INNOVATIVE TECHNOLOGY

PureLab HE Glovebox

User Manual

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Document Information

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1 About This Manual

This document explains how to install and operate your Glovebox system and accessories. References are made in the Installation section to features in the Operational section. It is imperative that you refer to them as indicated. If you have any further questions please call our offices at 978-462-4415

1.1 Firmware Revisions

This User Manual is based on a minimum PLC firmware Version 7 Revision 1. Enhancements made to this version may result in operator display screens or other operational functions that vary slightly from this manual's figures and descriptions.

1.2 Optional Equipment

This User Manual includes information about optional equipment that may not be installed on your system. It is presented for clarity and completeness. We have indicated which equipment is optional and which equipment is standard. In addition, a system that has been ordered with custom options may vary from what is documented in this User Manual.

There may be slight differences due to manufacturing changes.

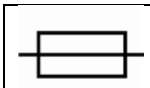
This User Manual includes information on Dual Column systems, Automatic Antechambers, and Automatic Purge systems, all of which are optional equipment.

1.3 Terms

The terms "box", "Glovebox", and "system" all refer to the entire standard PureLab HE configuration. The terms "regeneration," "regeneration cycle," and "regen" all refer to the components or process of regenerating the system's purifier or column.

1.4 Symbols Used

The following are symbols used in this manual and on the Glovebox itself:

	Circuit breaker
	Electrical Ground
	Electrical AC current

2 System Overview

PureLab HE is designed as a complete package including box, Antechamber(s), gas purification system and vacuum pump. The system is capable of removing O2 and H2O to levels less than 1 ppm. O2 and H2O are removed from the inert atmosphere by a combination of molecular sieve and copper catalyst. Once saturated, these materials are easily regenerated to their original state.

The PureLab HE has been designed with the user in mind.

- The Operator Interface comprises a color HMI (Human Machine Interface) touch screen that is mounted on a swing arm for ease of use.
- The foot pedal allows the operator hands free control of the box pressure.
- Interior and exterior doors are easy to operate.
- The controls and indicators are simple yet fully functional.

The PureLab HE (Figure 1) is designed to be a completely modular system. The gas purification system is contained within a separate module that is located beneath the large Antechamber. This module has casters allowing easy movement for servicing.

All service connections are located on the rear of the gas purification system and are clearly labeled.

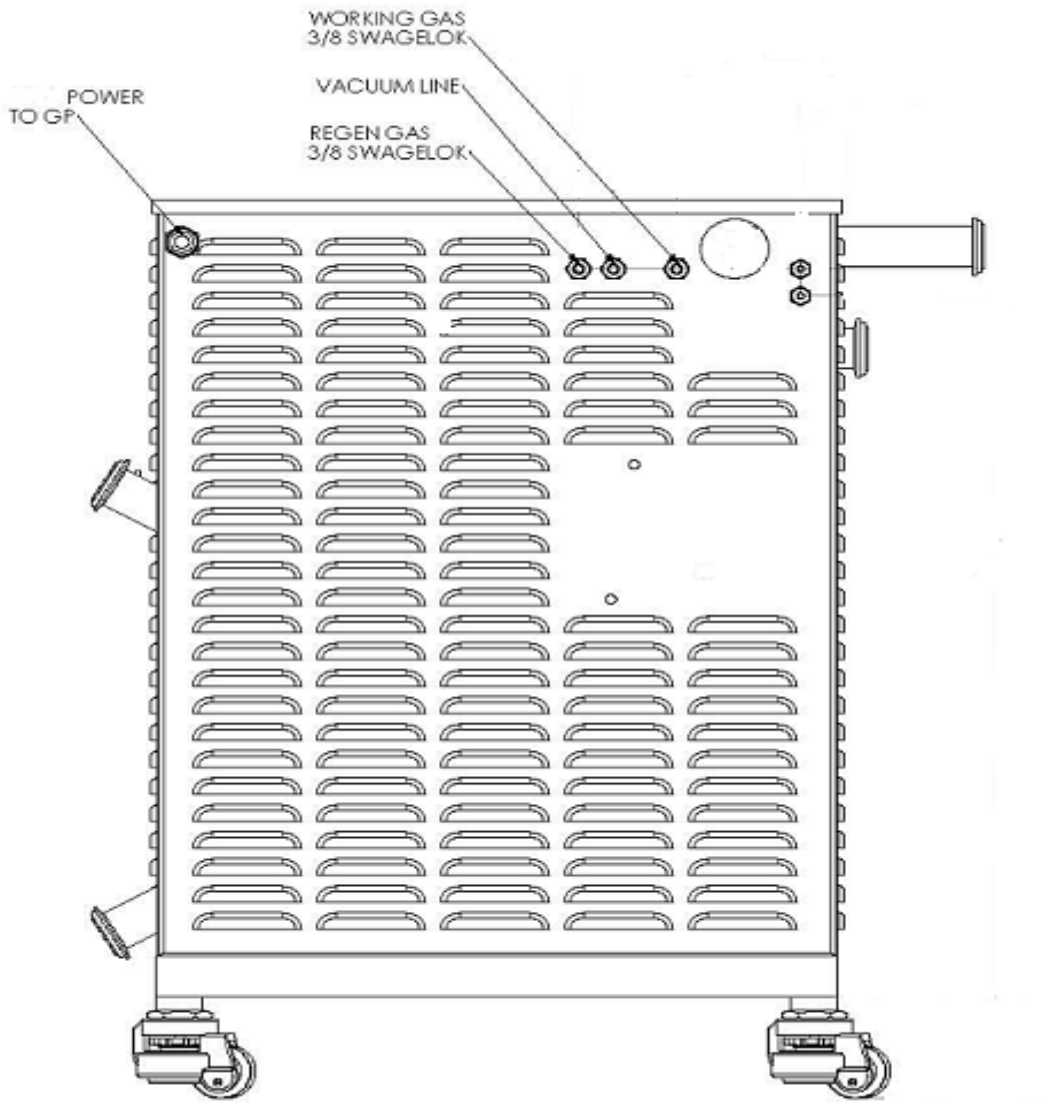


Figure 1 PureLab HE

The vacuum pump is located on the Glovebox stand, allowing for easy access and oil change.

The Gas Purification system module has removable side panels and a top panel, allowing easy access to the Valve Assembly, Purifier Column, Valves, and Blower.

In addition you will find:

- Visual indicators on the Automatic Column valves.
- Manual override should the Automatic Column Pilot Solenoids fail.
- Circuit breakers.
- Solid State Relays.

- Easy access for replacement of valves.
- The Antechamber has a door lifting mechanism so the door lifts gently and cannot close unless pulled down by the user.
- Gloveboxes are modular in design; there are no bolts through the end panel or front window that could cause potential leaks.
- All connections are stainless steel tubing, which is either welded or connected via KF-40 clamps or compression connectors. There are no rubber hoses or hose clamps which, over time, can develop leaks or cracks.
- The PureLab HE control system is PLC-based and has a color HMI touch screen interface. This system monitors and controls all box functions. Extensive functionality and user features are available in the System Controller.

2.1 The PLC Enclosure

The PLC enclosure is located on the front of the gas purification module.

2.2 Exterior Controls

On the PLC enclosure, mounted on the side wall, you will find several circuit breakers and an illuminated main circuit breaker that doubles as the main power on switch.

2.3 Circuit Breakers

There are seven (7) circuit breakers on the side wall. The function of each breaker is indicated on a label at the side of the breaker. When they are in the tripped position, a white colored tab extends from the middle of the breaker. To reset them, press the tab back in until it locks in place. A label on the inside of the enclosure door contains specific information regarding the circuit breakers.

Table 1 Circuit Breakers

Circuit Breaker #	Amperage 110/220 VAC	Function
1	15A/10A	Illuminated Main Power Switch
2	10A/5A	Vacuum Pump
3	6A/3A	24V Power Supply
4	5A/3A	Blower
5	4A/2A	Heater for Column 1
6	4A/2A	Heater for Column 2
7	5A/3A	Lighthood

2.4 Foot Pedal

A foot pedal is provided so that the box pressure can be increased or decreased without the operator having to remove their arms from the gloves. It is a dual pedal switch. The right pedal

increases the box pressure and the left pedal decreases it. Note that the working minimum and maximum pressure settings are still being maintained by the PLC control. The foot pedal allows the user to add or remove pressure within the working minimum and maximum set points.

3 Installation

This section explains how to install a PureLab HE Glovebox

3.1 Pre-Installation Requirements

3.1.1 Working Gas

The working gas requirement is Nitrogen, Argon or Helium with a suitable regulator to adjust pressure to 55-60 psi. The working gas must be connected to the gas inlet on the Glovebox either by flexible hose or hard copper plumbing to a 3/8" compression connector. Four (4) cylinders are required: three (3) for purging and one (1) for the final operation of the Glovebox.

Note 1: Refer to system specific installation requirements for further details. This document was supplied prior to shipping the system. Please contact your local Innovative Technology representative if you need another copy.

Note 2: The working gas tubing must be 3/8” outside diameter for the entire distance from the regulator to the working gas connection. Any reductions in tubing diameter will result in insufficient gas flow for optimum system performance. Outside North America the connections and tubing should be 10mm

3.1.2 Regeneration Gas

Note: The gas purification system has been regenerated and performance tested to < 1ppm of O2 ands H2O at our factory prior to shipment. It does NOT need to be regenerated prior to first use upon installation.

One cylinder of Nitrogen or Argon containing approximately 3 to 7% Hydrogen.

3.1.3 Electrical

All Innovative Technology, Inc. Glovebox systems are configured to operate using the electrical power standard for the region in which the Glovebox has been ordered.

Note: The standard 2-glove system requires 2 electrical outlets, one for the main system power and one for the power supplied to the power strip inside the Glovebox. Larger systems and those configured with other options require additional outlets.

3.1.4 System Exhaust

Note: The Regeneration Gas, Vacuum Pump, and Purge exhausts should be handled in accordance with your facility’s required specifications.

The regeneration gas exhaust is 3/8" I.D., 19/32" O.D. Tygon tubing. The Vacuum Pump exhausts are 1" OD tubing. The purge valve should also be vented, 1" Female NPT (manual purge) or KF-40mm flange (automatic purge).

WARNING: Proper ventilation of the exhausted gases is imperative as high levels of inert gas can cause asphyxiation.

3.2 Unpacking the System

All systems shipped outside North America are packaged in specially designed shipping crates. These systems require a forklift or similar lifting device to safely remove the Glovebox and Gas Purification module from the crate. For more information, please ask your Innovative Technology, Inc. representative.

WARNING: Glovebox systems are typically top-heavy.

All systems shipped within North America are shipped on a special-designed pallet that includes detachable ramps to enable the Glovebox and Gas Purification module to be rolled off the pallet. Please ensure that you have sufficient personnel available to assist in the unloading process to ensure personnel safety.

To unpack the Glovebox system

1. Place the Glovebox and gas purification module on a level floor in the desired location.
2. Remove the shrink-wrap and any other strapping that may be supporting the vacuum pump or any other accessories.
3. Depending on the exact system configuration purchased, there will be one or more boxes containing items such as gloves, power strips, etc. inside the large Antechamber and on the pallet. Carefully inspect all packaging materials before discarding to ensure that any small components are not misplaced.

3.3 Assembly

Figure 2 Assembled Glovebox

Note: For double box systems, the two boxes need to be joined prior to performing the following procedure. See the next procedure, “To assemble a double box system”.

To install the Glovebox system

1. See Glovebox layout drawing (Figure 1).

   The Glovebox system has lockable casters on each leg to facilitate its placement. Once in place, the casters can be adjusted to lock the system in place.
2. Level the system by adjusting the leveling feet underneath each leg.
3. Place the Gas Purification module underneath the Large Antechamber.
4. Connect the Gas Purification module to the Glovebox. Match up the labels on the piping and components to the labels on the Glovebox and the gas purification module. e.g., “1” connects to “1”, “2” connects to “2”, “A” connects to “A”, etc.
5. Lock the Purifier Cart into place by adjusting the casters.
6. Locate and install the shelves inside the box at your preferred height. The shelves are adjustable and can be relocated at any time. Fit the shelves into the box by sliding them through the Antechamber. It is not necessary to remove the window.
7. Place the power strip in the box as desired. Connect the male plug to the female outlet, which leads to the feed-through on the side of the box.
8. The oxygen analyzer requires that the small sampling pump be connected to the black tubing connected to the bulkhead fitting on the inside of the Antechamber wall. The batching pump should also be plugged into the electrical power strip inside the Glovebox.
9. Attach the purge valve to the corresponding KF-40 flange located on the top of the Glovebox. The purge valve and flange are labeled like the removed plumbing. For the auto-purge version, locate and connect the electrical and pneumatic lines.
10. Install the gloves. Gloves are placed inside the box through each glove port. The cuff end of the glove is stretched over the glove port until the lip fits into the last groove. Two O-rings are then stretched over each glove and placed in the outer two grooves.

To assemble a double box system

1. Remove the window from one box. See “*Removal and Replacement Procedures*” on page 71.
2. Press both boxes together and make them level on the inside by adjusting the leveling feet. After the boxes are level, lock the leveling feet into position.
3. Press both boxes apart far enough so that you can fit between them. Apply a bead of DAP latex sealant, approximately 1/8"-3/16" wide continuously around the flange of one box in the area between the inside of the box and the bolt holes.
4. Press the boxes together and put in the four corner bolts. After the four are in and hand tight, insert the rest of the hardware and tighten all bolts. Excess sealant will squeeze out from between the flanges.
5. Clean the excess sealant; it is easier to do this when the sealant is slightly dry. Clean the entire interior of the Glovebox.

6 Place the window on the box. See "*Removal and Replacement Procedures*" on page 71.

7 Install the gloves and glove O-rings. See "*Removal and Replacement Procedures*" on page 71.

3.4 Electrical Connections

The primary power cord has been retracted into the gas purifier module to prevent damage during shipment. Simply loosen the strain relief, pull the cord through the strain relief, and plug it into the proper wall receptacle.

The plug that is connected to the power strip is also inserted into the proper wall receptacle.

Note: Glove boxes are shipped with many different options. Please review each section in this User Manual that applies to the configuration of the system being installed.

3.5 Gas Connections

IMPORTANT: Male sure you have installed the proper regulator on the working gas cylinder and on the regeneration gas cylinder, connected tubing of sufficient length, and ensured that there are no leaks.

The fittings for both gases are located on the rear wall of the gas purifier module. Connect the working gas to the appropriately-labeled compression fitting and tighten it 1.25 turns from finger tight. Over tightening compression fittings can cause problems.

Note: If you are not familiar with compression fittings please call your Innovative Technology representative for further assistance.

Set the Working Gas pressure to 55 psi. Set the Regen Gas pressure to 7 psi. These connections are 3/8" in North America and 10mm outside North America.

3.6 Venting Connections

All exhaust connections should be made in accordance with your internal HVAC guidelines.

The fitting on the vacuum pump exhaust is 1" stainless steel tube stub.

The exhaust from the purifier is 3/8" ID hose.

The exhaust from the purge valve is 1" Female NPT.

WARNING: Proper ventilation of the exhausted gases is essential as high levels of inert gas can cause asphyxiation.

3.7 Commissioning the System

You are now ready to begin the commissioning the system. This section assumes that all prior sections have been completed as described.

3.7.1 Switching Power On

The main power ON/OFF switch is accessible from the left side of the gas purifier module on the side wall of the PLC enclosure.

Switch the power on. The main power switch light ups. All box electrical equipment is enabled with this switch. There is no other action necessary to turn power on with the possible exception of optional equipment.

The fluorescent light in the hood is controlled by its own manual switch located on the top of the light hood.

3.7.2 Pressure Testing the System

The Glovebox system is a leak-tight, hermetically sealed system. The entire system has been pressure and performance-tested prior to shipment. After assembly, the system must be pressure tested to ensure that all of the fittings and pipework have been connected properly.

After initial power on, the Glovebox Control screen shows the following display (Figure 3). In order to change any setting, the user must log in to the system.

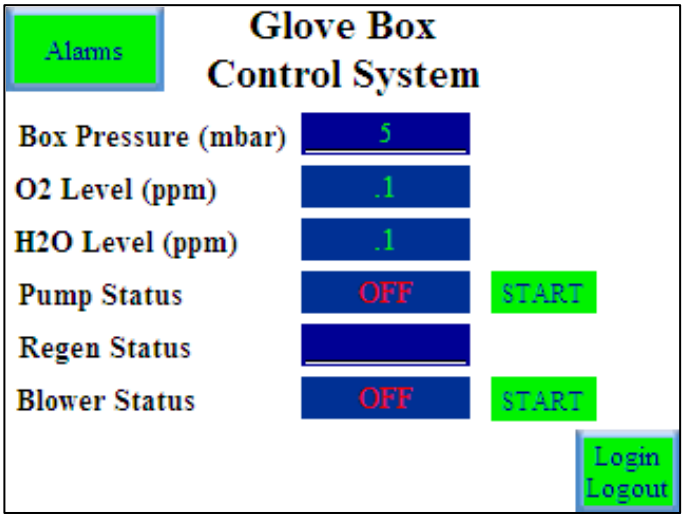


Figure 3 Glovebox Control screen

1 Press the **Login/Logou**t button (Figure 4).

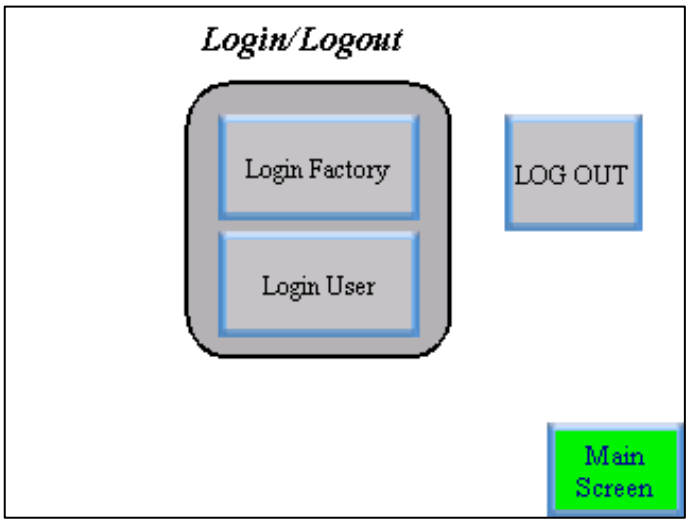


Figure 4 Login/Logout button

2 To Log in as a User, press the **Login User** button and then enter the code **7990**. The Login User button turns Green and flashes Accepted.

3 Press the **Main Screen** button to reach the Main Glovebox Control screen (Figure 5).

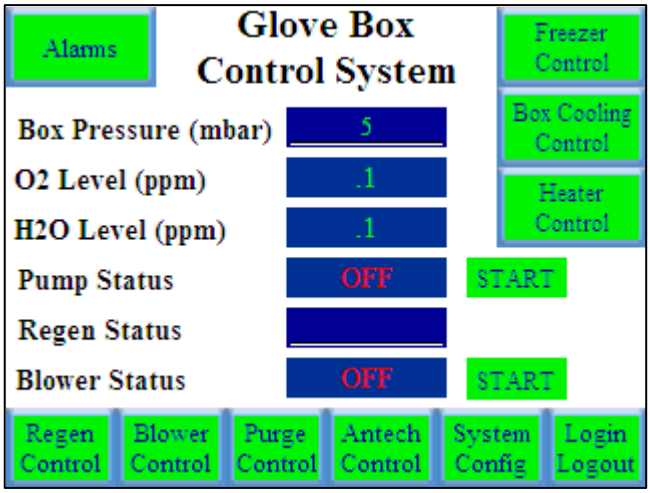


Figure 5 Main Glovebox Control screen

3.7.3 Adjusting the Box Pressures

The Glovebox Control system is programmed to maintain the Glovebox pressure between the minimum and maximum working pressure settings. To adjust these pressure settings:

1 Press the **System Config** button. The Glovebox Config Screen appears (Figure 6).

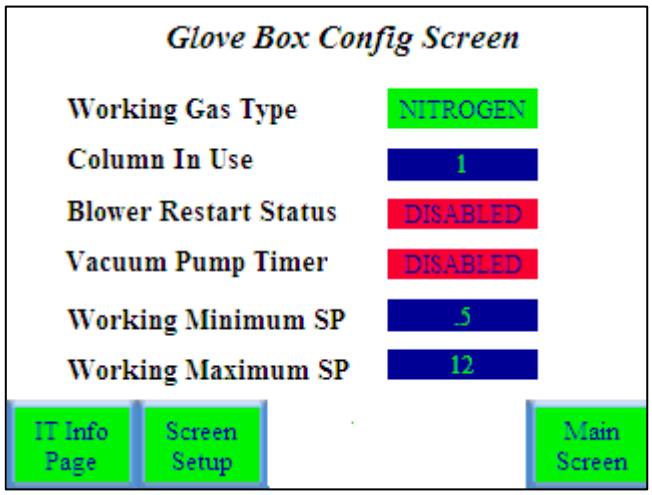


Figure 6 Glovebox Config Screen

2 Press the **Numeric blue display** button next to Working Maximum SP. A numerical input screen appears (Figure 7). Type in **12.0** and press the **Enter** key.

