INNOVATIVE TECHNOLOGY

Inert Lab Glovebox

User Manual

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Document Information

Version	Revision Date
1.00	04/06/2012
2.00	02/05/2013

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1 Introduction

1.1 General Product Description

ILab (Inert Lab Glovebox) is designed as a complete package including box, antechamber(s), gas purification system, and vacuum pump. The system is capable of removing O_2 and H_2O to levels less than 1 ppm. O_2 and H_2O 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. ILab contains the necessary valves and heater for this reversible reaction.

1.2 About this Manual

This manual explains how to install and operate your ILab 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

1.3 Firmware Revisions

This manual is based on a minimum PLC firmware 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.

1.4 Optional Equipment

This manual includes information about optional equipment that may not be installed on your system. This information is included for clarity and completeness. Every effort has been made to indicate 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 printed in this manual. There also may be slight differences due to manufacturing changes.

This document includes information on dual column systems, automatic antechambers, and automatic purge systems, all of which are optional equipment.

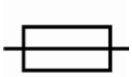
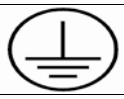
1.5 Terms

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

1.6 Symbols Used

Symbols used in this document and on the Glovebox itself are listed in the following table.

Table 1 Glovebox symbols

	Circuit breaker
	Electrical Ground
	Electrical AC current

2 System Overview

The ILab has been designed with the user in mind:

- The Operator interface comprises a color Human Machine Interface (HMI) touch screen.
- The foot pedal allows the operator hands free control of the box pressure.
- Automatic pneumatic column valves.
- Easy-to-operate Interior and exterior doors.
- Simple yet fully functional controls and indicators.

The ILab is designed to be a completely modular system. The gas purification system is contained underneath the Glovebox. The design allows all system components to be serviced easily. All gas connections are located on the right side of the system and are clearly labeled. The vacuum pump is located on the Glovebox stand, allowing for easy access and oil change.

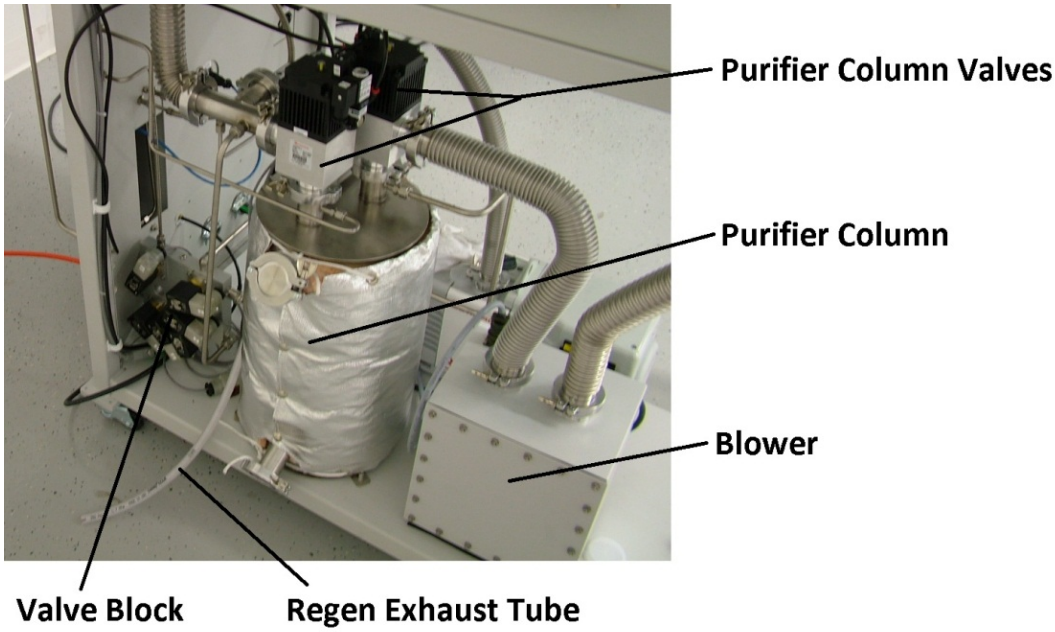


Figure 1 Gas purification system

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.

- An antechamber that has a door lifting mechanism so the door lifts gently and cannot close unless pulled down by the user.
- Glove boxes that are of modular designed. There are no bolts through the end panel or front window that could cause potential leaks.
- All stainless steel tubing connections that are 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 ILab control system which 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 (Figure 2) is located underneath the box on the right-hand side.

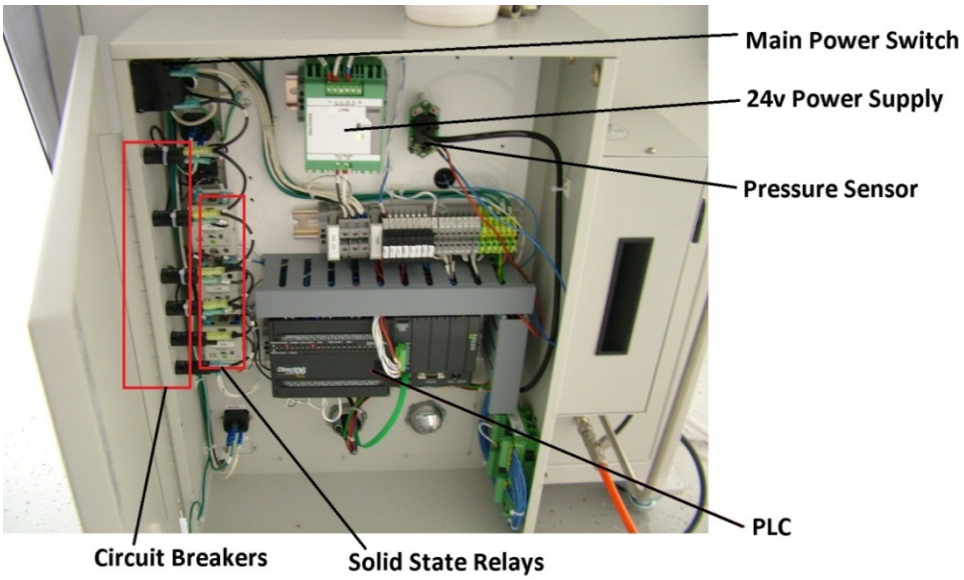


Figure 2 PLC enclosure

2.2 Circuit Breakers

There are seven (7) circuit breakers on the side wall. The function of each breaker is indicated on a label on 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, push 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 2 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	5A/3A	Lighthood

2.3 Foot Pedal

A foot pedal (Figure 3) is provided so that the box pressure can be increased or decreased without the operator having to remove his 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.

Figure 3 Foot pedal

3 Installation

3.1 Unpacking the system

All systems shipped outside North America are packaged in specially-designed shipping crates. Glovebox systems are typically top-heavy. 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.

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

1. Place the Glovebox 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. Please carefully inspect all packaging materials before discarding to ensure that any small components are not misplaced.

Figure 4 Unpacking the system

3.2 Installation Requirements

This section lists the minimum that is required to begin an installation.

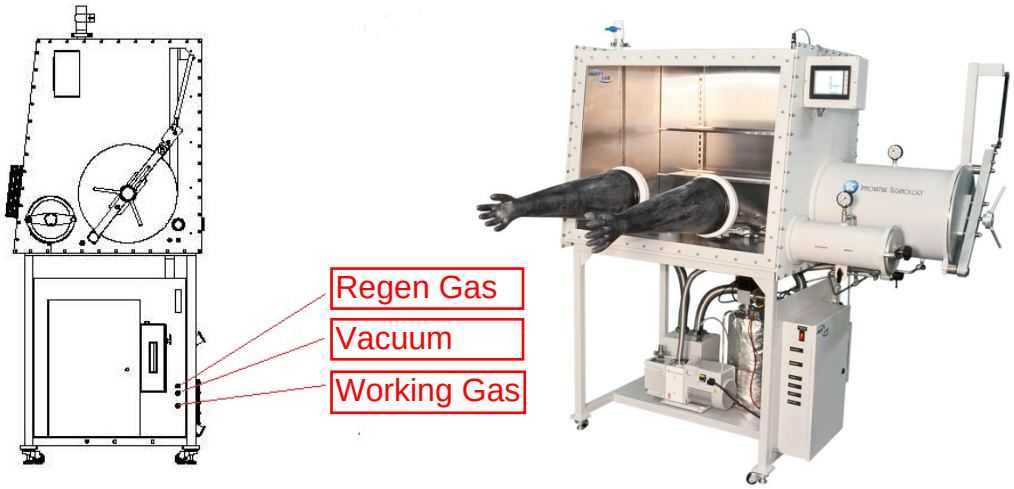


Figure 5 System front and side view

3.3 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 is to 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 you r 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 are 10 mm

3.4 Regeneration Gas

Note: The gas purification system has been regenerated and performance-tested to < 1 ppm at our factory prior to shipment. It does NOT need to be regenerated prior to first use after Installation.

Nitrogen or Argon containing approximately 3 to 7% Hydrogen with a suitable regulator to adjust pressure to 7 psi is required. One (1) cylinder should be available to regenerate the system as necessary.

3.5 Electrical

All Innovative Technology, Inc. Glovebox systems are configured to operate by the electrical power standard for the region to which the Glovebox is supplied.

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.

3.6 System Exhaust

Note: The regeneration gas, vacuum pump, and purge exhausts should be handled in accordance with your facility's customary practices.

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

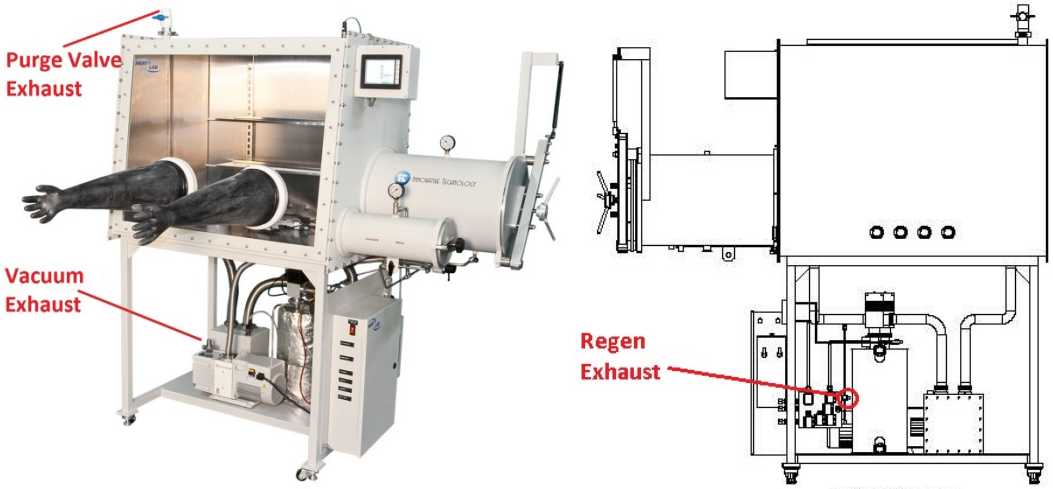


Figure 6 System exhaust

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

3.7 Assembling the Glovebox

Note: If you have a double box system, you must first perform the procedure as described in "*Assembling the Double Box Assembly*" on page 15.

