

# INSTALLATION AND OPERATION

miqa77e1-b (1310)



Catalog-No.

í í € €

550-701

Version 3

# PERNICKA 700H

Cumulative Helium Leak Detector

# Sales & Service

## WORLD HEADQUARTERS

**INFICON GmbH**  
**Bonnerstraße 498**  
**50968 Köln**  
**Germany**  
**Tel +49 221 56788-0**  
**Fax +49 221 56788-90**  
**Email: [reach.germany@inficon.com](mailto:reach.germany@inficon.com)**  
**[www.inficon.com](http://www.inficon.com)**

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# 1. Introduction

Congratulations on purchasing your new Pernicka 700H Cumulative Helium Leak Detector (CHLD). Soon you'll be leak testing parts with the most advanced leak detector on the market, but first, please read the following.

This manual gives step by step instructions to install and operate the Pernicka 700H.

All personnel with installation, operation, and/or service responsibilities must become familiar with the "CTI Cyro Pump Compressor Manual," to ensure safe and reliable cryo pump performance.

## 2. SPECIFICATIONS

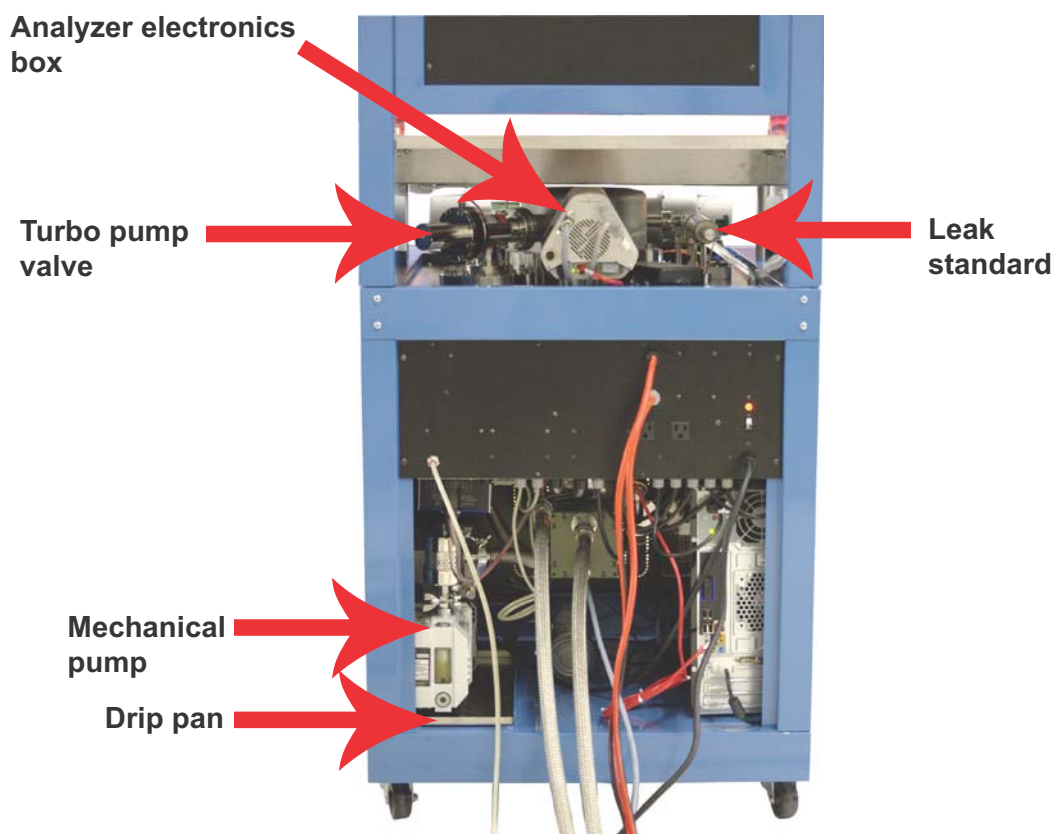
Minimum detectable leak rate for Helium (FINE mode)	> 4 x 10 <sup>-14</sup> mbar l/s
Maximum detectable leak rate for Helium (GROSS mode)	> 10 <sup>-4</sup> mbar l/s
Detectable masses	2 - 200
Mass Spectrometer	Quadrupole type
Calibrated built-in test leak in the range	10 <sup>-10</sup> mbar l/s
Test port	DN 16 CF
Vacuum pump system	turbomolecular pump oil sealed roughing pump cryo pump
Supply voltages unit	110/120 V, 50/60 Hz 15 A 220/240 V, 50/60 Hz 10 A
Cryo compressor (air cooled)	208-240 V, 50/60 Hz 10 A
Gas supply	
Valve operation	Compressed air, 100 - 110 PSI
Purge gas	Argon, 0.5 - 1 PSI
Ambient conditions	Intended for indoor use only
Max. permissible height above sea level (during operation)	2000 m
Operational temperature	15 - 28 °C (60 - 80° F)
Max. relative humidity	80%
Overvoltage category	II
Degree of contamination	2 (EN 61010)
Weight	245 kg (540.13)
Dimensions (W x H x T)	660 x 1390 x 870 mm (26 x 54.5 x 34.25 in)

## ORDERING INFORMATION

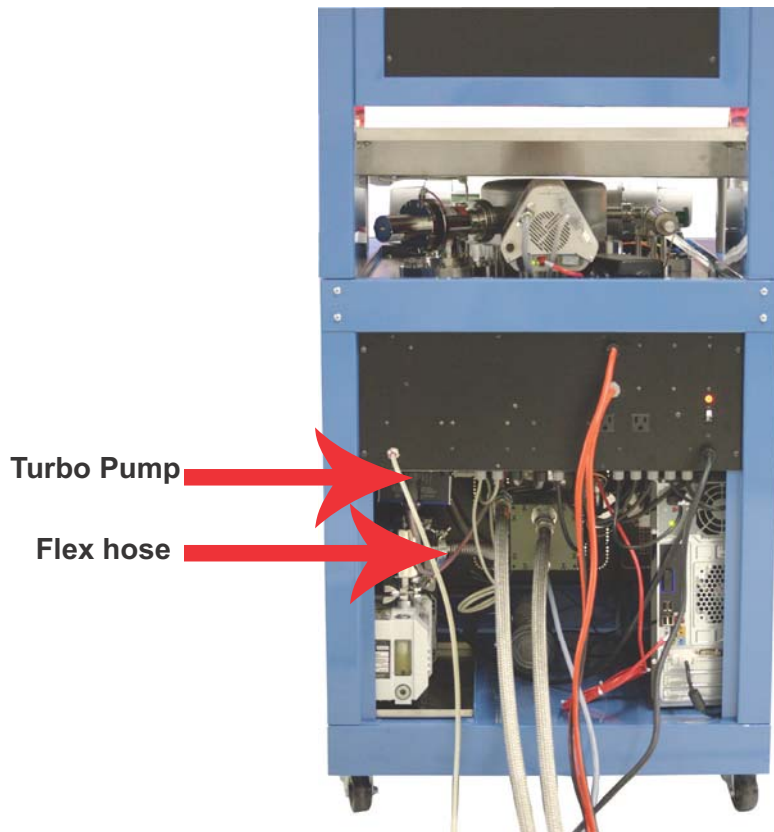
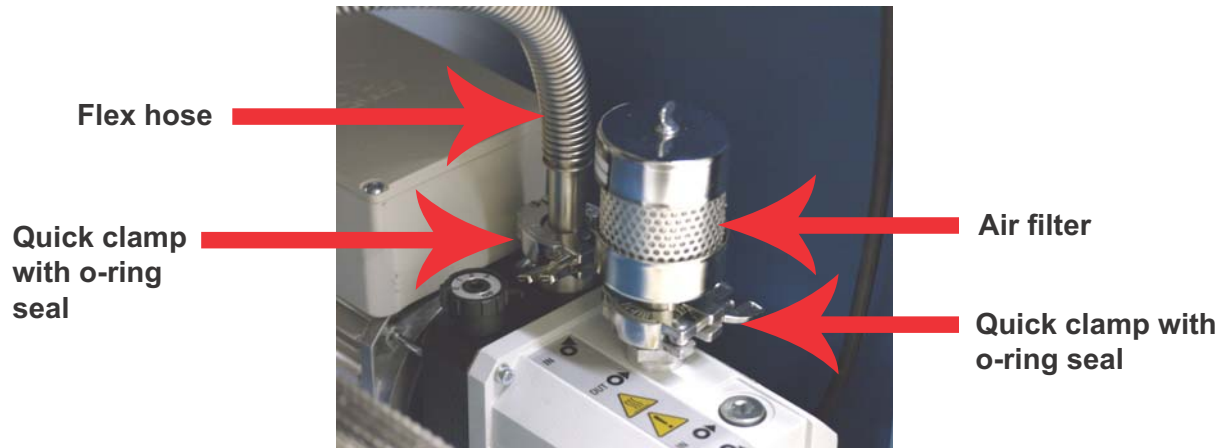
	PART NUMBER		PART NUMBER
Pernicka 700H		Options:	
Cumulative helium leak detector system,		Double O-ring test chamber	
110 V version	550-700	Large	551-710
230 V version	550-701	Medium	551-711
		Small	551-712
		Small metal seal test chamber	551-715
		High purity gas regulator, customized for Nitrogen/Argon, pressure range 30 or 240 PSI US or DIN connection to gas bottle	551-700S

### 3. Installation

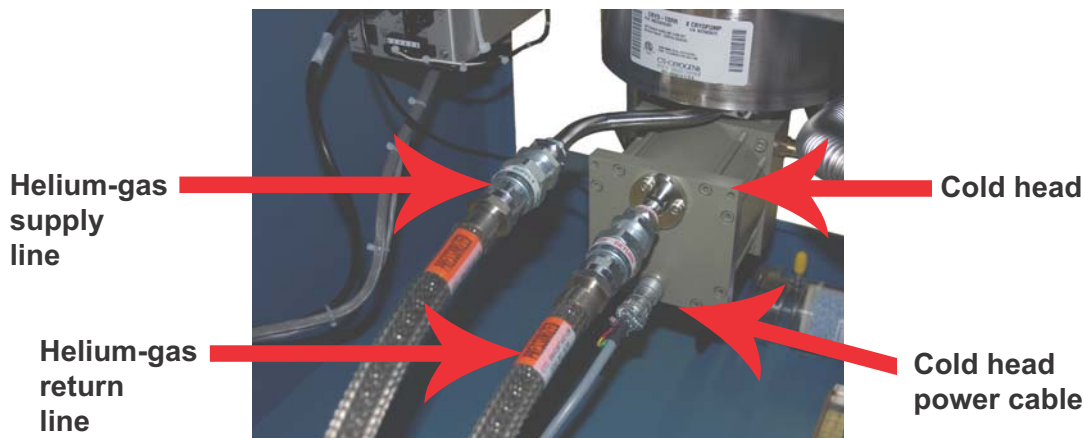
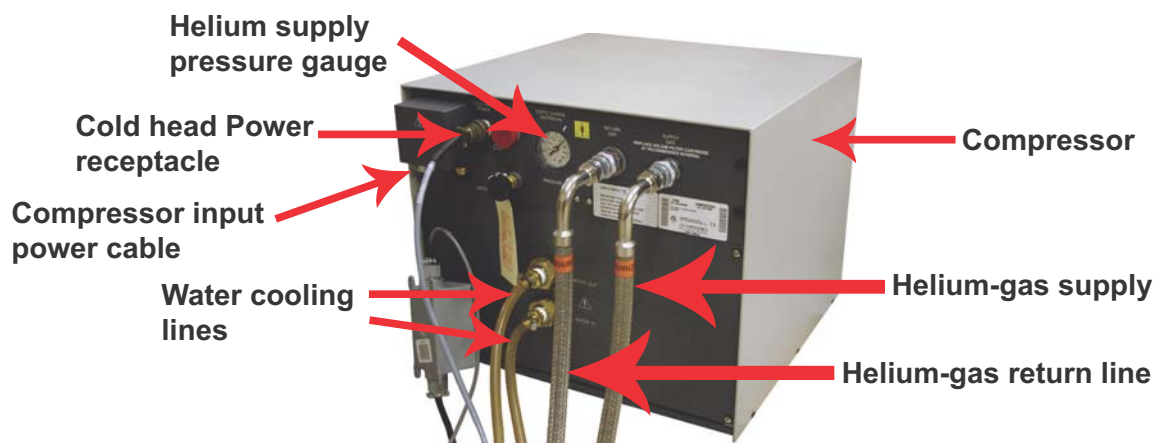
- 1 Remove the shipping foam from under the analyzer electronics box, leak standard, and turbo pump valve.
- 2 Place the drip pan for the mechanical pump in the lower cabinet.
- 3 Place the mechanical pump on the drip pan.
- 4 Attach the power cord to the front of the mechanical pump



- 5 Install the flex hose connecting the mechanical pump to the turbo pump using the supplied o-ring seals and quick clamps. Make sure the quick clamps are clamped properly.
- 6 Install the air filter to the mechanical pump using the supplied o-ring seal and quick clamp.



