PURE LAB HE

USER MANUAL

COPYRIGHT

COMPANY INFORMATION

Inert
1 Industrial Way
Amesbury, MA 01913
USA
Phone : 978-462-4415
www.inertcorp.com

DOCUMENT INFORMATION

VERSION	REVISION DATE	COMPLETED BY	CHANGES
0.0	8/5/2015	TBM	Innovative Technology to Inert
0.1	7/8/2016	SSJ	Spelling, Grammar, Fonts, Design
0.2	1/3/2017	SSJ	Switched 6.3.13 and 6.3.14
0.4	7/2/2024	JCL	Grammer, font, figure labels, page numbers.
0.5	10/3/24	JCL	Addition of Interlocking Antechamber functions
0.6	5/28/25	EJK	Formatting, remove redundancy

CONTENTS

FIGURES

TABLES

1 ABOUT THIS MANUAL

1. Documentation Reference:
    - This document serves as a comprehensive guide for the installation and operation of the PureLab HE system.
    - Pay close attention to references made in the Installation section to features explained in the Operational section.
2. Contacting Service Department:
    - For any queries or concerns during the installation and operation process, reach out to the Service Department.
    - Find contact details in the "SUPPORT" section on page 11 of the document.
3. Modification Warning:
    - Unauthorized modifications to the PureLab HE system are strongly discouraged.
    - Any unauthorized alterations or usage outside specified parameters may compromise equipment protection and potentially void warranties.
4. Operational Safety:
    - Follow the operational guidelines meticulously to ensure safety and optimal performance.
    - Refer to the Operational section for detailed instructions on using various features, including optional accessories like freezers and heated antechambers.
5. Warranty Implications:
    - Understand that unauthorized modifications or operations may impact warranties associated with the PureLab HE and its accessories.
    - Adhering to manufacturer-specified guidelines is essential to maintain warranty coverage.
6. Service Department Support:
    - Should further questions arise during installation or operation, promptly contact the Service Department for assistance.
7. Preserving Equipment Protection:
    - Strictly adhere to the manufacturer's guidelines to preserve the intended protection provided by the PureLab HE equipment.
8. Clarifications and Assistance:
    - If uncertainties arise or if clarification is needed on any aspect of installation or operation, don't hesitate to seek assistance from the Service Department.

By following the instructions outlined in this document and reaching out for support when needed, users can ensure the successful installation, proper operation, and longevity of the PureLab HE system.

1.1 FIRMWARE REVISIONS

This User Manual corresponds to a minimum PLC firmware Version 20123R4 for the PureLab HE system. Enhancements may have been made if your firmwar version is less than 20123R4. Verify the PLC firmware version through the System Information screen on your PureLab HE system, with the displayed version number indicating the currently running firmware. Regularly check for firmware updates provided by the manufacturer to benefit from enhancements and maintain compatibility with the latest features.

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.

1.3 TERMS

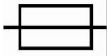
PureLab HE is an Inert Glovebox system.

Gas Purifier includes the gas purifier module with purifying columns.

1.4 SYMBOLS USED

The following are symbols used in this manual and on the PureLab HE:

Table 1 - Symbols

	CIRCUIT BREAKER
	ELECTRICAL GROUND
	ELECTRICAL AC CURRENT
	GENERAL WARNING SYMBOL
	HIGH VOLTAGE HAZARD

HOT SURFACE HAZARD

2 SUPPORT

If you need additional information about operating your PureLab HE Glovebox:
Visit https://inertcorp.com > Service or https://www.inertcorp.com/help/

Contact the Inert Service Department:

- Go to https://www.inertcorp.com/help/
  Enter your organization's information and a brief description of how we can help you.
- Or call 978-462-4415, then select Option 2

To request a quote for parts or service:

- Go to https://www.inertcorp.com/rfq/
- Fill out the short form and we will contact you to confirm your inquiry, review your particular needs, and address your questions or concerns.

3 SYSTEM OVERVIEW

The PureLab HE Glovebox includes the glovebox, antechamber(s), gas purifier, and vacuum pump. This system reduces O2 and H2O levels to less than 1 part per million (ppm). The elimination of oxygen and water vapor from the inert atmosphere uses a blend of molecular sieve and copper catalyst. Upon saturation, these substances can be regenerated to their initial state.

The PureLab HE prioritizes user convenience in its design:

- The Operator Interface is a color HMI touch screen positioned on a swing arm.
- A foot pedal provides hands-free control over the box pressure.
- Both interior and exterior doors are designed for easy operation.
- Modular Gas Purifier – allows mobility for servicing.
- Visual indicators on the Automatic Column valves for quick and easy status monitoring.
- Circuit breakers and Solid State Relays contribute to the system's robust and reliable performance.
- Simple access for valve replacement, ensuring ease of maintenance.
- All connections utilize stainless steel tubing, either welded or connected through KF-40 clamps or compression connectors.

Each Inert Gas Purifier is uniquely labeled based on the gas type and purifying capacity. The system shipped with your PureLab HE will be identified as ARGON or NITROGEN (or another gas) along with the number of purifying columns (1 or 2).
All service connections are located on the rear of the Gas Management system and are clearly labeled. Refer to Figure 1 for a visual representation.

The control system of the PureLab HE is PLC-based and features HMI touch screen operation. This system monitors and manages all functions of the glove box.

The vacuum pump is located on the floor to allow easy access for maintenance. Additionally, the Gas Purifier module is designed with removable side and top panels, allowing access to components such as the Valve Assembly, Purifier Column, Valves, and Blower.

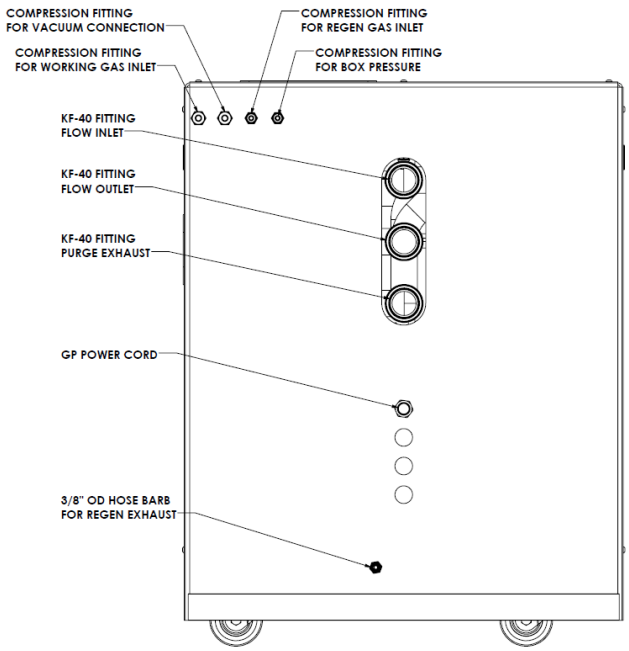


Figure 1 - Gas Purifier

3.1 THE PLC ENCLOSURE

The PLC enclosure, responsible for housing the electronics necessary to operate the glovebox, is positioned on the front of the Gas Purifier. This strategic placement ensures easy accessibility for monitoring, maintenance, and any required adjustments to the control system..

3.2 EXTERIOR CONTROLS

The PLC enclosure features exterior controls mounted on the sidewall. These controls include several circuit breakers and a main circuit breaker, which serves a dual purpose as the main power switch. This configuration provides a convenient and centralized location for managing power distribution and ensuring the overall safety and control of the glovebox system.

3.3 CIRCUIT BREAKERS

The sidewall of the PLC enclosure houses eight (8) circuit breakers, labeled to indicate its function. In the tripped position, a white-colored tab extends from the middle of the breaker. To reset a tripped breaker, press the tab back in until it locks in place.

For more information about the circuit breakers see Table 25 in this manual.

3.4 FOOT PEDAL

The PureLab HE is equipped with a dual pedal foot switch. This foot pedal enables adjustment of the box pressure without requiring the operator to remove their arms from the gloves. The functionality is straightforward, with the right pedal increasing the box pressure, and the left pedal decreasing it.

The PLC control system maintains the working minimum and maximum pressure settings. This ensures that pressure adjustments made using the foot pedal remain within the minimum and maximum setpoints.

4 INSTALLATION

4.1 PRE-INSTALLATION REQUIREMENTS

Location and Environment:

- Choose a suitable location for the glove box, considering factors such as ventilation, access for maintenance, and adherence to safety regulations.
- Ensure the installation site is free from potential hazards and provides ample space for the glove box and its associated modules.

Positioning:

- Place the glove box on a level surface to ensure stability.
- If applicable, position the Gas Management module in proximity to the glove box, ensuring proper alignment for connections.

Power Connection:

- Connect the glove box to a stable power source according to the provided electrical specifications.
- Verify that the main circuit breaker on the PLC enclosure is in the off position before connecting the power.

4.1.1 WORKING GAS

The PureLab HE requires Nitrogen or Argon as the working gas, regulated to a pressure of 55-60 psi. Connect the working gas to the inlet using either 3/8” or 10 mm stainless steel or copper plumbing, secured with a 3/8" or 10 mm compression connector. For the standard 1250mm 2-Glove Pure Lab HE, use four (4) 350 Liter high-purity cylinders—three for purging and one for final operation. Contact the Inert Service Department for gas requirements of other models.

Consult system-specific installation requirements provided before system shipping. If you require a copy of the PureLab HE installation requirements, please contact an Inert representative.

Ensure the working gas tubing maintains a 3/8" outside diameter throughout the entire distance from the regulator to the working gas connection. Using reduced tubing diameter may lead to insufficient gas flow, impacting system performance. Outside of North America, utilize 10 mm connections and tubing.

4.1.2 REGENERATION GAS – CONNECTOR REQUIREMENTS

The Gas Management system undergoes regeneration and performance testing at our factory before shipment, ensuring levels of O2 and H2O are maintained at < 1 ppm. Regeneration is not required upon installation. Connect the Gas Management system with 1/4" or 6 mm stainless steel or copper tubing.

For regeneration, use a cylinder of Regeneration Gas containing between 3% and 7% Hydrogen, balanced with Nitrogen or Argon gas.

4.1.3 ELECTRICAL

Inert PureLab HE systems are pre-configured to operate in accordance with the electrical power standards specific to the region of purchase. For the standard 1250mm 2-glove system, two electrical outlets on separate circuits are required. One outlet is designated for the main system power, while the other powers the strip inside the PureLab HE. Larger systems or those with additional configurations may necessitate extra outlets to accommodate specific power requirements.

4.2 UNPACKING THE SYSTEM

Shipping and Unpacking Instructions:
The PureLab crate requires a forklift to remove from the pallet.

WARNING: PureLab HE systems are top-heavy. Exercise caution when unloading and moving to guarantee equipment and personnel safety!

To unpack the PureLab HE system:

1. Place the Glovebox and Gas Purifier on a level floor at the desired location.
2. Remove the shrink-wrap and any additional strapping supporting accessories.
3. Depending on the system configuration, locate one or multiple boxes containing items such as gloves, power strips, etc., within the large Antechamber and on the pallet. Conduct a careful inspection of all packaging materials before disposal to prevent misplacing small components.

For further assistance or information, please reach out to your Inert representative.

4.3 ASSEMBLY

Figure 2 - Purelab HE

Installation of a Single PureLab HE System:

This procedure requires 9/16" and 11/16" wrenches.

1. Refer to the PureLab HE layout drawing (FIGURE 2).
    - The PureLab HE features lockable casters on each leg for ease of placement. Once positioned, adjust the casters to secure the system in place.
2. Level the system by adjusting the leveling feet under each leg.
3. Place the Gas Management module beneath the Large Antechamber.
4. Connect the Gas Management module to the PureLab HE.
    - Match labels on piping and components between the PureLab HE and Gas Management module (e.g., "1" to "1", "2" to "2", "A" to "A").
5. Install adjustable shelves inside the box at the preferred height, sliding them through the Antechamber without removing the window.
6. Place the power strip in the box as desired. Connect the male plug to the female outlet leading to the feed-through on the box's side.
7. Install the oxygen analyzer:
    - If using a Zirconia analyzer, attach it to the labeled plumbing.
    - For an electrochemical analyzer, follow section 5.14.2 on page 36 for proper installation during system purging.
8. Attach the Purge Valve to the corresponding KF-40 flange on the Gas Purifier. For the auto-purge version, connect electrical and pneumatic lines as instructed.
9. Install gloves through each glove port, stretching the cuff end over the port until the lip fits into the last groove. Place two O-rings on each glove in the outer two grooves.

To Install a Multiple Module Glovebox System:

This procedure requires two 7/16" wrenches.

1. Remove the window from one box (See "WINDOW" on page 79).
2. Press both boxes together and level them by adjusting the leveling feet. Lock the leveling feet in position once leveled.
3. Separate the boxes enough to fit between them.
4. Apply a 1/4" bead of sealant to one of the Glovebox flanges.
5. Press the boxes together and insert the four corner bolts. After hand-tightening the bolts, insert the remaining hardware and tighten all bolts.
6. Place the window on the box (See "WINDOW" on page 79).
7. Install gloves and glove O-rings as described in step 9 of the previous procedure.

NOTE: PureLab HE systems are shipped with various options. Review each section in this User Manual applicable to the specific configuration of the system being installed.

4.4 GAS CONNECTIONS

Gas Connection to Gas Purifier Module:

1. The fittings for both gases are positioned on the rear wall of the gas purifier module.
2. Connect the working gas to the compression fitting labeled appropriately.
3. Tighten the compression fitting to 1-1/4 turn from finger tight. Avoid over-tightening.

IMPORTANT:

- Ensure the proper regulator is installed on both the working gas cylinder and the Regeneration gas cylinder.
- Connect tubing of sufficient length, and carefully check for any leaks.
- Confirm that the regulator can supply 60 PSI at a flow rate of 250 LPM. Adjust the settings accordingly.

NOTE: If you are not familiar with compression fittings, please contact your Inert representative for further assistance.

Regulator Settings:

- Set the Working Gas regulator to 60 psi (4 bar).
- Set the Regen Gas regulator to 7 psi (0.5 bar).

Connection Specifications:

- For North America:
  - Working Gas: 3/8"
  - Regen Gas: 1/4"
- Outside North America:
  - Working Gas: 10 mm
  - Regen Gas: 6 mm

4.5 VENTING CONNECTIONS

Handling of the Regeneration Gas, Vacuum Pump, and Purge Exhausts should adhere to the specifications mandated by your facility.

- Regeneration Gas Exhaust:
  - 3/8" I.D., 19/32" O.D. Tygon tubing.
- Vacuum Pump Exhausts:
  - KF-25 mm flange connections.
- Purge Valve Exhaust:
  - 1" Female NPT (for manual purge) or KF-40 mm flange (for automatic purge).

DANGER: Proper ventilation of the exhausted gases is crucial, as elevated levels of inert gas can lead to asphyxiation. Ensure that your facility has adequate ventilation measures in place to mitigate any potential risks associated with gas handling. Safety protocols should be strictly followed during the handling and venting of these exhausts.

4.6 COMMISSIONING THE SYSTEM

You are now prepared to commence the commissioning of the system. It is assumed that all preceding sections have been completed as outlined in this manual. Follow the subsequent steps to proceed with the commissioning process.

4.6.1 SWITCHING POWER ON

Activating Main Power:

1. Plug in power cord for Gas Purifier.
2. Switch the power ON. The switch is located on the front door of the control panel. In most cases, there is no additional action required to power on, except for optional equipment.

Controlling the Glovebox Light:

The glovebox light in the hood is managed using the Box Light button on the Main Menu screen. Additionally, there is a switch on the top of the light hood for manual control. Both must be turned 'On" for the light to illuminate.

5 SYSTEM OPERATION

5.1 LOGGING IN

Tap the Login button.
The Login screen (**FIGURE 3**) appears. "User" appears in the User field.

Figure 3 - Login Screen

The login credentials are:

User: User
Password: 1111

Tap the Password field. The Data Entry keypad (**FIGURE 4**) appears.

For a password, enter 1111 and tap Enter. You are returned to the Main Menu screen (**FIGURE 19**).

Figure 4 - Keypad

5.2 LEAK TESTING THE SYSTEM:

The PureLab HE, a leak-tight system, undergoes a pressure and performance testing before shipment. After assembly, conduct a leak test to ensure proper connections of fittings and pipework.

To access the Leak Testing screen, tap the Diagnostics button from the Main Menu screen

Leak Test Procedure:

1. Ensure that the inside and outside doors to the Antechambers are closed.
2. Turn on the vacuum pump by tapping the Vacuum Pump button on the Main Menu screen. The Vacuum Pump button turns green.
3. Open the evacuate valve on the Large Antechamber and allow it to evacuate to -30 Hg. Refer to “MANUAL ANTECHAMBER CONTROL” on page 26.
4. Close the evacuate valve.
5. Repeat the process for the mini-Antechamber.

NOTE: Starting a pressure test overrides the working gas settings on the Pressure Setup screen. If the blower was running, it turns off and must be manually turned back on after the test.

1. From the Main Menu screen, tap the Diagnostics button to open the Diagnostics screen.
2. Select a Positive or Negative Leak Test
3. Tap the Leak Test button to start the test. The button turns green, and the status changes to Positive Settle State.
4. After the 10-minute timer elapses, the status changes to Positive Leak Test. The counter starts counting down from 5 minutes.
    i. The PLC compares the Actual Value (Box Pressure) to the Test Start Value, and the Delta value displays the difference. If leak is greater than 0.15 mbar, the test fails, and the failed indicator turns red.
5. To stop the pressure test, tap the Start Leak Test button, reset working gas values on the Pressure Setup screen, and the pass indicator will be green. The negative pressure test begins.
    i. If the test passes, tap the Stop Test button.
6. If the test fails:
    i. Tap the Stop Test button.
    ii. Verify all connections are tight.
    iii. Re-test.
7. If the test fails again, contact your Inert Service Department. Refer to “SUPPORT” on page 8.

5.3 PURGING THE SYSTEM

Purging the PureLab HE:

The purging process is crucial to displace O2 and H2O in the glovebox with inert gas, minimizing air content before circulating the inlet gas through the purifier column. For a standard 2-glove system, it is

recommended to use at least three cylinders of inert gas and reduce O2 and H2O levels to less than 50 ppm.

NOTE: If your system has a freezer, ensure the door is open during purging.

1. Set System Pressure:
    - Set the Working Maximum pressure to +10.0 mbar.
    - Set the Working Minimum Pressure to +5.0 mbar. Refer to “ADJUSTING THE SYSTEM PRESSURE” on page 26.
2. Open Manual Purge Valve:
    - Open the manual Purge Valve at the back of the Gas Purifier.
    - For systems with Auto Purge valve, refer to “PURGE VALVES” on page 30.

NOTE: Maintain the Box pressure above 1 mbar during purging.

3. Adjust Flow:
    - Adjust the flow using the Purge Valve to maintain a steady flow of incoming gas, keeping the box pressure above 1 mbar.
4. Create Turbulence:
    - Enhance purge efficiency by creating turbulence in the box. This can be done by pressing in the gloves, waving inside the box, or using a small electric fan.
5. Cylinder Replacement:
    - Change the working gas cylinder as it empties.
    - Close the Purge Valve before the inert cylinder is empty.

To continue purging:

6. Re-open Purge Valve:
    - After replacing the cylinder, open the Purge Valve and the valve on the cylinder.
7. Repeat Purging:
    - Purge the system with at least three cylinders of inert gas for a standard 2-glove system.

NOTE: If you don't have an Oxygen Analyzer, assume O2 content is 50 ppm or less after purging with three cylinders (for a single 2-glove system). Close the Manual Purge valve.

8. Measure Oxygen Content:
    - Use the Oxygen Analyzer:
        - For Zirconia analyzer, refer to “EOS-1- ZIRCONIA SENSOR” on page 35.
        - For electrochemical analyzer, refer to “EOS-2 ELECTROCHEMICAL OXYGEN SENSOR” on page 35.
9. Monitor O2 Levels after Blower Activation:

- If O2 levels exceed 100 ppm after turning on the blower for longer than 5 mins, stop the blower, and continue to purge. Repeat steps 6 and 7 as needed.

5.3.1 CIRCULATION

The blower in PureLab HE serves the crucial function of continuously circulating the atmosphere through the purifier column at a minimum speed of 50%. Optimal performance is achieved when the blower runs constantly, turning it off leads to degradation of the atmosphere within the glovebox.

NOTE: The atmosphere degradation occurs due to gas not circulating through the O2 and H2O absorbing materials in the purifying column. Stopping circulation by turning off the blower results in a rise in O2 and H2O levels inside the PureLab HE.

