

Atmospheric Control Unit Installation and Operating Manual for

**FLUOstar Omega
LUMIstar Omega
POLARstar Omega
SPECTROstar Omega**

This manual is designed to guide FLUOstar Omega, POLARstar Omega, LUMIstar Omega and SPECTROstar Omega users through the basic hardware features of the Atmospheric Control Unit.

Although these instructions were carefully written and checked, we cannot accept responsibility for problems encountered when using this manual. Suggestions for improving this manual will be gratefully accepted. BMG LABTECH reserves the right to change or update this manual at any time. The Revision-Number is stated at the bottom of every page.

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Omega Family of Readers with Atmospheric Control Unit (ACU)

The **FLUOstar Omega** is a multifunctional microplate reader that supports a wide variety of applications and the following reading modes: fluorescence intensity, time-resolved fluorescence, absorbance and luminescence.

The **POLARstar Omega** can measure in the same modes as the FLUOstar, as well as in fluorescence polarization mode with simultaneous dual emission.

The **LUMIstar Omega** is a luminescence microplate reader that can be upgraded to include all of the above mentioned modes.

The **SPECTROstar Omega** is an absorbance microplate reader that can be upgraded to include all of the above mentioned modes.

All Omega instruments achieve high-performance measurement data in a wide range of wavelengths. Additionally, the instruments have a built-in incubator and can be configured with up to two reagent injectors. BMG LABTECH's Atmospheric Control Unit can be added to any of the Omega family of readers.



FLUOstar Omega with Atmospheric Control Unit

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1 Safety Information

1.1 Description of Warnings



A general warning calls attention to a condition which is further described and must be strictly followed by the operator.



Warning for electrical hazard.

1.2 General Information



This equipment must be installed and used as outlined in this Operating Manual. Installation, service and any operation which requires opening of the instrument must be performed only by trained and certified personnel from BMG LABTECH. Failure to comply with these instructions will impair or even invalidate the warranty and can lead to unsafe operation of this equipment.



Please read the entire User's Guide before attempting to use this unit. If operational guidelines are not followed, equipment damage and personal injury may occur.



Prior to turning on the instrument for the first time, let the instrument adapt to room temperature for at least 3 hours to avoid condensation which can cause damage to the electronics of the reader. BMG LABTECH will void the warranty if damage occurs to electrical and/or mechanical parts in cases where the instrument was turned on before the recommended accommodation time.



Handling and operation of the equipment must be carried out only by qualified personnel and staff trained by an official BMG LABTECH representative.



Microplates and related accessories (e.g. LVis Plate) operated at temperatures higher than 55°C must cool down below 55°C before being handled and removed from the instrument.



Samples and reagents (solids, liquids, or gases) must be removed from the instrument immediately after measurement to avoid corrosion and accumulation of hazardous substances inside the instrument.



Lifting:

- Always disconnect the equipment from the mains and ancillary units before moving.
- The equipment is heavy: Use lifting aids or more than one person.

1.3 Environmental Safety Standards



The environmental safety standards for operation under norm IEC 61010-1 are met under the following conditions:

- Indoor use (adhere to the Occupational Exposure Limit Values for ECM, UPS, vibration, and sunlight when setting up the instrument in the laboratory)
- Altitude (up to 2000 m)
- Temperature (+15°C to +35°C)

- Relative Humidity (Maximum 80% at 31°C non condensing then decreasing linearly to 50% at 40°C)
- Mains supply voltage fluctuation (+/- 10%)
- Overvoltage category (II) acc. to IEC 60364-4-443
- Pollution degree (2) acc. to IEC 61010-1

1.4 Electrical Safety



Connect the unit only to a grounded supply socket. The instrument is Class 1 construction and must be grounded.

Always use the mains lead supplied. Your local sales office can provide a lead suitable for your country.

Before replacing a fuse, DISCONNECT THE EQUIPMENT FROM THE MAINS SUPPLY.



Connect the unit only to a power supply with a designated voltage rating corresponding to the label on the back of the instrument.

1.5 Chemical and Biological Safety



Daily routine use with this instrument may involve the handling and use of compounds that are toxic, flammable, or biologically harmful. When working with materials and compounds as stated, make sure to observe the following precautions:

- Handle all samples, be it liquid, solid, or in gaseous form according to good laboratory practice.
- Adhere to the maximum workplace concentration (MAC) and to laboratory safety regulations (e.g. BGI 850-0, formerly BGR120 in Germany).
- Wear safety goggles since spilling of liquids may occur.
- Contact your safety officer to dispose of hazardous waste solutions and when working with flammable liquids.

1.6 Cleaning

- Routinely clean the exterior of the Atmospheric Control Unit by wiping it with a soft cloth, moistened with soapy water.
- Rinse the soap from the cloth in clean water and wipe the exterior surfaces again.

2 Technical Specifications

O ₂ Control	
Range	1 – 19%
Control	± 0.1%
Stability	± 0.2% at 1% O ₂
Gas Connections	6mm Tubing
Required Gas Pressure	10 psi / 0.7 bar
CO ₂ Control	
Range	0.2 – 20%
Control	± 0.1%
Stability	± 0.2% at 5% CO ₂
Gas Connections	6mm Tubing
Required Gas Pressure	10 psi / 0.7 bar
Dimensions	Height: 46 cm, width: 44 cm and length 48 cm Weight: 31kg
Instrument Conformity	Over voltage category II, contamination class II, protection class I

NOTES:

Maximum operating ambient temperature is 32°C.

