HGRS

VISUAL CONTROL SYSTEM

SOFTWARE USERS MANUAL

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1.0 Introduction

Galiso Incorporated/Nuvac Innovations would like to thank you for your investment and participation in this exciting new technology. The Hot Gas Recirculation and Sweep process, HGRS, is the state of the art in chamber vacuum acquisition and contamination removal. The patented and patent pending HGRS systems utilize a viscous flow approach to eliminating both moisture and particulate chamber contaminants rather than the less efficient, more costly, high vacuum, molecular flow technology. A simplified schematic of the HGRS process is shown in figure 1-1, below.

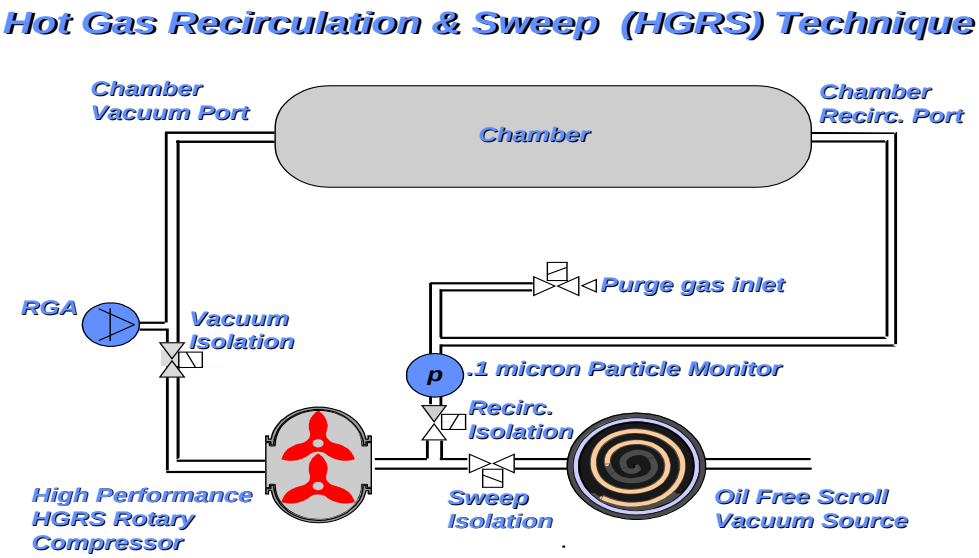


Figure 1 - 1 HGRS Process Schematic

The Visual Control System (VCS) software is designed monitor and control a Galiso/Nuvac MRP module. The MRP incorporates all of the necessary HGRS process components into a single equipment module. It is designed to be a portable tool connected to your chamber only when necessary for scheduled service. The process equipment, blowers, valves and gauges are all controlled and monitored by an on-board micro-controller that communicates directly with the VCS software. The VCS software provides a simplified Windows-based graphical user interface to monitor and control all required HGRS operations.

1.1 Scope of Manual

This manual was written for an operator/technician familiar with Microsoft Windows 95 and who is properly trained in the use and operation of the MRP. This manual covers the installation and use of the VCS software only. The installation, operation and use of the MRP, Data Acquisition System and Process Control Recipe Editor programs are the subject of separate manuals.

1.1 Scope of Manual, continued

Figure 1-2 depicts the four software programs comprising the System Control And Monitoring Software, and their relationship to each other. The four basic programs shown are:

- HGRS VCS; This is the Visual Control System which provides primary control over the MRP for chamber processing and is the subject of this manual.
- HGRS DAS; This is the Data Acquisition System which configures an Access database used for defining acceptance criteria and reporting chamber processing results.
- HGRS PCRE; this is the Process Control Recipe Editor which is used to develop process control recipes for execution by a MRP unit.
- The MRP micro-controller program interprets and executes VCS commands and process control recipes.

HGRS System Control And Monitoring Software Configuration Diagram

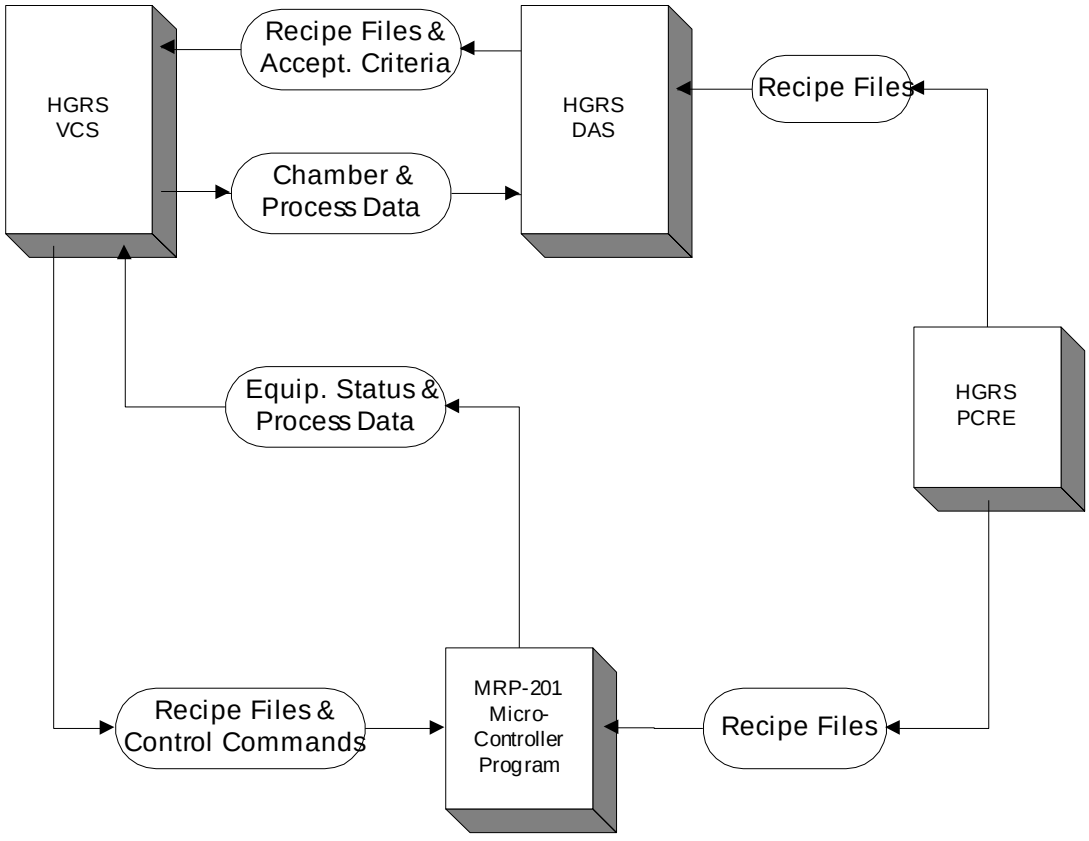


Figure 1 - 2

2.0 Installation

The following instructions describe installation of the VCS software used to control and monitor MRP HGRS chamber processing operations.

2.1 Prerequisites

In order to complete installation of the software, the following operating platform will be required:

A. **Processor:** 233 MHz Pentium II with 32 MB RAM and 1.0 GB hard drive.

B. **Software:** Windows 95 with HGRS suite only, installation and/or use of other programs/applications is not recommended.

C. **Network:** Windows Network Protocols, including NetBui and TCPIP

D. **Communications:** Cable connecting the computer to the MRP, Galiso part number 200-41-6483B

2.2 Installing the Software

The program will be provided on 3-1/2 inch floppy disks or CD-ROM.

2.2.1 Installation from Floppy Disk

The following steps describe installation of the program from floppy disk:

A. Insert disk 1 in the computers' A: drive. Access the A: drive file listing, and double click on the Setup.exe file from the list of disk 1 files.

B. The Welcome window will appear, click on OK, then select/type in the directory location you wish the program to be installed. The default directory is C:\HGRS\Hotgas.ini

C. Click OK and an icon will appear, click this icon to begin installing the program files. The system will prompt the user when to install the remaining disks.

D. When complete the system will indicate that the program has been successfully setup, click OK

Program installation automatically adds a new icon to the Start menu on your system. To run the program click the icon in the Start menu.

2.2 Installing the Software, continued

2.2.2 Installation from CD ROM

The VCS program may be supplied on CD ROM along with the other HGRS software programs. To install from CD, proceed as follows:

A. Close all applications in preparation for program installation.

B. Insert the CD into the computer's CD drive. The CD will automatically begin it's installation routine. Click on the desired operation from the installation menu selections shown in figure 2-1.

Figure 2 - 1

B. Click on the Install VCS/DAS bar to begin VCS installation. The system will prompt the user through the installation process.

C. When the installation is complete, the VCS program may be accessed from the Windows 95 programs menu. The user may want to make a shortcut for the Windows 95 desktop.

2.3 Installation Notes

The following installation notes are provided to help the user with specific installation issues.

A. The VCS install program uses various standard system files, including Mfc40.dll Msvcrt40.dll, stdole.tlb and vaen21.olb. The use of these files may cause a “Unable to register file” error depending on the version of Microsoft Windows/Office installed. See Microsoft Technical Support, Knowledge Base articles Q163556 and Q153733 for instructions regarding resolution of this potential problem.

B. The VCS program comes with the following Employee/Password setup:

- Employee Number = 100
- Password = Password

Note that the factory Employee Number and Passwords may only be changed (and/or new ones added) via the DAS program. See the DAS Users Manual for instructions regarding program user access.

2.4 VCS Program Initialization File Configuration

When the VCS program is installed, the factory default initialization, or .ini file is installed to the C:\HGRS\Hotgas.ini subdirectory. The .ini file is used to setup the communications and screen display parameters. An annotated file listing of the default Hotgas.ini file is included as an attachment to this Manual. To change the Hotgas.ini file settings, proceed as follows:

A. From Explorer, go to the C:\HGRS\Hotgas.ini subdirectory.

B. Right Click on the Hotgas.ini file and select Properties.

C. Un-check Read-only and Hidden and close the Properties box.

D. Double click the Hotgas.ini file, and type in the desired changes in accordance with the notes provided below.

E. Close the file.

2.5 Completed Installation

Figure 2-2, below, represents a complete system installation that is ready to run an HGRS process. Note that the required MRP process (and utility/supply) connections are specified in a separate Galiso/Nuvac manual. Note also, that the software may be installed and viewed without the MRP communication link. If the software is run without the communication link, the full functionality of the program will not be available. Also, the user will receive communications errors while running the software without the communications links.