- 7 Connect the compressor to the cold head
  - a. Remove dust plugs and caps from the supply fittings and return lines, compressor, and cold head. Check all fittings.
  - b. Connect the Helium-gas return line from the gas-return connector on the rear of the compressor to the gas-return connector on the cold head. When connecting the Helium-gas return line back the nut off a 1/4 turn once it is tight.
  - c. Connect the Helium-gas supply line from the gas-supply connector on the rear of the compressor to the gas-supply connector on the cold head. When connecting the Helium-gas supply line back the nut off a 1/4 turn once it is tight.
  - d. Verify proper helium supply static pressure by confirming that the Helium pressure gauge reads 245-250 psig (1690-1725 kPa), in an ambient temperature range of 60 to 100 degrees F (16-38 degrees C). If pressure is higher or lower than the specified range, see the Brooks Automation CTI-Cryogenics 8200 Compressor manual.
  - e. Connect the cold head power cable from the compressor to the cold head.
  - f. If the compressor is water cooled connect the supply and return water lines. For flow and pressure requirements see the Brooks Automation CTI-Cryogenics 8200 Compressor manual.
  - g. Hardwire the compressor input power cable from Pernicka 700H to compressor.





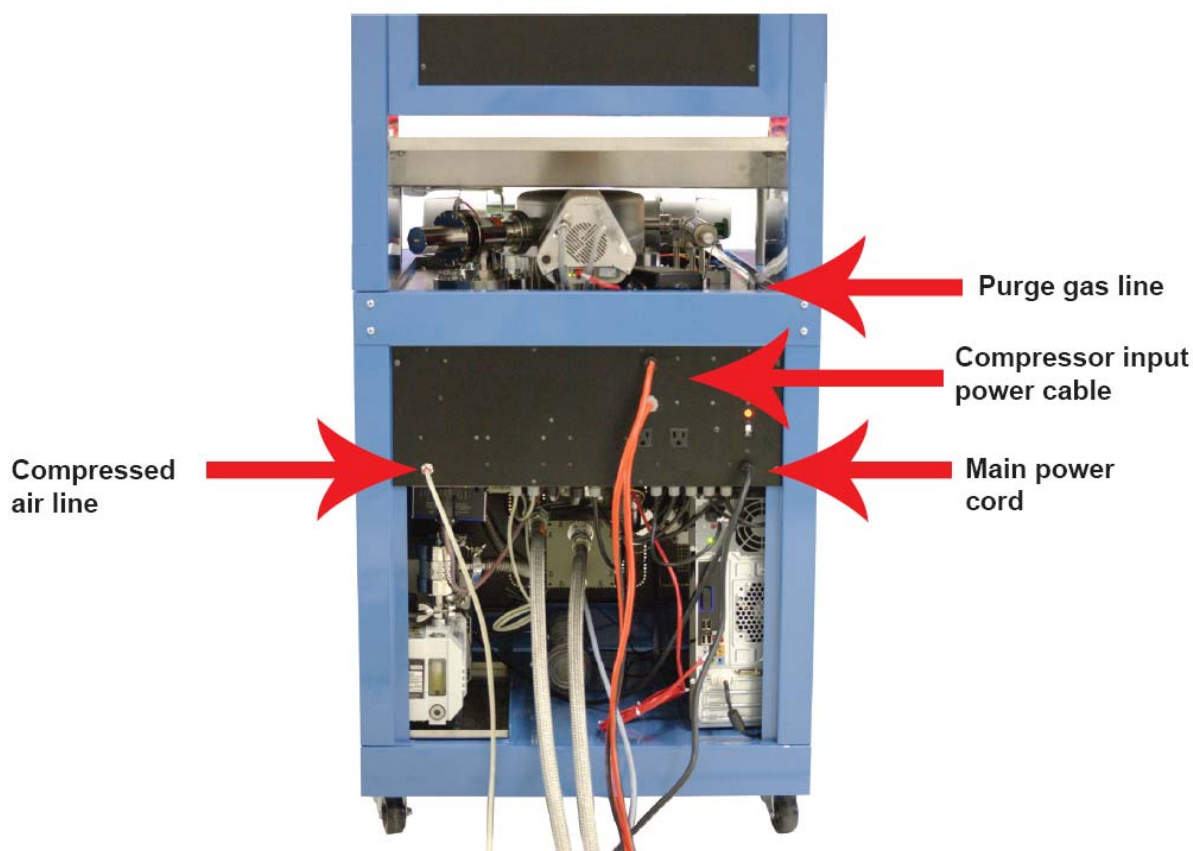
- 8 Install purge gas line (use 1/4 inch stainless steel, or copper tubing). Connector is on the right side of the back of the CHLD. Use 4.8 grade (99.998% pure) compressed Argon, or Nitrogen gas. Helium content should be less than 1 ppm if possible. Adjust the gas regulator to read 0.5-1.0 psig.
- 9 Install compressed gas line (use 1/4 inch Polypropylene tubing) to the CHLD (Connection is on the left side of the back of the CHLD). Adjust air regulator to read 100-110 psig.

### ATTENTION

#### High leakage current.

Operation without protection earth may cause electrical shock.

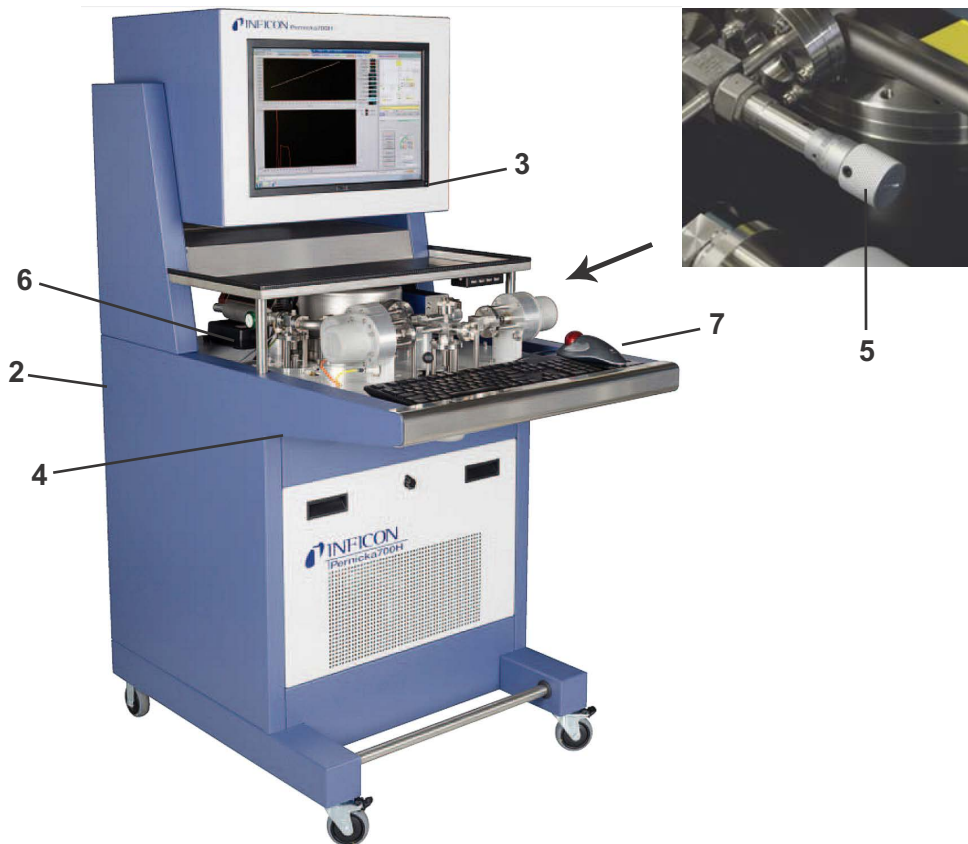
- 11 Connect the compressor input power cable to power source (208-240 Volt, 10 Amps, 50-60 Hz)
- 10 Plug the CHLD's main power cord into standard wall outlet or UPS (120 volts, 15 Amps, 60 Hz)



# 4. Operation

## Starting the system

- 1 Leak testing is made easy by following the steps in this chapter. To start the system follow the next seven steps (the locations are displayed in the figure below):
  - 1 All operators should complete the three day CHLD instruction class before operating the system.
  - 2 Turn the circuit breaker to the on position and the start delay timer will initiate. There will be a 20 second delay before power is applied to the system. After the delay period a red power LED will turn on indicating power is present. This feature protects the system from power transients which may occur during a power failure.
  - 3 The monitor will automatically turn on, if it doesn't, manually turn it on.
  - 4 The computer will automatically turn on, if it doesn't, manually turn it on.
  - 5 Make sure the Metering valve is open.
  - 6 Make sure the calibration leak standard is in calibration.
  - 7 Plug in ESD wrist strap.



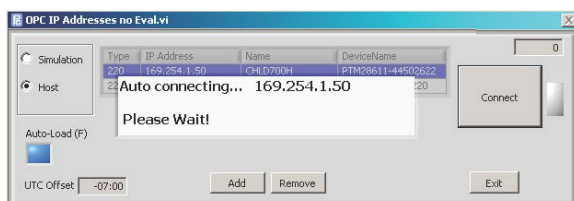
## Operation and control software

Software version 2-1.1.09-03.20

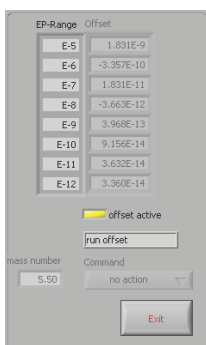
- 2 To access the operation and control software double click the [Pernicka 700H] icon on the desktop. While the software loads three different windows appear momentarily. To use the simulation mode, or to change the analyzer IP address, in the first window that appears place the cursor in the PC banner and left click the mouse.



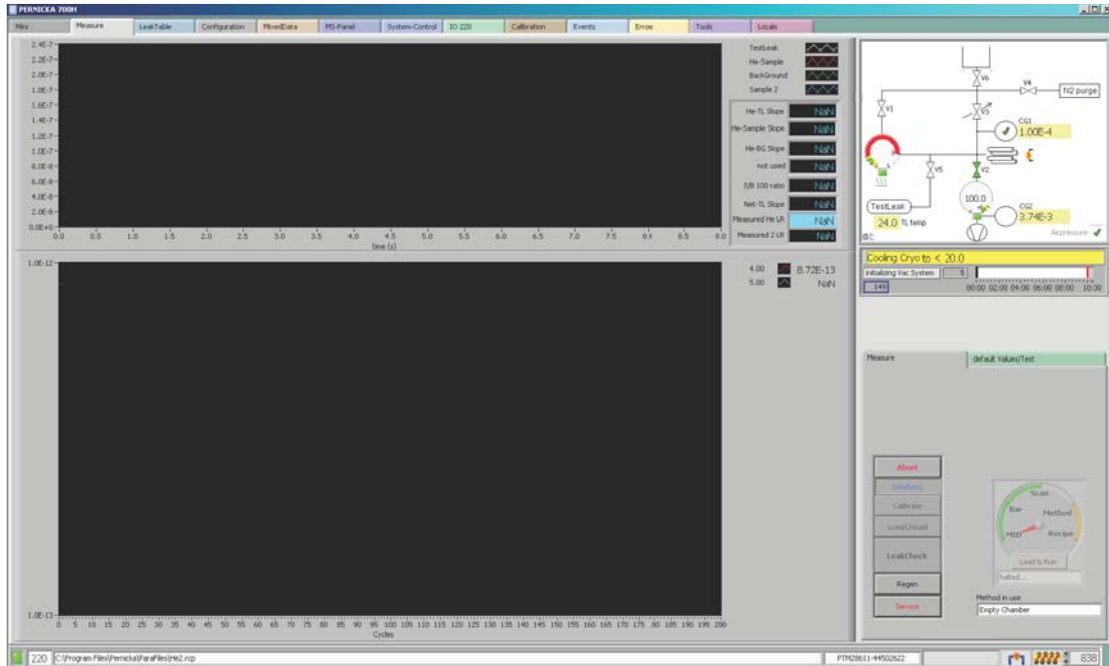
- 3 During the next window that appears the computer automatically connects to the analyzer.



- 4 The last window that appears before the software finishes loading automatically adjusts the offset for the gain ranges on the FET amplifier.

