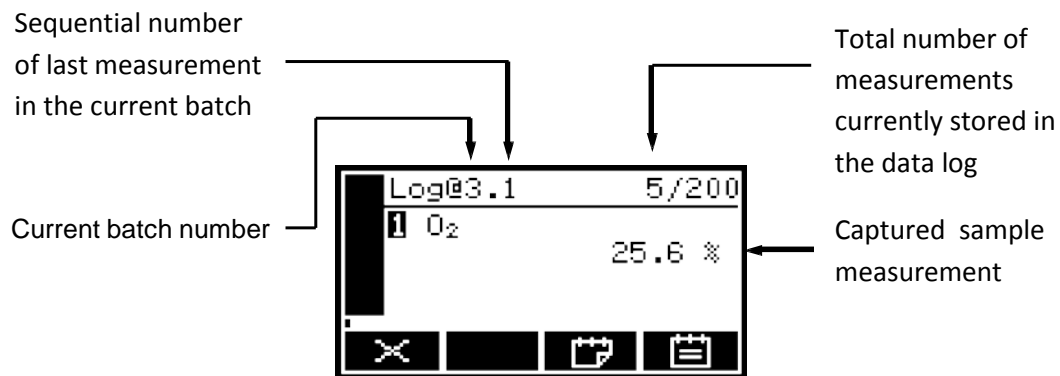
Figure 42 - The Data logging screen

2. To store the measurement data in the data log, press the ◻️ soft key. A Log taken screen (Figure 43) is then displayed for a few seconds to verify that the measurement data has been stored in the data log, then the Measurement screen is shown again.

☞ To return to the Measurement screen without storing the captured sample measurement data in the data log, press the ◻️✕◻️ soft key when the data logging screen is displayed.

6.6.5 Starting a new data log batch

1. With the Measurement screen displayed, press the ◻️ soft key. The Data logging screen will then be displayed (see Figure 42).

2. Press the ◻️ soft key. A new batch will then be started within the data log (and the batch sequence number of the next measurement will be reset to "1").

☞ No new measurement data is entered into the data log when you press the ◻️ soft key. To enter data into the new batch, you must press the ◻️ soft key again, or use the procedure given in Section 6.6.4.

6.6.6 Outputting the data log

1. With the Menu screen displayed, use the △ and ▽ soft keys to highlight the "Data log" option, then press the ✓ soft key. The Data log options screen will then be displayed, as shown in Figure 44.

2. Use the △ and ▽ soft keys to highlight the "Output log" option, then press the ✓ soft key. The output of the data log will be initiated, and the Measurement screen will then be shown again.

```
┌──────────────────────┐     ┌──────────────────────┐
│█Log@1.4      3/200    │     │█Data log             │
│█                      │     │█────────────────────│
│█                      │     │█▐View log▌           │
│█Log taken            │     │█ Output log           │
│█19/01/05 12:35       │     │█ Clear log            │
│█                      │     │█                      │
│▪                      │     │▪                      │
│ ✕ │   │   │   │     │ ✕ │ ▽ │ △ │ ✓ │
└──────────────────────┘     └──────────────────────┘
```

Figure 43 - The Data log taken screen   Figure 44 - The Data log options screen

☞ The data log will only be output if you have correctly configured the serial output parameters as described in Section 6.6.2.

6.6.7 Viewing the data log

1. With the Menu screen displayed, use the [△] and [▽] soft keys to highlight the "Data log" option, then press the [✓] soft key. The Data log options screen will then be displayed, as shown in Figure 44.

2. Use the [△] and [▽] soft keys to highlight the "View log" option, then press the [✓] soft key. The View log (batch) screen is then displayed, alternating with the View log (date) screen: see Figures 45 and 46.

3. Use the [△] and [▽] soft keys to scroll through all of the measurements stored in the data log.

4. When you have finished viewing the data log, press the [✓] soft key or the [✗] soft key to display the Data log options screen again.