4. The Glovebox system has lockable casters on each leg to facilitate its placement. After the casters are in place, they can be adjusted to lock the system in place.
5. Connect any plumbing and miscellaneous parts that were removed for shipping. Match up the labels on the piping and components to the labels. For example, "1" connects to "1." "2" connects to "2," "A" connects to "A," etc.
6. Locate and install the shelves inside the box at your preferred height. The shelves are adjustable and can be relocated at any time. The shelves fit in the box by sliding them through the antechamber. It is not necessary to remove the window.
7. The power strip is placed in the box as desired. The male plug is connected 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. Identify the purge valve and attach it to the correspondingly labeled KF-40 flange located on the top of the Glovebox. 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. Then stretch two O-rings over each glove and place in the outer two grooves.

3.8 Assembling the Double Box Assembly

If you have a double box system (Figure 7), the two boxes need to be joined prior to performing the procedure in the previous section (3.7).

1. Remove the window from one box. (See “*Removal and Replacement Procedures*” on page 45 for instructions.)
2. Push both boxes together and make them level on the inside by adjusting the leveling pads of one of the boxes. After the boxes are level, lock the levelers into position and push the unlocked module away.
3. Push 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. Push 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.
5. Excess sealant squeezes out from between the flanges. Clean it up now because it is easier to do this when the sealant is slightly dry. Then clean the entire interior of the Glovebox.
6. Replace the window on the box (See “*Removal and Replacement Procedures*” on page 45 for instructions.)
7. Install the gloves and glove O-rings. (See “*Removal and Replacement Procedures*” on page 45 for instructions.)

Figure 7 Double Box assembly

3.9 Electrical Connections

The primary power cord is coiled in the lower portion of the system. Remove the cable tie and plug it into the proper wall receptacle.

The plug that is connected to the power strip exits the Glovebox behind the antechamber. Remove the cable tie and plug it into the proper wall receptacle.

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

3.10 Gas Connections

It is imperative that you have installed the proper regulator on the working gas cylinder and on the regeneration gas cylinder, the connected tubing is of sufficient length, and you have verified that there are no leaks leading to the Glovebox.

The fittings for both gases are found on the right side behind the control cabinet.

1. Connect the working gas and regen gas to the appropriately-labeled compression fitting, and tighten it 1.25 turns from finger tight. Over-tightened compression fittings can cause problems. If you are not familiar with compression fittings, please call your Innovative Technology representative for further assistance.
2. Set the Working Gas pressure to 55 psi.

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

3.11 Exhaust Connections

The exhaust gases from the vacuum pump should be exhausted in accordance with your facilities regulations. The fitting on the vacuum pump is 1 inch O.D. stainless steel tube stub.

The exhaust from the purifier is 3/8" ID hose. This is a braided Tygon tube that is connected to a check valve on the valve block.

The exhaust from the purge valve is 1" Female NPT for a manual purge valve. Automatic purge valves vent to a KF40 flange.

All exhaust connections should be made according to your facilities HVAC rules.

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

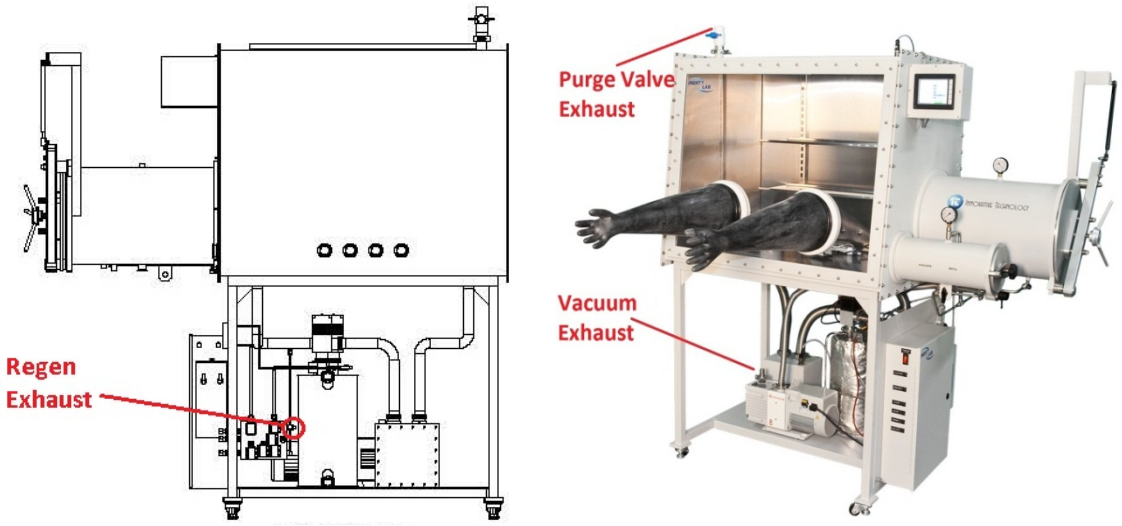


Figure 8 Exhaust connections

3.12 Commissioning the System

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

3.12.1 Switching Power On

1 Plug the main power cord into a wall outlet. Ideally the system should have its own independent circuit.

The main power On/Off switch also functions as a circuit breaker. The power switch is accessible from the front of the system. It is on the wall of the PLC enclosure.

2 Switch the power on. The main power switch lights up. All box electrical equipment is enabled with this switch. There is no other action necessary to turn power on with the exception of possibly any optional equipment.

The box light is mounted on the inside of the box. This is a 24v LED that is always powered on. If you need to turn off this light it can be disconnected by unscrewing the electrical connector on the roof of the box.

3.12.2 Logging In

After initial power on, the Glove Box Control System screen (Figure 9) appears. In order to change any settings, the user must log in to the system.

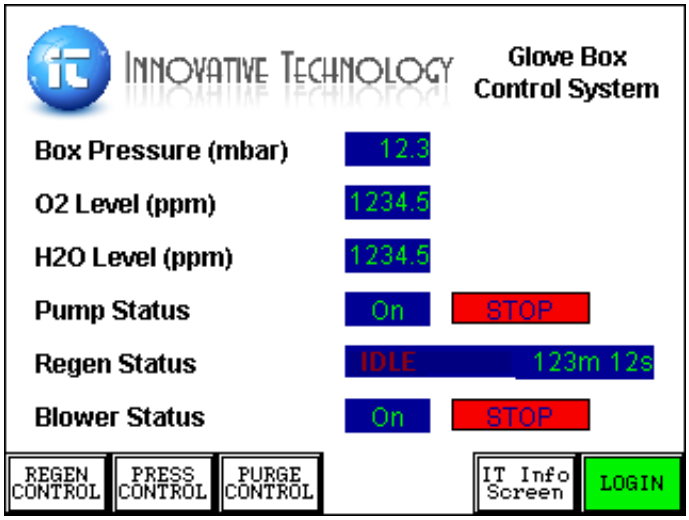


Figure 9 Glove Box Control System screen

1 Press the **Login** button. The Login/Logout screen (Figure 10) appears.

2 Press the **Login/Logout** button.

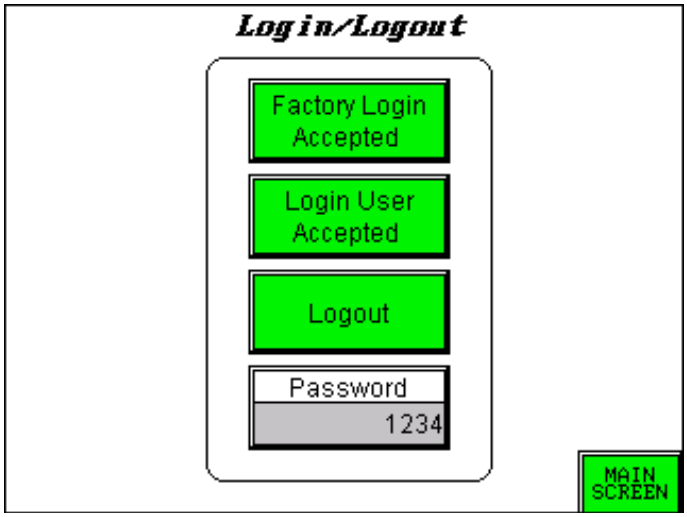


Figure 10 Login/Logout screen

3 To Log in as User, press the **Password** button and enter 7990 on the keypad, then press **Enter**. You are returned to the Login screen. Press **Login User** and it flashes **Accepted**.

4 Press the **Main Screen** button to reach the Main Glovebox Control screen.

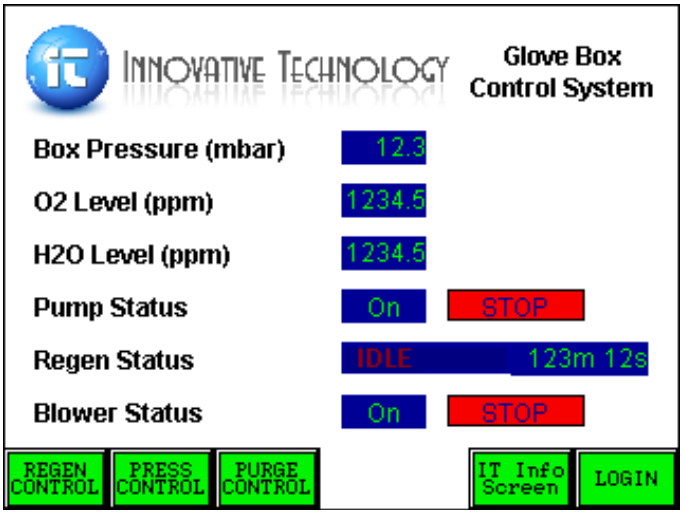


Figure 11 Glove Box Control System screen – after login

3.12.3 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.

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 **Press Control** button.

