

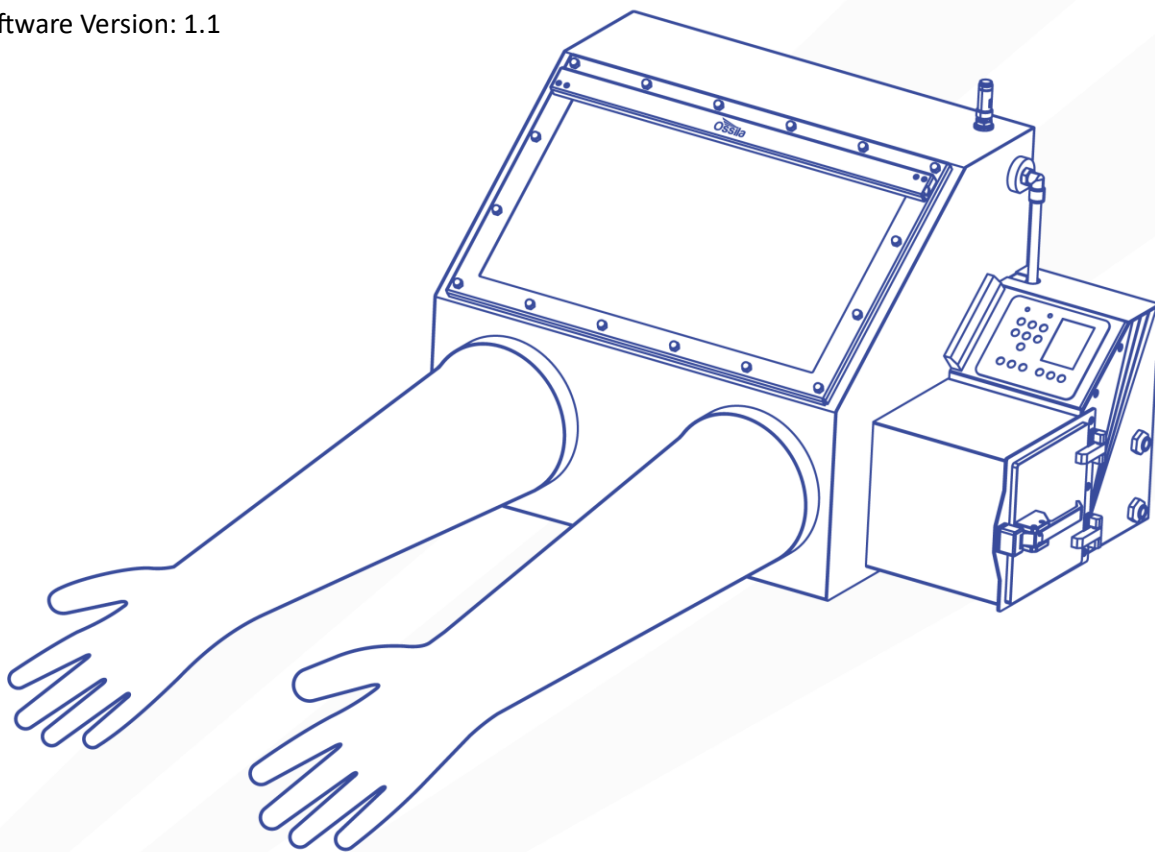
# GLOVE BOX USER MANUAL

Manual Version: 1.1.A

Product code: L2007A1

Product Version: 1.0

Software Version: 1.1



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# 1. Overview

Glove boxes are designed to produce and maintain an inert atmosphere for extended periods of time so that users can work with materials that would otherwise undergo reactions with water or oxygen. This is achieved by using an array of sensors that measure the content of the atmosphere within the system and purging fresh gas through when the pressure becomes too low, or the amount of unwanted gas exceeds thresholds set by the user. There is a wide array of applications that glove boxes are used for, both within research and development but also for production. Any situation where the material you are working with may be adversely affected by the presence of oxygen or moisture often requires the use of a glove box. The Ossila glove box is a single station glove box that provides an inert working atmosphere down to 0.5% oxygen and 0.1% relative humidity providing a high degree of protection against moisture and oxygen.

The Ossila Glove Box allows the user to specify the maximum oxygen content, maximum water content, and the range of acceptable over pressure that the system is at. This allows the glove box to automate the process of maintaining the atmosphere by purging fresh inert gas through the system. Equipped with high accuracy oxygen and humidity sensors the system can measure oxygen levels to as low as 0.5% and humidity levels as low as 0.1%. In addition, the system comes with quick purge functionality for quickly removing volatile solvents from the atmosphere; an antechamber transfer routine for simplifying the process of sample transfer in and out of the system; and leak rate testing for ensuring the system is as efficient as possible with gas usage.

Made from high quality low ingress materials such as stainless steel, hardened glass, butyl rubber, PTFE, and Viton. The glove box has extremely low moisture and oxygen ingress rates minimizing the amount of gas required to keep the system in an inert state. These materials also provide excellent chemical resistances while being robust enough for daily use. The glove box also has feed throughs allowing users to equip the systems with services such as power, data lines, and vacuum lines further increasing the functionality of the glove box.

## 2. EU Declaration of Conformity (DoC)

**We**

**Company Name:** Ossila BV

**Postal Address:** Biopartner 3 building, Galileiweg 8

**Postcode:** 2333 BD Leiden

**Country:** The Netherlands

**Telephone number:** +31 (0)71 3322992

**Email Address:** [info@ossila.com](mailto:info@ossila.com)

**declare that the DoC is issued under our sole responsibility and belongs to the following product:**

**Product:** Glove box (L2007A1)

**Serial number:** L2007A-xxxx

**Object of declaration:**

Glove box (L2007A1)

**The object of declaration described above is in conformity with the relevant Union harmonisation legislation:**

EMC Directive 2014/30/EU

RoHS Directive 2011/65/EU

**Signed:**



**Name:** Dr James Kingsley

**Place:** Leiden

**Date:** 16/11/2021

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## 3. Safety

### 3.1 Warning

- Only use the 24V power adapter and power cord supplied with the unit.
- Do not use non-inert gasses as an input gas, system is designed for nitrogen use only.
- Do not exceed the maximum input pressure of 4 bar, use a certified regulator valve to reduce pressure before connecting to the system.
- Do not use pressurized gas feedthroughs on KF flanges.
- Do not tamper with or obstruct the pressure relief valves.
- Output of the system should be piped into a vented fume hood or ventilation stack.
- Do not use in an enclosed space, minimum room volume of 30 m<sup>3</sup> recommended.
- Users should follow scheduled maintenance outlined in the user manual to ensure efficient and safe operation of the system.
- If using solvents and chemicals, users are expected to be trained in their usage and carry out a COSHH risk assessment. Frequent purges of the system should be done when using solvents to flush the system.

### 3.2 Use of Equipment

This Glove Box is designed to be used as instructed, it is intended to be used under the following conditions:






- Indoors in a laboratory environment (pollution degree 2)
- Altitudes up to 2000 m
- Temperatures of 5°C to 40°C; maximum relative humidity of 80% up to 31°C.

The Glove Box is supplied with a 24VDC power adapter with a power cord for the country of purchase, (in accordance with European Commission regulations and British Standards). The use of any other electrical power cables, adaptors, or transformers is not recommended.

### 3.3 Hazard Icons

The following symbols can be found at various points throughout this manual. Note and read each warning before attempting any associated operations associated with it:

Table 3.1 Hazard warning labels used in this manual.

Symbol	Associated Hazard
	General warning or caution, which accompanying text will explain
	Electrical shock
	Pinch point
	Risk of explosion
	Risk of asphyxiation

## 3.4 General Hazards

Before installing or operating the Glove Box, there are several health and safety precautions which must be followed and executed to ensure safe installation and operation.

**WARNING:** Improper handling when operating or servicing this equipment can result in serious injury or death. Read this manual before operating or servicing this equipment.

## 3.5 Power Cord Safety



- I. Emergency power disconnect options: Use the power cord as a disconnecting method and remove it from the power source. To facilitate disconnect, make sure the power outlet for this cord is readily accessible to the operator.

## 3.6 Servicing

Regular maintenance of the unit is recommended. For any servicing beyond that listed in the maintenance section (Section 9) please return the unit to Ossila Ltd. The warranty will be invalidated if:

- Modification or service has taken place by anyone other than an Ossila engineer.



- The Unit has been subjected to chemical damage through improper use.
- The Unit has been operated outside the usage parameters stated in the user documentation associated with the Unit.
- The Unit has been rendered inoperable through accident, misuse, contamination, improper maintenance, modification, or other external causes.

## 3.7 Health and Safety – Installation



- I. Heavy object. To avoid muscle strain or back injury either use lifting aids or multiple people to move the glove box to the location of installation.



- II. Pinch point. When moving the equipment be careful to avoid pinching hazards when lowering. Make sure all fingers and hands are clear of the object before releasing.



- III. Risk of explosion. Absolute maximum input pressure of 4 bar. When installing the system, the use of a certified pressure regulation valve is required.



- IV. Risk of explosion. Connect only inert gas to the glove box, the use of other gasses may present a risk of fire or explosion. The system is designed for nitrogen use only.



- V. Risk of asphyxiation. Improper installation of system may result in the formation of an asphyxiant atmosphere. Ensure input is at correct pressure and that connections are leak free. Output should be piped into a vented fume hood or a ventilation stack. Minimum room size of 30 m<sup>3</sup> with a minimum of 4 air changes per hour is recommended.

## 3.8 Health and Safety – Servicing



- I. Servicing beyond the replacement of standard components listed in the servicing section should only be performed by an Ossila engineer. Any modification or alteration may damage the equipment, cause injury, or death. It will also void your equipment's warranty.