Sequential number of measurement in the batch

Batch number

Date of sample measurement

Time of sample measurement

```
┌──────────────────────┐        ┌──────────────────────┐
│█ View log      1.1  ▐│        │█ 19/01/05 12:35     ▐│
│█ ▌ O₂               ▐│        │█ ▌ O₂               ▐│
│█       21.7 %       ▐│        │█       21.7 %       ▐│
│▪                    ▐│        │▪                    ▐│
├──────┬─────┬─────┬───┤        ├──────┬─────┬─────┬───┤
│  ✗   │  ▽  │  △  │ ✓ │        │  ✗   │  ▽  │  △  │ ✓ │
└──────┴─────┴─────┴───┘        └──────┴─────┴─────┴───┘
```
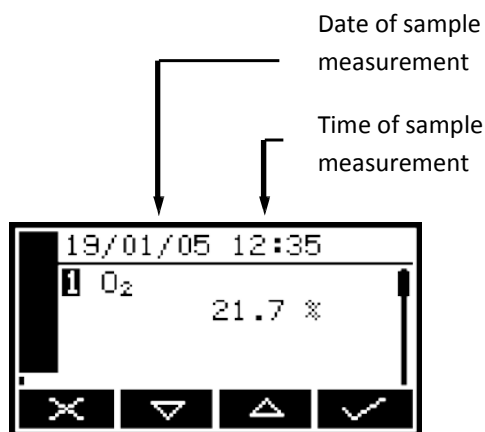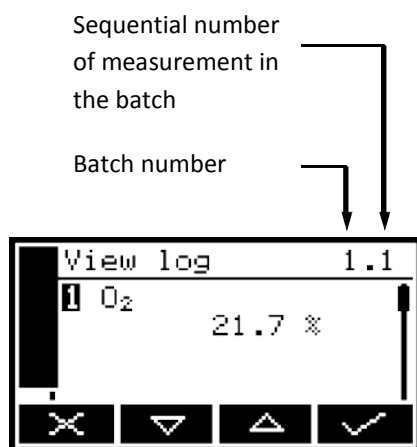
Figure 45 - The View log (batch)screen   Figure 46 - The View log (date)Screen

6.6.8 Clearing the data log

☞ Ensure that you have viewed the data log (see Section 6.6.7) or have output the data log if required (see Section 6.6.6) before you clear the log.

☞ You cannot clear batches or individual measurements from the data log.

1. With the Menu screen displayed, use the [△] and [▽] soft keys to highlight the "Data log" option, then press the [✓] soft key. The Data log options screen will then be displayed, as shown in Figure 44.

2. Use the [△] and [▽] soft keys to highlight the "Clear log" option, then press the [✓] soft key. The screen will then show an "Are you sure?" message:

    • Press the [✓] soft key to clear the data log. The Data log options screen is then displayed again.

    • Press the [✗] soft key to display the Data log options screen again without clearing the data log.

6.6.9 Printing a sample measurement report

If you have selected printed outputs (see Section 6.6.1), you must manually initiate the printing of each sample measurement report.

Press the ▦ soft key when you want to print a report. Refer to Appendix A3 for the format of the printed sample measurement report.

6.7   Adjusting the display

At any time, you can adjust the screen display to suit the ambient light conditions, as described in Sections 6.7.1 and 6.7.2.

6.7.1 Adjusting the backlight timer

When the GAB-1700 is first switched on, the backlight goes on to illuminate the screen. If no soft key is pressed, the backlight will remain on for the preset 'backlight time', and will then go off. The timer associated with the backlight time is restarted whenever a soft key is pressed (that is, the backlight remains on for the backlight time after the last soft key press). To adjust the backlight time:

1.   On the Settings screen, highlight the "Backlight" option, then press the ✓ soft key. The Backlight timer screen will then be displayed, as shown in Figure 47.

2.   Change the backlight time (Duration) setting as required, then press the ✓ soft key.

Figure 47 - The Backlight timer screen

☞   The backlight time (Duration) can be set between 0 and 999 seconds. Set the backlight time (Duration) to 0 seconds to leave the backlight permanently switched on.

6.7.2 Adjusting the contrast

1.　On the Settings screen, highlight the "Contrast" option, then press the ✓ soft key. The Contrast screen will then be displayed, as shown in Figure 48.

Figure 48 - The Contrast screen

2.　Use the △ and ▽ soft keys to increase or decrease the contrast to the required level, then press the ✓ soft key.

☞　Hold the △ or ▽ soft key pressed in to adjust the contrast quickly.

6.8　Switching off the GAB-1700 after use

When you have finished using the GAB-1700:

1.　Switch off the GAB-1700: press and hold the Power On/Off key for approximately 2 seconds, then release the key when the audible alarm goes on.

2.　If you will not use the GAB-1700 for several days:

▪　Disconnect any tubes from the sample gas outlet and from the bypass gas outlet (if fitted) on the rear of the GAB-1700 (see Figure 2).

▪　Fit protective plastic caps to the sample gas outlet and the bypass gas outlet (if fitted) on the rear of the GAB-1700 (see Figure 2), and to the sample gas inlet on the front of the GAB-1700 (see Figure 1).

3.　If required, disconnect the GAB-1700 from the electrical supply.

☞　If your GAB-1700 has the optional rechargeable battery, we recommend that you allow the battery to fully recharge before you disconnect the GAB-1700 from the electrical supply.

☞　If your GAB-1700 has the optional rechargeable battery, you can leave the GAB-1700 connected to the electrical supply. This will not affect the service life of the battery.

7 ROUTINE MAINTENANCE

⚠️

WARNING

Sample and calibration gases may be toxic or asphyxiant. Never inspect the inlet filter, remove the side panels from the GAB-1700, or service or repair the GAB-1700 while such gases are still connected to it.