Blower Control:

1. The blower can be controlled from the main control screen. Access the Blower Setup screen (refer to FIGURE 25) by tapping the Blower Setup button on the Main Menu screen (refer to FIGURE 19).
2. Starting the blower automatically opens the valves on the column, initiating the circulation of the box atmosphere through the purifier column.
3. The blower is continuously variable, allowing adjustment to very low speeds for handling sensitive materials or during weighing. It can also be set to the maximum speed for a quick recovery from operator errors.
4. It is recommended to set the blower at 50% during normal operation. Blower speed adjustments can be made by tapping the +/- buttons next to the Blower Manual Speed Setpoint setting or by entering a specific percentage.

NOTE: Refer to "HMI CONTROL BUTTONS" on page 46 for descriptions of the control buttons. The entered value represents a percentage, where 0% means the blower is not circulating, and 100% means it is at full speed.

5.4 ADJUSTING THE SYSTEM PRESSURE

ADJUSTING PRESSURE SETTINGS IN PureLab HE:

The PureLab HE control system is designed to maintain pressure within the specified working range. Adjusting pressure settings is crucial for system operation. Follow these steps to modify the pressure settings:

1. Access System Setup:
   - From the Main Menu screen (refer to FIGURE 19), tap the System Setup button to open the System Setup screen (refer to FIGURE 29).
2. Open Pressure Settings:
   - Tap the Pressure Settings button to access the Pressure Settings screen (refer to FIGURE 21).
3. Adjust Working Minimum Setpoint:

- Tap the setting for Working Minimum Setpoint. The Numerical Input keypad (refer to FIGURE 39) appears.
- Type the new setting and tap Enter or use the +/- buttons to adjust the value incrementally.

4. Adjust Working Maximum Setpoint:
   - Tap the setting for Working Maximum Setpoint. The Numerical Input keypad (refer to FIGURE 39) appears.
   - Type the new setting and tap Enter or use the +/- buttons to adjust the value incrementally.

NOTE: Ensure that the Working Minimum Setpoint is not set higher than the Working Maximum Setpoint to prevent alarms indicating the system exceeding parameters.

5.5 USING THE LARGE ANTECHAMBER

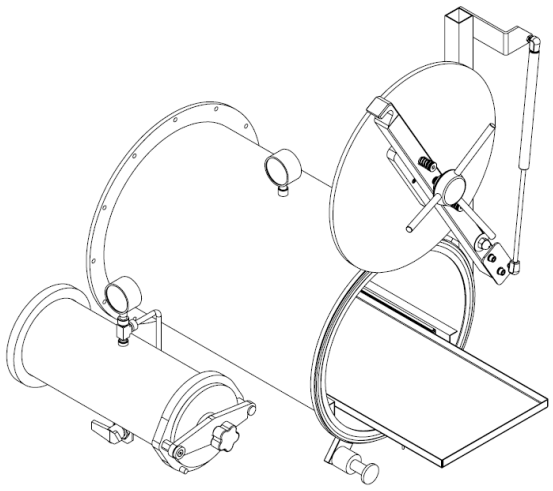


Figure 5 - 15" and 6" Mini Antechambers

5.5.1 MANUAL ANTECHAMBER CONTROL

MANUAL ANTECHAMBER CONTROL IN PureLab HE:

This section details the manual operation of the Large and Mini Glovebox Antechambers in PureLab HE, specifically outlining the steps for transferring objects into and out of the glovebox. These steps are based on the assumption that the atmosphere inside the chamber is at 1 ppm and not open to the outside air. Refer to FIGURE 5 on page 27.

Important Considerations:

- Perform all actions with the intention of maintaining the inert atmosphere's purity.

- The manual operation assumes that the atmosphere inside the chamber is at 1 ppm and not exposed to outside air.

NOTE: Always exercise caution and adhere to safety protocols when manually operating the antechambers to ensure the integrity of the inert atmosphere within the glovebox.

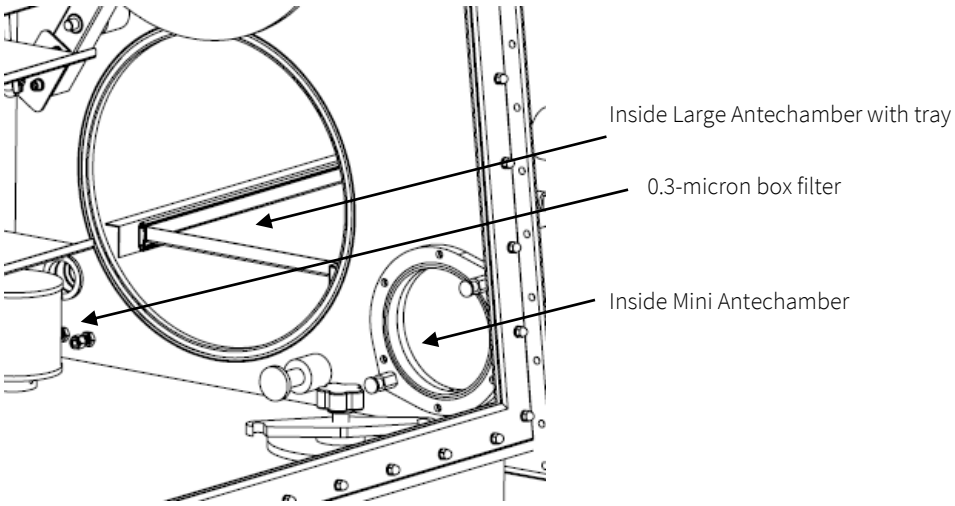
5.5.1 INTRODUCING AN ITEM INTO THE PURELAB HE BY USING THE LARGE ANTECHAMBER

Access Antechamber Control:

- Refer to FIGURE 5 on page 27 for a visual representation.
- Ensure that the atmosphere inside the glovebox is at the desired purity level (< 1 ppm).

Large Glovebox Antechamber:

1 For transferring objects into or out of the Large Antechamber:
2 Open the Manual Refill Valve on the Large Antechamber. This allows the antechamber to reach atmospheric pressure.
3 Once the pressure is equalized, carefully open the outside door of the Large Antechamber.
4 Transfer the object into the Large Antechamber.
5 Close the door securely.
6 Close the Manual Refill Valve on the Large Antechamber.
7 Open the vacuum valve to evacuate the Antechamber (-29 in. HG).
8 Close the vacuum valve
9 Open the refill valve until the pressure reads –15 in HG.
10 Close Refill Valve
11 Repeat steps 7 – 9 at least three times
12 finally refilling to atmospheric pressure.
13 Close the refill valve.
14 Open the inner door and remove the object from the Antechamber.



5.5.2 REMOVING AN ITEM FROM THE PURELAB HE BY 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 3 times before proceeding. See "USING THE LARGE ANTECHAMBER" on page 26.

NOTE: We suggest that you keep the Antechamber under vacuum as this will prompt you to refill before proceeding.

To remove an item from the PureLab:

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.

5.6 USING THE MINI ANTECHAMBER

The same precautions for the large Antechamber 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 PureLab HE. These steps assume that the atmosphere inside the chamber is pure and not open to the outside air.

5.6.1 INTRODUCING AN ITEM INTO THE PURELAB HE BY 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 the outside door and insert the object.
4 Close the outside door.
5 Turn the valve handle to evacuate until the vacuum level reaches -29 hg.
6 Turn the handle to the Refill position until the value reaches -15 hg.
7 Repeat steps 5 through 6 at least two times.
8 Turn valve handle until gauge reaches 0 hg.
9 Close the 3-way valve.
10 Open the inner door and remove the object from the chamber.

5.6.2 REMOVING AN ITEM FROM THE PURELAB HE BY 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 the inner door and insert the object.
4 Close the inner door.
5 Open the outer door and remove the object.

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

5.7 AUTOMATIC ANTECHAMBER CONTROL

AUTOMATIC ANTECHAMBER CONTROL IN PureLab HE:

Automatic Antechamber Control is a feature that is displayed if your PureLab HE system has been factory-fitted with this capability. The following steps describe how to access and utilize the Automatic Antechamber Control feature:

1. Access Antechamber Control:
    - From the Main Menu screen, tap the Antechamber button.
2. Automatic Antechamber Control:
    - The system will display the Antechamber 1 screen (refer to FIGURE 27).
    - Refer to TABLE 9 on page 56 for a description of the elements on the Antechamber 1 screen.

NOTE: The availability of the Automatic Antechamber Control feature depends on whether your system has been factory-fitted with this capability.

By tapping the Antechamber button, you can access and control the automatic features related to the antechambers. Ensure you refer to the provided documentation for a detailed description of the Antechamber 1 screen elements and their functionalities.

5.8 ANTECHAMBER SETUP

1. Access Antechamber Setup:
    - From the Main Menu screen, locate and tap the Antechamber button.
2. Antechamber 1 Setup Screen:
    - The system will display the Antechamber 1 Setup screen, which includes various settings for configuring automatic antechamber control.
    - Refer to TABLE 9 on page 56 for a detailed description of the elements on the Antechamber 1 Setup screen.
3. Set Vacuum Time:
    - Locate the setting for Vacuum Time on the Antechamber 1 Setup screen.
    - Adjust the Vacuum Time parameter to the desired value (e.g., 30 minutes) using the available controls.

NOTE: The Vacuum time is set to evacuate the antechamber after a specified time limit (30 minutes in this example) rather than being set to evacuate at a pressure limit.

Refer to the provided documentation for Antechamber 1 Setup screen and functionalitY. Adjusting parameters like Vacuum Time can enhance the efficiency and automation of the antechamber control system in PureLab HE.

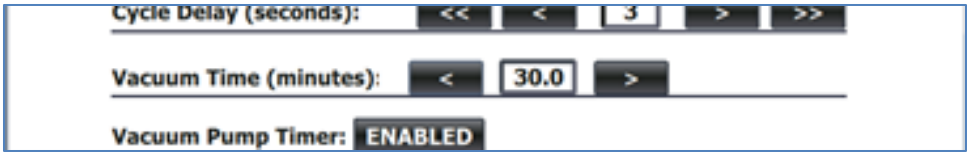


Figure 6 - Vacuum Time

5.8.1 INTERLOCKING ANTECHMABER DOORS

NOTE: This feature only displays if your system has been factory-fitted with automatic Antechamber control. Tap the Antechamber button from the Main Menu to open the Antechamber screen

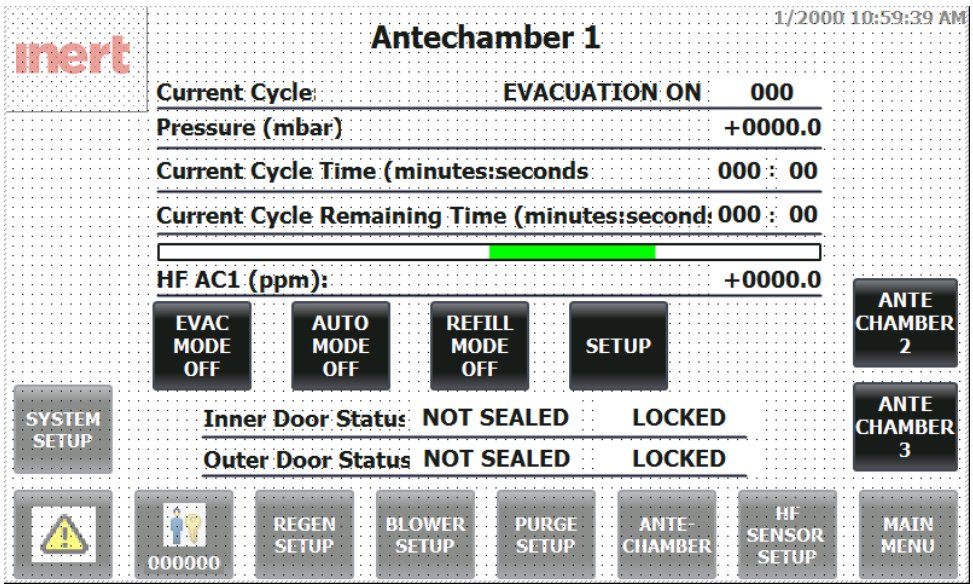


Figure 7 - Antechamber 1

Table 2 - Antechamber 1

ANTECHAMBER 2	Allows the user to select Antechamber 2 to control.
ANTECHAMBER 3	Allows the user to select Antechamber 3 to control.
INNER DOOR STATUS	Not Sealed: PLC indication that the inner door is opened on Antechamber 1.
	Sealed: PLC indication that the inner door is closed on Antechamber 1.
	Locked: PLC is actively forcing the inner door closed on Antechamber 1.
	Unlock: Operator can manual operate inner door on Antechamber 1.
OUTER DOOR STATUS	Not Sealed: PLC indication that the outer door is opened on Antechamber 1.
	Sealed: PLC indication that the outer door is closed on Antechamber 1.
	Locked: PLC is actively forcing the outer door closed on Antechamber 1.
	Unlocked: Operator can manual operate outer door on Antechamber 1.

5.9 MANUAL PURGE VALVE

MANUAL PURGE VALVE IN PureLab HE:

The PureLab HE is equipped with a Manual Purge Valve, which is a hand-operated 2-Way Ball Valve. This valve plays a crucial role in manually displacing the atmosphere from the PureLab HE. Here are the key details regarding the Manual Purge Valve:

1. Purpose:
    - The Manual Purge Valve is designed to manually displace the atmosphere within the PureLab HE, particularly during the purging process.
2. Operation:
    - The valve has two positions: open and closed.
    - When open, it allows the manual displacement of the atmosphere by enabling the flow of gas.
    - When closed, it prevents the loss of box pressure, maintaining the desired inert atmosphere within the glovebox.
3. Purging Process:
    - The Manual Purge Valve is opened during the purging process to facilitate the displacement of O2 and H2O with the inert gas of choice.
    - It should be operated in conjunction with the purging procedure outlined in the user manual.
4. Closing After Purging:
    - After completing the purging process, the Manual Purge Valve must be closed fully. This is essential to prevent any loss of box pressure and maintain the integrity of the inert atmosphere.

NOTE: Proper operation of the Manual Purge Valve is crucial for maintaining the desired atmospheric conditions within the PureLab HE.

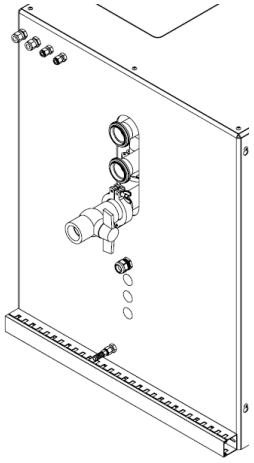


Figure 8 - Hand Operated 2 Way Ball Valve

5.10 AUTOMATIC PURGE VALVE

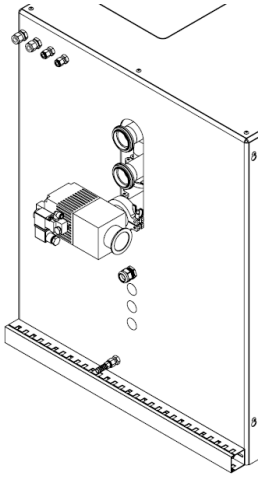


Figure 9 - Automatic Purge Valve

The Automatic Purge Valve is an available feature on the PureLab HE. Below are the steps to access and set up the Automatic Purge Valve using the Purge Setup screen:

1. Access Purge Setup:
    - On any screen, tap the Purge Setup button to open the Purge Setup screen. (Refer to FIGURE 26)
2. Purge Setup Screen:
    - The Purge Setup screen (FIGURE 26) provides various settings related to the Automatic Purge Valve.
    - Consult TABLE 8 on page 55 for a detailed description of the elements on the Purge Setup screen.
3. Automatic Purge Valve Feature:
    - This feature is only available if your system has been factory-fitted with an automatic Purge Valve.
4. Initiating Purge Sequence:
    - When initiating any purge sequence while the blower is running, the blower will be switched off until the purge sequence is complete.
    - The blower will automatically restart after the purge sequence is complete.

5.11 REGENERATION

To initiate the regeneration of the purification column in your PureLab HE, follow these steps using the Regeneration Setup screen:

1. Access Regeneration Setup:
    - From the Main Menu screen (FIGURE 19), tap the Regen Setup button to open the Regeneration Setup screen (FIGURE 22).
2. Regeneration Type:

- On the Regeneration Setup screen, select "SOLVENT REGENERATION" for the "Regeneration Type."

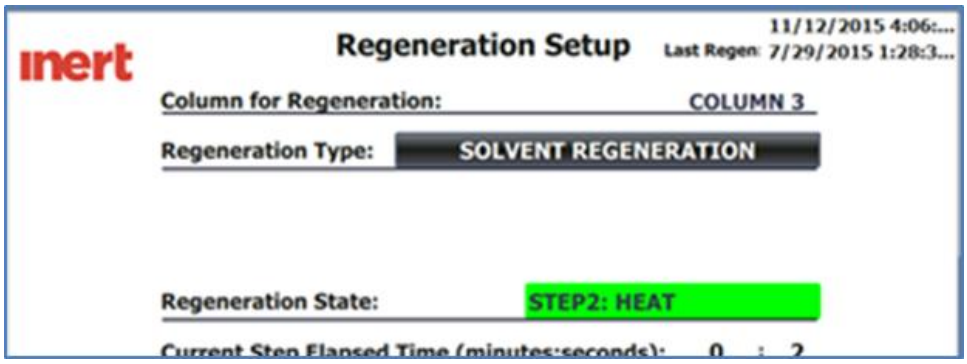


Figure 10 - Regeneration Setup

3. Purpose of Regeneration:
   - The purification column contains a mixture of copper-based catalyst and molecular sieve to absorb oxygen and moisture, respectively.
   - Over time, these materials become saturated and lose their ability to absorb oxygen and moisture.
   - The regeneration process restores these materials to their original state, allowing continuous scrubbing of oxygen and moisture.
4. Recommended Frequency:
   - It is recommended to perform regeneration every three years to maintain optimal performance.
   - The regeneration cycle involves five steps, each with default times measured in minutes.
5. Warning for Oxygen Levels:
   - The final step (Cooling) exposes the freshly regenerated purifier material to the PureLab HE atmosphere.
   - Ensure that the PureLab HE atmosphere contains less than 50 ppm oxygen before starting the regeneration.
   - If the oxygen level is above 50 ppm, initiate the purge process during regeneration.
6. Regeneration Steps:
   - The regeneration cycle comprises five steps: Drying, Purging, Heating, Cooling, and Standby.
   - Refer to TABLE 5 on page 52 for detailed descriptions of the Regeneration Timers screen.

NOTE: Ensure that you do not expose the purifier materials to atmosphere during the regeneration sequence. If you have any questions or need assistance, refer to the support section in the user manual or contact your Inert representative.

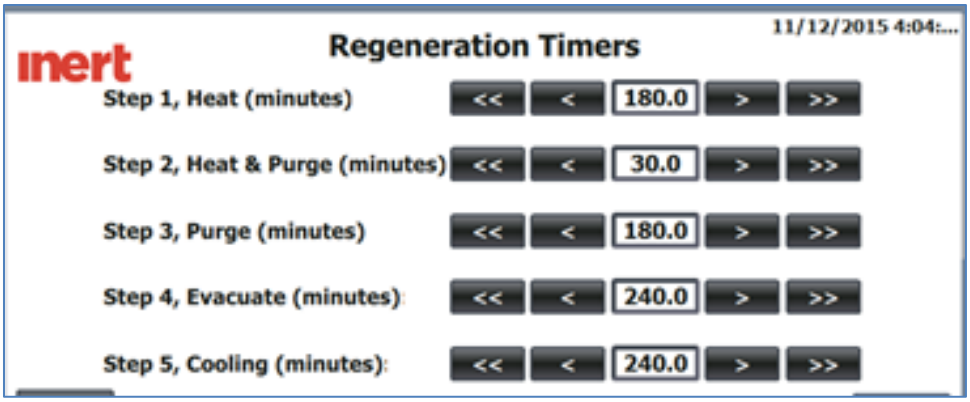


Figure 11 - Regeneration Timers

5.11.1 SINGLE-COLUMN PURIFICATION SYSTEM REGENERATION PROCEDURE

1. Connect Regeneration Gas Cylinder:
    - Connect a cylinder of regeneration gas (forming gas) to the regen gas connection on the rear of the Gas Management module.
    - The regeneration gas should contain between 3% and 7% hydrogen, with the balance being nitrogen or argon.
    - Ensure all connections are tightened correctly.
    - Open the regulator and set it to 7 psi.
2. Turn Off Blower:
    - On the Main Menu screen (FIGURE 19), turn off the Blower.
    - For a single-column system, this action automatically closes the purification column valves.
3. Initiate Regeneration:
    - Tap the "REGEN START" button on the Regeneration Setup screen (FIGURE 22).
4. Confirm Column Valve Closure:
    - Press the "Yes" button next to "Are the Column Valves Closed?"
    - A "click" sound indicates the solenoid valves opening to allow regeneration gas flow.

NOTE: Closed column isolation valves have a yellow indicator tab, not visible when the valve is closed.