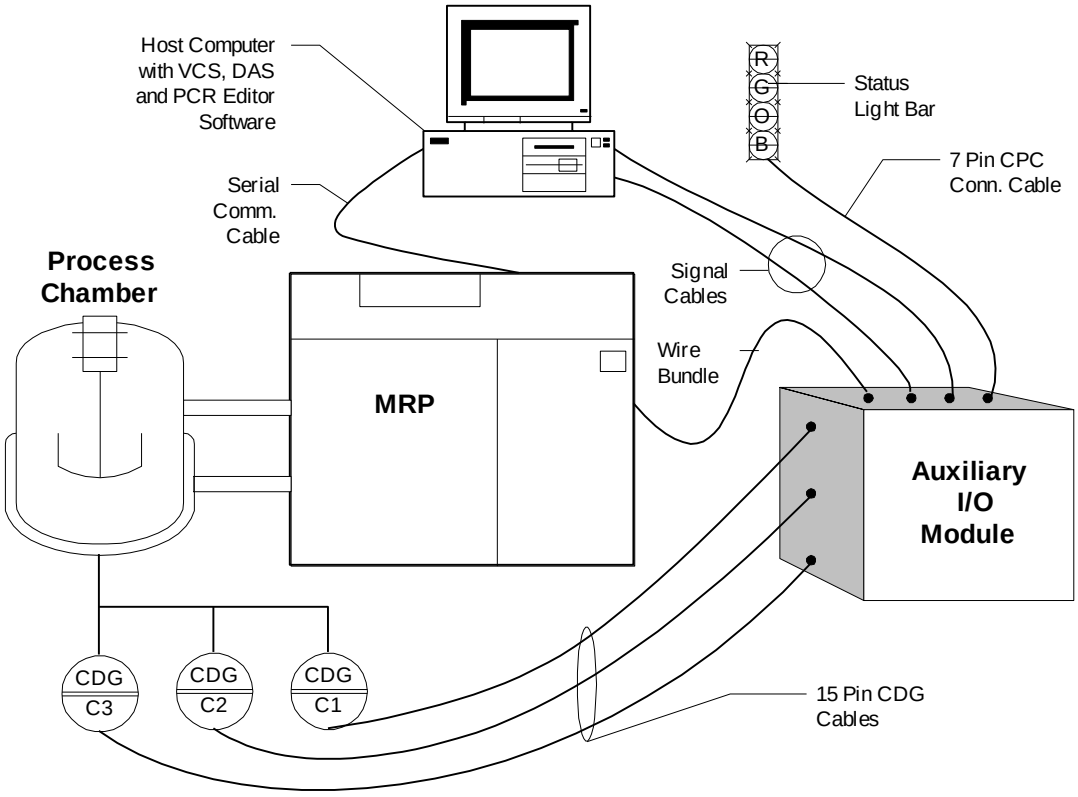


Figure 2 - 2 HGRS System Components

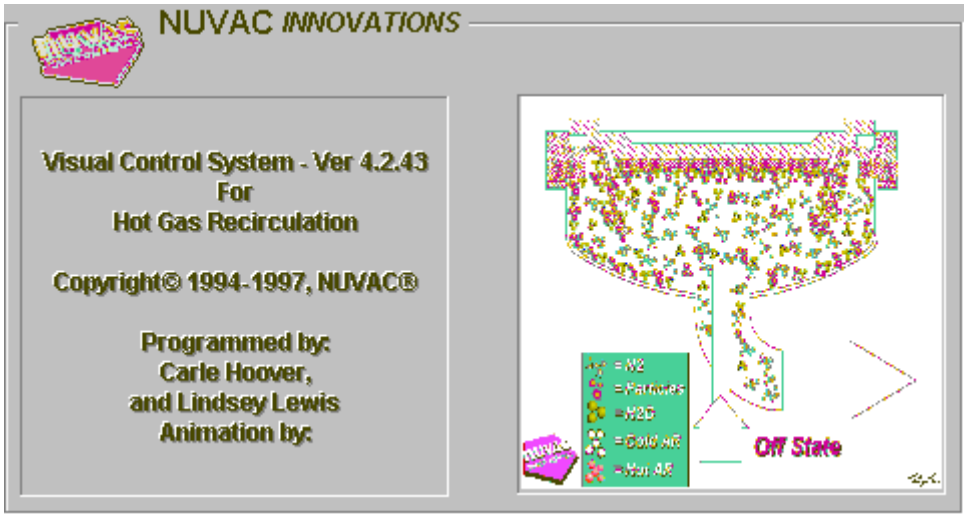
3.0 User Interface

This section describes the HGRS system monitoring and control features provided by the Visual Control System (VCS). As previously mentioned, the VCS software provides a Windows based graphical user interface. In order to enhance the user interface, we have removed the standard menu bar from all program windows to allow maximum use of screen space for the program's real-time controls, buttons and strip charts. All program menus are pop-up menus that can be accessed from any program window by right clicking with the mouse while the pointer is in the window background area. All buttons have status information that can be displayed in the program status window by right clicking the mouse over that button.

Because the program is visually oriented to display program information and status with control buttons, strip charts and indicator lights, the user can tell at a glance the current process status and any critical equipment operation information. Descriptions of the window screens, their available features and associated functions are provided below.

3.1 System Access

In order to access the system, either click the icon in the Start menu, or run the program file from Explorer. The system will display the splash/about screen shown below in figure 3-1.

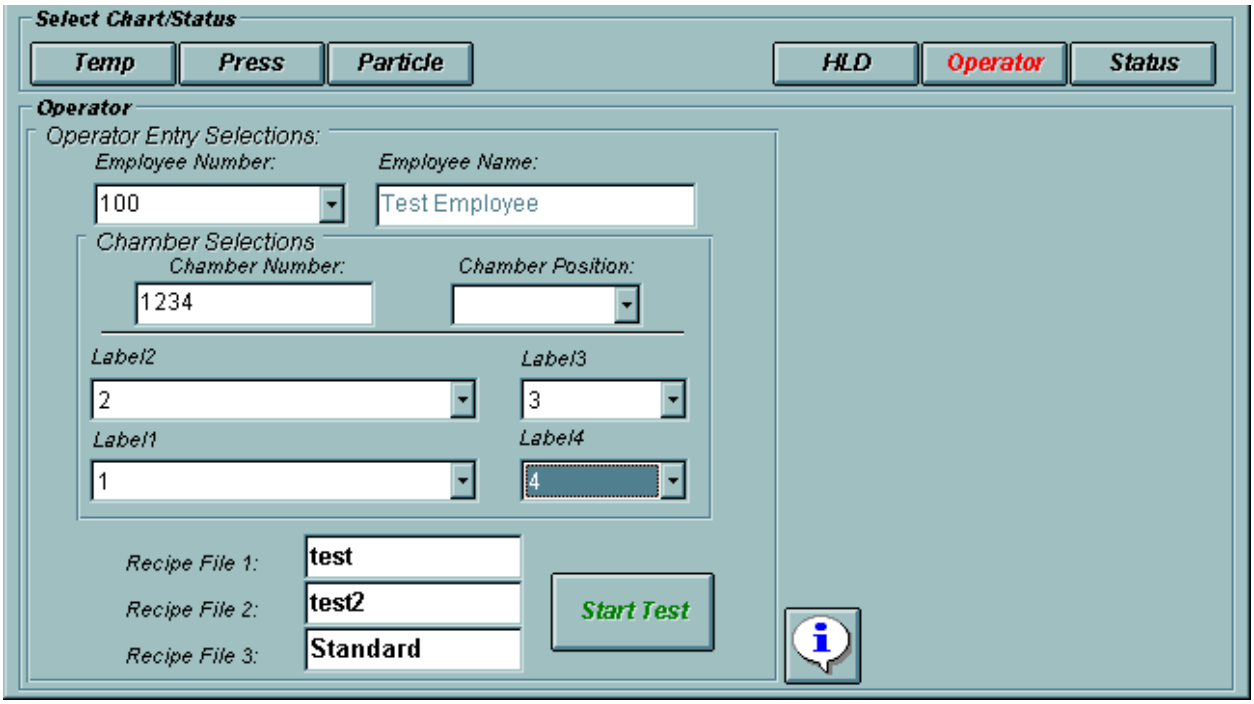


VCS Splash/About Screen

Figure 3 - 1

3.1 System Access (continued)

Immediately following the 'splash screen', the system will display the status page showing the status of communications with the MRP (ref. Figure 3-9). After establishing proper communications, the operator entry page on the process monitoring window will appear as shown in figure 3-2.



Operator Input Window

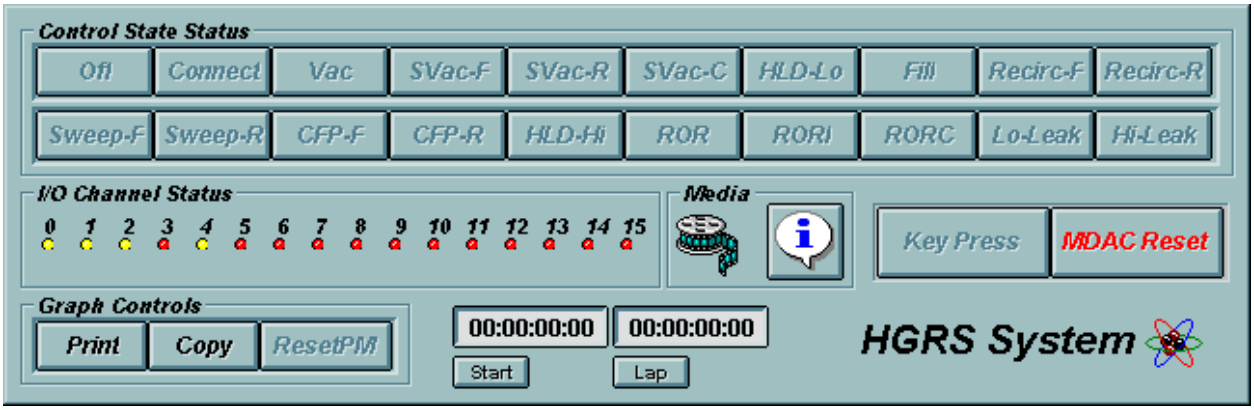
Figure 3 - 2

The operator entry page will always appear with the last data inputs used. To initiate chamber processing operations, type the user employee number in the indicated field. The system will check to verify that the user has been granted access to the system and will automatically display the employee name. Next, the user must type in the chamber number. The chamber property fields all have pull down menus to select from based on input to the database via the DAS software. Process control recipe files are automatically loaded from the HGRS Data Acquisition System (DAS) for the chamber specified. Note that there are three valid recipes per chamber specification. Once the operator input form is properly completed and the user presses the Start Test button, the system will download the selected recipe(s) and immediately initiate MRP chamber processing operations. The VCS system will then automatically run up to three recipes consecutively, assuming each recipe passes it's specified acceptance criteria.

3.1 System Access (continued)

If all of the required information has not been properly input the system will present an error message notifying the user to correct or complete the required information. Please note that it is up to the operator to insure that the chamber information matches the actual chamber to be processed.

The control panel window shown in figure 3-3 appears with the operator input window, however, the control functions are disabled until the operator completes the required information and presses the start button, or switches to the manual mode. The system monitoring and control panel windows (figures 3-2 and 3-3) are discussed in detail in Sections 3.3 and 3.4 of this manual.



VCS Control Panel Window

Figure 3 - 3

3.2 Pop-up Menus

To access the pop-up menus, right click the mouse anywhere on the background portion of the control panel or monitoring window. The first or main menu, figure 3-4, provides the standard Windows minimize, restore and exit functions as well as the additional items shown.

