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Agilent Technologies

Charge Management System Operator Manual

INSTALLATION AND OPERATION MANUAL

Manual No. TBD
Revision A
April 2010

Charge Management System Operator Manual

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Warranty

Products manufactured by Seller are warranted against defects in materials and workmanship for twelve (12) months from date of shipment thereof to Customer, and Seller's liability under valid warranty claims is limited, at the option of Seller, to repair, to replace, or refund of an equitable portion of the purchase price of the Product. Items expendable in normal use are not covered by this warranty. All warranty replacement or repair of parts shall be limited to equipment malfunctions which, in the sole opinion of Seller, are due or traceable to defects in original materials or workmanship. All obligations of Seller under this warranty shall cease in the event of abuse, accident, alteration, misuse, or neglect of the equipment. In-warranty repaired or replaced parts are warranted only for the remaining unexpired portion of the original warranty period applicable to the repaired or replaced parts. After expiration of the applicable warranty period, Customer shall be charged at the then current prices for parts, labor, and transportation. Reasonable care must be used to avoid hazards. Seller expressly disclaims responsibility for loss or damage caused by use of its Products other than in accordance with proper operating procedures. Except as stated herein, Seller makes no warranty, express or implied (either in fact or by operation of law), statutory or otherwise; and, except as stated herein, Seller shall have no liability under any warranty, express or implied (either in fact or by operation of law), statutory or otherwise. Statements made by any person, including representatives of Seller, which are inconsistent or in conflict with the terms of this warranty shall not be binding upon Seller unless reduced to writing and approved by an officer of Seller.

Warranty Replacement and Adjustment

All claims under warranty must be made promptly after occurrence of circumstances giving rise thereto, and must be received within the applicable warranty period by Seller or its authorized representative. Such claims should include the Product serial number, the date of shipment, and a full description of the circumstances giving rise to the claim. Before any Products are returned for repair and/or adjustment, written authorization from Seller or its authorized representative for the return and instructions as to how and where these Products should be returned must be obtained. Any Product returned to Seller for examination shall be prepaid via the means of transportation indicated as acceptable by Seller. Seller reserves the right to reject any warranty claim not promptly reported and any warranty claim on any item that has been altered or has been returned by non-acceptable means of transportation. When any Product is returned for examination and inspection, or for any other reason, Customer shall be responsible for all damage resulting from improper packing or handling, and for loss in transit, not with-standing any defect or non-conformity in the Product. In all cases, Seller has the sole responsibility for determining the cause and nature of failure, and Seller's determination with regard thereto shall be final. If it is found that Seller's Product has been returned without cause and is still serviceable, Customer will be notified and the Product returned at Customer's expense; in addition, a charge for testing and examination may be made on Products so returned.

Items Not Covered by the Warranty

Examples of items not normally covered under warranty include O-rings, mechanical pump oils, vacuum system overhauls and obvious abuse or customer error. These items are considered normal maintenance for this type of equipment.

Preface

This manual contains installation, operation, maintenance, and troubleshooting information for the Varian Charge Management System. The equipment is designed to ensure safety when used properly. It is the responsibility of every operator or service person to read and thoroughly understand the manual and any additional information provided by Varian. All warnings and cautions must be read carefully and strictly observed. Consult local, state, and national agencies regarding specific requirements and regulations. Address any safety, operation, and/or maintenance questions to your nearest Varian office.

Pressure Clarification

In the pressure measurement of gases it is very important to differentiate between absolute pressure and gauge pressure. Absolute pressure is measured relative to absolute zero pressure (the pressure that would occur at absolute vacuum). Gauge pressure is measured relative to the atmospheric pressure. The relationship between the two is best illustrated as follows:

Gauge pressure = Absolute pressure – Atmospheric pressure

NOTE

All the selectable pressure units in the Charge Management System are absolute pressure units.

WARNINGS

When conducting the proof test the operator must be sure that the product can withstand the pressure applied. If it is the first time a product is proof tested it has to be put in a closed container to minimize risk. Varian refers to recommended CE levels of test pressure of maximum 3 bars.

The Charge Management System is not designed for use with hazardous gases. Verify that the system to be charged has been purged of all hazardous gases prior to using the Charge Management System. Exposure to hazardous gases could result in serious injury or death.

The Charge Management System is supplied with a universal mains power supply adapter. Before powering the unit for the first time, verify that the power supply adapter is configured to operate for the local mains supply voltage. See Section 1.2 “Installation” on page 1-2.

Use surge protection to improve the immunity of the Charge Management System against unidirectional transients caused by the following phenomena:

- *Switching phenomena in the power network (e.g., switching of capacitor banks, inductive loads, electrical motors, etc.)*
- *Faults in the power network*
- *Indirect lightning strikes*

This equipment generates, uses, and can radiate RF energy, which if not installed and used in accordance with the instructional manual, can cause harmful interference to radio communications.

When this equipment is operated in a commercial environment, operation is subject to the following two conditions:

- *This equipment must not cause harmful interference*
- *This equipment must accept any interference received, including interference (RF and ESD) that may cause undesired operation*

The equipment may need to be reset after RF and/or ESD events by cycling the Power Switch/Circuit Breaker on the back panel of the unit.

Operation of this equipment in a residential area is also likely to cause harmful radio communications interference, in which case, the users will be required to correct the interference at their expense.

This equipment is designed to meet current EEC regulations: LVD (Low Voltage Directive, 73/23/EEC) and EMC (Electromagnetic Compatibility Directive, 89/336/EEC) for Installation Category II, Pollution Degree 2 environment for Industrial, Scientific, Measuring and Process Control Electrical Equipment and Machinery Directive 98/37/EC.

- A*ny modifications on the part of the user are liable to cause non-compliance with regulations or affect the EMC performance and the safety of the product. Varian cannot be held responsible for consequences resulting from such intervention.*
- *Before powering the unit the first time, verify that the unit is configured to operate for the local mains supply voltage.*

- *The equipment can be damaged by*:
  - *Incorrect mains AC supply voltages*
  - *Radio Frequency (RF) and Electrostatic Discharge (ESD) energy inputs that exceed the maximum ratings*
  - *Operating in very high temperatures or without adequate ventilation*
  - *Immersion in liquids*
  - *Physical abuse*
- All electrical connections must be performed by a qualified electrician and must comply with national and local codes.
- Opening the enclosure may expose hazardous voltages. Always disconnect the power cord and interface cables before opening the enclosure. Do not touch the power inlet's contacts for at least 10 seconds after disconnecting the power cord.
- Electrical installation must include the appropriate branch circuit (10 A maximum), with a long time delay and a reliable earth ground.
- Use only the power cord that was provided with your leak detector. The use of extension cords is not recommended and could result in damage to the equipment and loss of warranty.
- To avoid electric shock, connect the product power cord to a grounded power receptacle. A power cord with a grounding conductor is required.

The Charge Management System can be used in conjunction with various types of vacuum pumps. It is imperative for every operator or service person to read and thoroughly understand the respective manual prior to operating the pump.

The Charge Management System may be under pressure, be sure to vent the system prior performing any maintenance.

Limit supply/connection pressure(s). Refer to Table 1-1 on page 1-2 for details.

When determining the set points for the various test pressure parameters always keep in mind the pressure limitations of the part to be tested.

The CMS is used in conjunction with trace gas leak detectors and/or sniffers which lack the capability to properly introduce the trace gas to the part to be tested. The complete system includes; proof test, pressure and vacuum decay, evacuation of test objects, trace gas mixing and recovery, and cleaning and back-fill. The CMS can be used both in sniffing and hard vacuum applications. The following are a sampling of possible uses and configurations:

When setting the venting time be sure that the test part is properly vented prior to starting the evacuation function. Depending on the vacuum pump used, exposure to high pressure can cause serious damage to the pump and its operating environment. As a safety feature the

Charge Management System has been programmed so that the valve to the vacuum pump cannot be opened if the internal pressure of the test part is higher than 1500 mbar.

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Section 1. Introduction and Installation

1.1 CMS Usage

The CMS is used in conjunction with trace gas leak detectors and/or sniffers which lack the capability to properly introduce the trace gas to the part to be tested. The complete system includes; proof test, pressure and vacuum decay, evacuation of test objects, trace gas mixing and recovery, and cleaning and back-fill. The CMS can be used both in sniffing and hard vacuum applications. Figure 1-1 and Figure 1-2 are a sampling of possible uses and configurations.

Sniffer Application

The CMS is connected to the test object and conducts all the steps including; Proof test, Gross leak test (pressure and vacuum decay), evacuation, mixing, charging and recovery management. When the CMS indicates that it is ready, the operator uses a helium Sniffer to detect helium outside the product. After the test is completed helium is removed from the product by the CMS.

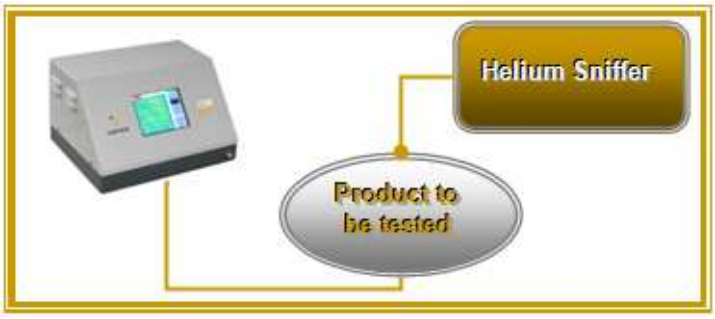


Figure 1-1 Helium Sniffer

Hard Vacuum Application

The CMS is connected to the test object which is placed in a vacuum chamber. It conducts all the steps including; Proof test, Gross leak test (pressure and vacuum decay), evacuation, mixing, charging and recovery management. When the CMS indicates that it is ready, the operator starts the helium leak detector which measures the helium inside the chamber. After the test is completed helium is removed from the product by the CMS.

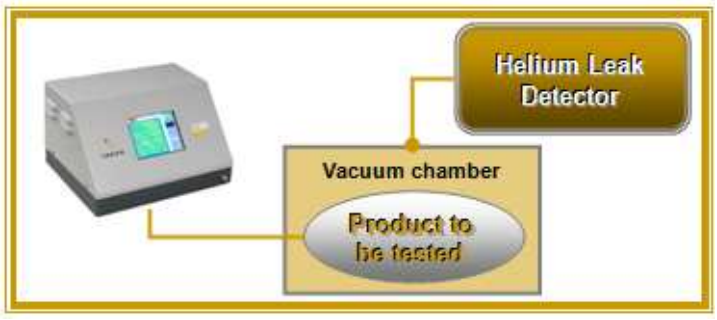


Figure 1-2 Helium Leak Detector

1.2 Installation

The Charge Management System is delivered completely assembled as ordered. Although various system configurations are possible, every system requires connection of the test gas supply lines. If vacuum is required and the Venturi Pump option is not selected, a mechanical vacuum pump must be connected to the system using the supplied connection kit. Table 1-1 details the installation requirements.

Table 1-1 Installation Requirements

Item	Requirement
Power supply	100-240 VAC, 50-60 Hz, 1.2 Amps
Power connection	Connection to a grounded outlet
Air (free of water and oil)	6 Bar/87 PSI/600kPa/4,500 Torr (minimum) 16 Bar/235 PSI/1600 kPa/12,000 Torr (maximum)
Helium	Low pressure: Up to 3 Bar/45 PSI/300 kPa/2,250 Torr (absolute) Maximum Standard pressure: Up to 16 Bar/235 PSI/1600 kPa/ 12,000 Torr (absolute) Maximum High pressure: Up to 21 Bar/310 PSI/2,100 kPa/15,750 Torr (absolute) Maximum

Table 1-1 Installation Requirements

Nitrogen	Low pressure: Up to 3 Bar/45 PSI/300 kPa/2,250 Torr (absolute) Maximum Standard pressure: Up to 16 Bar/235 PSI/1600 kPa/ 12,000 Torr (absolute) Maximum High pressure: Up to 21 Bar/310 PSI/2,100 kPa/15,750 Torr (absolute) Maximum
Mechanical vacuum pump (optional)	Please consult the Operation Manual that was supplied with the pump for the installation requirements and procedure.