5. Adjust Regeneration Flow:
    - Adjust the needle valve on the regeneration flow meter (located on the front of the Gas Management module) to 25-30 SCFH on the graduated scale.
6. Verify Flow:
    - Press "Yes" next to "Is Flow OK?"
    - At this point, regeneration gas flow stops, and "Step 1. Heating" begins.
    - The Regen Status displays as Heating, and the timer starts counting up.
    - The Regeneration Status is also shown on the Main Menu screen.
7. Automatic Progression Through Steps:
    - The system automatically progresses through regeneration steps 1 to 5.

- At the conclusion of the regeneration sequence, the blower automatically turns back on if enabled in the System Setup screen.
- Alternatively, you can manually turn on the blower by tapping the Blower button.

NOTE: Ensure proper safety measures during the regeneration process. The purifier column becomes very hot. Ensure regeneration exhaust gas is properly ventilated. If you encounter any issues or have questions, refer to the support section in the user manual or contact your Inert representative.

5.12 DUAL-COLUMN PURIFICATION SYSTEM REGENERATION PROCEDURE

For dual-column purification systems, the regeneration procedure allows one purifier column to regenerate while the other remains in use. This ensures continuous operation. Follow these steps:

1. Column Selection:
   - From the System Setup screen (FIGURE 29), identify the column currently in use in the "Column(s) In Use" field.
   - Tap the number of the column in use.
   - Enter a new column number in the Data Entry keypad and tap Enter (e.g., enter 2 for Column 2).

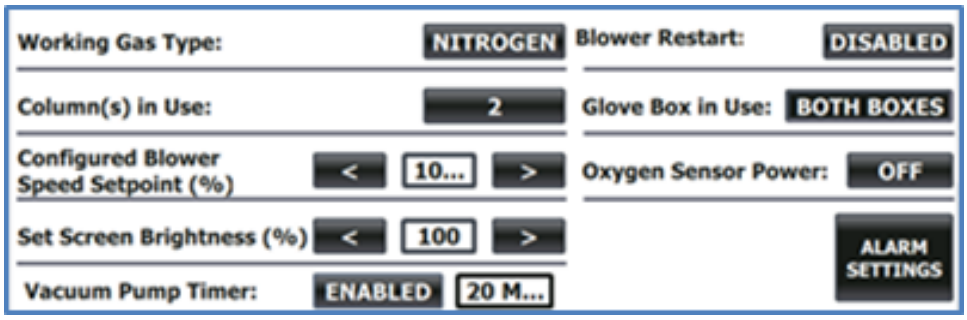


Figure 12 - System Setup

2. Regeneration Steps:
   - Follow steps 1, 3, 4, 5, and 6 of the single-column regeneration process.
   - Ensure the blower remains switched on during the regeneration of a dual-column system.

NOTE: Dual-column systems allow regeneration of one column while the other is in use.

NOTE: Ensure proper safety measures during the regeneration process. The purifier column becomes very hot. Ensure regeneration exhaust gas is properly ventilated. If you encounter any issues or have questions, refer to the support section in the user manual or contact your Inert representative.

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

5.13 SOLVENT REGENERATION

5.13.1 SOLVENT-COLUMN SYSTEM REGENERATION PROCEDURE

NOTE: The Blower does not need to be turned off.

NOTE: You will need a 1/8th" Allen wrench to loosen the screw that secures the sliding panel.

1 Connect a cylinder of high purity inert gas to the regen gas connection on the rear of the Gas Management 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 bypass valve (labeled A in **FIGURE 13** below). This is located in the Gas Purifier. The top must be removed to access the valve.

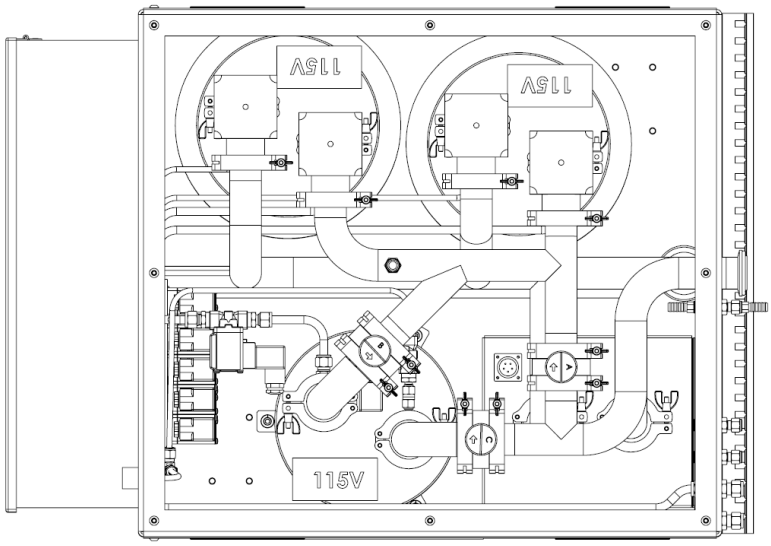


Figure 13 - Inside the Gas Purifier

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 Menu screen (**FIGURE 19**), tap the Regen Setup button. The Regeneration Setup screen (**FIGURE 14**) appears. Then tap the Regeneration Type button to select Solvent Regeneration.

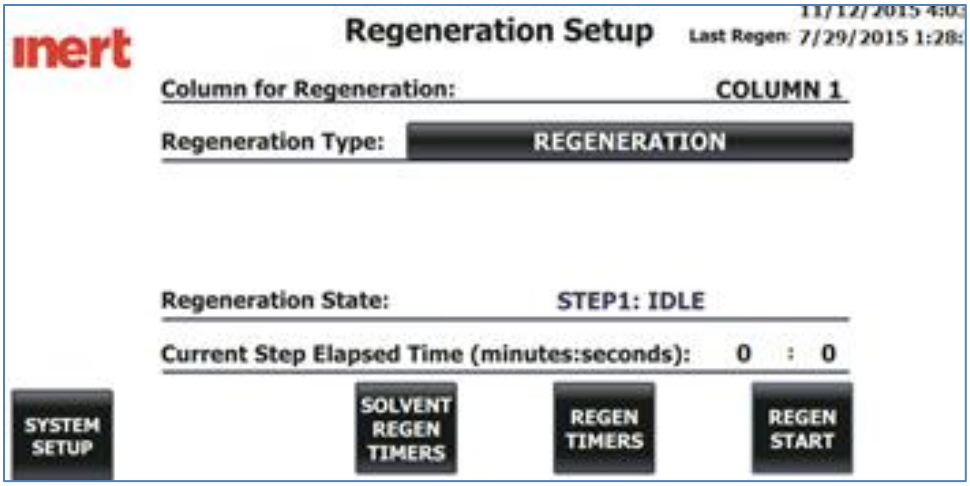
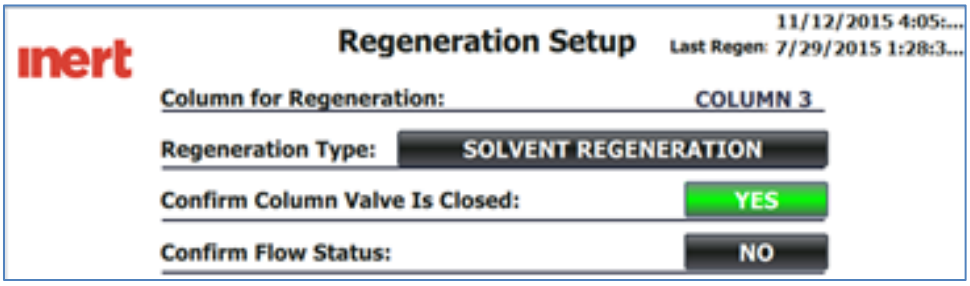


Figure 14 - Regeneration Setup Main

5 Tap the Regen Start button.

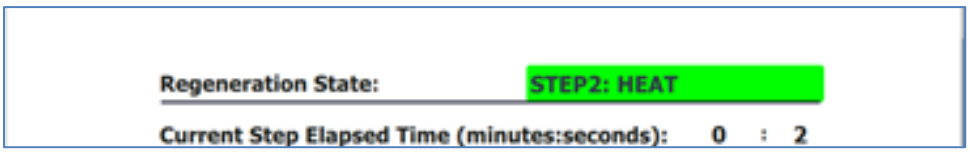
6 Tap the Yes button next to "Are the Column Valves Closed?" (**FIGURE 14**) A "click" will be heard as the solenoid valves open to allow regeneration gas to flow.



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

8 Verify that gas is flowing out of the exhaust line. If it is flowing, tap Yes next to "confirm Flow Status?" At this point the regeneration gas stops flowing. Step 1. Heating begins. The Regen Status shows as Heating and the timer begins 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).

5.14 ANALYZERS

Inert Oxygen Analyzers: Zirconia and Electrochemical Options

Inert provides two types of oxygen analyzers: Zirconia and Electrochemical. Additionally, a moisture analyzer is also offered. If you're uncertain about the type of oxygen analyzer in your system, please contact the Inert Service Department for clarification and assistance.

Contact Information:

- If you have questions or need support, refer to the "SUPPORT" section on page 11 of the user manual.
- In case of uncertainty regarding your oxygen analyzer, reaching out to the Inert Service Department is recommended.

NOTE: Understanding the type of oxygen analyzer in your system is crucial for proper operation and maintenance. In case of any issues or inquiries, prompt communication with the Inert Service Department is advised.

5.14.1 EOS-1- ZIRCONIA SENSOR

Eos-1 Zirconia Oxygen Analyzer

The Eos-1, Zirconia Analyzer designed to detect trace amounts of oxygen in inert gases. Key features and operational information for this analyzer are outlined below:

- Type: Eos-1 Zirconia Oxygen Analyzer
- Operational Range: 0.1 to 1,000 ppm
- Operating Temperature: 700°C

Main Menu Display:

- The Main Menu screen displays the oxygen content in parts per million (ppm).

Calibration:

- The analyzer is calibrated at the factory before shipment.
- Inert recommends yearly calibration

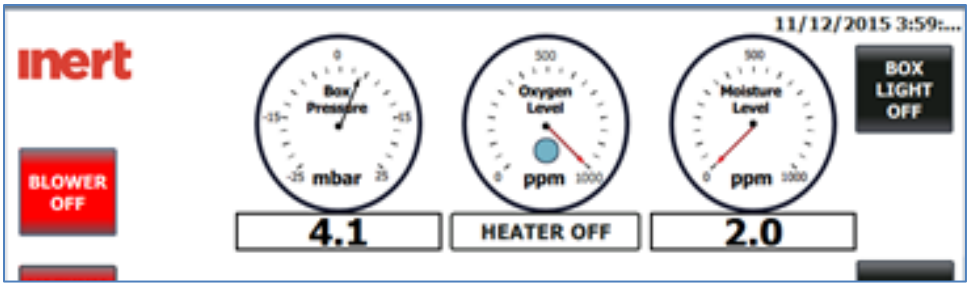
Contact Inert Service Department inquire about the calibration program

Power Control:

- To turn the Zirconia analyzer on or off, access the System Setup screen from the Main Menu (FIGURE 19). Then, tap the Oxygen Sensor Power button.

Special Considerations:

1. Solvent Usage: If solvents are used in the glovebox, ensure the Eos-1 analyzer heater is off until solvent vapors are purged.
2. Oxygen Content Limit: Turn off the Eos-1 analyzer if the oxygen content exceeds 1000 ppm.



5.14.2 EOS-2 ELECTROCHEMICAL OXYGEN SENSOR

Eos-2 Electrochemical Oxygen Analyzer

The Eos-2 analyzer utilizes a fuel cell to detect trace amounts of oxygen in inert gases. Here are key details and instructions for the Eos-2 Electrochemical Oxygen Analyzer:

- Type: Eos-2 Electrochemical Oxygen Analyzer
- Operational Range: 0.1 to 1,000 ppm

Main Menu Display:

- The Main Menu screen displays the oxygen content in parts per million (ppm).

Installation Steps:

1. Unpacking:
   - Locate the EOS-2 analyzer in the packaging box, usually in the large antechamber or strapped to the floor of the shipping pallet.
   - Connect tubing and fittings as per the provided manual.
2. Preparation:
   - Pressure test the system following the instructions in “PRESSURE TESTING THE SYSTEM” on page 23.
   - Once the system passes the pressure test, initiate the purging process. Refer to “PURGING THE SYSTEM” on page 26. Contact INERT for the crashing the box procedure if intended.
3. Analyzer Installation:
   - The EOS-2 analyzer is shipped with a black cap to seal the sensor during shipping.
   - Install the EOS-2 analyzer, ensuring proper tubing connections.

- Tighten the KF-40 clamp securely.

4. Purging Process:
   - Continue purging the system for at least 1 hour before connecting the EOS-2 analyzer.
   - Close the Purge Valve on the system after 1 hour.
   - Install the EOS-2 analyzer with the provided silver cap for operational conditions.
5. Final Steps:
   - Open the Purge Valve and continue purging the system for an additional 30 minutes.
   - Activate the "On" button on the HMI next to the Oxygen PPM display.
   - After purging for 1 hour and 30 minutes or using 3 containers of high-purity gas, close the Purge Valve and start the Blower.

NOTE: Ensure that the EOS-2 analyzer is only installed after the system has been thoroughly purged. Refer to "PURGING THE SYSTEM" on page 26. If you encounter issues or have questions, consult the user manual or contact the Inert Service Department for support.

5.14.3 MOISTURE ANALYZER

Moisture Analyzer Sensor Overview:

The moisture analyzer sensor is an aluminum oxide ultra-high capacitance design, incorporating automatic temperature compensation. Here are key details about the moisture analyzer sensor:

- Type: Aluminum oxide ultra-high capacitance moisture analyzer sensor
- Features: Automatic temperature compensation
- Mounting: Installed in the gas stream piping
- Calibration Certificate: Shipped with a calibration certificate traceable to international standards

Main Menu Display:

- The Main Menu screen displays the moisture content in parts per million (ppm).

Key Points:

- The moisture analyzer sensor is designed to measure moisture content in the gas stream.
- It utilizes aluminum oxide technology, providing high capacitance and accurate readings.
- Automatic temperature compensation ensures reliable measurements across varying temperatures.
- The sensor is mounted within the gas stream piping for direct and accurate moisture assessment.

Calibration Certificate:

- The sensor is shipped with a calibration certificate, ensuring traceability to international standards.
- Calibration certificates provide documentation of the sensor's accuracy and reliability.

Main Menu Display:

- The moisture content in the gas stream is prominently displayed on the Main Menu screen in parts per million (ppm).

Usage Guidelines:

- Follow the user manual guidelines for the proper installation, operation, and maintenance of the moisture analyzer sensor.
- Yearly Calibration intervals and procedures should adhere to the recommendations provided in the user manual.
- If you have any uncertainties or require assistance, refer to the user manual or contact the Inert Service Department for support.

NOTE: Always use the provided documentation, including the user manual and calibration certificate, for reference and guidance. Regular calibration and maintenance contribute to accurate and reliable moisture measurements.

5.15 FREEZERS

Freezers are an optional component for the PureLab HE, and their inclusion may vary based on the specific model. Here are key details about the freezer:

- Temperature Range: The freezer's temperature can be set within the range of +10°C to -35°C.

Important Points:

- Optional Nature: Users should be aware that the freezer is not a standard component and may need to be specified or ordered separately based on individual requirements.
- Temperature Range: The freezer provides a temperature-controlled environment, and users have the flexibility to set the temperature within the specified range, enabling storage of items at sub-zero temperatures if needed.

User Controls:

- Users can typically adjust and set the desired temperature within the freezer using the provided controls or interface.

Usage Guidelines:

- Follow the manufacturer's guidelines and user manual for installing, operating, and maintaining the freezer component.
- Ensure that the freezer is set to the appropriate temperature for the stored items, considering the specified temperature range.

NOTE: Verify the specific model and configuration of your PureLab HE to determine whether the freezer is included or can be added as an optional feature.

Always consult the provided documentation and guidelines for accurate and safe use of the freezer component in the PureLab HE system.

To configure and manage the freezer component in the PureLab HE system, follow these steps:

1. Access Freezer Setup:
    - Navigate to the Options Setup screen on the PureLab HE interface.

- Locate and tap the "Freezer Setup" button to open the Freezer Setup screen (FIGURE 32).

2. Adjust Temperature:
   - Within the Freezer Setup screen, users can adjust the desired temperature for the freezer.
   - Utilize the controls or interface provided to set the temperature based on specific requirements.
   - Refer to TABLE 14 on page 61 in the documentation for detailed descriptions of the options available in the Freezer Setup screen.
3. Shelves Configuration:
   - The freezer in the PureLab HE is equipped with three adjustable or removable shelves.
   - Users can configure the shelves based on their storage needs.
4. Save Changes:
   - Ensure to save any changes made in the Freezer Setup screen according to the system's user interface instructions.

NOTE: Always refer to the user manual or documentation accompanying the PureLab HE system for accurate and detailed instructions on accessing and configuring the Freezer Setup screen.
Configuring the freezer settings using the provided interface allows users to tailor the temperature and shelf configuration to meet specific storage requirements within the PureLab HE system.

5.15.1 BOX COOLING CONTROL

NOTE: This feature only displays your system has been factory-fitted with Box Cooling. The temperature range can be set from +15 C to +50 C.

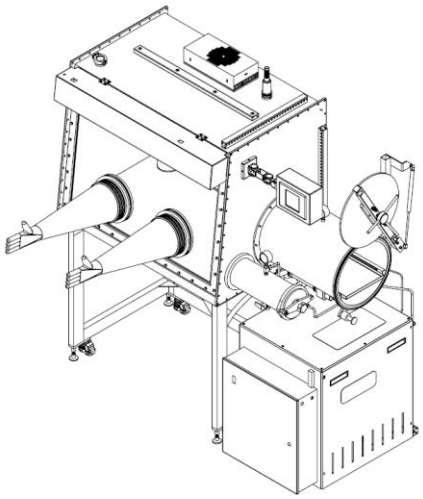


Figure 15 – Glovebox with Cooling

Tap the Box Cooler Setup button on the Options Setup screen to open the Box Cooler Setup screen (**FIGURE 34**). From here you can adjust the desired temperature. See **TABLE 16** on page 63 for a description of the Box Cooler screen.

NOTE: Box cooling will remove 10 degrees C from ambient system temperature.

5.16 HEAT CYCLE SETUP

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

To open the Heat Cycle Setup screen (**FIGURE 36**):

1. On the System Setup screen (**FIGURE 29**), tap the Options Setup button. The Options Setup screen (**FIGURE 33**) opens.
2. On the Options Setup screen, tap the Oven Temp Setup button. The Oven Temperature Setup screen (**FIGURE 35**) opens.
3. On the Oven Temperature Setup screen, tap the Heat Cycle Setup button. The Heat Cycle Setup screen (**FIGURE 36**) opens.

See **TABLE 18** on page 64 for a description of the Heat Cycle Setup screen. Open the Oven PID Tuning screen (**FIGURE 37**). On the Oven Temperature Setup screen (**FIGURE 35**), tap the Oven PID button.

DANGER: Users can be burned if Antechamber is not operated properly.

5.17 PARALLEL– PIPED SYSTEMS

Parallel-piping offers the convenience of using a single purifier to control two separate PureLab HE modules. It is intended that the primary mode of operation will be both PureLab HE modules running simultaneously. In this case the atmosphere inside each PureLab HE module is being circulated through the purifier column. The O_2 and H_2O values displayed are representative of the atmosphere in both Gloveboxes as they share a common atmosphere. Each PureLab HE module (1 & 2) is fitted with automatic valves on the gas inlet and outlet to allow isolation of the 2 PureLab HE modules.

The PureLab HE modules are defined as Box 1 and Box 2.

Under the Blower Setup screen (**FIGURE 25**), the system can operate 3 ways: using Box 1, Box 2 or both boxes. See **TABLE 7** on page 54 for a description of the Blower Setup screen.

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 O_2 and H_2O 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 O_2 and H_2O values are for Box 2 only.

NOTE: Only the selected box can be purged. However, both boxes will be purged if they are both selected. See "PURGING THE SYSTEM" on page 24 for more information.

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 exposed to the outside 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.

WARNING: Box 1 and Box 2 operate with pneumatic valves. If any of these valves are not opened, an alarm displays, and the gas and vacuum valves will lock and the blower will shut off. See "HMI ALARMS" on page 82 for more information.

5.17.1 MANUAL PURGING PARALLEL PIPED SYSTEM

From the Blower Setup screen (FIGURE 25), select which Box (1 or 2) to purge.

See "PURGING THE SYSTEM" on page 24 for an explanation of purging.

See "PURGE SETUP" on page 55 for further details.

5.17.2 AUTO PURGING PARALLEL PIPED SYSTEM

Press for Box 1 – Selects the module labeled Box 1 to be purged (See "PURGE SETUP" on page 55) 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 SETUP" on page 55) Box 2 Active button will be Green, indicating that it will be purged. Box 1 will be isolated.

See "PURGING THE SYSTEM" on page 21 for an explanation of purging.