## 4. Unpacking

### 4.1 Packing List

The items included with the Glove Box are:

- Glove Box assembly
  - I. Glove box
  - II. 2 x Window gaskets
  - III. 1 x 6mm glass panel
  - IV. 1 x window frame and LED
- Accessories Box
  - I. 1 x Pack of domed nuts and spring washers
  - II. 2 x Butyl rubber gloves
  - III. 2 x O-rings
  - IV. 1 x Pressure relief valve
  - V. 2 x KF flange blanking packs
  - VI. 2 x Sensor boards
  - VII. Power cord set (specific for country of operation)

### 4.2 Damage Inspection

Examine the components for any evidence of shipping damage. If damage has occurred, please contact Ossila directly for further action.

## 5. Specifications

The Glove Box specifications are shown in Table 5.1, Table 5.2, and Table 5.3.

Table 5.1. Glove Box Specifications

Glove Box	Specifications
External Dimensions	550 mm x 750 mm x 600 mm (D x W x H)
Internal Dimensions	450 mm x 600 mm x 500 mm (D x W x H)
Antechamber Internal Dimensions	150 mm x 150 mm x 150 mm (D x W x H)
Box and Antechamber Material	2 mm, Grade 304 Stainless Steel, 2B Surface Finish
Window Material	6 mm, Hardened Glass
Gloves	2 x Butyl Rubber Gloves, 10 Inch Diameter
Feedthroughs	2 x DN 40 ISO-KF Blanked Feedthroughs
Gas Inlet/Exhaust	12 mm Push-Fit Connector (PTFE Recommended)
Maximum Input Pressure	2 bar
Working Overpressure Range	0 mbar to 5 mbar
Purge Overpressure Range	10 mbar to 15 mbar
Leak Rate	< 0.25% Vol/hour (ISO Class II)
Lighting	9 W White Light LED
Power Supply	Input: 100 V – 230 V; 50 Hz / 60 Hz; 50 VA Output: 24 V DC, 2.0 A
Weight	35 kg

Table 5.2. Glove Box Sensor Board Specifications

Software Feature	Specifications
Oxygen Sensor Range	0.5 % to 25 %
Oxygen Sensor Precision	0.01 %
Moisture Sensor Range	5°C to 40°C; Up to 80% RH @ 31°C
Moisture Sensor Precision	0.1 % Relative Humidity (15 PPM)
Pressure Sensor Range	300 mbar to 1200 mbar
Pressure Sensor Precision	0.005 mbar
Temperature Sensor Range	40 °C to 120°C
Temperature Sensor Precision	0.1 °C

Table 5.3. Glove Box Software Specifications

Main Chamber Purge Settings	
Oxygen Set Point	Oxygen value above which purging is triggered
Moisture Set Point	Moisture value above which purging is triggered
Pressure Set Point	Pressure value that the system will target when inflating or deflating
Minimum Overpressure	Minimum overpressure before input opened
Maximum Overpressure	Maximum overpressure before exhaust opened
Purge Duration	Time period for each quick purge cycle
Purge Cycles	Number of purge cycles when performing quick purge
Antechamber Purge Settings	
Moisture Set Point	Moisture value above which purging is triggered
Oxygen Set Point	Oxygen value above which purging is triggered
System Settings	
Automate Purge Time	Set an automate quick purge to occur once per day
ECO Mode	Enable system timeout to dim display and turn off lights when system not in use
Auto Lights	Turn the lights off at a specified time
Leak Test	Performs a leak test on the system
Alarm	Sounds when values are outside of set range for an extended period
Alarm Mute	Temporary mute the alarm for 300 s

## 6. System Components

The Glove Box comes with the following components:

- Glove box unit
- Glove box accessories box

## 7. Installation

The process for installing the glove box is as follows:

1. Locate a suitable position to install the glove box.
2. Unpack the system.
3. Install the window and seals.
4. Install the gloves.
5. Install the KF Flanges.
6. Install the pressure relief valve.
7. Connect the gas inlet and vent line.
8. Install the sensor boards.
9. Turn the system on
10. Wait for system to load in pressure offset values for system.
11. Set the current time and date.
12. Perform initial leak test.
13. Set oxygen and humidity thresholds.
14. Wait for system to reach desired conditions.

### 7.1 Placement of the Glove Box

1. Remove all the contents from inside the glove box.
2. With the help of one or more additional people lift the glove box and place it on a level surface.

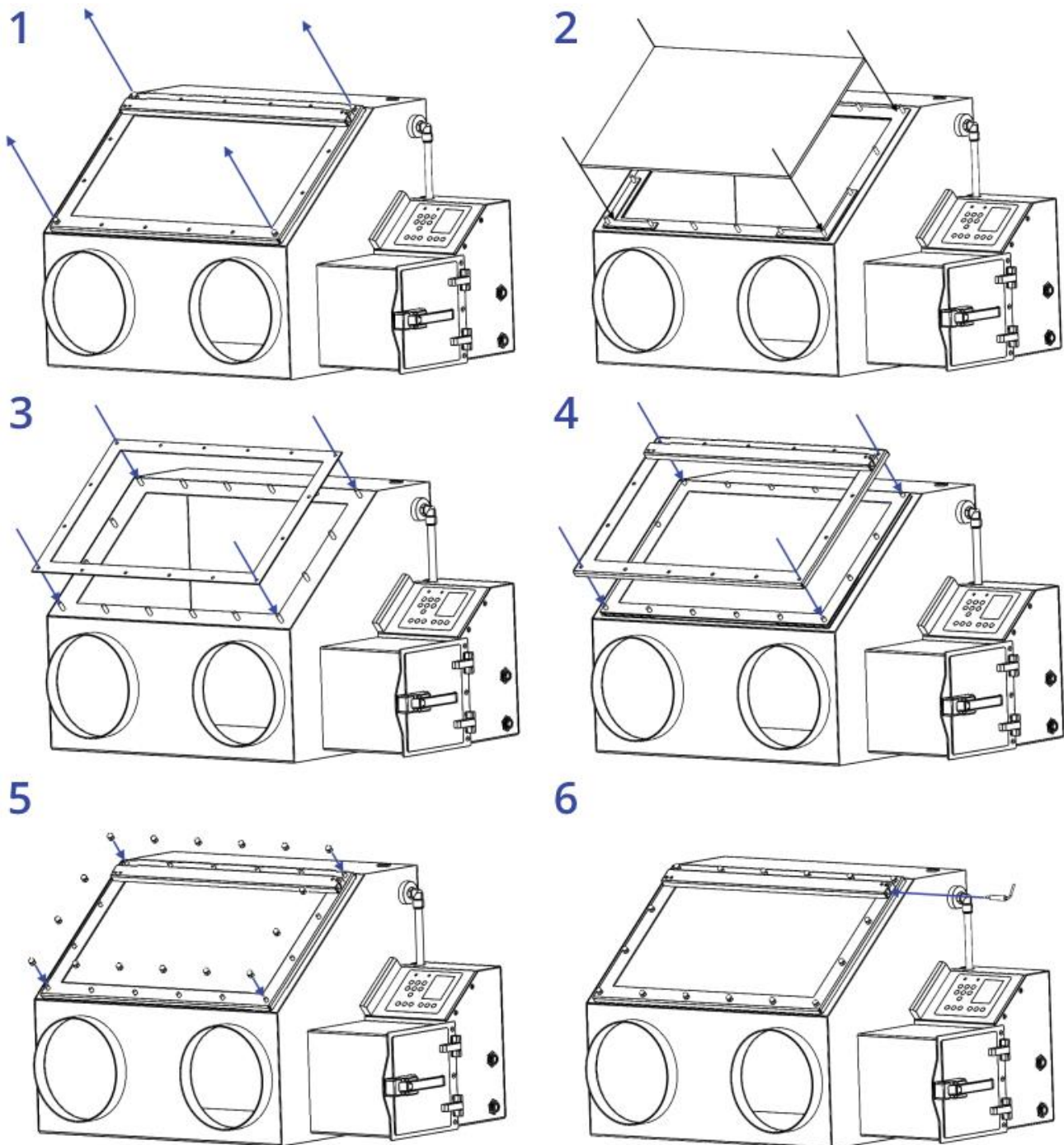
## 7.2 Window Installation

Inside the Ossila box there should be a rubber gasket, and a bag of 12 M6 domed nuts. Underneath the Ossila box wrapped in bubble wrap is a 6 mm thick glass panel. Following the instructions below and the Figure 7.1 install the window.

1. Unscrew the four domed nuts on the corners of the metal frame attached to the front of the box. Remove the frame and the top gasket.
2. Place the window on top of the bottom gasket using the L spacers provided to align it.
3. Taking the second gasket place it around the window opening of the glove box making sure to put the standoffs through the designated holes in the gasket.
4. Place the metal frame on top and ensure all the standoffs go through the frame.
5. Using the domed nuts and spring washers fasten each by hand until every nut is tightened. Using a wrench tighten each nut a little bit at a time. Ensuring the frame provides an even pressure on the glass panel. Once the metal frame is in contact with the metal box do not tighten any more, doing so may damage the box.
6. Take the power cord coming from the electronics case and plug it into the light strip.

The window installation is now complete.

Figure 7.1 Installation steps for the window of the glove box.



## 7.3 Glove Port Assembly

Inside the box there should be a pair of butyl gloves, and 4 O-rings. Following the instructions below and Figure 7.2 install the gloves.