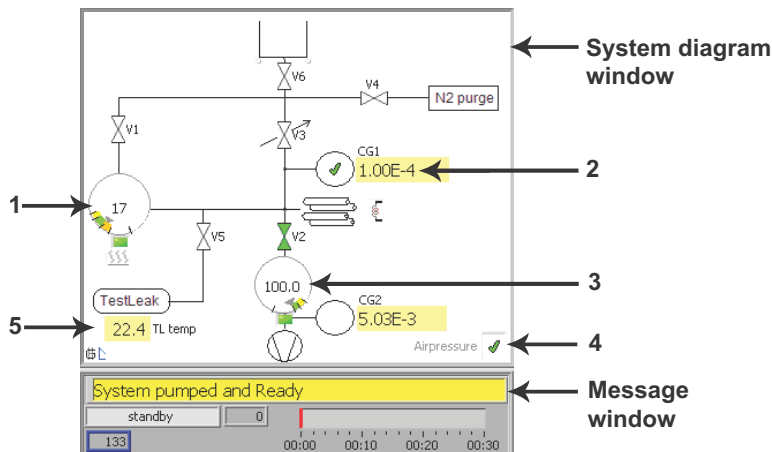


- When the software is finished loading the measurement window is displayed. Do not drag the window with the mouse, use the maximize button if it is necessary to enlarge the window. The status of the system is displayed in the yellow message window. When first starting the system the message window will say, "Cooling Cyro." It usually takes around 2 hours for the cryo pump to reach an operational temperature.

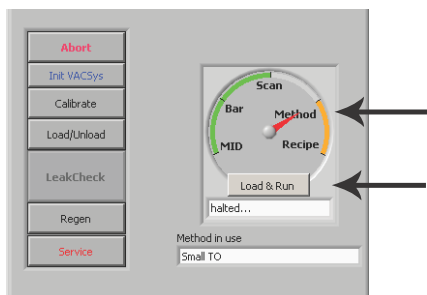


- The message window will read, "System Pumped and Ready" when the system has met five parameters in the system diagram window:

- Cyru pump has reached an operational temperature.
- The vacuum system has pumped down, indicated by a green check mark
- Turbo pump is at least 95% of full speed
- Air pressure line is between 100-110 psi, indicated by a green check mark
- Leak standard temperature is approximately room temperature in degrees Celsius



- Once the system is ready to operate, select [Method] in the program dial and click [Load&Run].

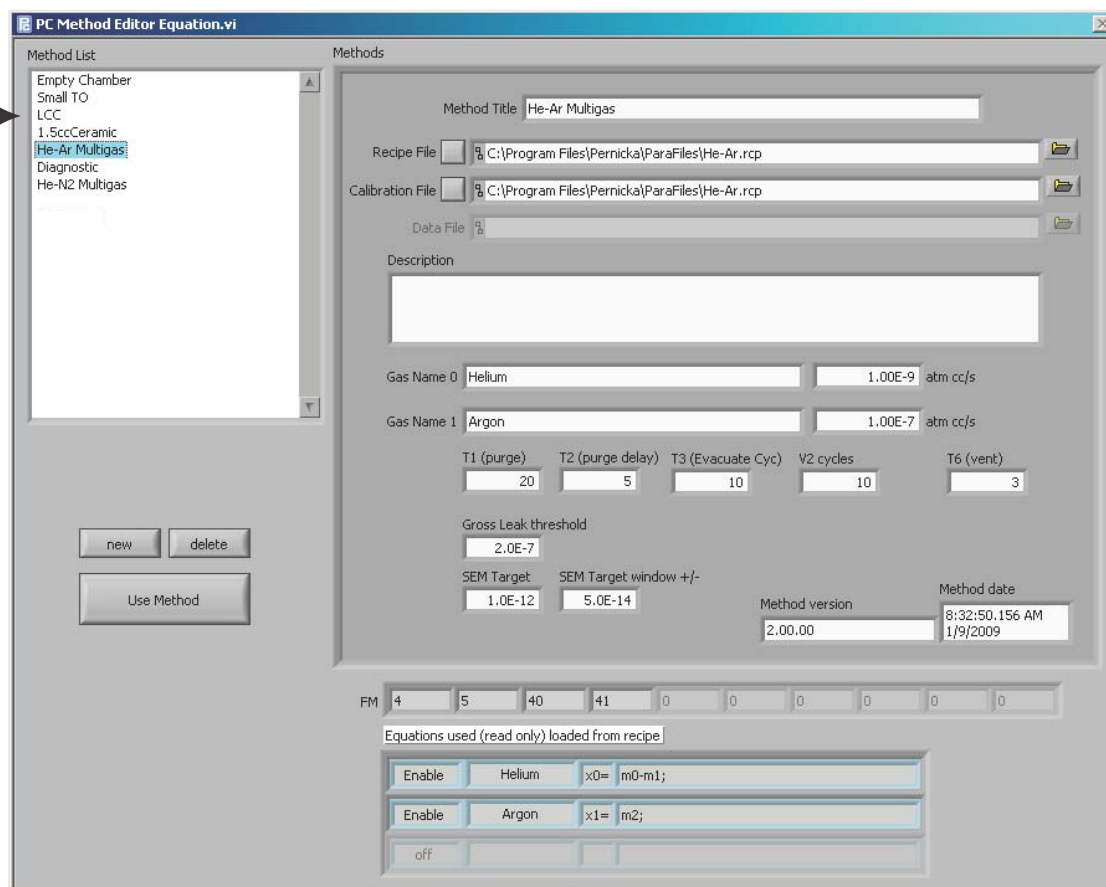


In the PC method editor window select the appropriate leak testing method from the method list, or create a new method. Method creation is taught during the three day CHLD training class. The example method [He-Ar Multigas] pictured below measures both Helium and Argon during the test cycle. The method was created taking into account the package type, military testing standards, and the test chamber used.

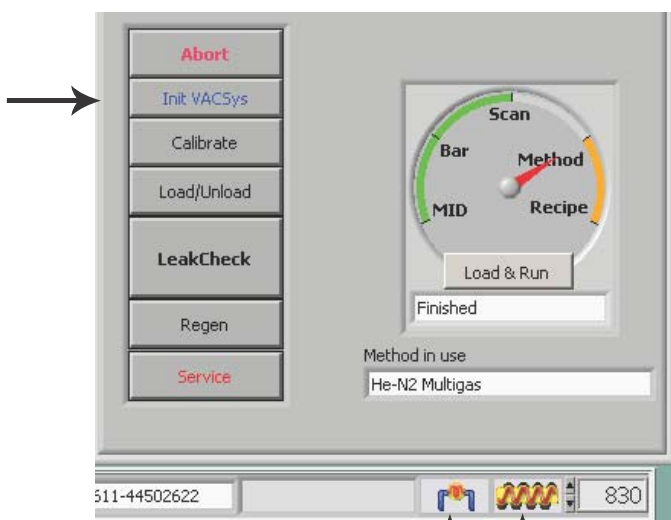
Make sure that the [SEM Target] is set to 1.0E-12, and the [SEM Target window +/-] is set to 5.0E-14. These values are used since the Helium test leak standard is a nominal 5E-10 atm-cc/sec leak rate. Do not change these two values.

Click [Use Method].

Example method list



- When the system is pumped and ready turn on the analyzer filament and secondary electron multiplier by clicking [Init VACSys].

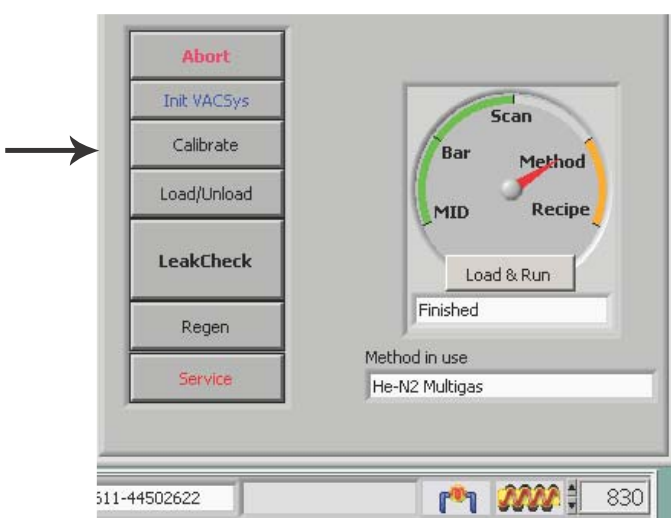


**Analyzer filament symbol      Secondary electron multiplier symbol**

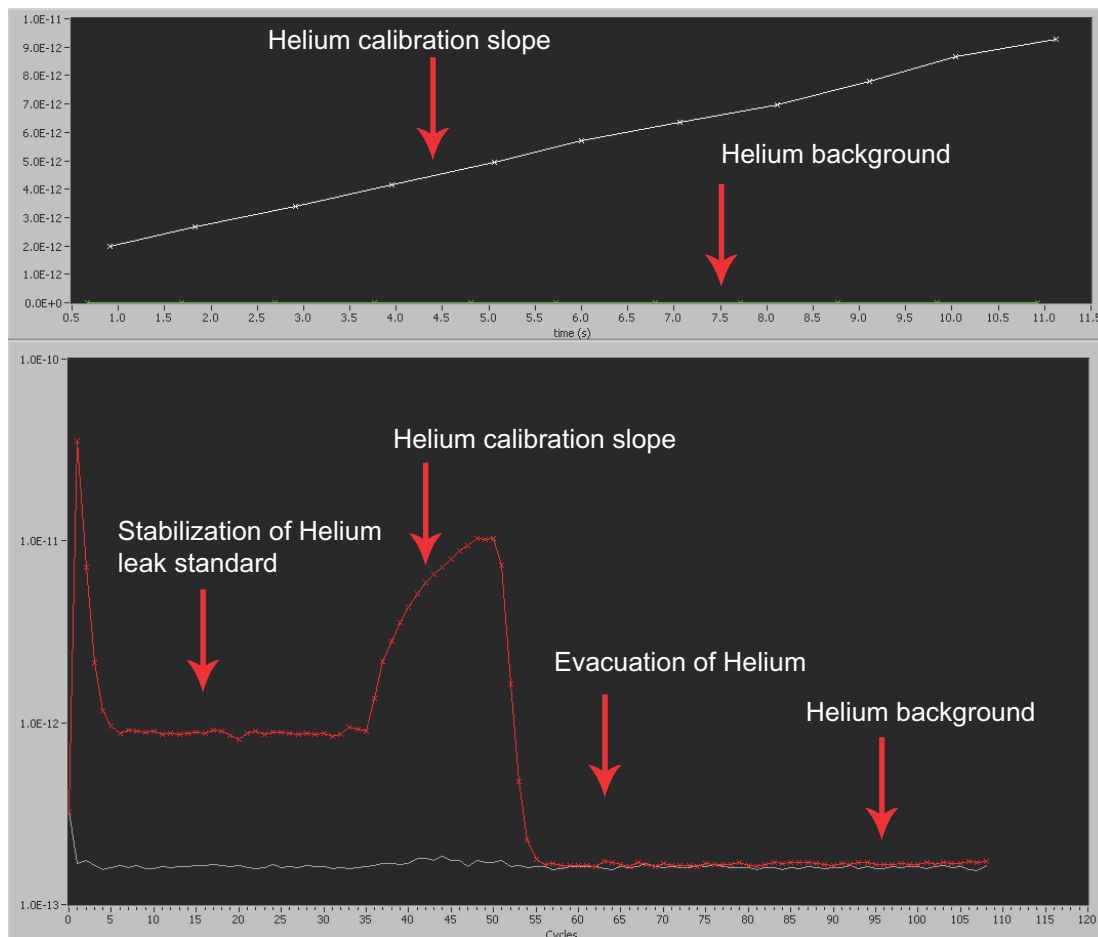
- The analyzer filament and secondary electron multiplier symbols turn gold when they are on. The operator may need to click [Init VACSys] more than once to turn on the analyzer filament and secondary electron multiplier.

### Calibration

- There are three different times when a calibration needs to be preformed: each day before parts are to be leak tested, when changing the method to one that uses a different calibration recipe, and after a cryo pump regeneration. To preform a calibration click [Calibrate].



Below are two windows used during the calibration of the system. Viewed in the top window is a linear plot of the Helium calibration slope and Helium background. In the lower window is a logarithmic plot providing greater dynamic range of the Helium signal during calibration.