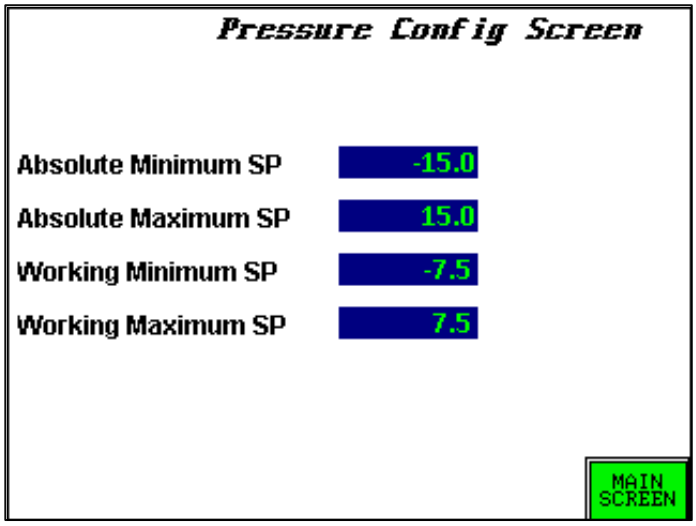


Figure 12 Pressure Config screen

2. Press the Numeric blue display button next to Working Maximum SP. A numerical input screen appears. Type **12.0** and press **Enter**.
3. Press the Numeric blue display button next to Working Minimum SP. A numerical input screen appears. Type **10.0** and press **Enter**.

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

Pressure Testing the System

Before the system can be operated it needs to be pressure tested to verify that all of the plumbing has been installed properly.

1. Ensure that the inside and outside doors to the antechambers are closed. Turn on the vacuum pump by pressing the pump **Start** button on the main screen. Open the evacuate valve on the large antechamber and allow the antechamber to evacuate to -30. Close the evacuate valve. Repeat this process for the mini antechamber.
2. Wait 20 minutes to allow the Glovebox to stabilize. Use the appropriate foot pedal to add/remove gas to/from the Glovebox to reach a pressure of 11.0 mbar.
3. 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.
4. If the pressure drops more than 1 mbar then check all of the connections that were made during the assembly process.
5. If you require troubleshooting assistance, contact your Innovative Technology, Inc. representative.

3.12.4 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 O_2 and H_2O levels to less than 50 ppm.

Our recommended method of purging is as follows:

1. Set the Working Maximum pressure at + 10.0 mbar and the Working Minimum Pressure at +5.0 mbar using the same procedures as above in section 3.12.3.
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, see “*Manual Purge Valve*” on page 36 for directions on using this feature.
3. Adjust the flow using the purge valve so that there is a steady flow within the pressure range selected.
4. During the purging process, create as much turbulence in the box as possible by pushing in the gloves and waving them around inside the box.
5. If you have a freezer, the door should be open.

6 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. Re-open the purge valve after replacing the cylinder and opening the valve on the cylinder.

- If you do not have an O_2 Analyzer, it can be assumed that after purging with three (3) cylinders (for a single 2-glove system), the O_2 content in the box is 25 ppm or less. Close the manual purge valve.
- If you do have an O_2 Analyzer, open the outlet valve, and 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 O_2 content on the display.

When shipped, the O_2 analyzer valves are closed as shown in the following picture (Figure 13):

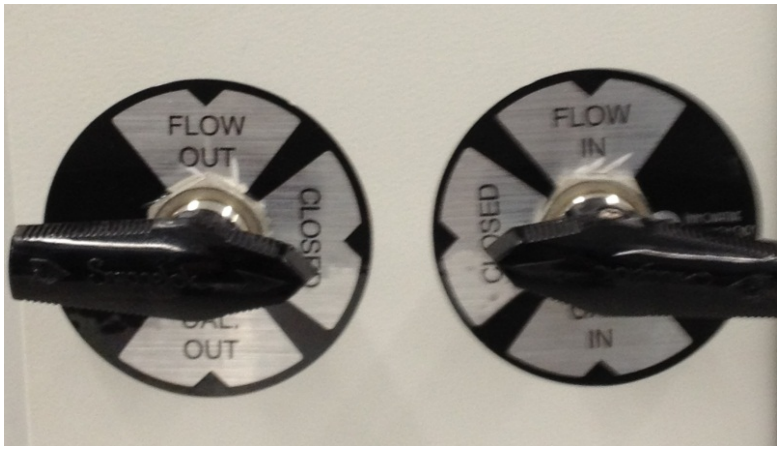


Figure 13 O_2 analyzer valves – closed

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 the following picture (Figure 14):

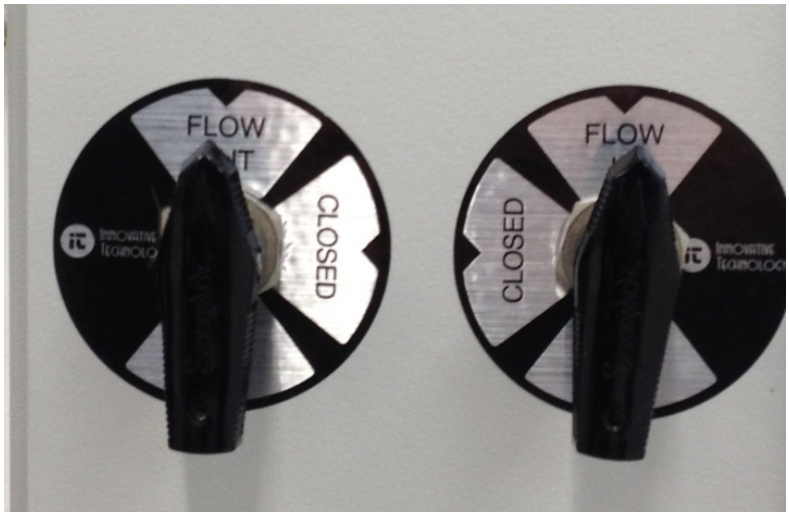


Figure 14 O_2 analyzer valves – Flow out and Flow in positions

At this time you may adjust the Minimum and Maximum Working pressures to attain the operating pressure that best suits your needs and comfort.

3.12.5 Circulation

The blower (Glovebox circulation) 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 because it is not being circulated through the oxygen and moisture absorbing materials contained within the purifier column. Oxygen and moisture levels inside the Glovebox rise if the blower is switched off.

The blower can be switched on and off from the main control screen.

Pressing the blower START button 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.

4 Control Panel Functions

4.1 Description

All Glovebox functions are controlled from the touch screen (HMI). This section describes the touchscreen and all control screens. The HMI is located on the side panel that has the large antechamber attached. The HMI is connected to the Programmable Logic Controller (PLC) that is contained within the PLC enclosure on the gas purification module.

Note: This section details each screen with general descriptions. System functions and operation are detailed in "*System Operation*" on page 29.

4.2 Main Control Screen

The Main Control Screen (Figure 15) is the "home" screen of the system. It contains all of the status information for ILab features and sensors. All sub-screens can be reached from here.

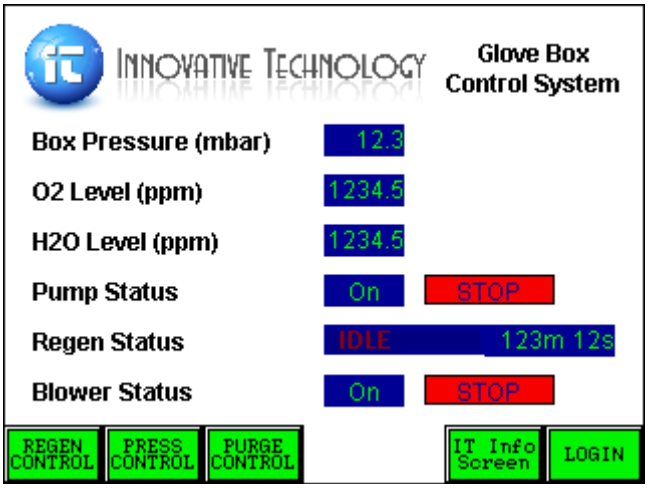


Figure 15 Main Control screen

Box Pressure (mbar)	The Main Control Screen continuously displays the current Glovebox pressure. The current pressure is displayed in the blue bar. This pressure is displayed in mbar relative to atmospheric pressure.
O_2 Level (ppm)	If your system is equipped with an O_2 Analyzer, the current real time O_2 level in ppm is displayed here. **Note:** The O_2 level is only displayed in real time if the batching pump (small pump inside the box) is connected to the sample line and plugged in. The analyzer valves must also be turned to "flow in" and "flow out."
H20 Level (ppm)	If your system is equipped with an H_2O Analyzer then the current real time H_2O level in ppm is displayed here.
Pump Status	Indicates whether the Vacuum Pump is currently powered ON or OFF. The Vacuum Pump can be toggled using the START/STOP button.
Regen Status	Indicates whether the purifier column is currently being regenerated. See "*System Operation*" on page 29 for further details regarding catalyst regeneration procedures.
Blower Status	Indicates whether the Blower is currently powered ON or OFF. The Blower can be toggled using the START/STOP button.

4.3 Control Sub-Screens

4.3.1 Regen Control

Pressing the **Regen Control** button opens Regeneration Control screen (Figure 16). This screen allows the user to initiate a regeneration of the purification column. See "*System Operation*" on page 29 for instructions on performing a regeneration.

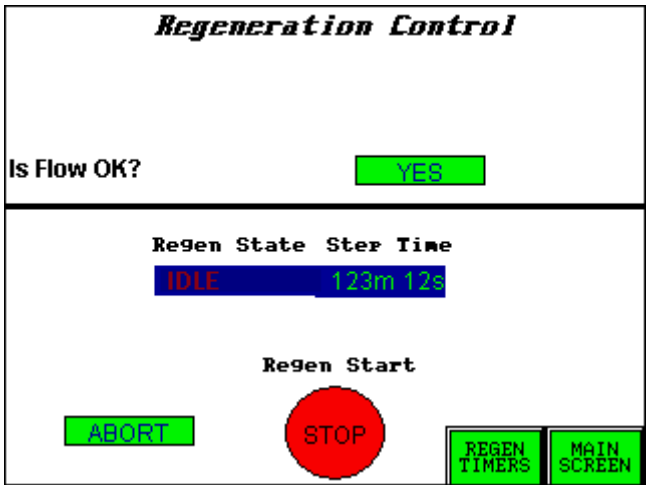


Figure 16 Regeneration Control screen

Start	Initiates a regeneration. The flow of regen gas begins to flow through the column.
Is Flow OK?	Prompts the user to acknowledge that the regeneration gas is flowing properly.
Regen Status	Indicates the current stage of the regeneration cycle.
Step Time	Indicates the elapsed time for the current stage.
Abort	Allows the user to abort regeneration within the first 5 minutes of starting.
Regen Timers	Accesses the sub-screen below (Figure 17).

4.3.2 Regen Timers

These are the set timers in minutes for each stage of regeneration.