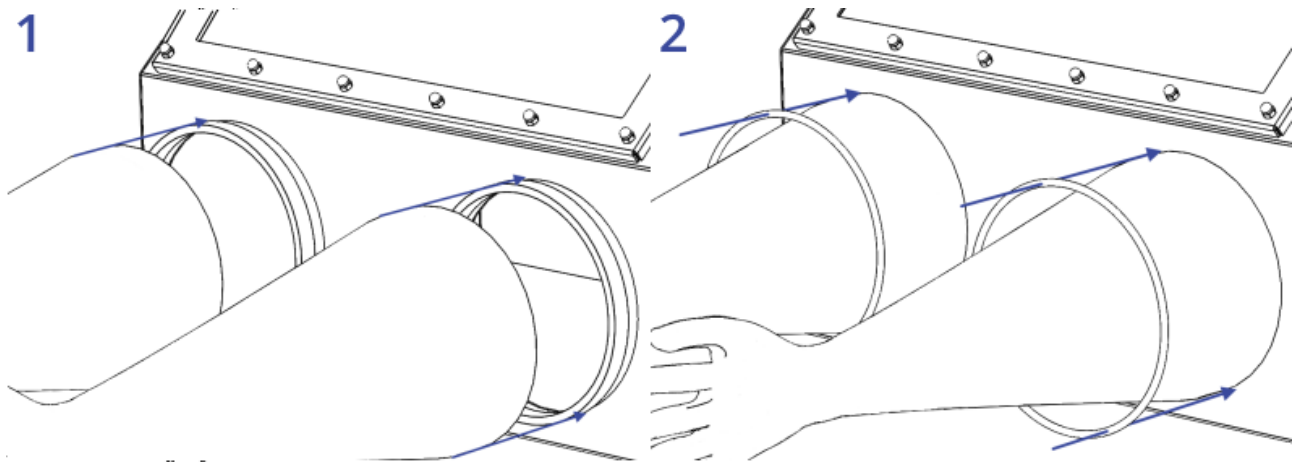
1. Place the gloves onto the glove ports ensuring they are a



2. Place two O-rings over the top of the gloves

The glove installation is now complete.

Figure 7.2 Installation steps for gloves of the glove box.



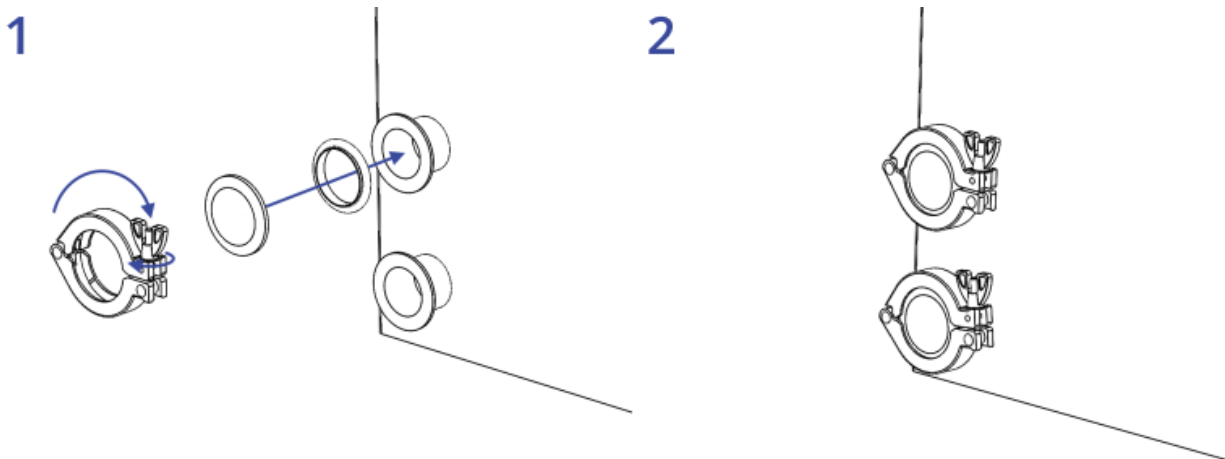
## 7.4 KF Flange Assembly

Taking the bags containing the KF flanges unpack the contents, there should be 2 centring rings, 2 blanking flanges, and 2 hinge clamps. Following the instructions below and Figure 7.3 install the KF flanges.

1. Sit the centring ring onto the flange nipple.
2. Place the blanking plate over the centring ring.
3. Close the hinge clamp around the flange, spacer, and blanking plate. Tighten the nut until a tight seal is formed between the O-ring and the surfaces.
4. Repeat for the second flange.

The flange installation is now complete.

Figure 7.3 Installation steps for the KF flange assembly.



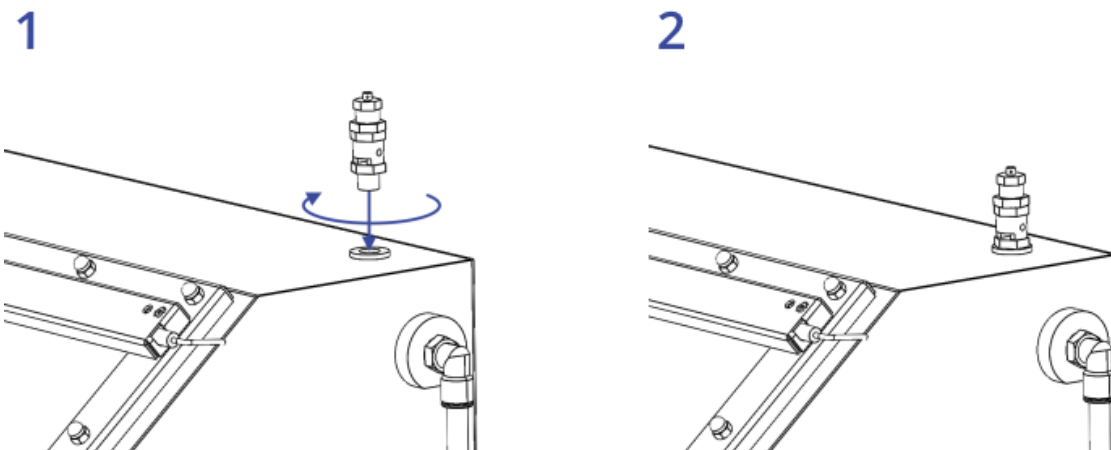
## 7.5 Pressure Relief Valve Assembly

Taking the bag containing the pressure relief valve and unpack the contents. There should be a single pressure relief valve and a Dowty washer. Following the instructions below and Figure 7.4 install the pressure relief valve:

1. Ensure that the washer supplied is seated on the threaded end of the pressure relief valve and insert it into the threaded hole on the top of the unit.
2. Tighten the pressure relief valve using a wrench, use the bottom nut for tightening the relief valve.

The pressure relief valve is now installed.

Figure 7.4 Installation steps for the pressure relief valve.



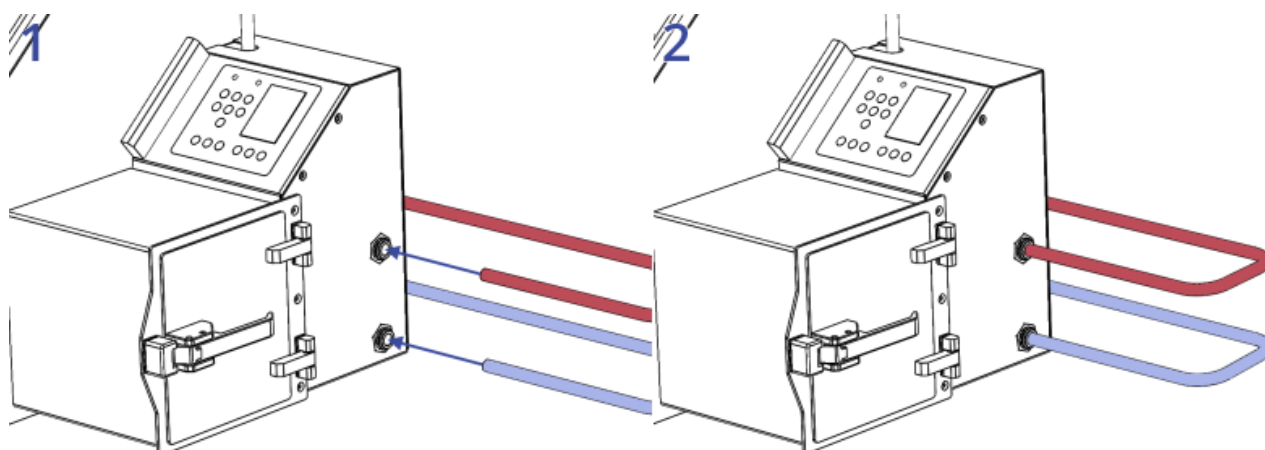
## 7.6 Gas Inlet and Outlet Installation

On the side of the right side of the unit there are two bulk-head feedthroughs into the electronics case. These are for the gas input and the output of the system. To correctly install the system, you will need 12 mm piping, ideally this should be rated for handling gasses at high pressures and have low rates of moisture and oxygen ingress. We recommended either a metal pipe or a PTFE pipe for this, use of other pipes may result in ingress of moisture into the feed line over time compromising performance of the glove box. Following the instructions below and Figure 7.5 install the gas and outlet pipes:

1. Using a 12 mm diameter pipe connect the input to the upper bulkhead feedthrough, the input should be down regulated to less than 2 bar before entering the system for optimal operation.
2. Depending upon the length of piping required for the exhaust you may need to use the adapters provided to connect to a wider diameter hose. For exhaust lengths of 1m or lower we recommend a 12mm diameter pipe, for 1 m to 3 m a 16 mm diameter pipe, while for distances of 3 m or more we recommend a 25 mm diameter pipe.
3. Using the appropriate connector and diameter pipe connect the output to the lower bulkhead feedthrough. The output should be piped into a vented fume hood or directly into a ventilation stack.

The gas inlet and outlet are now installed.

Figure 7.5 Installation steps for the gas inlet (red) and outlet (blue).