3.2 Pop-up Menus, continued

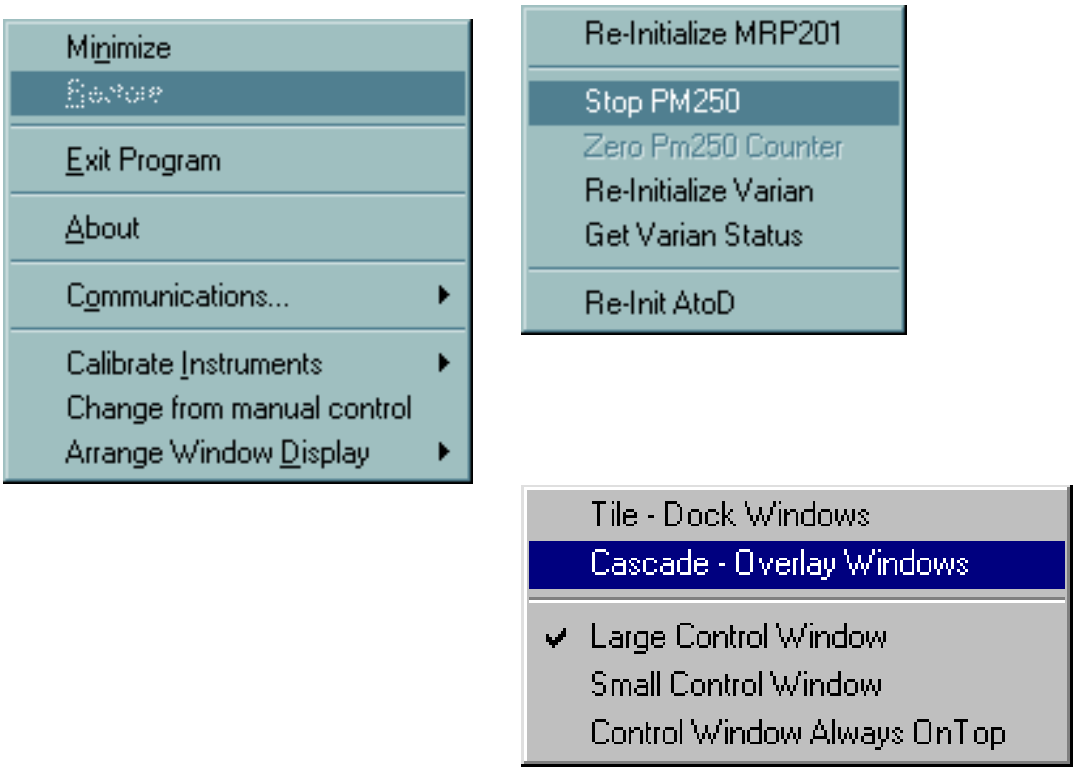


Figure 3 - 4 Pop-up Menus

The main menu is shown above on the left in figure 3-4. Clicking on the About bar will provide the user with general information regarding the development of the HGRS System (see figure 3-1). Highlighting the communications and arrange window display bars will display their respective pop-up menus.

The communications and Arrange Window menus, also shown in figure 3-4, are accessed from the main menu. The Arrange Window menu contains the standard window sizing and arrangement functions. The Communications menu allows the user to re-initialize the MRP micro-controller after a communications failure. The VCS also provides the capability to re-initialize and obtain the status of the Varian Helium Leak Detector, to stop and zero the Pm250 particle counter and reset the A/D card for MRP units with the HLD and particle monitoring options.

3.2.1 Change to Manual Control

The VCS has two operating modes, Manual and Automatic (recipe driven). To switch modes, highlight and click the mode change bar (see figure 3-4). The login window (figure 3-6) will appear. The user must enter his/her name and password to gain access to the Manual mode. The system will check to verify that the user has the required access level (level 2) to enter the manual mode. The modal dialog box shown in figure 3-6 will appear for the user to acknowledge manual (or Auto) mode entry. When in Manual mode, the user has control over all MRP operations. Manual mode capabilities are discussed in detail in Section 3.3.

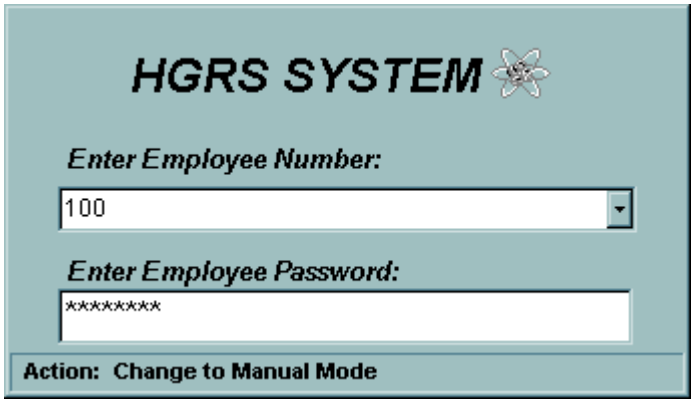


Figure 3 - 5 User Login Window

3.2.2 Calibrate Instruments

Highlighting the Calibrate Instrument bar (see figure 3-4) in the Manual mode provides user access to the selections shown in figure 3-6.

Figure 3 - 6

Clicking on the Zero Varian TC Gauge will reset the helium leak detector's internal thermocouple pressure gauge. This option is discussed in Section 5.0, Troubleshooting.

3.2.2 Calibrate Instruments, continued

Clicking on the Analog Inputs selection will pull up the calibration window shown below in figure 3-7. Note that this feature is disabled in the Auto mode. The calibration window allows the user to adjust the Zero value and the full scale of the 1000 Torr CDG, 1 Torr CDG and the forward and reverse thermocouple instrumentation. Adjustments made using this window do not affect the instrumentation, but will change the output values displayed on the process monitoring window strip charts. The Current Value text box will display the pressure values in Torr, and temperatures in ^{o}C. The raw output value window displays the gauge output voltages. To Adjust the zero or full range values, the selected MRP instrumentation must be outputting a voltage signal corresponding to it's zero or maximum reading.

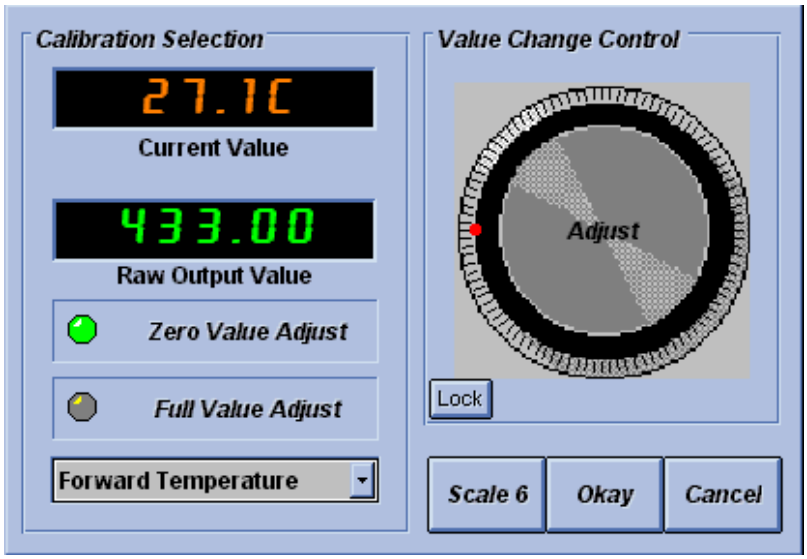
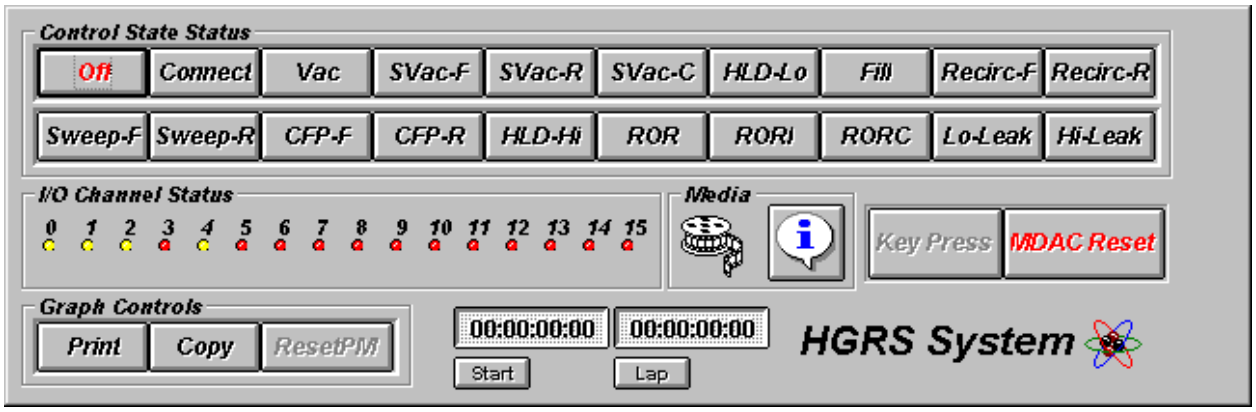


Figure 3 - 7 Calibrate Instruments Window

To adjust the zero or full range values, select the desired instrument and which value you wish to adjust. With the gauge raw output value reading either it's minimum value (zero adjust) or maximum value (full value adjust), select the desired scale of adjustment using the Scale button. Using the mouse, click and hold while turning the Value Change Control knob to obtain the desired gauge reading shown in the current value window. The lock button sets the adjustment selected as the base value for further adjustments. Clicking the OK button writes the adjustments made to the calibration .ini file. The .ini files are factory set to manufacturers recommendations.

3.3 HGRS Process Control Panel Window

The control panel window is shown in figure 3-8. The control panel will automatically be displayed, along with the process monitoring window, upon completion of the operator input screen (figure 3-2). The system will always start in the Auto mode by initiating the first step in the process control recipe selected in the operator input screen. The operating mode buttons on the Control States bar are disabled in the Auto mode, but will indicate the current MRP operating mode in red letters.



Control Panel Window

Figure 3 - 8

The I/O Channel Status bar indicates the position and/or operating state of MRP valves, instrumentation and equipment. Each micro-controller channel is associated with a specific MRP sub-component. The channel associations for each MRP sub-component are shown in Table 3-1.

The information shown in Table 3-1 is available ‘on line’ by clicking the desired channel status indicator light with the Status process monitoring window (ref. Figure 3-9) selected.

The Print button on the Graph Controls bar allows the operator to print the current screen or page displayed on the process monitoring window. The Copy button copies the current window or page to the Windows Clipboard to save in a file of the users choice. A stop watch and lap time feature that allows the user to time various HGRS processes is also provided on the bottom of the Control Panel.