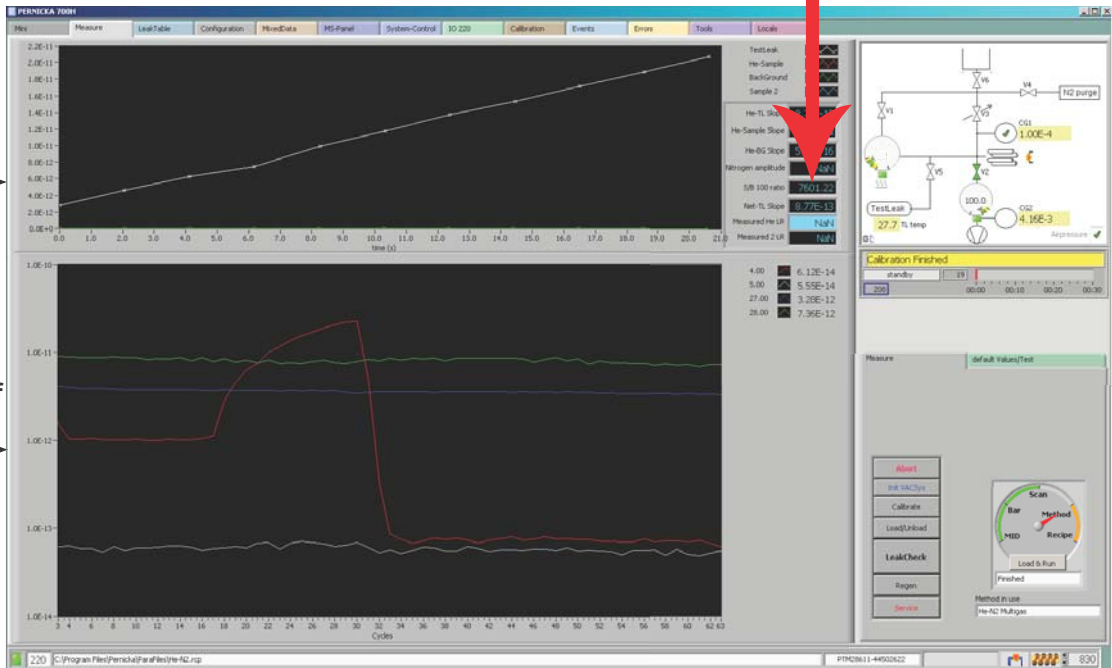


- 11** When the calibration is complete the message window will read, "Calibration Finished." The absolute magnitude of the ratio of the baseline to the calibration slope is calculated and should be greater than 100. If it is less than 100 the system will not leak test. This would indicate the cryo pump has excess ice build up and needs regeneration (See section on regeneration).

Ratio of the baseline to the calibration slope

Calibration slope

Log scale of gases of interest



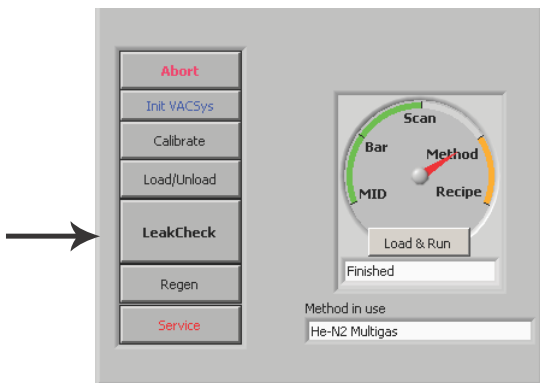
Installation and Operation

### Test chamber maintenance

- 12 Clean the test chamber and gasket with isopropyl alcohol and a lint free cloth. Make sure the gasket and base are free of any microscopic debris. A magnifying lens is useful when inspecting the gasket.

### Leak Testing

- 13 Before leak testing parts it is important to test an empty chamber to out-gas the elastomer gasket and to verify it's seal. This may be done more than once. Make sure the chamber lid is closed. Click [LeakCheck] to test the empty chamber.



(1310)


CHLD\_01.fm



- 14 In the PC UserInterface window input the operator's name by selecting from the drop down menu or by adding a new user name to the list. Click [Done] when finished.

PC UserInterface.vi

PC UserInput

 Pernicka Corporation

Date Tested  
9:30:15 AM  
12/22/2008

Operator

Customer

LIMS number

Part Number

Serial Number

Date Code  Series

Method

Measured Gas	LeakRate	LR limit	Pass/Fail
Helium	NaN	3.00E-10	
Argon	NaN	7.00E-10	

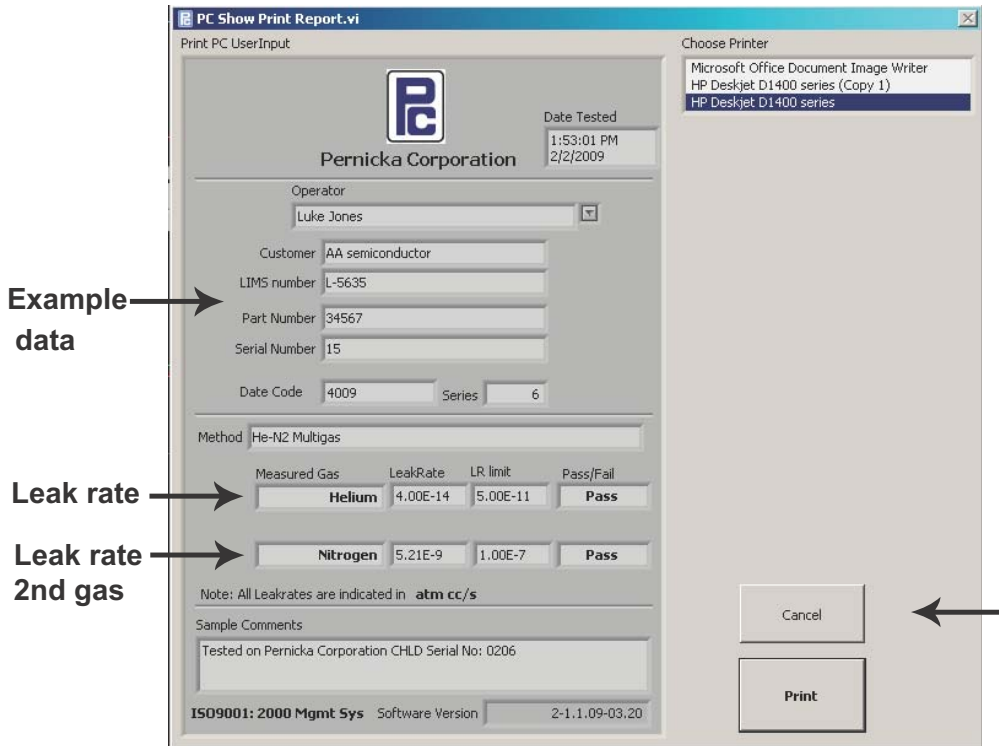
Note: All Leakrates are indicated in atm cc/s

Sample Comments

**Done**

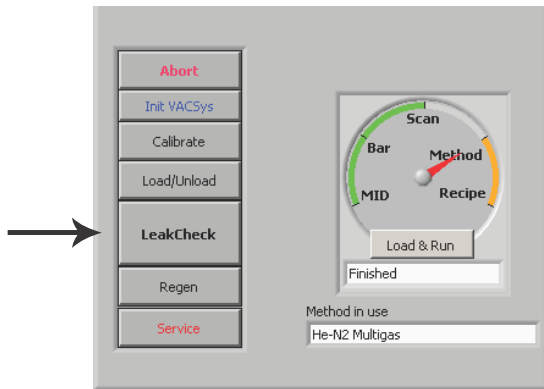
1509001: 2000 Mgmt Sys Software Version 2.12.03.08. 03.20

- 15 The leak test automatically starts after clicking [Done]. Make sure the test chamber lid is closed before starting the test cycle, or else the system will abort the test.
- 16 When the leak test is finished the PC Show Print Report window displays the leak rate.



17 Either cancel, or print the empty chamber test results.

18 If the leak rate of the empty chamber is satisfactory, click [LeakCheck].

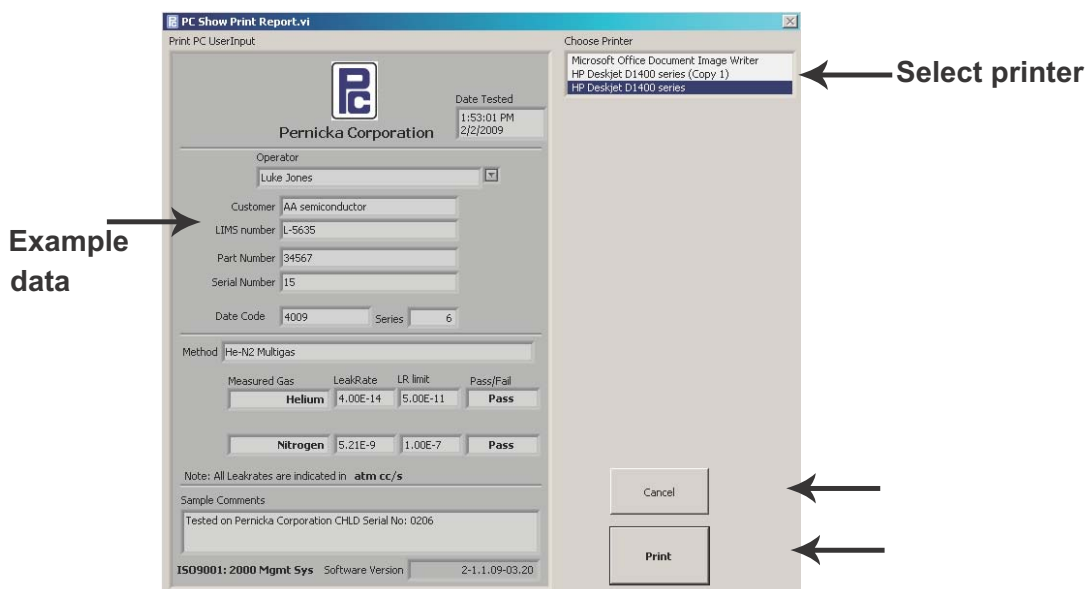


19 In the PC UserInterface window input the desired information for the first part to be leak tested. Use the tab key to jump from one box to the next. By pressing [return] you can skip this window, or click [Done] when finished. The leak test automatically starts after clicking [Done]. Make sure the part is loaded with the lid closed before starting the test cycle.

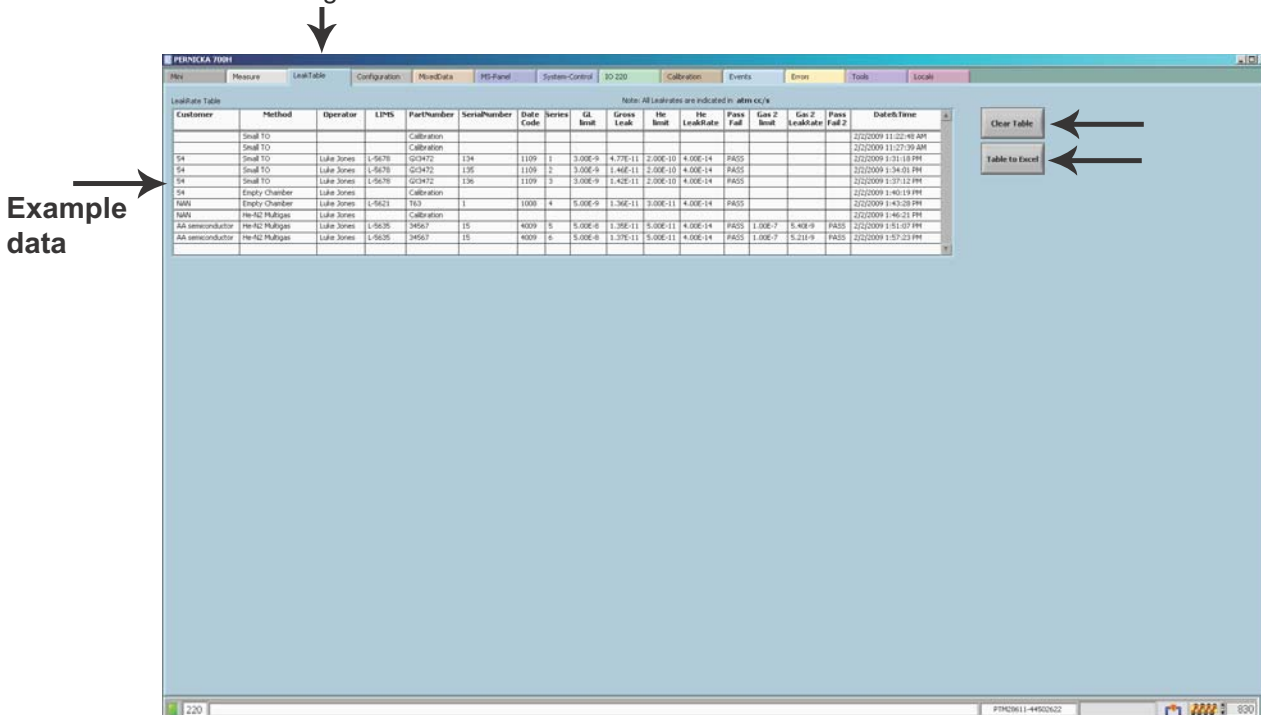
20 Systems equipped with an optional start switch assembly may need the start switch depressed for the leak test to start.