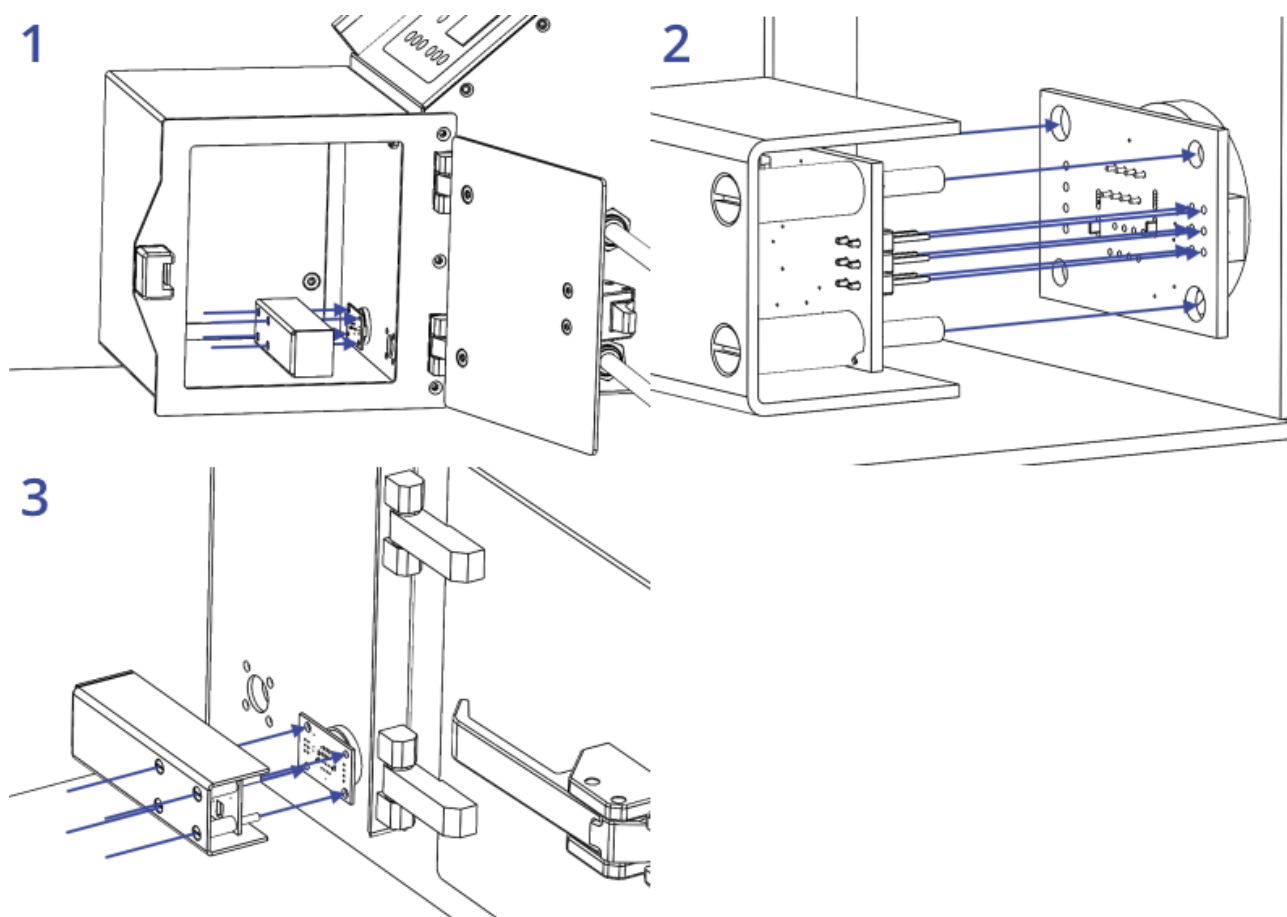
## 7.7 Sensor Board Assembly

On the inside of the antechamber on the back wall and in the main chamber at the bottom right there should be two feedthroughs with printed circuit boards attached. These are for connecting the sensor boards to. Taking the bag labelled sensor boards unpack the contents. There should be two sensor board assemblies. Following the instructions below and in Figure 7.6 install the sensor boards:

1. Opening the antechamber push the sensor board into the connection board.
2. The sensor board has four alignment legs which will fit into the holes in the corners of the connection board. Using these legs as guides ensure that the six pins highlighted slot into the header on the connector board.
3. Inside the main chamber push the second sensor board into the connection board. Just like in the antechamber the alignment legs can be used to help guide the board into place.

The sensor boards should now be installed.

Figure 7.6 Installation steps for the internal sensor boards.



## 7.8 Powering on the System

An AC/DC power adapter will be provided with the unit alongside a power cord that is appropriate for the country being shipped to. Once the previous assembly steps have been taken the power adapter can be plugged into the wall socket and then into the DC power jack at the rear of the system (see Figure 7.7). The power switch should then be turned from 0 to 1 on the back to turn on the unit.

## 7.9 Initial Leak Tests

When the system powers up the user must enter the time and date values. After this is complete it will go to the glove box status page. When a system is first installed it is advised to perform a leak test to ensure that the system is performing to acceptable levels and that there are no leaks that could cause excessive gas usage. Upon starting the leak test the overpressure will increase to a set level. The overpressure is monitored over a set period to see how much the value drops by. If during this testing the pressure drops below 0.25% there is likely a leak within the system and testing for the source of the leak should begin immediately. Otherwise, the user should wait for the results of the test to be complete.

Over the testing period the ideal range of pressure drop for the system is between 0.25% per hour and 0.05% per hour) if the pressure drop is in this region, then the leak test is successful, and the system is holding pressure. In the range of (0.25% per hour and 0.05% per hour) there is a minor leak present that should be addressed. If the pressure change is greater than 0.25% this indicates that there are several minor leaks or a major leak. To help find leaks within the system a leak detector fluid should be used, alternatively a combination of water and a surfactant (such as dishwashing soap) can be used.

Spraying small amounts of leak detector fluid near gaskets and O-rings check to see if there is any bubbling of the fluid that could indicate a leak. If bubbling occurs, try applying more pressure to the seal by tightening any screws or nuts. If this does not help, remove the seal, and clean the area taking care to ensure no debris falls onto the seal such as hairs or fibres. Repeat until no more bubbles are showing.

Once all seals are checked and no more bubbling is visible repeat the leak test and ensure that it is within the ideal range.

## 7.10 Threshold Settings and System Purge

Once the system has reached the desired range of leak rate the set point values for oxygen, humidity, and over pressure should be set. To begin with open the menu and navigate to the pressure parameters page within the main menu and set the over pressure parameters. We recommend setting the lower limit at 0 mbar, the upper limit at 5 mbar. These will be the minimum and maximum values the system will allow the pressure to get. The lower hysteresis limit we

recommend to set to 1mbar and the upper to 2 mbar. This should give a good balance between the working pressures, the frequency of gas inlet and the amount of gas lost when moving hands into and out of the glove box.

Once the pressure parameters have been set press the settings button, here set the oxygen and moisture set points along with the target pressure. These should be set based upon what you want to use the system for and the maximum allowed oxygen and moisture that you can allow, it should be noted that the lower the set point values are the more frequent the system will purge and the higher the gas usage will be. We would recommend a set pressure of 2 mbar. Along with the hysteresis limits set earlier this would let the system operate between 1 mbar and 4 mbar without purging or venting. When these have been set press the purge button and the system will begin to purge.

Once the system begins to purge it will continue to do this till the target oxygen and moisture values are reached, the pressure in the chamber at this point will be too high for a user to begin working in the system. The glove box should therefore be left alone until the purging has finished, the time required to go from a system at atmosphere to the lowest set point possible is around 20 minutes and should use up around 0.5 m<sup>3</sup> of gas. Once the glove box has finished purging the pressure should drop to within the working pressure range used within the settings.

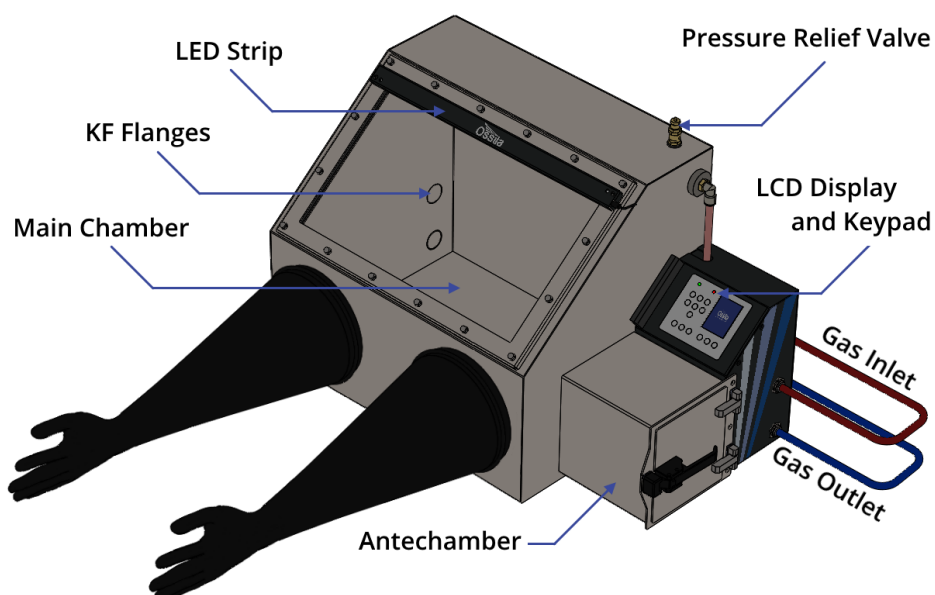
Upon first starting the system it is likely there will be outgassing of moisture over time, this will see the moisture levels increase quickly and the glove box will undergo frequent short purges to get it below the set threshold again. This can take a few hours till the system is fully settled and the system is fully outgassed.

## 8. Operating the Glove Box

### 8.1 Glove Box Diagram

An isometric view of the glove box is shown in Figure 8.1, with all the relevant components highlighted.

Figure 8.1. Glove Box schematic.