3.3 HGRS Process Control Panel Window, continued

Table 3 - 1

Micro-controller I/O Channels

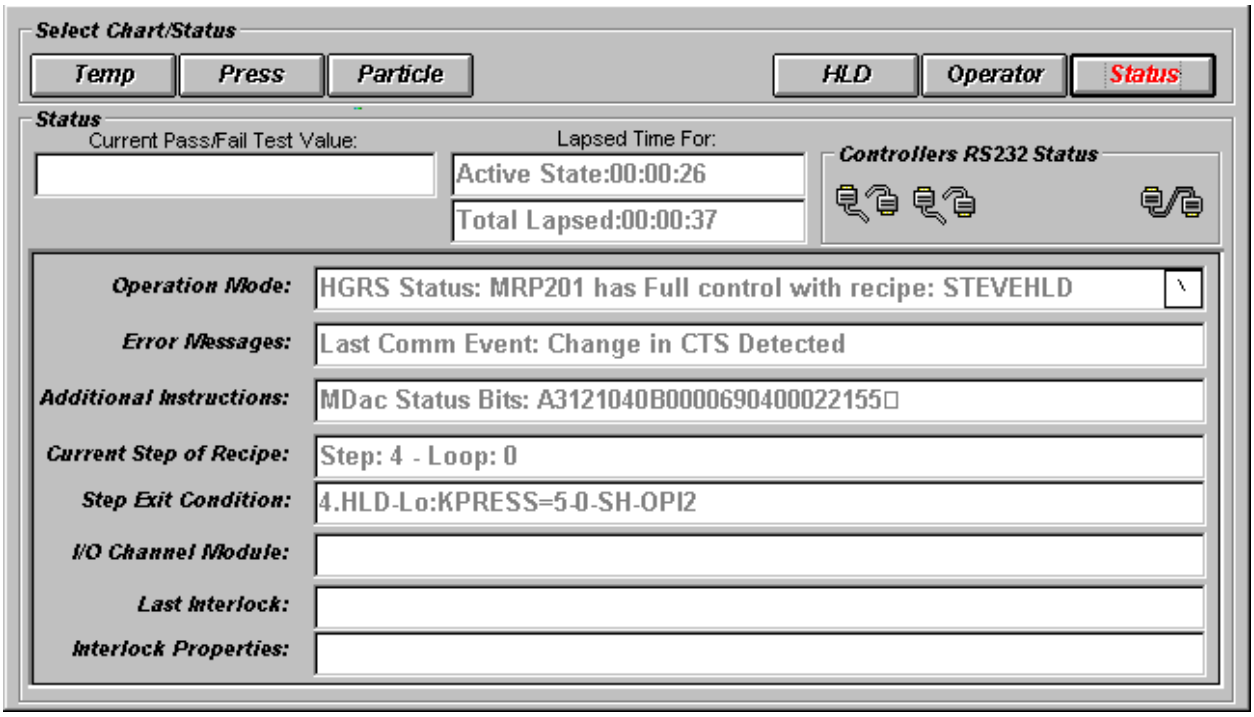
I/O Channel	MRP-201 Component	Indication
0	Fwd. Temp. Trans.	Degrees C
1	Rev. Temp. Trans.	Degrees C
2	Hi Range Press. 1K Torr CDG	0.1 to 1000 Torr
3	(Used for HLD Option only)	
4	Low Range Press. 1 Torr CDG	0.0001 to 1 Torr
5	Start Switch	On/Off
6	(Used for HLD Option only)	
7	Chamber Iso. Valves	Open/Closed
8	Top Argon Valve	Open/Closed
9	Top Recirc Valve	Open/Closed
10	Top Vacuum Valve	Open /closed
11	Bottom Argon Valve	Open/Closed
12	Bottom Recirc. Valve	Open/Closed
13	Blower Motor Forward	On/Off
14	Blower Motor Reverse	On/Off
15	Bottom Vacuum Valve	Open/Closed

When in the manual control mode, (see section 3.2.1.B) the Control Panel provides complete control over the MRP module. The Control States bar contains the control buttons for each of the available MRP operating modes. Double clicking on one of the buttons on the Control States bar will cause the MRP to initiate and continue the operating mode selected until further operator action is taken. All other features and functions on the control panel are the same in either the manual or auto mode.

3.4 HGRS Process Monitoring Windows

Several variations of the process monitoring window are shown in figures 3-9, 3-10, 3-11, 3-12, 3-13, 3-14, and 3-15. The process monitoring window provides a real time display of the process parameters (temperature, pressure, etc.) for the

current HGRS process. The current status of the MRP and the process control recipe are also available.



Process Monitoring Window - Status Page

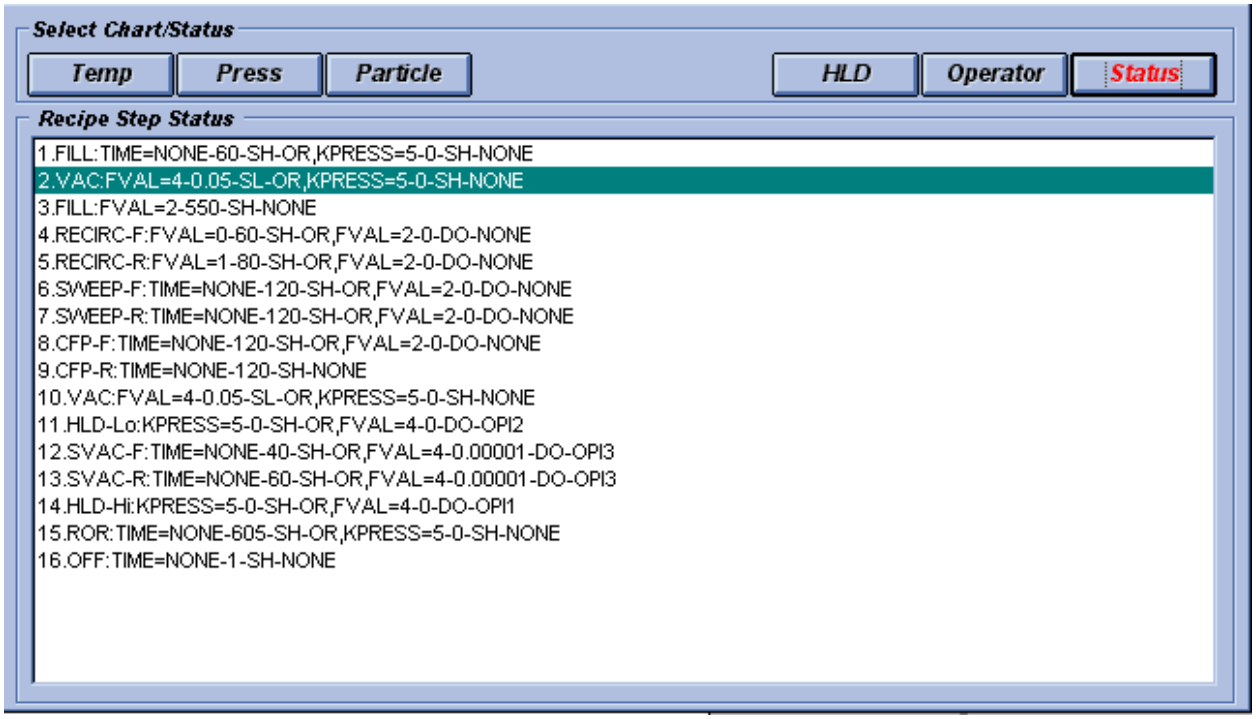
Figure 3 - 9

Figure 3-9, above, shows the process monitoring window with the Status page displayed during a recipe run.

3.4 Process Monitoring Windows, continued

Figure 3-10, below, again shows the process monitoring window with the Status page which, in this case, shows the current process control recipe. The Status screen switches between the process control recipe and the overall equipment

and HGRS process status each time the Status button is pushed. Note that the recipes can only be viewed in the VCS. To edit or create a new process control recipe, the Process Control Recipe Editor (PCRE) program must be used.

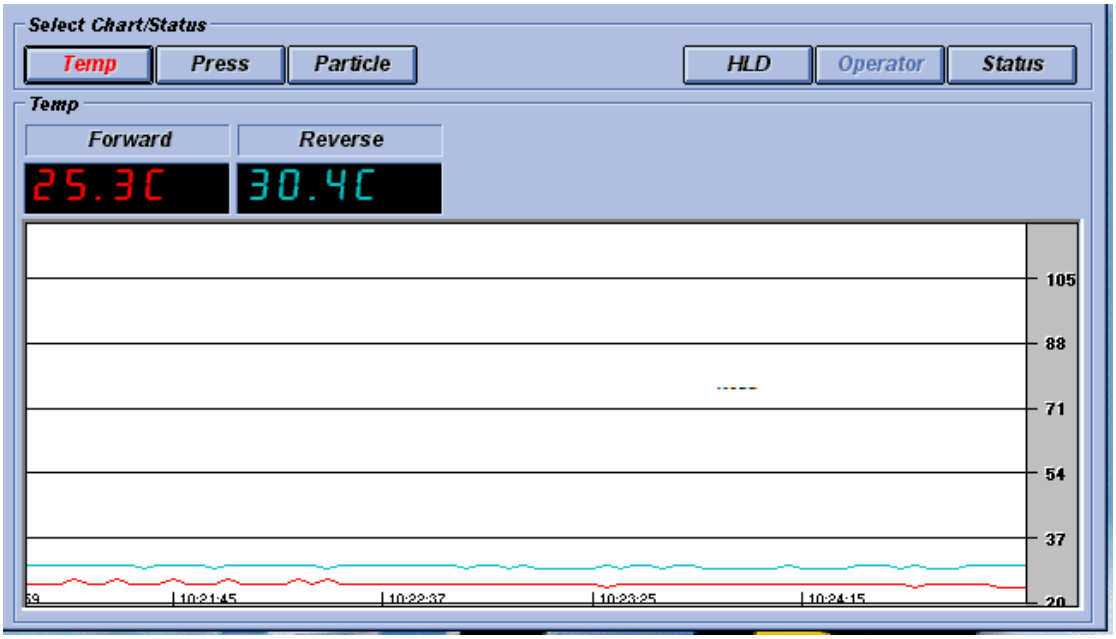


Process Monitoring Window - Status, View Recipe Page

Figure 3 - 10

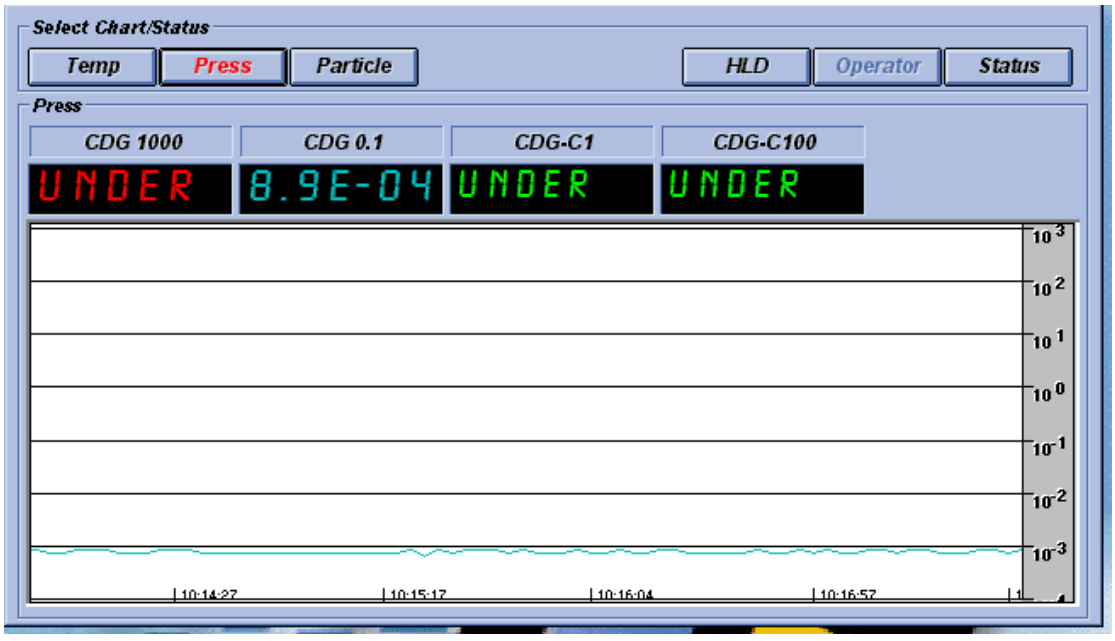
Figures 3-11, 12 and 13 show the pressure, temperature and particle count strip charts respectively. Each of these charts displays a real time indication of the selected process parameter. The VCS defaults to a specific process parameter display for each MRP operating mode as defined in the States.ini file, which is placed in the C:\HGRS directory during program installation. However, any of these charts may be viewed at any time by selecting/pressing the desired process parameter button in the upper left corner of the process monitoring window.