1.2.1 Front Panel Display

The display is used for the configuration and control of the Charge Management System and to display the test results. The front panel of the Charge Management System is shown in Figure 1-3.

Figure 1-3 Front Panel Display

1.2.2 Rear Panel Connection Ports

The rear panel of the Charge Management System is shown in Figure 1-4 and the connection ports are shown in Table 1-2.

Figure 1-4 Rear Panel View

Table 1-2 Back Panel Connection Ports

Port Nr. or Connection	Size	Description
1	1/4” G	Inlet regulator with filter connection, Air
2	1/4” G	W/ VSCMSLV con. Port 8 for press. & con. port 2 for meas W/O VSCMSLV con. Port 8 for pressurizing & measuring
3	1/4” G	Connection for Vacuum pump
4	1/8” G	Noise silencer for ventilation from prop valve
5	1/4” G	Venturi flow connection
6	1/4” G	Ventilation connection
7	1/8” G	Control air for a quick connector
8	1/4” G	Connection for test object
9	1/8” G	Control air for external evacuation vacuum valve
10		Needle valve for vacuum adjustment
A	RS-232	Remote control box connection

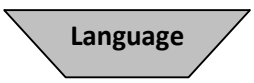
Table 1-2 Back Panel Connection Ports (Continued)

B	RS-232	PC connection for TestIT software
C	Ethernet	Prepared for Ethernet connection
D		Communication with Recovery system (provided by others)
E		Power input
F	1/4” G	Nitrogen (N2) input
G	1/4” G	Helium (He) input
H	1/4” G	Small volume charging kit connection
I	1/4” G	Safety valve for Nitrogen (N2)
J	1/4” G	Safety valve for Helium (He)

1.3 Menu Screens

The tabs located at the top of the display allow for the selection of the various menu screens. Table 1-3 details the various screens and their functions.

Table 1-3 Menu Screens

Tab	Function
	Control of the charging cycle and display of test results.
	Setting of the parameters and enabling of the various possible tests.
	Control of the valves in the system when operating in manual mode.
	Viewing the test statistics and resetting of the counters.
	Selection of the desired operating interface language.

1.3.1 Changing Parameters

The parameters can be changed as follows:

- Manual entry: Press the value field of the parameter that is to be changed. Using the keypad that then appears change the value and press the enter key on the keypad. The original screen is the shown with the updated value.
- ▲ or ▼ symbols: By pressing the respective symbol next to a value field, the value increases or decreases by a fixed interval.

NOTE

When pressing a value field and the keypad does not appear, it means that field is linked to other parameters and cannot be set.

1.3.2 Screen Flow

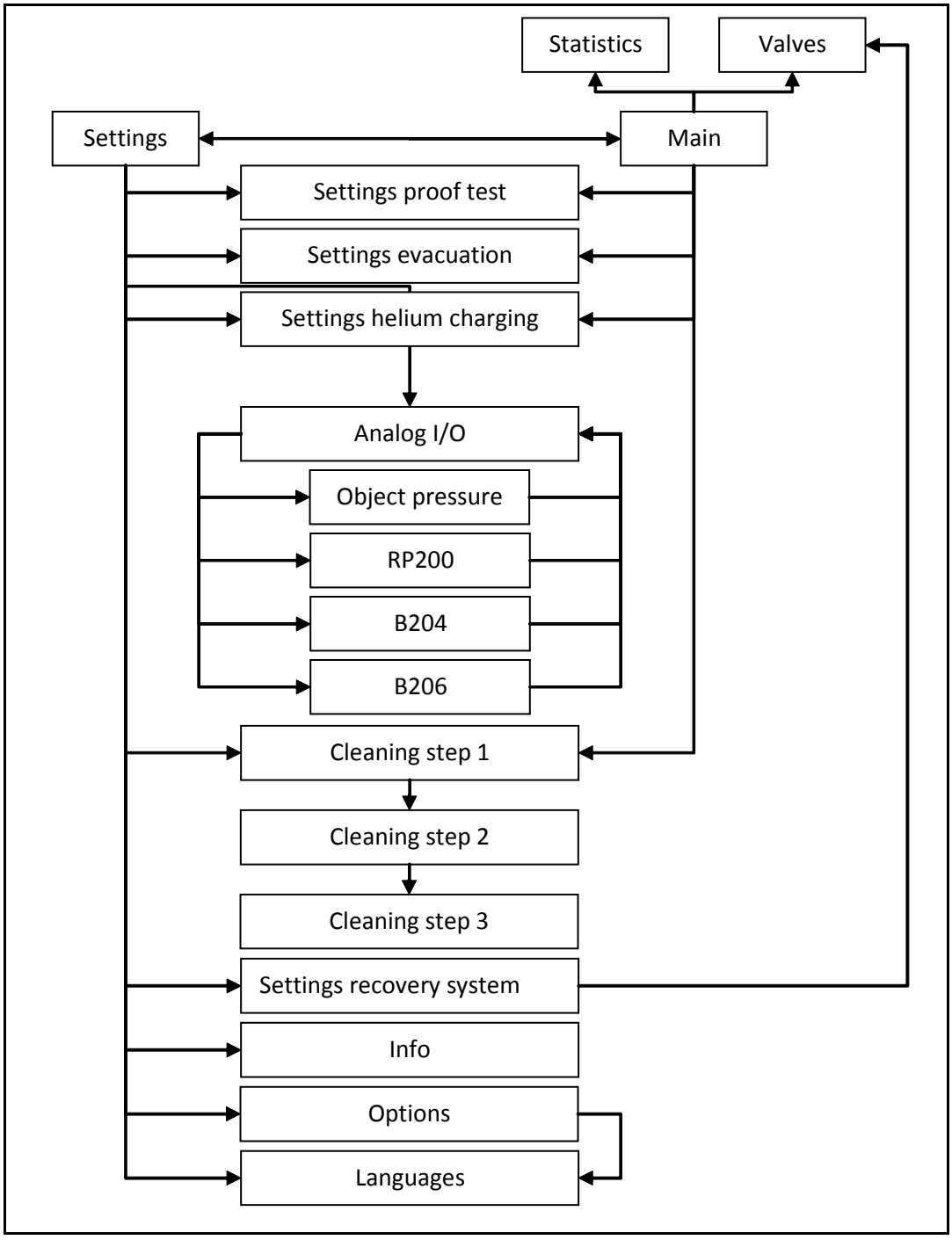


Figure 1-5 Screen Flow Diagram

NOTE *From all screens the main and setting menus can be accessed.*

1.3.3 Status Colors

Throughout the various screens uniform color highlights have been used to indicate the status of various tests and test steps. Table 1-4 details the colors and test and step status.

Table 1-4 Status Colors

Color	Test Status	Step Status
Yellow	Enabled	Test step in progress
Green	-	Test step successful
Red	-	Test step unsuccessful

NOTE

Refer to Section 4.5 "Troubleshooting" on page 4-4 for clarifications on unsuccessful test steps.

1.3.4 Password Protection

The screens to enable/disable the various functions and to set their parameters are password protected. The default User is *varian* (all lowercase) and the Password is *1234*.

1.4 Functions

1.4.1 Proof Test

The Proof Test function is a stress test during which the test part is pressurized to a specified positive pressure in relation to the part's standard operating condition. When conducting the proof test the operator must be sure that the product can withstand the pressure applied. If it is the first time a product is proof tested it has to be put in a closed container to minimize risk. Varian refers to recommended CE levels of test pressure of maximum 3 bars.

1.4.2 Pressure Decay

The Pressure Decay function is a check for gross leaks under positive pressure conditions. After the pressure specified in the Proof Test function is achieved, the test part is isolated and the internal pressure of the part is monitored for a specified period of time. If the pressure decay exceeds the specified limit an optional incremental pressure test is available to locate the leak(s). The test is done at incremental pressure levels using a 10% helium concentration. More information is found in Section 2.3.5.3 "Incremental Test" on page 2-11.

1.4.3 Evacuation (vacuum pump)

The Evacuation function evacuates the test part to a specified vacuum level. Without evacuating the test part there are limitations to the helium concentration that can be achieved during the charging process. This function is also essential in assuring the proper charging of test parts with capillary channels.

1.4.4 Vacuum Decay

The Vacuum Decay function is a check for gross leaks under vacuum conditions. After the vacuum level specified in the Evacuation function is achieved, the test part is isolated and the internal pressure of the part is monitored for a specified period of time. If the vacuum decay exceeds the specified limit an optional incremental pressure test is available to locate the leak(s). The test is done at incremental pressure levels using a 10% helium concentration. More information is found in Section 2.3.5.3 "Incremental Test" on page 2-11.

1.4.5 Helium Charging and mixing

The Helium Charging function charges the test part with helium. As a feature the charging function allows for the selection of the helium mixture that is charged into the test object. Although a certain mixture may be selected, the system displays the actual mixture charge into the test part depending on the selected evacuation level.

1.4.6 Helium Recovery management

The Helium Recovery Management function controls and sets the parameters of a helium recovery system if one is used. Your Varian Sales Engineer can advise you further if you are interested.

1.4.7 Cleaning and backfill

The Cleaning and Backfill function is a three step process by which the helium is removed from the part and can be back filled with the connected test gasses (commonly Air or N_2).

1.4.8 TestIT communication

The CMS can be connected to PC software, TestIT, that enables you to program and save recipies for many different products, and store all relevant test data. TestIT can simultaneously communicate with a Varian VS leak detector and save leak test data as well. A separate manual is available.

Section 2. Operating the Charge Management System

2.1 Startup

1. Verify that all test gas (commonly Air or N_2) lines are properly connected.
2. Plug the Charge Management System power cord into an appropriate mains supply receptacle.
3. The Caution screen as displayed in Figure 2-1 appears, requiring confirmation of the pressure settings. Pressing the Correct button advances to the Main Menu screen (Section 2.3.1 “Main Menu Screen” on page 2-2) to allow the start of a charging cycle. Pressing the Incorrect button advances to the Settings Menu screen (Section 2.3.2 “Settings Menu Screen ” on page 2-5) to define the settings.

NOTE

Whenever the power cord is connected to the mains supply receptacle, the Caution screen appears.

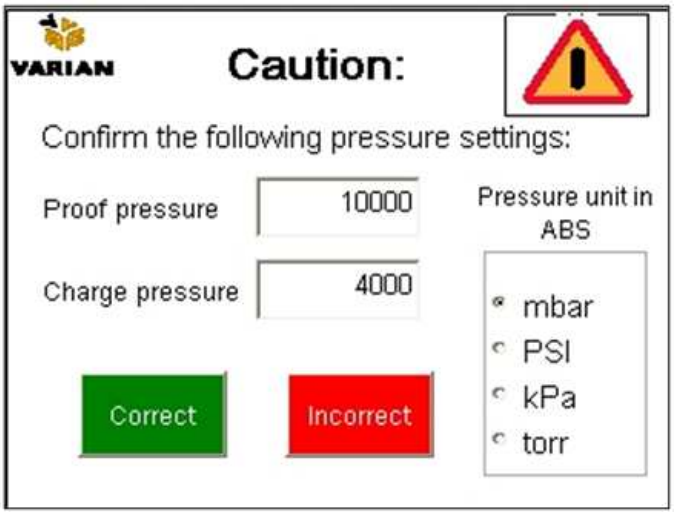


Figure 2-1 Caution Screen

2.1.1 Charging

1. Go to the Main Menu Screen (Section 2.3.1 “Main Menu Screen” on page 2-2).
2. Press the **Start** button to start the charging sequence.
3. At the end of the charge cycle and testing of the part, confirm condition of the part by pressing the **Accept** or **Abort** button. After pressing either button the cleaning cycle takes place and the Charge Management System is ready for a new charge cycle.

2.2 Shutdown

1. Verify that a charging cycle is not in progress. If one is, press the **Accept** or **Abort** button to end the cycle.
2. Unplug the power cord from the mains supply receptacle.

2.3 Menu Screens

2.3.1 Main Menu Screen

The Main menu screen (Figure 2-2) is used to control the Charge Management System and to display the test results.