# 8.2 Glove Box User Interface

Figure 8.2 shows the front panel of the glove box, where the function of each of the keypad buttons is explained in Table 8.1.

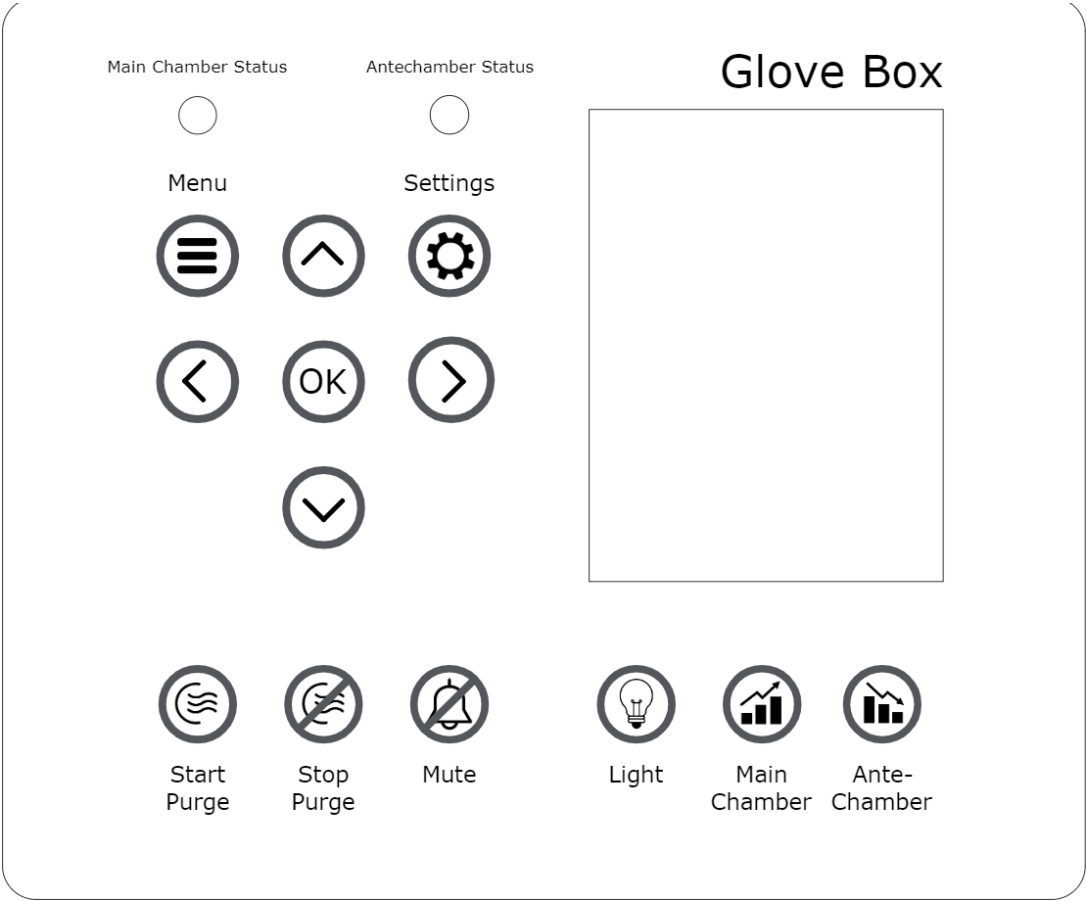















Figure 8.2. Glove Box LCD screen and keypad



Table 8.1. Operational buttons and their associated functions.

Button	Function
	Navigating 'up' through menus; increasing selected values by 1; cycling through options
	Navigating 'down' through menus; decreasing selected values by 1; cycling through options
	Navigating 'right' through menus
	Navigating 'left' through menus
	Press to select, edit, or accept changes
	Toggle the lights on and off
	Temporarily mute the alarm for 30 seconds
	Quick purge; purges the system for a short period of time
	Stop purge; stops the quick purge of the system
	Enters the main menu. Allows the navigation to diagnostic tests, settings, system information, and other options
	Enters the configuration menu. Here set point values can be set for the oxygen content, water content, and maximum and minimum operating pressures
	Enters the main chamber statistics screen. Shows information such as pressure, temperature, oxygen content, and water content in the main chamber
	Enters the antechamber statistics screen. Shows information such as pressure, temperature, oxygen content, and water content in the antechamber

## 8.3 Practical Operation

When using the glove box there are several things that should be taken into consideration to ensure that the atmosphere inside the glove box remains inert, and that excessive gas consumption does not occur.

### 8.3.1 Sample Transfer Protocol

The most likely time when the glove box chamber can be exposed to atmosphere is when moving samples in and out of the glove box through the antechamber. The internal door between the main chamber and antechamber should only be opened when the antechamber itself is filled with inert gas. To ensure that this happens it is useful to follow a standard process when opening the internal door. With the Ossila glove box the process becomes easier as there are sensors available to measure the condition of the air inside the chamber.

We recommend following the procedure outline below when moving samples into the glove box:

- Check that the internal door between the main chamber and antechamber is closed.
- Check that the antechamber is currently not purging.
- Open the outside door and place samples into the chamber.
- Close the outside door.
- Navigate to the antechamber display and set the desired oxygen and moisture target values.
- Press purge, the chamber will perform cycles of long purges and short rests.
- The system will produce a short beeping noise once the desired set points are reached.
- If after 5 minutes the system has not reached the set points the purging will end. You can either restart the purge process or check to see if a material is significantly outgassing.
- If the cycle is successful open the internal door and remove the samples.
- Close the internal door.

We recommend following the procedure outlined below when taking samples out of the glove box:

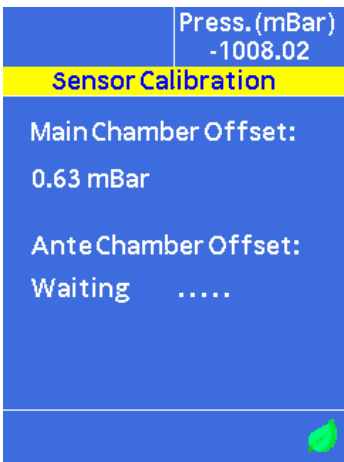
- Check that the external door of the antechamber is closed.
- Using the antechamber purge process outlined previously.
- Wait until the software says it is OK to continue.
- Open the internal door and place the samples into the chamber.
- Close the internal door.
- Open the external door and remove the samples.
- Close the external door.

# 8.4 Software Operation

## 8.4.1 Glove Box Start Up

- 1. Switch ON (position '1') the Ossila Glove Box power switch. The Ossila splash screen will be displayed for a few seconds before transitioning to the next screen.
- 2. On start up the system will check for sensor offset calibrations and load them if they are already set.

Figure 8.1. Glove Box Sensor Calibration Page



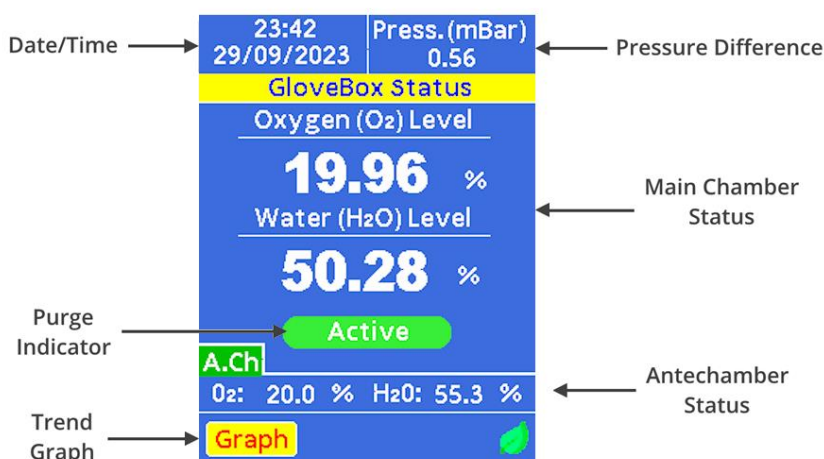
- 3. After the calibration values are loaded the system will require the user to input the date / time information along with the desired system set points.

Figure 8.2. Glove Box Date Time Setting



## 8.4.2 Glove Box Status Page

Figure 8.3. Glove Box Main Chamber Page



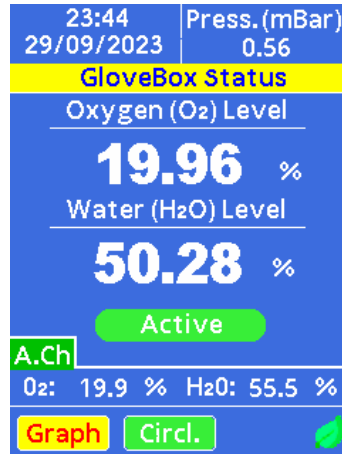
The main chamber status page can be accessed by pressing the main chambers page button, on this screen the following information can be seen:

- The date and time.
- The pressure difference.
- The current moisture and humidity levels in the chamber.
- The humidity and oxygen levels in the antechamber.

The page has an indicator to highlight if the main chamber is currently actively purging, this will toggle between a red 'inactive' indicator to a green 'active' one if purging is occurring. There is also the option to view the oxygen, humidity, and pressure values over time within the trend graph window. To access this trend graph, use the navigation keys to select the graph button and press OK. While this page is selected activating the purge button on the keypad will begin a purge of the main chamber bringing it down to the set values indicated.