## Data archival

- 21 The PC Show Print Report window is displayed when the leak test is finished. The operator can either print the test results, or choose to cancel the printing. Whether the operator chooses to cancel, or print the test data, it is stored in the leak table which can be viewed and printed at a later time. The printer can also be selected.

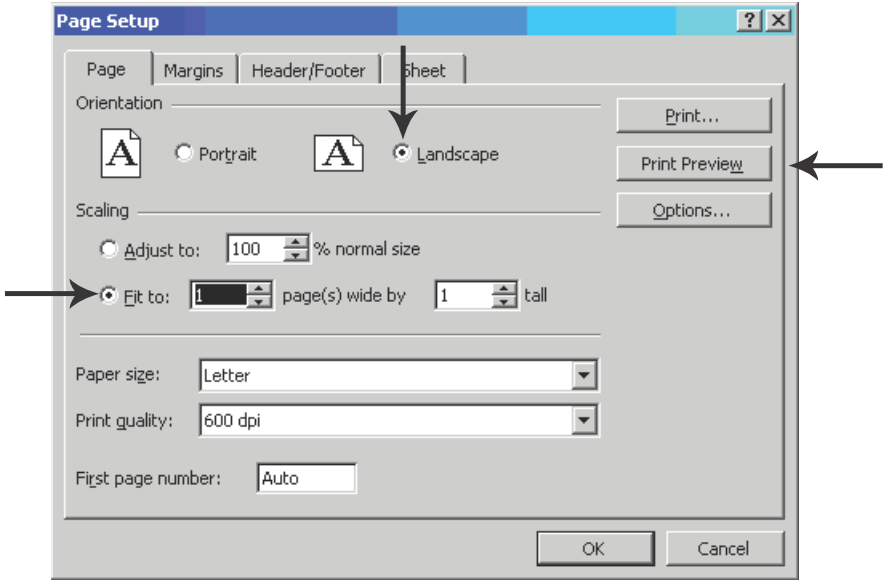


- 22 To access the leak table click the [LeakTable] Tab. The leak testing data in the leak table can be cleared, or transferred to Excel for printing and long term storage.



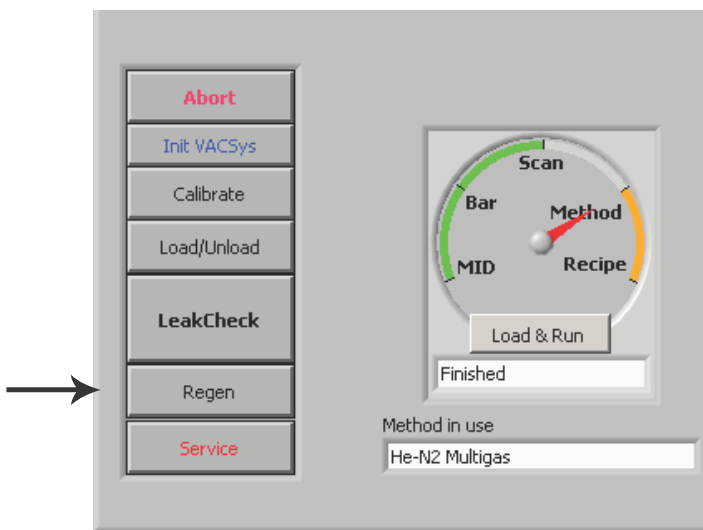
### Printing in Excel

- 23 If choosing to print from Excel the operator will find many options in the page setup window. For best printing results select [Landscape], [Fit to:], and [1] pages wide. Click [Print Preview] before printing. Click [OK] to print.

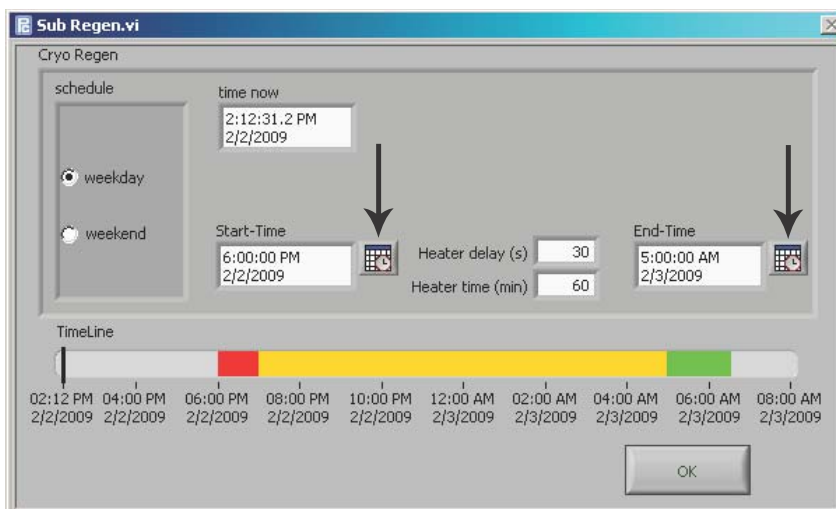


### Cryo pump regeneration

- 24 When finished leak testing parts for the day click [Regen].

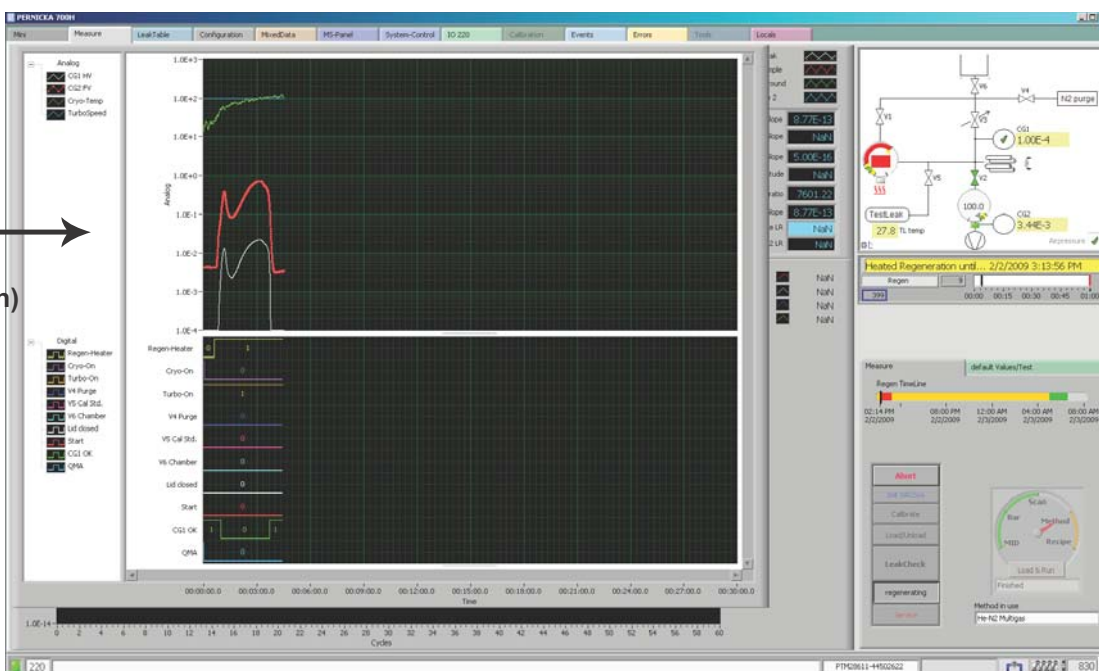


- 25 The regeneration schedule window gives options on when the regeneration cycle starts and stops. To adjust the start-time to the current time select the calendar button. Adjust the end-time to 2 hours before the system will be operated again. Keep in mind when selecting an end-time that it takes roughly 2 hours for the system to cool to an operational temperature. Click [OK] when finished.



- 26 The compressor turns off and the cryo pump begins to warm up. The pressure gauges 1 and 2 are plotted in the measurement window showing the rise and fall of pressure that takes place during a regeneration. This is from condensed gases being released from the cryo pump. The turbo pump removes these gases and the pressure returns to normal operating range. The message window gives the status of the regeneration. For a full regeneration to take place the cryo pump must reach 310 degrees Kelvin. This takes about 45 minutes.

Out-gassing cryo pump (Sublimation) →



## Short regeneration

An abbreviated regeneration may be conducted once it is clear that the gases collected on the cryo pump have been released and pumped out of the system. Typically this takes about 5-6 minutes. It should be noted that since the pump is still at low temperature the moisture will not be removed during this procedure. The regeneration cycle can be terminated at any time by simply pressing the abort button.

## Computer shut down

We recommend that a full shut down is performed on the computer once a week to prevent Microsoft memory issues from crashing the computer. Before this can be performed transfer all test data in the leak table to a secure location by either transferring to Excel, or printing a hard copy. Closing the Pernicka 700H program will erase any test data in the leak table. Then click the [X] in the upper right hand corner of the window to close the Pernicka 700H program.

Then shut down the computer (Cold reboot) by clicking [start] on the desktop and selecting [shutdown]. After the computer turns off restart by pressing the power button on the front of the system. If the system does not have a power button on the front of the system, restart the computer by turning the circuit breaker to the off position on the back of the CHLD system and after a few seconds turn the breaker back to the on position. There will be a 20 second delay before power is applied to the rest of the system. After the delay period a red power LED will turn on indicating power is present. This feature protects the system from power transients which may occur during a power failure. The computer will start automatically when power is applied to the system. We recommend that the Pernicka 700H software program remain running at all times except for the weekly rebooting of the computer since it controls the system.

## Turning off vacuum system

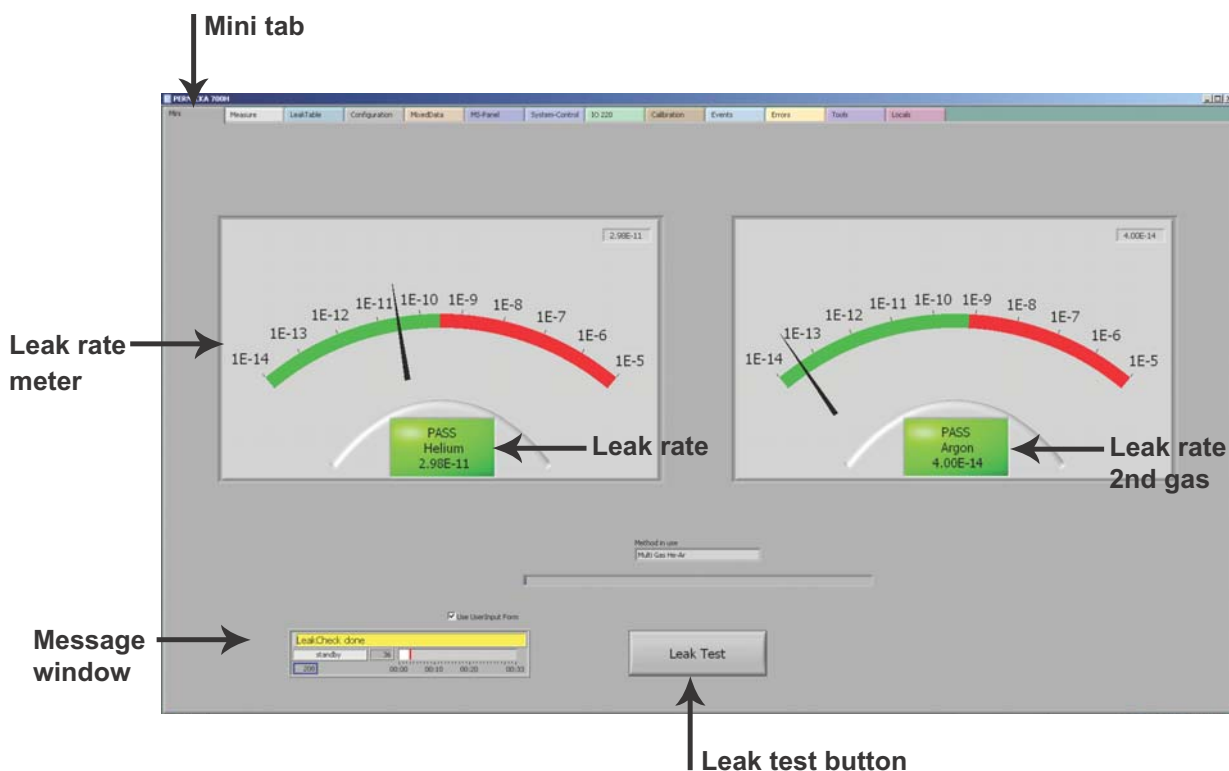
It is recommended to leave the computer, monitor, and vacuum system running. But, if it is desirable to turn off for an extended period of time such as a month, then a full cryo pump regeneration should be done before turning off the circuit breaker to the vacuum system. When the system is turned on after an extended period of being shut down it should run for several days to regain performance before leak testing. For optimal performance leave the system running.