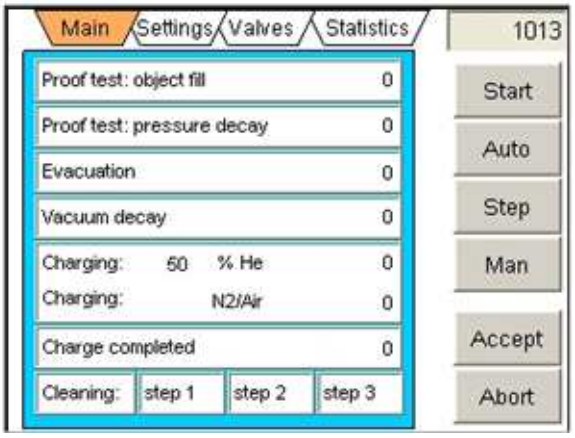


Figure 2-2 Main Screen

2.3.1.1 Test Steps

All the test steps are listed in sequential order in the main menu. Table 2-1 details all the possible test steps. Only the enabled steps are shown on the display. The status of each step is given by the color highlight as described in Table 1-4 on page 1-8. The values to the right of each step indicate the measured pressure value in the selected units (Section 2.3.2.2 “Pressure Unit Selection” on page 2-6). In the automatic test mode, should a test step be unsuccessful, the step is highlighted red and the system initiates the cleaning cycle.

Table 2-1 Test Steps

Test step	Function
Proof test: object fill	Filling of the test object with N_2/Air.
Proof test: pressure drop	Checking for a gross leak under positive pressure conditions.
Evacuation	Evacuation of the test object prior to charging.
Vacuum decay	Checking for a gross leak under vacuum conditions.
Charging: 50% He	Filling of the test part with helium. The percentage value indicates the actual helium concentration in the part.
Charging: N2/Air	Filling of the test object with a concentration balance of N_2/Air.
Charge completed	Part is charged and ready for external leak testing.
Cleaning steps 1,2 and 3	Completion of the cleaning steps.

NOTE

During the charging step, the step is highlighted yellow during the filling with helium and orange during the filling with N2/air.

2.3.1.2 Operation Buttons

Table 2-2 details the soft key push buttons used to operate the test cycles.

Table 2-2 Main Menu Buttons

Button	Function
Start	Starts the charging cycle.
Auto	Enables the automatic operating mode. To run a charging cycle the automatic mode must be enabled.
Man	Enables the manual mode. In this mode the control valves can be operated manually.
Step	Enables the semi-automatic mode. In this mode the charging cycle is completed one step at a time. Press the **Start** button to advance to the next step.
Accept	Acknowledges and records (for statistics) a good part and ends the charge cycle after the test object is charged. The pressure reading in the top right corner is highlighted green.
Abort	Acknowledges and records (for statistics) a bad part and ends the charge cycle after the test object is charged. The pressure reading in the top right corner is highlighted red.

2.3.1.3 Audio Alarm

An Audio alarm sounds:

- For ¾ of a second when the test part is ready to be tested by the helium leak detector.
- For 4 seconds when a failure in one of the test steps occurs.

2.3.2 Settings Menu Screen

The Settings menu screen (Figure 2-3) is used to enabled or disabled the various test steps and to advance to the screens where their parameters can be set.

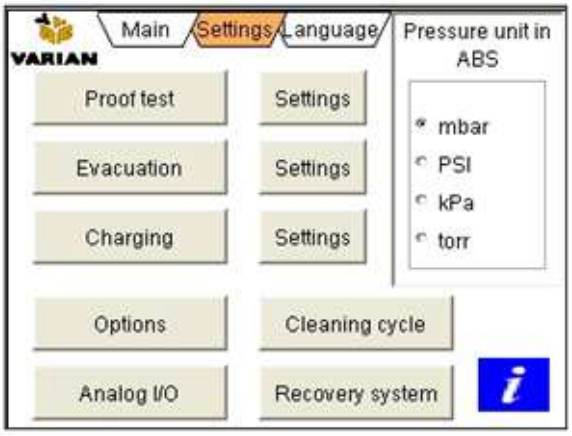


Figure 2-3 Settings Menu Screen

2.3.2.1 Configuration Buttons

Table 2-3 details the soft key push buttons used to configure the Charge Management System.

Table 2-3 Settings Menu Buttons

Button	Function
Proof test	Enables the function. When enabled the button is highlighted yellow and the respective **Settings** button appears.
Evacuation	Enables the function. When enabled the button is highlighted yellow and the respective **Settings** button appears.
Charging	Enables the function. When enabled the button is highlighted yellow and the respective **Settings** button appears.
Settings	Advances to a screen to set the parameters for the respective test step.
Options	Advances to a screen to enable various options.

Table 2-3 Settings Menu Buttons

Cleaning cycle	Advances to a screen to set the parameters for the Stop Cycle.
Analog I/O	Advances to a screen to set the parameters for the calibration of the analog in and analog out signals.
Recovery System	Advances to a screen to set the parameters for the recovery system.
	Advances to a screen that identifies the software versions.

2.3.2.2 Pressure Unit Selection

The desired pressure unit is selected on the top right of the Settings menu. All the pressure data displayed on the various menus are then displayed in the selected unit.

NOTE

All the selectable pressure units in the Charge Management System are absolute pressure units. Refer to "Pressure Clarification" on page viii for a clarification on pressure measurement.

2.3.3 Proof Test Configuration Screen

The Proof test configuration screen (Figure 2-4) is used to set the various test parameters.

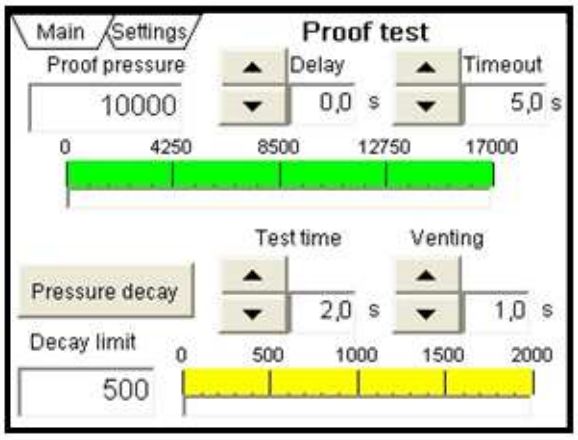


Figure 2-4 Proof Test Configuration Screen

2.3.3.1 Proof Test Parameters

Table 2-4 details the parameters used to configure the proof and pressure decay tests.

Table 2-4 Proof Test Parameters

Parameter	Function
Proof Pressure	Sets the desired pressure in the units specified. (Section 2.3.2.2 “Pressure Unit Selection” on page 2-6)
Delay	Sets a time delay (in seconds) for the closing of the fill valve upon reaching the set proof pressure.
Timeout	Sets the maximum time (in seconds) allowed to attain the Proof Pressure set point.
Decay Limit	Sets the maximum pressure drop allowed.
Test Time	Sets the time period (in seconds) during which the pressure drop is measured.
Venting	Set the amount of time (in seconds) the vent valve is opened to the atmosphere to vent the test part

WARNING

When setting the venting time be sure that the test part is properly vented prior to starting the evacuation function. See Warnings in the Preface for further clarifications.

2.3.3.2 Proof Test Buttons

Table 2-5 details the soft key push buttons used to enable the pressure decay function step.

Table 2-5 Proof Test Buttons

Button	Function
Pressure decay	Enables the pressure decay function.

2.3.4 Evacuation Configuration Screen

The Vacuum settings configuration screen (Figure 2-5) is used to set the various test parameters.

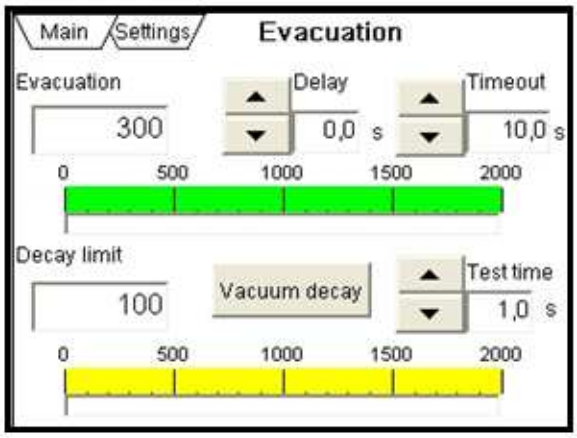


Figure 2-5 Evacuation Configuration Screen

2.3.4.1 Evacuation Parameters

Table 2-6 details the parameters used to configure the evacuation.

Table 2-6 Evacuation Parameters

Parameter	Function
Evacuation	Sets the desired pressure in the units specified. (Section 2.3.2.2 “Pressure Unit Selection” on page 2-6)
Delay	Sets a time delay (in seconds) for the closing of the evacuation valve upon reaching the set vacuum pressure.
Timeout	Sets the maximum time (in seconds) allowed to for the vacuum pressure goal to be attained.
Decay limit	The amount of pressure increase allowed during the test in the units specified. (Section 2.3.2.2 “Pressure Unit Selection” on page 2-6)
Test Time	Sets the time period (in seconds) during which the pressure drop is measured.

CAUTION

The test part is vented for the period specified in the parameter Vent time in the Proof Test. As an added safety feature, to assure proper venting, if the pressure in the test part is lower than 1500 mbar then the evacuation sequence continues. If not the sequence is aborted and the test steps before and after are highlighted red. The reason for both steps turning red is that the actual venting step is not shown in the screen.

2.3.4.2 Evacuation Buttons

Table 2-7 details the soft key push buttons used to enable the vacuum decay function step.

Table 2-7 Proof Test Buttons

Button	Function
Vacuum decay	Enables the vacuum decay function.

2.3.5 Helium Charging Configuration Screen

The Helium Charging configuration screen (Figure 2-6) is used to set the various test parameters.

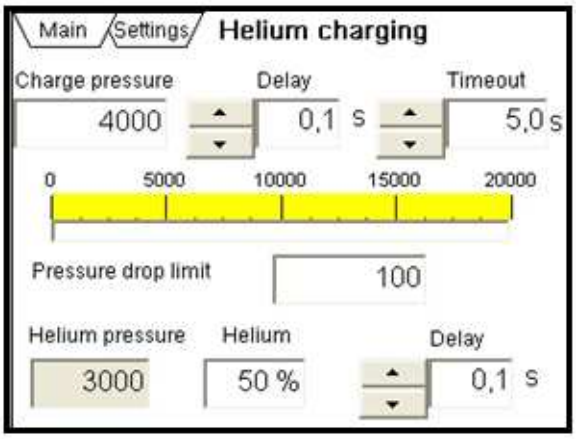


Figure 2-6 Helium Charging Configuration Screen

2.3.5.1 Helium Charging Parameters

Table 2-8 details the parameters used to configure the helium charging.

Table 2-8 Helium Charging Parameters

Parameter	Function
Charge Pressure	Sets the desired pressure in the units specified. (Section 2.3.2.2 “Pressure Unit Selection” on page 2-6)
Delay	Sets a time delay (in seconds) for the closing of the fill valve upon reaching the Charging Pressure set point.
Timeout	Sets the maximum time (in seconds) allowed to reach the Charging Pressure set point.
Pressure drop limit	Sets the maximum pressure drop allowed once the charge has reached the specified charge pressure
Helium Pressure	This pressure is automatically calculated from the data specified for Charge Pressure, Vacuum Pressure and the Helium % parameters.
Helium	Sets the concentration of helium to be charged.
Delay	Sets a time delay (in seconds) for the closing of the helium fill valve upon attaining the set charging pressure.

2.3.5.2 Helium Concentration Level

When selecting a helium concentration level that is not attainable a screen appears (Figure 2-7) that states this and gives the required pressure level that the evacuation must be set to.