3 Press the **Numeric blue display** button next to Working Minimum SP. A numerical input screen appears. Type in **10.0** and Press the **Enter** key.

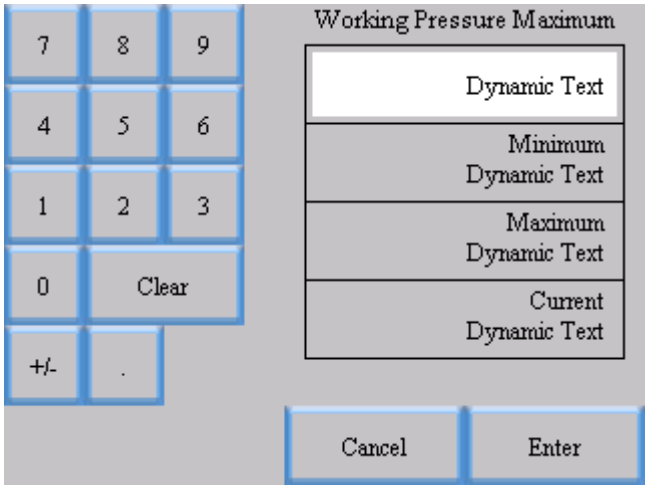


Figure 7 Numerical input screen

4 You will hear working gas enter the box automatically, and the pressure indicators will read 11mbar.

- **a** Ensure that the inside and outside doors to the Antechambers are closed.
- **b** Turn on the vacuum pump by pressing the **Start** button on the main screen.
- **c** Open the evacuate valve on the Large Antechamber and allow the Antechamber to evacuate to -30.
- **d** Close the evacuate valve.
- **e** Repeat this process for the mini Antechamber.

5 Wait 10 minutes to allow the Glovebox to stabilize.

6. Use the appropriate foot pedal to add/remove gas to/from the Glovebox to reach a pressure of 11.0 mbar.
7. Using a timer, wait 25 minutes and observe the current box pressure.
   - If the pressure has not decreased more than 1 mbar in this time period, the Glovebox is leak tight.
   - If the pressure drops more than 1 mbar, check all of the connections that were made during the assembly process. Contact your Innovative Technology, Inc. representative if you require assistance in troubleshooting.

3.7.4 Purging

The purpose of purging the system is to displace the air in the box with the inert gas of your choice. It is extremely important to displace as much of the air as possible prior to circulating the inlet gas through the purifier column. It is advisable to use at least three cylinders of gas per Glovebox module during this purging procedure and to reduce the O2 and H2O levels to less than 50 ppm.

Note: If you have a freezer, the door should be open during purging.

The purging method is as follows:

1. Set the Working Maximum pressure to +10.0 mbar and the Working Minimum Pressure to +5.0 mbar See "*Adjusting the Box Pressures*" on page 19.
2. Open the manual purge valve located on the top left of the box. If your Glovebox system is fitted with an Auto Purge valve, refer to "*Purge Control*" on page 31.
3. Adjust the flow using the purge valve so that there is a steady flow of incoming gas and the box pressure is maintained at >1mbar.
4. Create turbulence in the box to increase the efficiency of the purge. This can be done by pressing in the gloves and waving inside the box or installing a small electric fan inside the box.
5. During the purge process you will need to change the working gas cylinder as it empties. You must close the purge valve before changing the cylinder.
6. Re-open the Purge valve after replacing the cylinder and opening the valve on the cylinder.
7. Purge the system with at least 3 cylinders of inert gas for a standard 2-glove system.

   Note: If you do not have an Oxygen Analyzer, it can be assumed that after purging with three (3) cylinders (for a single 2-glove system), the Oxygen content in the box is 25 ppm or less. Close the Manual Purge valve.
8. Open the outlet valve of the O2 analyzer, then open the inlet valve. Make sure that the batching pump has power. It should be plugged into the power strip. The power strip should be plugged into the wall outlet. Within 15 minutes, you can read the Oxygen content on the display.

9 After 15 minutes if the O2 level is below 50 ppm close the Purge valve and start the circulation. See "*Circulation*" below on page 22.

10 The O2 level may increase after the blower has been turned on. If the O2 level exceeds 100 ppm, stop the blower and continue to purge. Repeat steps 9 and 10 as necessary.

WARNING: Do not open O2 analyzer valves until Glovebox has been properly purged. Exposure to high O2 levels will diminish the lifetime of the O2 sensor.

When shipped, the oxygen analyzer valves are closed as shown in Figure 8:

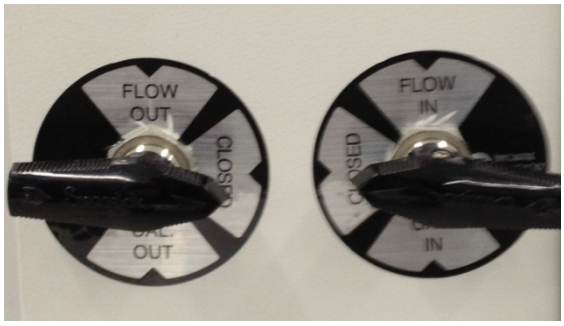


Figure 8 Oxygen analyzer valves - closed

In order to monitor the oxygen content inside the Glovebox the left Valve must be turned to the "Flow Out" Position and the Right Valve must be turned to the "Flow In" position as shown in Figure 9:

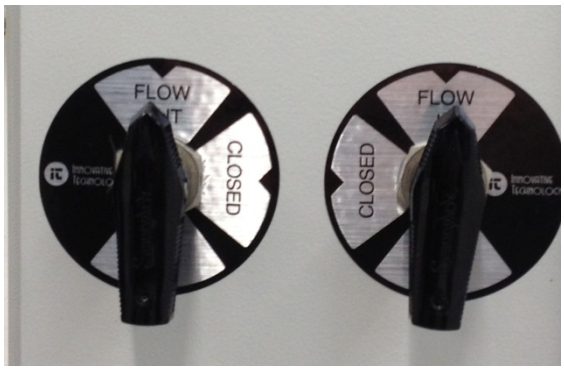


Figure 9 Oxygen analyzer valves - Flow In

Note: When purging is complete you may adjust the Minimum and Maximum Working pressures to attain the operating pressure that best suits your needs and comfort.

3.7.5 Circulation

The blower is designed to circulate the Glovebox atmosphere continuously through the purifier column. For optimum performance the blower must run constantly. Turning off the blower results in the atmosphere within the Glovebox degrading as it is not being circulated through the O2 and H2O absorbing materials contained within the purifier column. O2 and H2O levels inside the Glovebox will rise if the blower is switched off.

The blower can be switched on and off from the main control screen. The blower control screen can be accessed by Pressing the "Blower Control" button on the main control screen (Figure 10).

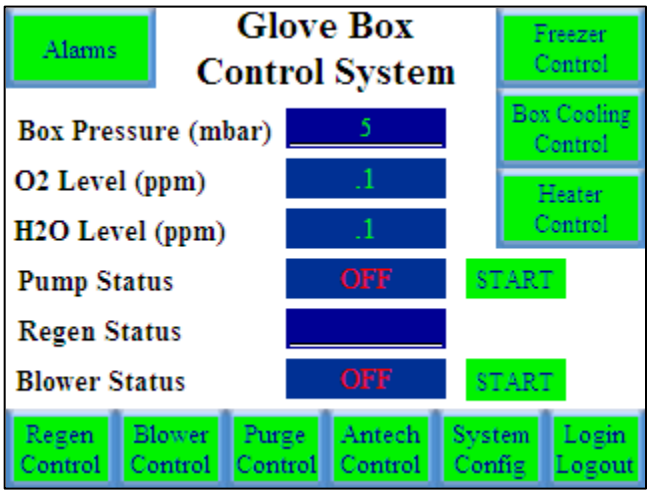


Figure 10 Glove Box Control System

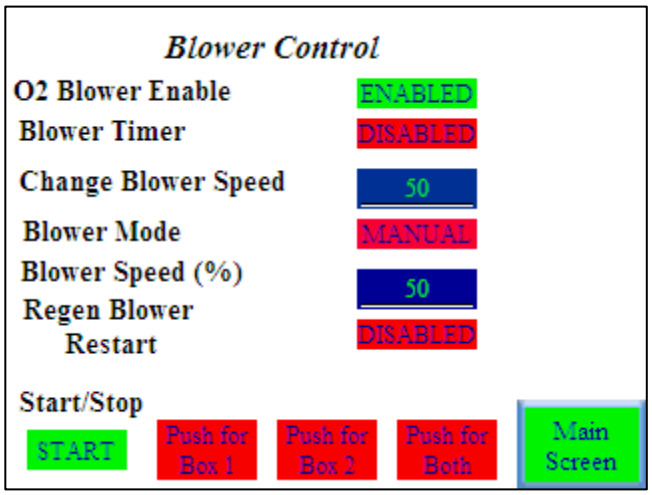


Figure 11 Bower Control screen

Starting the blower automatically opens the valves on the column and circulates the box atmosphere through the purifier column. There will be a momentary rise in oxygen because of the small amount of air trapped in the blower.

The blower provided is continuously variable; it can be set at a very low speed if you are handling sensitive crystals or during weighing. It can be set at a maximum to recover quickly from an operator error.

We suggest it be set at 50% during normal operation. Blower speed can be changed by pressing the numeric value next to the Change Blower Speed. Pressing this numeric value opens up a numeric entry screen where the desired blower speed can be entered. The value entered is a percentage. 0 means the blower is not circulating. 100% means that the blower is circulating at full speed.

4 Control Panel Functions

All Glovebox functions are controlled from the touch screen (HMI – Human Machine Interface). This section describes the touchscreen and all the functions associated with it. The HMI is typically located on the side panel that has the large Antechamber attached. Custom systems may have the HMI mounted in a different location.

The HMI communicates with the Programmable Logic Controller (PLC) that is contained within the PLC enclosure on the gas purification module.

4.1 The Main Control Screen

The main control screen (Figure 12) is the primary source of information for the system.

This screen provides real time display of all key Glovebox operating parameters.

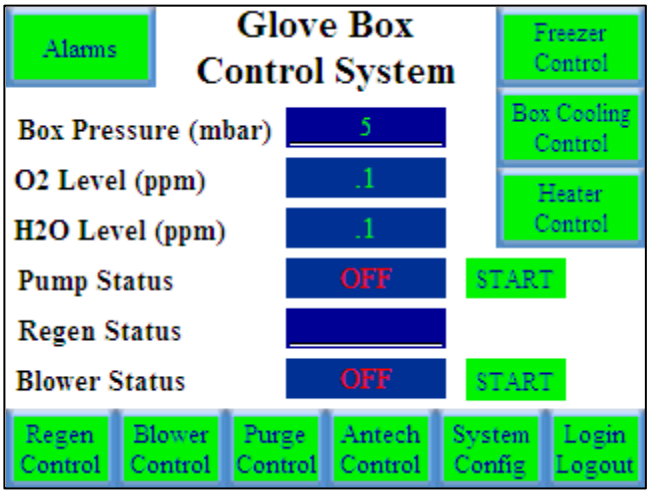


Figure 12 Glove Box Control System

4.2 Initial Power On

When the system is powered on the following screen (Figure 13) is appears:

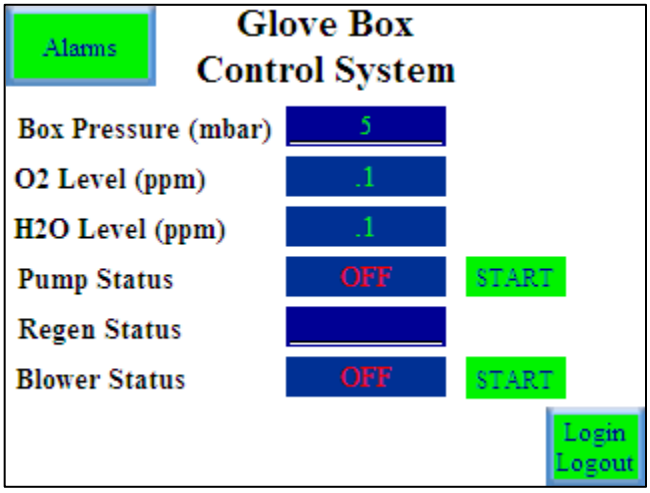


Figure 13 Glovebox powered on

This screen indicates the basic status parameters but does not allow any interaction until the user logs in to the HMI. Customers may only log in as a User.

To log in, press the **Login Logout** button. The following screen (Figure 14) appears:

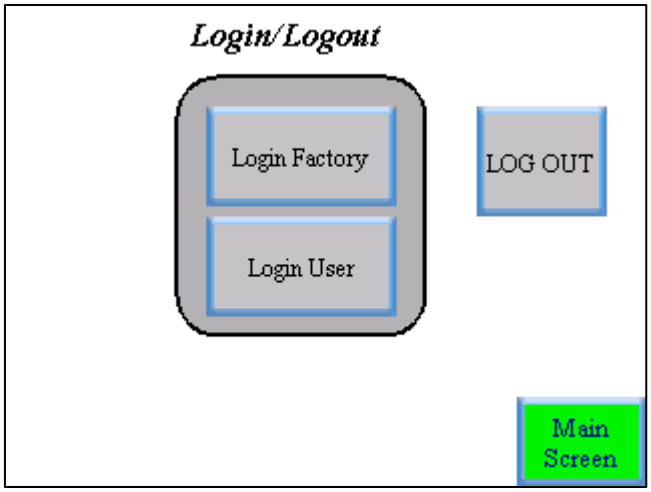


Figure 14 Login/Logout screen

To log in as User, press the gray **Login User** button. A numeric data entry screen appears. The User Login password is **7990**. After pressing the **Enter** button the Main Control Screen appears with fully functional buttons (Figure 15).

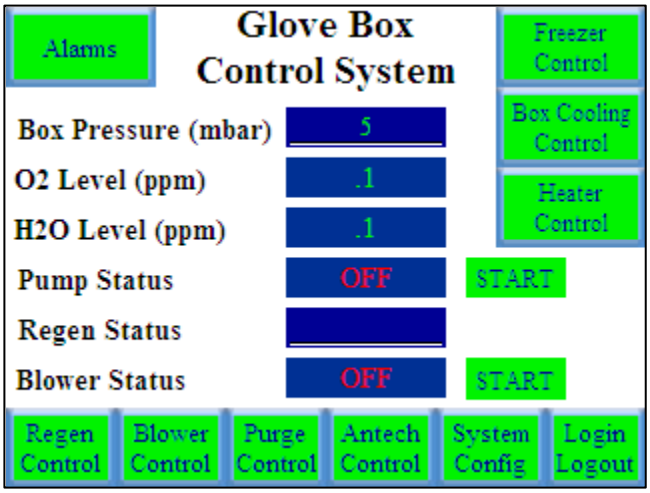


Figure 15 Glove Box Control System with fully functional buttons

Note: Depending on the particular configuration of your system not all buttons may be available.

Box Pressure (mbar)	The Main Control Screen continuously displays the current Glovebox pressure. This pressure is displayed in mbar relative to atmospheric pressure. The current pressure is displayed in the blue bar. For information on adjusting the box pressure, see "*Commissioning the System*" on page 17.
O2 Level (ppm)	If your system is equipped with an O2 Analyzer, the current real time O2 level in ppm will be displayed here.
H20 Level (ppm)	If your system is equipped with a H2O Analyzer, the current real time H2O level in ppm will be displayed here.
Pump Status	The Vacuum Pump is turned on and off by pressing the START/STOP button. The current Vacuum Pump Status is shown in the Blue Box. If the Blue Box indicates OFF then the Green button next to it will display START. Pressing the START button will turn on the vacuum pump. The pump status will now show as ON and the Red STOP button will be visible. Pressing this Red STOP button will turn off the vacuum pump. The pump also has its own on/off switch mounted on the motor. This should be in the on position at all times. The vacuum pump has three purposes in the Glovebox operation. • Removal of excess pressure from the Glovebox • Evacuation of the Antechambers • Evacuation of the purifier column during the Regeneration cycle
Regen Status	Indicates whether the purifier column is currently being regenerated. It displays the current stage of regeneration and the time in minutes that has elapsed in that stage. Refer to the regeneration section for further details regarding catalyst regeneration procedures.
Blower	The blower is a vital component in the Glovebox gas purification system because it is responsible for continuously circulating the Glovebox atmosphere through the purifier column to remove oxygen and moisture. The blower is comprised of a fan hermetically sealed inside an enclosure that is connected to the circulation pipework to create a leak-tight closed-loop. The blower is located inside the gas purification module, typically located beneath the large Antechamber. The Blower is turned on and off by Pressing the START/STOP button. The current Blower Status is shown in the Blue Box. If the Blue Box indicates OFF then the Green button next to it will display START. Pressing the START button will turn on the Blower. The Blower status will now show as ON and the Red STOP button will be visible. Pressing this Red STOP button turns off the Blower. When the BLOWER switch is activated, the PLC opens the column valves to enable circulation. The Blower Control button opens a control screen that allows further interaction with the blower settings. See "*Blower Control*" on page 30. **Note:** For the blower to operate correctly the system must be supplied with at least 55 psi of inert working gas pressure.

4.3 Control Sub-Screens

4.3.1 Regen Control

Pressing the "Regen Control" button brings up the following screen (Figure 16):

This screen allows the user to initiate a regeneration of the purification column.

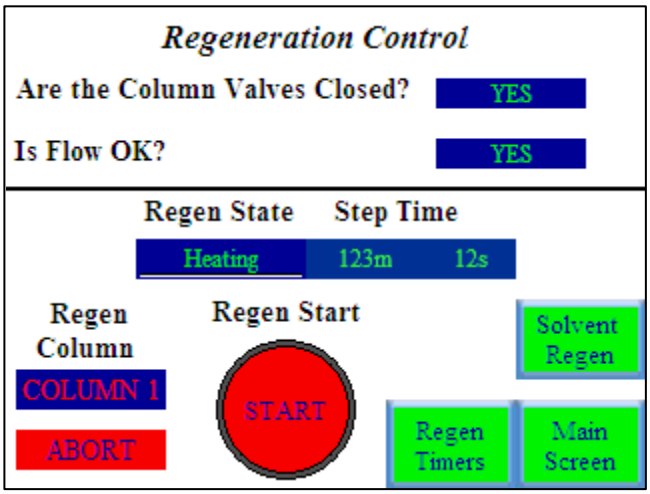


Figure 16 Regeneration Control screen

Start Button	Initiates a regeneration.
Are the Column Valves Closed?	Prompts the user to acknowledge that the column valves are closed.
Is Flow OK?	Prompts the user to acknowledge that the regeneration gas is flowing.
Last Regen	Indicates when the last regeneration occurred.
Regen Status	Indicates the current step in the regeneration cycle.
Step Time	Indicates the elapsed time for the current step.
Regen Column	Indicates which column will be regenerated.
Abort Button	Allows the user to abort a regeneration within the first 5 minutes of starting.
Regen Timers Button	Accesses sub-screen below.

4.3.2 Regen Timers

The Regen timers are set in minutes. Below are the factory default settings (Figure 17). Do not change these timers without contact your Innovative Technology service provider.

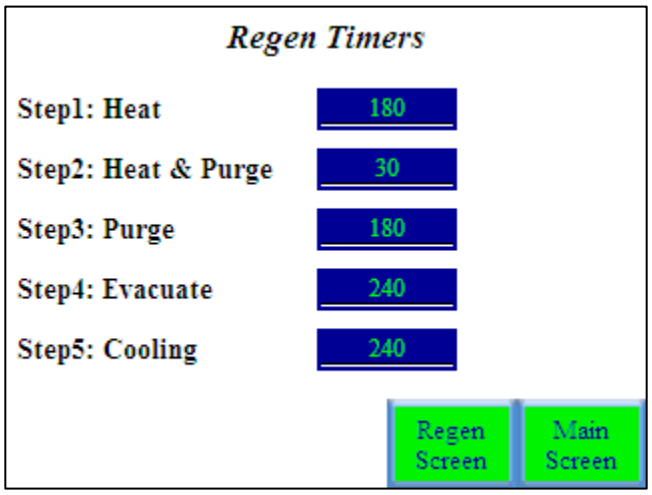


Figure 17 Regen Timers screen

Step 1: Heat	Indicates duration of Heating Cycle in minutes.
Step 2: Heat & Purge	Indicates duration of Heat & Purge Cycle in minutes.
Step 3: Purge	Indicates duration of Purge Cycle in minutes.
Step 4: Evacuate	Indicates duration of Evacuate Cycle in minutes.
Step 5: Cooling	Indicates duration of Cooling Cycle in minutes.
Regen Screen Button	Returns to the Regeneration Control screen.
Solvent Regen Button	Accesses sub-screen below (Figure 18).