⚠️

WARNING

Sample and calibration gases may be toxic or asphyxiant and may build up within the GAB-1700 during use. Always inspect the inlet filter, service the GAB-1700, or remove the side panels from the GAB-1700 in a well-ventilated environment, so that such gases (if present) do not present a hazard.

⚠️

WARNING

Sample and calibration gases may be toxic or asphyxiant. If you suspect there is a gross leak or internal pipework damage in the GAB-1700, leave the GAB-1700 in a well-ventilated environment for at least 8 hours before servicing or repair.

7.1 Cleaning the GAB-1700

Regularly use a damp (but not wet) cloth to wipe clean the outer surfaces of the GAB-1700, to prevent the entry of dust or other particulates into the gas sample inlet or the interior of the GAB-1700.

7.2 Inspecting the inlet filter element

☞ The filter element is made of borosilicate glass, and the filter retainer cap 'O' ring is made from FKM (fluoroelastomer).

☞ New filter elements and filter retainer cap 'O' rings are available as spares.

If you only use the GAB-1700 on applications which use clean, dry cylinder gases, you will only need to inspect the inlet filter element every 3 months. On other applications, we recommend that you inspect the inlet filter element more frequently.

1. Ensure that the GAB-1700 is switched off.

2. Unscrew and remove the filter retainer cap (see Figure 1).

3.   Inspect the condition of the white filter element (fitted to the spigot on the rear of the filter retainer cap). If the filter element is wet or dirty:

- Remove the used filter element from the filter retainer cap, then dispose of the element.

- Push a new filter element onto the spigot on the inner side of the filter retainer cap.

4.   Inspect the 'O' ring on the inner side of the filter retainer cap. If the 'O' ring is twisted or damaged:

- Remove the 'O' ring, then dispose of it.

- Fit a new 'O' ring to the inner side the filter retainer cap.

5.   Ensure that the 'O' ring is correctly located in the recess in the inner side of the filter retainer cap, then refit and tighten the filter retainer cap.

CAUTION

Do not operate the GAB-1700 with the filter element removed. If you do, particulates in the sample gas will seriously damage the GAB-1700.

7.3   Regenerate/replace the drying agent

A GAB-1700 is supplied with a flexible drying tube, containing an indicating silica gel drying agent.

You must regenerate or replace the drying agent when it has changed color from orange to green: if required, use the procedure given in Section A6 to regenerate the drying agent. After regeneration or replacement of the drying agent, take care when you refit the barbed connections on the drying tube, to ensure that they are securely fitted.

The recommended granule size for the indicating silica gel drying agent is 0.5-1.0 mm.

7.4   Use of the GAB-1700 for toxic gas measurements

WARNING

If you sample toxic gases you must regularly leak test the GAB-1700 and associated equipment. If leaks are found, do not continue to use the analyzer or associated equipment until the leaks have been sealed.

CAUTION

When you carry out a leak test, do not exceed a maximum pressure of 34.5 kPa gauge (5 psig, 0.35 bar gauge) and do not introduce a sudden change of pressure into the GAB-1700. If you do, you can damage it.

If you use the GAB-1700 for toxic gas sample measurements, you must regularly leak-test the GAB-1700 and the associated sample/vent lines or system.

We recommend that you leak-test the GAB-1700 at least once every 6 months:

• If there are leaks within the GAB-1700, do not continue to use the analyzer.

• You must seal any leaks in your sample/vent lines or system.

When you leak test, ensure that you do not exceed the maximum pressure, and do not increase the pressure in the GAB-1700 too quickly (see the caution above): we recommend that you allow at least 30 seconds to fully pressurize the GAB-1700 to the maximum pressure.

7.5   Preventative maintenance

To minimize unscheduled GAB-1700 downtime, to ensure the proper operation of the GAB-1700, and to comply with the guidelines of applicable regulatory bodies, we recommend that you utilize an annual preventative maintenance program for your GAB-1700.

The preventative maintenance program consists of a yearly inspection of the GAB-1700 at the Omega service facility, and repair of any faults, to ensure that the GAB-1700 meets its original factory specification. Once inspection and repair are complete, the GAB-1700 is returned, together with a dated service certificate.

8 FAULT FINDING

8.1 Introduction to faults and fault messages

When the GAB-1700 internal self-test facilities detect a fault:

- The audible alarm emits a single short tone.

- The amber fault LED (see Figure 1) goes on.

- A fault icon is shown on the measurement screen (see Figure 3).

- An appropriate fault message is stored.