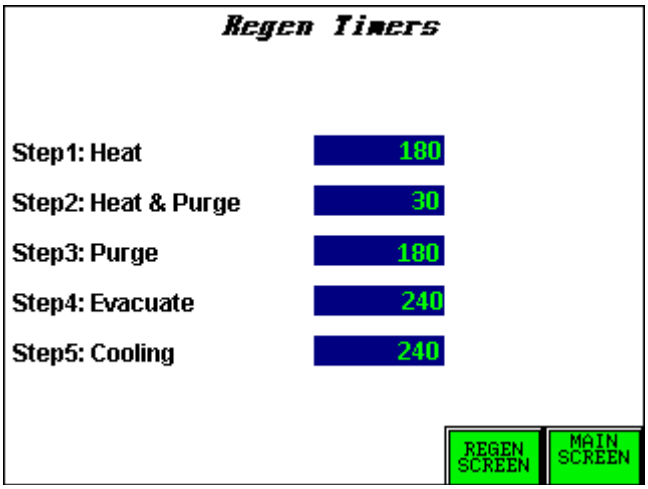


Figure 17 Regen Timers screen

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.
Note: All times shown are factory defaults. Do not change the timers without consulting your Innovative Technology service representative.	
Regen Screen	Returns to the Regeneration Control screen.

4.3.3 Purge Control

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

Pressing the **Purge Control** button brings up the following screen (Figure 18):

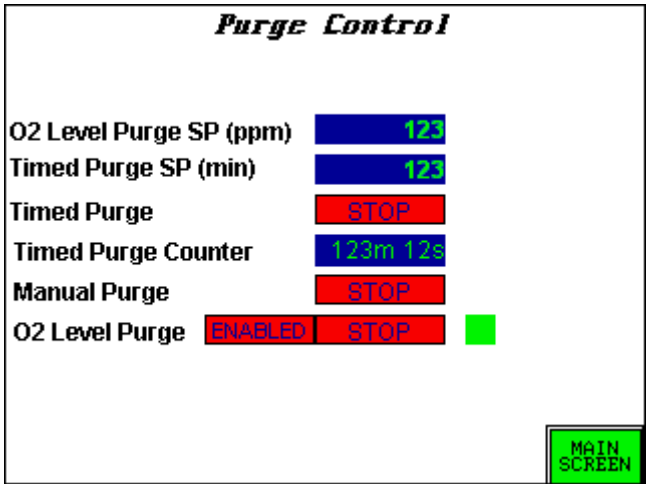


Figure 18 Purge Control screen

O_2 Level Purge SP (ppm)	If the system is fitted with an oxygen analyzer this setting opens the automatic purge valve if the oxygen level exceeds the set value. This value can be changed by pushing the value and entering the desired value on the numeric keypad. In order to operate this feature the "O_2 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. This value can be changed by pushing the value and entering the desired value on the numeric keypad.
Timed Purge	Pressing START initiates the timed purge.
Timed Purge 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 you press STOP.

4.3.4 Press Control (Pressure Control)

The Pressure Config screen (Figure 19) allows you to adjust the Working Pressure setpoints of the Glovebox.

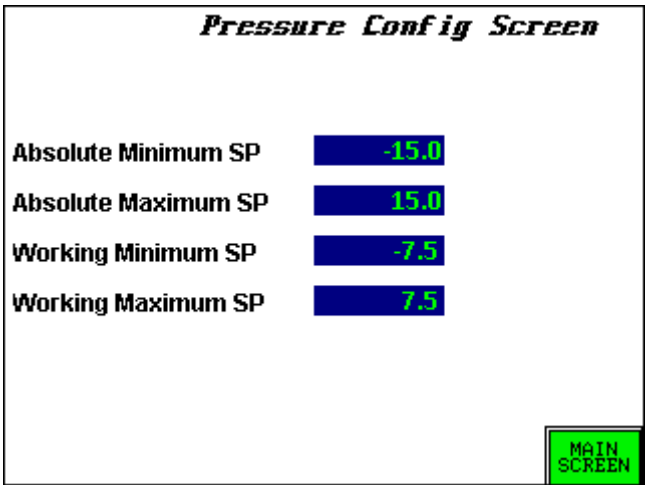


Figure 19 Pressure Config screen

Absolute Minimum SP	The absolute minimum pressure that triggers the systems safety interlock to close the Gas and Vacuum valve on the valve block.
Absolute Maximum SP	The absolute maximum pressure that triggers the systems safety interlock to close the Gas and Vacuum valve on the valve block.
Working Minimum SP	The lower working pressure set point. After this value is reached the Glovebox refills with Working Gas.
Working Maximum SP	The higher working pressure set point. After this valve is reached the Glovebox opens to the Vacuum Pump to remove pressure.

Note: The PLC control system maintains the Glovebox pressure between the Minimum and Maximum Working set points.

Warning: Do not change the Absolute Minimum and Maximum SPs without consulting your Innovative Technology service representative. This could drastically affect system operation.

4.4 IT Info Page

This screen (Figure 20) contains Innovative Technology's contact information.

Figure 20 IT Info page

5 System Operation

This section covers all system functions in detail. All Glovebox users should read this section before they begin to operate the system.

5.1 Login

When the system is powered on the following screen (Figure 21) appears:

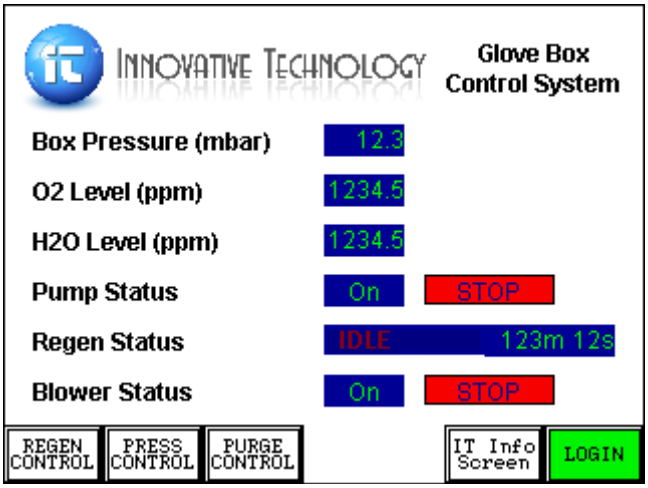


Figure 21 Glove Box Control System screen

This screen indicates the basic status parameters but does not allow any interaction until the User logs into the HMI.

1 To log in, press the **Login** button. The following screen (Figure 22) appears:

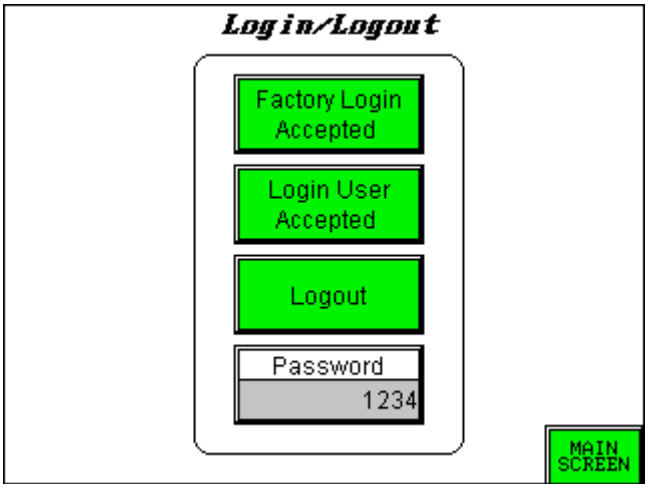


Figure 22 Login/Logout screen

2 To log in as User press the **Password** button. A numeric data entry screen appears. The User Login password is 7990. Press **Enter** to return to the Login screen. You can now press

Login User and it flashes **Accepted**. Return to the Main screen and all of the functions are now available.

Note: The Purge Control button is only visible if your system is configured with the automatic purge feature.

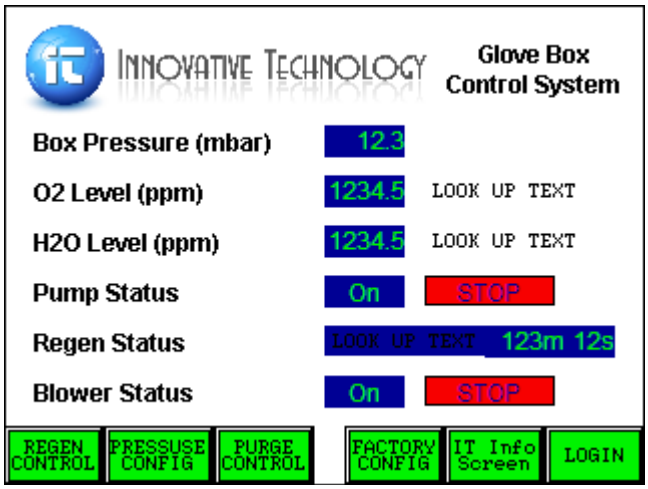


Figure 23 Glove Box Control System screen

5.2 Adjusting the system pressure

The system automatically controls the pressure of the Glovebox within the Working Pressure Setpoints. If the Working Max is reached the system open to the vacuum pump to remove excess pressure. If the Working Min is reached the box refills with gas until the midpoint of the Working Pressures is reached. The Glovebox performs best at a constantly positive pressure. The comfort level is different for every user. The Working Minimum is commonly 1-2 mbar and the Working Maximum 5-6 mbar. Reaching the Absolute Pressures triggers a safety interlock that will not allow gas vacuum to enter the system.

Warning: Do not adjust Absolute Maximum and Minimum pressures without contacting your Innovative Technology service representative.

1 To change the pressure settings press the **Pressure Config** button to enter the Pressure Config screen.

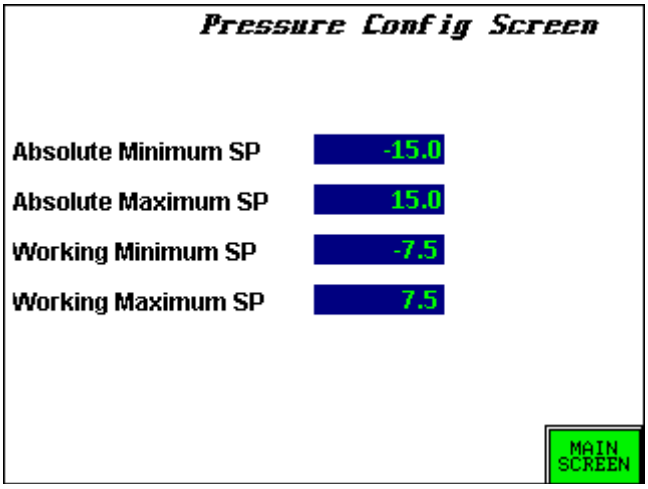


Figure 24 Pressure Config screen

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 **Enter**.