Factory calibration of the Atmospheric Control Unit is performed with an incubator temperature of 37°C and gas concentrations of 5.0% CO₂ and 1.0% O₂, which are at an ambient temperature of 20-25°C.

Software calibration adjustments may be required to optimize performance if the Atmospheric Control Unit is being used outside of these operating conditions. Performance specifications may also be affected.

For advice on calibration adjustments and relevant performance specifications, contact BMG LABTECH. Please have ready the model and serial number of your Atmospheric Control Unit system and the complete details of your operating conditions.

Specifications are subject to change without notice.

3 Introduction

The BMG LABTECH CO₂/O₂ Atmospheric Control Unit (A.C.U.) is controlled by a microprocessor which ensures accurate and reliable operation at the desired gas concentrations. For easy programming, control and monitoring of the conditions in the microplate reader chamber, the unit incorporates a back-lit LCD display, touch-sensitive keypad and a sophisticated control system. Furthermore, real-time system data and on-screen messaging simplify operation and maintenance of the system.

Solid-state sensors control the level of CO₂ and O₂, providing excellent reliability. The CO₂ component has a programmable automatic zero system (Auto-zero), which will re-reference the sensor baseline to atmospheric CO₂ levels at regular intervals. This is performed by a small pump that supplies HEPA-filtered atmospheric gas to the sensor. When activated, the atmosphere within the sensor chamber is completely displaced allowing the control system to automatically reference the sensor. After which the pump is switched off, allowing the atmosphere within the microplate reader chamber to homogenize back into the sensor. This provides accurate CO₂ control without disturbing the chamber environment within the microplate reader.

The Atmospheric Control Unit has an alarm system that warns the user if a problem has developed with system components that require user intervention. The programmable CO₂ alarm will alert users if the CO₂ level has not recovered within a pre-set time after the reagent door has been opened. This function can also be disarmed. The CO₂ and O₂ alarms will also warn users if the gas levels have drifted outside the desired settings.

4 Installation

The packaging is specifically designed for the Omega Atmospheric Control Unit accessory and microplate reader when assembled together. Carefully unpack the unit and retain packaging to return equipment for servicing.

If the equipment appears damaged in any way, return it to your local sales office in its original packaging. No responsibility for damage arising from the use of non-approved packaging will be accepted.

Ensure all items and accessories specified are present. If not, contact your local sales office or BMG LABTECH Ltd at the address given below.

When unpacking the instrument, please check to ensure that all of the following parts are included:

- Atmospheric Control Unit
- User Manual (contained in the Omega Manual)
- Power cord with IEC connectors
- 2x PVC Tubing (6mm bore), with an inline regulator and CO₂ HEPA-filter connected
- Two metal hose clips
- Two plastic hose clips (Pliers, not supplied, are needed to seal the plastic clips)
- Auto-Zero HEPA filter

Call BMG LABTECH immediately if any of these items are missing.

4.1 Location

Bench space

Please allow at least 10 cm space to the sides and back of the reader for ventilation and allow at least 30 cm above the reader to facilitate removal of the reader top cover.

Reader dimensions = Height: 46 cm, width: 44 cm and length 48 cm. Weight 31kg

4.2 Gas Connections

CO₂ gas supply connection

CO₂ gas cylinder/supply with 100% CO₂ vapor withdrawal is needed, together with a two-stage regulator (recommended) for pressure control at 30 psi (2 bar).

Connect the unit to the CO₂ supply using the supplied 6mm plastic tubing (with installed HEPA filter and inline regulator) by attaching the tubing between the two-stage regulator and the CO₂ inlet on the back right side of the Atmospheric Control Unit, with the HEPA filter nearest the microplate reader CO₂ inlet. Clamp the tubing at the two-stage regulator end using one of the supplied metal pipe clips. Clamp the tubing at the CO₂ inlet end using one of the supplied black plastic pipe clips (*see Figure 1a*).

Nitrogen gas supply connection

Oxygen free Nitrogen gas cylinder/supply is needed, together with a two-stage regulator (recommended) for pressure control at 30 psi (2 bar).

Connect the unit to the Nitrogen supply using the supplied 6mm plastic tubing (with installed HEPA filter and inline regulator) by attaching the tubing between the two-stage regulator and the Nitrogen inlet on the back right side of the Atmospheric Control Unit, with the HEPA filter nearest the microplate reader Nitrogen inlet. Clamp the tubing at the two-stage regulator end using one of the supplied metal pipe clips. Clamp the tubing at the Nitrogen inlet end using one of the supplied black plastic pipe clips (*see figure 1a*).



WARNING! Only connect the supplied tubing and regulators to the Nitrogen and CO₂ inlet ports on the rear of the Atmospheric Control Unit. Maximum inlet pressure to the Nitrogen and CO₂ inlet ports should not exceed 30 psi (2 bars).