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

5.18 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.

NOTE: A large solvent trap should only be used when the solvent's vapor is present in the glovebox

5.18.1 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 the valves, turn the black knob counterclockwise. To close them, turn the black knob clockwise.

The evac/refill valve is located on the right side of the Gas Management module. To the right 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.

5.18.2 OPENING THE SOLVENT REMOVAL COLUMN

WARNING: Before opening the solvent removal column to the system, make sure that the blower speed is reduced to 50%. Running the blower at higher speeds while using the solvent trap may cause overheating and damage to the blower.

To open the solvent removal column

1. Using a 5/32" Allen wrench, loosen the hardware to slide the top panel (**FIGURE 17**) open.
2. Refill the column by turning the evac/refill valve to refill until the pressure gauge has returned to 0, and then close the valve.
3. Open isolation valves B and C.
4. 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.
5. The flow of box atmosphere is now passing through the solvent removal column prior to passing through the purification column.

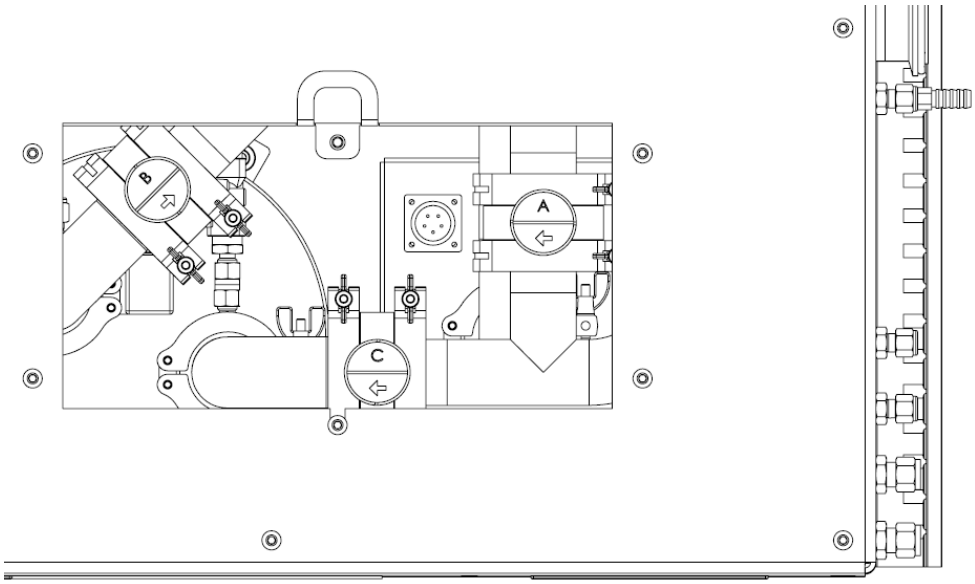


Figure 16 - Solvent Removal Column - Open

5.18.3 ISOLATING THE SOLVENT REMOVAL COLUMN AND REMOVING SOLVENT VAPORS

1 Using a 5/32nd " Allen wrench, loosen the hardware to slide the top panel (FIGURE 18) open.
2 Open isolation valve A. This allows the system to continue to circulate through the purification column.
3 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.
4 Turn evac/refill valve to evacuate.
5 Allow vacuum to pull on the column for at least 24 hours.

NOTE: When the solvent removal column is isolated from the system it is safe to run the blower up to 100%.

6 To begin circulation through the solvent removal column again, see "OPENING THE SOLVENT REMOVAL COLUMN" on page 41.

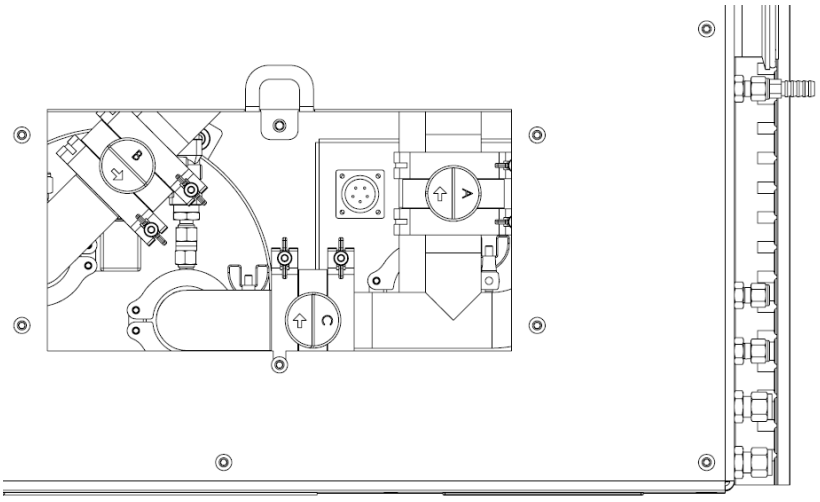


Figure 17 - Solvent Removal Column - Closed

5.18.4 REPLACING THE CARBON CHARGE IN A SOLVENT REMOVAL COLUMN

1. Follow the instructions for isolating the solvent column and removing solvent vapors on page 42.
2. Turn the evac/refill valve to refill until the pressure in the column has returned to zero (0).
3. Close the evac/refill valve.
4. Using a 1/8th" Allen wrench, remove the Gas Purifier right panel (looking at the front of the system).
5. Remove the KF40 clamps located on top of the purifier.
6. Using 9/16" and 11/16" wrench, disconnect the 1/4" and 3/8" compression line connected to the purifier.
7. Using a 3/16" Allen wrench, remove the three 1/4-20 hardware from the purifier to the Gas Purifier base.
8. Remove the Purifier column from the Gas Purifier.

DANGER: The next step must be performed with a Vent hood or in a well-ventilated room.

9. Pour a new carbon charge into the Fill Port. Use a funnel if necessary.
10. Reinstall the Purifier into the Gas Purifier.
11. Turn the evac/refill valve to evacuate and allow the vacuum to pull on the column for at least 48 hours.
12. For instructions on beginning circulation through the solvent removal column again.

See "OPENING THE SOLVENT REMOVAL COLUMN" on page 41.

5.19 LARGE CAPACITY REGENERABLE SOLVENT REMOVAL

The Large Capacity Regenerable Solvent Removal operates identical to the large capacity solvent removal, while having the added ability to regenerate the material within the column.

See "SOLVENT REGENERATION" on page 38 for further details.

5.19.1 SMALL CAPACITY SOLVENT REMOVAL – EXTERNAL

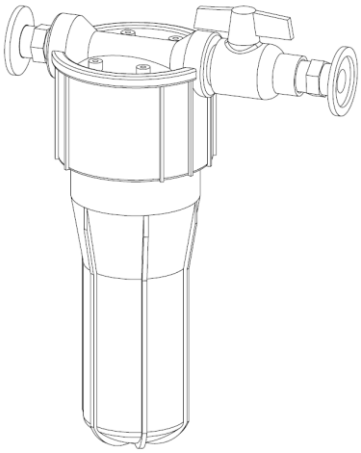


Figure 18 - Small Capacity Solvent Removal - External

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

WARNING: The Solvent Trap is fitted with an isolation valve that MUST remain OPEN at all times when the PureLab HE is running.

To replace the filter element:

1. Turn off the blower. Power down the PureLab HE using the main power switch on the Gas Management module.
2. Close the isolation valve on the housing of the solvent removal system. See FIGURE 19 above.
3. Twist the clear base counterclockwise 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. Pressure test the system. See "PRESSURE TESTING THE SYSTEM" on page 23.
9. Purge the PureLab HE until the O_2 level is less than 50 ppm. See "PURGING" on page 23.
10. Turn on the blower.

5.19.2 SMALL CAPACITY SOLVENT REMOVAL – INTERNAL

NOTE: This replaces the 3-micron filter inside the Glovebox.

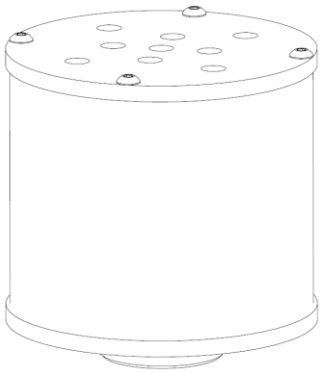


Figure 19 - Small Capacity Solvent Removal - Inertnal

WARNING: This solvent removal system must 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 management system. The cartridge must be removed from the Glovebox, then emptied and refilled. The cartridge can be removed by hand and brought out through the Antechamber.

6 HMI REFERENCE

The PureLab HE is controlled through the use of the Color HMI (Human Machine Interface) Touch Screen (FIGURE 21). The HMI directs glovebox operations through the lower PLC control box, which generally turns on and off relays to control box pressure, circulation, purifier regeneration, and other glovebox functions. Each of these sub-systems is described in this section.

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.

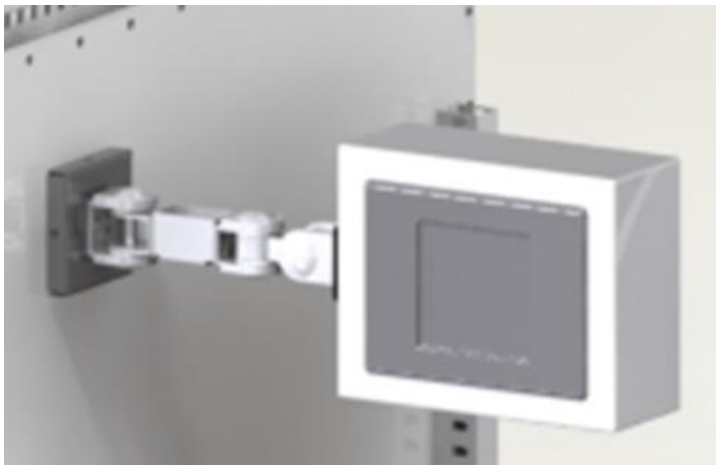


Figure 20 - HMI Touch Screen

All Input and Output functions are controlled by the PLC with touch screen HMI.

6.1 HMI CONTROL BUTTONS

Numerical settings can be adjusted in the HMI screens by using the following methods:

180.0	Tap the field to enter a different unit. The Numerical Input keypad (FIGURE 39) appears. Enter a new unit and then tap **Enter.**
<<	Tap once to decrease the value 10 units.
<	Tap once to decrease the value one unit.
>	Tap once to increase the value one unit.
>>	Tap once to increase the value 10 units.

6.2 MAIN MENU SCREEN

When the system is powered on the Main Menu screen (FIGURE 19) appears. It is the primary source of information for the system.

This screen provides real-time display of all key PureLab HE operating parameters.

The Main Menu screen displays 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. See **"LOGGING IN"** on page 24 for instructions on logging in.

The HMI communicates with the Programmable Logic Controller (PLC) that is contained within the control enclosure on the Gas Purifier.

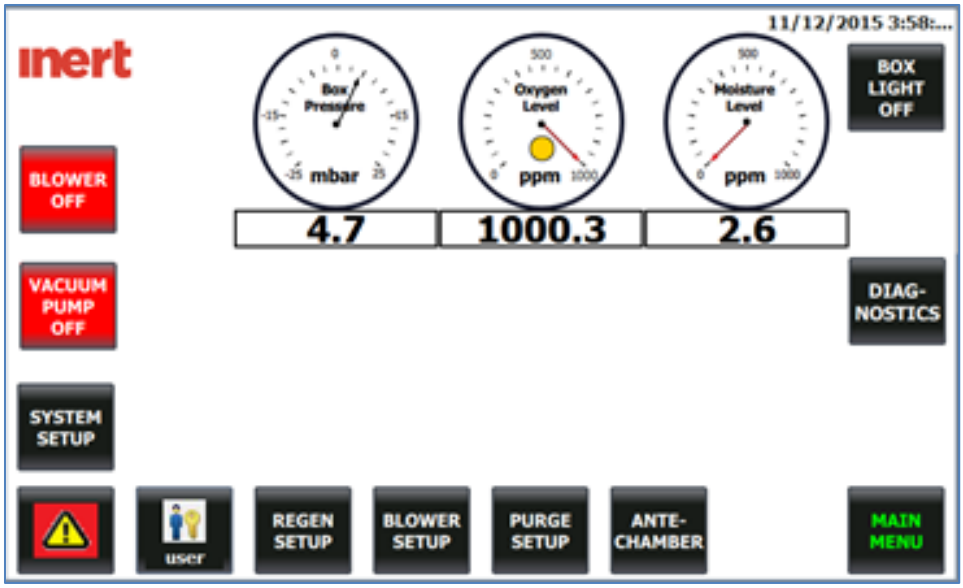


Figure 21 - Main Menu Screen

Table 3 - Main Menu Description

BLOWER	Indicates whether the Blower is currently powered ON (green) or OFF (red). Tap the button to change. The blower is responsible for continuously circulating the PureLab HE atmosphere through the purifier column to remove oxygen and moisture. The blower is comprised of a fan sealed inside an enclosure, inline with the circulation pipework to create a leak-tight closed-loop. The blower is located inside the Gas Purifier. When the Blower switch is activated, the PLC opens the column valves to enable circulation. The Blower Setup button opens the Blower Setup screen which allows further interaction with the Blower settings. **NOTE:** For the blower to operate correctly, the system must be supplied with at least 55 psi of inert working gas pressure.
VACUUM PUMP	Indicates whether the Vacuum Pump is currently powered ON (green) or OFF (red). Tap the button to change. 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 PureLab HE operation. • Removal of excess pressure from the PureLab HE • Evacuation of the Antechambers • Evacuation of the purifier column during the Regeneration cycle
SYSTEM SETUP	Tap this button to move to the System Setup screen.
BOX LIGHT	Indicates whether the Box Light is ON (green) or OFF (black). Tap the button to change.
DIAGNOSTICS	Tap this button to view which valve should be on during the different stages of the regeneration.

BOX PRESSURE (MBAR)	The Main Control Screen continuously displays the current PureLab HE pressure. This pressure is displayed in mbar relative to atmospheric pressure. The current pressure is displayed in the blue bar.
O2 LEVEL (PPM)	The current real time O_2 level in ppm is displayed here.
MOISTURE LEVEL (PPM)	The moisture content is displayed in ppm.
BOX TEMPERATURE FREEZER TEMPERATURE OVEN TEMPERATURE	The temperature for these features is displayed in Celsius (°C).
ALARM	Tap the Alarms button  to open the Alarms screen.
LOGIN/LOGOFF	Tap the Login button  to log in **NOTE:** To log off, tap the **Log Off** button on the System Setup screen
REGEN SETUP	Tap this button to open the Regen Setup screen. The Regeneration Setup screen 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.
BLOWER SETUP	Tap the Blower Setup button to open the Blower Setup screen.
PURGE SETUP	Tap the Purge Setup button to open the Purge Setup screen.
ANTECHAMBER	Tap the Antechamber button to open the Antechamber screen.
OPTIONS SETUP	Tap the Options Setup button to open the Options Setup screen
MAIN MENU	The Main Menu button appears throughout the program. Tap the button to return to the Main Menu screen.

6.3 CONTROL SUB SCREENS

6.3.1 DIAGNOSTICS

Pressure/Leak tests are performed from the Diagnostics screen **(FIGURE 23).**

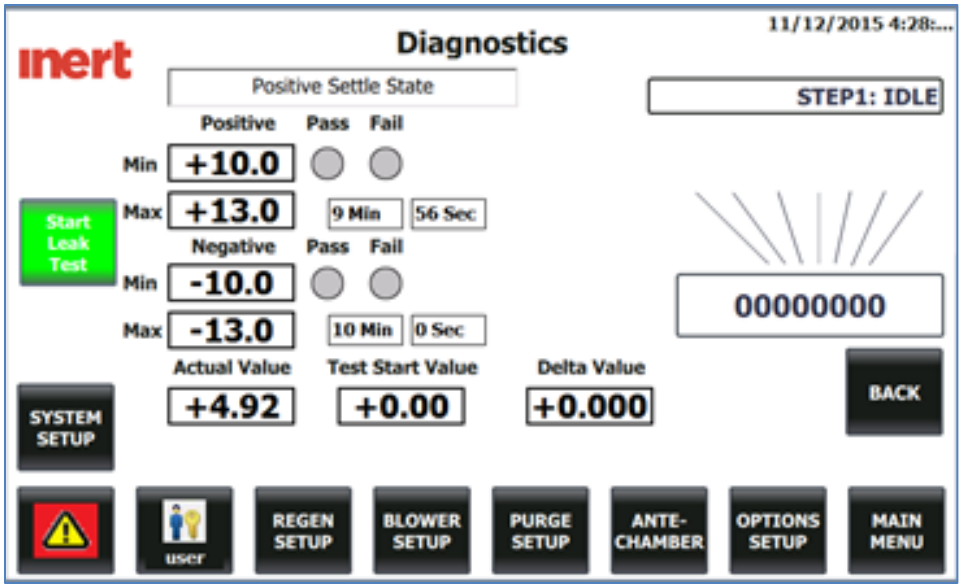


Figure 22 - Diagnostics Screen

Table 4 - Diagnostics Screen Description

START LEAK TEST	Tap this button start a Leak test. The button turns green when activated. To stop the pressure test tap the **Start Leak Test** button again.
TOP STATUS	Displays the status of the Leak test.
POSITIVE / NEGATIVE	Indicates: The Minimum / Maximum pressure settings, Whether the test passed or failed, The length of time of the test
ACTUAL VALUE	The actual pressure value.
TEST START VALUE	The Glovebox pressure at the start of the test.
DELTA VALUE	The difference between the Actual Value and the Test Start Value.
STEP	The current regeneration step.
DISPLAY	Indicates a number 1 when a valve in the regeneration process is open; 0 indicates the process is closed.

6.3.2 PRESSURE SETTINGS

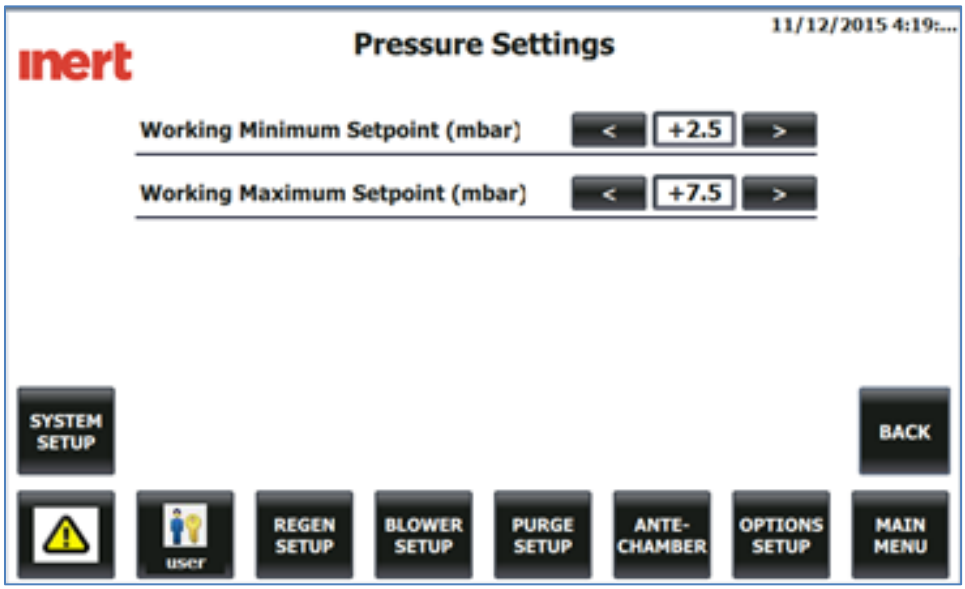


Figure 23 - Pressure Settings

Table 5 - Pressure Settings Description

WORKING MINIMUM SETPOINT (MBAR)	To adjust the Working Minimum Setpoint, tap the setting. The Numerical Input keypad (see FIGURE 39 on page 67) appears. Then type a new setting and tap **Enter**. Or tap the < > buttons to increase or decrease the value one point at a time.
WORKING MAXIMUM SETPOINT (MBAR)	To adjust the Working Maximum Setpoint, touch the setting. The Numerical Input keypad (see FIGURE 39 on page 67) appears. Then type a new setting and tap **Enter**. Or tap the < > buttons to increase or decrease the value one point at a time.

6.3.3 REGENERATION SETUP

Tapping the Regen Setup button on the Main Menu screen (FIGURE 22) opens the Regeneration Setup screen (FIGURE 14). From here you can initiate a regeneration of the purification column.