Note 1: All times shown are factory defaults.

Note 2: This feature is only available on systems fitted with a Large Capacity Regenerable Solvent Removal System.

4.3.3 Solvent Regen

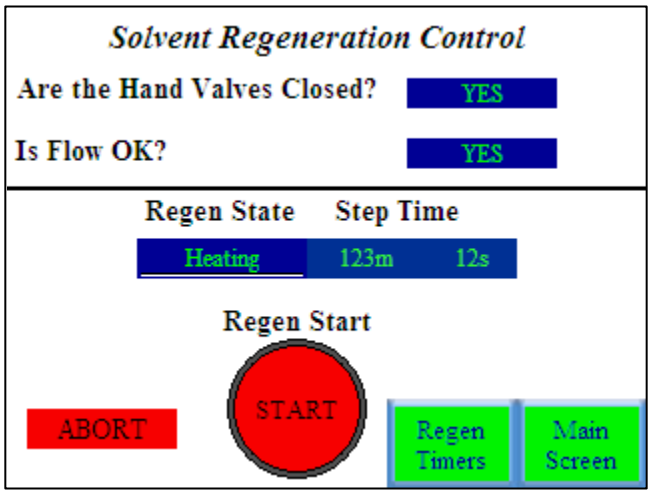


Figure 18 Solvent Regeneration Control screen

Start Button	Initiates a solvent regeneration.
Are the Column Valves Closed?	Prompts the user to CLOSE the manual isolation valves on Large Capacity Regenerable Solvent Removal Column.
Is Flow OK?	Prompts the user to acknowledge that the inert gas is flowing.
Regen Status	Indicates the current step in the regeneration cycle.
Step Time	Indicates the elapsed time for the current step.
Abort Button	Allows the user to abort a regeneration within the first 5 minutes of starting.
Regen Timers Button	Accesses sub-screen below (Figure 19).

4.3.4 Solvent Regen Timers

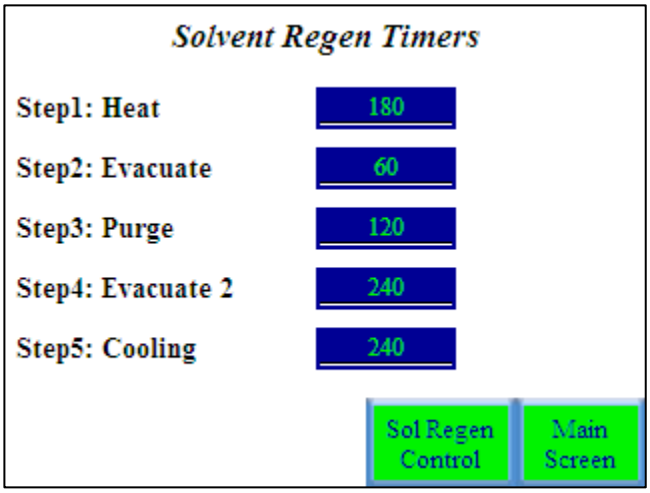


Figure 19 Solvent Regen screen

Step 1: Heat	Indicates duration of Heating Cycle in minutes.
Step 2: Evacuate	Indicates duration of Evacuate Cycle in minutes.
Step 3: Purge	Indicates duration of Purge Cycle in minutes.
Step 4: Evacuate 2	Indicates duration of Evacuate 2 Cycle in minutes.
Step 5: Cooling	Indicates duration of Cooling Cycle in minutes.
Sol Regen Control Button	Returns to the Solvent Regeneration Control screen.

Note: All times shown are factory defaults.

4.3.5 Blower Control

Pressing the **Blower Control** button brings up the following screen (Figure 20):

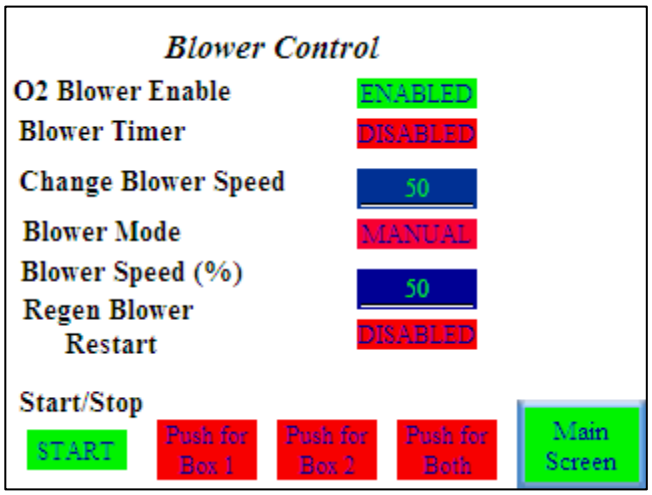


Figure 20 Blower Control screen

The blower can be turned on or off from this screen as well as from the Main Screen.

O2 Blower Speed	Enabling this feature automatically adjusts the blower speed based on the oxygen level within the Glovebox. If the oxygen level is above 10 ppm the blower speed increases in an attempt to scrub out the excess oxygen more quickly.
Blower Timer	Enabling this feature automatically returns the Blower speed to 50% after 30 minutes.
Change Blower Speed	Pressing this button brings up a numeric keypad that allows the blower speed to be changed between 0 and 100%.
Blower Mode	Displays either Automatic (AUTO) or Manual (MANUAL). This is not directly adjustable and is used in diagnostics.
Blower Speed (%)	Displays the current speed of the blower.
Regen Blower Restart	Disabled – Blower will not automatically restart after regeneration cycle is complete. Enabled – Blower automatically restarts after regeneration cycle is complete.
Press for Box 1	Refer to section concerning parallel-piped Glovebox systems**.** See "*Parallel – Piped Systems*" on page 55.
Press for Box 2	Refer to section concerning parallel-piped Glovebox systems**.** See "*Parallel – Piped Systems*" on page 55.
Press for Both	Refer to section concerning parallel-piped Glovebox systems**.** See "*Parallel – Piped Systems*" on page 55.

4.3.6 Purge Control

This feature only displays if your system has been factory-fitted with an Automatic Purge valve.

Pressing the **Purge Control** button brings up the following screen (Figure 21):

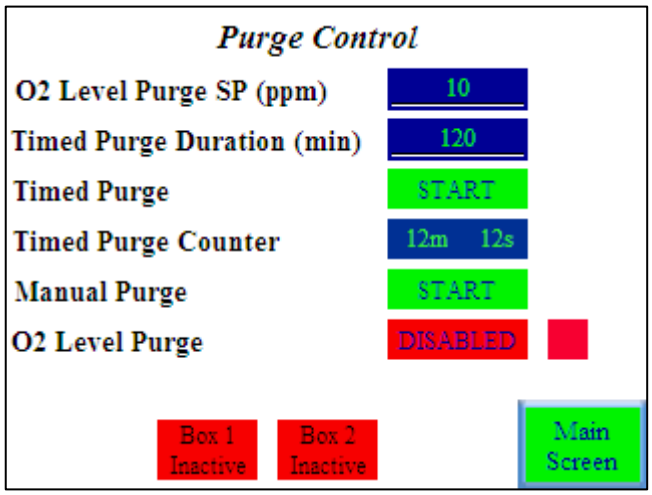


Figure 21 Purge Control screen

O2 Level Purge SP (ppm)	If the system is fitted with an oxygen analyzer this setting will open the automatic purge valve if the oxygen level exceeds the set value. This value can be changed by pressing the value and entering the desired value on the numeric keypad. In order to operate this feature the “O2 Level Purge” must be ENABLED.
Timed Purge Duration (min)	This value sets the length of time that the automatic purge valve will be open if the “Timed Purge” is started.
Timed Purge	Pressing START initiates the timed purge.
Timed Purge Counter	The counter indicates the elapsed time since the Timed Purge was started. After the time limit is reached the automatic purge valve closes.
Manual Purge	Pressing START will open the automatic purge valve. The purge valve will remain open until STOP is Pressed.
Box 1 Active/Inactive	Indicates whether Box 1 can be purged using the auto purge valve.
Box 2 Active/Inactive	Indicates whether Box 2 can be purged using the auto purge valve.

4.3.7 Automatic Antechamber Control

This feature is only displayed if your system has been factory-fitted with automatic Antechamber control.

Pressing the “Automatic Antechamber Control” button brings up the following screen (Figure 22):

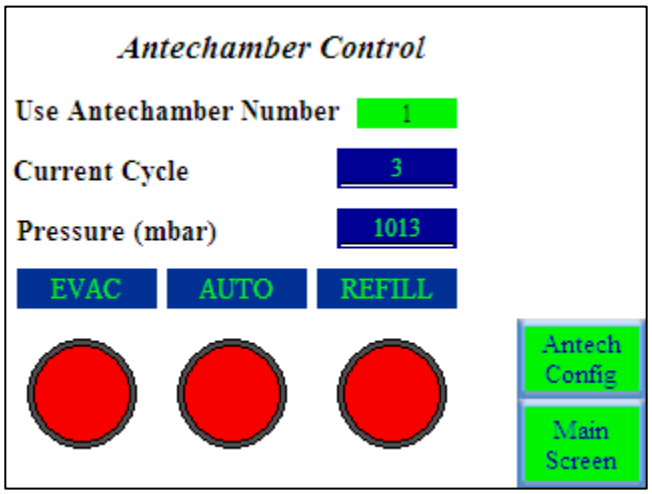


Figure 22 Antechamber Control screen

Use Antechamber Number	Allows the user to select which Antechamber to control. This is only utilized if your system is configured with multiple automatic Antechambers.
Current Cycle	Indicates how many evacuate/refill cycles have already been completed.
Pressure (mbar)	Indicates the absolute pressure within the Antechamber as measured with the digital vacuum gauge.
EVAC	Pressing this evacuates the Antechamber. Press again to stop evacuating.
REFILL	Pressing this refills the Antechamber with inert gas from the Glovebox. Press again to stop refilling.
AUTO	Pressing this causes the button to turn Green and start the evacuate/refill sequence. The individual steps associated with this are accessed and changed in the Antechamber Config screen (Figure 23).

4.3.8 Antechamber Config

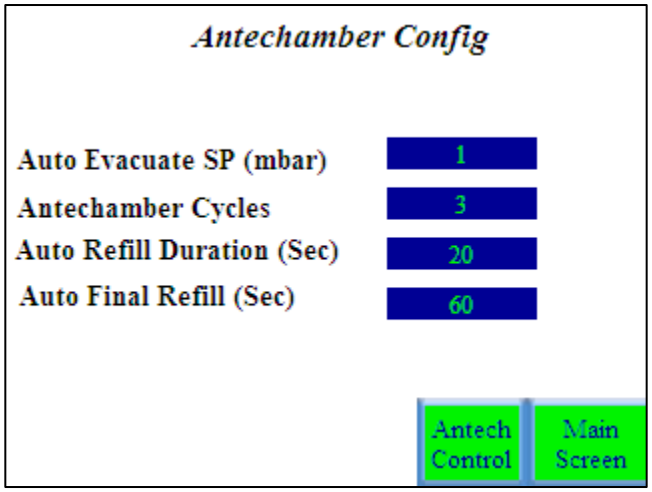


Figure 23 Antechamber Config screen

Auto Evacuate SP (mbar)	The set point that the Antechamber will be evacuated to.
Antechamber Cycles	Determines the number of evacuate/refill cycles that occur under Automatic operation.
Auto Refill Duration (sec)	Determines the duration of all refills except the final refill.
Auto Final Refill	Determines the duration of the final refill.

4.3.9 System Config

Pressing the **System Config** button brings up the following screen (Figure 24):

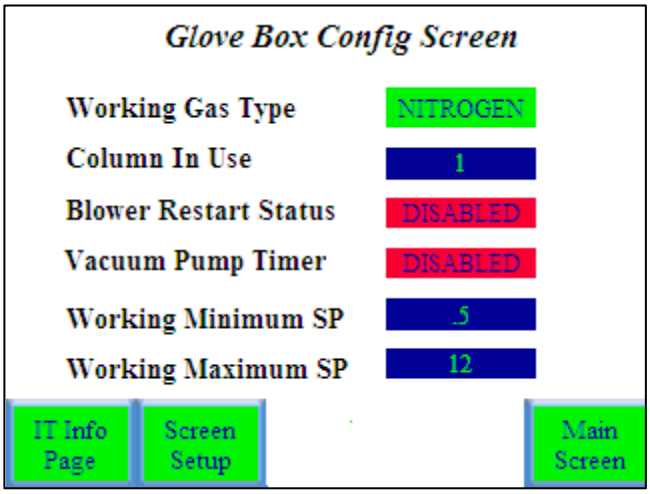


Figure 24 Glove Box Config screen

Working Gas Type	Allows selection of Nitrogen or Argon as working gas.
Column in Use	Indicates which purifier column is currently in use.
Blower Restart Status	When enabled, the blower will automatically restart after a power failure.
Vacuum Pump Timer	When enabled, the vacuum pump will automatically power down after 10 minutes. The vacuum pump will be automatically powered on as required by the system.
Working Minimum SP	The lower working pressure set point.
Working Maximum SP	The higher working pressure set point. **Note:** The PLC control system will maintain the Glovebox pressure between these Minimum and Maximum set points.
IT Info Page	Contains contact information for customer support.
Screen Setup	Allows the contrast of the HMI screen to be adjusted.

4.3.10 Alarms

Pressing the **Alarms** button brings up the following screen (Figure 25):

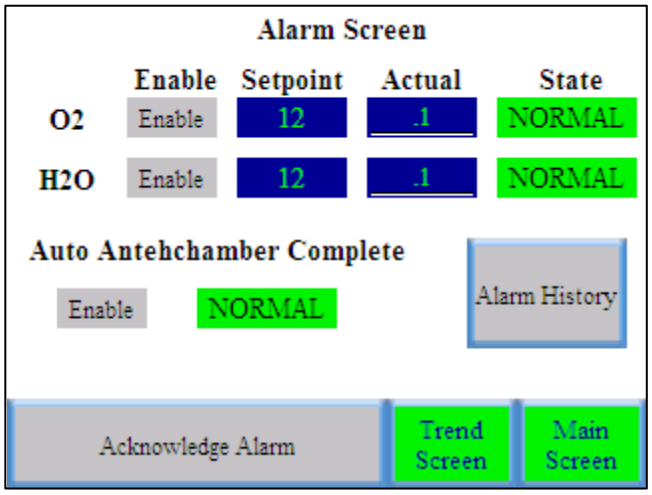


Figure 25 Alarms screen

O2 Alarm	Enabling this feature turns on the O2 level alarm. Set point allows the alarm to be adjusted. Actual is the real-time O2 level. State indicates whether the alarm has been triggered.
H2O Alarm	Enabling this feature turns on the H2O level alarm. Set point allows the alarm to be adjusted. Actual is the real-time H2O level. State indicates whether the alarm has been triggered.
Auto Antechamber Complete	Enabling this feature triggers a pop-up banner indicating the cycle is complete.
Alarm History	A log of the various alarms that have been triggered. **Note:** When an alarm is triggered a pop-up banner displays on the current screen to alert the user.
Acknowledge Alarm	This button must be pressed to clear any active alarms.

Trend Screen

This button access graph (Figure 26) logs 02 and H20 levels over time.

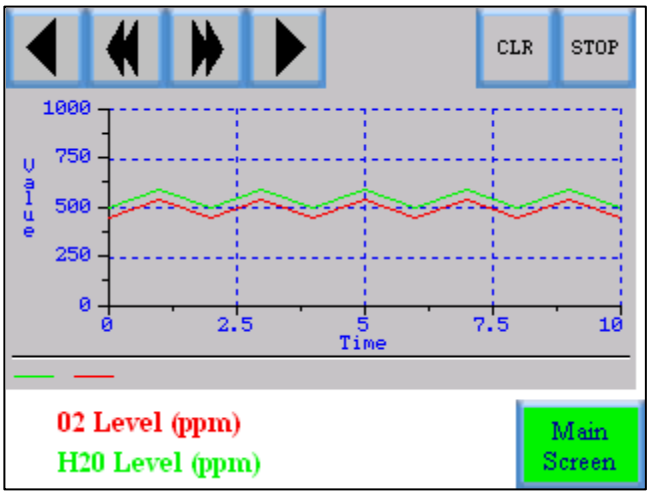


Figure 26 Trend screen

4.3.11 Freezer Control

This feature only displays if your system has been factory-fitted with a freezer.

Pressing the **Freezer Control** button brings up the following screen (Figure 27):

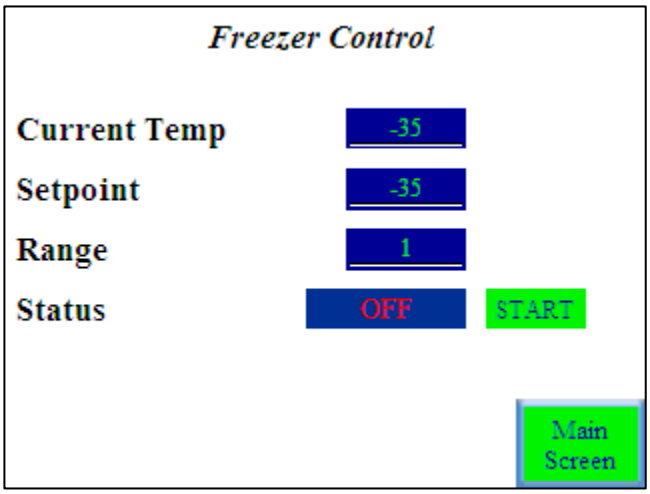


Figure 27 Freezer Control screen

Current Temp	Indicates the actual temperature (°C) inside the freezer.
Set point	Allows the temperature inside the freezer to be adjusted.
Range	The deviation +/- °C from the set point.
Status	Turns the freezer On and Off.

Note: If your Glovebox is equipped with a freezer do not plug in or turn on the freezer until the box has been purged with the freezer door open.

Turning the freezer on while the Glovebox contains room atmosphere will result in the condensation of moisture preventing the Glovebox from achieving optimum atmosphere conditions, i.e. preventing the system from being able to reach 1 ppm moisture content.

4.3.12 Box Cooling Control

This feature is only displayed if your system has been factory-fitted with Box Cooling.

Pressing the Box Cooling Control button brings up the following screen (Figure 28):

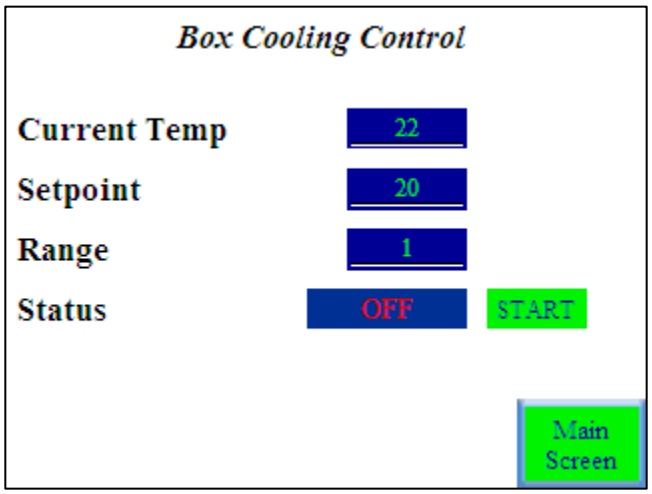


Figure 28 Box Cooling Control screen

Current Temp	Indicates the actual temperature (°C) inside the Glovebox.
Set point	Allows the temperature inside the Glovebox to be adjusted.
Range	The deviation +/- °C from the set point.
Status	Turns the Box Cooling On and Off.

4.3.13 Heater Control

This feature only displays if your system has been factory-fitted with a heated Antechamber.

Pressing the Heater Control button brings up the following screen (Figure 29):

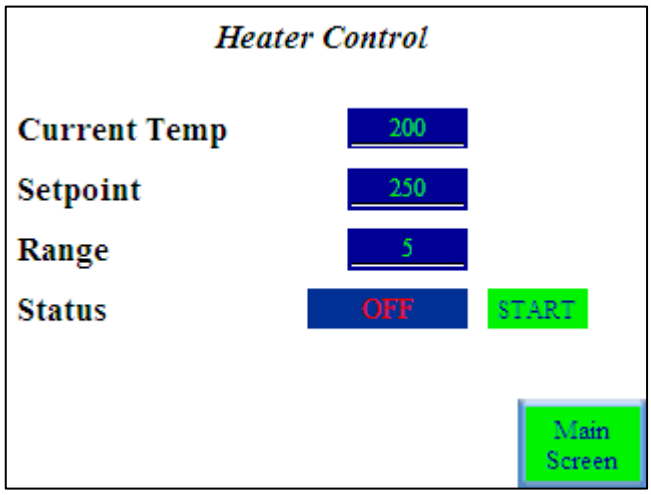


Figure 29 Heater Control screen

Current Temp	Indicates the actual temperature (°C) inside the heated Antechamber.
Set point	Allows the temperature inside the Antechamber to be adjusted.
Range	The deviation +/- °C from the set point.
Status	Turns the Heater On and Off.