## User Windows

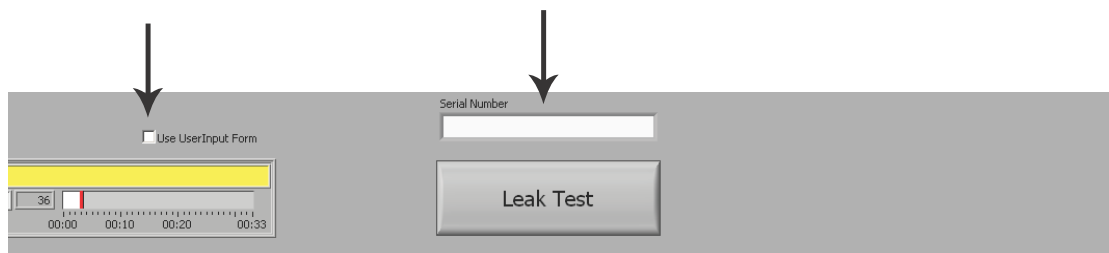
The Pernicka 700H has two operator windows, the measurement and mini. The measurement window gives the operator many different control and research options, while the mini window has a simplified display that is designed for mass production testing.

### Mini Window

To choose the mini window select the [Mini] tab.



To start, or abort a test cycle click the [Leak Test] button. The message window gives the status of the system. The green box gives the leak rate. If the leak rate is below the pass/fail value (R1 value) the box will turn red and will say fail. If the test cycle is above the pass/fail value the box will turn green and will say pass. If it is desirable to input only the serial number for each part to be tested and to skip the PC user interface window deselect the [Use UserInput Form] box. In doing so, a box will appear to input the serial number. The operator can choose to type, or scan with a bar code scanner to enter the serial number into the box.



## Measurement window

In the measurement window the operator can select different programs to run by selecting the program with the program dial and then clicking the [Load & Run] button. There are five different program options on the program dial:

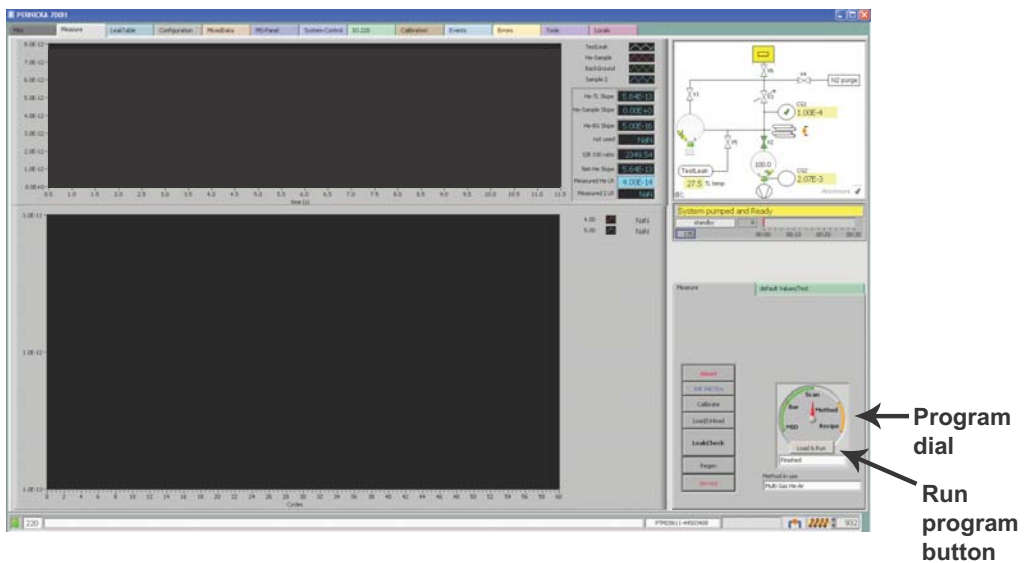
MID - plots helium

Bar - not used

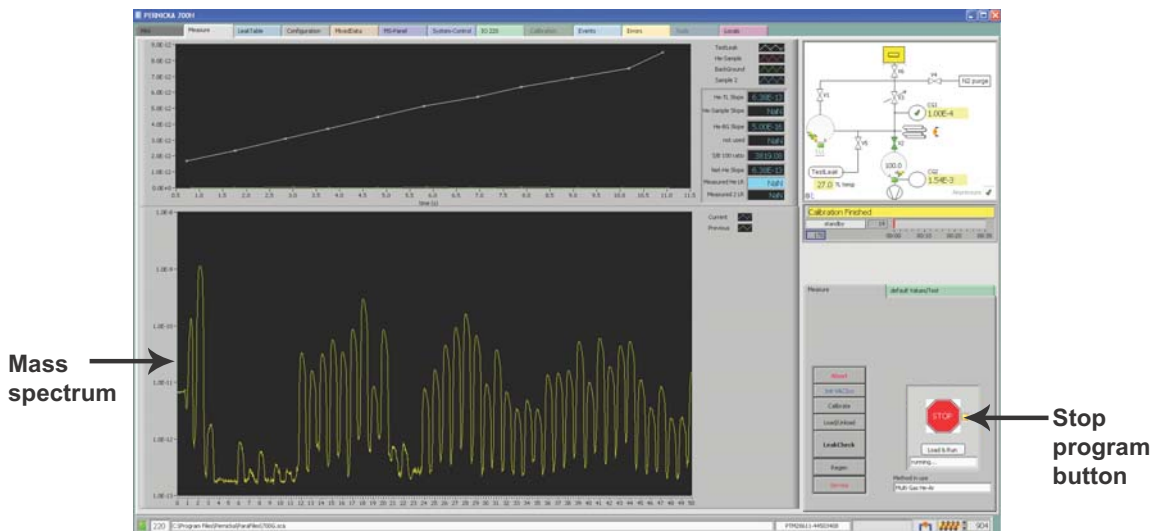
Scan - scans the mass spectrum

Method - allows the operator to choose different leak test methods

Recipe - allows editing of the mass spectrometer parameters

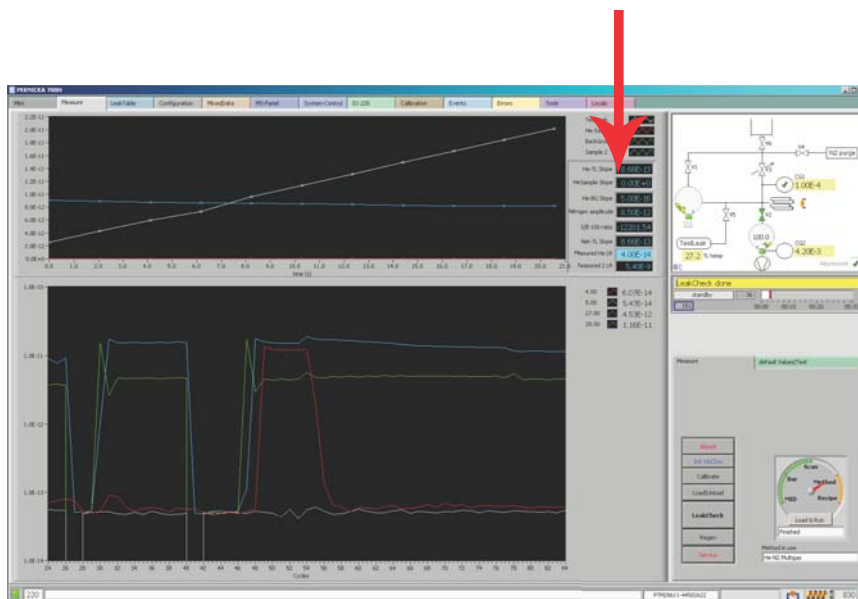


The scan program gives the operator a view of the mass spectrum in the window below. To stop the program click the [STOP] button.





The measurement window displays values of importance. Below the values are defined.



He-TL Slope	8.66E-13	← The measured Helium slope of the leak test standard
He-Sample Slope	0.00E+0	← The measured Helium slope of the sample under test
He-BG Slope	5.00E-16	← The Helium background slope measured during the calibration
Nitrogen amplitude	8.50E-12	← Signal amplitude of second gas (optional)
S/B 100 ratio	12201.54	← The slope/baseline ratio of Helium measured during the calibration
Net-TL Slope	8.66E-13	← The measured Helium slope of the leak test standard corrected for background
Measured He LR	4.00E-14	← The leak rate of Helium measured during a test cycle
Measured 2 LR	5.40E-9	← The computed leak rate of a second gas (optional)

## Leak table window

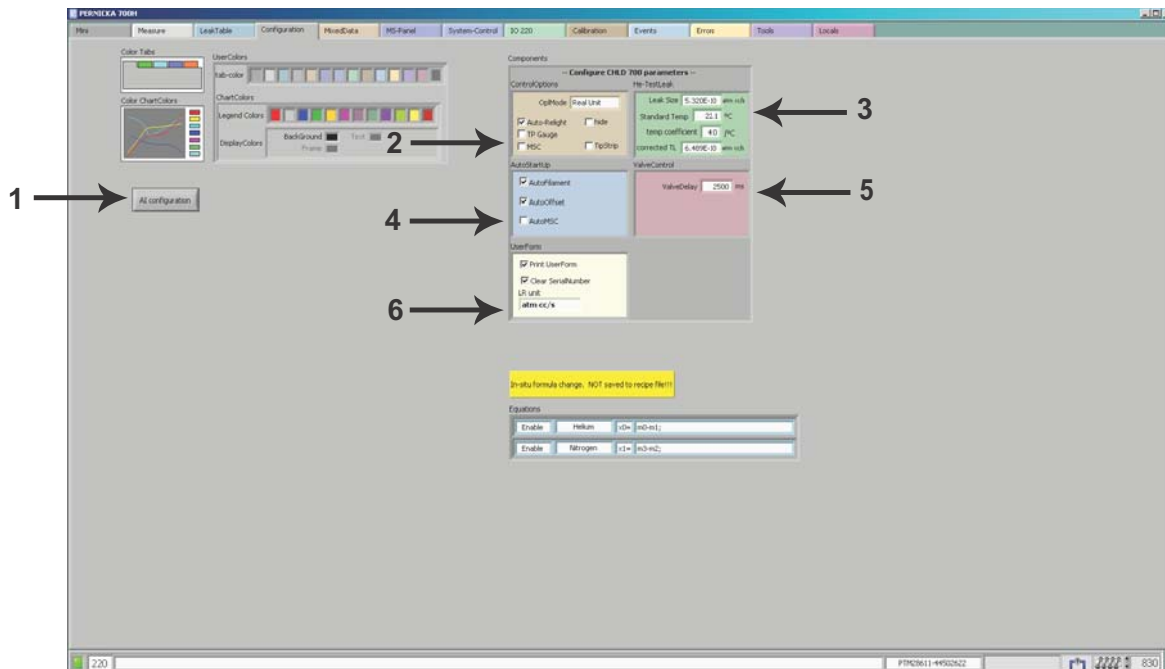
The leak table window gives the operator access to the leak testing and calibration data. The data in the leak table can be cleared, or transferred to Excel for printing, or long term storage. If it is necessary to close the Pernicka 700H operation program make certain that all of the data is transferred to a secure location, since it will not be saved in the leak table window.