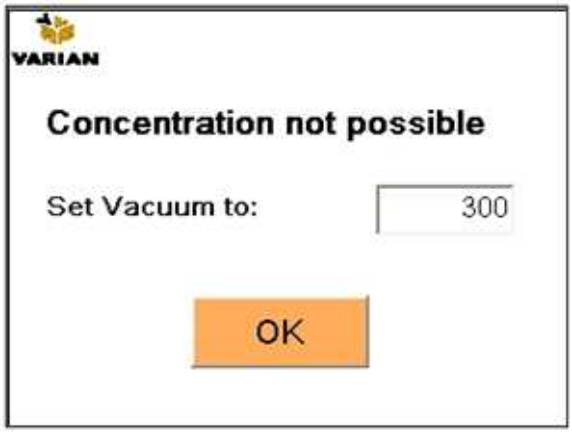


Figure 2-7 Helium Concentration Level

2.3.5.3 Incremental Test

The incremental test (Figure 2-8) can be enabled in either or both the proof test or evacuation test steps. When an error occurs the test object is vented and is then filled with a helium charge that is 10% of the specified total charge pressure from atmospheric pressure (+ 1000 mbar of N^2/air). The part can now be leak checked with a helium leak detector. If no leak is found, the pressure can be increased by 10% increments of N^2/air until the specified charge pressure is obtained. The green light illuminates when the part is ready to be leak checked. The yellow light illuminates when the specified final charge pressure is obtained at which point the part is vented and a new test cycle can be started.

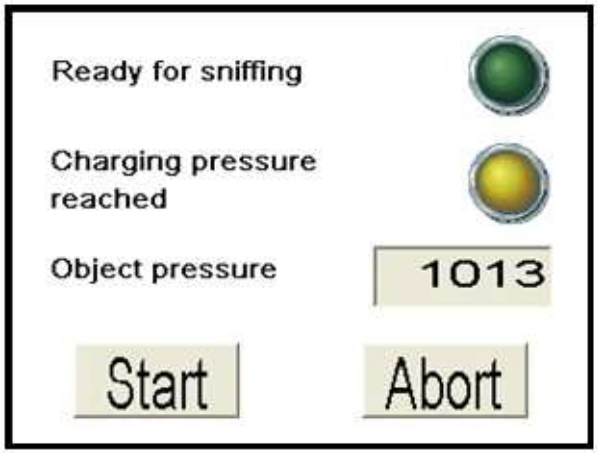


Figure 2-8 Incremental Test Screen

2.3.6 Cleaning Configuration Screen

The cleaning configuration screen (Figure 2-9) is used to set the parameters for the three (3) cleaning steps that run sequentially. There are three equal screens, one for each step. The cleaning cycle can be configured in several ways. If the button *Time limit* is enabled then the actual step is enabled for as long time as the *Time* is set to. If the button *Press limit* is enabled then the step is enabled for as long time for the pressure to be reached. When pressure is to be used in a cleaning step – this can have different meaning depending on which valve that is enabled. I.e. if the valve *Q201* or *Q202* is chosen then it means that the pressure must be lower than (in this case) 200 mbar before the step is finished. Of course if the valve *Q202* is chosen and pressure limit is enabled then the limit never will be finished due to the valve *Q202* is only vent and it is not possible to reach a absolute value of 200 mbar without evacuation of the object. That is why the system has a timeout function. If one of the cleaning steps is not fulfilled before the *Time out* time has elapsed then the cleaning cycle will end and the vent valve will open. This is then shown in the main screen with a red step on the actual cleaning step that was not ended correctly. If the valve *Q203* is chosen together with *press limit* then pressure set in the pressure field is put out by the proportional regulator and the step is enabled until the pressure in the object is higher than the set pressure for this cleaning step. This could be useful for backfilling the object with dry air.

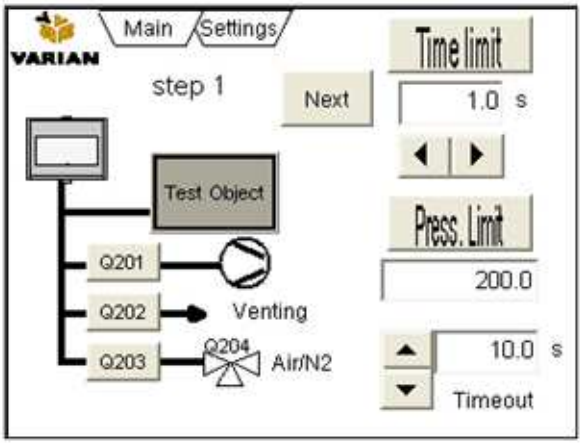


Figure 2-9 Cleaning Configuration Screen

2.3.6.1 Cleaning Parameters

Table 2-9 details the parameters used to configure the cleaning steps.

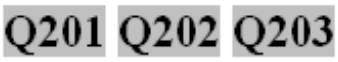
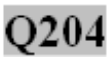
Table 2-9 Cleaning Parameters

Parameter	Function
Time	Sets the time for valve(s) to be open.
Press. Limit	Sets the pressure that the test object is to be vented to down.
Timeout	Sets the maximum time (in seconds) allowed to for the pressure goal to be attained.

2.3.6.2 Cleaning Buttons

Table 2-10 details the soft key push buttons used to configure the cleaning steps.

Table 2-10 Cleaning Buttons

Button	Function
	Select which valves are to be open (they are normally closed) and set the time or pressure limitations.
	Selects which gas supply line is open.
	Enables the time limit function and disables the pressure limit function.
	Enables the pressure limit function and disables the time limit function.
	Press the **Next** button to advance to the settings screen for the next cleaning step.

2.3.7 Analog I/O Selection Screen

The Analog I/O configuration screen (Figure 2-10) is used to view and set the calibration of the analog inputs.

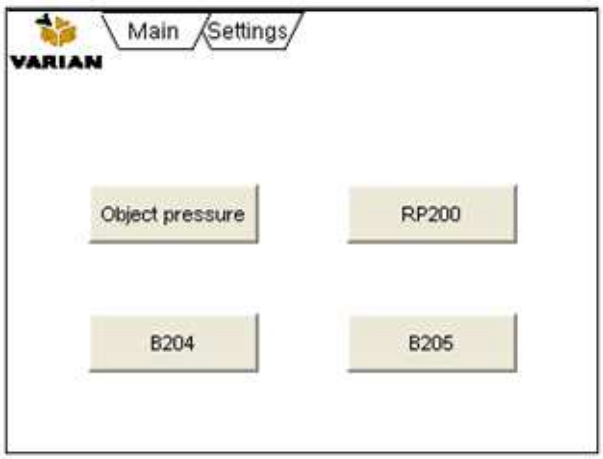


Figure 2-10 Analog I/O Selection Screen

2.3.7.1 Analog I/O Buttons

Table 2-11 details the soft key push buttons used to select the I/O.

Table 2-11 Analog I/O Buttons

Button	Function
Object pressure	Advances to a screen to set the parameters for the respective analog in signal.
RP200	Advances to a screen to set the parameters for the respective analog out signal.
B204	Advances to a screen to set the parameters for the respective analog in signal.
B206	Advances to a screen to set the parameters for the respective analog in signal.

NOTE

See the schematic in Appendix A "Charging Flowchart" on page A-1 for an explanation of the analog signals.

2.3.8 Analog I/O Configuration Screen

The Analog I/O configuration screen (Figure 2-11) is used view and set the calibration of the analog I/O.

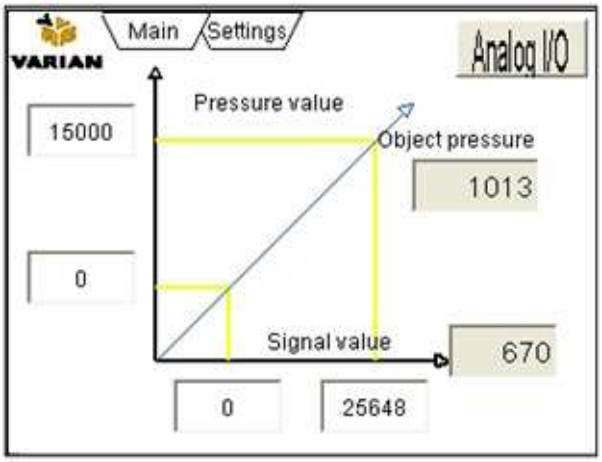


Figure 2-11 Analog I/O Configuration Screen

2.3.8.1 Analog I/O Parameters

Table 2-12 details the parameters used to configure the analog I/O.

Table 2-12 Analog I/O Parameters

Parameter	Function
Signal Value	This is the raw signal from the selected analog signal. 0 bits is equal to 0 mbar and 25648 bits is equal to 16000 mbar
Pressure Value	Sets the desired calibrated values for the selected analog signal in the units specified. (Section 2.3.2.2 “Pressure Unit Selection” on page 2-6)
Object pressure (this name changes per parameter selected)	Indicates the calibrated value with the actual values for the selected analog signal.

2.3.8.2 Analog I/O Buttons

Table 2-13 details the soft key push buttons used to select the I/O screen.

Table 2-13 Analog I/O Button

Button	Function
Analog I/O	Advances to the Analog I/O selection screen.

2.3.9 Recovery System

The Recovery System configuration screen is used enable/disable a custom recovery system and to view and set parameters. Consult your Varian Sales Engineer for more information.

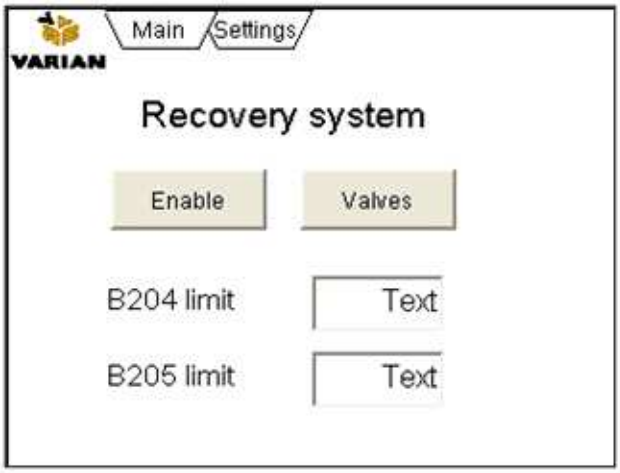


Figure 2-12 Recovery System

2.3.9.1 Recovery System Parameters

Table 2-14 details the parameters used to configure the recycling system.

Table 2-14 Recovery System Parameters

Parameter	Function
B204 Limit	Sets the pressure limit for the tank C204 that evacuates the test object after the completion of a charge. When the pressure exceeds the limit, the tank is evacuated and the contents are transferred into tank C205.
B205 Limit	Sets the pressure limit for the over pressurized tank C205 that contains the recycled helium mixture. When the pressure in the tank is lower than the set value, a valve is opened and helium from the helium cylinder fills the tank up to the set pressure.

NOTE

Parameter B204 is linked to tank C204 and parameter B205 is linked to tank C205 on the Recovery System Valves Configuration screen, see Section 2.3.10 "Recovery System Valves Configuration Screen" on page 2-18 for details.

2.3.9.2 Recovery System Buttons

Table 2-15 details the soft key push buttons used to configure the recycling system.

Table 2-15 Recycling System Buttons

Button	Function
Enable	Enables the recovery system.
Valves	Advances to a screen to manually control the recycling system valves.

2.3.10 Recovery System Valves Configuration Screen

The Recovery System Valves configuration screen (Figure 2-13) is used to control the recycling system valves. Each valve symbol is highlighted green when the valve is open. There are also fields that displays the pressure inside each of the respective tanks.

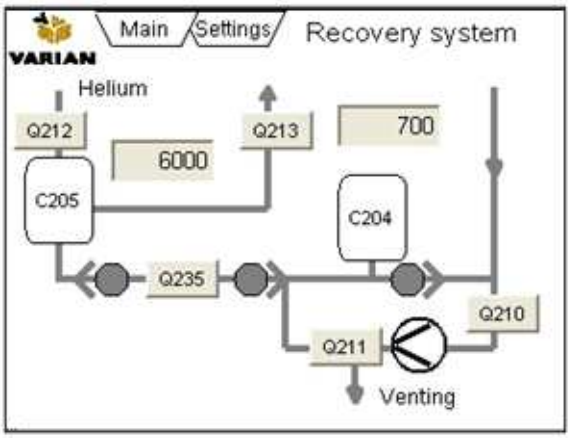


Figure 2-13 Recovery System Valves Configuration Screen

NOTE

The valves can only be controlled manually, when the system is operating in the Man mode.