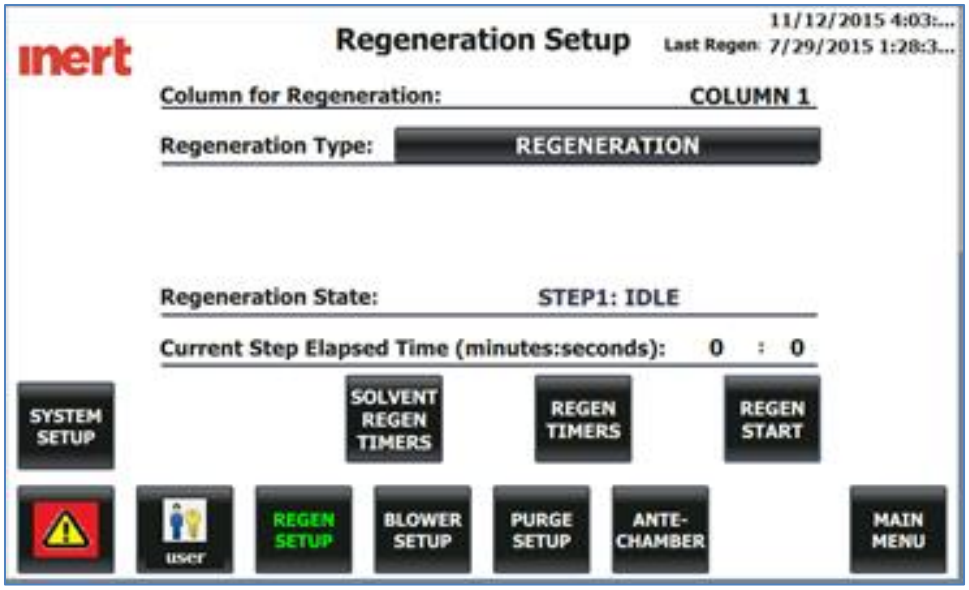


Figure 24 - Regeneration Setup Screen

Table 6 - Regeneration Setup Screen Description

REGEN START	Tap this button to initiate regeneration.
COLUMN FOR REGENERATION	Indicates which column is regenerating. • If your system has one column, the display indicates that column (Column 1) is regenerating. • If your system has two columns, it indicates which column is regenerating (Column 1 or 2) while the other column is in circulation.
REGENERATION TYPE	Indicates the Regeneration type. Tap the button to select Regeneration or Solvent Regeneration.
REGENERATION STATE	Indicates the current step in the regeneration cycle.
CURRENT STEP ELAPSED TIME	Indicates the Current Step Elapsed Time in minutes: seconds.
SOLVENT REGEN TIMERS	Tap this button to open the Solvent Regeneration Timers screen. (see SOLVENT REGENERATION TIMERS on page 54)
REGEN TIMERS	Tap this button to open the Regeneration Timers screen. (see REGENERATION TIMERS on page 53)

6.3.4 REGENERATION TIMERS

The regeneration timers are set in minutes. Below are the factory default settings (FIGURE 24). Do not change these timers without contacting the Inert Service Department. (See "SUPPORT" on page 11.)

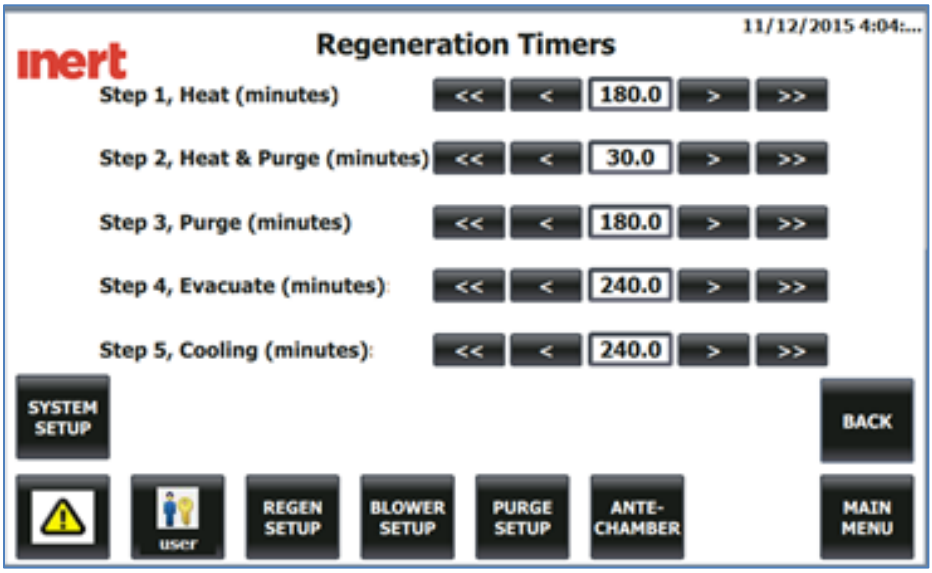


Figure 25 - Regeneration Timers Screen

Table 7 - Regeneration Timers Screen Description

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.
BACK	Returns to the Regeneration Setup screen.

6.3.5 SOLVENT REGENERATION TIMERS

Tap the Solvent Regen Timers button on the Regeneration Setup screen (FIGURE 24) to open the Solvent Regeneration Timers screen (FIGURE 25).

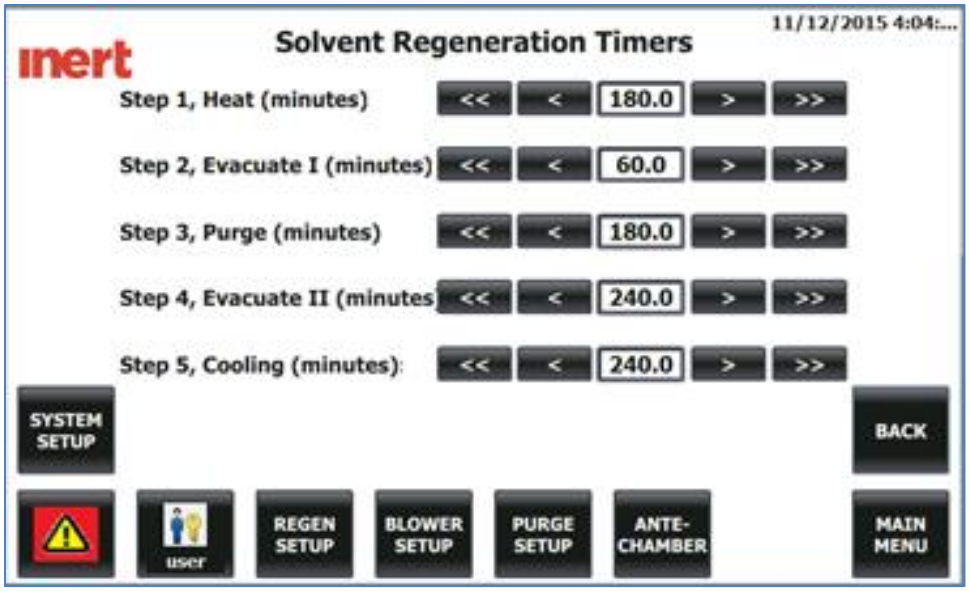


Figure 26 - Solvent Regeneration Timers Screen

NOTE: All times shown are factory defaults. This feature is only available on systems fitted with a Large Capacity Regeneratable Solvent Removal System.

Table 8 - Solvent Regeneration Timers Screen Description

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.
BACK	Returns to the Regeneration Setup screen.

6.3.6 BLOWER SETUP

Tapping the Blower Setup button opens the Blower Setup screen (FIGURE 26).

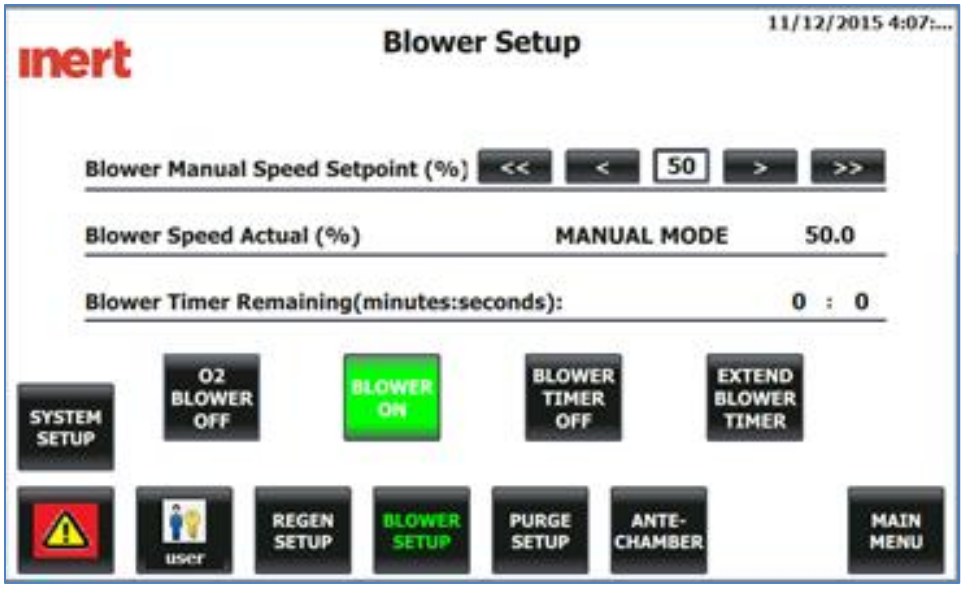


Figure 27 - Blower Setup Screen

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

Table 9 - Blower Setup Screen Description

BLOWER MANUAL SPEED SETPOINT (%)	Tap the << < > >> buttons to adjust the blower speed between 0 and 100%.
BLOWER SPEED ACTUAL (%)	Indicates the current % speed of the blower.
BLOWER TIMER REMAINING	Indicates the time remaining in minutes:seconds.
O2 BLOWER SPEED	Enabling this feature automatically adjusts the blower speed based on the oxygen level within the PureLab HE. If the oxygen level is above 10 ppm the blower speed increases in an attempt to scrub out the excess oxygen more quickly.
BLOWER	Tap this button to turn the Blower on and off.
BLOWER TIMER	Tap this button to enable and disable the Blower Timer. Enabling this feature automatically returns the Blower speed to 50% after 30 minutes.
EXTEND BLOWER TIMER	Tap this button to extend the Blower Timer back to 30 minutes.

6.3.7 PURGE SETUP

Tapping the Purge Setup button from the Main Menu Screen **(FIGURE 22)** opens the Purge Setup screen **(FIGURE 27)**.

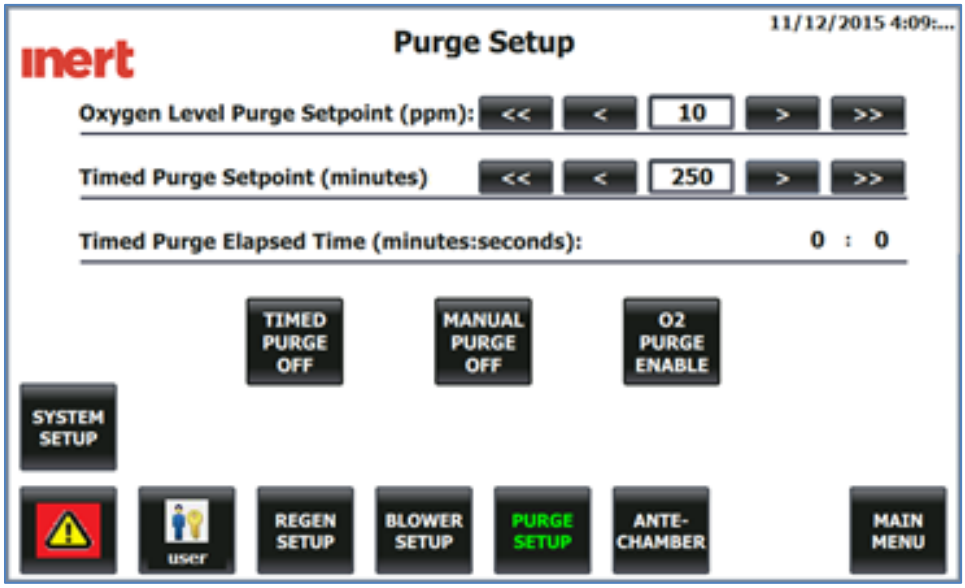


Figure 28 - Purge Setup Screen

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

Table 10 - Purge Setup Screen Description

OXYGEN LEVEL PURGE SETPOINT (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 tapping the value and entering a new number or tapping the << < > >> buttons to adjust the set point. In order to operate this feature the "O2 Level Purge" must be ENABLED.
TIMED PURGE SETPOINT (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 tapping the value and entering a new number or tapping the << < > >> buttons to adjust the value.
TIMED PURGE ELAPSED TIME	The counter indicates the elapsed time since the Timed Purge was started. After the time limit is reached the automatic Purge Valve closes.
TIMED PURGE	Tap this button to turn the Timed Purge ON and OFF.
MANUAL PURGE	Tap this button to turn the Manual Purge ON and OFF. Tapping ON opens the automatic Purge Valve. The Purge Valve will remain open until OFF is tapped.
O2 PURGE	When enabled (tap button to Enable/Disable), the Purge valve automatically opens when the Oxygen Level Purge Setpoint is exceeded. When the levels drop below the setpoint, the valve closes

6.3.8 AUTOMATIC ANTECHAMBER CONTROL

NOTE: This feature only displays if your system has been factory-fitted with automatic Antechamber control.

Tap the Antechamber button from the Main Menu (FIGURE 22) to open the Antechamber screen (FIGURE 30).

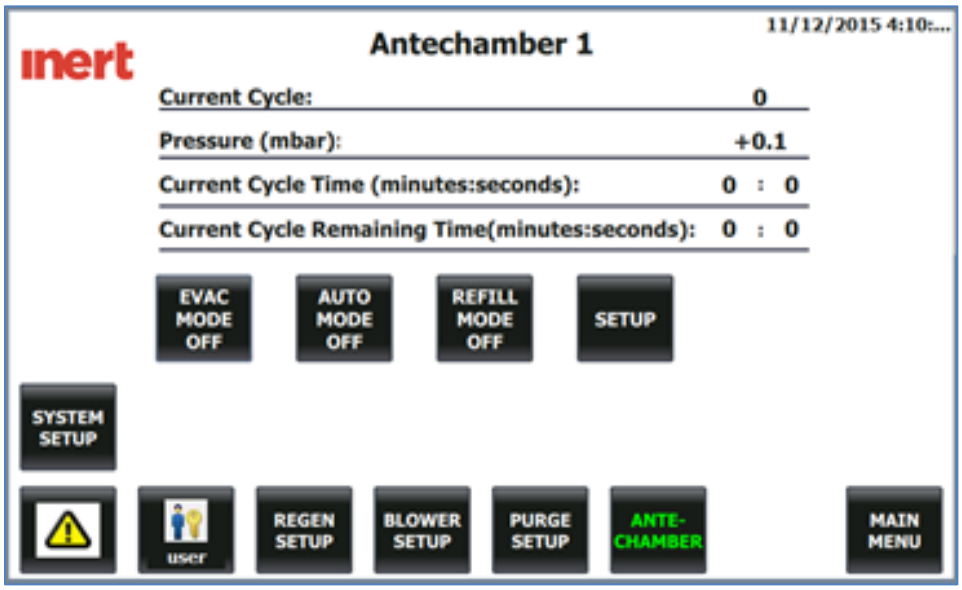


Figure 29 - Antechamber 1 Screen

Table 11 - Antechamber 1 Screen Description

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.
CURRENT CYCLE TIME	Indicates the current cycle time in minutes : seconds.
CURRENT CYCLE REMAINING TIME	Indicates the current cycle remaining time in minutes : seconds.
EVAC MODE	Tap this button (ON) to evacuate the Antechamber. Hold the button down for three seconds to stop evacuating.
AUTO MODE	Tap this button (ON) to start the evacuate/refill sequence. The individual steps associated with this are accessed and changed in the Antechamber 1 Setup screen (Hold the button down for three seconds to end the sequence.
REFILL MODE	Tap this button (ON) to refill the Antechamber with inert gas from the PureLab HE. Hold the button down for three seconds to stop refilling.

ANTECHAMBER 2	Allows the user to select which Antechamber to control. This is only utilized if your system is configured with multiple automatic Antechambers.

6.3.9 ANTECHAMBER SETUP

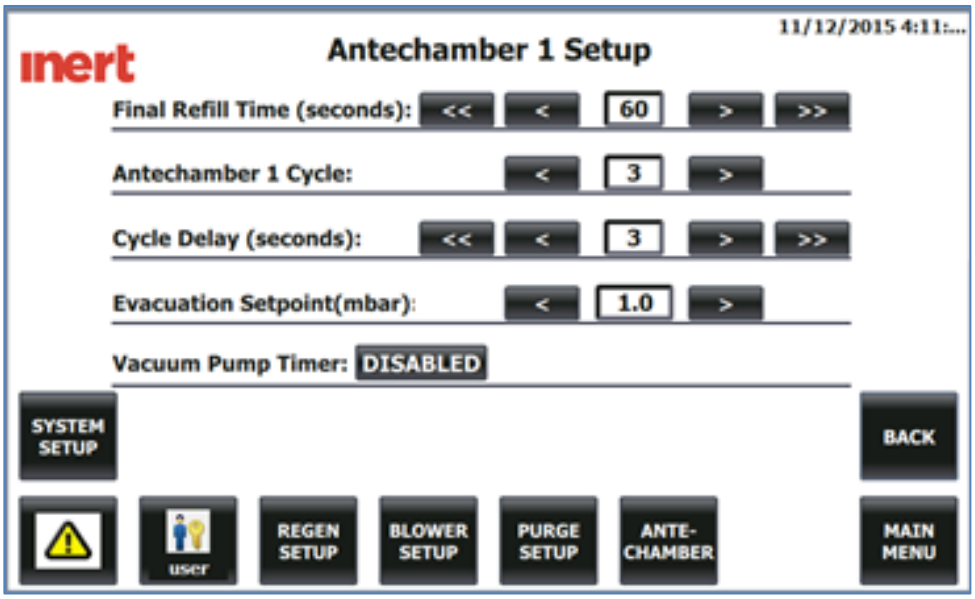


Figure 30 - Antechamber 1 Setup Screen

Table 12 - Antechamber 1 Setup Screen Description

FINAL REFILL TIME	Tap the << < > >> buttons to enter the Final Refill Time in seconds.
ANTECHAMBER CYCLES	Tap the < > buttons to enter the number of evacuate/refill cycles that occur under Automatic operation.
CYCLE DELAY	Tap the << < > >> buttons to enter the Cycle Delay in seconds.
EVACUATION SETPOINT (MBAR)	Tap the << < > >> button to enter the set point (mbar) that the Antechamber will be evacuated to.
VACUUM PUMP TIMER	Tap the setting to enable or disable the Vacuum Pump Timer. This feature enables you to evacuate based on a specific time rather than a specific mbar level.
BACK	Tap this button to return to the previous Antechamber screen.

6.3.10 SYSTEM SETUP

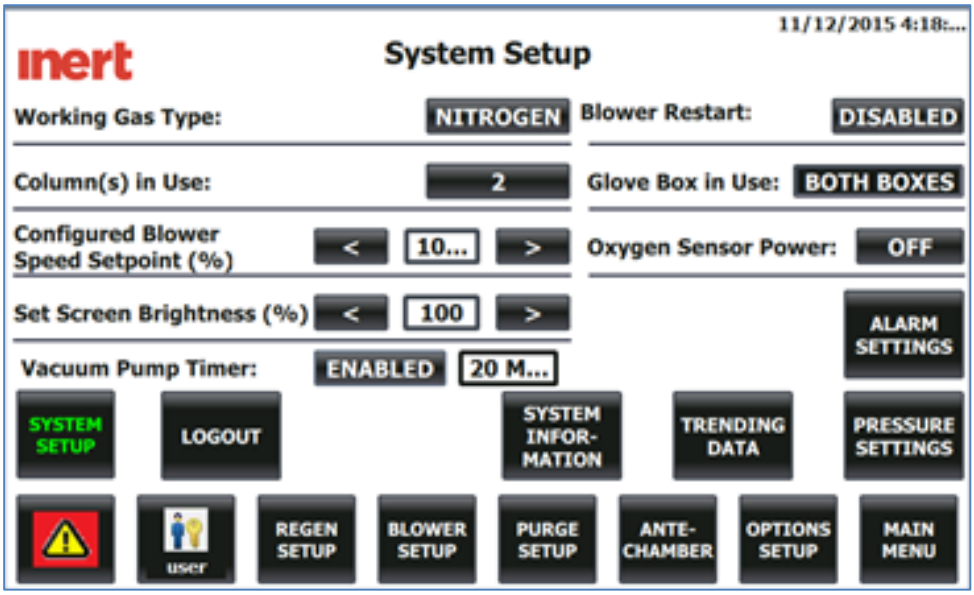


Figure 31 - System Setup Screen

Table 13 - System Setup Screen Description

WORKING GAS TYPE	Tap the field to select Nitrogen or Argon as working gas.
COLUMN IN USE	Tap the field to select which purifier column (1 or 2) is currently in use.
SET SCREEN BRIGHTNESS	Tap the < > buttons to adjust the HMI Screen Brightness.
BLOWER RESTART	When enabled, the blower automatically restarts after a power failure. Tap the field to toggle between Enabled and Disabled.
OXYGEN SENSOR POWER	Tap the Oxygen Sensor Power button to turn ON or OFF the analyzer heating element.
ALARM SETTINGS	Tap the Alarms button to open the Alarms screen. (See HMI ALARMS on page 83)
LOGOUT	Tap the Logout button to log out of the system.
SYSTEM INFORMATION	Tap the System Information button to view contact information for customer support.
TRENDING	Tap the Trending Data button to open the Trend Data Screen.