You can view the current faults as described in Section 8.2. The fault messages which can be shown - together with the recommended actions you should take - are listed (in alphabetical order) in the table below:

Fault message	Recommended actions
Battery fault	This message will only be shown on a GAB-1700 which has the optional rechargeable battery fitted.
	Disconnect the power supply unit plug from the electrical supply outlet, wait 30 seconds, then reconnect the plug to the electrical supply outlet. If the fault persists, contact Omega for assistance.
Calibration fault	Recalibrate (both low and high) as described in Section 6.1. If the fault persists, contact Omega for assistance.
Charging Timeout	This message will only be shown on a GAB-1700 which has the optional rechargeable battery fitted.
	Check that the ambient temperature is in the correct range for charging (see Section 2.4), and try to charge the battery again. If the fault persists, contact Omega.
Code fault	Contact Omega for assistance.
Communication fail	Turn the GAB-1700 off, and then turn it on again. If the fault message is then displayed again, contact Omega for assistance.
Database fault	Contact Omega for assistance.

Fault messages (Sheet 1 of 3)

Fault message	Recommended actions
Date/Time invalid	This usually occurs because a GAB-1700 without the optional rechargeable battery has been left disconnected from the electrical supply for more than a week. On a GAB-1700 with the optional rechargeable battery, this may occur when the battery is fully discharged. Connect the GAB-1700 to the electrical supply, then set the date/time as described in Section 5.3.2. If the fault persists, contact Omega for assistance.
Fatal fault	Contact Omega for assistance.
mA fault	This fault message will only be shown on a GAB-1700 with the optional milliamp output. Ensure that the electrical cabling connected to the GAB-1700 is not open circuit. Turn the GAB-1700 off, and then turn it on again. If the fault persists, contact Omega for assistance.
mA not detected	This fault message will only be shown on a GAB-1700 which has the optional milliamp output. Contact Omega for assistance.
mA reset	This fault message will only be shown on a GAB-1700 which has the optional milliamp output. Contact Omega for assistance.
Power Config fault	Contact Omega for assistance.

Fault messages (Sheet 2 of 3)

Fault message	Recommended actions
Pump fault	This fault message will only be shown on a GAB-1700 with an internal sample pump. Check that the sample gas inlet (see Figure 1) and the sample gas outlet and bypass gas outlet (see Figure 2) are not blocked or obstructed, and that any pipes or tubes connected to the inlet and outlets are not blocked or obstructed. After checking the inlet, outlets and pipes/tubes, restart the sample pump (see Section 5.3.6). If the fault persists, contact Omega for assistance.
Static RAM fault	Turn the GAB-1700 off, and then turn it on again. If the fault message is then displayed again, contact Omega for assistance.
Transducer error	Ensure that you are using the GAB-1700 in the specified operating conditions (refer to Section 2). If the fault persists, contact Omega for assistance.
Tx incorrect type	Contact Omega for assistance.
Tx Maintenance	Check that the sample gas concentration is not higher than the transducer Full Scale Range. Recalibrate (both low and high) as described in Section 6.1. If this does not clear the fault, turn the GAB-1700 off, and then turn it on again. If the fault message is then displayed again, contact Omega for assistance.
Tx not detected	Contact Omega for assistance.

Fault messages (Sheet 3 of 3)

8.2   Viewing fault messages

If you want to view details of faults currently detected by the GAB-1700, use the [△] and [▽] soft keys to highlight the "Faults" option on the Menu screen, then press the [✓] soft key. The Fault status screen will then be displayed as shown in Figure 49.

```
Fault 1 of 1
1 O₂
21/01/05 07:47
Fault
Calibration fault
  ✕    ▽    △    ⊞
```
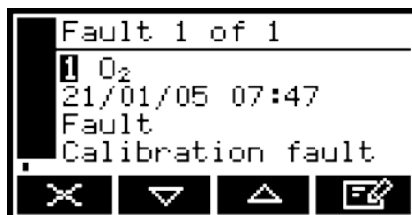
Figure 49 - The Fault status screen

If there is more than one currently detected fault, this will be indicated by the screen heading and by the scroll bar at the right of the screen. If required you can use the [△] and [▽] soft keys to scroll through and view all of the current faults.

Each fault status screen shows:

• Date and time of fault

• Fault indicator

• Fault message.

Refer to Section 8.1 for the recommended actions associated with the displayed fault messages.

8.3   General fault finding

For general GAB-1700 fault finding, refer to the table on the following pages.

If you have read through the table and still cannot rectify a fault, or cannot identify the cause of a fault, contact Omega for assistance.