2.3.11 Valves Screen

The valves screen (Figure 2-14) is used to control the Charge Management System valves. Each valve symbol is highlighted green when the valve is open. There is also a field that displays the pressure inside the test object. There is a field for setting the analog pressure you want for Helium and Nitrogen/Air.

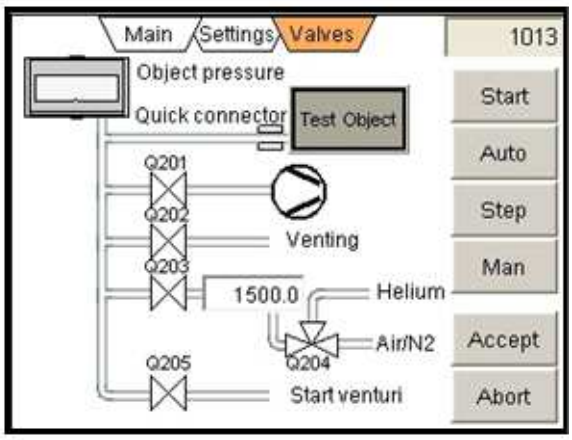


Figure 2-14 Valves Screen

NOTE

The valves and analog proportional regulator can only be controlled manually, when the system is in Man mode.

2.3.11.1 Operation Buttons

See section 4.1.2 on page 4-2 for an explanation of the control buttons.

2.3.12 Option Configuration Screen

The Option configuration screen (Figure 2-15) is used to enable various options.

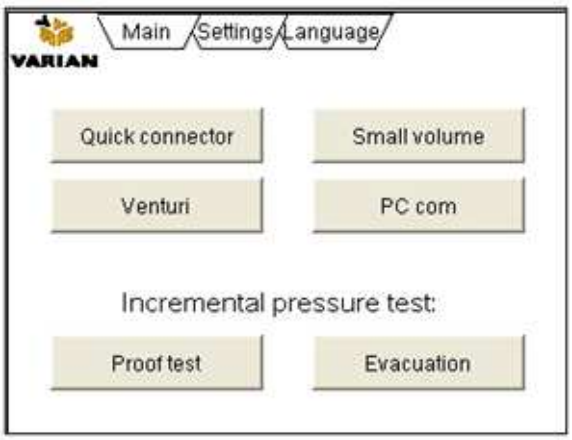


Figure 2-15 Option Configuration Screen

2.3.12.1 Option Buttons

Table 2-16 details the soft key push buttons used to enable the options.

Table 2-16 Analog I/O Buttons

Button	Function
Quick connector	Enables the use of a quick connector. The quick connector closes when the **Start** button is pressed in the main menu and releases when the **Accept** or **Abort** is pressed.
Small volume	Enables the fill valve to fill with short bursts for a more accurate filling.
Venturi	Enables the venturi pump.
PC Com	Enables communication on RS-232 port.
Proof test	Enables the incremental test during the proof test.
Evacuation	Enables the incremental test during the evacuation.

NOTE

For a higher mixing accuracy with small volumes a premixed helium cylinder can be used with a 100% helium charge.

2.3.12.2 Operation Buttons

Table 2-17 details the soft key push buttons used to control the incremental test.

Table 2-17 Analog I/O Buttons

Button	Function
Start	When pressed it increases the pressure by 10%
Abort	Ends the incremental pressure test, runs a cleaning cycle and returns to the main screen.

2.3.13 Language Menu Configuration Screen

The Language menu configuration screen (Figure 2-16) is used to select the operating language.

Figure 2-16 Language Menu Configuration Screen

2.3.14 Statistics Screen

The Statistics screen (Figure 2-17) is used to view the test statistics.

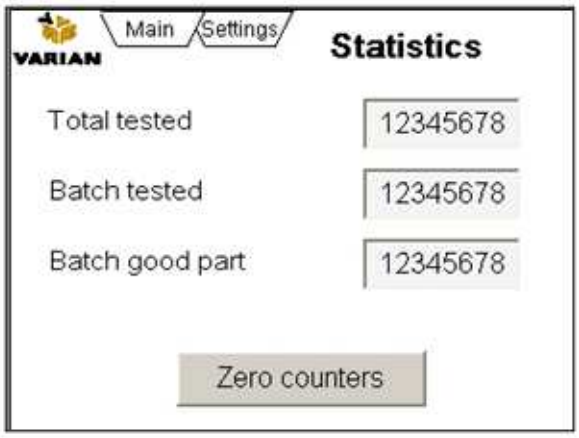


Figure 2-17 Statistics Screen

2.3.14.1 Statistics Parameters

Table 2-18 details the categories for which statistics are kept.

Table 2-18 Statistics Categories

Statistic category	Clarification
Total tested	The total number or charge cycles completed with the Charge Management System.
Batch tested	The total number of charge cycles completed for a particular batch of products being tested.
Batch good part	The total number of good cycles (none leaking test parts) in the particular batch of products being tested.

2.3.14.2 Statistics Buttons

Table 2-19 details the soft key push buttons used to zero the counters.

Table 2-19 Statistics Menu Buttons

Button	Function
Zero counters	Resets the counters for Batch tested and Batch good part to zero. The counter for Total tested can not be reset.

2.3.15 Software Information Screen

The Software information screen (Figure 2-18) is used view the software versions used for the operator panel and the PLC.

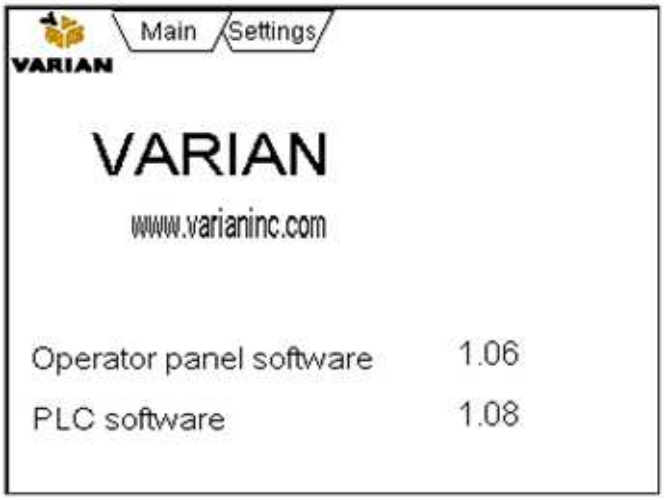


Figure 2-18 Software Information Screen

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Section 3. RS232 Protocol Description CMS PLC Version

3.1 Control Characters Codes

STX	Hex 2	decimal 2
ETX	Hex 3	decimal 3
DLE	Hex 10	decimal 16

3.2 Message Frame

All packages are packed into a message frame starting with STX and ending with ETX. The protocol sends the numeric value as binary encoded values, not ascii characters. This means that the values in our message bytes that we want to send can have the same values as our control characters for example 2. This requires us to have a special principle for the control characters described in chapter byte stuffing.

Byte number for transmission:

0	STX
1	MESSAGE BYTE 0
2	MESSAGE BYTE 1
3	MESSAGE BYTE 2
..	
xx	ETX

3.3 Handling of Units

The instrument is internally working in mBar. The units are numbered as in Table 3-1.

Table 3-1 Unit Numbering

Unit index	Unit	Scale factor in relation to mBar
0	mbar	1
1	Psi	0.01450377
2	kPa	0.1
3	Torr	0.7500617

When sending parameters to the instrument we are sending also the unit we use. The values are therefore transmitted as values of the unit selected, no conversion is necessary. When responding though, the instrument is always sending the result in mbar. However the package also includes the value (0..3) to indicate the unit the instrument is set to. If you want to display the result in the result selected you have to multiply the response with a scale factor in relation to mbar.

Code samples:

```
Function GetScaleFactor(UnitINDEX) As Double
   Select Case UnitINDEX
    Case 0 'mBar
        GetScaleFactor = 1
    Case 1 'Psi
        GetScaleFactor = 0.01450377
    Case 2 'kPa
        GetScaleFactor = 0.1
    Case 3 'torr
        GetScaleFactor = 0.7500617
   End Select
End Function
```

```
Function GetUnitText(UnitINDEX) As String
   Select Case UnitINDEX
    Case 0 'mBar
        GetUnitText = "mBar"
    Case 1 'Psi
        GetUnitText = "Psi"
    Case 2 'kPa
        GetUnitText = "kPa"
    Case 3 'torr
        GetUnitText = "torr"
   End Select
End Function
```

3.4 Byte Stuffing

Because the protocol is binary we need to have a way to send control characters within the package. This is done by using a special control character DLE.

Before sending a package we run the package through a small routine that makes the byte stuffing. We look if any character is below H20 (that we use for control characters). If a character within the package is below H20 we insert our special control character DLE before the character and adds H20 to the byte we want to send. This makes all characters below H20 control characters.

On the receiving end, the process is reversed and if we get a DLE a memory is set and the next character that comes should be subtracted with H20.

The principle is best shown with a small program example in VB. CmdBuff holds the package we want to send before byte stuffing. This routine also adds the STX and ETX before and after the package.

Code sample:

```
Private Sub SendPackage(CmdBuff() As Byte, NUMBYTES As Integer)
  Dim obuff(2000) As Byte ' Buffer for holding the bytestuffed bytes…
  Dim Cnt As Integer          ' Keep track of number of characters in obuff for sending
  Dim N As Integer
    obuff(0) = STX ' Start sending with STX
  Cnt = 1
   For N = 0 To NUMBYTES – 1 'Number of characters we want to send before byte stuffing…..
'Check if character in our package is below H20, if so perform byte stuffing by inserting a DLE before the
character and add H20      to the byte we are processing. If character is above or equal to H20 just add the byte
to the actual output buffer.
     If CmdBuff(N) < &H20 Then
         obuff(Cnt) = DLE
       obuff(Cnt + 1) = CmdBuff(N) + &H20
       Cnt = Cnt + 2
      Else
        obuff(Cnt) = CmdBuff(N)
        Cnt = Cnt + 1
     End If
   Next N
    obuff(Cnt) = ETX ' Finish package with ETX
   Cnt = Cnt + 1
mComPort.WritePort obuff, Cnt
  End Sub
```

3.4.1 Command Overview

Many of the commands are very simple. They consist of a single character for executing a command in the instrument. In these commands the instrument only echoes the character back so that the sender can verify that the command has been recieved.

Command 1	Send time group	Echo only
Command 2	Start instrument	Echo only
Command 3	GetStatus	
Command 4	Reset	Echo only
Command 5	Continue	Echo only...

3.4.2 Command 1 Send Time Group

Send (excluding STX/ETX and bytestuffing)

The scale column indicates that some integers have 2 decimals…

Table 3-2 Command 1 Send

Message Byte	Parameter name	Datatype	Scale
0	Command number (always=1)		
1-10	GroupName	STRING	1
11	Unit	INT	1
13	ProofTest_OnOff	BOOL	1
14	ProofTest_ProofPressure	DOUBLE	1
18	ProofTest_TimeOut	INT	100
20	ProofTest_ProofDelay	INT	100
22	ProofTest_PressureDecay	BOOL	1
23	ProofTest_DecayLimit	DOUBLE	1
27	ProofTest_Venting	INT	100
29	ProofTest_TestTime	INT	100
31	Evacuation_OnOff	BOOL	1
32	Evacuation_Evacuation	DOUBLE	1
36	Evacuation_Timeout	INT	100
38	Evacuation_Delay	INT	100
40	Evacuation_VacuumDecay	BOOL	1
41	Evacuation_TestTime	INT	100
43	Evacuation_DecayLimit	DOUBLE	1
47	Charging_OnOff	BOOL	1
48	Charging_Pressure	DOUBLE	1
52	Charging_TimeOut	INT	100
54	Charging_Delay	INT	100
56	Charging_PressureDropLimit	DOUBLE	1
60	Charging_Heliumproc	INT	1
62	Charging_PressureDropDelay	INT	100
64	CleaningStep1_Q201_ 0	BOOL	1

Table 3-2 Command 1 Send (Continued)

65	CleaningStep1_Q202_ 0	BOOL	1
66	CleaningStep1_Q203_ 0	BOOL	1
67	CleaningStep1_Q204_ 0	BOOL	1
68	CleaningStep1_LimitType_ 0	BOOL	1
69	CleaningStep1_TimeLimit_ 0	INT	100
71	CleaningStep1_PressureLimit_ 0	DOUBLE	1
75	CleaningStep1_Timeout_ 0	INT	100
77	CleaningStep1_Q201_ 1	BOOL	1
78	CleaningStep1_Q202_ 1	BOOL	1
79	CleaningStep1_Q203_ 1	BOOL	1
80	CleaningStep1_Q204_ 1	BOOL	1
81	CleaningStep1_LimitType_ 1	BOOL	1
82	CleaningStep1_TimeLimit_ 1	INT	100
84	CleaningStep1_PressureLimit_ 1	DOUBLE	1
88	CleaningStep1_Timeout_ 1	INT	100
90	CleaningStep1_Q201_ 2	BOOL	1
91	CleaningStep1_Q202_ 2	BOOL	1
92	CleaningStep1_Q203_ 2	BOOL	1
93	CleaningStep1_Q204_ 2	BOOL	1
94	CleaningStep1_LimitType_ 2	BOOL	1
95	CleaningStep1_TimeLimit_ 2	INT	100
97	CleaningStep1_PressureLimit_ 2	DOUBLE	1
101	CleaningStep1_Timeout_ 2	INT	100
103	Options_QuickConnector	BOOL	1
104	Options_SmallVolume	BOOL	1
105	Options_Venturi	BOOL	1
106	Options_ProofTest	BOOL	1
107	Options_Evacuation	BOOL	1

Response (excluding STX/ETX and bytestuffing).