DATA	
PRESSURE SETTINGS	Tap the Pressure Settings button to open the Pressure Setting screen.

6.3.11 ALARMS

Tap the Alarms button  to open the Alarms screen (FIGURE 30).

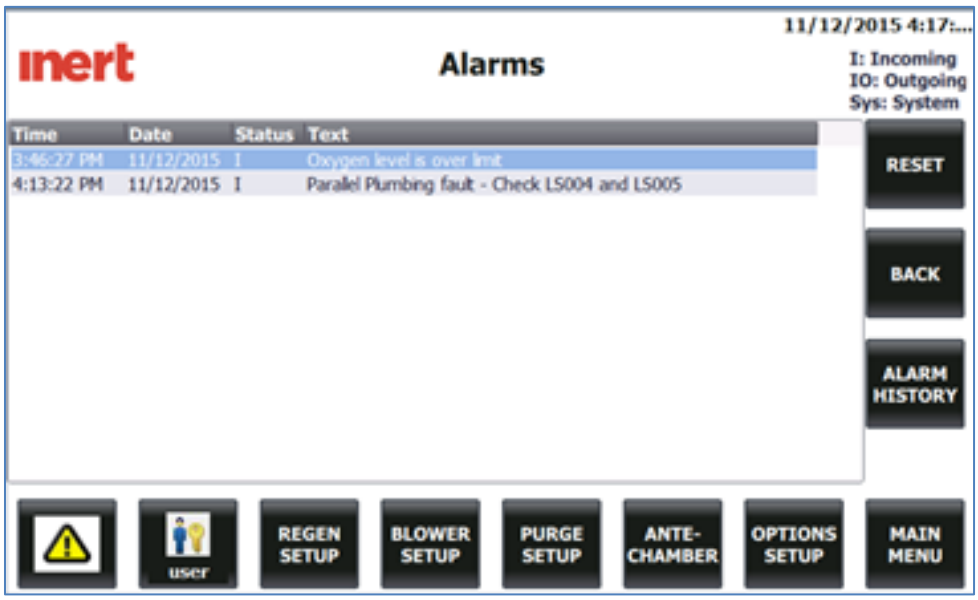


Figure 32 - Alarms Screen

Table 14 - Alarms Screen Description

STATUS	**Time** – Lists the time the alarm happened. **Date** – Lists the date the alarm happened. **Status** – Indicates if the alarm is Incoming, Outgoing, or System. **Text** – Describes the alarm.
RESET	Tap this button to reset the alarm.
BACK	Tap this button to return to the previous screen.
ALARM HISTORY	Tap this button to view a log of the various alarms that have been triggered.

6.3.12 TRENDING SCREEN

The Trend Data screen (**FIGURE 31**) displays the O_2 and H_2O and pressure levels over time. This information is stored for up to 24 hours. Historical Data is stored in a portable thumb drive inserted in the HDI.

RED line – O_2
BLUE line – H_2O
BLACK line – Pressure inside glovebox

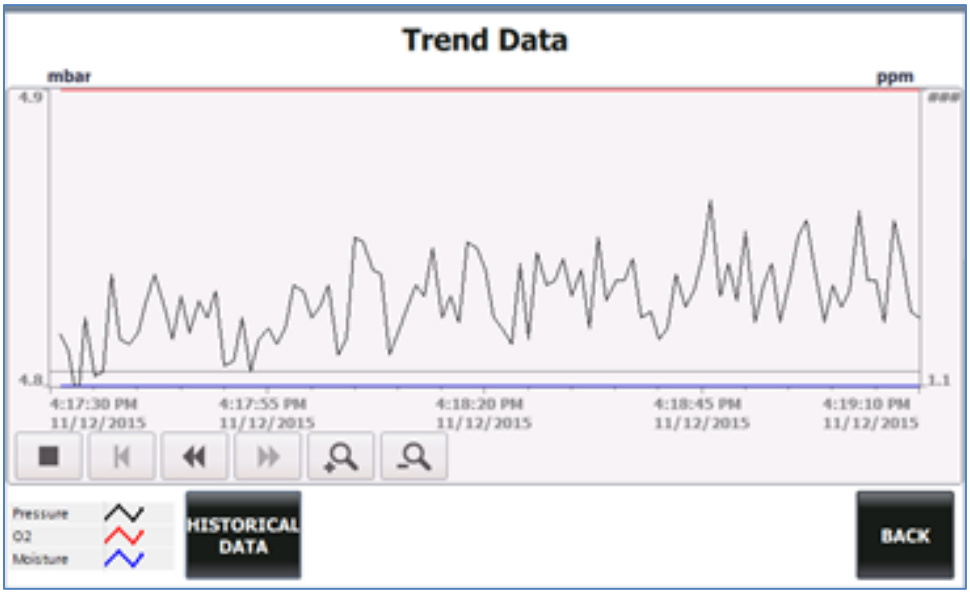


Figure 33 - Trending Data Screen

Table 15 - Trending Data Screen

HISTORICAL DATA	Tap this button to view the Historical Data. A USB thumb drive must be installed to access the Historical Data. This thumb drive needs to be installed with the system powered off to log the historical data.
STOP	Tap ■ to pause the Trending screen from recording data.
BACK	Tap ⏮ to display the recorded data from the earliest saved date.
REWIND	Tap ⏪ to rewind backward to review the data on the screen
FAST FORWARD	Tap ⏩ to scroll forward to review the data on the screen. Fast forward is only accessible if the Rewind button has been used.
ZOOM IN	Tap 🔍+ to display a small fixed data area over a smaller time frame.
ZOOM OUT	Tap 🔍- to display a larger fixed data area over a larger time frame.

6.3.13 OPTIONS SETUP

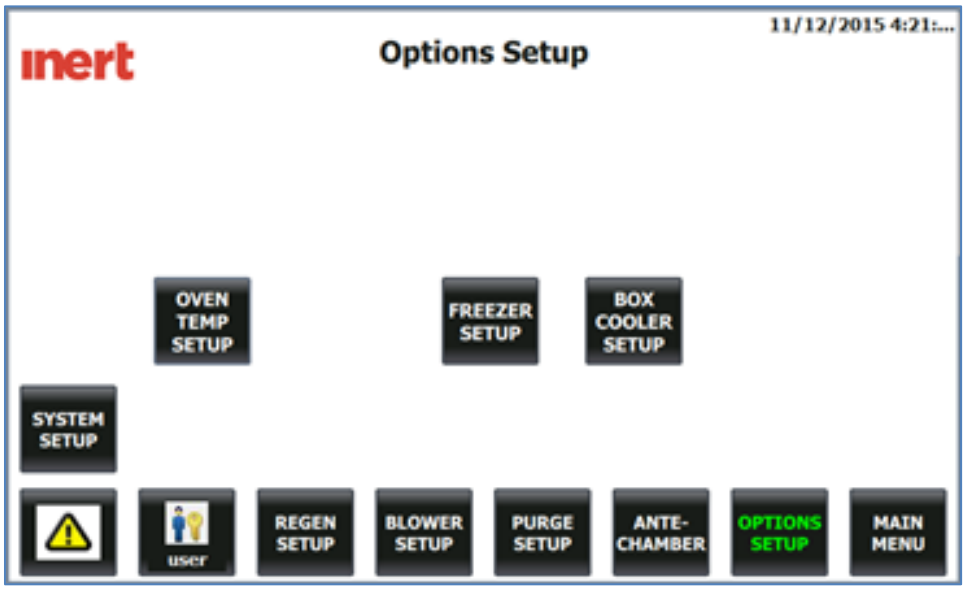


Figure 34 - Options Setup Screen

Table 16 - Options Setup Screen Description

OVEN TEMP SETUP	Tap this button to open the Oven Temp Setup screen.
FREEZER SETUP	Tap this button to open the Freezer Temp Setup screen.
BOX COOLER SETUP	Tap this button to open the Oven Cooler Setup screen.

6.3.14 FREEZER SETUP

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

If your system has been fitted with a freezer, the Main Menu (**FIGURE 19**) displays three temperature gauges: Box, Freezer, and Oven.

To open the Freezer Setup screen (**FIGURE 32**)

1 Tap the Options Setup button on the Main Menu screen (**FIGURE 19**).
2 On the Options Setup screen (**FIGURE 33**), tap the Freezer Setup button.

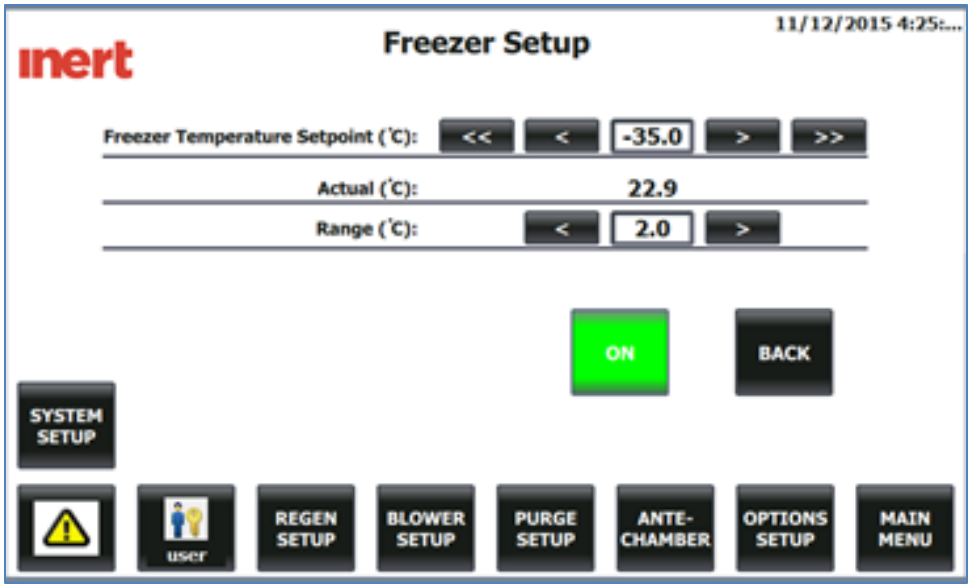


Figure 35 - Freezer Setup Screen

Table 17 - Freezer Setup Screen Description

FREEZER TEMPERATURE SETPOINT (C)	Tap the << < > >> buttons to adjust the freezer temperature.
ACTUAL (C)	Indicates the actual temperature (°C) inside the freezer.
RANGE (C)	Tap the < > buttons to adjust deviation +/- °C from the set point.
ON / OFF	Tap the ON/OFF button to turn the freezer on and off.
BACK	Tap this button to return to the previous screen.

NOTE: If your PureLab HE 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 PureLab HE contains room atmosphere will result in the condensation of moisture, preventing the PureLab HE from achieving optimum atmosphere conditions, i.e. preventing the system from being able to reach < 1 ppm moisture and oxygen content

6.3.15 BOX COOLER SETUP

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

Tap the Box Cooler Setup button on the Options Setup screen (**FIGURE 33**) to open the Box Cooler Setup screen (**FIGURE 34**).

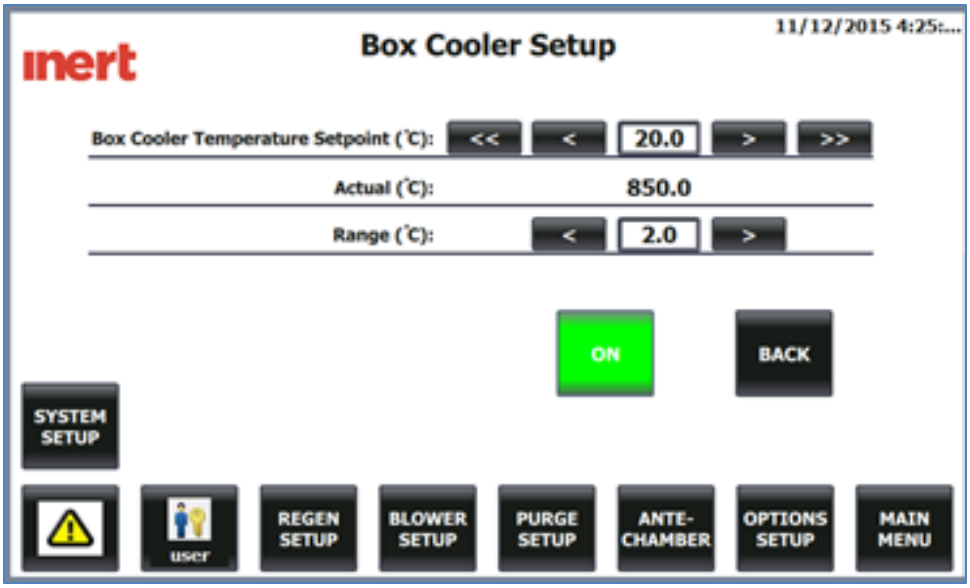


Figure 36 - Box Cooler Setup Screen

Table 18 - Box Cooler Setup Screen Description

BOX COOLER TEMPERATURE SETPOINT (C)	Tap the << < > >> buttons to adjust the temperature inside the Box Cooler.
ACTUAL (C)	Indicates the actual temperature (°C) inside the Box Cooler.
RANGE	Tap the < > buttons to adjust the deviation +/- °C from the setpoint.
ON/OFF	Tap the ON/OFF button to turn the Box Cooling on and off.

6.3.16 OVEN TEMPERATURE SETUP

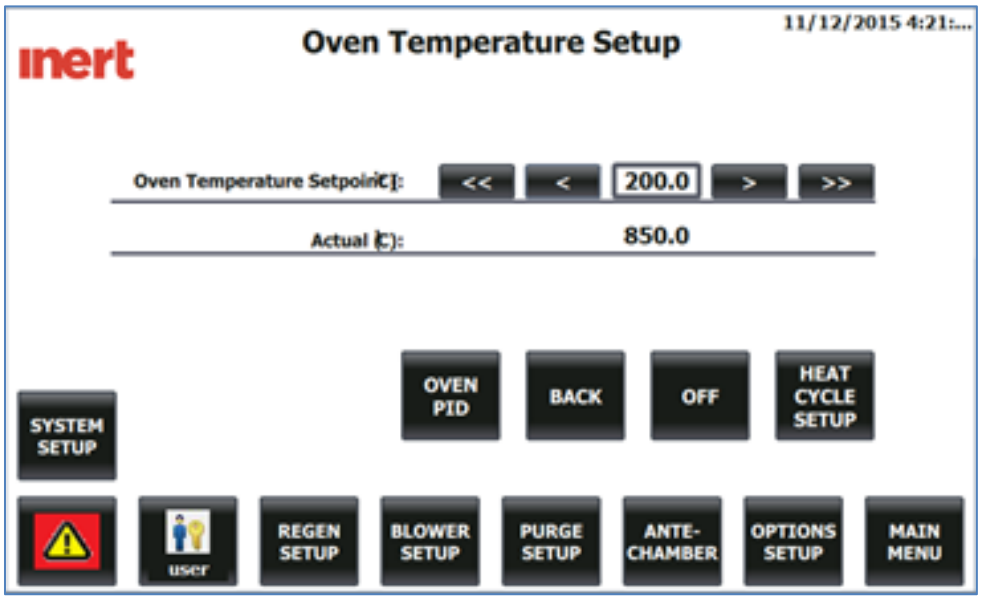


Figure 37 - Oven Temp Setup Screen

Table 19 - Oven Temp Setup Screen Description

OVEN TEMPERATURE SETPOINT (C)	Tap the << < > >> buttons to adjust the temperature inside the Box Cooler.
ACTUAL (C)	Indicates the actual temperature (°C) inside the Box Cooler.
OVEN P I D	Tap the < > buttons to adjust the deviation +/- °C from the setpoint.
BACK	Tap this button to go back to the Options Setup screen.
ON / OFF	Tap the button to turn the oven on. It remains on until the button is tapped again which changes it to Off.
HEAT CYCLE SETUP	Tap this button to open the Heat Cycle Setup screen (FIGURE 36).

6.3.17 HEAT CYCLE SETUP

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

To open the Heat Cycle Setup screen (FIGURE 36):

1 On the System Setup screen (FIGURE 12), then tap the Options Setup button. The Options Setup screen (FIGURE 33) opens.

2 On the Options Setup screen, tap the Oven Temp Setup button. The Oven Temperature Setup screen (**FIGURE 35**) opens.

3 On the Oven Temperature Setup screen, tap the Heat Cycle Setup button. The Heat Cycle Setup screen opens.

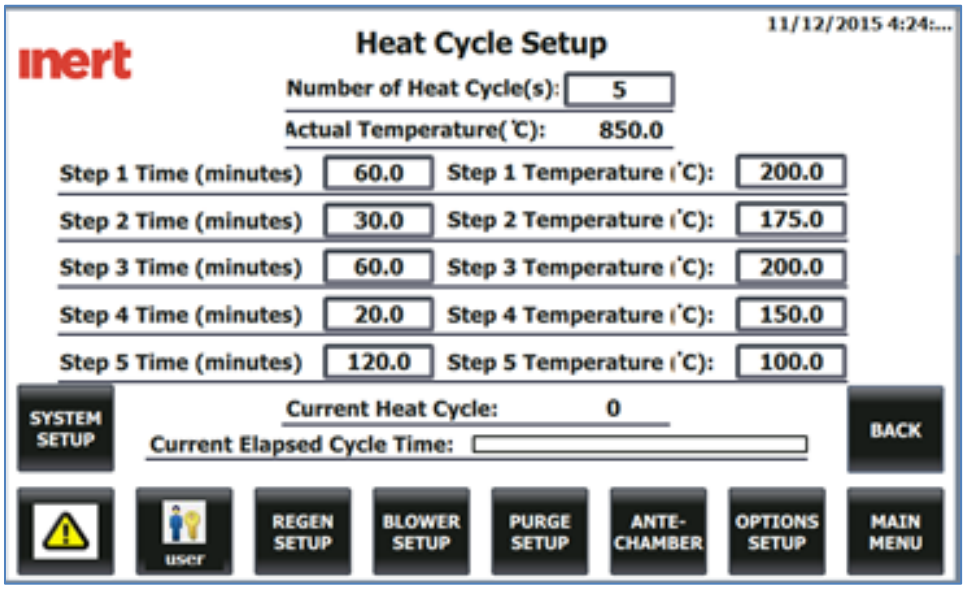


Figure 38 - Heat Cycle Setup Screen

Table 20 - Heat Cycle Setup Screen Description

NUMBER OF HEAT CYCLE(S)	Enter the number of cycles you want to run. To enter a new value, tap the field. The Numerical Input keypad appears. Then type a new value and then tap **Enter.**
ACTUAL TEMPERATURE (C)	Indicates the actual temperature (°C) inside the heated Antechamber.
STEP 1 - 5 TIME	Indicates the Step Time in minutes. To enter a new time, tap the field. The Numerical Input keypad appears. Then type a new time and tap **Enter.**
STEP 1 - 5 TEMPERATURE	Indicates the temperature (°C) inside the Antechamber to be adjusted. To enter a new temperature, tap the field. The Numerical Input keypad appears. Then type a new temperature and tap Enter.
CURRENT HEAT CYCLE	Indicates the current Heat Cycle stage.
CURRENT ELAPSED CYCLE TIME	Indicates the Cycle time has elapsed.

6.3.18 OVEN PID TUNING

To open the Oven PID Tuning screen (FIGURE 40), on the Oven Temperature Setup screen (FIGURE 38), tap the Oven PID button. The black line on the graph indicates the actual oven temperature. The red line indicates the oven setpoint temperature.