3.4 Process Monitoring Windows, continued



Process Monitoring Window - Temperature Strip Chart

Figure 3 - 11



Process Monitoring Window - Pressure Strip Chart

Figure 3 - 12

3.4 Process Monitoring Windows, continued

Process Monitoring Window - Particle Strip Chart

Figure 3 - 13

It should be noted that the Hotgas.ini and Particle.ini files must be properly configured for the particle monitoring option screen to appear. An annotated Particle.ini file is shown below and the Hotgas.ini file is included as an attachment to this manual.

```
[PM250 Setup]
ErrorDisplay=Every,1
CommPort=3
Address=1
Pollinginterval=1000
Units=#####0
Label=PM Head1
Display=Graph3,1
Max=100000
Min=0
```

Set to match hardware configuration

Screen Display Parameters

Instrument Range

3.5 Helium Leak Detection

The main Helium Leak Detection (HLD) option window is shown in figure 3-14. As with the particle monitoring option, the Hotgas.ini file must be properly configured for the HLD monitoring and calibration windows to appear.

The HLD window and associated capabilities are accessed by pressing the HLD button on the top right of the process monitoring window while in either manual or automatic mode. HLD monitoring window features include:

A. HLD Ready Light: The HLD Ready Light shown in figure 3-14 indicates the HLD status. When the light is red, either the Turbo Pump has not established the requisite high vacuum and/or the Spectrometer tube is not operating properly. A green light indicates that the HLD system is ready to perform leak checking operations. Note that the HLD system is in an “Idle” mode when the MRP is not in one of the four HLD states. The “run/idle” HLD system operation causes the ready light to initially come up red. When the system is operating properly, the ready light should turn green within one to two minutes after HLD mode initiation.

B. HLD Communications Status: The comm. Status icon,  , shown on the status page (figure 3-9) indicates whether the VCS has established communications with the HLD controller. If the icon shows a broken link, HLD capabilities will not be available and a system re-boot may be required to re-establish HLD communications.

C. Calibrate Button: Double clicking the calibrate button accesses the calibration boxes shown in figures 3-15 and 3-16 and allows the user to calibrate the HLD system.

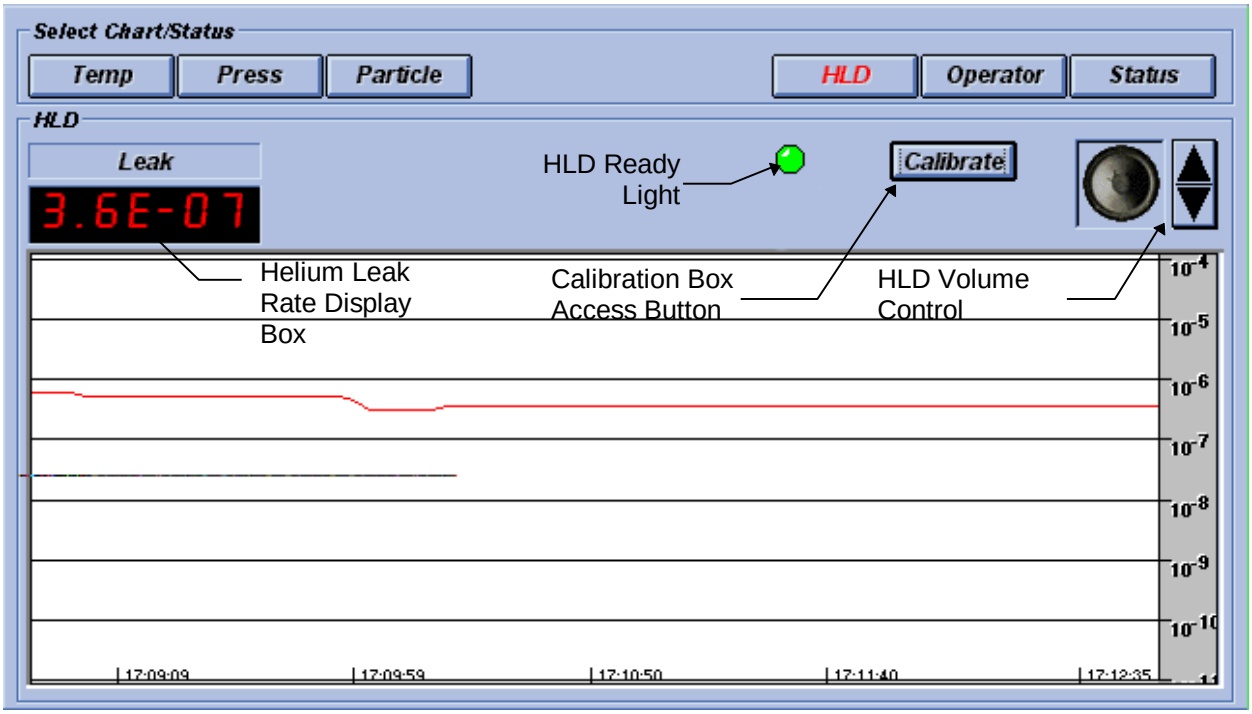
D. HLD Volume Control: The HLD Volume Control allows the user to adjust the audio leak signal for use during leak checking operations.

E. HLD Leak Value Display: The display box on the left side of the screen shows the current helium leak rate in Atm*cc/sec.

Note that the process control recipe interlocks OPI1 and OPI2 (ref. PCREditor Manual, Section 3.0) will not allow entry to the HLD operating modes if the following conditions are not satisfied:

- HLD-Hi - System pressure must be below 0.0005 torr (OPI1)
- HLD-Lo - System pressure must be below 5.0 Torr (OPI2)

3.5 Helium Leak Detection, continued



Helium Leak Monitoring Window

Figure 3 - 14

3.5.1 HLD Calibration - Recipe Mode

The HLD system calibration box for Helium leak rate display adjustment during process recipe operations is shown in figure 3-15. HLD system calibration during automated chamber processing recipe's may only be performed if a Lo-Leak or Hi-Leak operating mode is included in the process control recipe.

To perform calibration adjustments, the VCS must be in communication with the MRP's micro-controller and the HLD controller. In addition, the ready light must be green.

Double click on the Calibrate button (see figure 3-14) to access the calibration box shown in figure 3-15. Perform the following steps:

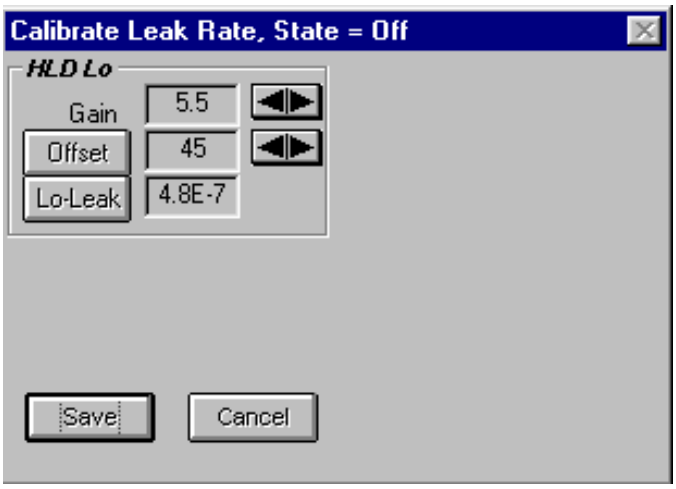
3.5.1 HLD Calibration - Recipe Mode, continued

A. Double click the Offset button, and use the spinner arrows to slowly reduce the (zero) offset value until the Leak reading in the Helium Leak Rate Display Box (see figure 3-14) shows the word ‘UNDER’. Leave the offset value one click below the last reading before the ‘UNDER’ display appears. Double click the Offset button to turn off the offset adjustment box.

B. Wait until the helium reading stabilizes on the HLD monitoring strip chart. Use the Gain adjustment spinner arrows to match the Helium Leak Rate Display Box (figure 3-14) reading to the calibrated leak value, 4.6E-7 Atm*cc/sec. for the Lo Leak, and 5.3E-9 Atm*cc/sec for the Hi Leak. Double click the Lo-Leak button to turn off the calibrated leak module.

C. Double click the Offset button again to check the (zero) offset. Adjust as necessary per paragraph 3.5.1.A.

D. Double click the Save button to save the calibration adjustments and close the calibration window.



Recipe Mode HLD Calibration Box

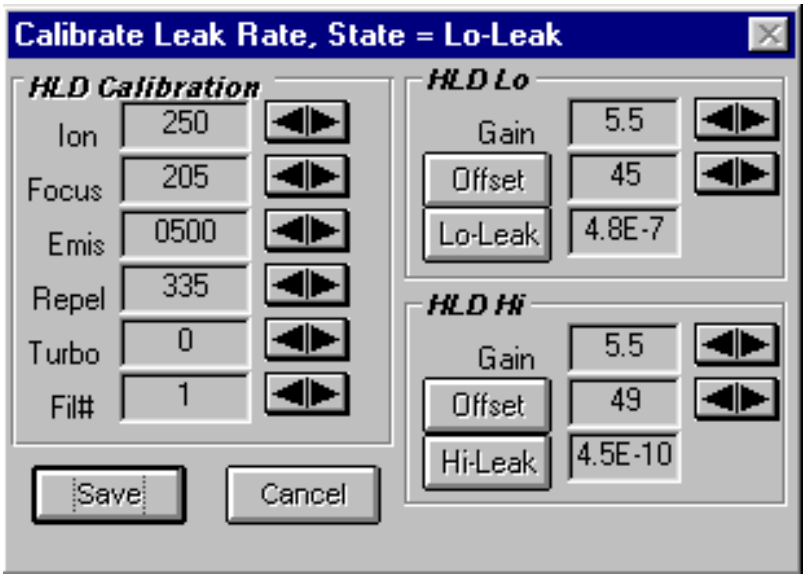
Figure 3 - 15

3.5.2 Manual Mode HLD Calibration

First, ensure that a process control recipe is not currently running, or the Manual Mode calibrate function will not be available. Place the system in the Manual Mode (see Section 3.2.1.B), then double click either the Lo-Leak or Hi-leak button on the control panel. The HLD Process Monitoring page (figure 3-14) should automatically appear. Double click on the calibrate button on the HLD monitoring page to bring up the manual calibration box shown in figure 3-16. Perform the following steps:

NOTE:

The VCS software must be in communication with the MRP and the Varian dCLD controller and the green HLD ready light must be lit (see figure 3-14) in order to perform calibration adjustments.