Table 3-3 Command 1 Response

Message Byte	Parameter name	Datatype
0	Command echo always 1	BYTE

3.4.3 Command 2 Start Instrument

Send (excluding STX/ETX and bytestuffing).

Table 3-4 Command 2 Send

Message Byte	Parameter name	Datatype
0	Command number = 2	BYTE

Response (excluding STX/ETX and bytestuffing).

Table 3-5 Command 2 Response

Message Byte	Parameter name	Datatype
0	Command echo always 2	BYTE

3.4.4 Command 3 GetStatus

Polls the instrument for the current status. See also chapter about units in order to correctly interpret the Value and Limit fields. These values are always send in mbar by the instrument.

Table 3-6 Command 3 Send

Message Byte	Parameter name	Datatype
0	Command number = 3	BYTE

Response (excluding STX/ETX and bytestuffing).

Table 3-7 Command 3 Response

Message Byte	Parameter name	Datatype
0	Command echo always 3	BYTE
1-2	StepNumber	INT
3-4	ErrorNumber	INT
5	Ready	BOOL

Table 3-7 Command 3 Response (Continued)

6	IResult	BOOL
7-10	Value	REAL
11-14	Min limit	REAL
15-18	Max limit	REAL
19-20	Unit	INT16

StepNumber = Actual stepnumber from CMS.

ErrorNumber = Step where the test failed.

Ready = Step completed/finished/Result ready.

IResult = True if OK/False if failed.

Value = Value from step.

Min Limit = Min limit for step or if no min limit in step then equal to Value.

Max limit = Max limit for step or if no max limit in step then equal to Value.

Unit = Unit.

3.4.5 Command 4 Reset Instrument

Send (excluding STX/ETX and bytestuffing)

Table 3-8 Command 4 Send

Message Byte	Parameter name	Datatype
0	Command number = 4	BYTE

Response (excluding STX/ETX and bytestuffing)

Table 3-9 Command 4 Response

Message Byte	Parameter name	Datatype
0	Command echo always 4	BYTE

3.4.6 Command 5 Continue

Send (excluding STX/ETX and bytestuffing)

Table 3-10 Command 5 Send

Message Byte	Parameter name	Datatype
0	Command number = 5	BYTE

Response (excluding STX/ETX and bytestuffing)

Table 3-11 Command 5 Response

Message Byte	Parameter name	Datatype
0	Command echo always 5	BYTE

Section 4. Maintenance

The Charge Management System requires a minimal of maintenance.

4.1 Electrical

Check carefully that no proximity switches, wiring or other electrical equipment outside the casing is damaged.

4.2 Mechanical

1. Vacuum Valves and Measurement Valves:
   - ❑ Check the sealing surface and replace the O-ring when necessary.
2. Maintenance Vacuum Pump
   - ❑ See the supplied manual, but in general for oil sealed pumps, the oil level should be checked on a daily basis and refilled when necessary.

4.3 Spare Parts

Table 4-1 lists the spare parts available.

Table 4-1 Spare Parts

Part number	Description
PVENQ-008	Reconditioning set for Varian valve 2/2
PVENQ-009	Reconditioning set for Varian valve 3/3

For all other spare parts, contact Varian with your system serial number.

4.4 Accessories

4.4.1 CMS Options

Below is a description of the different CMS options, answering three questions about each: What is it? When it is it required? and How to use it? Do not hesitate to ask if you need any further clarifications. All options are field installed.

A. VENTURI PUMP KIT

What is it?
This is a small vacuum pump directly mounted on the instrument with minimum vacuum of 0.08 Bar/1.2 PSI/8 kPa/60 Torr. There is also an extra valve inside the instrument that controls the pump.

When is it required?
The pump is used to pump vacuum in the test object before it is filled with gas and the mixing sequence. After test the gas is pumped out with the same pump.

How to use it?
It is directly mounted on the backside of the instrument, Ports 3 & 5. It includes a restrictor to control the vacuum in small volumes. See Appendix C for connection locations.

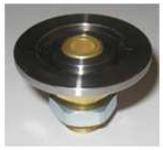
B. LARGE OR SPECIAL VOLUME CHARGING KIT

What is it?
An adapter used to obtain separate pressure identification of the test object. A standard CMS uses the same port for charging and pressure measurement.

When is it required?
It is used with larger volumes to increase the sensitivity of test pressure and gas mixture.

How to use it?
The CMS has two (2) connections for the test object. Port 8 is used for the charging and Port 2 is used for pressure identification. See Appendix C for connection locations.

1. VACUUM PUMP CONNECTION KIT



What is it?
A connection adapter to the vacuum pump (DN 25).

When is it required?
When an external vacuum pump is used for evacuation (if DN 25 is the preferred means of connection).

How to use it?
In is connected in the vacuum connection on port 3, on the backside of the instrument. See Appendix C for how to connect it.

2. VACUUM PUMP KIT FOR LARGE VOLUMES

What is it?
An external vacuum/ over pressure valve with larger flow that is controlled by the instrument.

When is it required?
When testing larger volumes in need of shorter vacuum pumping time and if longer maintained vacuum is required.

How to use it?
The valve is connected externally, directly between the vacuum pump and the test object. The control signal to the valve is connected to port 9 on the backside of the instrument. See Appendix C for how to connect it.

3. REMOTE CONTROL BOX, WITH START AND RESET

What is it?
An external remote control box for start, reset and abort.

When is it required?
When user wants to start and reset the instrument externally, perhaps at a more ergonomic placement for the user. The box can be placed up to two meters from the instrument.

How to use it?
Connect the control box with the included cable to the RS-232 port. It is then ready to be used. See Appendix C for how to connect it.

4. SMALL VOLUME CHARGING KIT

What is it?
Two (2) needle valves used to reduce the flow of Helium and Nitrogen.

When is it required?
When testing small volumes to increase the sensitivity of test pressure and gas mixture.

How to use it?
The two connection screws for the gas connection plate on the backside of the instrument are replaced by the two needle valves. See Appendix C for how to connect it.

5. INLET REGULATOR WITH FILTER

What is it?
Protects the instrument from unwanted pollution from the inlet air.

When is it required?
When there is a risk of contamination from the compressed air supply, or if the pressure is higher than 6 bar.

How to use it?
The regulator pressure is set to 5-6 bar. See Appendix C for more information.

6. TESTIT DATA COLLECTION SOFTWARE

What is it?
This software enables the user to store test data, export it to Microsoft Access and/or Excel to view, print, or save. The software is required when using a barcode reader.

When is it required?
For test data collection and/or use a barcode reader for data entry.

How to use it?
See separate manual. Only available in English.

7. INLET REGULATOR W/O FILTER (FOR INLET N2/AIR)

What is it?
A pressure regulator for setting the connection pressure with N2 or Air. (port N2)

When is it required?
It is used if the customer has not regulated the pressure to the instrument.

How to use it?
The regulator is set to a pressure that is approximately 10% higher than the instruments working pressure.

8. INLET REGULATOR W/O FILTER (FOR HELIUM INLET)

What is it?
The is a pressure regulator for setting the connection pressure with Helium.

When is it required?
It is used if the customer has not regulated the pressure to the instrument.

How to use it?
The regulator is set to a pressure according to instructions.

4.5 Troubleshooting

Table 4-2 details step faults and causes.

Table 4-2 Statistics Categories

Step	Clarification	Reason
Proof test: object fill	The specified pressure is not obtained during the given timeout period.	Check air supply to CMS.
		Check settings in proof test step.
		Quick connector is not chosen for object with quick connector.
		Big leak in object.
Proof test: pressure drop	The actual pressure drop is greater than the specified drop.	Leaking object or wrong settings.

Table 4-2 Statistics Categories (Continued)

	Turns red even though drop smaller than the specified drop	Venting time to short after proof test. For protection of the vacuum pump there is a limit of 1500 mbar ABS for opening to the vacuum pump.
Evacuation	The specified pressure is not obtained during the given timeout period.	Venturi not enabled for CMS without vacuum pump or vacuum pump not started or damaged.
		Check settings for evacuation step or big leak in object.
	Turns red even though pressure is obtained.	Venting time to short after proof test. For protection of the vacuum pump there is a limit of 1500 mbar ABS for opening to the vacuum pump.
Vacuum decay	The actual pressure drop is greater than the specified drop.	Leaking object or wrong settings.
Charging	The specified pressure is not obtain during the given timeout period.	Check gas supply and settings for charging step.
Charge completed	The color for the steps turns purple – the specified pressure drop is greater than the specified pressure drop.	Check settings or leaking object.
Cleaning steps	Only step 1 is enabled and the vent valve is open.	The object have not been contaminated with the gas mixture due to charging not enabled or proof test or evacuation steps have failed.
	Cleaning steps becomes red and the cleaning sequential is aborted	Check settings for the cleaning sequence.

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Appendix A. Charging Flowchart