5 System Operation

5.1 Adjusting the System Pressure

The Glovebox control system is programmed to maintain the Glovebox pressure between the minimum and maximum working pressure settings.

To adjust these pressure settings

1 Press the **System Config** button.

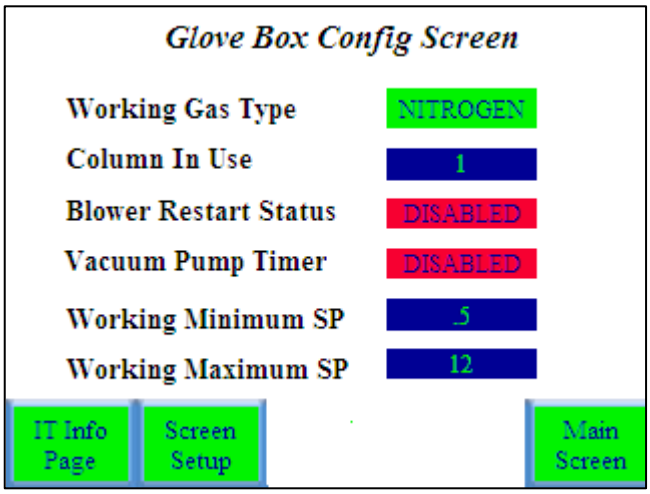


Figure 30 Glove Box Config screen

2 Press the Numeric blue display button next to Working Maximum SP. A Numerical Input screen appears. Type in the desired maximum pressure and Press the **Enter** key.

3 Press the Numeric blue display button next to Working Minimum SP. A Numerical Input screen will appear. Type in the desired minimum pressure and Press the **Enter** key.

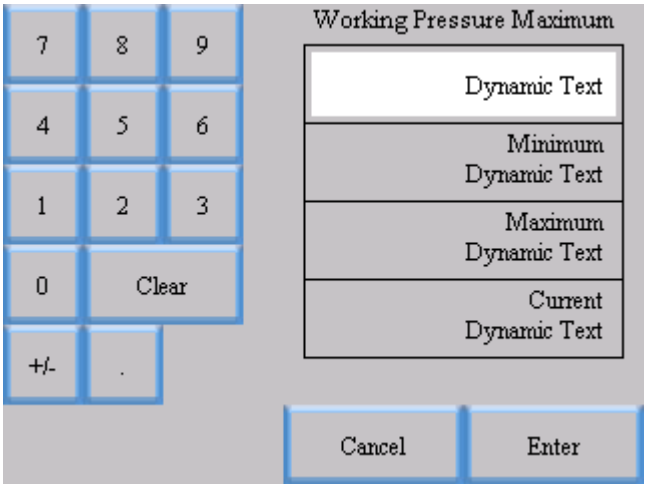


Figure 31 Numerical Input screen

The Glovebox will automatically adjust the Glovebox pressure to be between these two limits.

5.2 Using the Antechambers

5.2.1 Manual Antechamber Control

This section describes the manual operation of the large Antechamber. Specifically, it lists the steps necessary to transfer an object into and out of the Glovebox. These steps assume that the atmosphere inside the chamber is pure and not open to the outside air.

Introducing an item into the Glovebox using the Large Antechamber

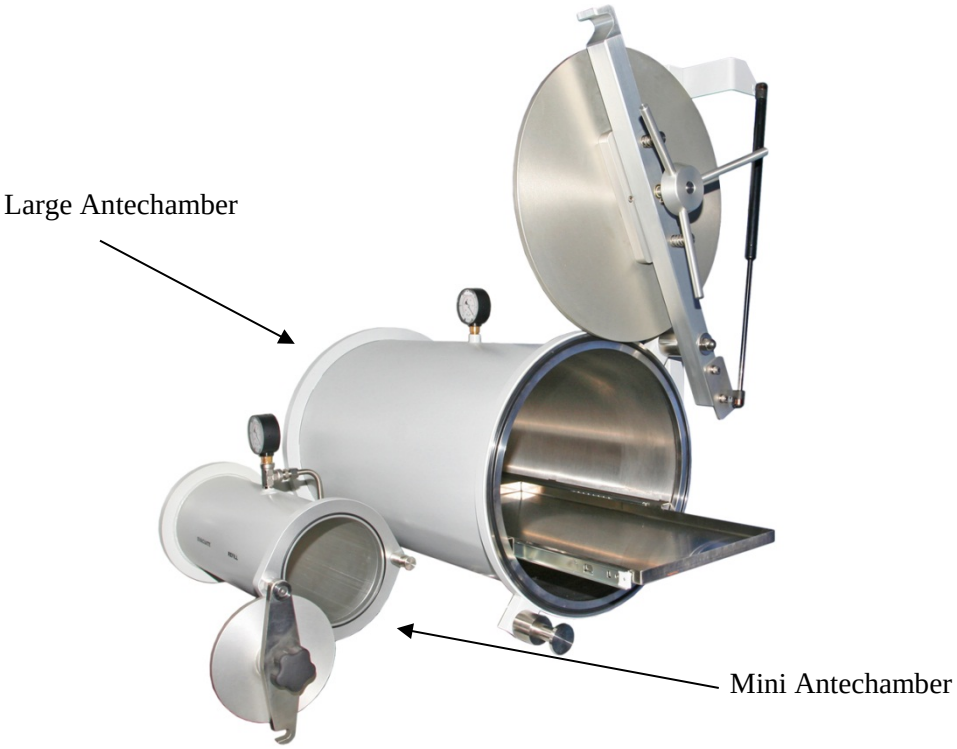


Figure 32 Large and Mini Antechambers

1. Ensure that the inner door is fully closed.
2. Ensure that the refill valve is closed.
3. Open the outside door and insert the object into the Antechamber.
4. Close the outside door.
5. Open the vacuum valve to evacuate the Antechamber (-29 in. HG).
6. Close the vacuum valve and open the refill valve until the pressure reads –15 in HG.
7. Repeat steps 5) and 6 at least three times, finally refilling to atmospheric pressure.
8. Close the refill valve.
9. Open the inner door and remove the object from the Antechamber.

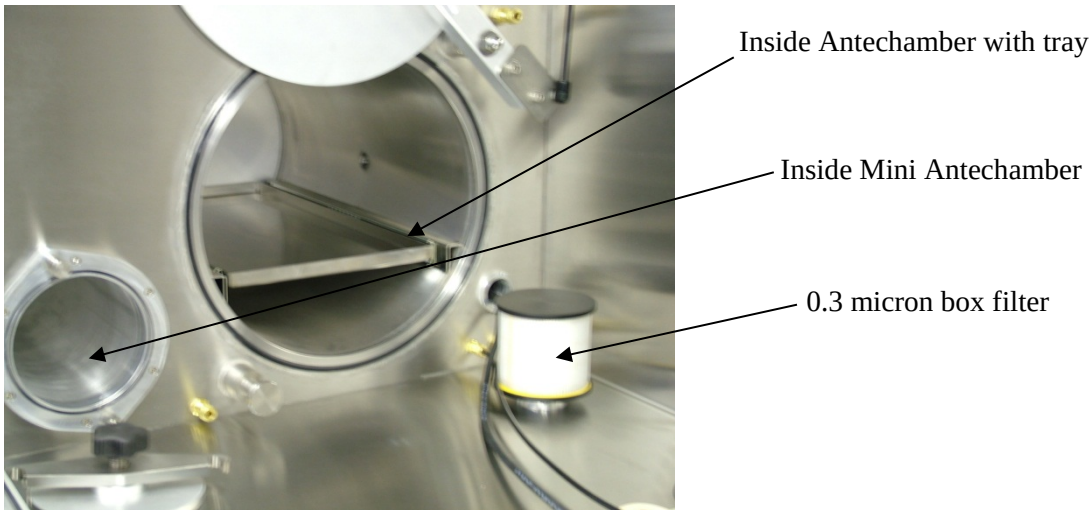


Figure 33 Inside Antechambers

5.3 Removing an Item from the Glovebox Using the Large Antechamber

It is extremely important that the Antechamber contains purified gas since opening the inner door will expose the box to the Antechamber. If you are not certain of the status of the Antechamber, then evacuate and refill 3 times before proceeding.

We suggest that you keep the Antechamber under vacuum. This will prompt you to refill before proceeding.

1. Ensure that the outside door is fully closed.
2. Ensure that the refill valve is closed.
3. Open the inner door.
4. Insert the object into the Antechamber and close the inner door.
5. Open the outside door and remove the object.

5.4 Mini Antechamber

The same precautions above are true for the mini Antechamber.

This section describes the manual operation of the mini Antechamber. Specifically, it lists the steps necessary to transfer an object into and out of the Glovebox. These steps assume that the atmosphere inside the chamber is pure and not open to the outside air.

5.4.1 Introducing an Item into the Glovebox Using the Mini Antechamber

1. Ensure that the inner door is fully closed.
2. Ensure that the 3-way valve for mini is closed.
3. Open outside door and insert the object.

4 Close outside door.

5 Turn 3-way valve to evacuate.

6 Evacuate to best level of vacuum (-29 hg).

7 Turn 3-way valve to refill.

8 Repeat steps 5 through 7 at least three times.

9 Close 3-way valve.

10 Open inner door and remove object from chamber.

5.4.2 Removing an Item from the Glovebox Using the Mini Antechamber

1 Ensure that the outside door is fully closed.

2 Ensure that the 3-way valve for mini is closed.

3 Open inner door and insert the object.

4 Close inner door.

5 Open the outer door and remove the object.

Since the chambers share common vacuum and gas piping, we do not recommend using both at the same time.

5.5 Automatic Antechamber Control

This feature is only displayed if your system has been factory-fitted with automatic Antechamber control.

Pressing the “Automatic Antechamber Control” button brings up the following screen:

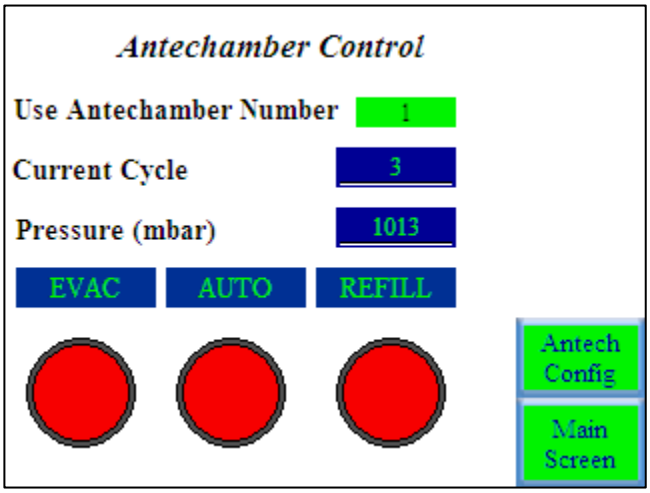


Figure 34 Antechamber Control screen

Use Antechamber Number	Allows the user to select which Antechamber to automatically control. Typical systems will have one large Antechamber equipped with automatic control.
Current Cycle	Indicates how many evacuate/refill cycles have already been completed.
Pressure (mbar)	Indicates the absolute pressure within the Antechamber as measured with by the digital vacuum gauge.
EVAC	Pressing this evacuates the Antechamber. Press again to stop evacuating.
REFILL	Pressing this refills the Antechamber with inert gas from the Glovebox. Press again to stop refilling.
AUTO	Pressing the AUTO button causes the button to turn Green and start the evacuate/refill sequence. The individual steps associated with this are accessed and changed in the 'Antechamber Config" screen.

Antechamber Config

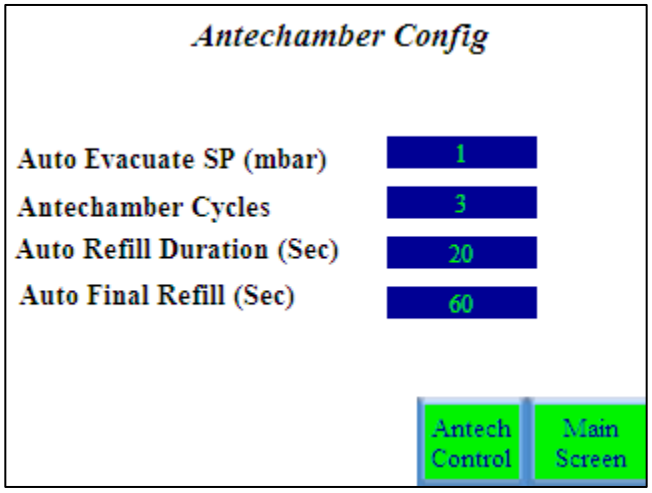


Figure 35 Antechamber Config screen

Auto Evacuate SP (mbar)	The set point that the Antechamber will be evacuated to.
Antechamber Cycles	Determines the number of evacuate/refill cycles that occurs under Automatic operation.
Auto Refill Duration (sec)	Determines the duration of all refills except the final refill.
Auto Final Refill	Determines the duration of the final refill.

5.6 Introducing an Item into the Glovebox Using the Large Antechamber

1. Ensure that the inner door is fully closed.
2. Ensure that the refill valve is closed.
3. Open the outside door and insert the object into the Antechamber.

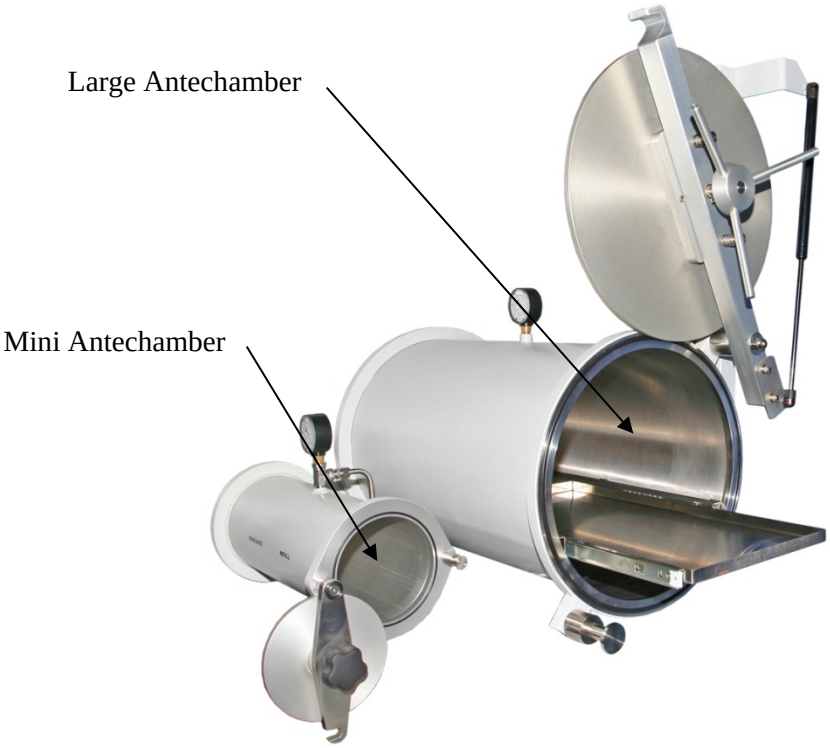


Figure 36 Inserting an object into the Antechamber

4 Close the outside door.

5 Press the Auto button.

The system evacuates and refills as many cycles as programed.

The system final refills.

6 Open the inner door and remove the object from the Antechamber

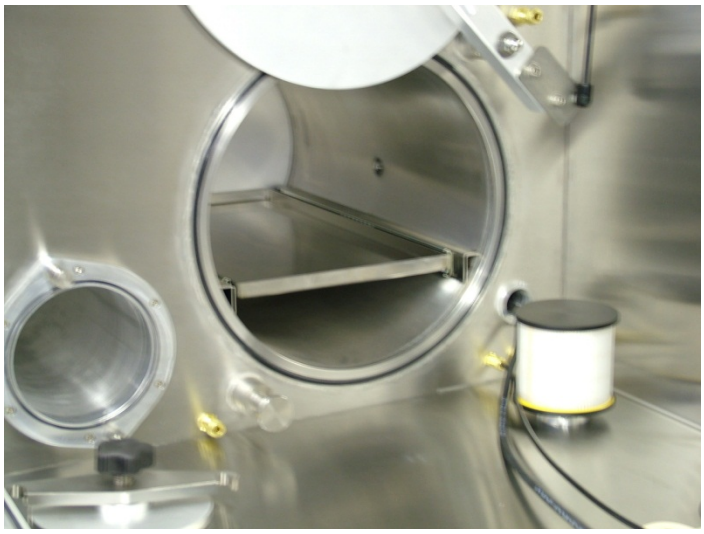


Figure 37 Removing object from Antechamber

5.7 Removing an Item from the Glovebox Using the Large Antechamber

It is extremely important that the Antechamber contains purified gas because opening the inner door will expose the box to the Antechamber. If you are not certain of the status of the Antechamber, then evacuate and refill 3 times before proceeding.

We suggest that you keep the Antechamber under vacuum. This will prompt you to refill before proceeding.

1. Ensure that the outside door is fully closed.
2. Ensure that the refill valve is closed.
3. Open the inner door.
4. Insert the object into the Antechamber and close the inner door.
5. Open the outside door and remove the object.

5.8 Purge Valves

Manual Purge Valve – As standard the Glovebox is fitted with a hand-operated 2-Way Ball Valve that is used to manually displace atmosphere from the Glovebox. The valve must be closed fully after purging process to prevent loss of box pressure.

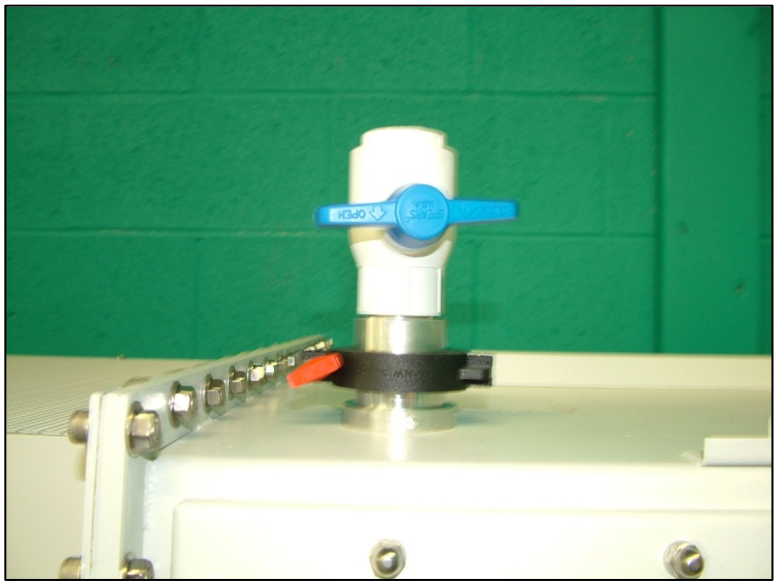


Figure 38 Hand-operated 2-Way Ball Valve

5.8.1 Automatic Purge Valve

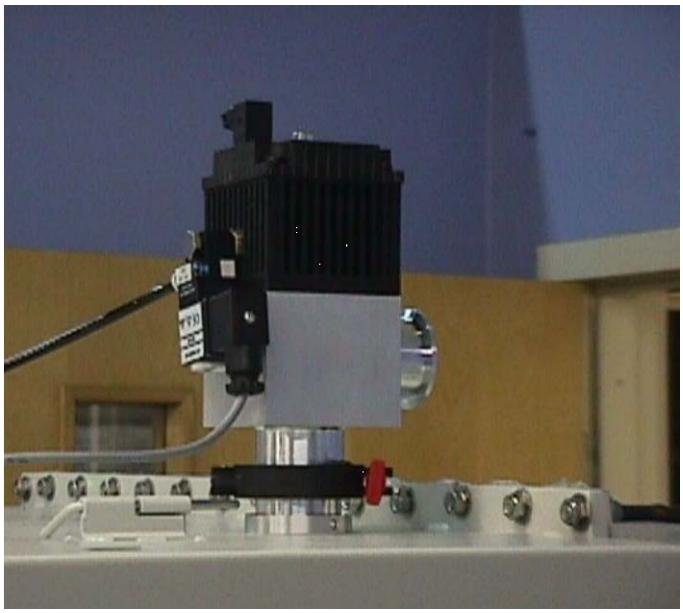


Figure 39 Automatic purge valve

This feature is only available if your system has been factory-fitted with an automatic purge valve.