Figure 1a, 1b: Making Connections

Auto Zero HEPA Filter

Install the Auto Zero HEPA filter, by pressing the Auto Zero HEPA filter gently into the white plastic filter socket on the back of the Atmospheric Control Unit, marked 'Autozero' (see *Figure 1b*)

4.3 Power Connections



First check that the power switch on the back of the instrument is in the "Off" position. Inspect the voltage information on the label below the power switch to ensure that it corresponds to the local main power specifications. Insert the power cord provided into its receptacle on the back of the Atmospheric Control Unit (see *Figure 1 above*).

5 Operation

5.1 Control Panel

The control panel consists of an LCD display, five function keys & four direction keys (see Figure 2):



Figure 2: Control Panel

The illustration above shows the screen in normal operation. This is also how the screen should look when you switch the Atmospheric Control Unit On.

The purpose of each Function Key is identified at the bottom of the display (above each key); the function may change from screen to screen.

The cluster of four arrowed Direction Keys will move the cursor around the screen and will adjust values.

5.2 Preparing for Operation



NOTE: IMPORTANT – Before Switching on the Atmospheric Control Unit the Omega must be switched ON, the incubator set to the desired temperature, and the reader left on for at least 30 minutes to allow the incubator temperature to stabilize.

Initiating Operation

1. Using the power cord provided, connect the Atmospheric Control Unit to a suitable grounded power supply.
2. Switch the ACU ON using the on/off switch at the rear. The display will illuminate immediately.
3. Calibrate the O₂ sensor by completing an 'Oxygen Sensor-Ref To Atmosphere', detailed in Section 10.4.
4. Calibrate the CO₂ sensor by completing a CO₂ AutoZero, detailed in Section 7.3.
5. Turn on the CO₂ gas supply with the inline pressure regulator set to 10 psi or 0.7 bars.
6. Turn on the Nitrogen gas supply with the inline pressure regulator set to 10psi or 0.7 bars.
7. Leave the Atmospheric Control Unit to stabilize until the programmed O₂ and CO₂ concentrations have been reached, and the 'Chamber Alarm' is 'Armed'. The ACU system is then ready for use.



NOTE: Different gas pressures are recommended when using only one gas in the Atmospheric Control Unit (see Table 2).

Table 2: In-Line Gas Pressure Settings for Different Modes of Operation

ACU Mode	CO ₂ pressure regulator setting	Nitrogen pressure regulator setting
CO ₂ and O ₂	10 psi or 0.7 bars.	10 psi or 0.7 bars.
CO ₂ Only	5 psi or 0.35 bars.	Nitrogen Gas Off
O ₂ Only	CO ₂ Gas Off	15 psi or 1.0 bar.

6 Programming the ACU

6.1 Setting CO₂ and O₂ Levels

1. Press the **PROG** function key (see Figure 2 above, left-most menu button):
2. In the **PROG** screen that appears, press the desired function key, **O₂** or **CO₂**, and then use the ◀ & ▶ direction keys to adjust the value.
3. When the desired set point is displayed, press the **ENTER** function key. Then press the **EXIT** function key to return to the main screen
4. After making adjustments (if any were made), allow the unit to stabilize at the set points before continuing.

6.2 User Access Code

A user access code is programmable, if required. The user access code will restrict access of the **PROG**, **USER**, and **ALARM** screens to authorized persons only (see *below*).



Figure 3: User Access Code

To set the User Access Code:

- In the **PROG** screen (accessed by pressing the **PROG** function key), the user access code will be displayed as a series of four asterisks.
- Use the left and right direction keys to move to each code position, and the up and down direction keys to select a number from 0 to 9.
- Once the number is selected, press the **ENTER** function key to save the code.
- After returning to the main screen, programming access will require the code to make any further programming changes.

To cancel the User Access Code:

- In the **PROG** screen, enter the current access code.
- Now program **0000** as the new access code.
- Press the **ENTER** function key to save the change.
- The code is now cancelled and programming is no longer restricted.



NOTE: If the access code has been misplaced, you will be unable to make changes to your Atmospheric Control Unit's settings. Contact customer service or your service representative for instructions on how to regain access to your ACU.

6.3 Referencing the CO₂ Sensor with AutoZero

Prior to using the Atmospheric Control Unit, you should manually perform a CO₂ AutoZero (see Section 7.3 for an explanation of this feature):

- Perform a CO₂ AutoZero by pressing the **USER** function key (see Figure 9), selecting the **PROGRAMMABLE CO₂ AUTOZERO**, and pressing the **START** key.
- Press **EXIT** to get back to the main screen. The unit will display a countdown as the AutoZero is running.
- When the countdown is complete, the unit is ready to use.



NOTE: It may be necessary to open the reagent compartment door momentarily if, after performing an AutoZero, the CO₂ level is too high.

6.4 USER Settings

In the **USER** screen (see Figure 4 below), you can adjust the features displayed on the screen.

- Use the ▲ & ▼ Direction Keys to move the cursor.
- Use the ENTER Function Key to select an option.



Figure 4: USER SETTINGS Screen

7 This section explains each of the USER SETTINGS screen features:

7.1 SET DATE AND TIME

The date and time is factory-set and will only require adjustment if you are in a different time zone, or when you change your clocks to Daylight Saving Time from Standard time. You may also select the style of display for the date.

A battery back-up system ensures that the correct time/date setting is never lost.



Figure 5: SET DATE AND TIME Screen

7.2 AUDIO VOLUME ADJUST

The audible volume can be adjusted to your own preferences.