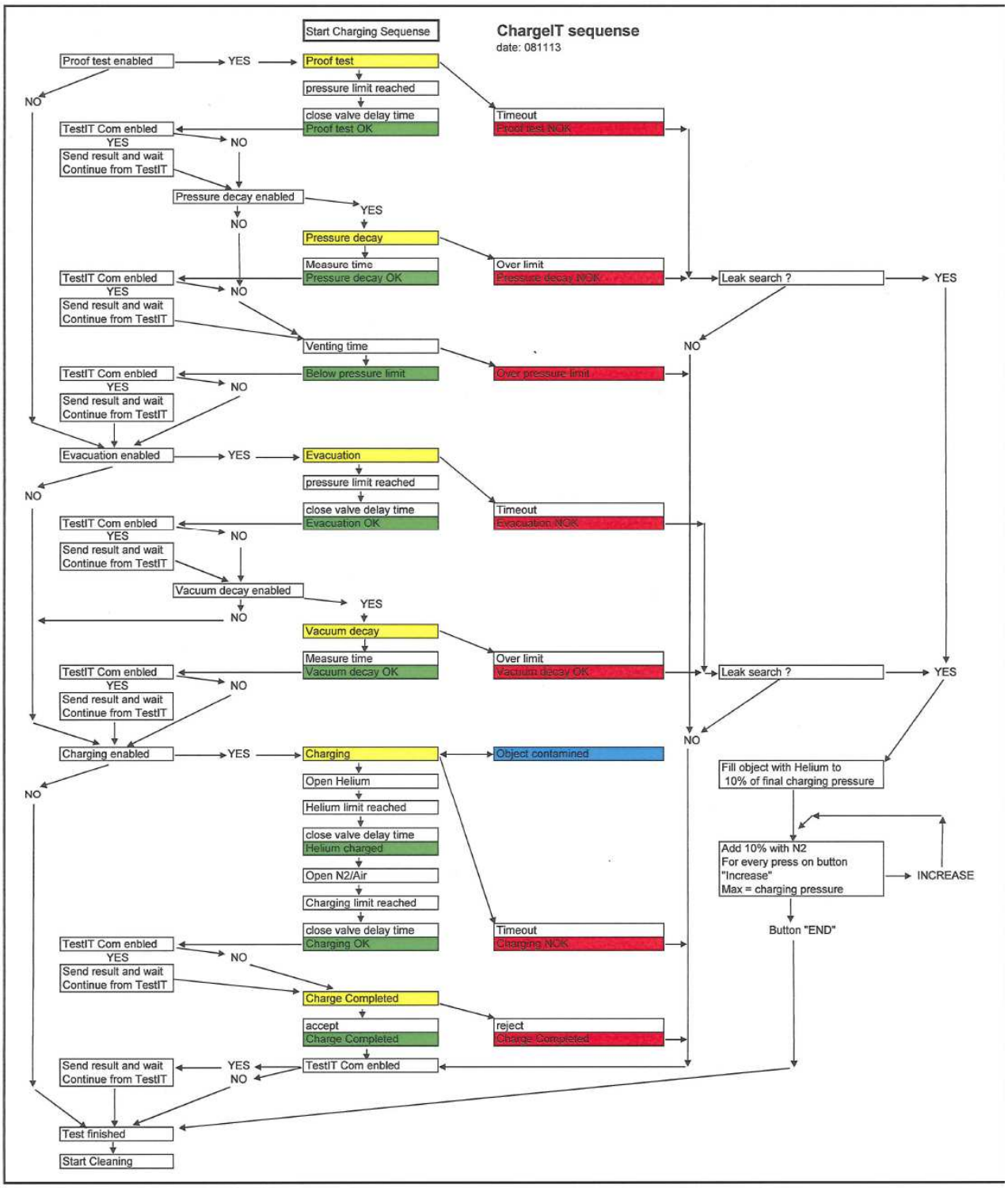

Figure A-1 Charging Flowchart

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Appendix B. Cleaning Flowchart

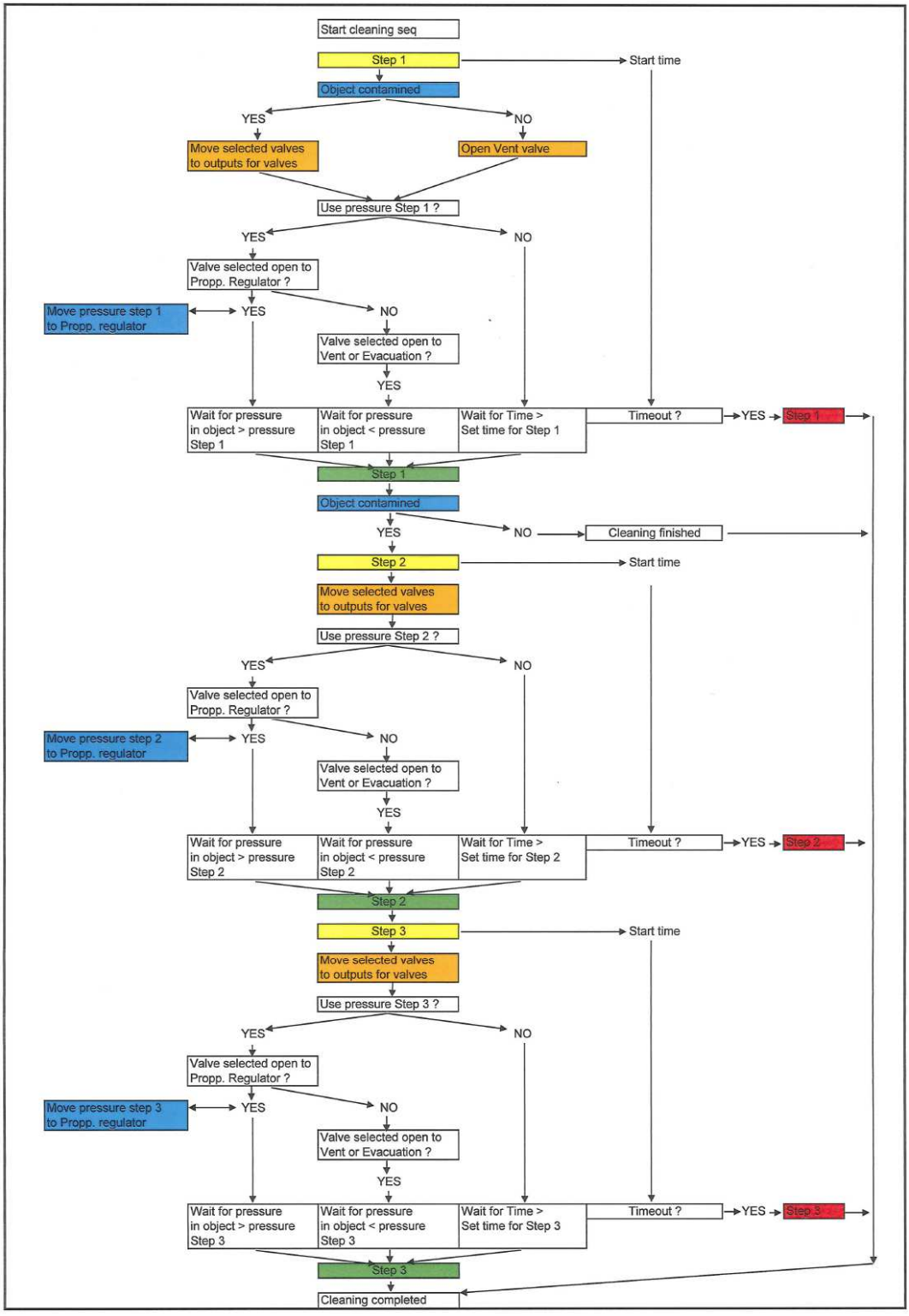

Figure B-1 Cleaning Flowchart

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Appendix C. Connecting Instructions

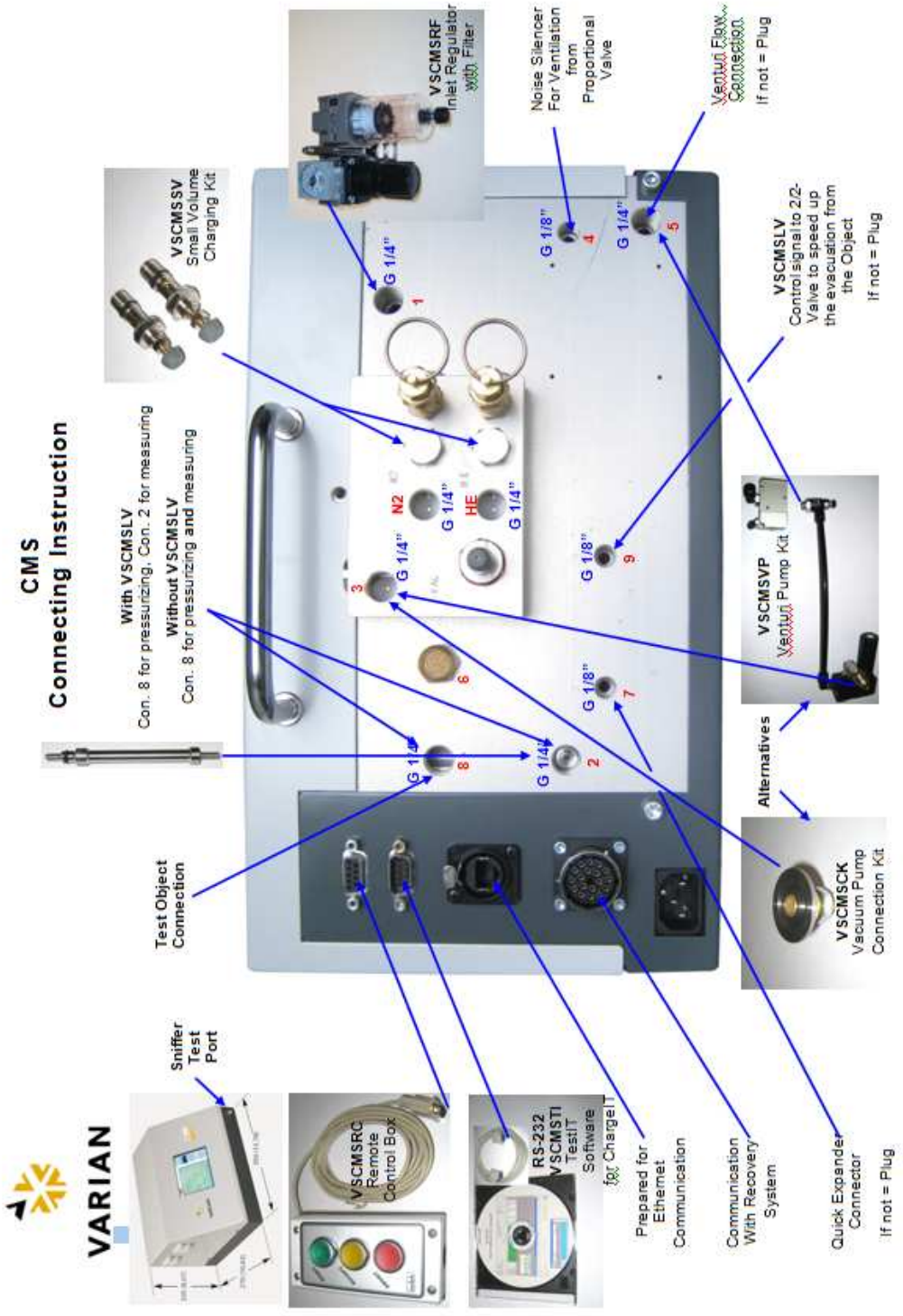

Figure C-1 Connecting Instructions

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Appendix D. Vacuum and Pressure Conversion Tables

Vacuum Conversion Table

mbar	torr	PSI	kPa
10	7.50	0.15	1.00
20	15.00	0.29	2.00
30	22.50	0.44	3.00
40	30.00	0.58	4.00
50	37.50	0.73	5.00
60	45.00	0.87	6.00
70	52.50	1.02	7.00
80	60.00	1.16	8.00
90	67.51	1.31	9.00
100	75.01	1.45	10.00
110	82.51	1.60	11.00
120	90.01	1.74	12.00
130	97.51	1.89	13.00
140	105.01	2.03	14.00
150	112.51	2.18	15.00
160	120.01	2.32	16.00
170	127.51	2.47	17.00
180	135.01	2.61	18.00
190	142.51	2.76	19.00
200	150.01	2.90	20.00
210	157.51	3.05	21.00
220	165.01	3.19	22.00
230	172.51	3.34	23.00
240	180.01	3.48	24.00
250	187.52	3.63	25.00
260	195.02	3.77	26.00
270	202.52	3.92	27.00
280	210.02	4.06	28.00
290	217.52	4.21	29.00
300	225.02	4.35	30.00
310	232.52	4.50	31.00
320	240.02	4.64	32.00
330	247.52	4.79	33.00
340	255.02	4.93	34.00
350	262.52	5.08	35.00
360	270.02	5.22	36.00
370	277.52	5.37	37.00
380	285.02	5.51	38.00
390	292.52	5.66	39.00
400	300.02	5.80	40.00
410	307.53	5.95	41.00
420	315.03	6.09	42.00
430	322.53	6.24	43.00
440	330.03	6.38	44.00
450	337.53	6.53	45.00
460	345.03	6.67	46.00
470	352.53	6.82	47.00
480	360.03	6.96	48.00
490	367.53	7.11	49.00
500	375.03	7.25	50.00
510	382.53	7.40	51.00
520	390.03	7.54	52.00
530	397.53	7.69	53.00
540	405.03	7.83	54.00
550	412.53	7.98	55.00
560	420.03	8.12	56.00
570	427.54	8.27	57.00
580	435.04	8.41	58.00
590	442.54	8.56	59.00
600	450.04	8.70	60.00
610	457.54	8.85	61.00
620	465.04	8.99	62.00
630	472.54	9.14	63.00
640	480.04	9.28	64.00
650	487.54	9.43	65.00
660	495.04	9.57	66.00
670	502.54	9.72	67.00
680	510.04	9.86	68.00
690	517.54	10.01	69.00
700	525.04	10.15	70.00
710	532.54	10.30	71.00
720	540.04	10.44	72.00