Pressing the “Purge Control” button brings up the following screen (Figure 40):

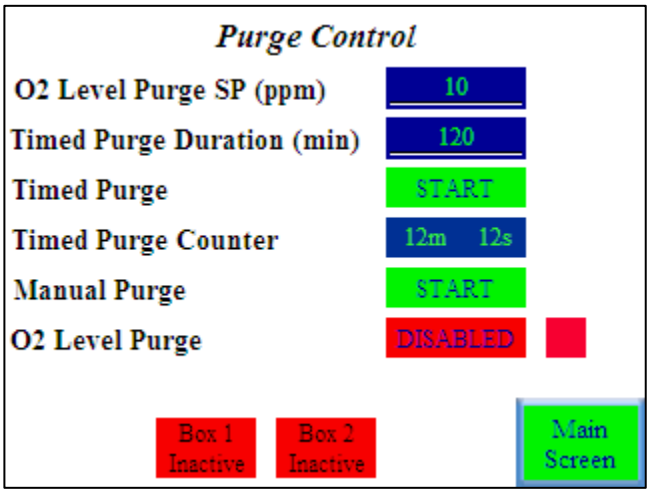


Figure 40 Purge Control screen

O2 Level Purge SP (ppm)	If the system is fitted with an oxygen analyzer this setting will open the automatic purge valve if the oxygen level exceeds the set value. This value can be changed by pressing the value and entering the desired value on the numeric keypad. In order to operate this feature the “O2 Level Purge” must be ENABLED.
Timed Purge Duration (min)	This value sets the length of time that the automatic purge valve will be open if the “Timed Purge” is started.
Timed Purge	Pressing START initiates the timed purge.
Timed Purge Counter	The counter indicates the elapsed time since the Timed Purge was started. After the time limit is reached, the automatic purge valve closes.
Manual Purge	Pressing START opens the automatic purge valve. The purge valve remains open until STOP is pressed.
Box 1 Active/Inactive	Indicates whether Box 1 can be purged using the auto purge valve.
Box 2 Active/Inactive	Indicates whether Box 2 can be purged using the auto purge valve.

Note: Initiating any purge sequence while the blower is running will switch off the blower until the purge sequence is complete. The blower will automatically restart after the purge sequence is complete.

5.9 Regeneration

Pressing the “Regen Control” button brings up the following screen (Figure 41):

This screen allows the user to initiate a regeneration of the purification column.

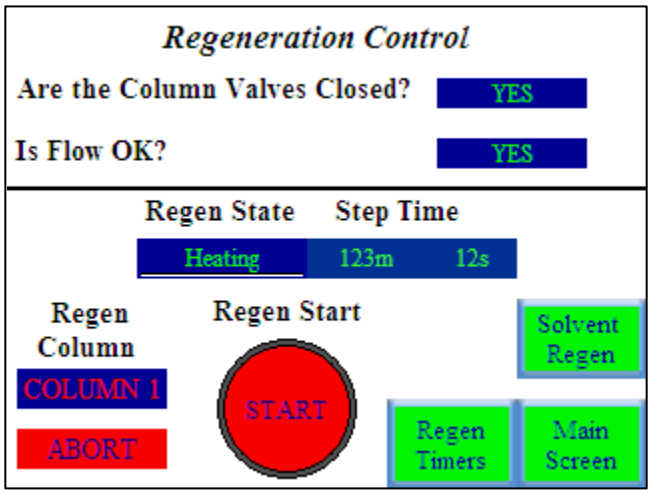


Figure 41 Regeneration Control screen

The purification column contains a mixture of copper-based catalyst to absorb oxygen and molecular sieve to absorb moisture. Over time these materials will become saturated and will no longer be able to absorb the oxygen and water. The regeneration process allows these materials to be returned to their original state thus allowing continued scrubbing of oxygen and moisture.

To maintain optimal performance it is recommended to change the purifier catalyst every three years.

WARNING: The final step (step 5 Cooling) of the regeneration process exposes the freshly-regenerated purifier material to the Glovebox atmosphere. The Glovebox must contain less than 100 ppm oxygen prior to starting the regeneration.

A regeneration cycle comprises five steps as shown below (Figure 42). The default times are shown and are measured in minutes.

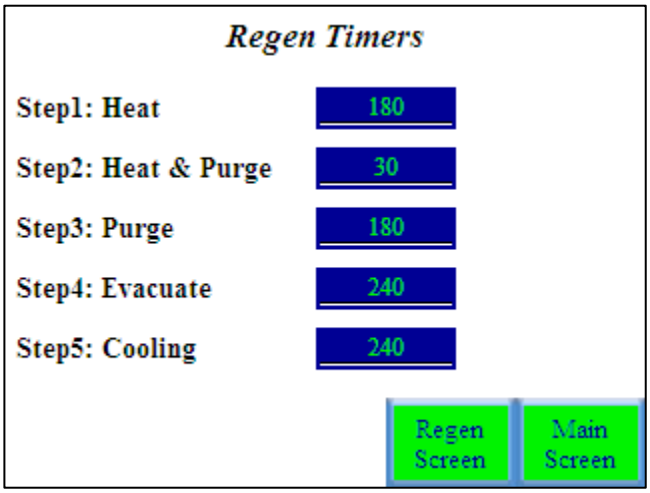


Figure 42 Regen Timers screen

5.9.1 Single-Column Purification System Regeneration Procedure

1. Connect a cylinder of regeneration gas (forming gas) to the regen gas connection on the rear of the gas purification module. The regeneration gas must contain 3 to 7% hydrogen with the balance being nitrogen or argon. Ensure that the connections are tightened correctly. Open the regulator and set it to 7 psi.
2. Turn off the Blower on the Main screen. On a single column system this automatically closes the purification column valves.
3. Press the START button.
4. Press the Yes button next to “Are the Column Valves Closed?” A “click” will be heard as the solenoid valves open to allow regeneration gas to flow.

   Note: All column isolation valves have a yellow indicator tab. This yellow tab is not visible when the valve is closed.
5. Adjust needle valve on the regeneration flow meter located on the front of the gas purification module to set the flow to 25-30 scfh on the graduated scale on the flow meter.
6. Press **Yes** next to “Is Flow OK?”. At this point the regeneration gas will stop flowing. “Step 1. Heating” begins. The Regen Status displays as Heating and the timer begins to count up. The Regeneration Status is also shown on the Main Screen.
7. The system automatically progresses through the regeneration steps 1 to 5. At the conclusion of the regeneration sequence the blower automatically turns back on if this feature has been

enabled in the “System Config” Screen. The blower can also be turned on using the Blower Start button.

5.10 Dual-Column Purification System Regeneration Procedure

Dual column purification systems allow the regeneration of one purifier column while still circulating the Glovebox atmosphere through the second column. This permits constant uptime.

Initiating a regeneration on a dual column system automatically regenerates the column that is NOT in use. The column in use can be selected from the “System Config” Screen (Figure 43).

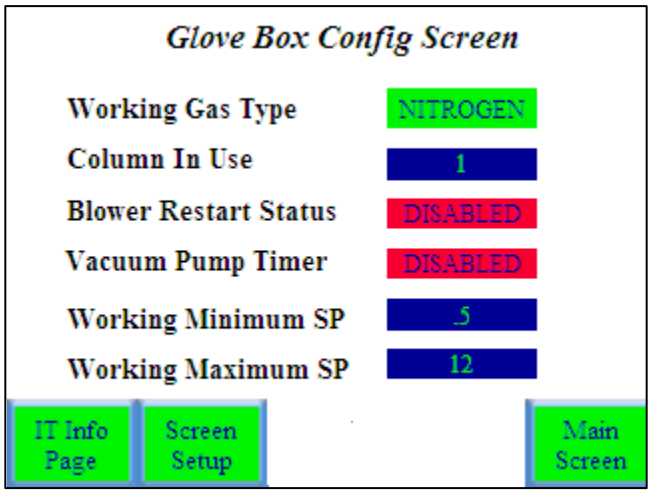


Figure 43 Glove Box Config screen

If the “Column In Use” is shown as “1” then pressing the blue bar brings up a numeric entry keypad. To select column 2, press number **2** and then enter.

To regenerate perform steps 1, 3,4,5,6 as for the single column purification system regeneration. The blower should remain switched on during the regeneration of a dual column system,

5.11 Solvent Regeneration

5.11.1 Solvent-Column System Regeneration Procedure

Note: Blower does not need to be turned off.

1. Connect a cylinder of high purity Inert Gas (Nitrogen or Argon) to the regen gas connection on the rear of the gas purification module. The Inert gas should be 99.998 nitrogen or argon. Ensure that the connections are tightened correctly. Open the regulator and set it to 7 psi.
2. Open the by-pass valve (labeled A in Figure 44 below). This is located in the Gas Purifier. The top must be removed to access valve

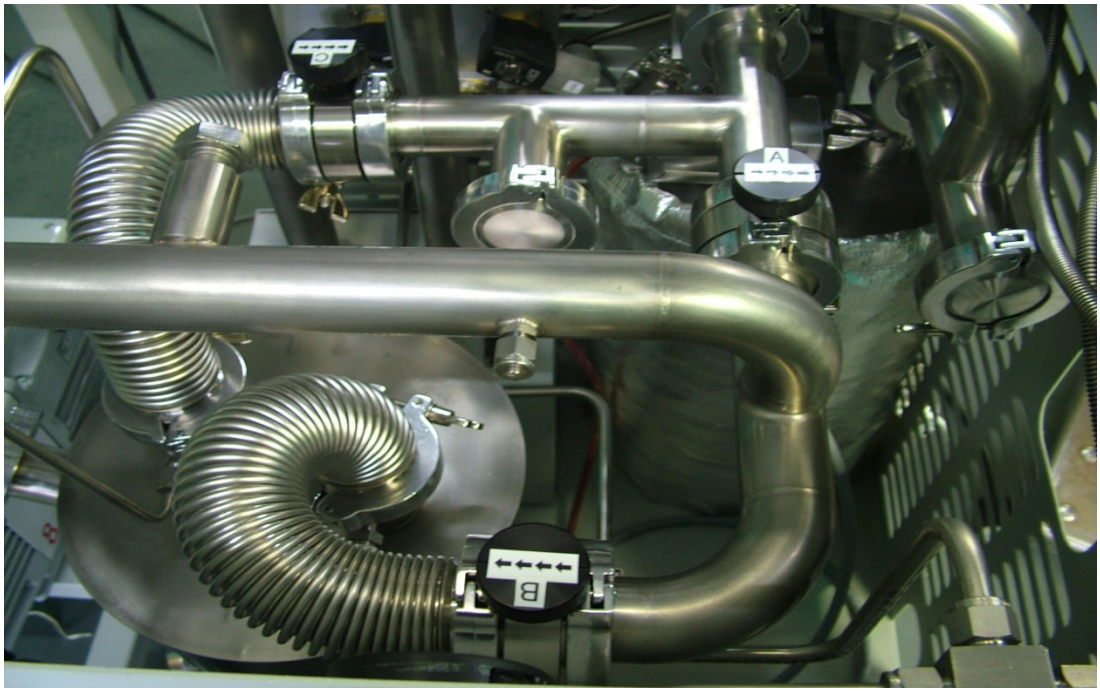


Figure 44 Gas purification module

3 Close the isolation valves (labeled B & C) connected to the solvent column. This is located in the Gas Purifier. The top must be removed to access valve.

4 From the Main Control Screen select Regen Control. Then select Solvent Regen.

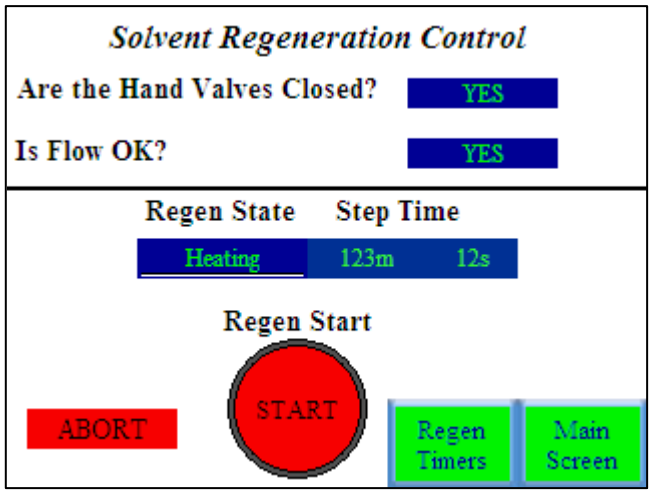


Figure 45 Solvent Regeneration Control screen

5 Press the START button (Figure 45).

6 Press the **Yes** button next to “Are the Column Valves Closed?” A “click” will be heard as the solenoid valves open to allow regeneration gas to flow.

7 Adjust needle valve on the regeneration flow meter located on the front of the gas purification module to set the flow to 25-30 scfh on the graduated scale on the flow meter.

8 Press **Yes** next to “Is Flow OK?”. At this point the regeneration gas stops flowing. Step 1. Heating begins. The Regen Status shows as Heating and the timer begin to count up. The Regeneration Status is also shown on the Main Screen.

9 The system automatically progresses through the regeneration steps 1 to 5.

10 Upon completion of the solvent regeneration, open the column isolation valves (B & C), then close the Solvent by-pass valve (A).

5.12 Analyzers

5.12.1 O2 Analyzer

When shipped, the oxygen analyzer valves are closed as shown in Figure 46 below:

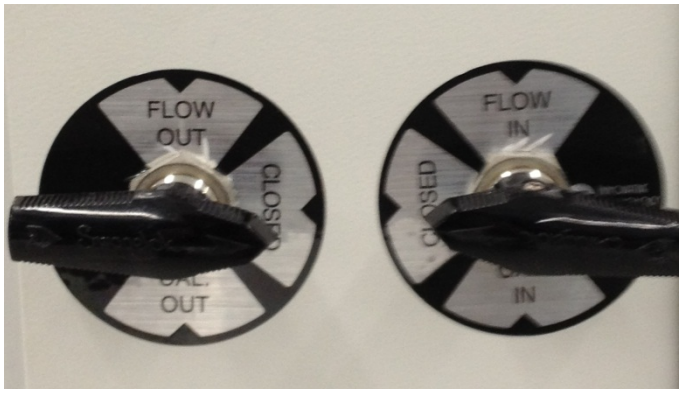


Figure 46 Oxygen analyzer valves – “Closed” position

WARNING: The analyzer isolation valves should remain closed until the Glovebox has been properly purged.

In order to monitor the oxygen content inside the Glovebox, the left Valve must be turned to the “Flow Out” Position and the Right Valve must be turned to the “Flow In” position as shown in Figure 47 below:

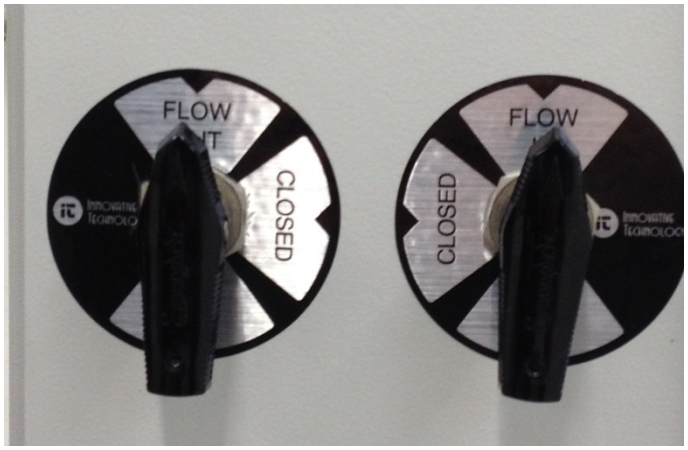


Figure 47 Oxygen analyzer valves – “Flow Out” position

The Oxygen analyzer is designed specifically for detecting trace amounts of oxygen in inert gases. The operational range of this analyzer is 0.1 to 1,000 ppm.

Note 1: The analyzer requires that the small batching pump inside the Glovebox be connected and powered on at all times.

Note 1: The analyzer is calibrated at the factory prior to shipment.

5.13 Moisture Analyzer

The moisture analyzer sensor is aluminum oxide ultra-high capacitance designed. It incorporates automatic temperature compensation. It is mounted in the gas stream piping.

It is shipped with a calibration certificate traceable to international standards.

The moisture content is shown on Main Screen of the Color HMI touch screen in ppm.

Freezer

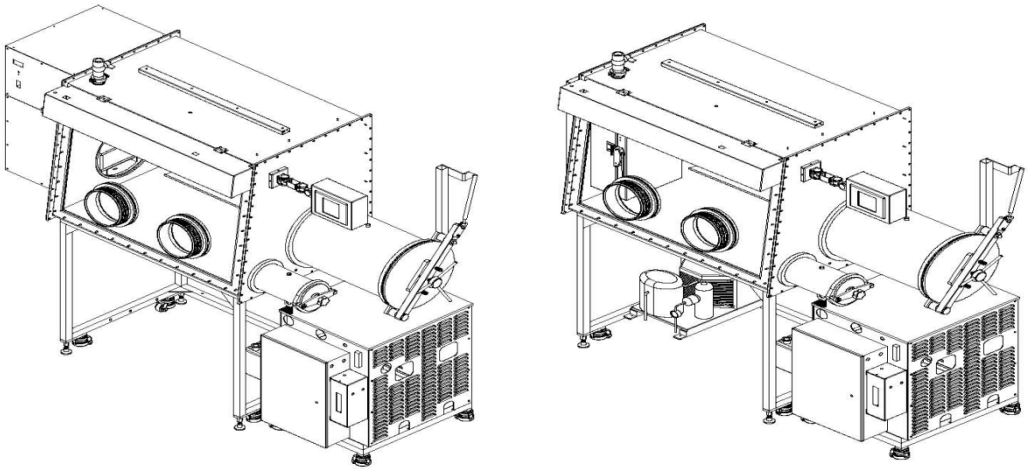


Figure 48 Moisture Analyzer

The freezer is controlled from the HMI.

Pressing the “Freezer Control” button brings up the following screen (Figure 49):

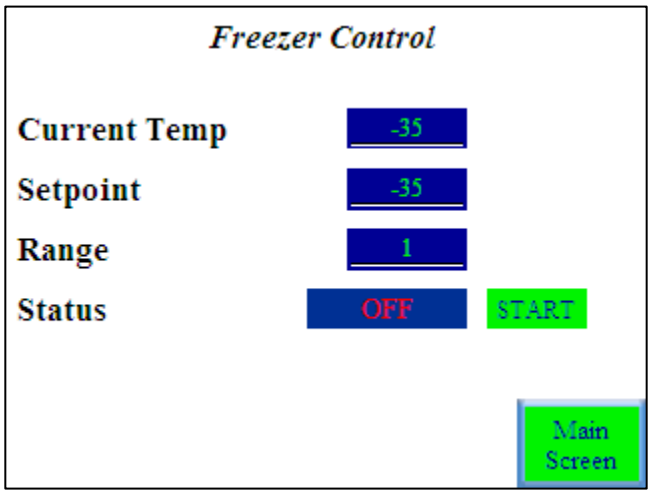


Figure 49 Freezer Control screen

Current Temp	Indicates the actual temperature (°C) inside the freezer.
Set point	Allows the temperature inside the freezer to be adjusted. Max set point is -35 c.
Range	The deviation +/- °C from the set point.
Status	Turns the freezer On and Off. By pressing the green start button or red stop button.

Shelves

Cylinderical freezer has a sliding tray with 2 or 3 shelves.

Rectangle freezer has 5 removable shelves.

5.13.1 Box Cooling Control

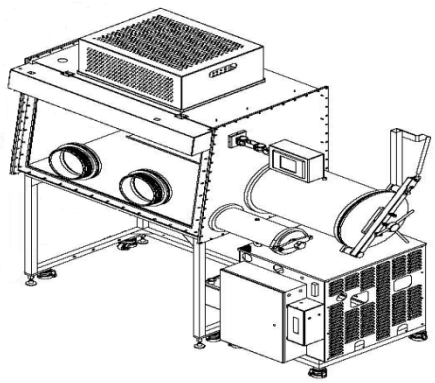


Figure 50 Box Cooling Control

This feature is only displayed if your system has been factory-fitted with Box Cooling.

Pressing the “Box Cooling Control” button brings up the following screen (Figure 51):

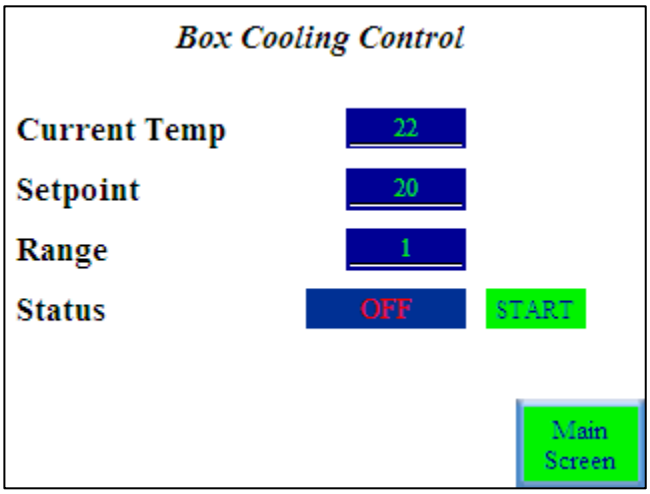


Figure 51 Box Cooking Control screen

Current Temp	Indicates the actual temperature (°C) inside the Glovebox.
Set point	Allows the temperature inside the Glovebox to be adjusted.
Range	The deviation +/- °C from the set point.
Status	Turns the Box Cooling On and Off. By pressing the green start button or red stop button.