Fault symptom	Recommended actions
The Fault LED is on.	Check any current fault messages (see Section 8.2), and carry out the recommended actions (see Section 8.1). If there are no applicable fault messages stored, or if you cannot rectify the fault after you have carried out the recommended actions: • Switch off the GAB-1700, then switch it on again. • If the fault persists, contact Omega for assistance.
The software health indicator is not moving on the display.	Carry out the recommended actions for the "The Fault LED is on" symptom above.
"- - - - - " is displayed instead of a sample measurement (or appears in the data log).	This indicates a possible measurement error, or a communications error between a transducer and the GAB-1700 controller. Check that the GAB-1700 is not being knocked, moved, or subjected to high levels of vibration during sample measurements. If the fault persists, contact Omega for assistance.
"↑↑↑↑↑↑↑" is displayed instead of a sample measurement (or appears in the data log).	This indicates that the sample gas measurement is above the upper measurement limit of the GAB-1700. If this is displayed or appears during calibration, check that the calibration gas is as specified in Section 2.3 and recalibrate the GAB-1700. If this is displayed or appears during sample measurement, check that the sample gas target range is within the specification of the GAB-1700 (see Section 2.2).

General fault finding (Sheet 1 of 5)

Fault symptom	Recommended actions
"↓↓↓↓↓↓↓" is displayed instead of a sample measurement (or appears in the data log).	This indicates that the sample gas measurement is below the lower measurement limit of the GAB-1700. If this is displayed or appears during calibration, check that the calibration gas is as specified in Section 2.3 and recalibrate the GAB-1700. If this is displayed or appears during sample measurement, check that the sample gas target range is within the specification of the GAB-1700 (see Section 2.2).
GAB-1700 response is slow.	Check that the sample gas inlet is not blocked, and that the sample gas supply to the GAB-1700 is not restricted. Check that the sample gas outlet and bypass gas outlet are not blocked, and that any tubes or pipes connected to the outlets are not restricted. Inspect the inlet filter element and replace it if necessary: refer to Section 7.2. Check that the sample gas supply pressure is correct: refer to Section 2.2. Check that the GAB-1700 is being used in the correct ambient conditions: refer to Section 2.4.
GAB-1700 measurements are not as expected.	Check that any cross-interference offsets that you have entered are correct (see Section 6.3.2).

General fault finding (Sheet 2 of 5)

Fault symptom	Recommended actions
GAB-1700 measurements are unstable.	Check that the sample gas supply pressure is correct: refer to Section 2.2. Check that the GAB-1700 is not being subjected to high levels of vibration. Check that the sample gas inlet is not blocked, and that the sample gas supply to the GAB-1700 is not restricted. Check that the sample gas outlet and bypass gas outlet (if fitted) are not blocked, and that any tubes or pipes connected to the outlets are not restricted. Inspect the filter element and replace it if necessary: refer to Section 7.2.
The GAB-1700 will not calibrate.	Check that the correct low and high calibration gases are being used: refer to Section 2.3. Check that the sample gas inlet is not blocked, and that the sample gas supply to the GAB-1700 is not restricted. Check that the sample gas outlet and bypass gas outlet (if fitted) are not blocked. On a GAB-1700 with an internal sample pump, check that the calibration 'T' piece is not blocked. Check that any tubes or pipes connected to the outlets (or to the calibration 'T' piece) are not restricted. Inspect the filter element and replace it if necessary: refer to Section 7.2.

General fault finding (Sheet 3 of 5)

Fault symptom	Recommended actions
The GAB-1700 will not switch on.	If the green light on the power supply unit is on: • Check that the power supply is correctly connected to the GAB-1700: see Section 5.1. • If the power supply is already correctly connected to the GAB-1700, contact Omega for assistance. If the green light on the power supply unit is off: • Check that the power supply unit is correctly connected to your electrical supply outlet, and that your external electrical supply is correct: see Section 2.1. • Check the fuse in the power supply unit plug. If the fuse has failed, replace it with a new fuse of the correct rating. • If the power supply unit is correctly connected to your electrical supply outlet, your external electrical supply is correct and the correct fuse is fitted, then the power supply unit may have failed: contact Omega for assistance. If you have a GAB-1700 with the optional rechargeable battery, and the power supply unit is not connected to the electrical supply and to the GAB-1700, the battery may be flat: connect the power supply unit and recharge the battery (refer to Section 5.2).
The GAB-1700 display is blank or is too dark.	Check that the ambient temperature is within the valid GAB-1700 operating temperature range: refer to Section 2.4. Check that the display contrast adjustment has been correctly set (refer to Section 6.7.2), and has not been altered.
The measurement alarms are activating more often than expected.	Check that the GAB-1700 is not being knocked, moved, or subjected to high levels of vibration during sample measurements. Check that the alarm modes, alarm levels and hysteresis levels have been correctly set: refer to Section 6.4.4.