Example data

Customer	Method	Operator	LIMS	PartNumber	SerialNumber	Date Code	Series	G1 limit	Gross Leak	He limit	He LeakRate	Pass Fail	Gas 2 limit	Gas 2 LeakRate	Pass Fail 2	Date&Time	
	Small FO			Calibration												2/2/2009 11:22:40 AM	
	Small FO			Calibration												2/2/2009 11:27:29 AM	
TS4	Small FO	Luke Jones	L-5678	G03472	134	1109	1	3.00E-9	4.77E-11	2.00E-10	4.00E-14	PASS				2/2/2009 1:21:18 PM	
TS4	Small FO	Luke Jones	L-5678	G03472	135	1109	2	3.00E-9	1.46E-11	2.00E-10	4.00E-14	PASS				2/2/2009 1:26:01 PM	
TS4	Small FO	Luke Jones	L-5678	G03472	136	1109	3	3.00E-9	1.43E-11	2.00E-10	4.00E-14	PASS				2/2/2009 1:37:12 PM	
TS4	Empty Chamber	Luke Jones		Calibration												2/2/2009 1:40:19 PM	
TAW1	Empty Chamber	Luke Jones	L-5621	763			1008	4	5.00E-8	1.36E-11	3.00E-11	4.00E-14	PASS			2/2/2009 1:43:28 PM	
TAW1	He-N2 MultiGas	Luke Jones	L-5626	34567	15		4009	5	5.00E-8	1.39E-11	5.00E-11	4.00E-14	PASS	1.00E-7	5.40E-9	PASS	2/2/2009 1:51:07 PM
AA semiconductor	He-N2 MultiGas	Luke Jones	L-5626	34567	15		4009	6	5.00E-8	1.37E-11	5.00E-11	4.00E-14	PASS	1.00E-7	5.21E-9	PASS	2/2/2009 1:57:23 PM

## Configure window

There are several important functions in the configuration window:

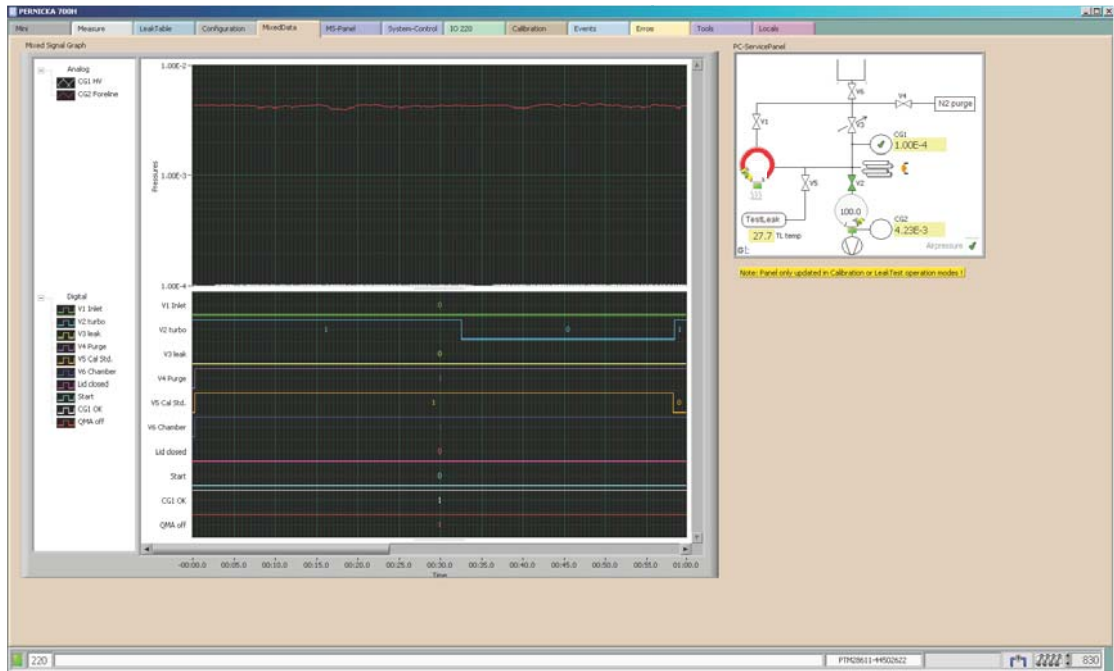


1. AI configuration  
Displays conversion factors for analog inputs (maintenance function).
2. Control options  
The [Op/Mode] function should be set to [Real Unit], other settings are for diagnostic purposes only.  
The [Auto-Relight] function automatically turns the analyzer filament on.  
The [TP gauge] is not used.  
The [MSC] is not used.  
The [hide] function hides the maintenance tabs.  
The [TipStrip] function gives details about the schematic diagram when the cursor is positioned on individual items.
3. Helium test leak  
The leak standard parameters can be input into the [TestLeak] window. These values should be updated when ever the leak standard is changed.
4. Auto start-up  
The [AutoFilament] function turns on the filament when the system is pumped and ready. This should be selected. The other functions are for other analyzer applications.
5. Valve control  
Should be set to 2500 ms.
6. User form  
The [Print User Form] function when selected will provide the option of printing a data sheet after each test cycle.  
The [Clear Serial Number] function when selected will clear the serial number after each test cycle.  
The [LR unit] function gives the option of displaying the leak rate in either atm cc/s, or mbar l/s.

## Maintenance Windows

### Mixed data window

The mixed data window plots digital outputs as a function of time (maintenance function).



## MS-panel window

The MS-panel window displays the digital data values for the current completed test. The important value is the [Gross-Leak-Int] which is used to set the gross leak threshold in the methods window.

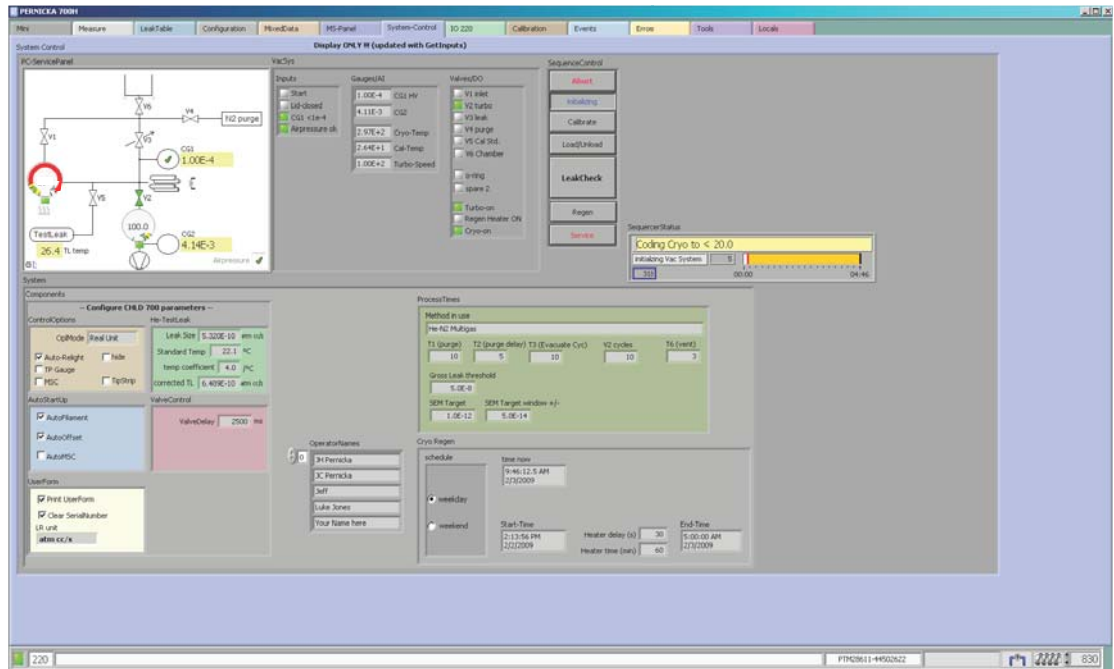
The screenshot shows the 'MS-Panel' window in the INFICON software. The window title is 'PERMICKA 1000'. The main area displays test parameters and results for a Helium leak test. The 'Gross-Leak-Int' value is highlighted with a black arrow.

Annunciator	He-T1 Slope	He-TestLeak	He-Background	He-Sample	Sample-2
He-T1 Slope	0.0	0.79E-12	0.0	1.4E-14	0.0
He-T1 Slope	0.77E-13	2.1	4.90E-12	2.1	1.8E-14
He-Sample Slope	4.1	6.25E-12	4.1	2.0E-14	0.0
He-S1 Slope	5.00E-16	6.2	7.47E-12	6.2	1.3E-14
Sample-2 amplitude	NaN	7.3	9.90E-12	7.2	2.0E-14
Scale	0.000E+0	10.3	1.10E-11	10.3	1.4E-14
Gross-Leak-Int	13.3	1.37E-11	12.4	2.3E-14	0.0
He-T2 Slope	0.77E-13	14.4	1.50E-11	14.4	1.4E-14
Measured He LR	NaN	16.5	1.72E-11	16.5	2.0E-14
Measured 2 LR	NaN	18.6	1.89E-11	18.5	2.5E-14
		20.6	2.07E-11	20.6	1.4E-14

The 'Gross-Leak-Int' value is 13.3, which is used to set the gross leak threshold in the methods window.

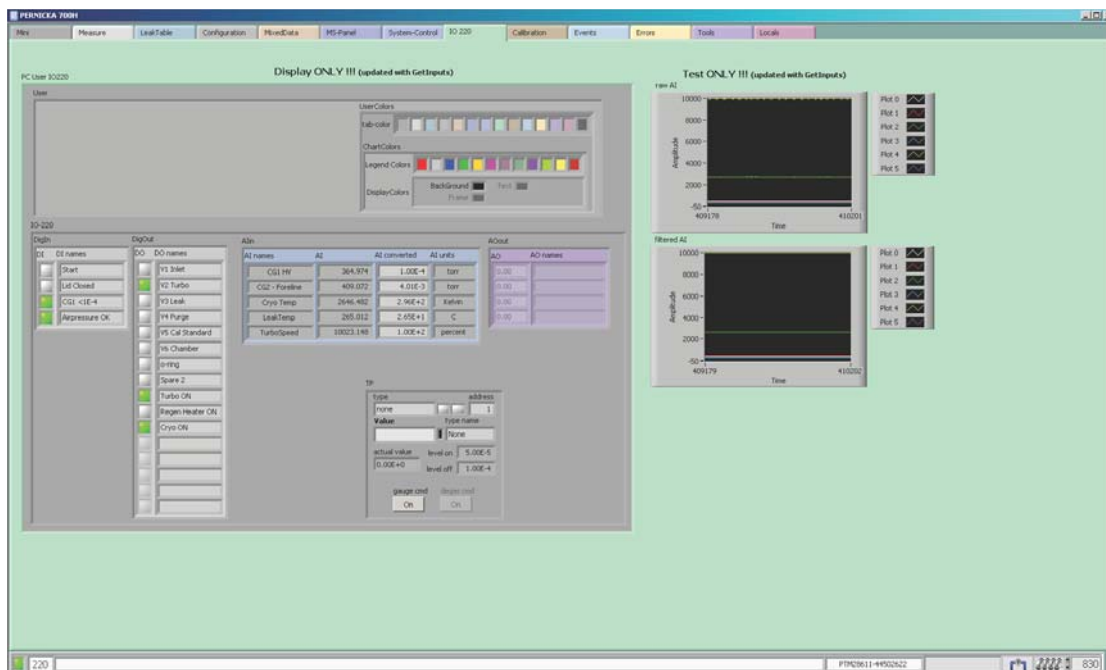
## System control window

The system control window indicates the status of current user inputs.



## IO 220 window

The IO 220 window displays the status of all digital and analog inputs and outputs. The upper chart plots the raw analog output signals. The lower chart plots the analog signals after passing through a digital noise reduction filter.