Note: Boxing will remove 10 degrees for ambient system temp.

5.14 Heater Control

This feature is only displayed if your system has been factory-fitted with a heated Antechamber.

Pressing the “Heater Control” button brings up the following screen (Figure 52):

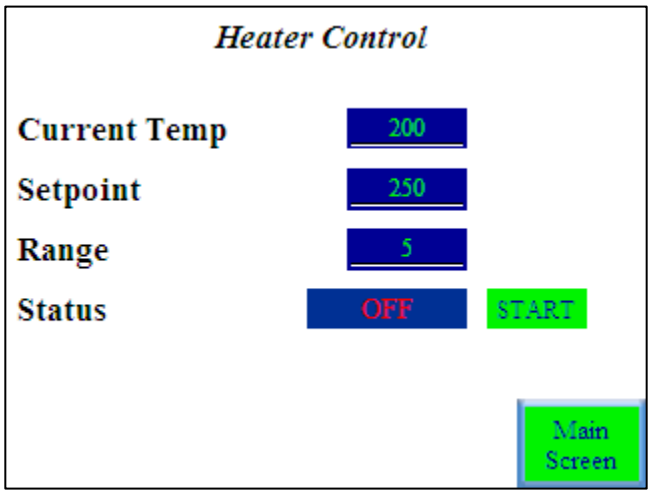


Figure 52 Heater Control screen

Current Temp	Indicates the actual temperature (°C) inside the heated Antechamber.
Set point	Allows the temperature inside the Antechamber to be adjusted up to 250 C.
Range	The deviation +/- °C from the set point.
Status	Turns the Heater On and Off. By pressing green start button or red stop button.

WARNING: Users can be burned if Ante chamber is not operated properly.

5.14.1 Parallel – Piped Systems

Parallel-piping offers the convenience of using a single purifier to control two separate Glovebox modules. It is intended that the primary mode of operation will be both Glovebox modules running simultaneously. In this case the atmosphere inside each Glovebox module is being circulated through the purifier column. The O2 and H2O values displayed are representative of the atmosphere in both Gloveboxes as they share a common atmosphere. Each Glovebox module (1 & 2) is fitted with automatic valves on the gas inlet and outlet to allow isolation of the 2 Glovebox modules.

One Glovebox module is defined as Box 1 and the other module is Box 2.

Under the sub screen Blower Control. The system can operate 3 ways.

Press for Box 1 – Selecting this will change the button to green to indicate that the purifier will only interact with Box 1. Pressure will only be controlled in Box1 and the displayed O2 and H2O values are for Box 1 only.

WARNING: In this state Box 2 is completely isolated and should not be used. This mode would typically be used to enable Box 2 to be opened to air for cleaning while continuing to circulate Box 1 atmosphere through the purifier.

Press for Box 2 – Selecting this will change the button to green to indicate that the purifier will only interact with Box 2. Pressure will only be controlled in Box 2 and the displayed O2 and H2O values are for Box 2 only.

WARNING: In this state Box 1 is completely isolated and should not be used. This mode would typically be used to enable Box 1 to be opened to air for cleaning while continuing to circulate Box 2 atmosphere through the purifier.

Press for Both – Selecting this changes the button to green to indicate that the purifier will circulate through both Box 1 AND Box 2 when the blower is started.

Note: For the three modes of operation described above the Blower Start button must be used to initiate circulation.

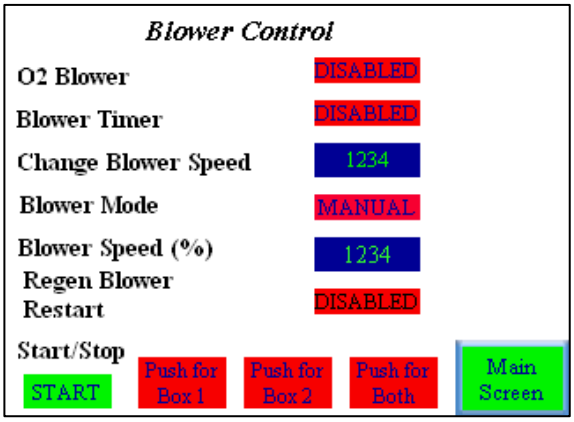


Figure 53 Blower Control screen

Purging Parallel Piped System

The user must select which Box (1 or 2) to purge.

Manual Purge – Only open the purge valve on the selected Glovebox module (1 or 2).

See "*Purge Control*" on page 31 for further details.

Auto Purge

Press for Box 1 – Selects the module labeled Box 1 to be purged (See "*Purge Control*" on page 31) (Purge control – refer to Purge Control Screen in Figure 54 below) Box 1 Active button will be Green indicating that it will be purged. Box 2 will be isolated.

Press for Box 2 – Selects the module labeled Box 2 to be purged (See "*Purge Control*" on page 31) (Purge control – refer to Purge Control Screen in Figure 54 below) Box 2 Active button will be Green indicating that it will be purged. Box 1 will be isolated

Note: Only one module should be selected to purge at a given time.

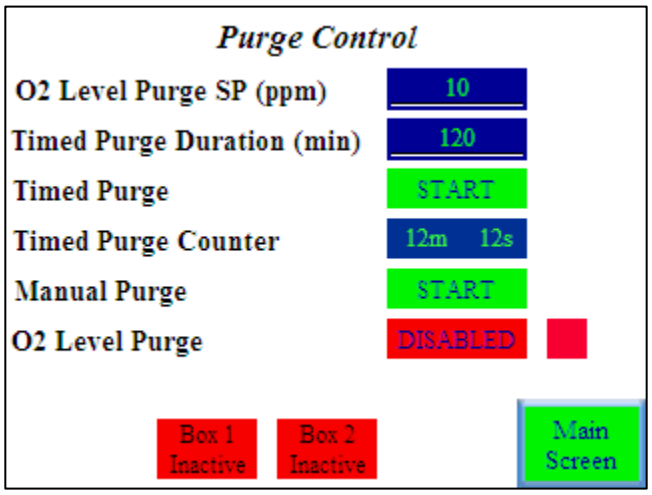


Figure 54 Purge Control screen

5.15 Solvent Removal Systems

Various sizes of solvent removal systems are available. These are optional extras that can absorb solvent vapors that would otherwise contaminate the purification media.

5.15.1 Large Capacity Solvent Removal

There are three isolation valves labeled A, B, and C. The isolation valves dictate the flow of box atmosphere, routing it directly to the purification column or through the solvent removal column prior to the purification column. There are arrows on these valves, indicating the direction of flow through them. To open them, turn the black knob counterclockwise. To close them, turn the black knob clockwise.

The evac/refill valve is located on the front of the unit. To the left of the valve is a pressure gauge that indicates the pressure inside the solvent removal column. Evacuate will open the solvent removal column directly to the vacuum pump. Refill will expose it to the box atmosphere as well as the incoming working gas supply.

5.15.2 Opening the Solvent Removal Column

1. Refill the column by turning the evac/refill valve to refill until the pressure gauge has returned to 0, and then close the valve.
2. Open isolation valves B and C.
3. Close isolation valve A. It is important that B and C be opened prior to A being closed so that flow to the blower will not be interrupted.
4. The flow of box atmosphere is now passing through the solvent removal column prior to passing through the purification column.

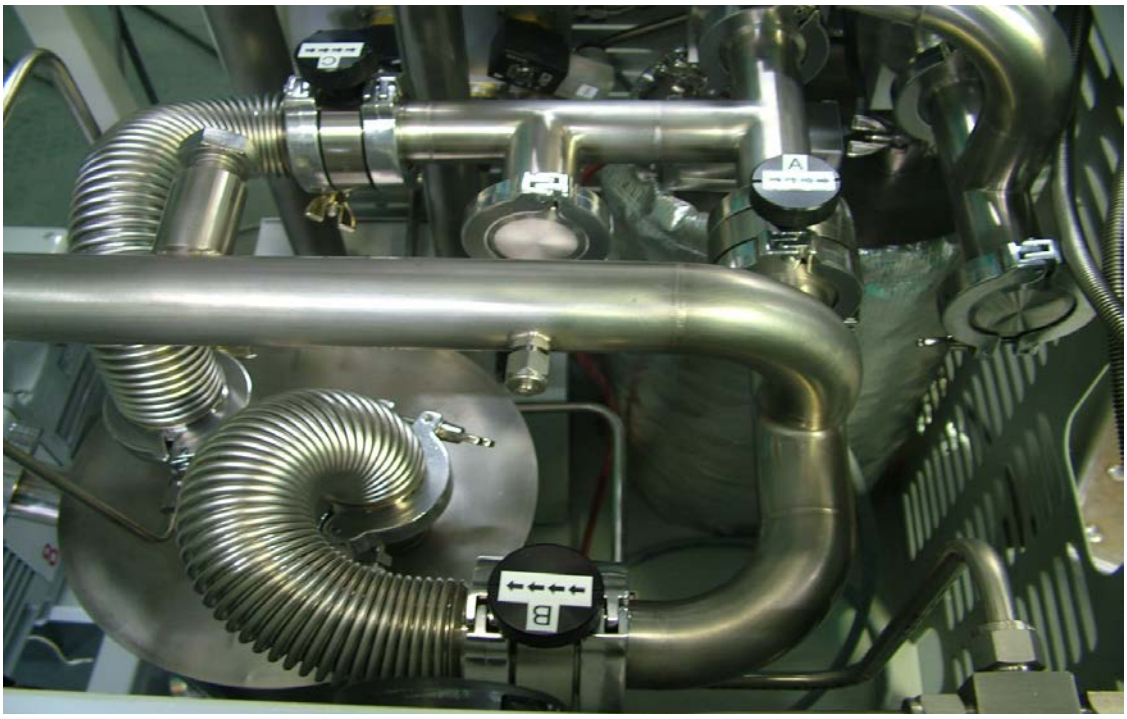


Figure 55 Solvent Removal Column - Open

5.15.3 Isolating the Solvent Removal Column and Removing Solvent Vapors

1. Open isolation valve A. This allows the system to continue to circulate through the purification column.
2. Close isolation valves B and C. This isolates the solvent removal column so that you can evacuate it without affecting the rest of the system. It is important to open valve A prior to closing B and C so that flow to the blower is not interrupted.
3. Turn evac/refill valve to evacuate.
4. Allow vacuum to pull on the column for at least 24 hours.
5. To begin circulation through the solvent removal column again, see “*Opening the Solvent Removal Column*” on page 57.

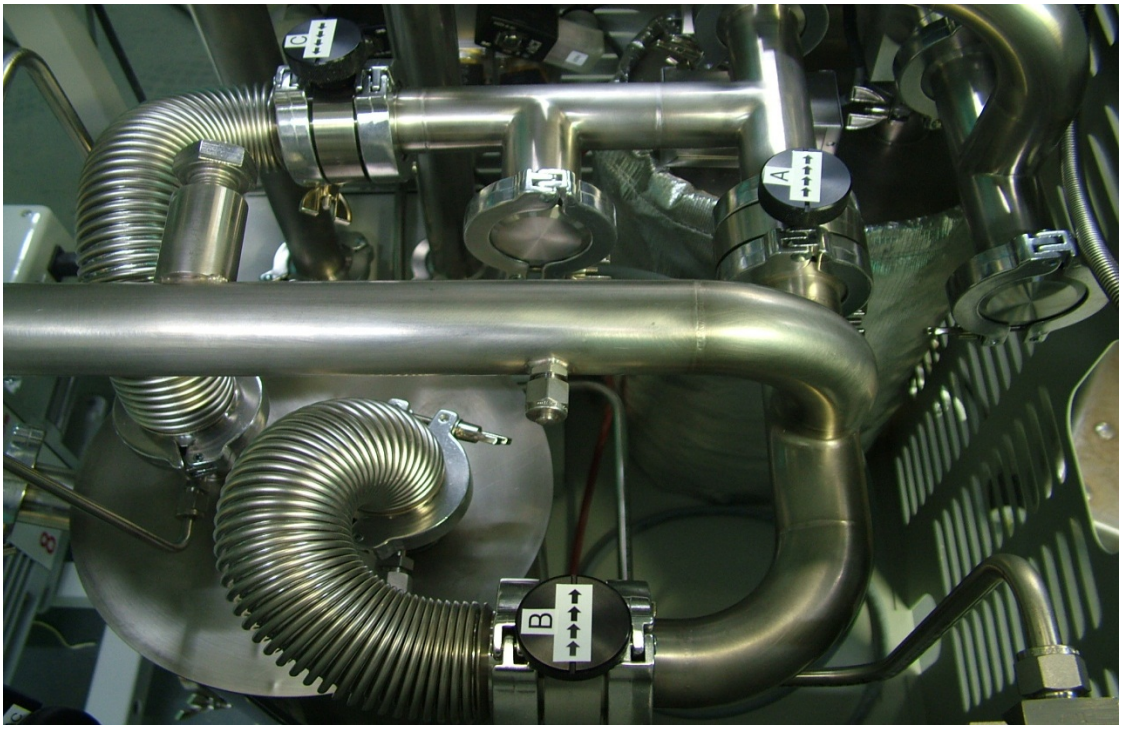


Figure 56 Solvent Removal Column – Closed

5.15.4 Replacing the Carbon Charge in a Solvent Removal Column

1. Follow the instructions for isolating the solvent column and removing solvent vapors on page 58.
2. Turn the evac/refill valve to refill until the pressure in the column has returned to 0.
3. Close the evac/refill valve.
4. Place receptacle below the Empty Port to catch the old carbon charge.
5. Remove the Fill Port clamp and blank.
6. Remove the Empty Port blank and begin to collect the old carbon charge.
7. Replace the Empty Port clamp and blank. Make sure the centering ring is clean.
8. Pour new carbon charge into Fill Port. Use a funnel if necessary.
9. Turn evac/refill valve to evacuate and allow vacuum to pull on the column for at least 48 hours.
10. To begin circulation through the solvent removal column again, see "*Opening the Solvent Removal Column*" on page 57.

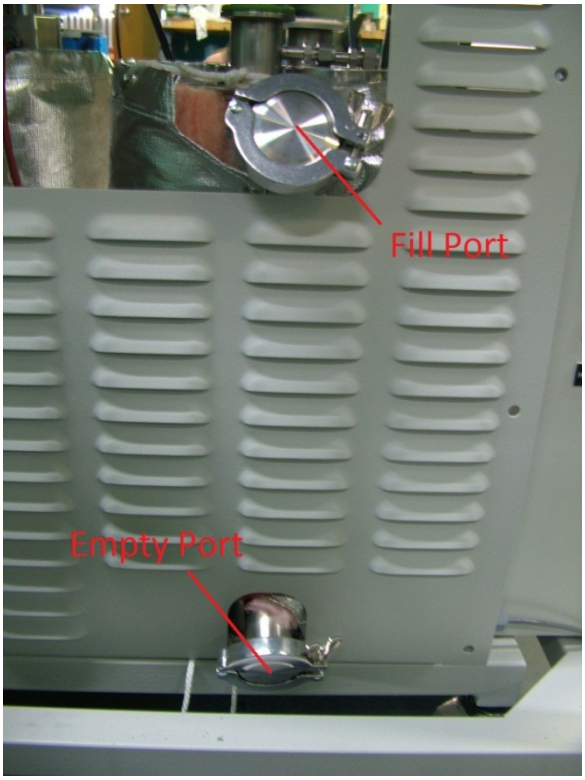


Figure 57 Fill and Empty Ports

Figure 58 Evac/Refill Valve at Evacuate

5.16 Large Capacity Regenerable Solvent Removal

Operates identical as the large capacity solvent removal while having the added ability to regenerate the material with in the column.

See "*Solvent Regeneration*" on page 49 for further details.

5.16.1 Small Capacity Solvent Removal – External

Figure 59 Small Capacity Solvent Removal – External

This contains an activated carbon-impregnated filter element. It is located in the Glovebox circulation piping.

WARNING: It is fitted with an isolation valve that MUST remain OPEN at all times when the Glovebox is running.

Replacing the filter element

1. Turn off the blower. Power down the Glovebox using the main power switch on the gas purification module.
2. Close the isolation valve on the housing of the solvent removal system. See Figure 59 above.
3. Twist the clear base counter-clockwise to open the trap.
4. Replace the filter element.
5. Screw the clear base back into the lid.
6. Open the isolation valve.
7. Power the system on.
8. Purge the Glovebox until the O2 level is less than 50 ppm. See "*Purging*" on page 21.
9. Turn on the blower.

Small Capacity Solvent Removal – Internal

Figure 60 Small Capacity Solvent Removal – Internal

This replaces the Glovebox HEPA filter on the suction side of the gas purification system. It is filled with activated carbon. It should be unscrewed before purging the Glovebox to prevent activated carbon particles being dispersed inside the Glovebox. Cartridge must be removed from Glovebox to be emptied and refilled.

6 Routine Maintenance

Regular preventive maintenance will help to reduce box problems that cause down time and increase the overall performance of the system. Different environments require different maintenance intervals, but the following are the recommended minimum levels of service required.

6.1 Daily Tasks

- Check the gloves for wear or holes. Check that they are seated properly and that the exterior “O” rings are in place. Replace worn or defective gloves or “O” rings as soon as possible. See “*Removal and Replacement Procedures*” on page 71.
- Inspect the exterior of the system. Ensure that it is kept free from excessive dirt. Check that the piping is intact and that all gas supply and vent lines are well connected. If necessary, clean the exterior. Tighten any loose connections.
- Check that the gas supply is sufficient and the flow is adequate. If necessary, replace the gas supply and adjust the flow rate.

6.2 Weekly Tasks

- Check and replace, if necessary, the vacuum pump oil. This step is crucial to the life of the pump and its ability to perform to specifications. Because each pump is different, refer to the pump manual for service procedures.
- Check the ante chambers “O” rings. Replace them if they are worn.
- Check the box filters. Replace if necessary.

6.3 Annual or Semi Annual Tasks

- If the purification capability of the column is not sufficient (it can no longer maintain low oxygen and moisture levels), regenerate the filter column material.
- If time between regenerations has become minimal, replace filter column material.
- Replace box filters.

6.4 Safety Inspections

- Inspect all box wiring for signs of wear or damage. Replace any suspect wiring found during the inspection.
- Inspect the window for signs of stress or cracks. Replace as needed.
- Never place or stack materials, tools, or documentation on any part of the Glovebox exterior surfaces except for those that are designed for such purposes. Vibration or contact with people or other objects may cause the items to fall.

Follow all of the routine maintenance tasks listed in this section.

7 Troubleshooting

These are some of the most frequently-asked questions and our responses.

Problem: There is no working gas going into the Glovebox.

Possible causes/solutions:

- If cylinder gas, is the tank empty? If empty, replace the tank.
- Is the regulator open? If closed, open the regulator.
- Is the needle valve on the regulator open? If not, open the valve.
- What is the gas pressure? If the pressure is too high the valve won't open. Pressure on a Purelab HE should be 55 PSI.
- Is the electrical signal getting to the gas (GA) valve? The Valve will illuminate if it is receiving the proper voltage.
- Is the Working Minimum Pressure set higher than the current pressure box pressure? The system will not call for gas unless the box pressure drops below the Working Minimum set point.

Problem: There is no regen gas flowing.

Note: Regen gas will only flow after you have confirmed that the column valves are closed. After the regen starts the gas will no longer flow until the Purge stage of the regen begins.

Possible causes/solutions:

- If cylinder gas, is the tank empty? If empty, replace the tank.
- Is the regulator open? If closed, open the regulator.
- Is the needle valve on the regulator open? If not, open the valve.
- Are the RG and EX valves illuminated?
- Is the flow meter on the front of the purifier cart open?

Problem: The Antechamber won't hold a vacuum.

Possible causes/solutions:

- Clean the Antechamber door and O-rings of debris. Replace the O-rings if necessary.
- Verify the refill valve is closed.
- Verify both doors are closed.
- Verify all fittings on the chamber are tight.

Problem: Box is leaking.

Possible causes/solutions:

- Normally a box will not begin to leak on its own. If none of the fittings have been modified the leak is most likely in the gloves. Inspect the gloves closely for leaks. Replace gloves as required.
- Verify that all Antechambers are left under a static vacuum and are not leaking.
- Refer to pressure test section of this manual. Record the rate of leakage.

Problem: Vacuum pump is making noise or has reduced performance.

Possible causes/solutions:

- Change the pump oil if it looks bad.
- Verify that all fittings connected to the vacuum pump are tight.
- If there is no improvement after changing the pump oil and checking the fittings upstream from the pump, put a vacuum gauge directly on the inlet of the pump. Refer to the pump manual for obtainable vacuum. If the pump cannot obtain specified levels repair or replace the pump.

Problem: The window is "cloudy" or scratched.