General fault finding (Sheet 4 of 5)

Fault symptom	Recommended actions
The GAB-1700 does not communicate correctly through the serial output connector.	Check that the update rate has been correctly set.
	Check whether data logging has been enabled, and disable data logging if necessary (refer to Section 6.6.1). (If data logging is enabled, continuous serial data outputs will be disabled.)
	Check that the GAB-1700 serial output parameters have been correctly set for the system to which you have connected the serial outputs (refer to Section 6.6.2).
	Check that the external device is correctly connected to the GAB-1700 serial port: refer to Appendix A4.
	If you have connected the serial outputs to a PC (Personal Computer), check that the correct serial port is selected on the PC. (Note that you may have to restart the PC for serial port changes to take effect.)
A milliamp output is at 0 or 21.5 A.	If you have configured the milliamp output to jam high or jam low, check whether a fault condition exists (see Section 6.5.3). Otherwise, contact Omega for assistance.
A milliamp output is not as expected.	Ensure that the electrical cabling connected to the GAB-1700 is not open circuit.
	Check that the milliamp output is calibrated correctly (see Section 6.5.5).
	Check that you have selected the correct Range (see Section 6.5.1).

General fault finding (Sheet 5 of 5)

9   STORAGE AND DISPOSAL

9.1   Storage

Refit any protective plastic covers (see Section 3) and place the GAB-1700 and any associated equipment in its original packaging before storage. Alternatively, seal it inside a waterproof plastic bag, sack, or storage box.

Store the GAB-1700 and any associated equipment in a clean, dry area. Do not subject it to excessively hot, cold, or humid conditions: see Section 2.4.

☞   If your GAB-1700 has an optional rechargeable battery, recharge the battery every 2 months: see Section 5.2.

9.2   Disposal

Dispose of the GAB-1700, the power supply unit and any other associated equipment safely, and in accordance with all of your local and national safety and environmental requirements.

☞   The GAB-1700 is not suitable for disposal in municipal waste streams (such as landfill sites, domestic recycling centers and so on). Refer to Appendix A7 for disposal requirements in accordance with the WEEE Directive within the EC.

☞   If you send the GAB-1700 to Omega for disposal, the analyzer must be accompanied by a correctly completed decontamination certificate.

APPENDIX

A1   DATA LOG OUTPUT FORMATS

The data log is output in the form of an identifier line, followed by a number of log lines, one line for each entry stored in the data log.

The identifier line is in the form: "<serial number> ; <gas>", where <serial number> is the GAB-1700 serial number as shown on the Information screen (see Figure 7) and <gas> is as specified below.

Each log line consists of a number of elements, separated from each other by the delimiter string " ; " (space, semicolon, space), in the following format:

<log id> ; <date> ; <time> ; <gas> ; <measurement> ; <units> ; <alarm status> ; <fault status> [; <gas> ; <measurement> ; <units> ; <alarm status> ; <fault status>]

where:

<log id>	Is in the form "X.Y", where "X" is a digit (or digits) specifying] the batch number and "Y" is a digit (or digits) specifying the number of the measurement within the batch.
<date>	Is the date on which the data log entry was made.
<time>	Is the time at which the data log entry was made.
<gas>	Specifies the sample gas measured.
<measurement>	Is the actual sample measurement as displayed on the measurement screen.
<units>	Is the measurement units, as displayed on the measurement screen.
<alarm status>	Is either blank (not output), or "Alarm" if a measurement alarm condition existed when the log entry was made.
<fault status>	Is either blank (not output), or "Fault" if a fault condition existed when the log entry was made.
"[" and "]"	Elements between these bracket symbols are only output when the GAB-1700 is configured for two sample measurements. The bracket symbols themselves do not appear in the output.

A typical extract from a GAB-1700 data log output is shown below:

```
05250A1/45678 ; O2
 1.1  ; 19/01/05 ; 14:57:04 ; O2 ;  14.8 ; % ; Alarm ;
 1.2  ; 19/01/05 ; 14:57:09 ; O2 ;  14.8 ; % ; Alarm ;
 1.3  ; 19/01/05 ; 14:57:16 ; O2 ;  14.8 ; % ; Alarm ; Fault
 2.1  ; 19/01/05 ; 14:57:36 ; O2 ;  14.8 ; % ; Alarm ;
 2.2  ; 19/01/05 ; 14:57:42 ; O2 ;  14.8 ; % ; Alarm ;
 2.3  ; 19/01/05 ; 14:57:58 ; O2 ;  14.8 ; % ; Alarm ; Fault
 3.1  ; 19/01/05 ; 14:58:13 ; O2 ;  14.8 ; % ; Alarm ;
 3.2  ; 19/01/05 ; 14:58:46 ; O2 ;  20.5 ; % ; ;
 3.3  ; 19/01/05 ; 14:58:51 ; O2 ;  20.5 ; % ; ;
 3.4  ; 19/01/05 ; 14:58:55 ; O2 ;  20.5 ; % ; ; Fault
 4.1  ; 19/01/05 ; 14:59:03 ; O2 ;  20.5 ; % ; ; Fault
 4.2  ; 19/01/05 ; 14:59:08 ; O2 ;  20.5 ; % ; ;
```

A2   SERIAL OUTPUT FORMATS

The serial output consists of a number of measurement lines, one line for each update.