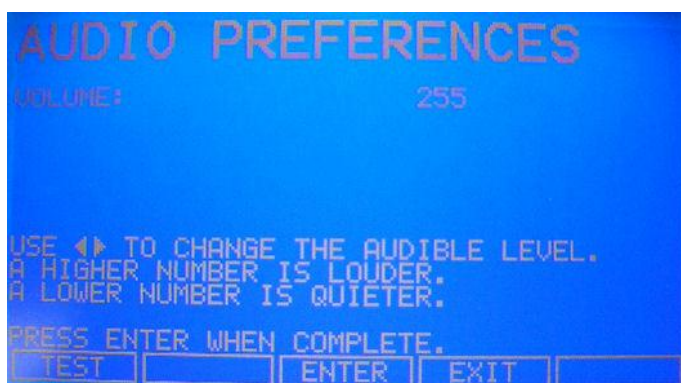


Figure 6: AUDIO PREFERENCES Screen

7.3 PROGRAMMABLE CO₂ AUTOZERO

When this feature is selected, the **PROGRAM CO₂ AUTOZERO** screen (see Figure 7 below) allows you to program the AutoZero frequency and time, or to run the AutoZero function manually.

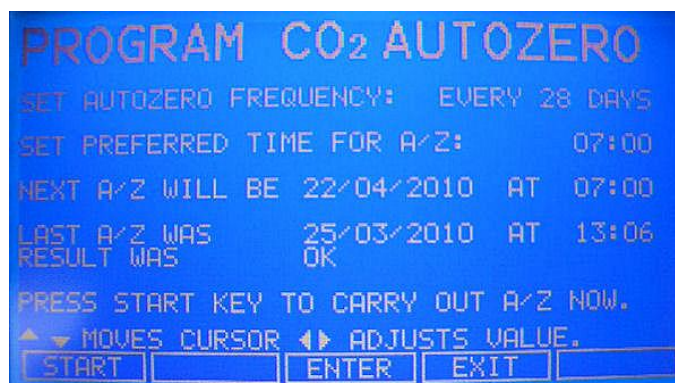


Figure 7: PROGRAM CO₂ AUTOZERO Screen

The AutoZero System automatically re-references the CO₂ Sensor to atmospheric CO₂ in the following way:

- A pump is activated for two minutes, pumping HEPA-filtered atmospheric gas into the sensor's measuring chamber at 0.3 L/min. This displaces the chamber atmosphere completely from the sensor.
- At the end of the countdown, the control system adjusts the AutoZero Factor to reference the sensor to 0.05% CO₂, which approximates atmospheric CO₂ levels.
- The pump will switch off and the reader's incubator atmosphere diffuses back into the sensor's measuring chamber. This takes three minutes, after which the normal CO₂ control system takes over.
- The result of the AutoZero (listed as **A/Z** on some screens) is sent to the **DATALOGGER ALARM EVENTS** screen so that a record of the results will be kept.
- The frequency of the AutoZero can be set to occur once a day or up to once every 28 days. It is recommended to set the default setting to **disable** to avoid an AutoZero during a plate measurement.
- The default time setting for AutoZero is 7:00 am. This can be altered to suit individual requirements.
- If the AutoZero function is to be run manually, simply press the **START** function key, within the **PROGRAM CO₂ AUTOZER** window.



NOTE: It may be necessary to open the reagent compartment door momentarily if, after performing an AutoZero, the CO₂ level is too high.

7.4 POWER FREQUENCY

You can adjust the power frequency to either 50 or 60 Hz to match the local electrical supply.



Figure 8: POWER FREQUENCY Screen

7.5 MANUAL DISABLE Turns Off Certain Features

This feature allows you to inform the control system to ignore certain sensors if their function is not required.

- **CO₂ PRESSURE SWITCH** (for Auto Zeroing)
- **OXYGEN CONTROL** (Disable if CO₂ Only is required)

To disable a feature, scroll to **OFF** using the ◀ & ▶ direction keys, then press the **ENTER** function key.

7.6 DATA LOGGER Screen

The function **CO₂ / O₂ level graph** shows a diagram with time axis and gas concentration level. The status of the reagent door is also monitored. With this function you are able to follow the gas concentration level of the past and to recognize time dependent events.

7.7 OXYGEN SENSOR-REF TO ATMOSPHERE

This feature allows users to manually reference the O₂ sensor to atmospheric O₂ content. See Section 10.4 for detailed description

7.8 CHAMBER ALARMS Menu Screen

The CHAMBER ALARMS screen (Figure 9) allows the various alarm options to be selected and modified.

Press the ▲ & ▼ direction keys to select the options and the ◀ & ▶ direction keys to adjust values. The CO₂ and O₂ High and Low Alarm setpoints automatically adjust to within ± 0.5 of the CO₂ and O₂ setpoints.

The alarm setpoints can also be manually adjusted.