3 Press the Numeric blue display button next to Working Minimum SP. A numerical input screen appears. Type in the desired minimum pressure and press **Enter**.

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

Warning: Entering the Glovebox too quickly may cause the Absolute Maximum to be reached. You will need to back out until the pressure is restored to normal. You can only enter the box as fast as the vacuum pump can reduce the pressure.

5.2.1 Vacuum Pump

The Vacuum Pump is turned on and off by pressing the START/STOP button on the Main screen. The current Pump Status is shown in the Blue Box. See "*Maintenance*" on page 44 for instructions on changing the pump oil.

If the Working Maximum Pressure is reached, the Vacuum Pump automatically turns ON and removes excess pressure.

The pump has a manual 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 evacuate cycle of regeneration.

Figure 25 Vacuum pump

5.2.2 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 next to the purifier column underneath the box.

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 displays START. Pressing the START button turns on the Blower. The Blower Status now shows as ON and the Red STOP button is 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.

Note: For the blower to operate correctly the system must be supplied with at least 55 psi of inert working gas pressure.

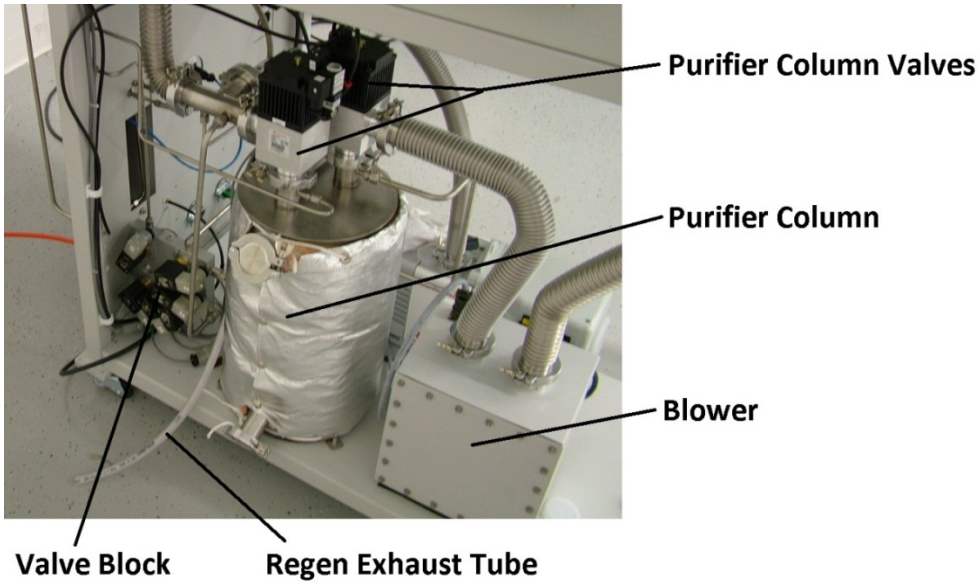


Figure 26 Blower

5.3 Using the Antechambers

This section describes the operation and maintenance of the antechambers.

Always keep the antechambers under a static vacuum when they are not in use. Evacuate the antechambers and then close the evacuate valves. This ensures that the chambers are sealed.

It is faster to use the mini antechamber to transfer materials into and out of the Glovebox. The large antechamber must be used for larger items or a large quantity of materials. The sliding tray of the large antechamber helps to easily remove multiple items.

The mini antechamber has a single valve that controls both evacuating and refilling of the chamber. To use this valve, point the arrow towards the desired function. To close the valve, return the valve to the UP position.

The large chamber has separate valves for evacuating and refilling. The valves are indicated in the picture below (Figure 27). Do not open these valves at the same time.

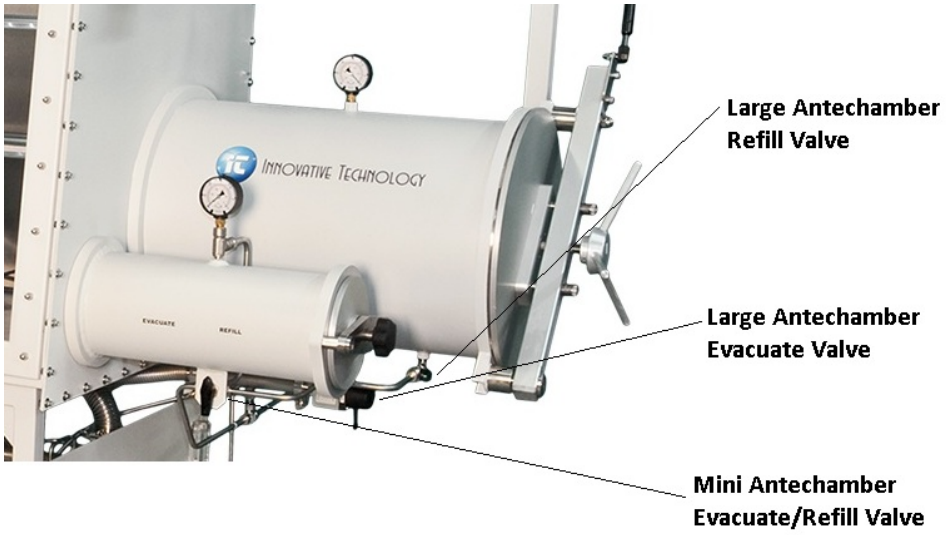


Figure 27 Large and Mini Antechambers - I

5.3.1 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.
4. Close the outside door.
5. Open the evacuate valve to pull a vacuum on the antechamber (-29 in. HG). Allow the vacuum to be pulled on the mini antechamber for 5 minutes, 10 minutes for the large antechamber.
6. Close the vacuum valve and open the refill valve until the pressure reads -15 in HG, then close the refill valve.
7. Repeat steps 5 and 6 at least three times.
8. Open the refill valve until the antechamber fully refills.
9. Open the inner door and remove the object from the antechamber.
10. Close the inner door.
11. Open the evacuate valve and pull the chamber down to -29 in. HG.
12. Close the evacuate valve to leave the antechamber under a static vacuum.

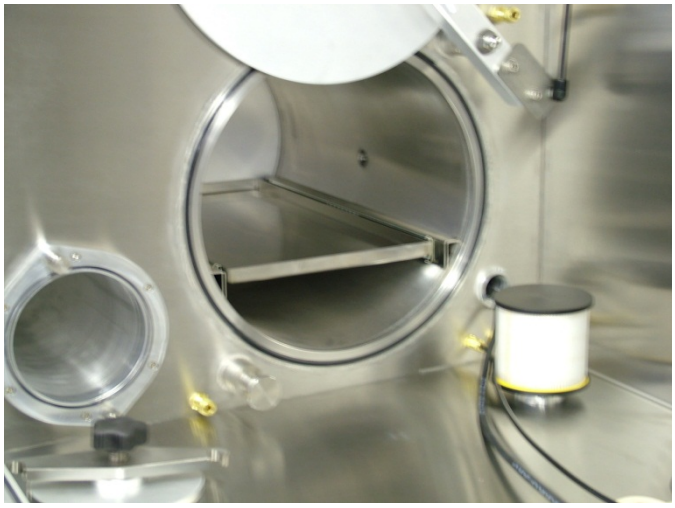


Figure 28 Large and Mini Antechambers - II

5.3.2 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 exposes the box to the antechamber. If you are not certain of the status of the antechamber, then evacuate and refill three times 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.
6. Close the outside door.
7. Open the evacuate valve and pull the chamber down to -29 in. HG.
8. Close the evacuate valve to leave the antechamber under a static vacuum.

5.4 Purging

Warning: Always turn off the blower before purging. If the blower is on while the purge valve is open, you risk allowing the labs atmosphere to enter the Glovebox and saturate the purifier column.

Purging is performed to protect the purification column from high levels of O_2 and H_2O, or solvent vapors. If high volumes of solvents are being worked with or O_2 and H_2O have been let into the box for any reason, the blower should be turned off immediately and the Glovebox should be purged.

Purging is most efficient when there is constant gas flow into and out of the Glovebox. The box pressure should be maintained at above 1 mbar during purging. After the purge valve is opened the Glovebox pressure begins to decrease. After the minimum working setpoint is reach the

system refills with gas. The flow of gas comes into the box and flows out the purge valve taking excess O_2 and H_2O with it.

Purge Valves: There are two types of purge valves that your system may be equipped with.

5.4.1 Manual Purge Valve

Standard ILab Gloveboxes are fitted with a hand-operated 2-Way Ball valve. The valve must be opened and closed by hand to begin and end the purging process.

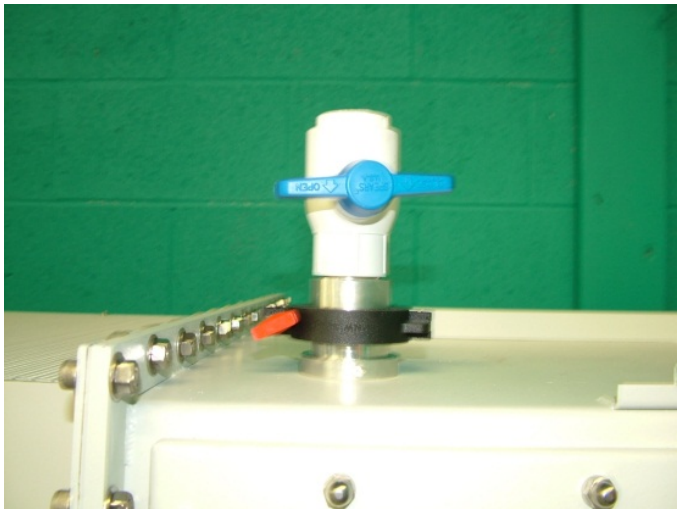


Figure 29 Manual purge valve

Purge Procedure with a Manual Purge Valve

1. Turn OFF the blower.
2. Adjust the Working Maximum Pressure to 10 mbar (refer to Adjusting Pressure CR).
3. Adjust the Working Minimum Pressure to 5 mbar (refer to Adjusting Pressure CR).
4. Open the purge valve.
5. Adjust handle of the purge valve so that the box pressure is maintained above 1mbar and there is a constant flow of gas into the Glovebox.
6. Allow gas to flow until you have removed excess O_2, H_2O, or solvent vapors.
7. Close the purge valve.
8. Turn ON the blower.
9. Reset Working Pressures to desired values.

5.4.2 Automatic Purge Valve

This feature is only available if your system has been factory-fitted with an automatic purge valve. This valve can be opened and closed through the touch screen interface. There are automatic features that are explained below.