Each measurement line consists of a number of elements, separated from each other by the delimiter string " ; " (space, semicolon, space), in the following format:

<date> ; <time> ; <gas> ; <measurement> ; <units>[; <gas> ; <measurement> ; <units>]

where:

<date>	Is the date on which the data log entry was made.
<time>	Is the time at which the data log entry was made.
<gas>	Specifies the sample gas measured.
<measurement>	Is an actual sample measurement, as displayed on the measurement screen.
<units>	Is the measurement units, as displayed on the measurement screen.
"[" and "]"	Elements between these bracket symbols are only output when the GAB-1700 is configured for two sample measurements. The bracket symbols themselves do not appear in the output.

An extract from a typical serial output is shown below:

```
19/01/05 ; 14:50:25 ; O2 ;  20.3 ; %
19/01/05 ; 14:50:35 ; O2 ;  20.3 ; %
19/01/05 ; 14:50:45 ; O2 ;  20.3 ; %
19/01/05 ; 14:50:55 ; O2 ;  20.3 ; %
19/01/05 ; 14:51:05 ; O2 ;  20.3 ; %
```

☞   Alarms and fault information are not provided in the serial outputs.

A3   PRINTER OUTPUT FORMATS

If you have selected printed outputs (see Section 6.6.1), each time you press the 🖶 soft key, a single sample measurement report is printed. The format of this report is as shown below:

```
Date:            <date>

Time:            <time>

I.D.:            <serial number>

Batch:

Product:
                 _____

Measurement:

1  <gas>         XXXX <units>        <alarm>




Signature
                 _____
```

where:

<date>   Is the date on which the report was printed, in the currently selected format (see Section 5.3.2).

<time>   Is the time at which the report was printed, in the format hh:mm:ss (hours:minutes:seconds).

<serial number>   Is the serial number of the GAB-1700.

1 <gas>   Specifies transducer 1 and the sample gas measured.

XXXX   Is the sample measurement.

<units>   Is the measurement units, as displayed on the measurement screen.

<alarm>   Specifies the alarm or other status:

- "PASS" indicates that alarms have been configured, and that the sample measurement has not triggered an alarm.

- "FAIL" indicates that alarms have been configured, and that the sample measurement has triggered an alarm.

- "FAULT" indicates that a transducer fault is present.

- "RECALIB" indicates that the transducer needs to be recalibrated. (This will be shown when the sample measurement is >100% or < 0% and no alarms have been configured.)

If no alarms have been configured (and no transducer or recalibration fault is present), <alarm> will be blank.

Batch and Product   Are fields which you can complete (by hand) to identify, for example, a specific batch, and a specific product within that batch.

Signature   Is a field which can be used for the signature of the person who printed the report.

☞   Refer to your company procedures for the correct usage of the Batch, Product and Signature fields of printed sample measurement reports.

☞   Refer to the printer manual for additional information (for example, on how to replace the printer roll).

A4   RS232 CONNECTION DETAILS

	WARNING
⚠️	Ensure that the electrical installation of any equipment connected to the GAB-1700 conforms with all applicable local and national electrical safety requirements.

A4.1   Overview

The serial port on the rear of the GAB-1700 (see Figure 2) is an RS232 ± 5.5 V 9-way 'D' type connector.

The pins on the connector are used as shown in Figure A1 below:

Pin(s)	Use
1	Not used
2	Rx (to GAB-1700)
3	Tx (from GAB-1700)
4	Not used
5	0 V
6, 7, 8, 9	Not used
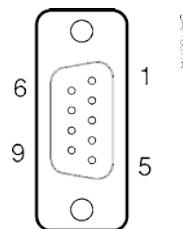
Figure A1 - RS232 connection pin details

A4.2   Connecting the GAB-1700 to a PC

The GAB-1700 can be directly connected to the 9-way 'D' type serial port (usually designated "COM1" or "COM2") on your PC. To comply with EMC immunity standards, we recommend that you use the serial output cable supplied. If you do not use the cable supplied, use a compatible 9-way 'D Null Modem' cable (with a recommended maximum length of 3 m), with female-to-female connectors.

If your PC only has USB serial ports, use a commercially available 9-way 'D' type serial to USB converter to connect the GAB-1700 to one of the serial ports.

A4.3 Capturing data using Windows® and HyperTerminal™

If you use one of the Windows operating systems, HyperTerminal is probably already installed on your PC. For detailed instructions on the installation and use of HyperTerminal, refer to the help files on your PC, or to the documentation supplied with your PC. The following information is provided as a summary only, for quick reference.

1.   Install HyperTerminal (if not already installed).

2.   Start HyperTerminal. You can usually do this by clicking on the Start button, then by clicking on: Programs, Accessories, Communications, HyperTerminal.