Possible causes/solutions:

- Safety glass can be washed with alcohol. Scratches in glass are not easily repaired, especially if they are on the inside. A glass company professional might repair scratches on the outside of the glass.
- Lexan, can be washed gently with mild soap or detergent using a soft cloth. Organic solvents such as aliphatic hydrocarbons, kerosene, or naphtha may also be used. To remove light scratches try automotive wax.

When a Service Call is Necessary

Should a service call be necessary, the more information that can be provided about the problem, the better we will be able to respond with a quality answer in a timely fashion. If a service call is necessary or you cannot resolve one of the above issues, call your local Innovative Technology representative for help.

8 System Control Electronics

8.1 General Description

The Glovebox is controlled through the use of the Color HMI Touch Screen. It directs box operation through the lower PLC control box, which generally turns on or off relays to control box pressure, circulation, purifier regeneration and other functions. Each of these subsystems are described in this section.

8.1.1 PLC Controller

All inputs and Output are controlled by the PLC.

8.1.2 Display panel

The display panel is Color HMI Touch Screen.

8.2 Lower Control Box

The Lower Control Box houses the following components:

- Power Supply
- PLC
- Connections
- Solid State Relays

8.2.1 Power Supply

The power supply generates 24 volts DC from an input of 115 volts AC. It can be strapped for operation at other input voltages. The 24 VDC is for the operation of the upper control electronics, the lower PC board, and for other miscellaneous components. It can easily be removed for repair or replacement.

8.2.2 Box Pressure Sensor

This section connects the tubing from the box directly to the on board pressure sensor. The sensor input is calibrated and provided to the microprocessor.

8.2.3 24 Volt Low Power Relays

This section of the board is where the PLC control lines activate or deactivate the low power relays. These relays then switch on and off other relays in the system. Note that there is an LED for each relay on the PLC. When this LED is illuminated, it indicates that 24 VDC is present on the switched or output side of the relay. When trouble shooting a control problem, this is the best indication that the box electronics are functioning properly, and that perhaps the higher power relay is not working.

Table 2 Relay Functions and Connections

Connector	Function	*Connection*
GAS	Gas valve, opens the box to the working gas source, increases box pressure.	Valve block, GA
VAC	Vacuum valve, opens the box to the vacuum pump, reduces box pressure.	Valve block, VA
AE1	Antechamber 1 evacuate, opens the chamber to the vacuum pump.	Antechamber 1
AE2	Antechamber 2 evacuate, opens the chamber to the vacuum pump.	Antechamber 2
AR1	Antechamber 1 refill, allows the Antechamber to refill from the box.	Antechamber 1
AR2	Antechamber 2 refill, allows the Antechamber to refill from the box.	Antechamber 2
BL1	Blower, activates the column 1 valves to enable the blower speed control to turn on the blower.	Column 1 valves
BL2	Blower, activates the column 2 valves to enable the blower speed control to turn on the blower.	Column 2 valves
CO1	Cooling, vents column 1.	Valve block, CO
CX1	Column 1 flow control, used in dual column systems.	Dual column in-line pipe
CX2	Column 2 flow control, used in dual column systems.	Dual column in-line pipe
EX1	Regeneration gas exit, column 1.	Main cell block, EX
FRZ	Freezer control.	Freezer Power Crydom
HTR	Heater control.	Furnace power Crydom
HT1	Heater control, column 1.	Heater Crydom
HT2	Heater control, column 2.	Heater Crydom
PG1	Automatic purge valve control.	Purge valve
PMP	Vacuum pump control.	Vacuum pump Crydom
RG1	Regeneration gas, opens column 1 to regeneration gas.	Valve block,RG
RG2	Regeneration gas, opens column 2 to regeneration gas.	Valve block,RG
RV	Regeneration vacuum, opens column 1 to the vacuum pump.	Valve Block RV
PG2	Automatic purge valve control.	Purge Valve

8.2.3.1 Solid State Relays

This section of the board is where the PLCcontrol lines activate or deactivate the solid state relays (SSR's). These SSR's then switch on and off motors and heaters in the system.

Table 3 Solid State Relays

Solid State Relay	Function
FRZ	Turn on AC power for the freezer motor. Only used in some systems.
BXC	Turn on AC power for the box cooling motor. Only used in some systems.
HTR	Turn on AC power for the heater element. Only used in some systems.
HT2	Turn on AC power for the heater for the second column in a dual column system.
HT1	Turn on AC power for a single column system's heater.
VP	Turn on AC power for the vacuum pump.

8.2.4 Circuit Breakers

Table 4 Circuit Breakers

Circuit Breaker #	Amperage 110/220 VAC	Function
1	15A/10A	Illuminated Main Power Switch
2	10A/5A	Vacuum Pump
3	6A/3A	24V Power Supply
4	5A/3A	Blower
5	4A/2A	Heater for Column 1
6	4A/2A	Heater for Column 2
7	5A/3A	Lighthood

8.3 Specifications

Table 5 Specifications

Input Operating Voltage and Frequency	110-120, 200-240 V~, 50/60Hz
Operating Temperature	10-40° Celsius
Relative Humidity	Non condensing 5% to 95% RH

9 System Components

9.1 Box Flow

The general box flow is described below. When circulation is on, gas is drawn by the blower from the box, through the column, and then back into the box. When the box requires a more positive pressure, valve ‘GA’ opens enabling working gas to enter the circulation loop prior to the column. This allows the gas to be purified before entering the box. When the box requires less pressure, valve ‘VA’ opens enabling the gas from the box to be drawn out by the vacuum pump. The remaining valves are for system regeneration purposes.

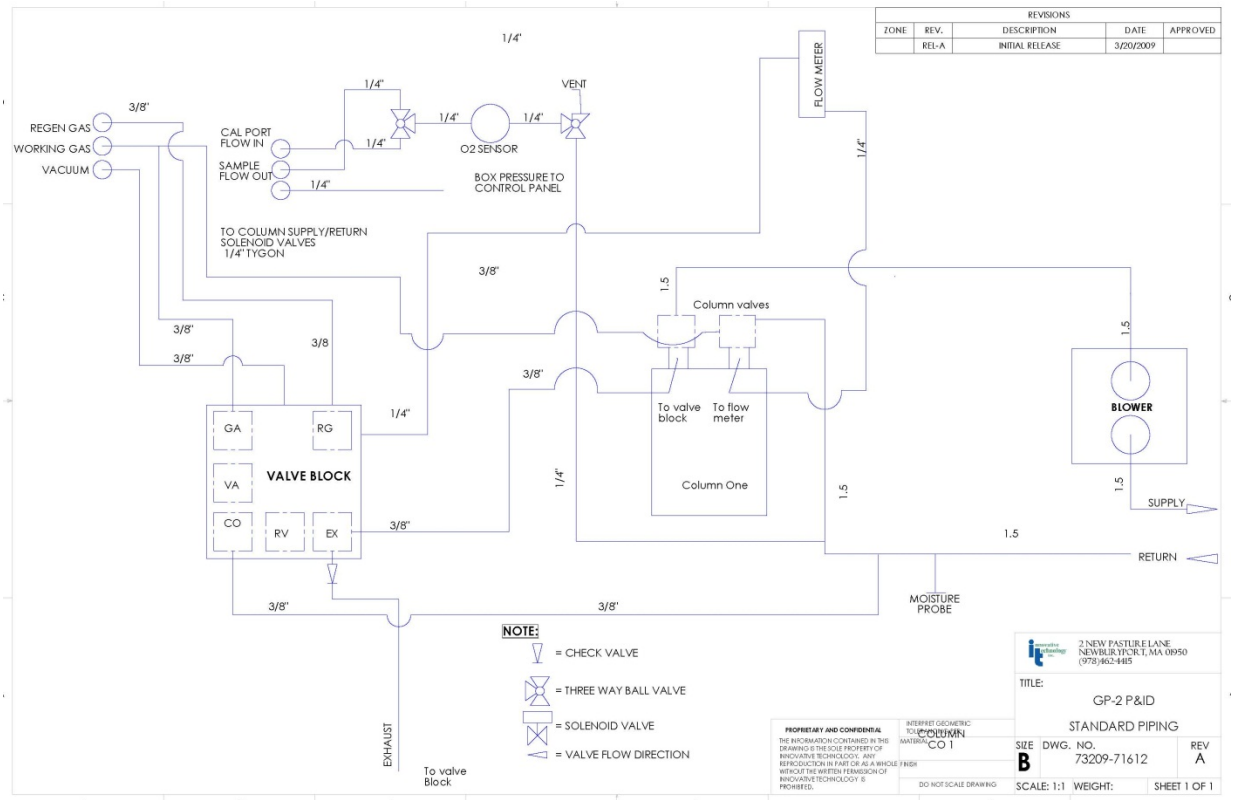


Figure 61 General Box Flow

9.1.1 Piping and Valves

All piping and tubing is stainless steel unless otherwise specified. All electromagnetic valves are stainless steel with brass bases unless otherwise specified. All electro pneumatic valves are stainless steel unless otherwise specified.

9.1.2 Column

The column contains the material that purifies the box gas, a heater for regeneration purposes, and a set of either manual or automatic valves that switch on or off the circulation of the box through the column. Construction is of stainless steel.

9.1.3 The Blower

The blower circulates the gas in the Glovebox through the column for purification. It is mounted inside an enclosure that is attached to the floor of the purifier module. The blower enclosure is connected through two pipes using two KF-40 connections.

9.1.3.1 Variable Speed

The variable speed blower is fully variable from off through full speed. There is one electrical connection containing five wires. Two of the wires are for 115 VAC input power and the other two are for a 0 to 10 VDC reference voltage that controls the blower's speed. This reference voltage is provided by the PLC controller.

9.1.4 Vacuum Pump

The vacuum pump provides the means to reduce overall pressure levels in the main box and the Antechamber(s). It is electrically turned on via a Press button on the main control screen. In response to this user action, the PLC controller turns on a solid state relay. The relay supplies line voltage to turn on the pump. In response to a requirement to lower the box pressure, or pump down an Antechamber, the PLC will open valve, “VA”, or “AE”, respectively. The pump will turn on automatically if it is needed by the system.

9.1.5 Chambers

There are many different types of Antechambers available from Innovative Technology, Inc. However, the standard chamber is a 15" I.D. by 24" long cylinder mounted on the left or right side of the box. In addition to this, a 6" x 15" mini Antechamber is also available on either side.

10 Removal and Replacement Procedures

These procedures are intended to be a guideline for removing and replacing various components of the system, for either routine maintenance or basic repair of the system. They are not intended to be exact step-by-step instructions. It is assumed that the person using these procedures is capable of performing basic mechanical and electrical tasks.

10.1 Blower

To replace the blower, proceed as follows.

1. Turn off the blower.
2. Turn off the system main power.
3. Remove the left side panel from the purifier module.
4. Remove the electrical connector from the blower.
5. Loosen and remove the two clamps that attach the piping. Cover the opening with KF-40 blanks or plastic caps to prevent excess outside air from entering the system.
6. Remove the blower box assembly and replace it with a new one.
7. If possible, purge the box piping with working gas.
8. Connect the piping with the clamps.
9. Connect the electrical connector.
10. Power the system on and check for leaks.

10.2 Column

To replace the filter material in the purifier column you will need a vacuum cleaner, funnel, and a waste bins to collect old material.

1. Turn off the blower.
2. Turn off the system main power.
3. Place the waste bin under the bottom port of the column.
4. Remove the two KF-40 clamps and blanks from the side of the column.

   Note: As soon as the bottom blank is removed the filter material will begin to come out.
5. Drain the old material and use the vacuum to remove any remaining material.
6. Empty the entire contents of the purifier according to your safety regulations.
7. Replace the blank onto the bottom port of the column.
8. Use the funnel in the top port of the column and add half of the molecular sieve, all of the copper catalyst, and then the rest of the sieve.
9. Replace the blank to the top port of the column. Be certain that KF-40 connections are tight.
10. Restore the main power to the system.

11 Perform two regenerations of the column for optimum performance.

12 Resume normal system operation.

10.3 Filters

To replace the box filters, simply exchange them with new filters. They are installed hand tight and should be replaced the same way.

10.4 Gloves

Replacing a glove increases the risk of exposing the system to the outside environment. Prior to proceeding, ensure that every precaution is taken to protect the contents of the box.

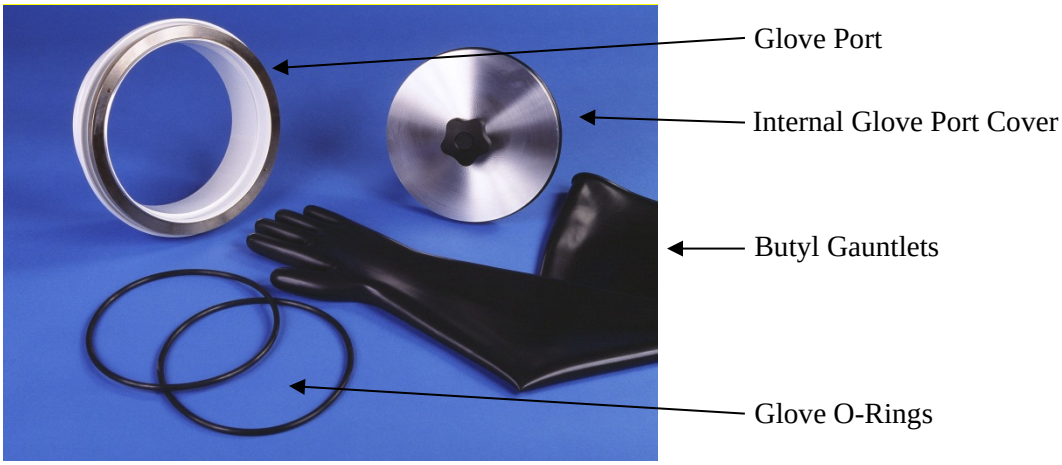


Figure 62 Gloves

10.4.1 Replacement with an Internal Glove Port Cover

An internal glove port cover is used to seal off the glove port from the inside of the Glovebox.

1 If the glove port cover is not inside the Glovebox, bring it in via the Antechamber.

2 Install and tighten the glove port cover on the port that has the glove that is to be replaced.

3 Remove the “O” rings that hold the glove onto the glove port.

4 Remove the old glove and discard it properly.

5 Compress the new glove as much as possible to remove excess air.

6 Install the new glove over the glove port.

7 If possible, purge the new glove by venting working gas into it via a separate gas line (this removes as much air as possible, and hence reduces the amount of air being introduced into the system).

8 Install the “O” rings onto the new glove port, over the new glove.

9 Remove the internal glove port.

10.4.2 Replacement without an Internal Glove Port Cover

Without an internal glove port cover, the old glove can be used to cover the port while the new glove is installed.

1. Press the glove that is to be replaced into the box.
2. Remove the inner glove port “O” ring (that which is closest to the window).
3. Fold back the glove onto the outer “O” ring, taking care not to let the glove come off of the port.
4. Compress the new glove as much as possible to remove excess air.
5. Install the new glove over the glove port, over the old glove.
6. Install the inner “O” ring onto the glove port, over the new glove.
7. If possible, purge the new glove by venting working gas into it via a separate gas line. (This removes as much air as possible, and hence reduces the amount of air being introduced into the system.)
8. From the inside of the Glovebox, using the other glove, remove the old glove by taking it into the Glovebox.
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, and discard it properly.

10.4.3 Control Box Panel

The control box consists of the circuit breakers, electronics module, power supply, and the solid-state relays. Some systems will require the white backing plate to be removed prior to removing the power supply and the solid-state relays.

10.4.4 Circuit Breakers

When replacing a circuit breaker, always use a replacement part of the same rating.

1. Remove system AC power from the source.
2. Disconnect the two fast-on type connectors using pliers. Do not remove them by pulling on the wire to which they are attached.
3. Depress the two tabs on the breaker body and Press out through the front door.
4. Install new circuit breaker in reverse order.

10.4.5 Power Supply

To replace the 24 VDC power supply, proceed as follows:

1. Remove system AC power at the source.
2. Disconnect the DC power cable (right side, Blue & White with Blue wires).
3. Disconnect the AC power cable.
4. Release the clip on the bottom of the power supply. This will release it from the DIN rail.

5 Reinstall in reverse order.

10.4.6 Solid State Relays

Mark all wiring before removal. To replace the SSRs, proceed as follows:

1 Remove system AC power at the source.
2 Disconnect the DC control wiring, right side of SSR, screws 3 & 4.
3 Disconnect the AC control wiring, left side of SSR, screws 1 & 2.
4 Remove the screws holding the SSR to the white backing panel.
5 Reinstall in reverse order.

10.4.7 Valves

If an electrical valve should fail, it can be replaced as follows.

1 Remove Glovebox AC power. Do not assume that the valve is off and will stay off, because the PLC can switch a valve on due to an external event.
2 If the GA valve is being replaced, ensure that the gas supply is off.
3 If the VA valve is being replaced, ensure that the vacuum source is off.
4 Remove the electrical connection by loosening the center screw.
5 Remove the solenoid by removing the four top screws.
6 Replace the new solenoid in reverse order.
7 Turn on the gas and vacuum supply, and power on the system.
8 Test the new valve for operation and for leaks.

10.4.8 Vacuum Pump

To replace the vacuum pump, proceed as follows.

1 Remove box AC power. If the vacuum pump is powered separately from the system, ensure that the power is removed.
2 Disconnect the clamp from the pipe.
3 Disconnect the AC line cord.
4 Remove the bolts that secure the pump to the box frame.
5 Remove the old pump.
6 Install the new pump in reverse order.
7 Ensure that the new pump has the proper oil and that the oil level is correct.
8 Power on the system and test for proper operation.

10.5 Window

Replacing a window requires the box be exposed to open air, and later purged and possibly regenerated.

1. Stop box circulation by turning off the blower switch.
2. Remove all of the bolts from the window frame, and remove the frame.
3. Remove the window and discard properly.
4. Ensure that the window gasket is completely attached to the box frame and that it is free from all dirt or other material that would prevent a good seal.
5. Mount the new window. Ensure that the window is sitting above the window shims (clear plastic material along the bottom edge).
6. Position the window frame over the window and insert all corner bolts, but do not tighten them.
7. Insert the remaining bolts while ensuring the window is properly positioned.
8. Tighten all bolts.