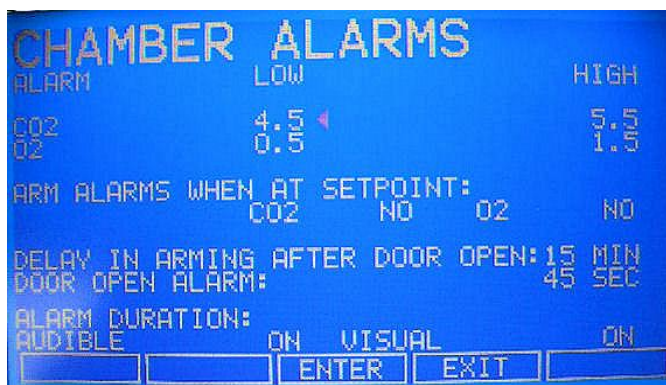


Figure 9: CHAMBER ALARMS Screen

To arm the CHAMBER ALARMS after a selectable delay:

- Choose the option ARM ALARMS WHEN AT SETPOINT:
 - Select NO for CO₂ (as shown in Figure 9 above)
 - Choose the option DELAY IN ARMING AFTER DOOR OPEN: and select the desired delay (15 minutes in the sample screen above) to allow for CO₂ recovery after the door has been opened.

The alarm system can also be set to re-arm only after the original O₂ and CO₂ setpoints have been achieved:

- Choose the option ARM ALARMS WHEN AT SETPOINT:
 - Select YES for both O₂ and CO₂.
 - When YES is selected for this function, the DELAY IN ARMING AFTER DOOR OPEN will be ignored.

A **DOOR OPEN ALARM**: can be adjusted, choosing from seven pre-set durations (45 seconds in *Figure 10*) to warn of an improperly closed door.

- The **AUDIBLE** and **VISUAL** alarms can be adjusted from **OFF** to **ON** (which means the alarm will be on continuously until it is acknowledged) in seven preset time increments.
- In the **OFF** position, any Chamber Alarms that occur will be displayed on the screen without flashing and with the audible alarm inhibited.



Figure 10: DOOR OPEN ALARM Message

8 ACU Alarm System Function

When the Atmospheric Control Unit is switched **ON**, and O₂ or CO₂ levels have been reprogrammed, the alarm system is inactive until the setpoint values (± 0.1) are achieved, after which the alarm system is armed.

If O₂ and/or CO₂ levels deviate more than the programmed limits, the display flashes, the audible alarm sounds and a message appears on the screen.

Acknowledge the alarm by pressing any key.



Figure 11: SYSTEM ALARM Message

After setpoints have been achieved for the first time, when the reagent door is opened, the alarm system is disabled. Upon closing the door, if selected, a **programmable alarm delay** starts:

- If the reader incubator chamber conditions recover within the programmed alarm delay time, the alarm system is immediately re-armed. After this delay, the alarm system is armed and if the O₂ and CO₂ are outside of the alarm high & low settings, the alarm will be activated.
- If an alarm occurs and the reader incubator chamber subsequently recovers, the alarm stops and the system will be re-armed.

If the CO₂ valve is opened and no pressure is detected, an alarm occurs and a warning message appears on the screen, alerting you to **CHECK CO₂ SUPPLY**:

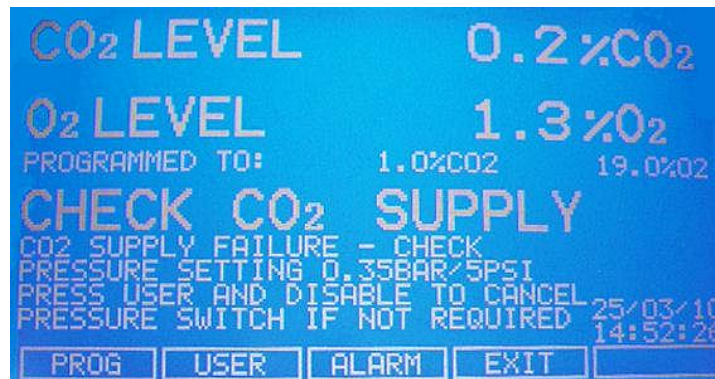


Figure 12: CHAMBER ALARM to Check CO₂ Supply

As shown in Figure 12 above, instructions are provided in the **ALARM** screen to deal with the situation that triggered the alarm.

9 DIAGNOSTIC Menu Screen

The diagnostics screen contains technical information regarding the status of many of the system components found on the Atmospheric Control Unit. This screen is mainly for technical service use, and can be used to troubleshoot the Atmospheric Control Unit systems before service is scheduled.

10 O₂ CONTROL

This oxygen control option is designed to cover the 1-19% range by introducing nitrogen into the reader to reduce the O₂ level below atmospheric O₂.

10.1 Setting-up Oxygen Control

Connect your nitrogen cylinder or laboratory supply set at 30psi (2 bar) to the 6mm ID PVC tubing assembly provided and connect it to the nitrogen inlet on the rear of the Atmospheric Control Unit (see Figure 1). Set the supplied inline nitrogen regulator to 10 psi (0.7 bar). The nitrogen will be fed into the Atmospheric Control Unit through a HEPA filter that is already installed in the gas line. The gas flow rate is approximately 15 L/min.



NOTE: If the programmed O₂ level is close to the atmospheric oxygen, it may be necessary to reduce the nitrogen cylinder pressure below 0.7 bar to stop the oxygen level from undershooting the programmed value.

10.2 Enabling Oxygen Control

To Enable the oxygen control: (a) press the **USER** function key (Figure 13), (b) select **MANUAL DISABLE** (see 14, below), (c) press the **ENTER** function key, (d) select **ENABLED** for Oxygen Control using the **▲** or **▼** direction key, then (e) press the **ENTER** function key.