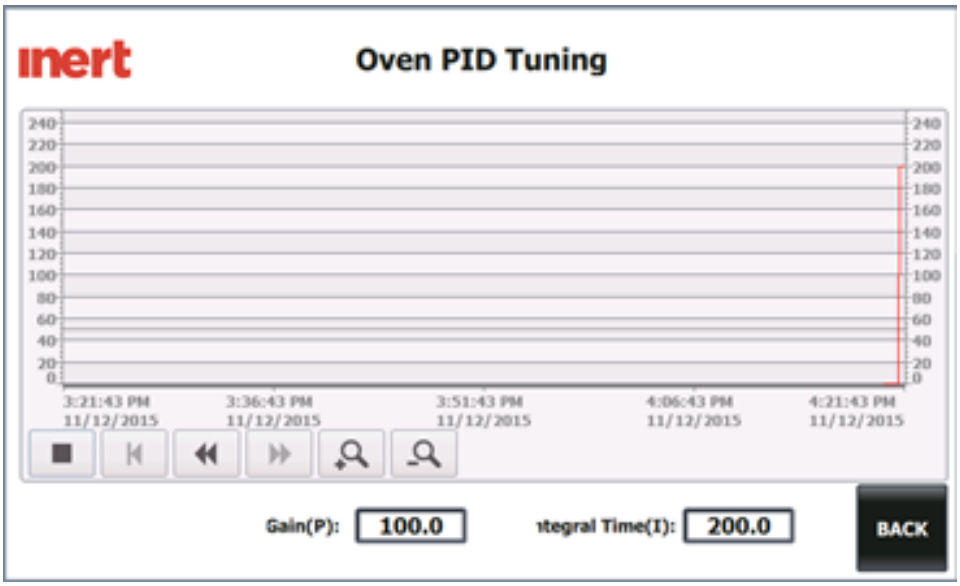


Figure 39 - Oven PID Tuning Screen

Table 21 - Oven PID Tuning Screen Description

STOP	Click ■ to pause the PID screen from recording data.
REWIND	Click ◀◀ to scroll backward to review the data on the screen.
FAST FORWARD	Click ▶▶ to scroll forward to review the data on the screen. This button is only accessible if the Rewind button has been used.
ZOOM IN	Click 🔍+ to display a small fixed data area over a smaller time frame.
ZOOM OUT	Click 🔍- to display a larger fixed data area over a larger time frame.
BACK	Click ⏮ to display the recorded data from the earliest saved date.

GAIN	Set point: 0-999 Factory set point: 100 The gains of a PID controller can be obtained by trial-and-error method. Once an engineer understands the significance of each gain parameter, this method becomes relatively easy. In this method, the 'I' and 'D' terms are set to zero first and the proportional gain is increased until the output of the loop oscillates. As one increases the proportional gain, the system becomes faster, but care must be taken not make the system unstable. Once P has been set to obtain a desired fast response, the integral term is increased to stop the oscillations.
INTEGRAL TIME	Adjust this number to fine-tune the oven to maintain the set point temperature. Set point: 0-999 Factory set point: 200 The integral term reduces the steady state error, but increases the overshoot. Some amount of overshoot is always necessary for a fast system so that it can respond to changes immediately. The integral term is tweaked to achieve a minimal steady state error. Once the P and I have been set to get the desired fast control system with minimal steady state error, the derivative term is increased until the loop is acceptably quick to its set point. Increasing derivative term decreases overshoot and yields higher gain with stability but would cause the system to be highly sensitive to noise. Engineers often need to trade off one characteristic of a control system for another to better meet their requirements.

6.4 INERT INFO PAGE

This screen (FIGURE 41) contains Inert's contact information and the software version.

Figure 40 - Inert Info Screen6.5

7 SYSTEM CONTROL ELECTRONICS REFERENCE

7.1 GENERAL DESCRIPTION

The PureLab HE 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 is described in this section.

7.1.1 PLC CONTROLLER

All input and output is controlled by the PLC.

7.1.2 DISPLAY PANEL

The display panel is a Color HMI Touch Screen.

7.2 LOWER CONTROL BOX

The Lower Control Box houses the following components:

- Power Supply
- PLC
- Connections
- Solid State Relays

7.2.1 POWER SUPPLY

The power supply generates 24 volts DC from an input of 115 or 220 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.

7.2.2 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.

7.2.3 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. An LED indicates an active state (+24V DC) of each

relay on the PLC. When troubleshooting 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 22 - 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, RG2
RV	Regeneration vacuum, opens column 1 to the vacuum pump.	Valve Block RV
PG2	Automatic Purge Valve control.	Purge Valve

7.2.3.1 SOLID STATE RELAYS

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

Table 23 - 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.

7.2.4 CIRCUIT BREAKERS

Table 24 - Circuit Breakers

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.

NOTE: The Antechamber oven, Freezer, and Box cooling operate on their own dedicated power circuit.

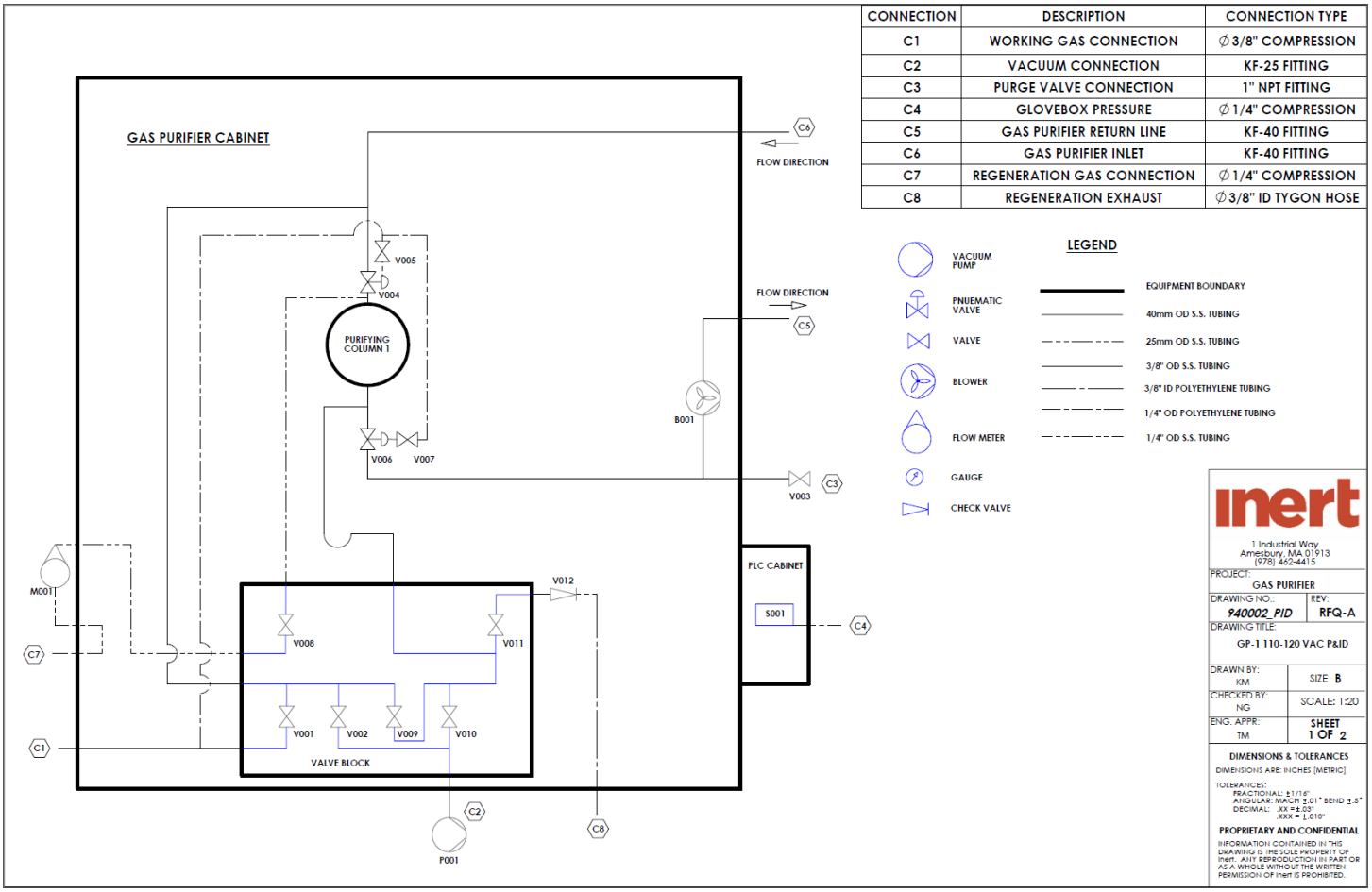
7.3 OPERATING SPECIFICATIONS

Table 25 - Operating Specifications

INPUT OPERATING VOLTAGE AND FREQUENCY	110-120, 200-240 V~, 50/60Hz 15 Amps
OPERATING TEMPERATURE	10-40 (°C)
RELATIVE HUMIDITY	Noncondensing 5% to 95% RH

7.4 BOX FLOW

The P&ID diagram is shown below.



CONNECTION	DESCRIPTION	CONNECTION TYPE
C1	WORKING GAS CONNECTION	∅3/8" COMPRESSION
C2	VACUUM CONNECTION	KF-25 FITTING
C3	PURGE VALVE CONNECTION	1" NPT FITTING
C4	GLOVEBOX PRESSURE	∅1/4" COMPRESSION
C5	GAS PURIFIER RETURN LINE	KF-40 FITTING
C6	GAS PURIFIER INLET	KF-40 FITTING
C7	REGENERATION GAS CONNECTION	∅1/4" COMPRESSION
C8	REGENERATION EXHAUST	∅3/8" ID TYGON HOSE

Figure 41 - General P&ID

7.4.1 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 electropneumatic valves are stainless steel unless otherwise specified.

7.4.2 PURIFICATION 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.

7.4.3 BLOWER

The blower circulates the gas in the PureLab HE through the purification column. It is mounted inside a sealed enclosure inside the purifier module. The blower enclosure is connected through two pipes using two KF-40 connections.

7.4.3.1 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 or 220 (depending on your system) VAC input power and the other two are for a 0 to 10 VDC reference voltage that controls the blower's speed. The final wire is ground.

7.5.4 VACUUM PUMP

The vacuum pump provides pressure reduction in the main box and the antechamber(s). It is turned on via a button on the main control screen. The power for the pump is controlled with a solid state relay. In response to a requirement to lower the box or Antechamber pressure, the PLC will open valve, “VA”, or “AE”, respectively. The pump will turn on automatically if needed by the system.

7.5.5 CHAMBERS

There are many different types of antechambers available from Inert. However, the standard chamber is a 15" 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.

8 ROUTINE MAINENTANCE

Regular preventive maintenance will reduce issues that cause down time while increasing the overall performance of the system. The following are the recommended minimum levels of service for the PureLab HE.

8.1 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 74.

- 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.

8.2 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.

8.3 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 column material.
- If time between regenerations has become minimal, replace column material.
- Replace glovebox HEPA filters

8.4 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 PureLab HE 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.

8.5 REMOVAL AND REPLACEMENT PROCEDURES

These procedures are intended to be a guideline for removing and replacing various components 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.

8.6 BLOWER

To replace the blower, proceed as follows.

1. Turn off the blower. (EOS-2 Analyzers must have their blank cap on. See page 43.)
2. Turn off the system main power.
3. Remove the right-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 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.

8.7 COLUMN

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

1 Turn off the blower. (EOS-2 Analyzers must have their blank cap on. See page 43.)
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.

8.8 FILTERS

To replace the box filters, simply exchange them with new filters. They are installed hand tight and should be replaced the same way. Turn clockwise to install. Turn counterclockwise to remove.

8.9 GLOVES

WARNING: 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.

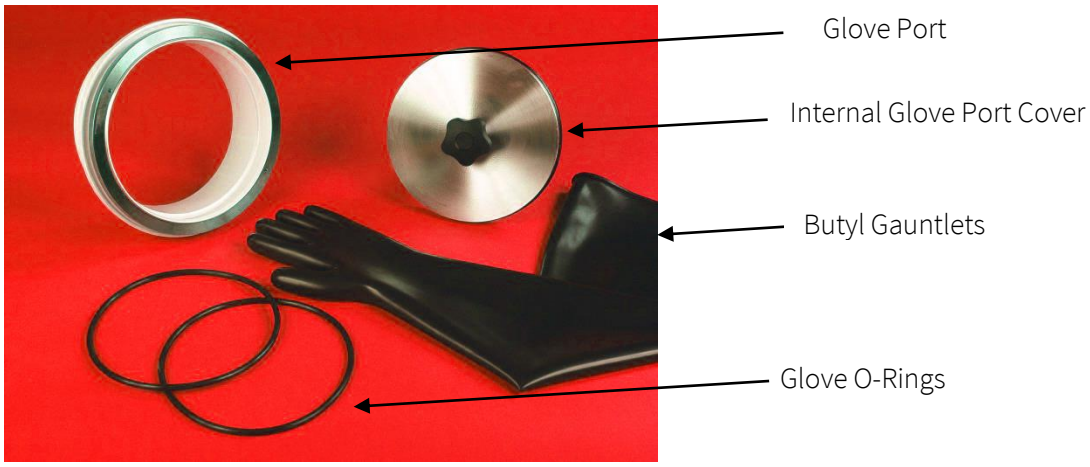


Figure 42 - Gloves

8.9.1 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 PureLab HE.

To replace a glove with an internal glove port cover:

1. If the glove port cover is not inside the PureLab HE, 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.

8.9.2 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, which reduces the amount of air being introduced into the system.)
8 From the inside of the PureLab HE, using the other glove, remove the old glove by taking it into the PureLab HE.
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.

8.9.3 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.

8.9.4 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.

8.9.5 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.

8.9.6 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.

8.9.7 VALVES

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

1. Remove PureLab HE 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.

8.9.8 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.

8.10 WINDOW

Replacing a window requires the box to be exposed to open air, then purged, and possibly regenerated. Contact INERT for the crashing the box procedure if intended.

1. Turn off the system main power. (EOS-2 must be blanked. See Page 43.)
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. Torque to 15-inch pounds, and then purge the box.

8.11 SPARE PARTS

Table 26 - Spare Part Numbers

PART #	COMPONENT	TAG #
X800024	.3 Micron Filters	F001-F002
G8B1532-9.75 L / R	Butyl Glovebox Gloves 15 mm thick	GLV01
G8B1532-9.75 A	Amb Butyl Glovebox Gloves 15 mm thick	GLV02
G8B3032-9.75 L / R	Butyl Glovebox Gloves 30 mm thick	GLV03
G8B3032-9.75 A	Amb Butyl Glovebox Gloves 30 mm thick	GLV04
X800022 (WELDED) X800130 (BOLTED)	15” Antechamber Door O-rings	ACR01-ACRO2
X800020	6” Mini Antechamber Door O-rings	ACR03-ACR04

Several spare parts for the PureLab HE are specific to the voltage and region where the system has been shipped to. Please contact Inert’s service department for questions or pricing of spare parts, help, or support.

See SUPPORT on page 11.

9 TROUBLESHOOTING

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

Problem: There is no working gas going into the PureLab HE.
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.un
- 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 Inert Service Department for help (See "SUPPORT" on page 11.).

9.1 HMI ALARMS

Table 27 - HMI Alarms

ALARM ID	DESCRIPTION
1	System is below Absolute Minimal pressure value.
2	System is above Absolute Maximum pressure value.
3	Regeneration Fault override.
4	Regeneration halted.
5	Oxygen Level is over set limit.
6	Moisture Level is over set limit.
7	Helium is below low limit.
8	Helium is above high limit.
9	Oxygen Sensor Heater failure.
10	Parallel Plumbing Valve failed to open.
11	Outer Door was opened. Auto Antechamber Sequence required.
12	Oxygen Sensor failure.
13	Moisture Sensor failure.
14	Purifier Valve failed to open.
15	Alarm_15
16	Alarm_16