Pressure Conversion Table

PSI	torr	mbar	kPa
1.0	51.71	68.95	6.89
2.0	103.43	137.90	13.79
3.0	155.14	206.84	20.68
4.0	206.86	275.79	27.58
5.0	258.57	344.74	34.47
6.0	310.29	413.69	41.37
7.0	362.00	482.63	48.26
8.0	413.72	551.58	55.16
9.0	465.43	620.53	62.05
10.0	517.15	689.48	68.95
11.0	568.86	758.42	75.84
12.0	620.58	827.37	82.74
13.0	672.29	896.32	89.63
14.0	724.01	965.27	96.53
15.0	775.72	1034.21	103.42
16.0	827.44	1103.16	110.32
17.0	879.15	1172.11	117.21
18.0	930.87	1241.06	124.11
19.0	982.58	1310.00	131.00
20.0	1034.30	1378.95	137.90
21.0	1086.01	1447.90	144.79
22.0	1137.73	1516.85	151.68
23.0	1189.44	1585.79	158.58
24.0	1241.16	1654.74	165.47
25.0	1292.87	1723.69	172.37
26.0	1344.59	1792.64	179.26
27.0	1396.30	1861.58	186.16
28.0	1448.02	1930.53	193.05
29.0	1499.73	1999.48	199.95
30.0	1551.45	2068.43	206.84
31.0	1603.16	2137.38	213.74
32.0	1654.88	2206.32	220.63
33.0	1706.59	2275.27	227.53
34.0	1758.31	2344.22	234.42
35.0	1810.02	2413.17	241.32
36.0	1861.74	2482.11	248.21
37.0	1913.45	2551.06	255.11
38.0	1965.17	2620.01	262.00
39.0	2016.88	2688.96	268.90
40.0	2068.60	2757.90	275.79
41.0	2120.31	2826.85	282.69
42.0	2172.03	2895.80	289.58
43.0	2223.74	2964.75	296.47
44.0	2275.46	3033.69	303.37
45.0	2327.17	3102.64	310.26
46.0	2378.89	3171.59	317.16
47.0	2430.60	3240.54	324.05
48.0	2482.32	3309.48	330.95
49.0	2534.03	3378.43	337.84
50.0	2585.75	3447.38	344.74
51.0	2637.46	3516.33	351.63
52.0	2689.18	3585.27	358.53
53.0	2740.89	3654.22	365.42
54.0	2792.61	3723.17	372.32
55.0	2844.32	3792.12	379.21
56.0	2896.04	3861.07	386.11
57.0	2947.75	3930.01	393.00
58.0	2999.47	3998.96	399.90
59.0	3051.18	4067.91	406.79
60.0	3102.90	4136.86	413.69
61.0	3154.61	4205.80	420.58
62.0	3206.33	4274.75	427.48
63.0	3258.04	4343.70	434.37
64.0	3309.76	4412.65	441.26
65.0	3361.47	4481.59	448.16
66.0	3413.19	4550.54	455.05
67.0	3464.90	4619.49	461.95
68.0	3516.62	4688.44	468.84
69.0	3568.33	4757.38	475.74
70.0	3620.05	4826.33	482.63
71.0	3671.76	4895.28	489.53
72.0	3723.48	4964.23	496.42

PSI	torr	mbar	kPa
102.0	5274.92	7032.65	703.27
103.0	5326.64	7101.60	710.16
104.0	5378.35	7170.55	717.05
105.0	5430.07	7239.50	723.95
106.0	5481.78	7308.44	730.84
107.0	5533.50	7377.39	737.74
108.0	5585.21	7446.34	744.63
109.0	5636.93	7515.29	751.53
110.0	5688.64	7584.23	758.42
111.0	5740.36	7653.18	765.32
112.0	5792.07	7722.13	772.21
113.0	5843.79	7791.08	779.11
114.0	5895.50	7860.03	786.00
115.0	5947.22	7928.97	792.90
116.0	5998.93	7997.92	799.79
117.0	6050.65	8066.87	806.69
118.0	6102.36	8135.82	813.58
119.0	6154.08	8204.76	820.48
120.0	6205.79	8273.71	827.37
121.0	6257.51	8342.66	834.27
122.0	6309.22	8411.61	841.16
123.0	6360.94	8480.55	848.06
124.0	6412.65	8549.50	854.95
125.0	6464.37	8618.45	861.84
126.0	6516.08	8687.40	868.74
127.0	6567.80	8756.34	875.63
128.0	6619.51	8825.29	882.53
129.0	6671.23	8894.24	889.42
130.0	6722.94	8963.19	896.32
131.0	6774.66	9032.13	903.21
132.0	6826.37	9101.08	910.11
133.0	6878.09	9170.03	917.00
134.0	6929.80	9238.98	923.90
135.0	6981.52	9307.92	930.79
136.0	7033.23	9376.87	937.69
137.0	7084.95	9445.82	944.58
138.0	7136.66	9514.77	951.48
139.0	7188.38	9583.72	958.37
140.0	7240.09	9652.66	965.27
141.0	7291.81	9721.61	972.16
142.0	7343.52	9790.56	979.06
143.0	7395.24	9859.51	985.95
144.0	7446.95	9928.45	992.85
145.0	7498.67	9997.40	999.74
146.0	7550.38	10066.35	1006.63
147.0	7602.10	10135.30	1013.53
148.0	7653.81	10204.24	1020.42
149.0	7705.53	10273.19	1027.32
150.0	7757.24	10342.14	1034.21
151.0	7808.96	10411.09	1041.11
152.0	7860.67	10480.03	1048.00
153.0	7912.39	10548.98	1054.90
154.0	7964.10	10617.93	1061.79
155.0	8015.82	10686.88	1068.69
156.0	8067.53	10755.82	1075.58
157.0	8119.25	10824.77	1082.48
158.0	8170.96	10893.72	1089.37
159.0	8222.68	10962.67	1096.27
160.0	8274.39	11031.61	1103.16
161.0	8326.11	11100.56	1110.06
162.0	8377.82	11169.51	1116.95
163.0	8429.54	11238.46	1123.85
164.0	8481.25	11307.40	1130.74
165.0	8532.97	11376.35	1137.64
166.0	8584.68	11445.30	1144.53
167.0	8636.40	11514.25	1151.42
168.0	8688.11	11583.20	1158.32
169.0	8739.83	11652.14	1165.21
170.0	8791.54	11721.09	1172.11
171.0	8843.26	11790.04	1179.00
172.0	8894.97	11858.99	1185.90
173.0	8946.69	11927.93	1192.79

PSI	torr	mbar	kPa
203.0	10498.13	13996.36	1399.64
204.0	10549.85	14065.31	1406.53
205.0	10601.56	14134.26	1413.43
206.0	10653.28	14203.20	1420.32
207.0	10704.99	14272.15	1427.22
208.0	10756.71	14341.10	1434.11
209.0	10808.42	14410.05	1441.00
210.0	10860.14	14478.99	1447.90
211.0	10911.85	14547.94	1454.79
212.0	10963.57	14616.89	1461.69
213.0	11015.28	14685.84	1468.58
214.0	11067.00	14754.78	1475.48
215.0	11118.71	14823.73	1482.37
216.0	11170.43	14892.68	1489.27
217.0	11222.14	14961.63	1496.16
218.0	11273.86	15030.57	1503.06
219.0	11325.57	15099.52	1509.95
220.0	11377.29	15168.47	1516.85
221.0	11429.00	15237.42	1523.74
222.0	11480.72	15306.37	1530.64
223.0	11532.43	15375.31	1537.53
224.0	11584.15	15444.26	1544.43
225.0	11635.86	15513.21	1551.32
226.0	11687.58	15582.16	1558.22
227.0	11739.29	15651.10	1565.11
228.0	11791.01	15720.05	1572.01
229.0	11842.72	15789.00	1578.90
230.0	11894.44	15857.95	1585.79
231.0	11946.15	15926.89	1592.69
232.0	11997.87	15995.84	1599.58
233.0	12049.58	16064.79	1606.48
234.0	12101.30	16133.74	1613.37
235.0	12153.01	16202.68	1620.27
236.0	12204.73	16271.63	1627.16
237.0	12256.44	16340.58	1634.06
238.0	12308.16	16409.53	1640.95
239.0	12359.87	16478.47	1647.85
240.0	12411.59	16547.42	1654.74
241.0	12463.30	16616.37	1661.64
242.0	12515.02	16685.32	1668.53
243.0	12566.73	16754.26	1675.43
244.0	12618.45	16823.21	1682.32
245.0	12670.16	16892.16	1689.22
246.0	12721.88	16961.11	1696.11
247.0	12773.59	17030.05	1703.01
248.0	12825.31	17099.00	1709.90
249.0	12877.02	17167.95	1716.80
250.0	12928.74	17236.90	1723.69
251.0	12980.45	17305.85	1730.58
252.0	13032.17	17374.79	1737.48
253.0	13083.88	17443.74	1744.37
254.0	13135.60	17512.69	1751.27
255.0	13187.31	17581.64	1758.16
256.0	13239.03	17650.58	1765.06
257.0	13290.74	17719.53	1771.95
258.0	13342.46	17788.48	1778.85
259.0	13394.17	17857.43	1785.74
260.0	13445.89	17926.37	1792.64
261.0	13497.60	17995.32	1799.53
262.0	13549.32	18064.27	1806.43
263.0	13601.03	18133.22	1813.32
264.0	13652.75	18202.16	1820.22
265.0	13704.46	18271.11	1827.11
266.0	13756.18	18340.06	1834.01
267.0	13807.89	18409.01	1840.90
268.0	13859.61	18477.95	1847.80
269.0	13911.32	18546.90	1854.69
270.0	13963.04	18615.85	1861.58
271.0	14014.75	18684.80	1868.48
272.0	14066.47	18753.74	1875.37
273.0	14118.18	18822.69	1882.27
274.0	14169.90	18891.64	1889.16

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VARIAN

IMPORTANT
Instructions for returning products

Dear Customer,

Please follow these instructions whenever one of our products needs to be returned:

1. Complete the *Request for Return* form on our website (www.varianinc.com) and send it to Varian (see below), taking particular care to identify all products that have pumped or been exposed to any toxic or hazardous materials.
2. After evaluating the information, Varian will provide you with a Return Authorization (RA) number via email or fax, as requested.

   Note: Depending on the type of return, a Purchase Order may be required at the time the Request for Return is submitted. We will quote any necessary services (evaluation, repair, special cleaning, e.g.).
3. **Important steps for the shipment of returning product**:
   - ❑ Remove all accessories from the core product (e.g. inlet screens, vent valves).
   - ❑ Prior to shipment, drain any oils or other liquids, purge or flush all gasses, and wipe off any excess residue.
   - ❑ If ordering an Advance Exchange product, **use the packaging from the Advance Exchange to return the defective product**.
   - ❑ Seal the product in a plastic bag, and package the product carefully to avoid damage in transit. You are responsible for loss or damage in transit.
   - ❑ Varian, Inc. is not responsible for returning customer provided packaging or containers.
   - ❑ **Clearly label package with the RA number.** Using the shipping label provided ensures the proper address and RA number are on the package. Packages shipped to Varian without an RA clearly written on the outside cannot be accepted and will be returned.
4. Return only products for which the RA was issued.
5. **Product being returned under an RA must be received within 15 business days**.
6. **Ship to the location specified on the printable label, which will be sent, along with the RA number, as soon as we have received all of the required information.** Customer is responsible for freight charges on returning product.
7. Return shipments must comply with all applicable **Shipping Regulations** (IATA, DOT, etc.) and carrier requirements.

Return the completed request for return form to your nearest location:

North America:	Europe:	Pacific Rim:
FAX: 1-781-860-9252	FAX: 00 39-011-9979125	
Toll Free: 800-8VARIAN	Fax Free: 00 800 345 345 00	Please visit our website for individual office information.
(800-882-7426	Toll Free: 00 800 234 234 00	
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