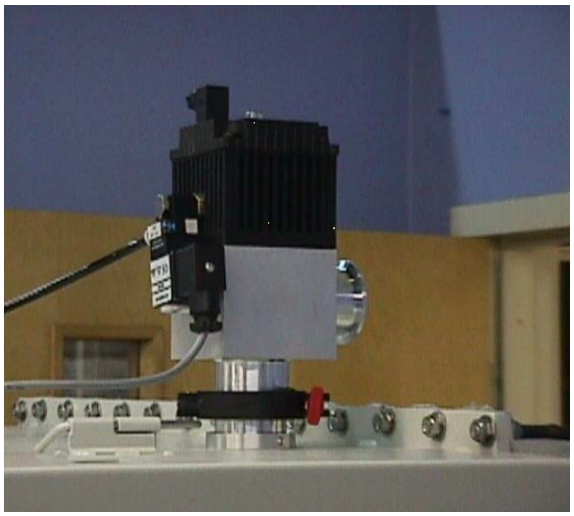


Figure 30 Automatic purge valve

Pressing the **Purge Control** button brings up the following screen (Figure 31):

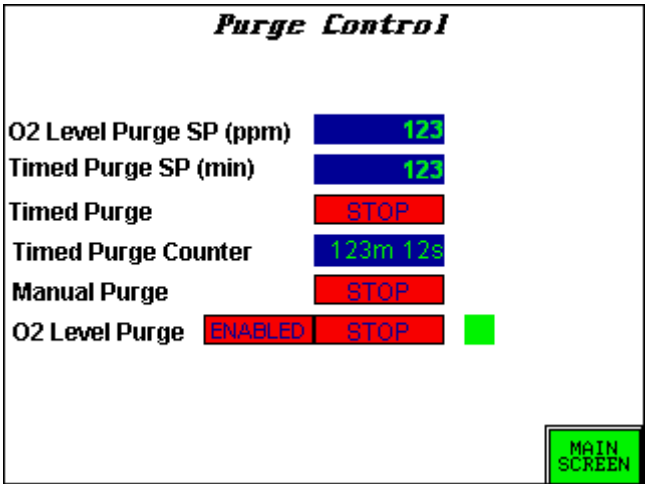


Figure 31 Purge Control screen

Note 1: Initiating any purge sequence while the blower is running switches off the blower until the purge sequence is complete. The blower automatically restarts after the purge sequence is complete.

Note 2: Automatic purge valves should be fitted with a manual valve in the exhaust line that can be used to adjust the flow during purging.

O_2 Level Purge SP (ppm)	If the system is fitted with an O_2 analyzer, this setting will open the automatic purge valve if the O_2 level exceeds the set value. This value can be changed by pushing the value and entering the desired value on the numeric keypad. In order to operate this feature the "O_2 Level Purge" must be ENABLED. If the O_2 level exceeds the setpoint, the blower will turn off and the purge valve will open. After the O_2 level has dropped back below the setpoint the Glovebox resumes normal operation. **Warning:** If the O_2 Level Purge is ENABLED it will function automatically at any time. This can result in large amounts of working gas being consumed while no user is present.
Timed Purge Duration (min)	This value sets the length of time that the automatic purge valve is open if the "Timed Purge" is started.
Timed Purge	Pressing START initiates the timed purge. The blower automatically turns off and the purge valve opens. After the set duration has elapsed, the purge valve closes, the blower turns on, and the system resumes normal operation.
Timed Purge 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.

Purging Procedure with an Automatic Purge Valve

1. Adjust the Working Maximum Pressure to 10 mbar. See "*Press Control (Pressure Control)*" on page 27.
2. Adjust the Working Minimum Pressure to 5 mbar. See "*Press Control (Pressure Control)*" on page 27.
3. Start a Manual or Timed purge.
4. Adjust the exhaust flow of the purge valve so that the box pressure is maintained above 1 mbar and there is a constant flow of gas into the Glovebox. This step requires a separate valve or dampener to be installed after the automatic purge valve.
5. Allow gas to flow until you have removed excess O_2, H_2O, or solvent vapors.
6. Stop the Manual Purge. A Timed Purge stops automatically at the end of the timer.
7. Reset Working Pressures to desired values.

5.4.3 Regeneration

Pressing the **Regen Control** button opens the following screen (Figure 32). This screen allows the user to initiate a regeneration of the purification column.

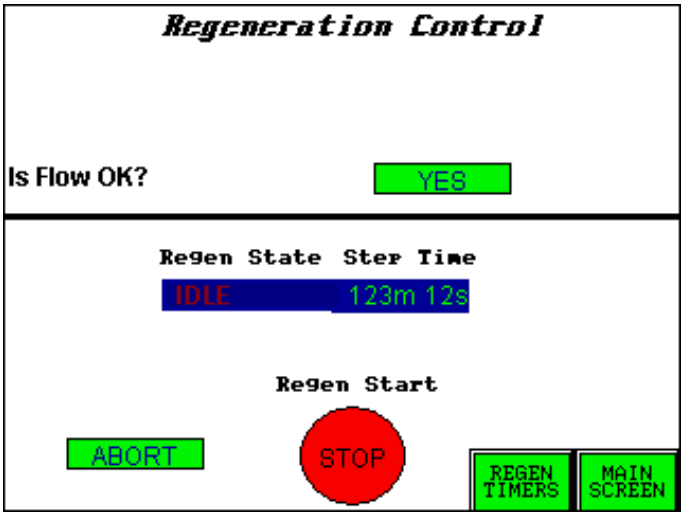


Figure 32 Regeneration Control screen

The purification column contains a mixture of copper-based catalyst to absorb O_2 and molecular sieve to absorb H_2O. Over time these materials become saturated and no longer able to absorb the O_2 and H_2O. The regeneration process allows these materials to be returned to their original state, enabling them to continue removing O_2 and H_2O. To maintain optimal performance, it is recommended that you change the purifier catalyst every 3 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 50 ppm O_2 prior to starting the regeneration.

A regeneration cycle comprises 5 steps as shown below (Figure 33). The default times are shown and are measured in minutes. This screen can be viewed by pressing the **Regen Timers Button** from the Regen Control screen.

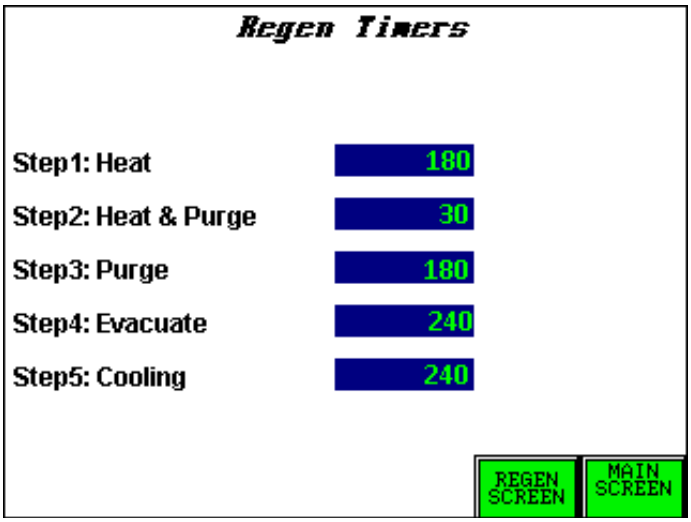


Figure 33 Regen Timers screen

Warning: Do not change the factory set regen timers without consulting your Innovative Technology service representative.

5.4.3.1 Regen Stages

Heat	The column is heated for 3 hours.
Heat and Purge	The column continues to heat while the regen gas begins to flow into the column and out of the regen exhaust for 30 minutes.
Purge	The regen gas flows through the column and out of the regen exhaust for 3 hours.
Evacuate	The column is opened to the vacuum pump. Vacuum is pulled on the column for 4 hours.
Cooling	The column is opened to the Glovebox to use the inert air to cool the column down.

5.4.3.2 Regeneration Procedure

1. Purge the system to less than 50 ppm of O_2. (See "*Purging*" on page 35.)
2. Connect a cylinder of regeneration gas (forming gas) to the regen gas connection on the lower right side of the Glovebox. 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 cylinder and set the regulator to 7 psi.
3. Turn off the blower. The column valves close automatically. There is a yellow indicator pin that protrudes from the top of the column valves. This pin recedes into the valve after it closes.
4. Enter the Regen Control screen and press **START**. The regen gas begins to flow through the column and out of the regen exhaust line.
5. Adjust the flow of the regen gas by using the flow meter on the right side of the Glovebox above the regen gas connection. Set the flow to 25-30 scfh.
6. Press **YES** at the "Is Flow OK?" prompt. The regen starts.
7. A regeneration takes 14.5 hours to complete. After the regen completes, turn ON the blower to resume normal operation.

5.5 O_2 Analyzer

When shipped, the oxygen analyzer valves are closed as shown in the picture below (Figure 34):

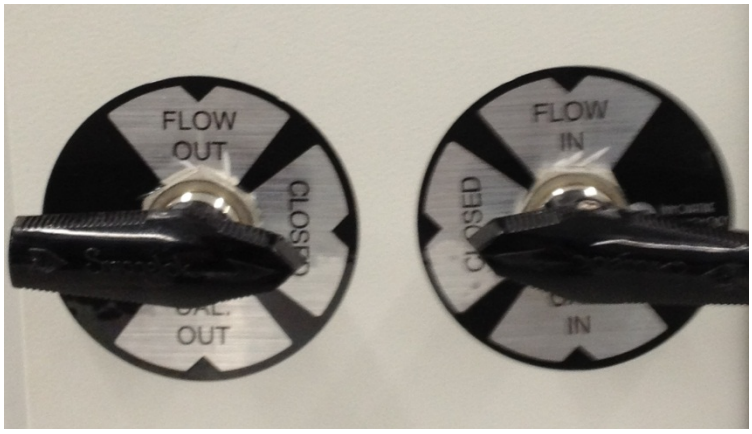


Figure 34 Oxygen Analyzer valves - closed

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 the following picture:

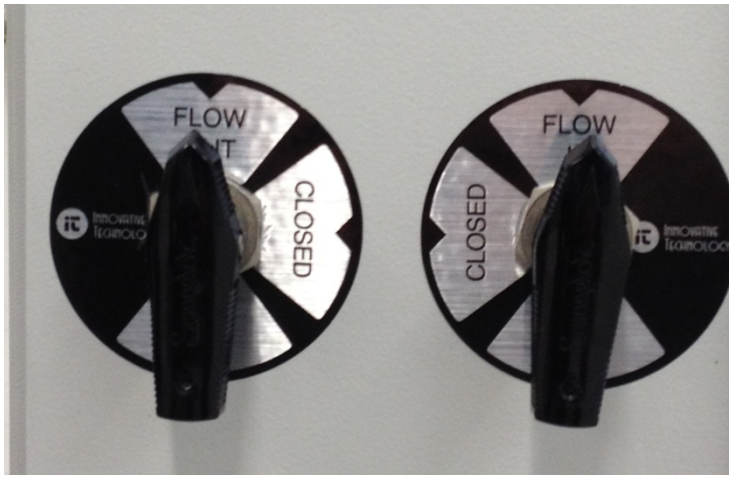


Figure 35 Oxygen Analyzer valves – Flow Out

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

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

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.