Manual Mode Calibration Box

Figure 3 - 16

A. Use the spinner arrows to set the Ion, Focus, and Repel values to 250, 190 and 320, respectively.

B. Starting with the ION value, change the value up or down to obtain the maximum Helium leak reading shown in the leak rate display box, see figure 3-14. Repeat these adjustments for the Focus and Repel values.

3.5.2 Manual Mode HLD Calibration, continued

C. Double click the Offset button, and use the spinner arrows to slowly reduce the (zero) offset value until the Leak reading in the Helium Leak Rate Display Box (see figure 3-14) shows the word ‘UNDER’. Leave the offset value one click below the last reading before the ‘UNDER’ display appears. Double click the Offset button to turn off the offset adjustment box

D. Wait until the helium reading stabilizes on the HLD monitoring strip chart. Use the Gain adjustment spinner arrows to match the Helium Leak Rate Display Box (figure 3-14) reading to the calibrated leak value, 4.6E-7 Atm*cc/sec. for the Lo Leak, and 5.3E-9 Atm*cc/sec for the Hi Leak. Double click the Lo-Leak button to turn off the calibrated leak module.

E. Double click the Save button to save the adjustment values and exit the calibration window.

NOTE:

See the Vendor OEM literature for additional information on adjusting the Ion, Focus, Emis, Repel, Turbo and Fil# values.

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4.0 HGRS System Operations

This section provides an overview of HGRS system operations.

4.1 Prerequisites

In order to successfully perform an HGRS process, the following software and hardware systems must be in place:

A. The MRP must be installed and tested in accordance with the MRP equipment manual, and connected to the host computer via a RS-232 communications link.

B. The Access database and the HGRS System Control and Monitoring Software programs must be installed and ready for operation. The programs required include:

- The Data Acquisition System (DAS)
- The Visual Control System (VCS)
- The Process Control Recipe Editor (PCRE)
- The MDAC micro-controller machine code

C. The various system .ini files must be properly configured for the MRP unit and any associated equipment options.

4.2 Process Control Recipes

Prior to initiating any processing operations, the operator must create or verify that the process control recipes necessary for automatic system operation are completed. The recipes required are constructed using the PCRE program. Process control recipes must be specified in accordance with the PCRE Users Manual. However, operational experience and/or chamber characterization to determine the effectiveness of various recipe configurations is very important. This is particularly true when attempting to optimize chamber processing operations.

Once the necessary recipes are created, they must be saved into the DAS database file for use in preparing acceptance criteria.

4.3 Acceptance Criteria

The DAS program will need to be installed and operational to enter chamber data and prepare Acceptance Criteria for each chamber to be processed. As indicated in Section 4.2, process control recipes will need to be available to complete the required acceptance criteria. When developing acceptance criteria, it is very important to insure that the pass/fail specifications used are appropriate for the recipes to be run for a particular chamber process. See the Data Acquisition System Users Manual for instructions on developing chamber processing acceptance criteria.

4.4 Chamber Processing

To initiate chamber processing, access the Visual Control System (VCS), complete the Operator Input Selections, and click on the Start Test button. As noted in Section 3.0, up to three recipes may be specified for a single automated chamber processing operation. The VCS system is designed to automatically sequence through each recipe based on successful recipe completion. The flowchart shown in figure 4-1 depicts the automatic sequencing.

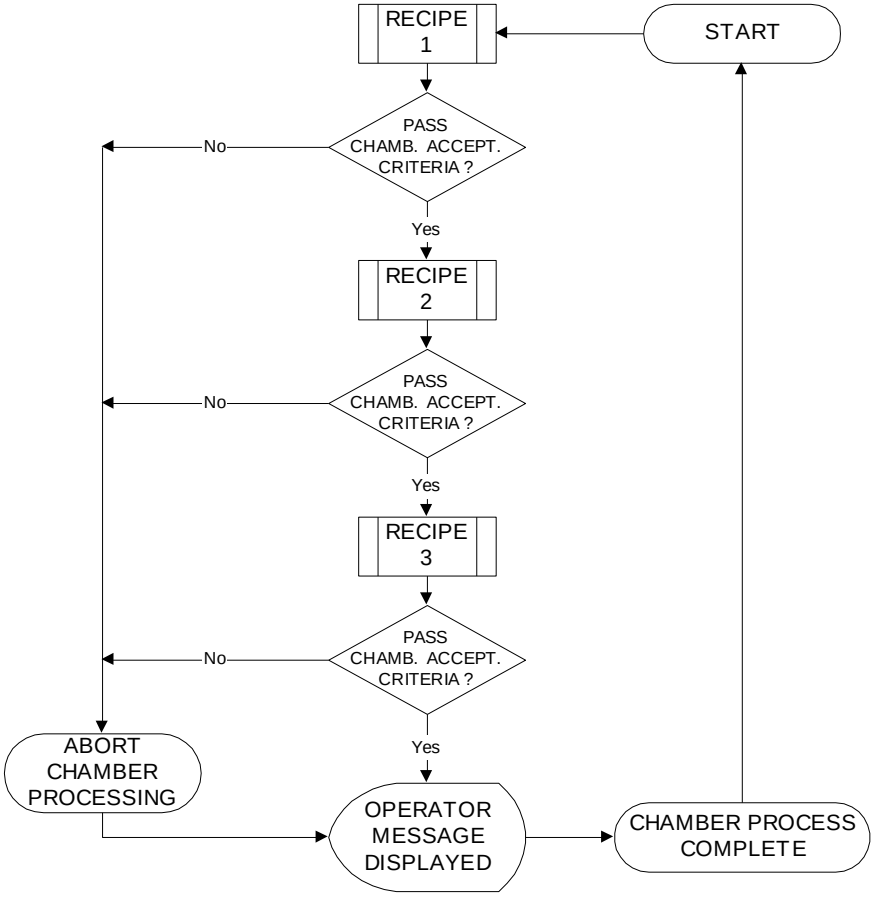
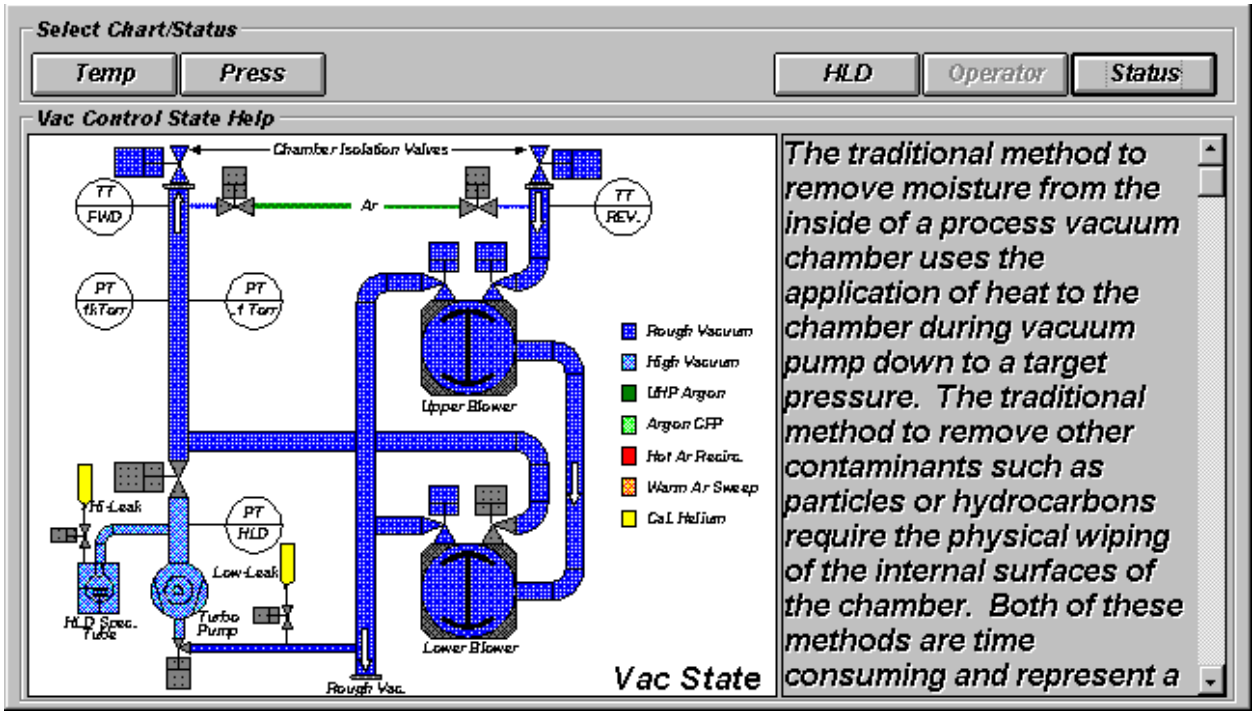


Figure 4 - 1

4.4 Chamber Processing, continued

Note that if the MRP is already operating when the VCS is launched, the recipe in the VCS will not be downloaded to the MRP's micro-controller. If this occurs, the VCS may be used to monitor the MRP, but all control functions will be disabled. To regain VCS control over the MRP, click on the MDAC Reset button. This will cause the MRP to go into an Off state until process control recipes are downloaded from the VCS Operator Input page, (ref. section 3.1).

To obtain additional information regarding HGRS processes, the operator may press the " i " button. This will provide an operator with text and graphics similar to that shown in figure 4-2, depending on the current MRP operational state.