Navigate back to the **PROG** screen to set the required Oxygen level.

The Alarm levels are automatically set to $\pm 0.5\%$ above or below the programmed value, but you can modify these limits in the **ALARM** screen (Figure 11). Re-arming the alarm can be delayed until the programmed value is achieved: select the relevant option in the **ALARM** screen.

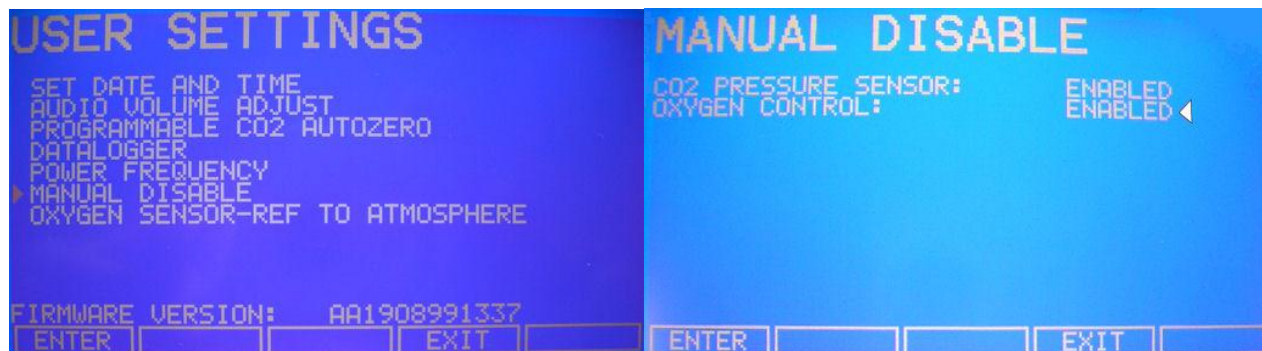


Figure 14: USER SETTINGS Screen

NOTE: At low oxygen levels, the CO₂ and O₂ levels may not have fully recovered within the Alarm limits after the 15-minute “Delay in arming after door opening”. This time period can be increased (in the **ALARM** screen, Figure 11) to suit individual circumstances.



By controlling the Duty Cycle of the N₂ valve, Oxygen Control can be tailored to achieve programmed Oxygen and Carbon Dioxide levels at approximately the same time.

10.3 OPERATING GUIDELINES

We recommend that you repeat the **OXYGEN SENSOR-REF TO ATMOSPHERE** procedure (see Section 10.4) once a month to ensure that any long-term drift in sensor output will be corrected. Be sure to do this at the incubator operating temperature.

10.4 Referencing to Atmosphere

The oxygen sensor is a self-powered electrochemical cell that has a finite life shortened by high oxygen levels and high temperatures. A typical lifespan is 1 to 2 years at atmospheric levels and 20°C. During the sensor’s lifespan, the signal produced will slowly degrade until it is ultimately unusable. For this reason, we recommend that you reference the sensor to atmospheric oxygen levels on a monthly basis.

This procedure is best carried out first thing in the morning after the gases have and ACU have been turned off overnight. Leave the gases turned off and switch on the ACU. Select the **USER** menu, then select **OXYGEN SENSOR-REF TO ATMOSPHERE** (see Figure 13) and follow the onscreen instructions to automatically calibrate the oxygen sensor to atmospheric oxygen levels. The oxygen reading is automatically adjusted to 19.7%, which is the true reading taking into account the relative humidity level

The **OXYGEN SENSOR-REF TO ATMOSPHERE** procedure has three possible outcomes. The first is that the procedure was completely successful, and no further action need be taken until the following month’s test. The second and third outcomes are presented in detail in Sections 10.5 (*Replace Sensor Soon*) and 10.6 (*Replace Sensor Now*).

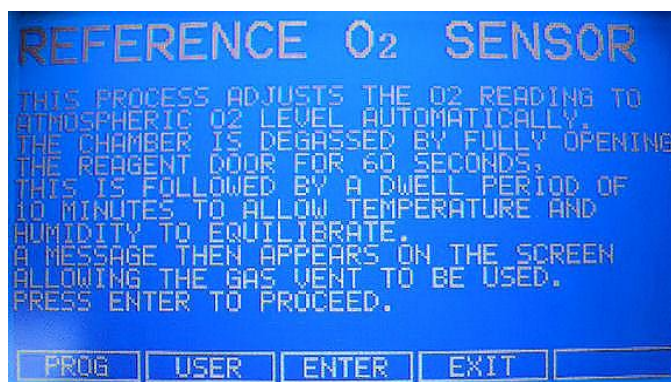


Figure 13: Selecting OXYGEN SENSOR-REF TO ATMOSPHERE

10.5 Replace Sensor Soon

If the referencing procedure was successful but the sensor is nearing the end of its working life, the following message will appear in the display:

O2 REFERENCE OK BUT SENSOR REQUIRES REPLACEMENT SHORTLY**PRESS ENTER TO PROCEED**

When you press the **ENTER** function key, the message will change to this:

O2 SENSOR**THE RESULT OF THE O2 REFERENCE PROCESS SHOWS THAT THE SIGNAL FROM THE O2 SENSOR HAS REDUCED INDICATING IT IS APPROACHING THE END OF ITS LIFE.****REPEAT THE REFERENCE PROCEDURE TO CONFIRM THIS RESULT.****PRESS ENTER TO PROCEED.**

Press the **ENTER** function key.