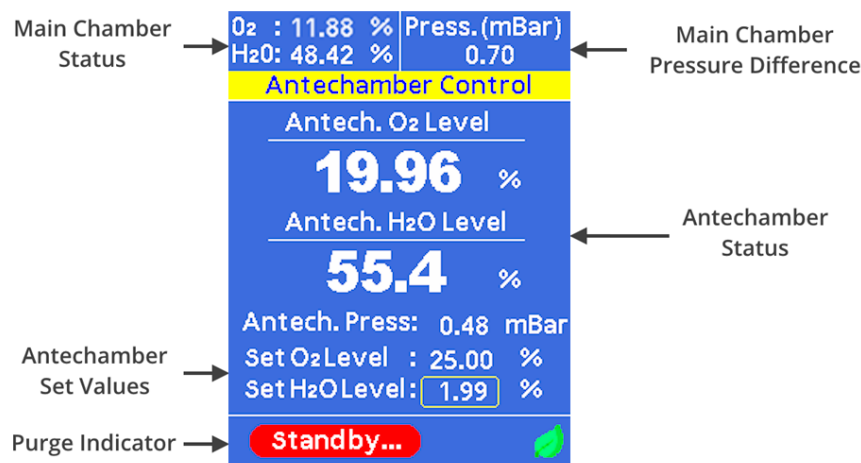
While the main chamber is currently 'active' the user has the option to enable a quick purge of the system to circulate fresh nitrogen, this will perform a series of short purge cycles. This is for when users have been actively using solvents and chemicals within the glove box and wish to rapidly remove any vapours present within the system. To do this, users can press the purge button from the main chamber page.

Figure 8.4. Circulation On



### 8.4.3 Antechamber Status Page

Figure 8.5 Glove Box Antechamber Status Page



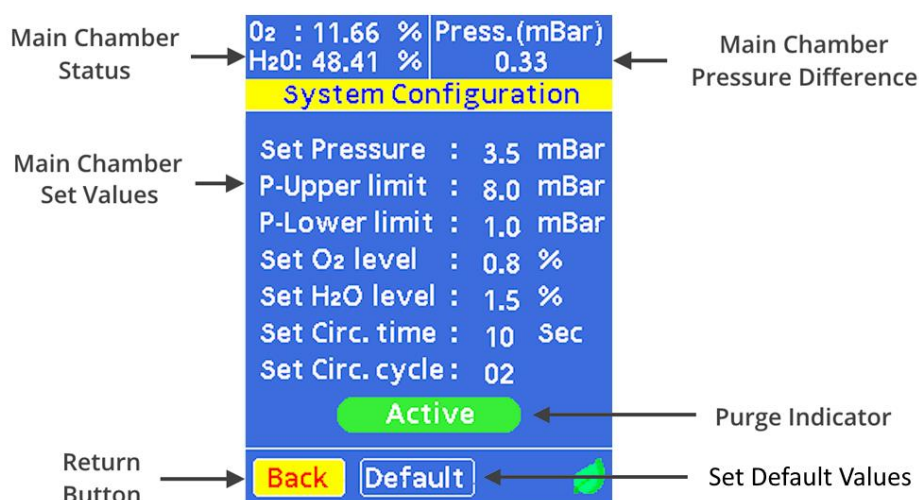
The antechamber status page can be accessed by pressing the antechamber status page button, on this screen the following information can be seen:

- Main Chamber Status
- Main Chamber Pressure Difference
- Antechamber Status
- Antechamber Set Values

In addition, the page has an indicator to highlight if the antechamber is currently actively purging. This will toggle between an inactive red 'purge' indicator and an active green 'purge' indicator. While this page is selected activating the purge button on the keypad will begin a purge of the antechamber bringing it down to the set values indicated.

## 8.4.4 Settings Page

Figure 8.6 Glove Box Settings Page



The configuration page allows the user to quickly set control points for the overpressure, oxygen levels, and humidity levels. It can be accessed by pressing the configuration page button or via the menu, on this screen the following information can be seen:

- Main Chamber Status
- Main Chamber Pressure Limits
- Main Chamber Set Values
- Main Chamber Circulation Settings

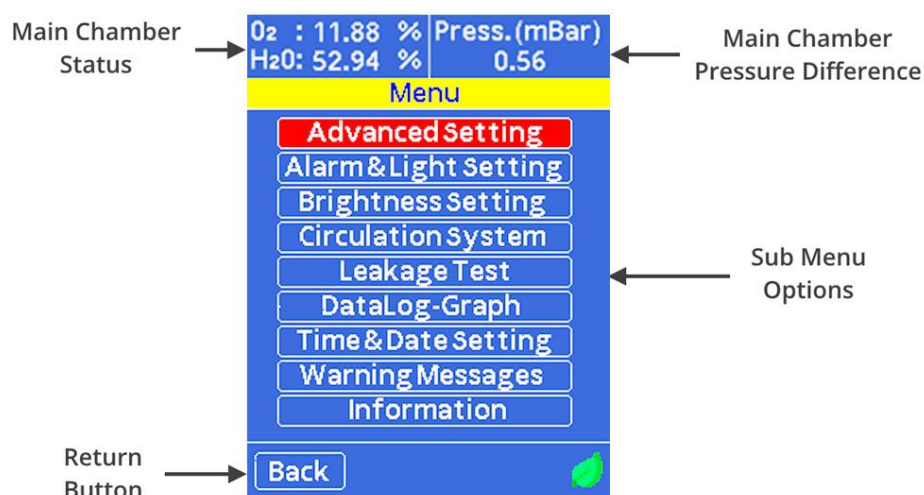
To modify the set values, use the navigation arrows to highlight (in yellow) the value you wish to edit. By pressing OK this will allow you to edit the value, you can use the left and right buttons to move what significant digit you wish to change and the up and down arrows to increase or decrease this value. To confirm the changes to the value, press OK.

In addition, the page has an indicator to highlight if the chamber is currently actively purging. This will toggle between an inactive red 'inactive' indicator and an active green 'active' indicator. There is also a back button that will allow you to navigate back to the menu page. While this page is selected activating the purge button on the keypad will begin a purge of the main chamber bringing it down to the set values indicated.

Users can return to the default values by highlighting 'Default' and pressing 'OK'.

## 8.4.5 Menu Page

Figure 8.7 Glove Box Menu Page



The menu page allows the user to navigate to a series of different options available within the software. It can be accessed by pressing the menu button. On this screen the following information can be seen:

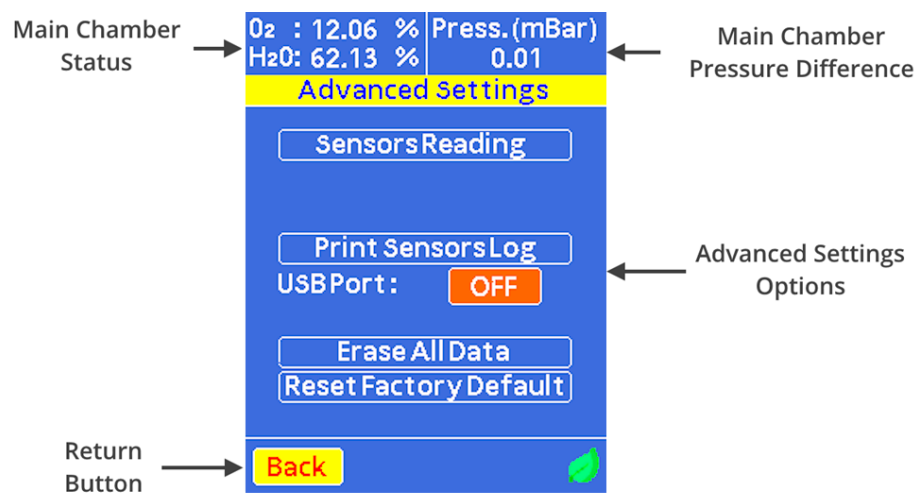
- Main Chamber Status
- Main Chamber Pressure Difference
- Sub Menu Options

The options for the sub menu contain the following functionality:

- Advanced Settings: All sensor data, sensor analysis, print sensor data, USB settings, clear stored data, and restore factory default settings.
- Alarm and Light Settings: Turn on/off the alarm, set box light to auto or manual.
- Brightness Settings: Change screen brightness.
- Circulation System: Set a short purge of system for a specific time.
- Leakage Test: Set leakage test settings and start leakage test.
- Data Log-Graph: Look at chamber status over time and navigate through log data.
- Time and Date Settings: Update time and date of the system.
- Warning Messages: Log of previous warning messages and time they occurred.
- Information: Manufacturer's information

### 8.4.6 Sub Menu Pages

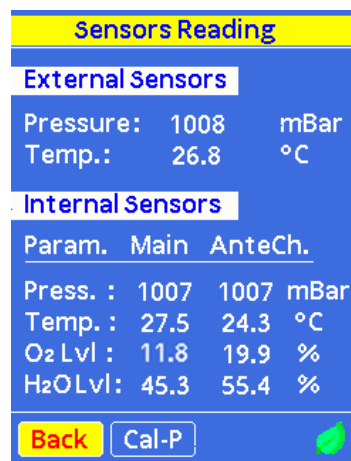
Figure 8.8 Advanced Settings Page



The advanced settings page gives users access to additional information and options.

- All Sensors: Provides raw data reading from all sensors including internal/external pressure, temperature, oxygen, and humidity.
- Print Sensor Logs: Prints sensor data to USB as a string of comma delimited data.
- USB Setting: Update settings of USB for printing a continuous stream of sensor data.
- Erase All Data: Erases currently logged sensor data that is stored on the system.
- Reset Factory Defaults: Resets software settings to the original factory default values.