The analyzer is calibrated at the factory prior to shipment. Calibration should be performed at least every two years. Contact your Innovative Technology service representative for a calibration procedure.

5.6 H_2O Analyzer

The moisture analyzer sensor (Figure 36) is comprised of the aluminum oxide ultra-high capacitance design which incorporates automatic temperature compensation. It is mounted in the circulation plumbing prior to the purification column.

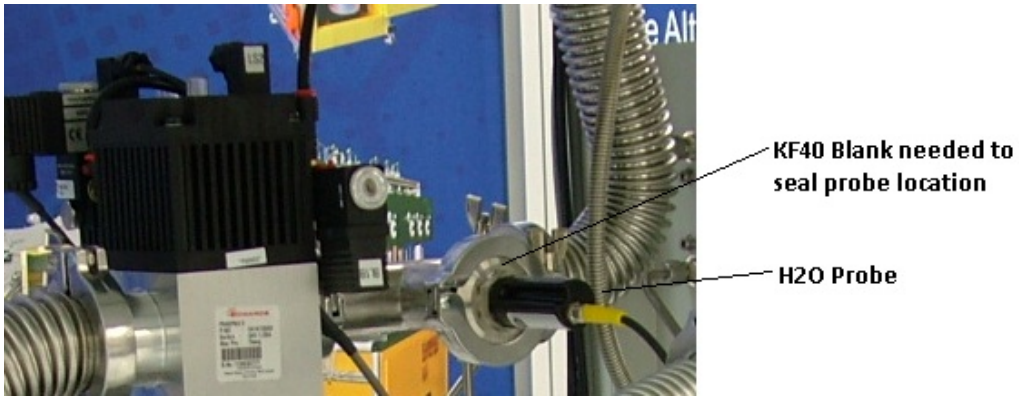


Figure 36 H_2O Analyzer

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

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

5.7 Solvent Removal Systems

Internal and External Solvent Removal Systems are optional extras that can absorb solvent vapors that would otherwise contaminate the purification media. These systems are located inline with the circulation plumbing of the Glovebox.

5.7.1 External Solvent Removal

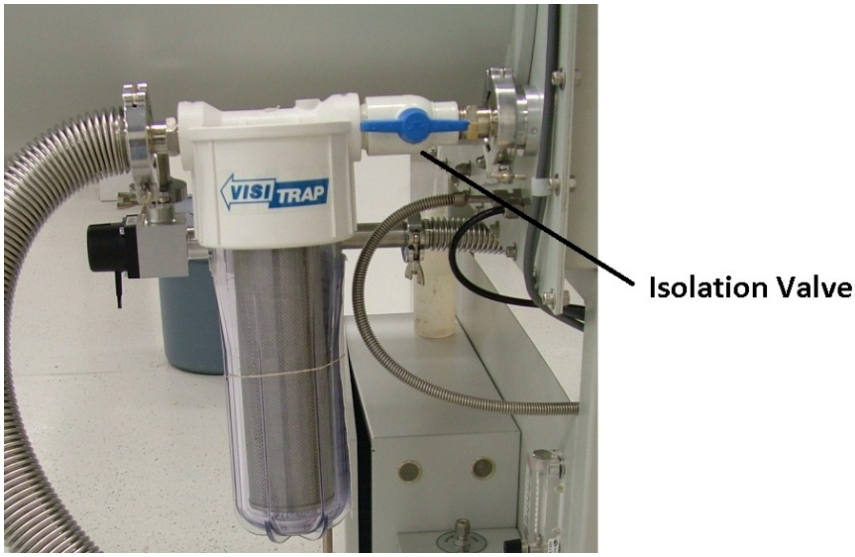


Figure 37 External Solvent Removal system

The External Solvent Removal systems contain an activated carbon-impregnated filter element. It is located behind the large antechamber.

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 main power of the Glovebox.
2. Close the solvent removal systems isolation valve. This protects the atmosphere in the Glovebox.
3. Twist the clear base counter-clockwise to open the trap.
4. Replace the filter element.
5. Replace the plastic base. Ensure that is screwed in tight.

   Important: Open the solvent removal systems isolation valve. Failure to open the valve before the system is turned on could result in over-pressurizing the Glovebox plumbing.
6. Turn ON the main power of the Glovebox.
7. Purge the Glovebox to remove the O_2 and H_2O that is now in the solvent removal system.
8. Turn ON the blower to resume normal operation.

5.7.2 Internal Solvent Removal System

Warning: This solvent removal system should be unscrewed and put aside before purging the Glovebox to prevent activated carbon particles from being dispersed inside the Glovebox.

This replaces the Glovebox HEPA filter on the suction side of the gas purification system. It is filled with activated carbon. The cartridge must be removed from the Glovebox to be emptied and refilled. The cartridge can be removed by hand and brought out through the antechamber.

6 Maintenance

Regular preventive maintenance helps to reduce box problems that cause down time and increases 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 45.
- 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 antechambers' O-rings. Replace them if they are worn.
- Check the box filters. Replace if necessary.

6.3 Monthly 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 if they are visibly dirty.

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

6.5 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. It is assumed that the person executing these procedures is qualified to perform mechanical and electrical tasks.

6.5.1 Blower Replacement

1. Turn off the system main power.
2. Remove the electrical connector from the blower.
3. 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.
4. Remove the blower box assembly and replace it with a new one.
5. Connect the piping with the clamps.
6. Purge the box piping with working gas.
7. Connect the electrical connector.
8. Power the system on and pressure test to check for leaks.

6.5.2 Column Replacement

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

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

   Note: After the bottom blank is removed, the filter material begins to come out.
4. Drain the old material and use the vacuum to remove any remaining material.
5. Empty the entire contents of the purifier according to your safety regulations.
6. Replace the blank onto the bottom port of the column.
7. 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.
8. Replace the blank to the top port of the column. Ensure that KF-40 connections are tight.
9. Restore the main power to the system.
10. Perform two regenerations of the column for optimum performance.
11. Resume normal system operation.

6.5.3 Filter Replacement

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

6.5.4 Gloves Replacement

Warning: Replacing a glove increases the risk of exposing the system to the outside environment. Prior to proceeding, ensure that precautions are taken to protect sensitive materials inside the Glovebox.

There are two methods to changing a glove: with an Internal Glove Port Cover, and without the Cover. Both are detailed below.

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, reducing 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.

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. Push the glove that is to be replaced into the box.
2. Remove the inner glove port O-ring (the one 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, reducing 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 ante chamber, and discard it properly.

6.5.5 Circuit Breaker Replacement

Note: 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 push out through the front door.

4 Install new circuit breaker in reverse order.

6.5.6 24v Power Supply Replacement

1 Remove system AC power at the source.

2 Disconnect the DC power cable (right side, Blue and White with Blue wires).

3 Disconnect the AC power cable.

4 Release the clip on the bottom of the power supply. This releases it from the DIN rail.

5 Reinstall in reverse order.

6.5.7 Solid State Relays

1 Mark all wiring before removal.

2 Remove system AC power at the source.

3 Disconnect the DC control wiring, right side of SSR, screws 3 and 4.

4 Disconnect the AC control wiring, left side of SSR, screws 1 and 2.

5 Remove the screws holding the SSR to the white backing panel.

6 Reinstall in reverse order.

6.5.8 Valve Replacement

This procedure is for replacing one of the six valve block valves.

1 Remove the Glovebox AC power. Do not assume that the valve is off and stays 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.

6.5.9 Vacuum Pump Replacement

1. Remove the Glovebox 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.

6.5.10 Window Replacement

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

1. Stop the Glovebox 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.

7 Troubleshooting

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

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

1. If cylinder gas, is the tank empty? If empty, replace the tank.
2. Is the regulator open? If closed, open the regulator.
3. Is the needle valve on the regulator open? If not, open the valve.
4. What is the gas pressure?
5. If the pressure is too high the valve won't open. Pressure on a Purelab HE should be 55 PSI.
6. Is the electrical signal getting to the gas (GA) valve? The Valve illuminates if it is receiving the proper voltage.
7. 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 only flows after you have confirmed that the column valves are closed. After the regen starts, the gas no longer flows until the Purge stage of the regen begins.

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

Problem: The antechamber will not hold a vacuum.

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

Problem: Box is leaking.

1. Normally a box does 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.
2. Verify that all antechambers are left under a static vacuum and are not leaking.
3. Refer to "*Pressure Testing the System.*" Record the rate of leakage.

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

1. Change the pump oil if it looks bad.
2. Verify that all fittings connected to the vacuum pump are tight.
3. 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.

1. 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 can repair scratches on the outside of the glass.
2. 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.

7.1 When a Service Call is Necessary

Call your Innovative Technology service representative. Be prepared to provide your system’s serial number and a detailed description of the problem.

8 Technical Information

8.1 Specifications

The Lower Control Box contains the following components:

- 24v Power Supply
- PLC
- Wiring connections
- Solid state relays
- Pressure sensor
- Circuit breakers

8.2 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.

8.3 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.

8.4 PLC

The PLC is responsible for activating 24v relays to power many system components. 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. This is the best indication that the box electronics are functioning properly. Contact your Innovative Technology service representative if you need wiring diagrams.

Table 3 Connector PLC functions

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
BL1	Blower, activates the column 1 valves to enable the blower speed control to turn on the blower	Column 1 valves
CO1	Cooling, vents column 1	Valve block, CO
EX1	Regeneration gas exit, column 1	Main cell block, EX

Connector	Function	*Connection*
HT1	Heater control, column 1	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
RV	Regeneration vacuum, opens column 1 to the vacuum pump	Valve Block RV

8.5 Solid State Relays

This section of the board is where the PLC control lines activate or deactivate the solid state relays (SSRs). These SSRs then switch on and off motors and heaters in the system.

Table 4 Solid State Relays

Solid State Relay	Function
HT1	Turn on AC power for the purifier column's heater
VP	Turn on AC power for the vacuum pump

8.6 Circuit Breakers

Table 5 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	Spare
7	5A/3A	Lighthood

8.7 Equipment Rating

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

8.8 Piping and Valves

All piping and tubing are 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.