10.6 Replace Sensor Now

If the referencing procedure failed, Oxygen Control will be disabled but the Atmospheric Control Unit will function perfectly in all other ways until a new sensor is installed and corrected references to the atmosphere. The following message will appear in the display:

O2 REFERENCE FAILED**PRESS ENTER TO PROCEED**

When you press the **ENTER** function key, the message will change to this:

O2 SENSOR**THE RESULT OF THE O2 REFERENCE PROCESS SHOWS THAT THE SIGNAL FROM THE O2 SENSOR HAS REDUCED BELOW AN ACCEPTABLE LEVEL AND HAS REACHED THE END OF ITS LIFE.****REPEAT THE REFERENCE PROCEDURE TO CONFIRM THIS RESULT.****PRESS NEXT TO PROCEED.**

When you press the **NEXT** function key, the message will change to this:

O2 SENSOR**OXYGEN CONTROL HAS BEEN DISABLED AS A RESULT BUT THE ATMOSPHERIC CONTROL UNIT IS OTHERWISE FULLY OPERATIONAL.****PRESS PREV TO VIEW PREVIOUS SCREEN.****PRESS EXIT TO EXIT.**

When you press the **EXIT** function key, you will return to the **USER** screen and normal operation.



NOTE: The Oxygen sensor should only be replaced by BMG LABTECH qualified service personnel.

11 ROUTINE MAINTENANCE

11.1 General Notes

To ensure that reader incubator chamber conditions remain as stable as possible, be sure to minimise the length of time that the reagent door is open.

11.2 Oxygen Sensor Life

The accurate measurement of oxygen concentration in the microplate reader is in part provided by the electrochemical sensor. Electrochemical cells are active even when not in use and therefore have a limited natural life.

Their useful life expectancy is typically one to two years from the date of manufacture but the life can be shortened by a variety of environmental factors such as high humidity, high temperatures and continuous exposure to the target gas or any interfering gas.

To ensure the instrument is working to the highest standards the ACU has built in diagnostics to allow the user to confirm the status of the sensor. It is recommended that this should be performed on a monthly basis and will provide warning that replacement is imminent.

Note that the sensor must only be replaced by a BMG LABTECH service engineer.

11.3 Daily Checks

Check that the O₂ and CO₂ levels are reading within specification.

Check the reserve pressure in the CO₂ cylinder (normally 725psi or 50bar when full).

The design of the Atmospheric Control Unit ensures very low consumption of CO₂: during normal working conditions, a typical large cylinder should last approximately 12 months (frequent door openings will deplete the supply more rapidly). If there is a significant drop at the cylinder pressure of 725 psi or 50bar, it means that the cylinder is almost empty and should be replaced. Ensuring that there are no leaks at any of the connections will ensure a greater lifetime to the CO₂ supply and will help avoid accidentally running out of CO₂.

11.4 Monthly Check

If required, you can take a sample of the gas inside the chamber using the Sample Port, and check it using a CO₂/O₂ gas analyser.

The Sample Port is located at the back of the Atmospheric Control Unit housing (*see Figure 1*).

If you conduct a sampling, please ensure the following:

- Turn off the CO₂ gas by re-programming the setpoint for CO₂ to 0.0% to prevent CO₂ from being injected into the chamber and giving a false reading.
- Turn off the N₂ gas by re-programming the setpoint for O₂ to 19.0% to prevent N₂ from being injected into the chamber and giving a false reading.
- A flow rate ≤ 0.5 litres/minute is used to take a sample.
- The reagent and plate carrier doors are kept closed.
- Remember to reset the CO₂ and O₂ setpoints to the desired level after sampling.

We recommend that you perform a CO₂ AutoZero prior to sampling (*see Section 3.5*).

We also recommend that you AutoZero the CO₂ system at least once every month to ensure that CO₂ level is correct.

11.5 Annual Checks

- Visually inspect the condition of the gas tubing and regulators.
- It is recommended that the microplate reader has a preventative maintenance service.
- It is recommended that the O₂ sensor is replaced.
- It is recommended that the microplate reader and Atmospheric Control Unit should be tested by a qualified person at least every two years.

12 SERVICE

Fuse Replacement

- To replace a fuse, you will need an ordinary flat-bladed (5mm maximum) screwdriver.
- Disconnect the mains lead from the back of the A.C.U.
- Using the flat-bladed screwdriver, lever out the fuse holder (see Figure 15 for location).
- Remove the spent fuse or fuses.
- Install a new fuse or fuses, of the same type.
- Orientate the fuse holder back in the rear panel and push it fully home.



NOTE: With the exception of the external fuse all repair and replacement of parts within the O₂ Atmospheric Control Unit and microplate reader should be carried out by a qualified BMG LABTECH representative.



Figure 15: Fuse Replacement

13 CLEANING

- Routinely clean the exterior of the Atmospheric Control Unit by wiping it over with a soft cloth, moistened with soapy water.
- Rinse the soap from the cloth in clean water, and wipe the exterior surfaces again.

14 Frequently Asked Questions (FAQs)

Q: What readers can be adapted with ACU?

✦ **BMG LABTECH's Omega series of readers.**

Q: Are current Omegas upgradable?