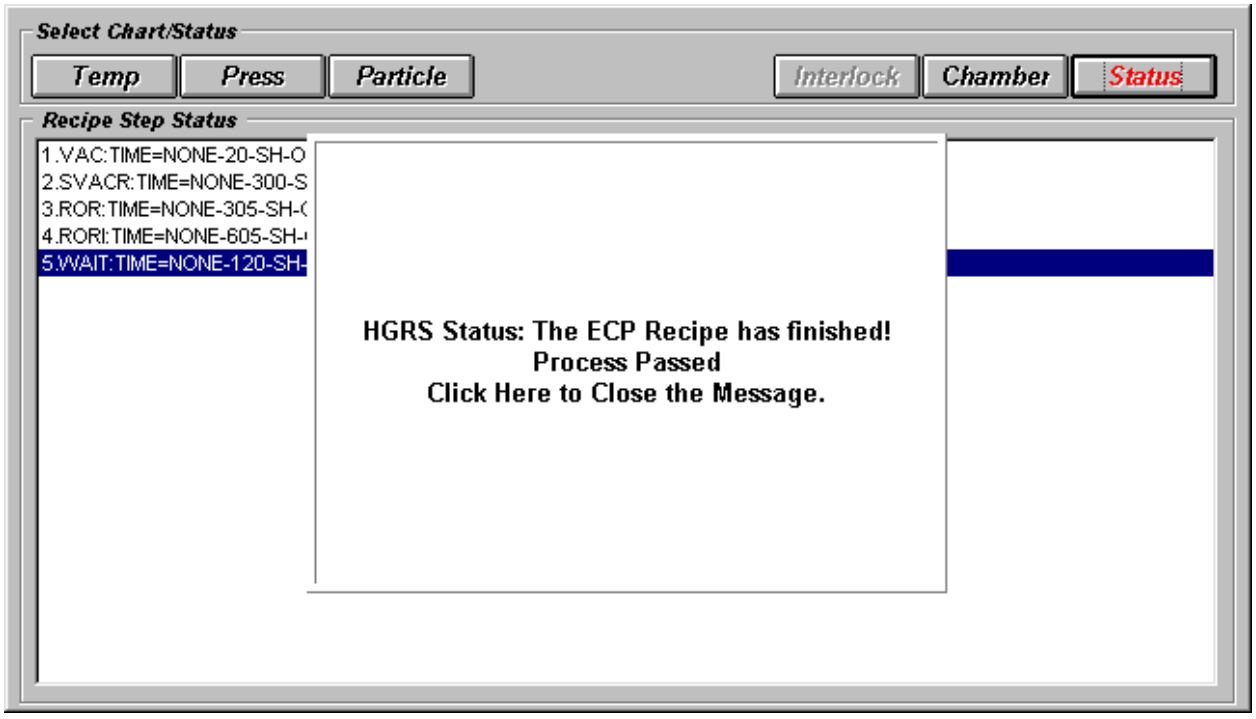


HGRS Operator Information Screen

Figure 4 - 2

4.5 Process Completion

The VCS will automatically download and monitor the specified process control recipe(s). During processing, the DAS may or may not be running. However, the Access database must be installed to datalog the information necessary for evaluating HGRS processing results. When a process control recipe has successfully processed a chamber the message shown in figure 4-2 will appear for operator acknowlegement.



Process Monitoring - Successful Completion Message

Figure 4 - 3

The modal dialog box shown in figure 4-3 will appear to indicate that a process has been completed and passed or failed. After process completion the operator will need to use the DAS to document chamber processing results. After accessing the DAS program, the operator may preview and print the Traveler Report for the chamber processed. See the DAS Users Manual for specific instructions regarding the Traveler Report.

The Traveler Report will also indicate whether or not the chamber processing results meet the specified acceptance criteria in the Pass/Fail box. After completion of chamber processing, refer to the appropriate ‘in house’ procedures for additional actions.

4.6 Leak Checking Operations

The MRP unit may be supplied with an optional helium leak detector module. Helium leak detection features of the MRP unit are described in detail in the Operations Manual Addendum for the MRP Helium Leak Detector Option. Prior to performing leak checking, ensure that the HLD module is calibrated once per day in accordance with Section 3.5 and/or the vendors OEM requirements. Leak checking capabilities may be used as follows:

A. Automatic (recipe controlled) Mode Leak Checking

To use the leak checking capabilities in the automatic mode, a process control recipe containing either the HLD-Hi or HLD-Lo operating mode or state must be constructed using the PCRE software program. When the MRP is in one of these two states, chambers may be leak checked using a helium source. The HLD monitoring window will show an increasing helium concentration proportional to the size of the leak, and the audio indicator will increase in pitch and volume through each decade of helium concentration increase. The HLD recipe steps will normally have a Keypress end condition. Therefore, to continue the current process control recipe after leak checking is complete, the operator must press the Keypress button on the VCS Control Panel (ref. Figure 3-8). Note that the HLD-Hi mode is more sensitive than the HLD-lo mode and therefore will detect smaller leaks than the HLD-Lo mode.

B. Manual Mode Leak Checking

To leak check in the manual mode, access the manual mode in accordance with Section 3.2.1.B, and double click on either the HLD-Hi or HLD-Lo operating mode or state. Perform any desired leak checking as described above.

NOTE:

Use of the Lo-Leak or Hi-leak modes to ensure the system is properly calibrated prior to running the HLD-Lo or HLD-Hi modes is recommended.

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5.0 VCS Troubleshooting

Generally, VCS problems may be grouped into three categories; system configuration, communications, and system interlocks. A discussion of each of these potential problem areas is provided in the following sections.

5.1 System Configuration Problems

5.1.1 Hardware/.ini File Compatibility

The VCS software must be set-up or configured to match the hardware device inputs and outputs required. Set-up of the system is factory preset using the various .ini files contained within the VCS program file structure. The .ini files provide initialization and operating limit parameters and instructions for various internal and external devices. The various devices include the host computer, A/D card(s), pressure gauges, thermocouples, moisture meter, particle counter helium leak detector and communications ports. Should any of these devices require replacement, care must be takes to ensure that the new device parameters are compatible with the appropriate .ini file settings. An annotated printout of the Hotgas.ini and States.ini files used for setup or initialization of the VCS are included as attachments to this manual.

The factory default settings for the Hotgas.ini files are shown in the attached Hotgas.ini file printout. Note that the equipment option flags, (990 dCLD, Dual Chamber, PM250, Moisture (Panametrics), Stephens and AtoD Board) must be set to True if these devices are connected to the HGRS host computer for use with the MRP unit.

If the system displays any .ini file errors, either access the appropriate .ini file and make the appropriate modifications, or contact your Nuvac Innovations representative for instructions regarding .ini file changes.

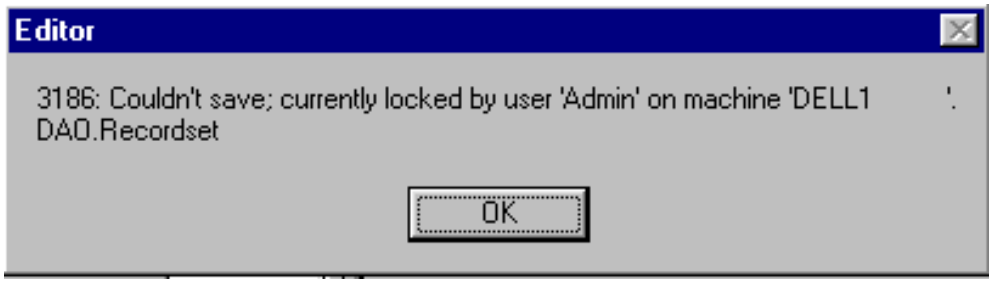
5.1.2 Database Transaction Problems

The VCS reads and writes various types of information to an Access database defined by the DAS database program. Several problems may occur associated with data transfers to and/or from the database.

A. Record Locking Errors

Record locking errors may occasionally occur when multiple simultaneous database access commands have been issued. For example, if the VCS is currently datalogging test data to the database and a user attempts to save a new recipe (from the PCRE program) or other information to the database, the error message shown in figure 5-3 may appear.

5.1.2 Database Transaction Problems, continued



Database Record Locking Error Message

Figure 5 - 1

A. Record Locking Errors, continued

These record locking errors are caused by the database engine which locks-out a 2K block of records when an application is writing or retrieving data from the DAS database. If this error occurs, the user must wait until the application currently accessing the database completes its' transaction in order to access the database.

B. Database Update Problems

When completing the Operator Entry data form (ref. figure 3-2), several database update issues will need to be considered. In order to properly complete the Operator Entry data form. The database must have the appropriate information entered into it via the DAS system. Specifically, the database must contain the Acceptance Criteria required for the chamber test to be performed. The Acceptance criteria consist of information contained in various look-up tables, including:

- Process Control Recipes (constructed and saved to the database using the PCRE software)
- Chamber Type
- Turbo Type
- Chamber Product Type
- CDG

Note that the Chamber Type, Turbo Type, Chamber Product Type and CDG table header names are user configurable in the DAS software.

B. Database Update Problems, continued

When a new process control recipe is entered into the database for an acceptance criteria or an existing recipe is changed, the new information will not be immediately available to the VCS. To obtain the new or changed recipe information in the operator entry screen, the operator must switch to another process monitoring window page (such as the Status page) to refresh the data. When the operator returns to the Operator Entry page, the recipe file will be updated with the new information after the operator tabs through the operator entry selections.

In the case of look-up table data additions or changes, a similar situation exists. That is, the VCS will not automatically pick up additions or changes to the database look-up tables made using the DAS while the VCS is operating. The operator must exit and restart the VCS to obtain the new look-up table information.

C. Database Integrity Errors

In addition to the record locking problem discussed above, there are several conditions which can prevent the VCS system from properly accessing the database.

If the VCS returns a 3000 series error message number (similar to the modal dialog box error message shown in figure 5-1), one of the following two problems may have occurred:

1. The database resides on a server which has ‘crashed’, or

2. The database has become corrupted

In either of these cases, the VCS, DAS and PCRE programs must be shut down and the database must be repaired and compacted prior to restarting the HGRS software programs. Instructions for compacting and repairing the database are included in the DAS Users Manual.

D. Datalogging Problems

The VCS datalogs pressure, particle count and/or helium concentration information to the Access database, depending on the acceptance criteria specifications input to the DAS for a particular chamber test. The most common problems associated with datalogging are failure to enter the necessary or correct specification in the chamber acceptance criteria, and process control recipe configuration errors.

1. Acceptance Criteria Specifications - In order to datalog HGRS process data, one or more of the following specifications must be entered in the DAS Acceptance Criteria Input screen:

SPECIFICATION	DATA LOGGED	UNITS
Allowable Leak-up Rate	Pressure	MilliTorr
Particle Count	Number of Particles	Each
Helium Leak Rate	Helium Concentration	Atm*cc/sec.

Note that if no entries are made for these specifications, the VCS will not datalog the information. Also, if the specification value entered is beyond the range of the HGRS (MRP) system instrumentation, the test will 'fail'.

2. Process Control Recipe Requirements - The VCS is designed to datalog information only in the following operating modes:

SPECIFICATION	OPERATING MODE	UNITS
Allowable Leak-up Rate	ROR and RORI	MilliTorr
Particle Count	CFP-R	Each
Helium Leak Rate	HLD-Hi and HLD-Lo	Atm*cc/sec.

As indicated above, specific operating modes must be included as steps in the process control recipe or the VCS will not datalog the necessary information. For example, if a particle specification is entered in the acceptance criteria for a particular test and the associated process control recipe does not include the CFP-R operating mode, the test will automatically fail. Note that the Pump Down Test Traveler report will indicate that the necessary data was not available if the process control recipe does not contain the appropriate operating mode for VCS datalogging.