10 SYSTEM DIAGRAMS

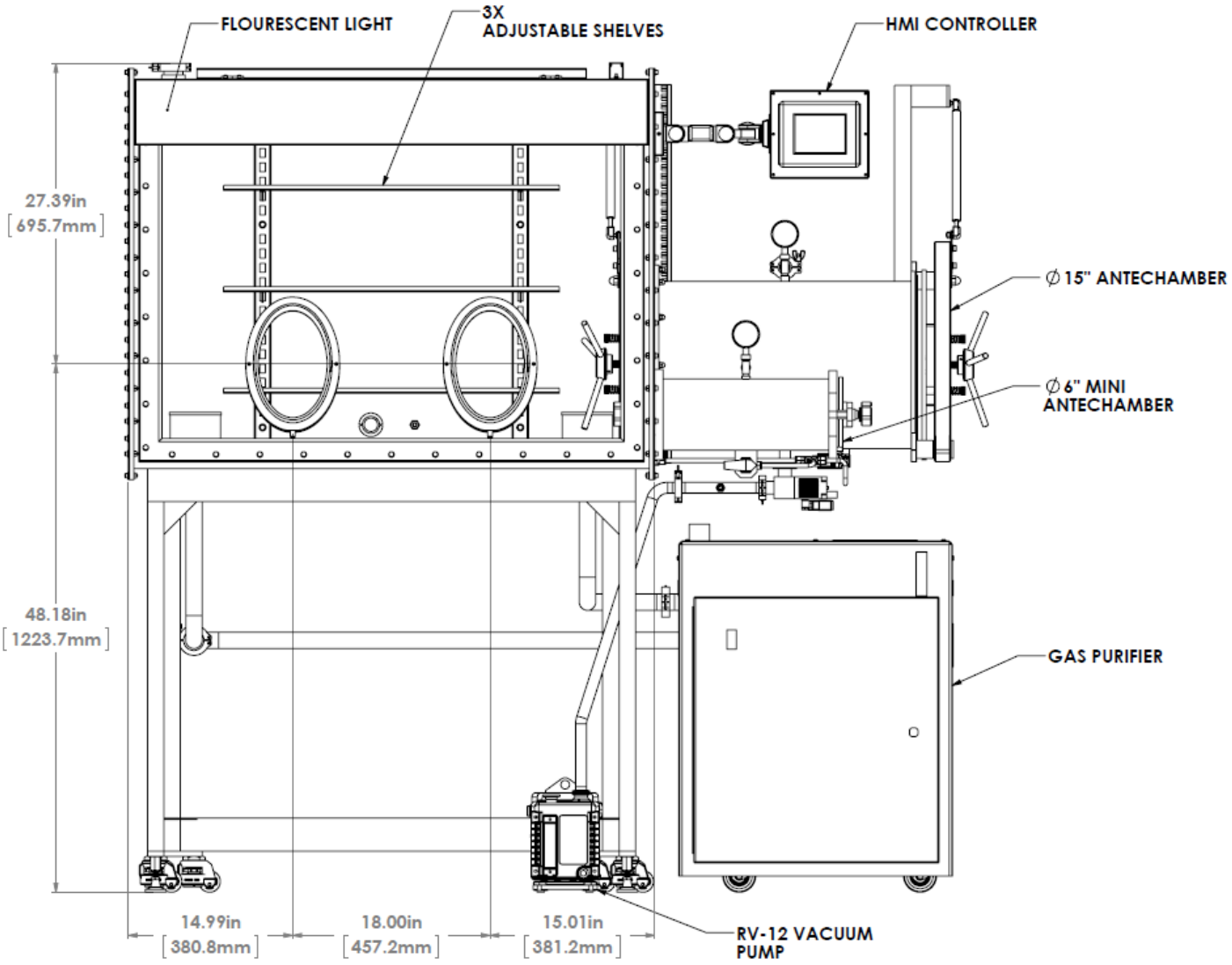


Figure 43 - PureLab HE 1250 -Front View

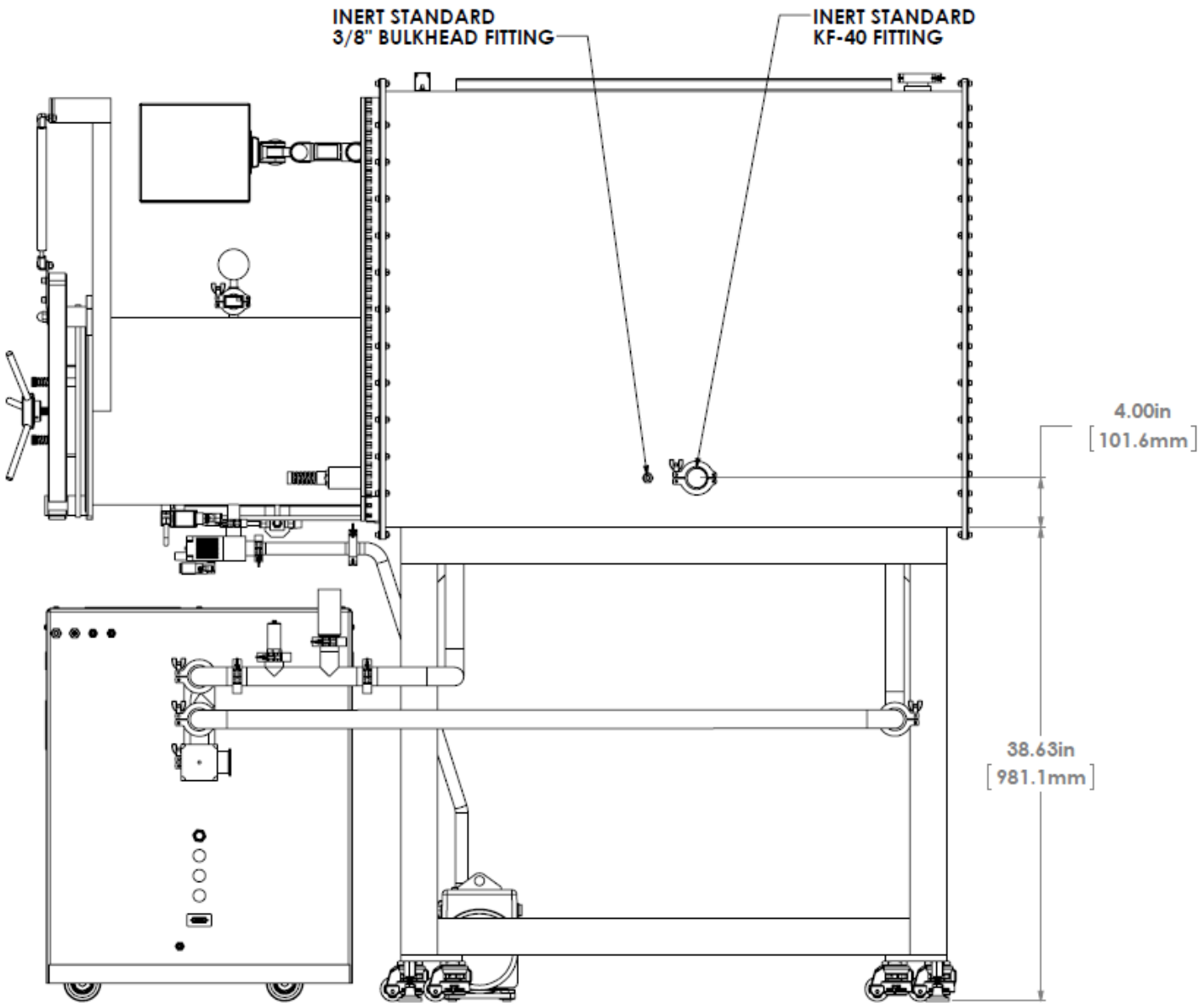


Figure 44 - PureLab HE 1250 - Back View

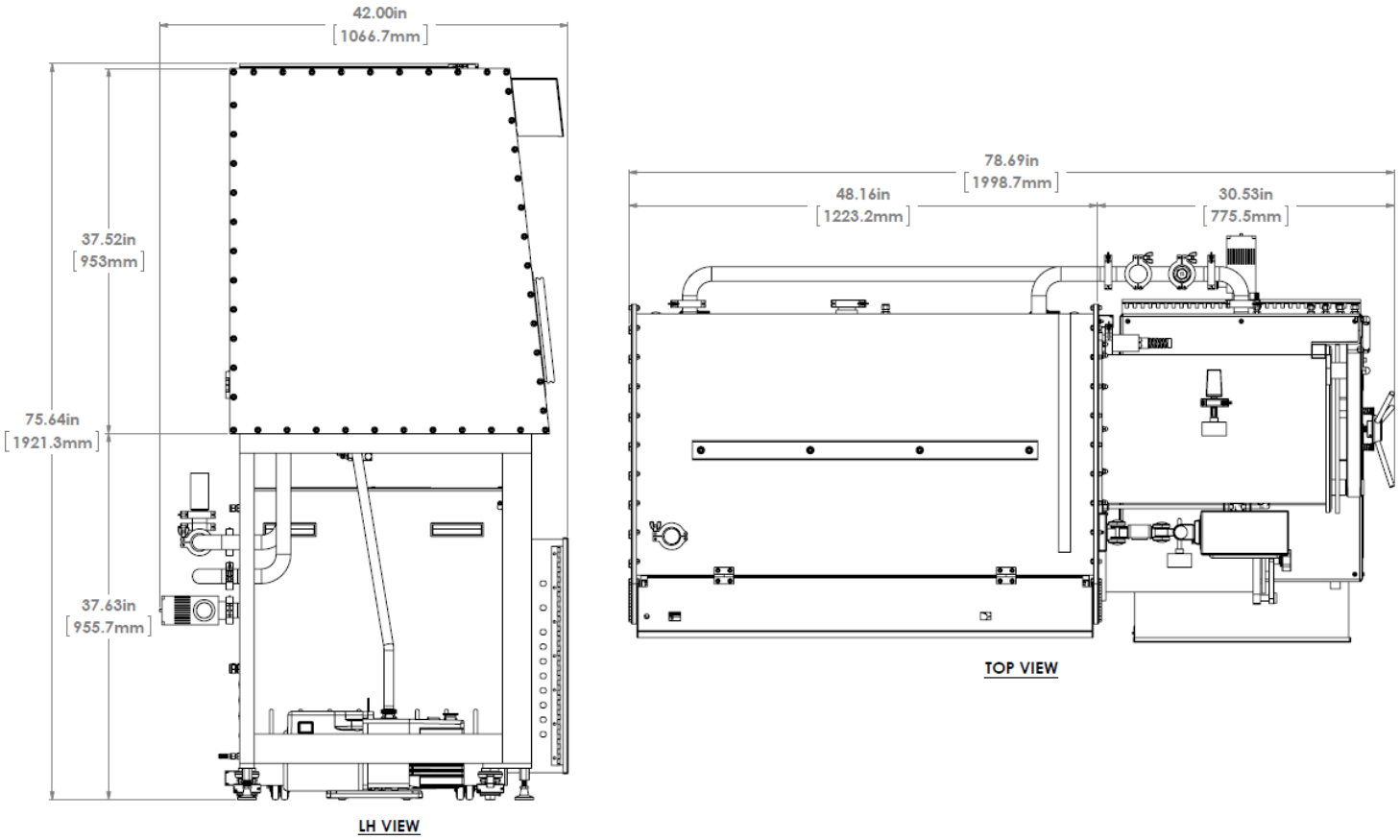


Figure 45 - PureLab HE 1250 Side and Top

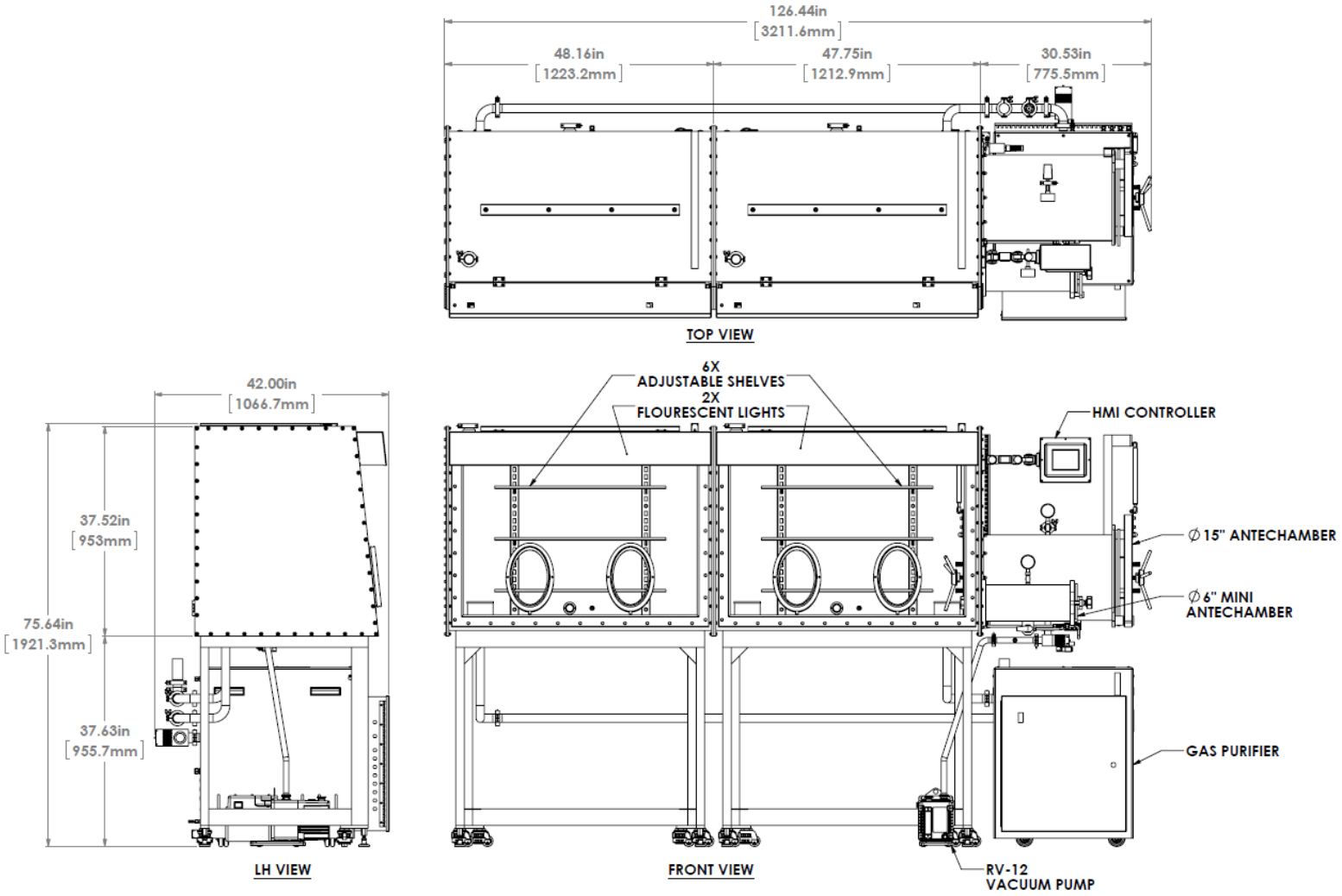


Figure 46 - PureLab HE 2500 Diagram

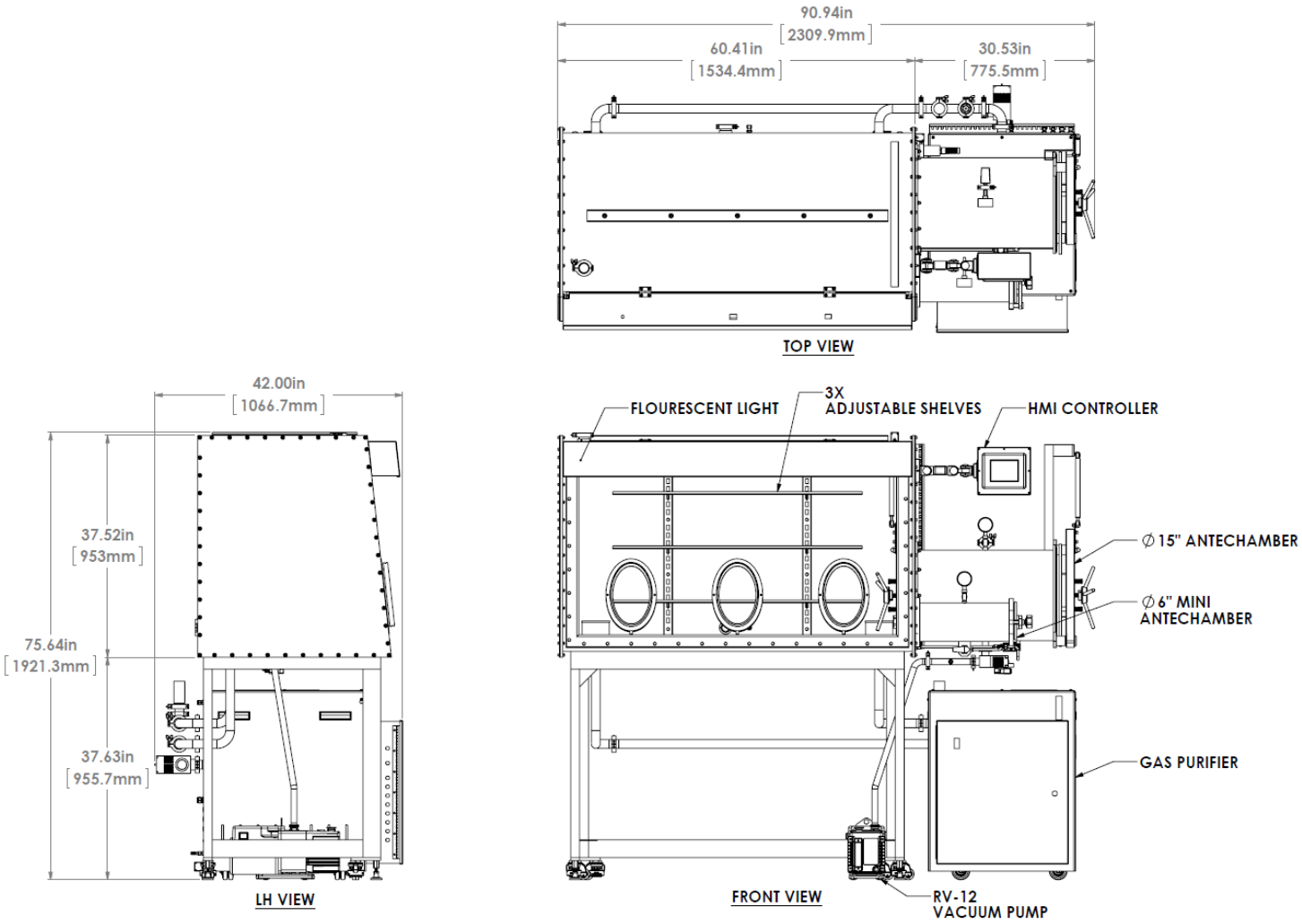


Figure 47 - PureLab HE 1500 Diagram

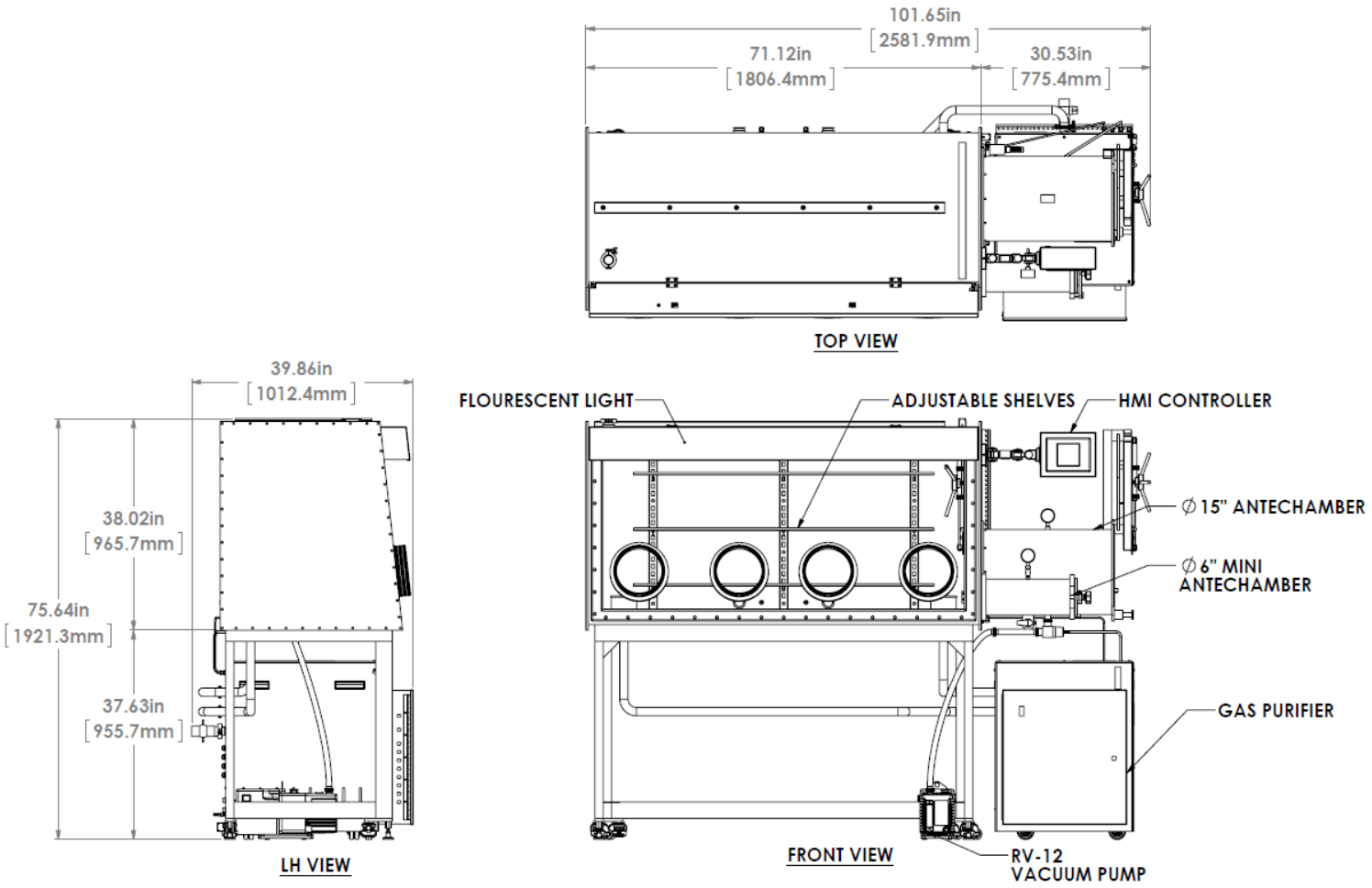


Figure 48 - PureLab HE 1800 Diagram

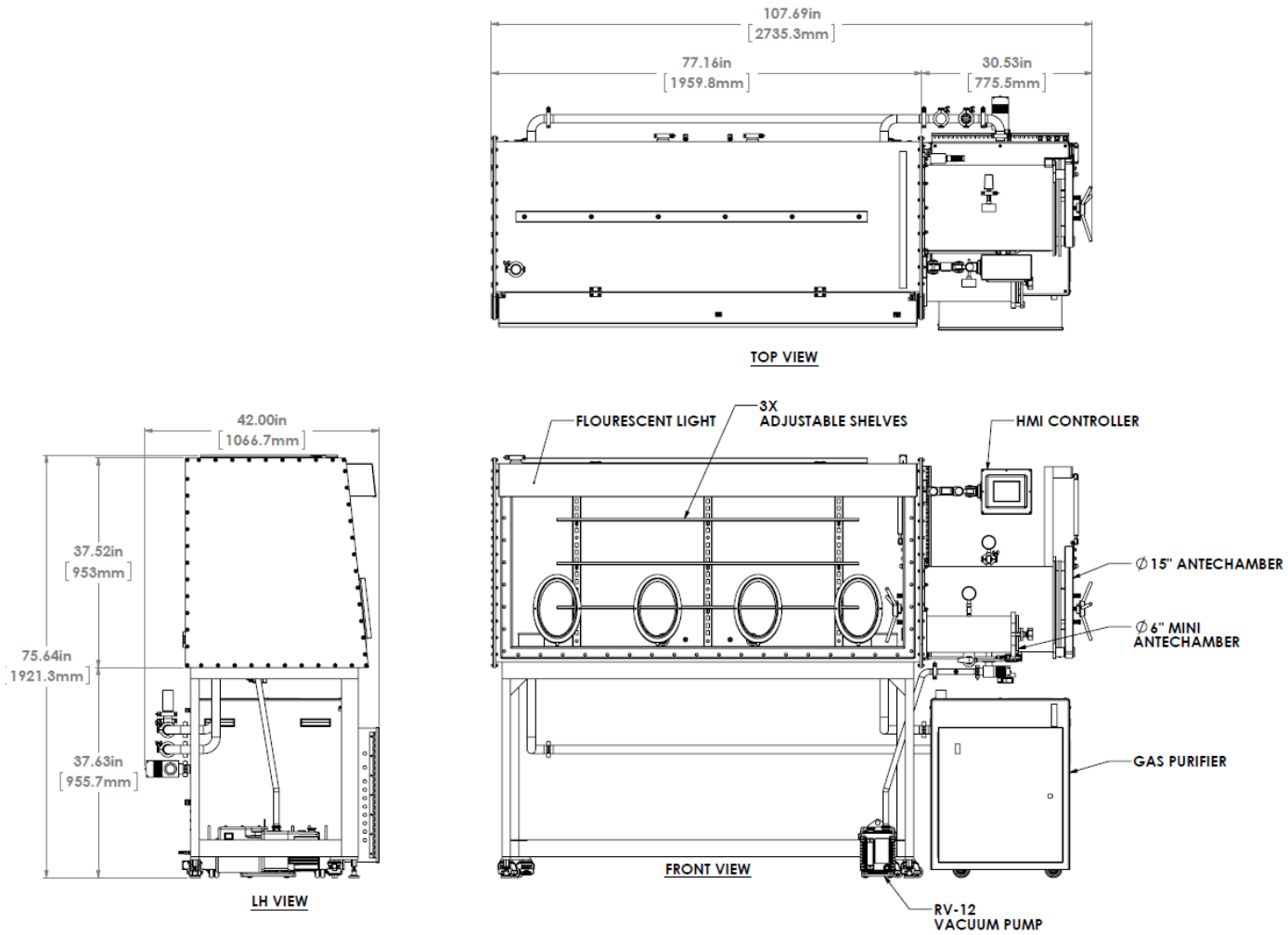


Figure 49 - PureLab HE 1950 Diagram