✦ **Please contact your local BMG LABTECH representative for compatibility information.**

Q: What are the benefits of having independent control of both O₂ and CO₂, i.e. two different gas ports with separate sensors?

✦ **Using independently controlled gas supplies means users have true flexibility. They can work with different cellular organisms that require different conditions using the same gas supplies.**

✦ **Manual ramping can be achieved to simulate conditions such as ischemia and reperfusion without the need to change gas supply.**

✦ **Using individual gas supplies is more cost effective and efficient than using pre-mixed gases, on average costing 5-6 times less.**

Q: What type of gas regulator should be used?

✦ **A two-stage gas regulator on the CO₂ and N₂ tank is suggested for optimal control and safety.**

Q: What gas regulators are provided by BMG LABTECH?

✦ **There will be two secondary in-line regulators that go to 1.7 Bars, which should be used in combination with the recommended two stage cylinder regulator.**

Q: What type of gases should be used?

- ✦ CO₂ – should be in a liquid form and output must be vapor free. Since it is a liquid the psi will always be around 50 bar (725psi)
- ✦ Nitrogen – should have no O₂ with a purity of 99.9995% (rating of 3.5)

Q: How long after the ACU is turned on can it be used?

- ✦ The instrument and the ACU should be turned on at the same time, the ACU sensors will require approximately 10 minutes to equilibrate prior to use, approximately the same time as the incubator takes to equilibrate.

Q: How often should the O₂ sensor be referenced to atmospheric oxygen?

- ✦ It is recommended to perform this check once per month; full instruction is given in the supplied user manual.

Q: At what pressure should the BMG provided gas regulators be set?

- ✦ This information can be found in the ‘User Manual’

ACU Mode	CO ₂ pressure regulator setting	Nitrogen pressure regulator setting
CO ₂ and O ₂	10 psi or 0.7 bars.	10 psi or 0.7 bars.
CO ₂ Only	5 psi or 0.35 bars.	Nitrogen Gas Off
O ₂ Only	CO ₂ Gas Off	15 psi or 1.0 bar.

Q: What are the flow rates?

- ✦ Maximum flow rates are Nitrogen ~30-40 L/min; CO₂ ~315 mL/min. Once the set points have been reached the gases are pulsed and the gas consumption is minimized.

Q: How often should the HEPA filters be changed?

- ✦ Once every year.

Q: If an alarm goes off, what is the cause?

- ✦ There are three possible alarm conditions:
 - The instrument has deviated from the desired O₂ or CO₂ setpoint by more than 0.5% or a value set by the user.
 - The reagent door has been left open for more than 45 seconds (adjustable by user).
 - There is no CO₂ pressure (i.e. CO₂ cylinder is empty or valve is closed).

Q: What is the Diagnostics Screen used for?

- ✦ This screen contains technical information that can help BMG Support Engineers trouble shoot problems.

Q: How can I tell if the instrument (ACU) is working?

- ✦ The ‘Main Menu’ screen shows actual CO₂ & O₂ concentrations and alarm conditions. If the alarms are ‘armed’, the ACU is ready.

Q: What is the ‘Data logger’ screen for?

- ✦ The Data Logger screen (USER Settings) shows a log of CO₂ and O₂ levels along with door open and alarm indication. This is good for troubleshooting assays.

Q: How long does it take to reach the set points?

- ✦ The time taken to reach set points will vary depending on start point gas concentrations and the desired set points, for example starting from atmospheric conditions using the recommended gas pressure it would take approximately 30 minutes to achieve 5% CO₂ and/or 1% O₂ levels.

15 CE DECLARATION OF CONFORMITY

Declaration of Conformity

The Manufacturer of the Products covered by this Declaration is

BMG LABTECH Ltd.

5 Merlin Centre, Gatehouse Close,
Aylesbury, Bucks HP9 8DP



The Directives covered by this Declaration

2004/108/EC Electromagnetic Compatibility directive and its amending directives
2006/95/EC Low Voltage Equipment directive and its amending directives

The Products Covered by this Declaration

O₂-CO₂ Atmospheric Control Unit Accessory fitted to the FLUOstar/POLARstar Omega.

The Basis on which Conformity is being Declared

The manufacturer hereby declares under his sole responsibility that the products identified above comply with the protection requirements of the EMC directive and with the principal elements of the safety objectives of the Low Voltage Equipment directive, and that the following standards have been applied:

EN 61326-1 "Electrical equipment for measurement, control and laboratory use - EMC requirements – Part 1: General requirements"

EN 61010-1 "Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements"

EN 61010-2-081 "Particular requirements for electrical equipment for automatic and semi-automatic laboratory equipment for analysis and other purposes"

The technical documentation required to demonstrate that the products meet the requirements of the Low Voltage Equipment directive has been compiled and is available for inspection by the relevant enforcement authorities. The CE mark was first applied in 2010

Signed:

A handwritten signature in black ink, appearing to read 'Robert Mount', written over a dotted line.

Dr Robert Mount

Date: 21st May 2010

Authority: Managing Director

Attention!

The attention of the specifier, purchaser, installer, or user is drawn to special measures and limitations to use which must be observed when these products are taken into service to maintain compliance with the above directives.

Details of these special measures and limitations to use are available on request, and are also contained in the product manuals.

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