10.6 System Diagrams

10.6.1 Front View

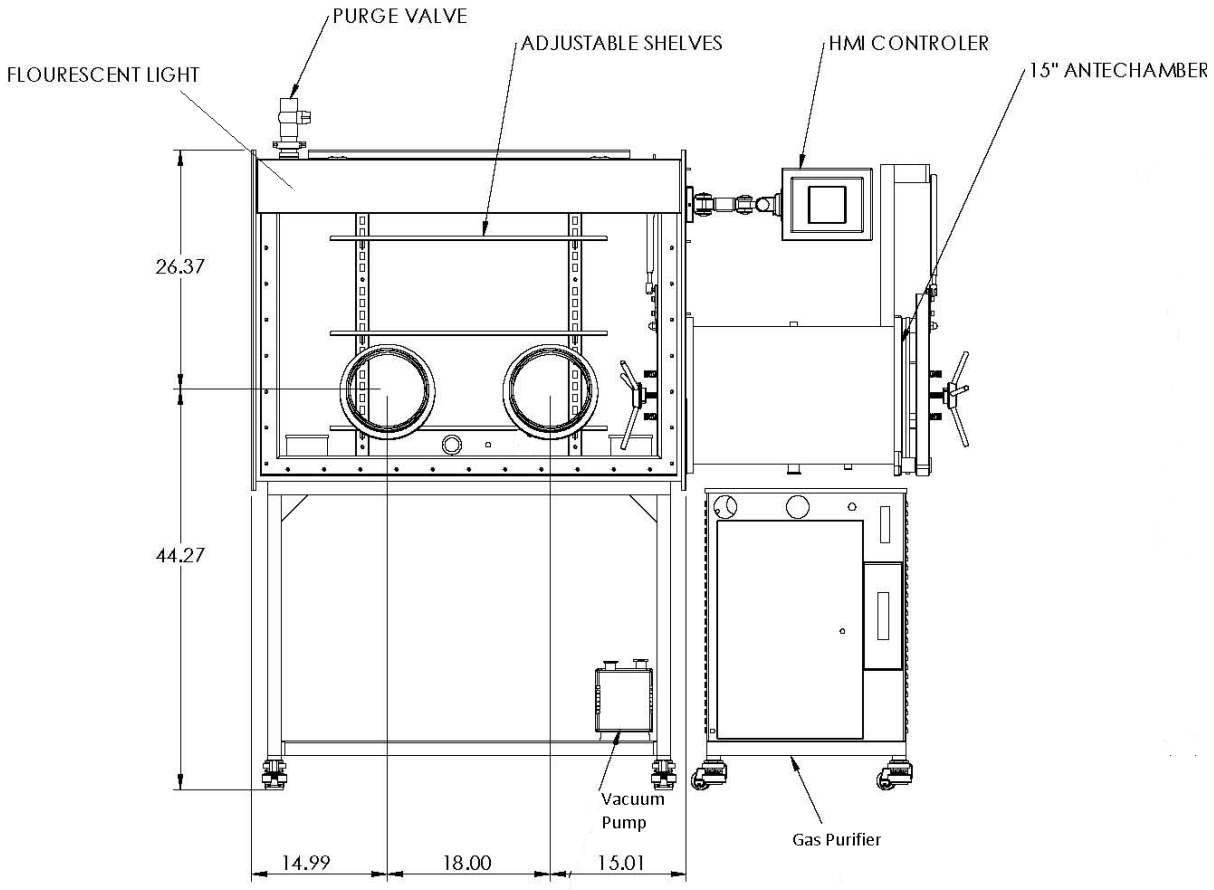


Figure 63 Front view

10.6.2 Back View

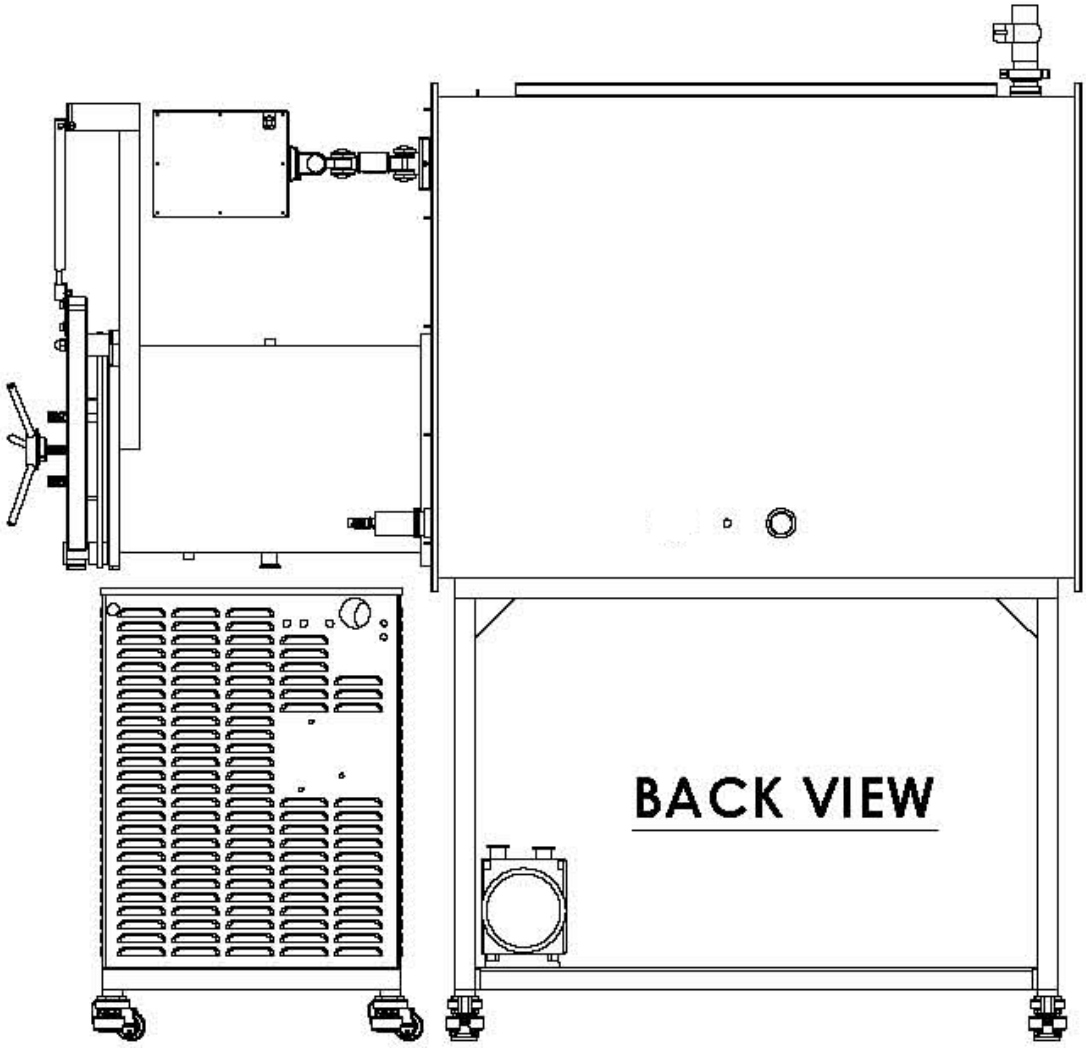


Figure 64 Back view

10.6.3 Pure Lab HE 2GB and Pure Lab HE 4GB-2500 Overall Dimensions

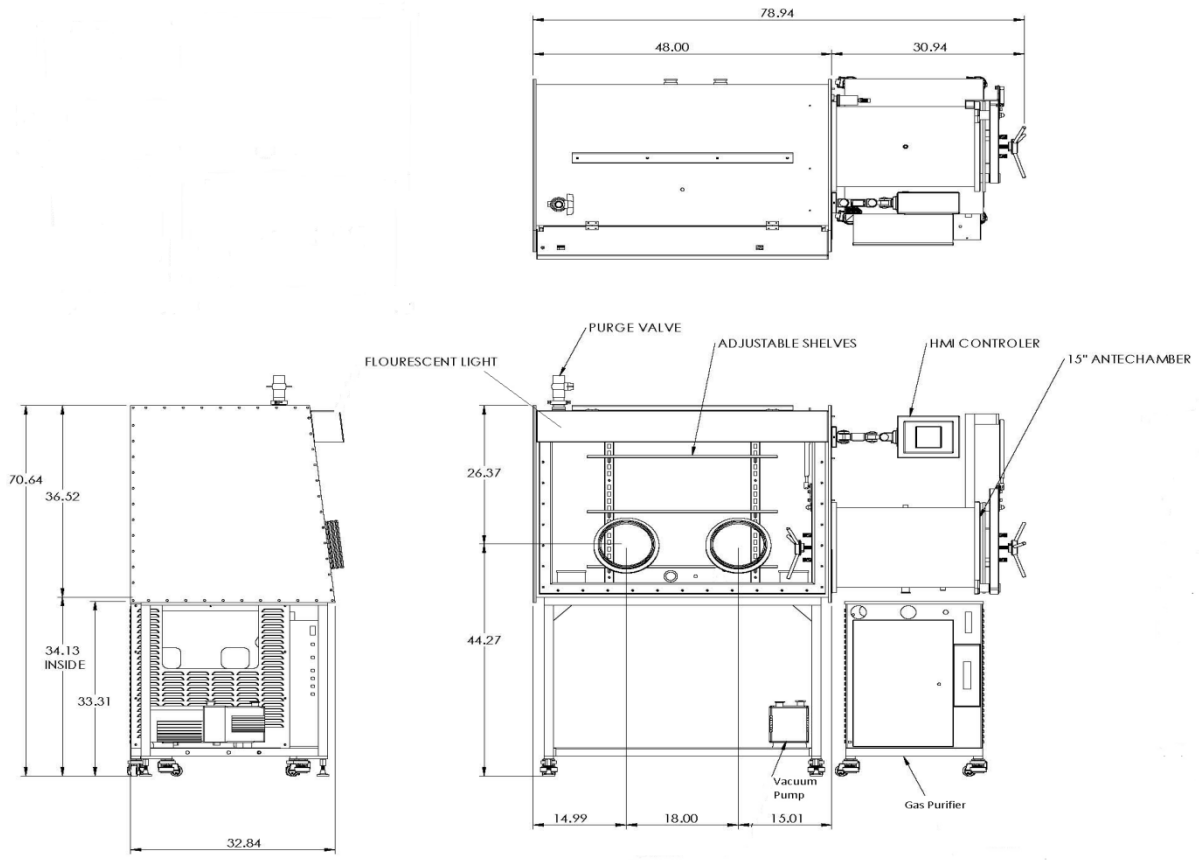


Figure 65 Pure Lab HE 2GB

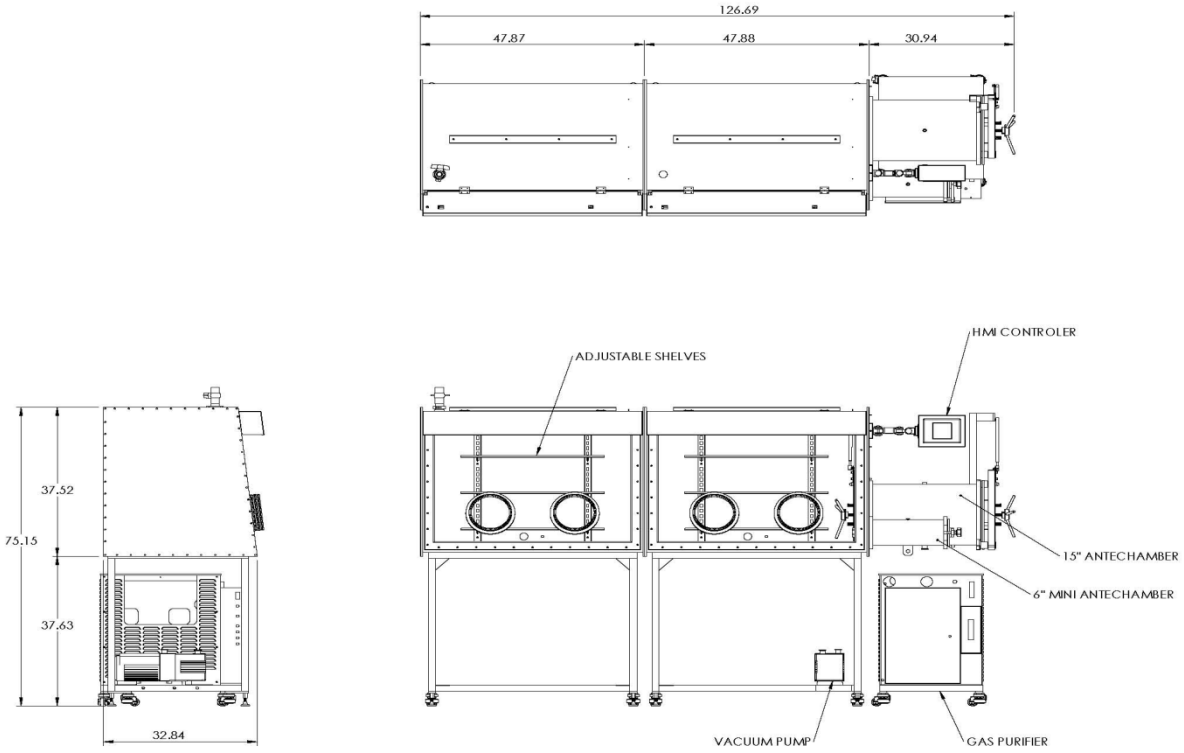


Figure 66 Pure Lab HE 4GB-2500

10.6.4 Pure Lab HE 3GB Overall Dimensions

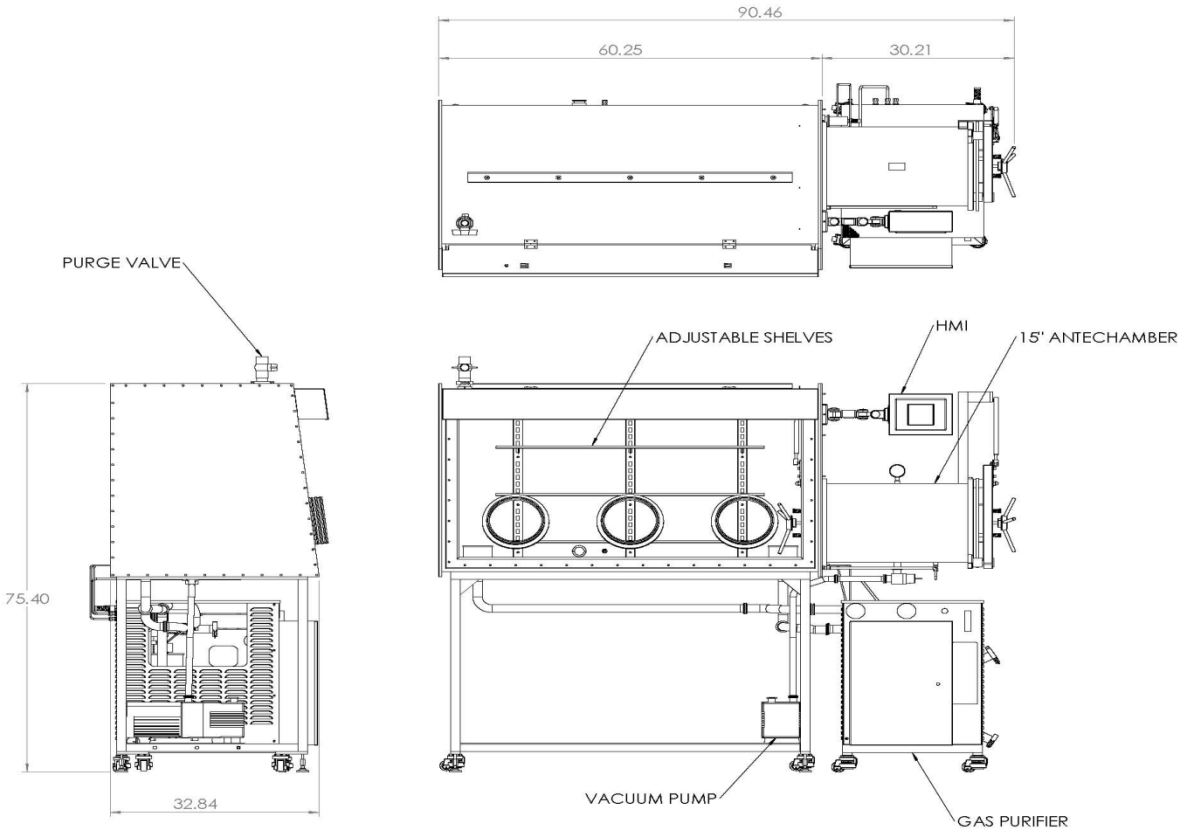


Figure 67 Pure Lab HE 3GB

10.6.5 Pure Lab HE 4GB-1800 Overall Dimensions

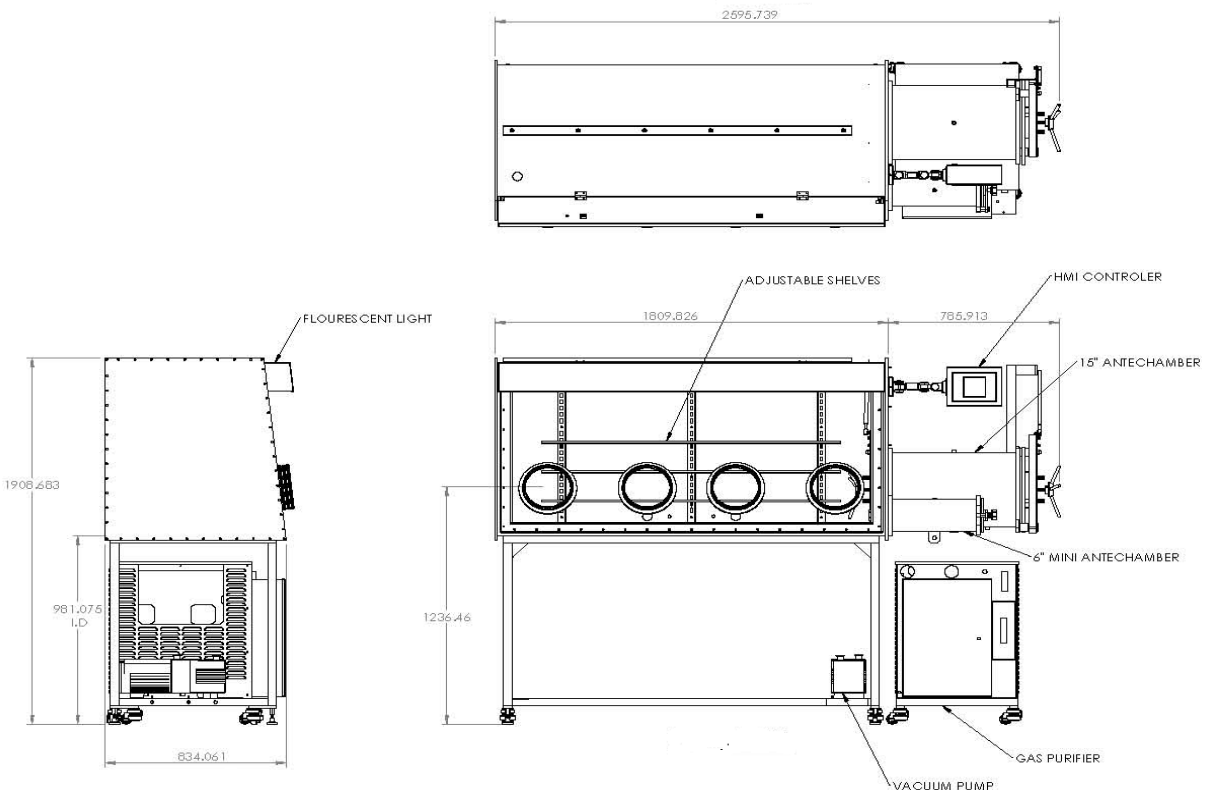


Figure 68 Pure Lab HE 4GB-1800

10.6.6 Pure Lab HE 4GB-1950 Overall Dimensions

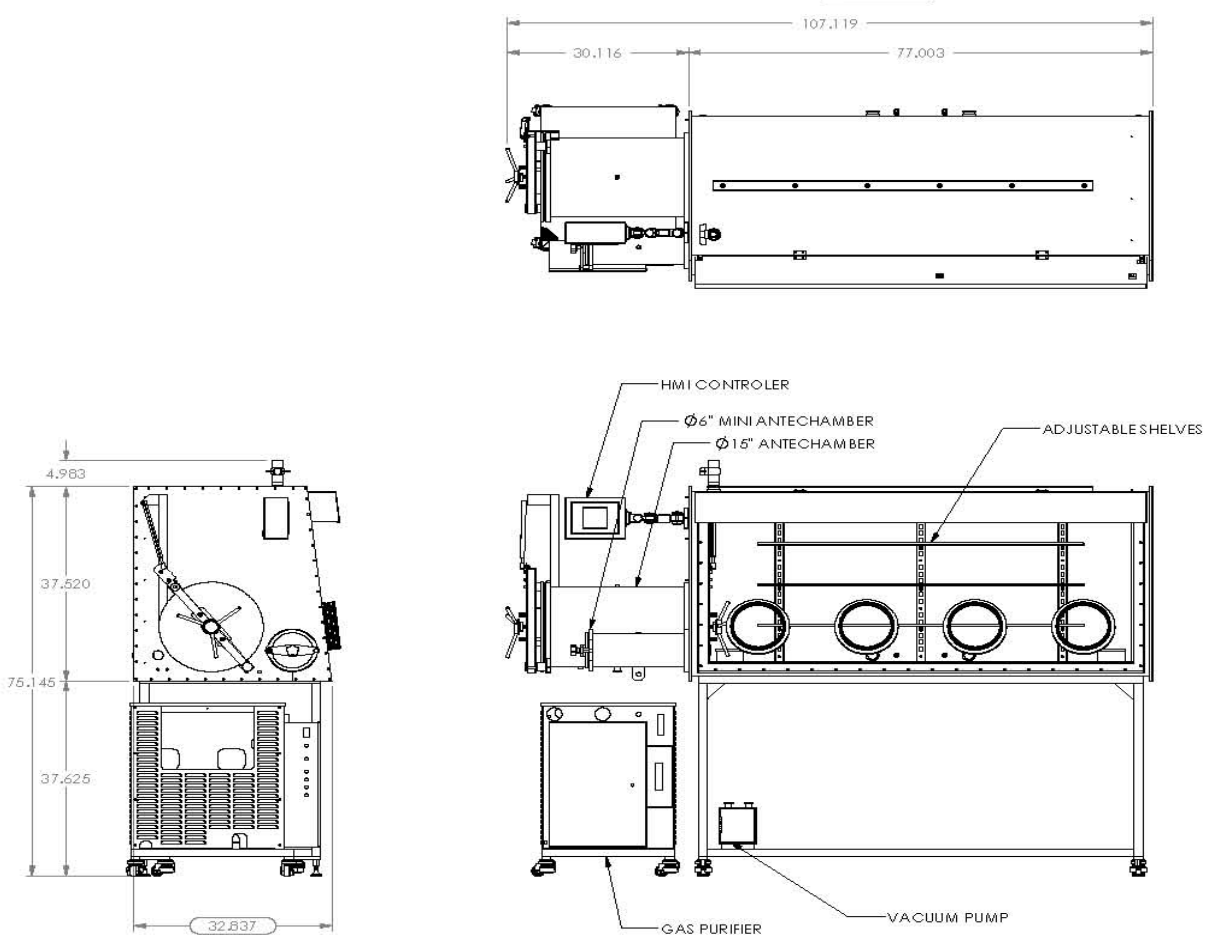


Figure 69 Pure Lab HE 4GB-1950