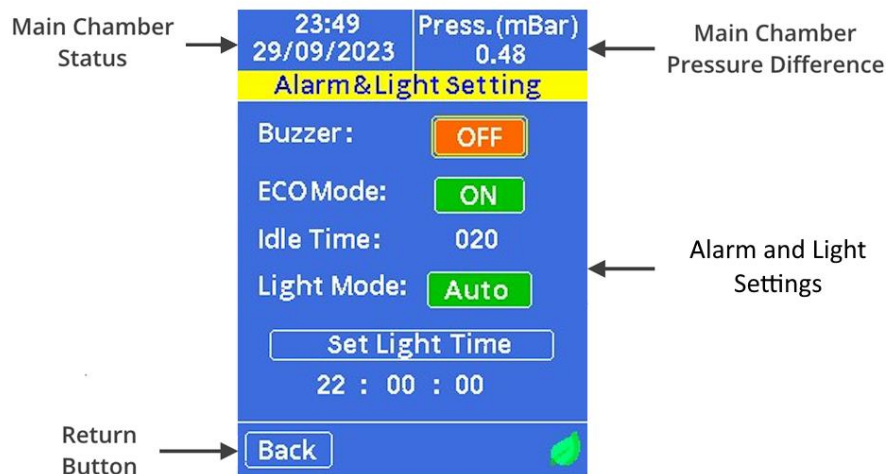
Figure 8.9 All Sensors Page



The all-sensors page outputs the raw sensor values for the user. Users can also perform a pressure sensor recalibration by navigating to 'Cal-P' and pressing 'OK'.



Figure 8.10 Alarm and Light Settings Page



The alarm and light settings page allow you to change some of the default settings for the alarm and internal light of the glove box:

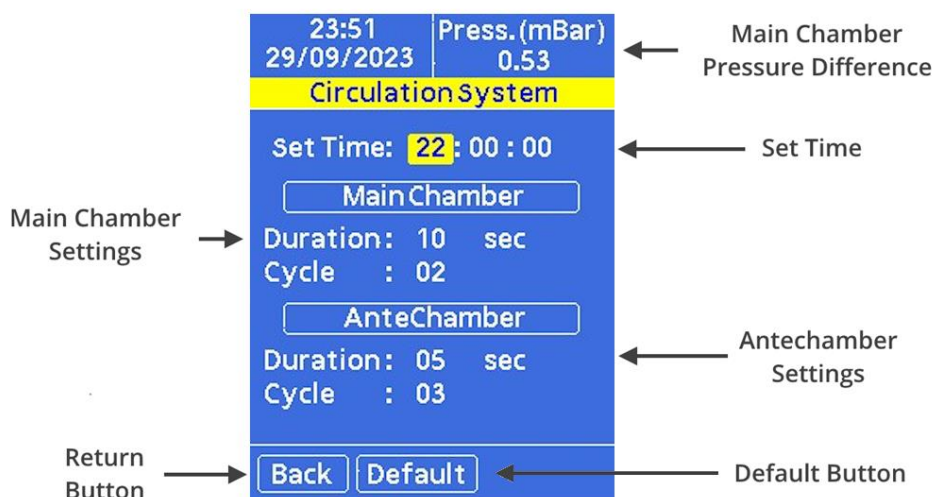
- Buzzer: Set the alarm to have an audible alarm or not to alert users of warnings from the system.
- ECO Mode: Automatically dims the lights and the display after a set idle time.
- Idle Time: The time in minutes for the system to enable ECO mode.
- Light Mode: Set the light to turn off automatically or to leave for manual control only.
- Set Light Time: Sets the time the lights will turn off at automatically.

Figure 8.11 Brightness Settings



The brightness settings allow the user to change the screen brightness on the display. To do this use the left navigation button to decrease the value or the right navigation button to increase the value.

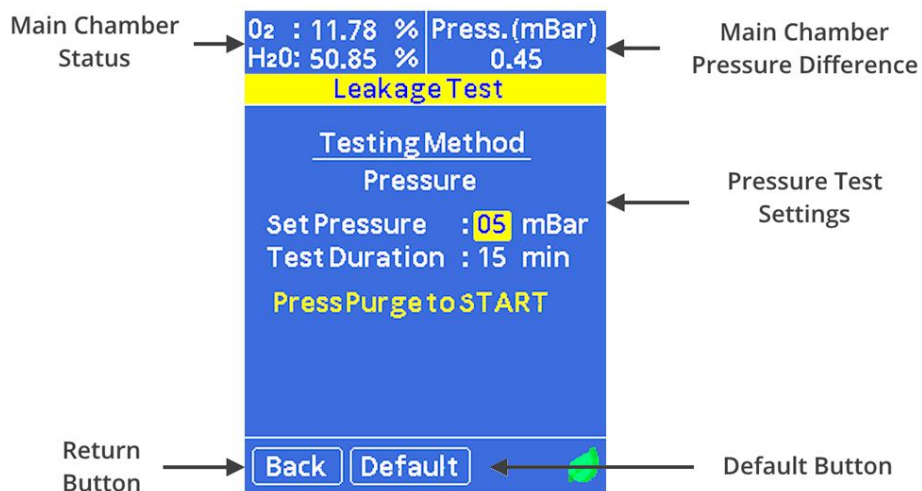
Figure 8.12 Circulation System Settings



The circulation system settings allow users to set the chamber to undergo a short purge to provide air movement in the chamber during times where air movement may be reduced, such as overnight. It is also useful when storing solvents in the box to allow for the removal of any solvent vapours that may build up overnight. We recommend setting a short circulation cycle early in the morning before working in the system, by providing air movement in the system it helps to disrupt pockets of air that form and help give a more accurate indication of the atmospheric condition in the box. This can also be useful when outgassing items overnight in the antechamber.

- Set Time: Allows the user to set the time of when the short circulation occurs.
- Main Chamber Settings: Here the length of each purge and the number of times it occurs can be adjusted. We recommend several short purges to create as much air flow as possible.
- Antechamber Settings: Just like the main chamber the antechamber can be cycled to create air flow. Here the duration and number of purge cycles can be adjusted.
- Default Button: Returns the settings to the default values used in the factory settings.

Figure 8.13 Leakage Test



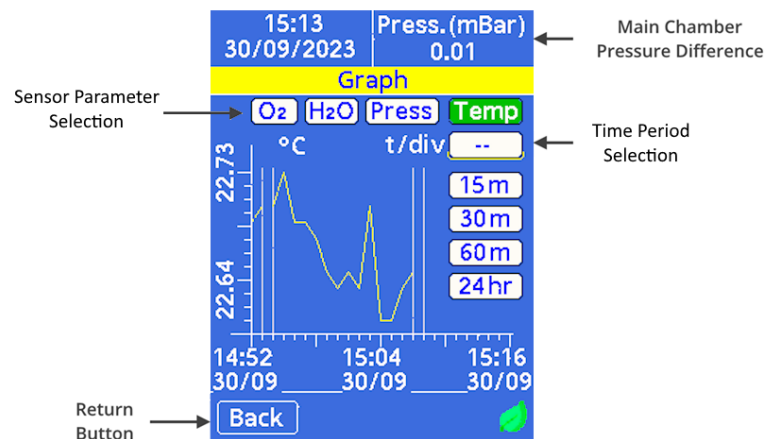
The leakage test page allows users to test the leak rate of the system using a pressure drop test. Here the system will increase the pressure difference to a value set by the user and measure the pressure drop for a set time. At the end of the test, it will display a leak rate for the chamber. The pressure test will not begin until the internal temperature value becomes constant. The reason for this is that the chamber temperature sees a drop when the chamber pressure is increased. While the temperature returns to an equilibrium value this will cause further pressure changes not related to the leak rate of the chamber.

- **Pressure Test Settings:** Allows the user to set the over pressure during the test and the maximum test duration.
- **Default Button:** Returns the set pressure value and test duration to their default values.

When complete the system will display a leak rate in percentage volume per hour. The system should be below 0.25% volume per hour.

Users can access the ISO controlled leak test by holding down the purge button for 3 seconds when starting the test. This method will have strict controls on the temperature and pressure variance inside and outside the system. The leak test will continue until the variance over the set testing period is within the ISO standards or the total testing time has exceeded double the target leak test time. An I icon will appear on the leak test screen to indicate the ISO test is underway.

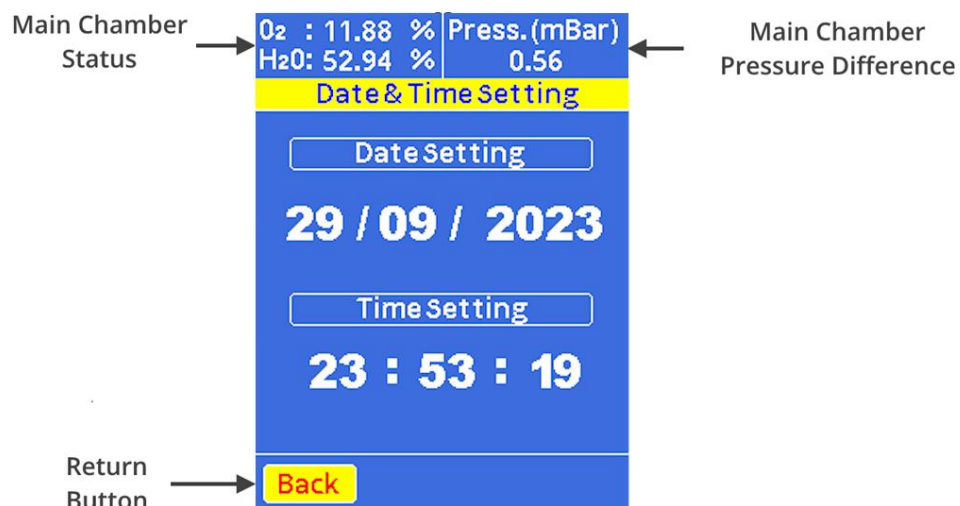
Figure 8.14. Data Log and Graph Page



The data logging page graphs out the change in sensor output over time. The user can select the parameters they wish to view over time this includes oxygen, moisture, pressure, and temperature. The user can also set the time period for the graph this can be either 15 minutes, 30 minutes, 1 hour, and 24 hours.

Breaks in data acquisition are highlighted as pairs of vertical bars indicating where the break started and where it ended. These breaks can occur on power out of the system or if communication is lost with the sensor when the measurements are being saved.