2. Process Control Recipe Requirements, continued

Note also that if there are multiple database locations, the datalogging file path specified in the Hotgas.ini file must point to the correct database location. The factory default file path to the database specified in the Hotgas.ini file is:

DataLogPath=C:\DATA\DAS\DASHGRS.MDB

5.2 Communications Errors

The VCS system will display a number of error messages associated with device communications. Most external devices (such as the particle monitor and helium leak detector), as well as the MRP unit itself, must be serially connected to the host computer for the VCS to monitor and control HGRS processes. The various .ini file factory default settings for error messaging are:

[Initialize]
ErrorDisplay=Never

This minimizes the number of error messages displayed during a system fault. To obtain additional error messaging for diagnostic purposes, the error display setting may be changed to =Every,1. Note that each .ini file's (Hotgas, Moisture, etc.) Error Display setting may be changed individually.

If the serial port connections are loose or inadvertently disconnected the communications error message similar to that shown in figure 5-2 should appear.

Figure 5 - 2

5.2 Communications Errors, continued

As indicated in the error message, the operator will need to check the comm. port and power connections. After restoring communications, the operator will need to reset or re-initialize communications with the MRP, see section 3.2 for re-initialization instructions.

It should also be noted that if the EMO button on the MRP is pushed, a communications error message will appear (the status light bar will also flash the red and blue lights). This is because the EMO interrupts all power to the MRP, shutting down the micro-controller and terminating communications with the VCS. If the EMO is pushed, the EMO Reset must be pushed and communications with the MRP reinitialized as discussed above.

5.2.1 MDAC Switch Setup

There are three DIP switches internal to the MDAC micro-controller, SW1, SW2 and SW3. Switch locations are shown in figure 5-3.

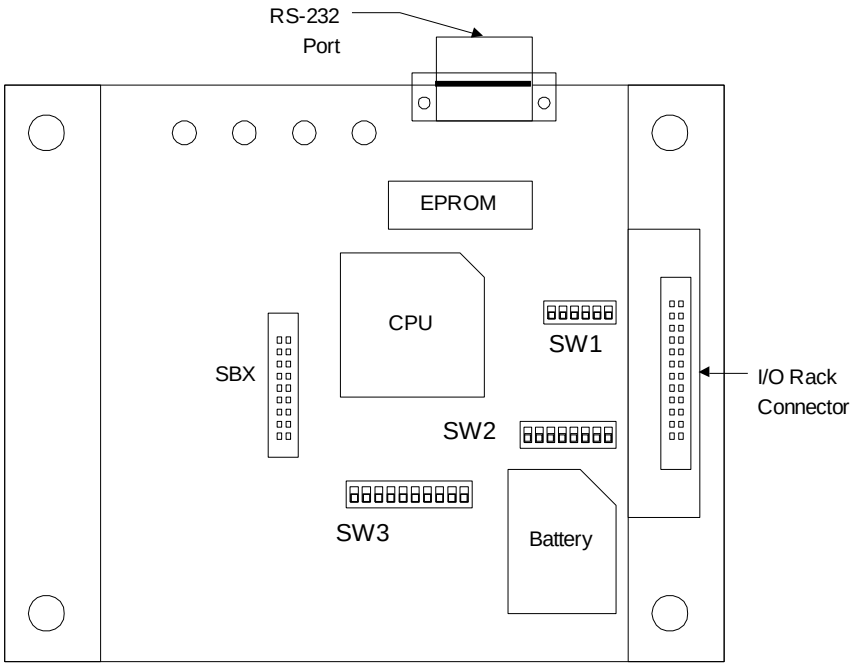


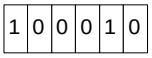
Figure 5 - 3

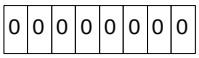
5.2.1 MDAC Switch Setup, continued

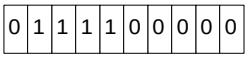
Switch details are summarized below.

Switch Label	No. of Positions	Function(s)
SW1	6	Comm. Protocol, Baud Rate and Autostart ECP Bit
SW2	8	Command Signal Base Address
SW3	10	Comm. Routing and Termination

The factory default switch settings for these switches are:

SW1 - 

SW2 - 

SW3 - 

Where “0” designates the OFF position and “1” denotes the ON position. The factory default setting for the Base Address (SW2) should not be changed. Similarly, since the MDAC is set up for four wire RS422 communications, the factory default setting for SW3 should not be changed.

The SW1 switch controls the communication speed, or Baud Rate. Positions 4,5 and 6 on SW1 are used to set the Baud Rate. The factory Baud Rate setting is 9600 baud. The available settings are as follows:

	Switch Position/Setting		
Baud Rate	**4**	**5**	**6**
1200	0	0	0
2400	0	0	1
9600	0	1	0
19200	0	1	1
38400	1	0	0
57600	1	0	1
115200	1	1	0
307000	1	1	1

It may be desirable to increase the communications Baud Rate. However, it should be noted that the VCS will loose communications with the MDAC if speed of the computer (MHz) is not fast enough to support the baud rate increase. Note also that the Baud Rate setting in the Hotgas.ini file must match the MDAC switch setting.

5.3 System Interlocks

There are several Interlock conditions designed to provide equipment protection during system operation including:

- **OPI1:** The OPI1 interlock is defined as Over Pressure Interlock number 1 and is set to switch an MRP unit to the OFF state if the system pressure, as monitored by the 0.1 Torr CDG, rises above 0.0005 Torr. This interlock is the default end condition for the HLD-Hi operating mode and protects the HLD spectrometer tube from over-pressurization.

- **OPI2:** The OPI2 interlock is defined as Over Pressure Interlock number 2 and is set to switch an MRP unit to the OFF state if the system pressure, as monitored by the 1000 Torr CDG, rises above 5.0 Torr. This interlock is the default end condition for the HLD-Lo operating mode and protects the HLD spectrometer tube from over-pressurization.

- **OPI3:** The OPI3 interlock is defined as an Over Pressure Interlock number 3 and is set to switch an MRP unit to the off state if the system pressure, as monitored by the 1000 Torr CDG, rises above 100 Torr. This interlock is the default end condition for the SVAC operating modes to protect the blowers.

- **VTLI:** The Variable Time Length Interlock is designed to provide automatic shut-down of the MRP unit after a specified time period for process steps with final value end conditions. This step exit condition is typically added to FVAL conditions to prevent the MRP from getting ‘stuck’ in an operating mode due to a faulted system condition (such as a significant leak during the VAC process).

If an interlock condition occurs during system operation, the VCS will immediately switch the MRP to the OFF mode or state, isolating the MRP from the process chamber. When an interlock condition occurs, all automatic system operating modes are disabled until the interlock condition is cleared. The error message shown in figure 5-3 will also appear.

5.3 System Interlocks, continued

Figure 5 - 4 System Interlock Error Message

To determine which interlock has occurred, switch the VCS process monitoring window to the status page showing the recipe that was active at the time of the interlock. The recipe step in which the interlock occurred should be highlighted. The highlighted step end condition will indicate which interlock has occurred.

Generally, an interlock may be cleared by eliminating the condition that initially caused the interlock to occur. However, in most cases, interlocks are caused by Process Control Recipe structure errors. For example, consider a process control recipe that contains a FILL and RECIRC sequence (with default end conditions) immediately followed by a SVAC step (with the default end condition). In this case, the system will enter an OPI3 interlock condition as soon as the MRP attempts to switch to the SVAC mode. This is because the system pressure after the FILL and RECIRC sequence will be above maximum pressure (100 Torr for OPI3) allowable to enter the SVAC mode(s).

5.3 System Interlocks, continued

For this example, the recommended course of action is to switch the VCS to the Manual mode and place the MRP in the VAC mode. This will abort the current automatic process control recipe. Then the operator will need to access the PCRE software to modify the recipe to add a VAC step prior to the SVAC step to insure that the system pressure will be below the 100 Torr maximum prior to the initiating the SVAC step. The modified recipe must then be saved to the database and re-run with the VCS in the auto mode.

VTLI interlocks may be cleared without aborting the current automatic process control recipe. For example, if the VTLI interlock is used on a SVAC process step and the system contains a leak large enough to prevent the system from achieving the specified final value (FVAL) base pressure, the VTLI will eventually time out and cause an interlock condition to occur. If the source of the leak can be identified and fixed, then simply executing a KEYPRESS will re-initiate the SVAC step and, assuming the leak was fixed, the process control recipe will continue as originally written.

5.4 Helium Leak Detector Enabling

This section discusses several issues associated with helium leak detector (HLD) operations.

5.4.1 HLD Communications

The HLD controller is connected to the host computer (and VCS software) via a serial communications link. The status of the HLD communications may be viewed by switching the VCS process monitoring window, Status page. VCS communications with the HLD controller are fully automated. In the event of a consistent HLD communications error, contact your Nuvac Innovations representative for further instructions, or access the windows Hyper terminal to directly access the Varian dCLD controller.

To communicate directly with the dCLD controller, access the Hyper Terminal from the Windows 95 Start, Programs, Accessories menu. Select the Hypertrm icon, enter a name for the Varial dCLD controller and select an icon. Next, specify the communications port for the HLD. Comm 2 is the factory set default port for the leak detector. Type in the following communications settings when prompted:

5.4.1 HLD Communications, continued

Baud Rate: 9600
Parity: None
Data Bits: 8
Stop Bits: 1

The Hyper terminal should now allow direct communication with the dCLD controller. Referencing the Varian OEM literature type in the desired commands. The Hyper Terminal will first echo the typed in information for review and then transmit the commands to the dCLD controller. The controller should respond in accordance with the OEM literature.

5.4.2 HLD Interlocks

There are several system interlocks which are designed to protect HLD components under adverse system conditions. The interlocks affecting HLD operations are OPI1 and OPI2. These interlocks are discussed in detail in Section 5.3 above. As stated above, these interlocks will prevent the system from entering an HLD operating mode if the system/chamber pressures are above the required setpoint values.

In order to successfully enter one of the HLD operating modes in automatic system operation, the process control recipe used must include the proper sequence of steps. To enter the HLD-Hi mode, the recipe must include an SVAC step immediately prior to the HLD-Hi step to reduce the system or chamber pressure below the 0.5 milliTorr maximum. Similarly, the HLD-Lo operating mode must be preceded by a VAC or SVAC step to reduce the system pressure below the 5.0 Torr maximum.

5.4.3 Spectrometer Tube Operation

If the spectrometer tube enabled LED indicator (located on the Varian dCLD controller) does not light or flashes intermittently, one of the two problems discussed below may have occurred.

- Ion Gauge Malfunction - The ion gauge must be properly functioning to enable the spectrometer tube. Refer to the vendor OEM literature for diagnostic and/replacement instructions.

5.4.3 Spectrometer Tube Operation, continued

- TC Gauge Operation - The Varian TC Zero command is available from the Communications bar on the VCS main menu. Clicking on Varian TC Zero will re-zero the Varian TC pressure gauge. This gauge is used internally by the HLD controller to enable the spectrometer tube when the measured pressure is less than 20 milliTorr. If the system is experiencing difficulties enabling the spectrometer tube, the operator should zero the TC gauge to ensure that the gauge is performing properly.

! CAUTION !

The operator must verify that the system pressure is less than 20 milliTorr prior to TC Zero actuation. Use of the TC Zero feature above the 20 milliTorr limit could result in Turbo pump and/or Spectrometer Tube damage.

If problems with spectrometer tube operation persist, consult the Varian OEM literature.