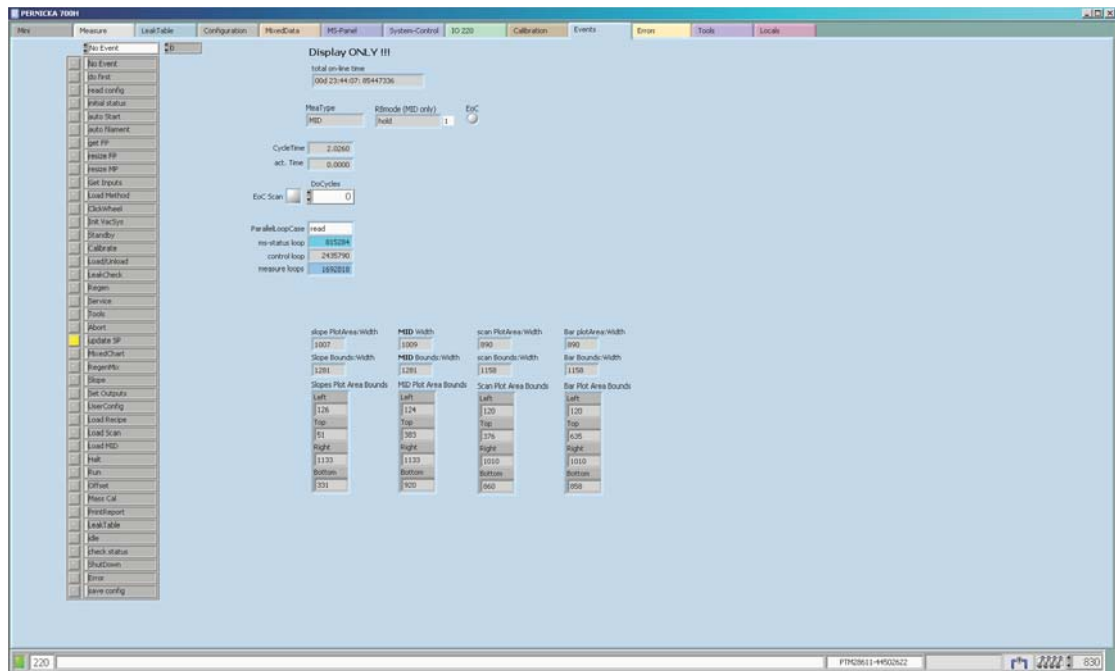






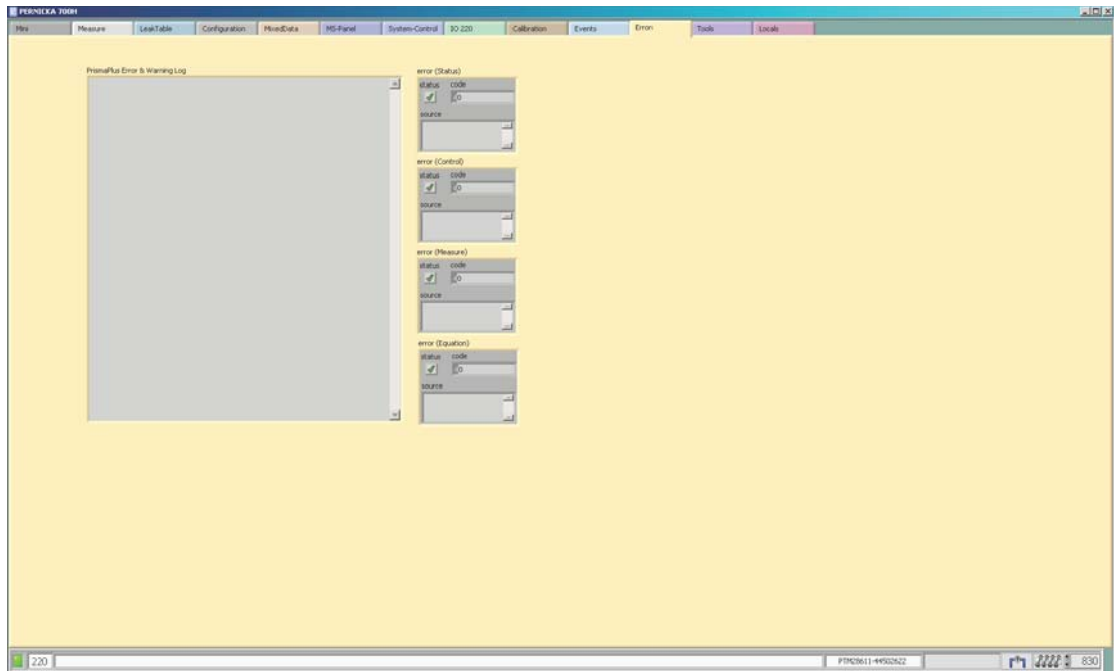
## Events window

The events window displays critical software parameters.



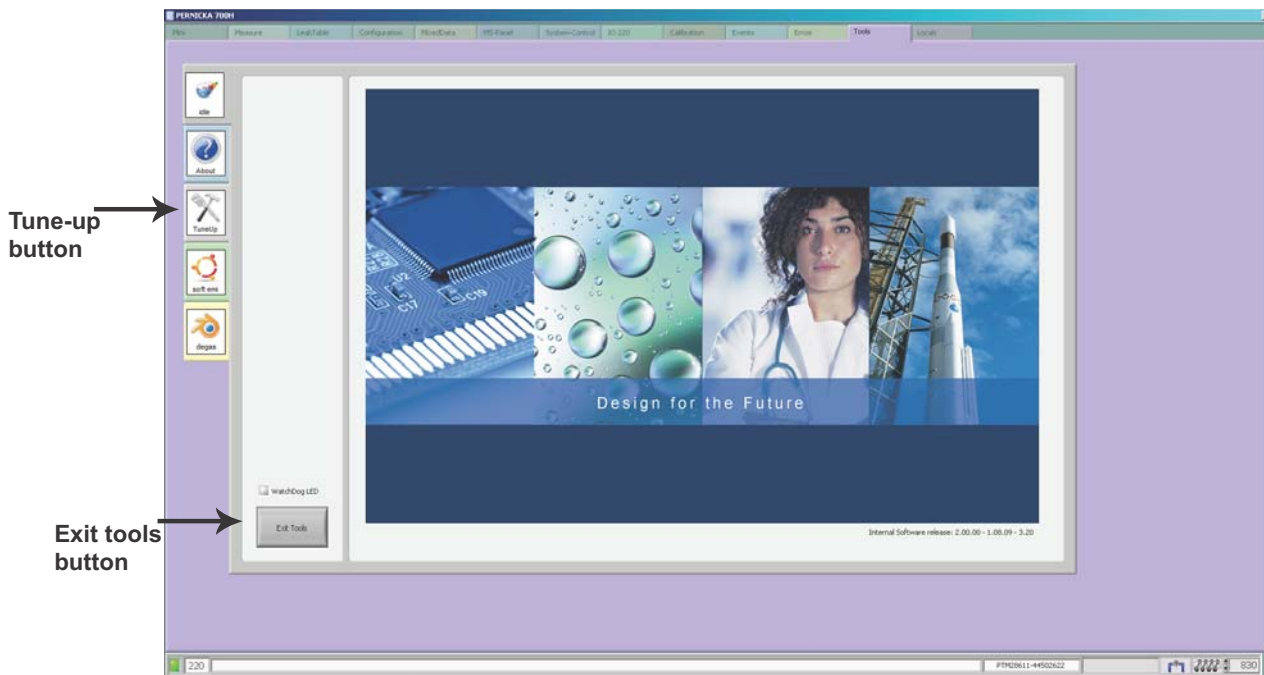
## Errors window

Records the Prisma's emission errors.



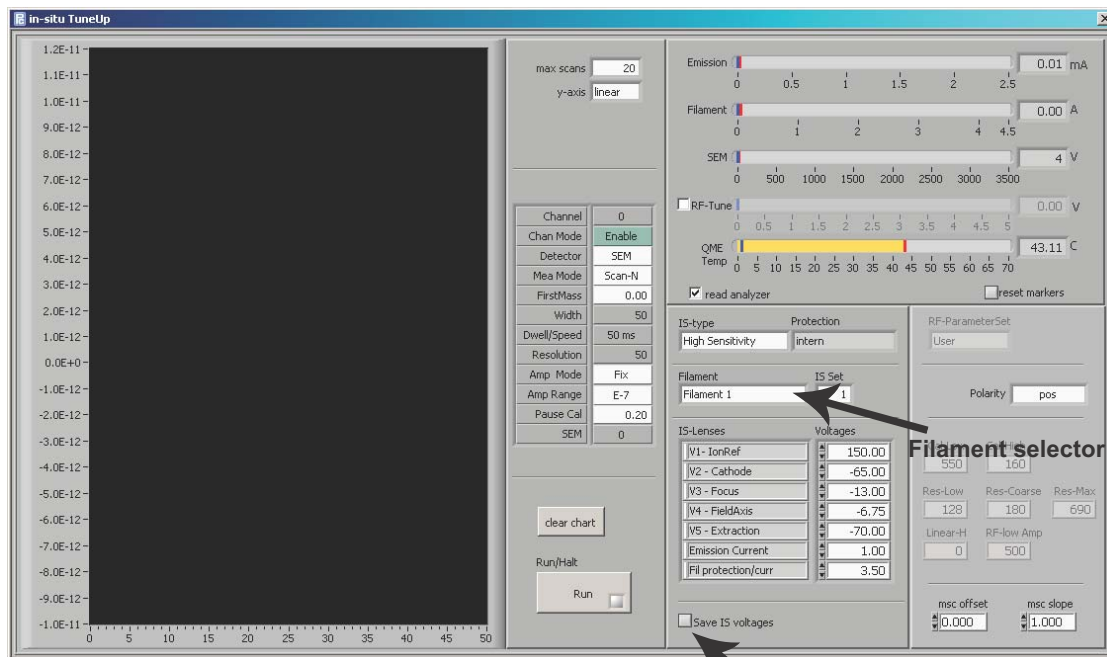
### Tools window

The tools window is used for Maintenance functions. To exit the tools window click the [Exit Tools] button.



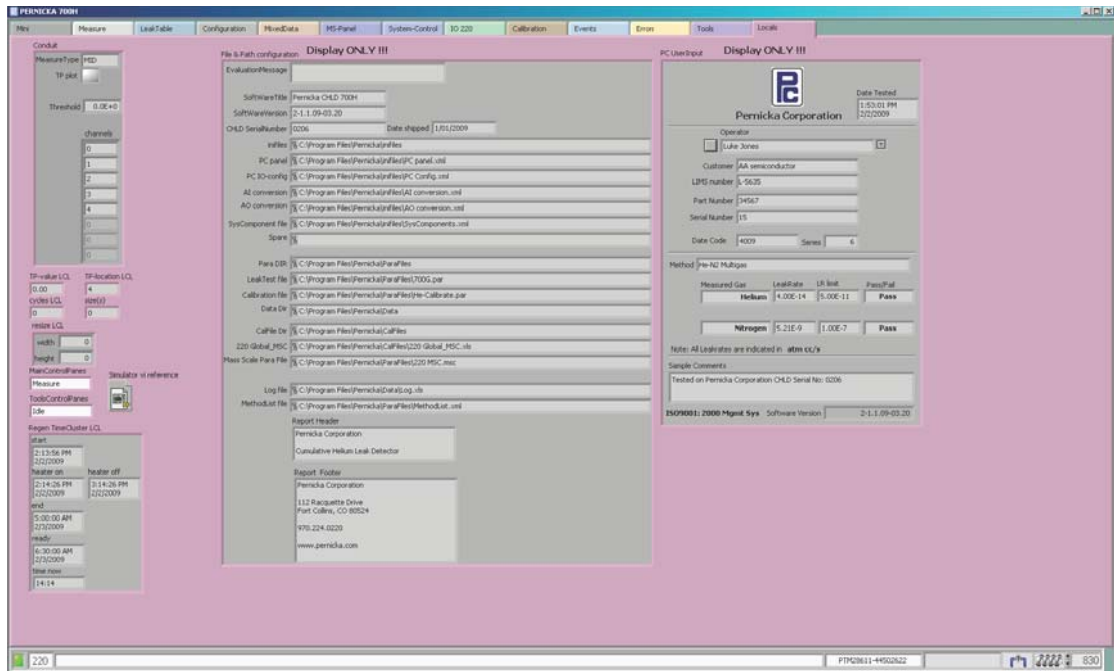
### Tune-up window

In the [TuneUp] window the operator can choose to activate filament 1, or filament 2. After selecting a filament the operator must select [Save IS voltages] for the change to be saved.



## Locals window

The locals window is a maintenance function.



## 5. Maintenance

### Annually:

- 1 Replace the compressor absorber (8080255K001) on the 8200 compressor. If the compressor Helium lines remain intact this service interval may be extended to a three-five year period. For more information see the 8200 compressor manual.
- 2 Replace test chamber elastomer gasket (Viton-A O-ring) at least once a year. Keep seal clean and free of oil, grease, dirt, and particles.
- 3 Change oil (Leybold N 62) in rotary vane vacuum pump (Trivac D2.5E). For more information see page 18, Leybold pump operating instructions (GA01.602/1.02).

### Every three years:

- 1 Replace oil reservoir on Turbomolecular Drag Pump TC 600. For more information see page 38 of the TC 600 operating instructions.
- 2 Calibrate the leak standard every three years, or according to laboratory policies.

## 6. Trouble shooting

Problem	Possible causes	Solution
The CHLD system will not turn on.	<ul style="list-style-type: none"> <li>• Main power cord is not plugged in.</li> </ul>	<ul style="list-style-type: none"> <li>• Plug main power cord into standard wall outlet (120 volts, 15 Amps, 60 Hz).</li> </ul>
There is a red x in the air pressure box.	<ul style="list-style-type: none"> <li>• The compressed air line is less than 100 PSIG.</li> </ul>	<ul style="list-style-type: none"> <li>• Adjust air regulator to read 100-110 PSIG.</li> </ul>
The test chamber will not open.	<ul style="list-style-type: none"> <li>• The test chamber is under vacuum.</li> </ul>	<ul style="list-style-type: none"> <li>• First, Click the [Load/Un-load] button.</li> <li>• Second, the purge gas regulator should read 1-2 psig.</li> <li>• Third, the pneumatic air regulator should read 100-110 psig.</li> </ul>

## Additional Options

<b>Pos.</b>	<b>Option</b>	<b>Cat.-No.</b>
1.	High Purity Gas Regulator for Argon, Nitrogen with US connection	551-701
2.	High Purity Gas Regulator for Argon, Nitrogen with DIN connection	551-702
3.	Large Double Oring Chamber	551-710
4.	Medium Double Oring Chamber	551-711
5.	Small Double Oring Chamber	551-712
6.	Small Metal Seal Chamber	551-715



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INFICON GmbH, Bonner Strasse 498, D-50968 Cologne, Germany

UNITED STATES TAIWAN JAPAN KOREA SINGAPORE GERMANY FRANCE UNITED KINGDOM HONG KONG

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Dokument: miqa77e1-b (1310)