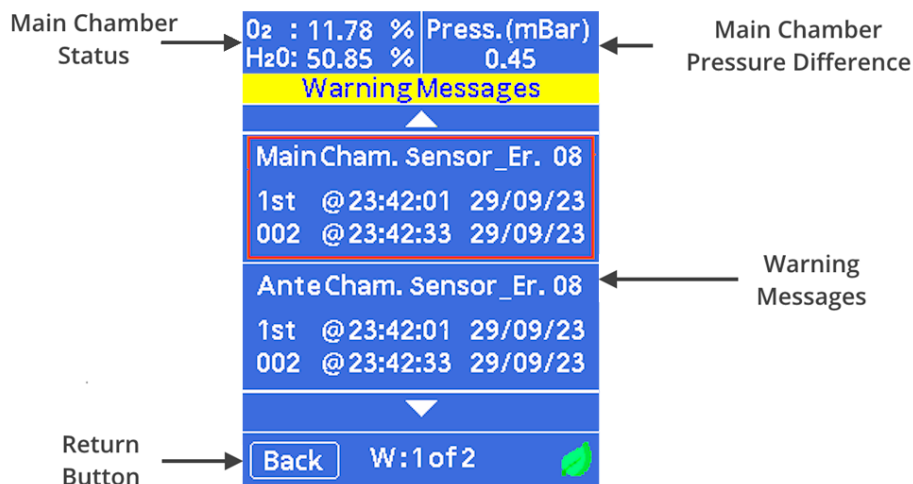
Figure 8.15 Time and Date Page



The time and date page allows users to set the time and date of the system clock to their local time.

- Date Settings: Allows the user to set the current days date.
- Time Settings: Allows the user to set the current time.

Figure 8.16 Warning Page



The warnings page has all the unread warnings that have occurred, these are time and date stamped so that the user can correlate it with working patterns within the glove box to help identify the reason for specific warning occurring. The warnings can be removed by navigating to a specific warning and pressing the OK button, this will delete them from memory. The warnings can be scrolled through using the up and down navigation arrows.

The warnings will indicate the date and time that the first instance of this warning has occurred, and below this will be the total occurrences of these errors and the last time this error occurred.

Figure 8.17 Information Page



The information page provides contact details for users of the system along with information on the software version currently installed on the system.

## 8.5 Operational Safety

Any procedure that is done with the dip coater should be carried out with a suitable operating procedure, risk assessment, and COSHH forms to ensure that the user knows and understands the potential hazards inherent to the system of work they are undertaking. The following are safety points that should be noted by the user before any procedure is undertaken with the glove box.

### 8.5.1 High Pressure System

The glove box when operated within the range of pressures indicated within the manual poses very little danger. Input pressures should be operated at the ideal pressure of 2 bar or lower. Higher pressure values pose a significant danger as connection, and valves are not designed to operate at pressures above those stated. Using higher pressure inputs could result in significant leaks of inert gas or pressurisation of chambers beyond what they are designed for.

Pressurised gas inputs should never be connected via the KF-Flanges, pressure relief valves installed within the system have a maximum flow rate that can be vented. The connection of a pressurised gas line via the KF flanges could result in an inflow of gas at a rate higher than the pressure relief valve can vent at. Resulting in over pressurising of the system and significant damage to the system and installation, along with potential harm to users.

### 8.5.2 Use of Asphyxiant

The glove box requires the use of an inert gas to function as intended. Although the box is designed to ensure that inert gasses are maintained within the system and are expelled through an exhaust pipe the presence of leaks or damage to the box could result in the release of gas from the system. It is advised that the minimum room size that the system should be used within is 28.8 m<sup>3</sup>, however it is recommended that when working with inert gasses that an oxygen monitor is present to check that the workspace is safe to use.

## 9. Maintenance

### 9.1 Cleaning

Cleaning inside of the system should be done with care to ensure that the environment in the chamber is not compromised. The use of dry lint free cloths is recommended, if solvents are required to clean ensure that there is no residual water content in the solvents and that the

solvents are used sparingly. If solvents are used the system should be purged afterwards to ensure any residual solvent is removed from the system.

## 9.2 System Purging

If solvents are used within the glove box, the system should be purged for a short period of time to help remove any build-up of solvents. Excess solvent within the system can result in damage to the sensor board reducing its operational lifetime. In addition, excess solvent within the system can remain for long periods of time and affect experiment results and damage materials and samples stored within the glove box.

## 9.3 Glove Replacement

Glove should be checked for damage regularly. If punctures occur within the gloves the systems leak rate will increase significantly and there is potential for moisture and oxygen ingress to occur. If damage occurs the gloves should be replaced, the recommended port diameter of the system is 10 inches. It is recommended that the gloves should be made from butyl rubber due to the low ingress rates of moisture and oxygen. To replace the gloves without exposing the system to atmosphere follow these steps:

1. Push the glove that is to be replaced into the box.
2. Remove the O-Ring that is closest to the main chamber.
3. Roll back the glove onto the second outer O-ring. Please take care not to let the glove come off the port completely.
4. Compress the new glove as much as possible to remove excess air.
5. Place the new glove over the glove port, over the old glove.
6. Install the O-ring closest to the main chamber onto the glove port, over the new glove.
8. Using the other glove, remove the old glove pulling it into the glove box.
9. Install the outer O-ring onto the glove port, over the new glove.
10. Remove the old glove from the box via the Antechamber.

## 9.4 Oxygen Sensor Replacement

The oxygen sensors used within the system need replacing once every 6 - 12 months, this is dependent upon exposure to moisture and solvents. Replacements can be purchased directly from Ossila. To replace the sensor, follow these instructions:

1. Turn the system off, leave the power cable attached and plugged into the wall to ensure proper grounding of the system.
2. Unscrew the two screws on the sensor board cover.
3. Remove the sensor board from the chamber.
4. Detach the sensor board from the sensor board cover.
5. Gently pull on the oxygen sensor, it should detach from the sensor board.
6. While wearing gloves push in the new oxygen sensor and reattach the board to the sensor cover.
7. Reconnect the sensor to the feedthrough and screw it in place to secure it.
8. Turn the system back on.

## 9.5 Sensor Recalibration

The pressure sensors undergo a calibration process to ensure any difference between the internal and external pressure sensors are correctly accounted for. This process is typically done at Ossila before a unit is shipped out. However, in some circumstances the sensors may need recalibrating. This includes when the software is updated, and when the sensor boards are replaced. When the software is updated, the system will automatically run through the recalibration process on startup. If the sensor board is replaced users will need to navigate to the all-sensors menu and select Cal-P option to force a recalibration for the new sensor.

When the calibration process occurs, the following happens:

- The system will begin by opening the exhaust valve for the main chamber and leaving it open for 60s. This allows the internal pressure of the main chamber to equalise with the external pressure.
- Users should refrain from touching the gloves of the system during this period.
- After 60s pressure readings are taken from the main chamber sensor and the external sensor and any offset measured is used in the calibration process.
- The main chamber will then seal itself and the antechamber exhaust valve will open for 60s. This allows the internal pressure of the antechamber to equalise with the external pressure.
- After 60s pressure readings are taken from the antechamber sensor and the external sensor and any offset measured is used in the calibration process.

If the system is unable to communicate with the sensor boards the process will repeat once more. The display will show “!Repeat Calibration!” and will begin again. If, during this repeat process, either sensor fails to communicate with the main processor an error message will occur, and the calibration process will fail. If this occurs please check the sensors to ensure they are properly connected to the system.



## 9.6 Humidity Sensor Reconditioning

The glove box will automatically undergo a reconditioning of the humidity sensor once per day, this is scheduled at 1am and will last 2 hours. This process involves heating up the sensor in a low humidity environment. This helps to remove any residual solvents trapped within the protective membrane of the sensor and reduces the likelihood of drift in the sensor over time.

When the reconditioning is occurring a heater icon will appear at the bottom of the display, temperature measurements will also increase for the system and the humidity measured by the sensors will be artificially lower than the surrounding environment due to the elevated temperature of the sensor.

The reconditioning process will be interrupted if users begin to operate the system by putting their hands within the glove box.

## 10. Glove Box Troubleshooting

Problem	Possible cause	Action
No power / display	The power switch on the unit is in the OFF position	<ul style="list-style-type: none"><li>• Check the connection and ensure the power is turned ON</li></ul>
	The power supply may not be connected properly	<ul style="list-style-type: none"><li>• Ensure the unit is firmly plugged in to the power supply, and the plug is firmly connected to both the adapter and the working power socket</li></ul>
	The fuse on the rear panel has blown	<ul style="list-style-type: none"><li>• Ensure the unit is unplugged.</li><li>• Check the fuse on the rear panel. If it has blown, replace with a suitably rated 1A slow blow fuse</li></ul>
	The power supply adapter has a fault	<ul style="list-style-type: none"><li>• Contact Ossila for a replacement power supply adapter</li></ul>
	No obvious cause	<ul style="list-style-type: none"><li>• If all the above causes have been considered, there may be a fault on the board. Please contact Ossila for information</li></ul>
High Gas Usage	Leak present in the chamber	<ul style="list-style-type: none"><li>• Run a leak test on the system to determine if a leak is present. If the leak rate from the test is high there is a leak within the chamber.</li></ul>

Problem	Possible cause	Action
		<ul style="list-style-type: none"> <li>• Check gloves for damage, small holes and tears can cause significant leaking. Use leak detection spray to quickly locate any potential holes.</li> <li>• If there is no damage to the gloves check often used seals such as the door for any debris or damage. Clean the seals and test the system for leaks.</li> </ul>
	Check set points	<ul style="list-style-type: none"> <li>• Check to see what set points are causing the system to top up with inert gas. If the lower pressure limit is being reached there is likely a leak. If the oxygen or humidity set points are being reached then there may be outgassing or ingress. If no set points are being triggered it could be a leak in the delivery line.</li> </ul>