3.   Enter a suitable name and select a 'connect' icon for the connection.

☞   You can drag the icon onto your desktop for quick access to HyperTerminal.

4.   Identify the "COM" port that you have used to connect the GAB-1700 to the PC.

5.   Set the port settings to be consistent with the GAB-1700 serial output parameters (see Section 6.6.2). The recommended settings are as follows:

Parameter	Recommended setting
Baud rate	38400
Data bits	8
Parity	None
Stop bits	1
Flow control	None *

* This is not an option on the GAB-1700.

6.   Click on the 'connect' icon to initiate the connection:

• If you have configured the GAB-1700 to provide serial output (see Section 6.6.1), data will then be displayed on the PC.

• If you have configured the GAB-1700 for data logging, data will only be sent to the PC when you output the data log (see Section 6.6.6).

Data output from the GAB-1700 can be saved (as a text file) using the 'capture text' command in HyperTerminal. You can then import this text directly into applications such as Excel ®.

A5   MATERIALS IN CONTACT WITH SAMPLE GAS

The materials of the parts of the GAB-1700 in contact with the sample and calibration gases are listed below. These materials have a wide range of chemical compatibility and corrosion resistance.

Common gas path in the GAB-1700: Nickel
      FKM
      302 stainless steel [*]
      PPS (polyphenylene sulfide) with carbon fiber filler
      PPS (polyphenylene sulfide) [†]
      Borosilicate glass
      PVDF: polyvinylidene fluoride Polysulfone

Industrial oxygen sensor:

      316 stainless steel
      Borosilicate glass
      Platinum
      Platinum/iridium Alloy
      Electroless Nickel
      FKM

[*] GAB-1700 without internal sample pump only.
[†] GAB-1700 with internal sample pump only.

A6   REPLACING/REGENERATING THE DRYING AGENT

<table>
<tr>
<td>⚠️</td>
<td>WARNING

If you replace the drying agent, ensure that you comply with any safe handling and usage requirements specified on or with the package containing the new drying agent.</td>
</tr>
</table>

☞   If required, replace the silica gel drying agent supplied with calcium sulfate (for example, use Drierite®), to improve the response time.

The color of the silica gel drying agent in the drier is orange as supplied, and the column of drying agent will turn progressively green as moisture is absorbed. When the whole column of drying agent has turned green, the drying agent needs to be regenerated or replaced.

You can regenerate the drying agent by passing dry air or dry nitrogen through the drier, or:

• Removing it from the drier and laying it out on a tray, approximately 1 granule thick.

• Heating the silica gel on the tray in an oven at a temperature of 110 to 120 °C (230 to 248 °F) until the granules have turned orange again, or heating the calcium sulfate (Drierite®) on the tray at a temperature of 210 °C (425 °F) for 1 hour.

The drying agent supplied will turn orange again when it has been successfully regenerated. More than 100 regenerations can be made before the drying agent becomes ineffective.

When necessary, dispose of the drying agent and replace with new drying agent.

A7   DISPOSAL IN ACCORDANCE WITH THE WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE) DIRECTIVE

The label shown in Figure A5 is fitted to the analyzer.

Figure A5 - The WEEE label

This label identifies that:

• The analyzer is considered to be within the scope of the Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC.

• The analyzer is not intended for disposal in a municipal waste stream, but shall be submitted for material recovery and recycling in accordance with the local regulations which implement the WEEE Directive.

For additional information and advice on the disposal of the analyzer in accordance with the requirements of the WEEE Directive, contact Omega using the contact details given on the cover of this manual.

☞   If you send the analyzer to Omega the analyzer must be accompanied by a correctly completed decontamination certificate.

A8   COMPLIANCE AND STANDARDS INFORMATION

- The GAB-1700 Gas Analyzer complies with the European Community "Electromagnetic Compatibility Directive", 89/336/EEC (as amended by 92/31/EEC and 93/68/EEC).

- The GAB-1700 is excluded from the scope of the European Community "Low Voltage Directive", 73/23/EEC.

- The GAB-1700 has been assessed to IEC 61010-1:2001 (+Corr 1: 2002 + Corr 2:2003) for electrical safety, rated in accordance to IEC 60664-3 Category II, Pollution Degree 2.

- The GAB-1700 has been validated and fully complies with the requirements of The Food and Drug Act - specifically, 21 CFR 211.165 (e) and 211.194 (a)(2) - for verification of the strength, identity and purity of: MEDICAL OXYGEN (USP) and OXYGEN IN NITROGEN NF 19.

- The power supply unit supplied with the GAB-1700 complies with the European Community "Low Voltage Directive", 73/23/EEC.

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:	FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:
1. Purchase Order number under which the product was PURCHASED,	1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product under warranty, and	2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.	3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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