8.9 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 stainless steel.

8.10 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.

8.11 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 opens valve, “VA,” or “AE,” respectively. The pump turns on automatically if it is needed by the system.

8.12 Antechambers

The large antechamber is a 15" I.D. by 24" long cylinder mounted on the left or right side of the box. In addition, 6" x 15" mini antechamber is also available on either side.

8.13 Box Flow

The general box flow is illustrated below (Figure 38). When circulation is on (the blower 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.

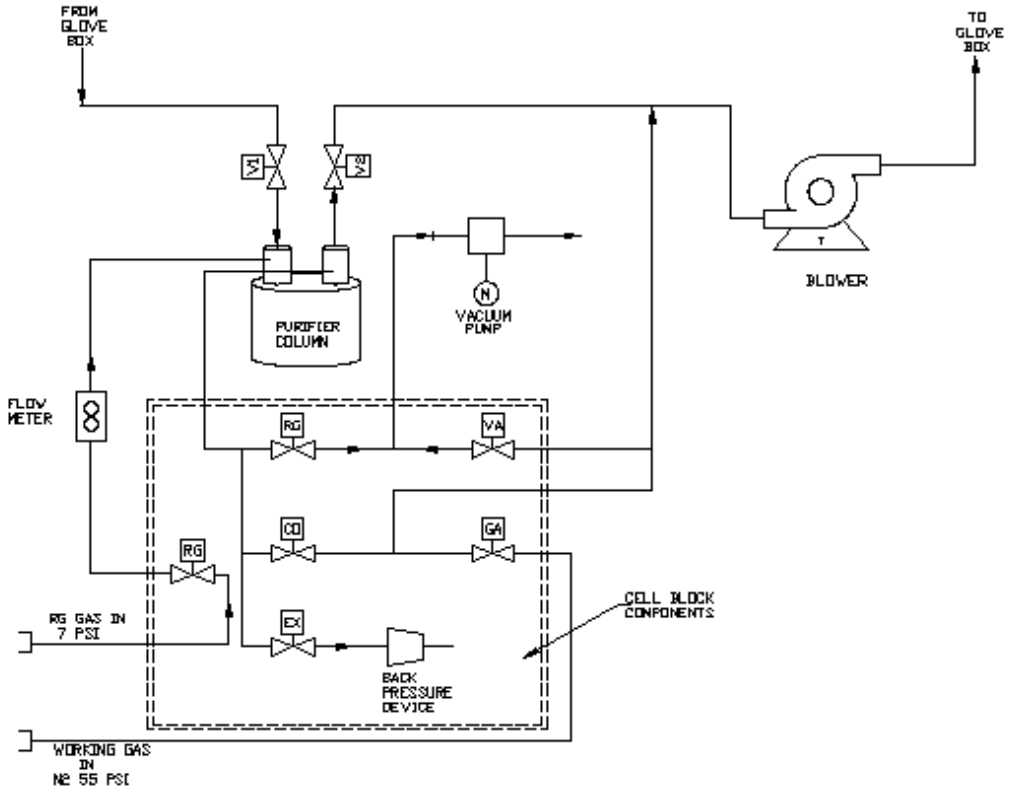


Figure 38 General box flow

8.14 Drawings

Below are mechanical drawings of a standard ILab system. For additional drawings or electrical schematics please contact your Innovative Technology service representative.

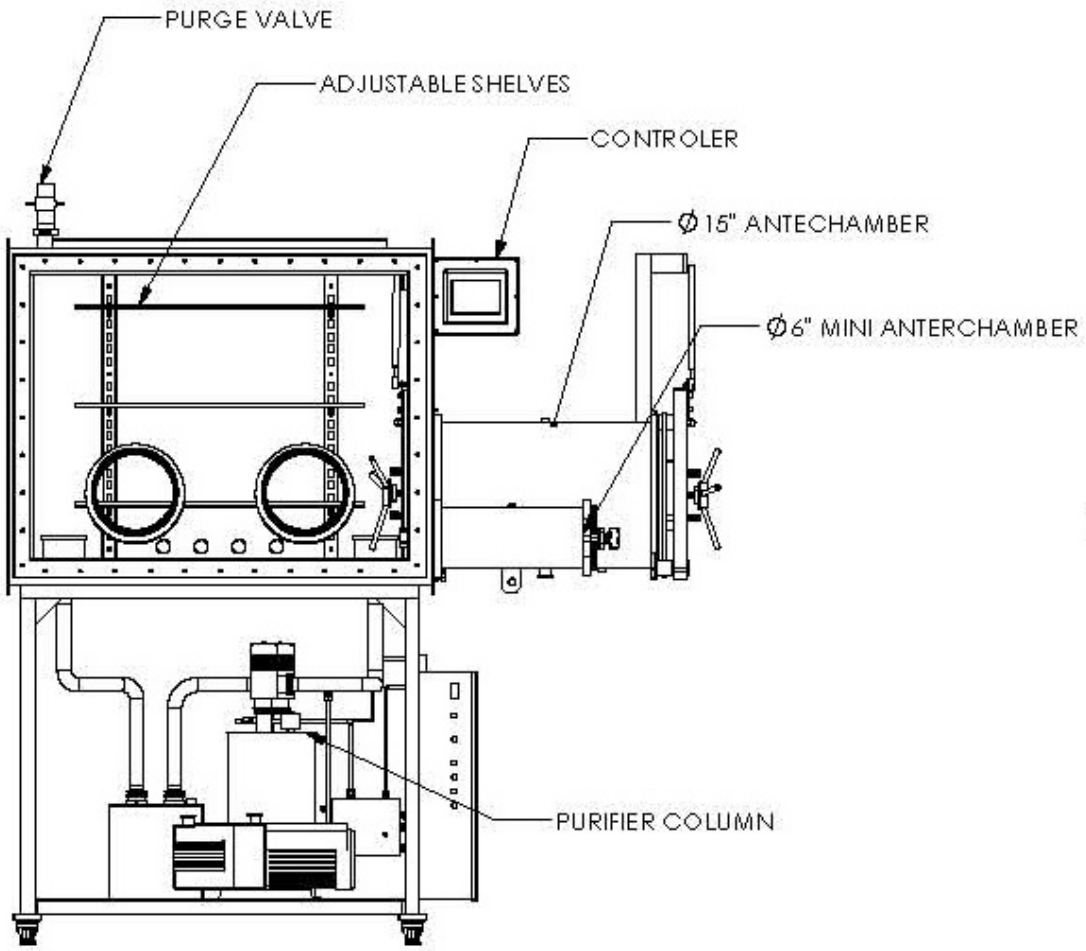


Figure 39 ILab Front View

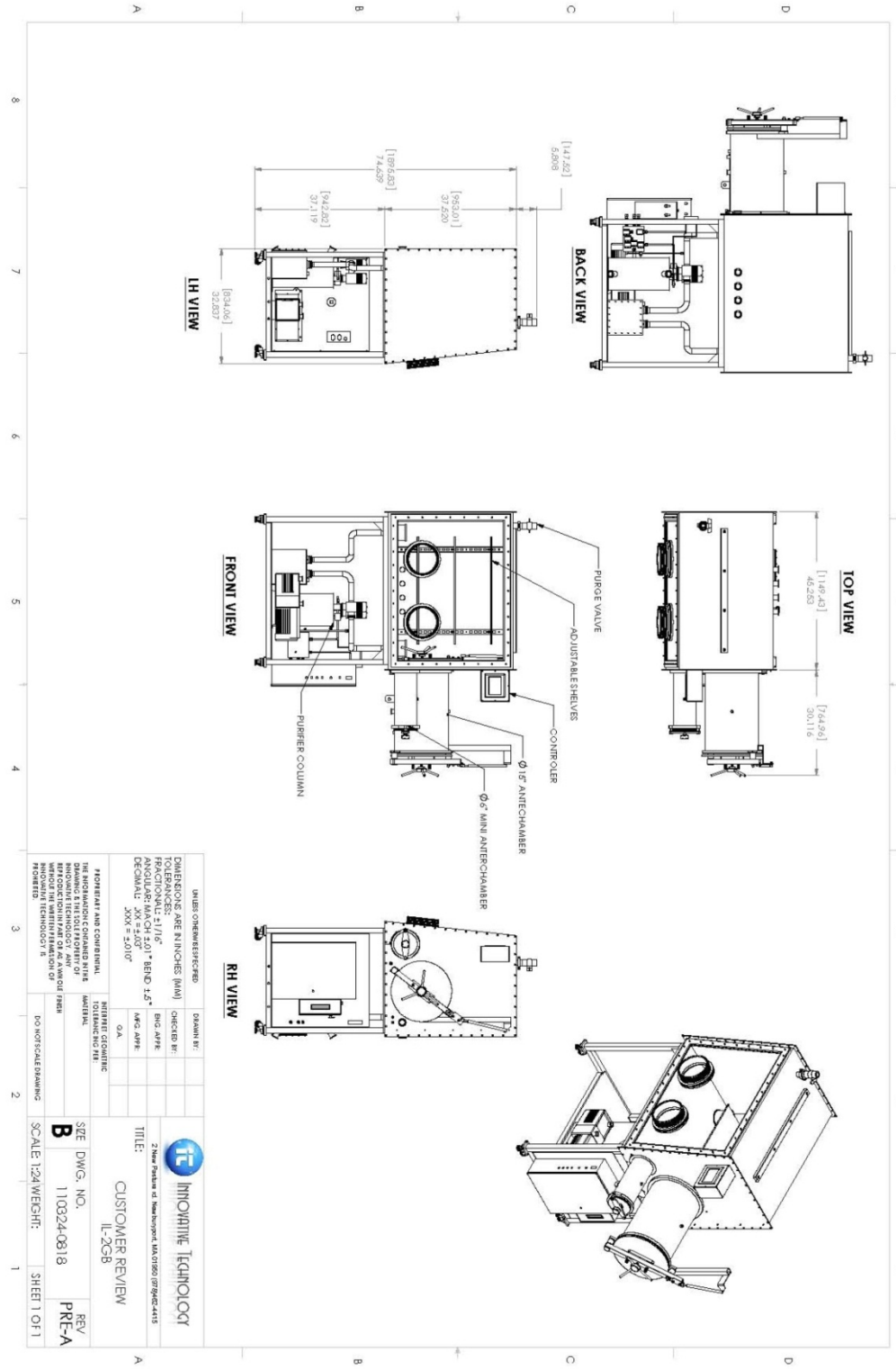


Figure 40 ILab All Views