

# Temescal

## FerroVac Vacuum Controller User Manual



**FerroTec**



Revision E, February, 2020

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## Revision History

### 0101-9036-0

Rev.	Description	Application/Reason for Change	Date	Appvd. By
A	First published version of manual	--	Oct. 2017	IA
B	Reorganized section structure to allow more logical coverage of multiple types of high-vacuum pumps. Created new Section 4, which describes configuration procedures that do not vary depending on high-vacuum pump selection; new Section 5 to cover configuration and operational procedures specific to systems with on-board cryopumps; Section 6 to cover the same material for systems with off-board cryopumps; and Section 7 to cover the same material for systems with turbo pumps without turbo-isolation valves. Sections 1-3 revised as needed in connection with UI changes mainly pertaining to the addition of non-iso turbopump functionality. Former Section 7, covering Troubleshooting renumbered as Section 8.	Applies to software Rev. 1.8.12, which extended FerroVac functionality to include control of turbo pumps without hi-vac pump iso valves.	Sept. 2018	IA
C	Reversed the order of former Sections 2 and 3. Added section 3.9 to describe the new Backup and Restore function. Revised sections 4.3 through 4.6 consistent with the revised order of Configuration mode screens. Reversed the order of former sections 4.7 and 4.8 to improve continuity. Added new section 4.8.2 to describe configuration and use of new on-screen buttons. Added Section 8 to cover diffusion pump configuration and operation and Section 9 to cover the new dome rotation control option.	Applies to software Rev. 3.9.0, which extended FerroVac functionality to include control of diffusion pumps. Other new functions include Backup and Restore, user-configured on-screen buttons, and dome rotation control.	Sept. 6, 2019	IA
D	Added new Sections 9 and 10, covering system types Onboard + Load Lock and Offboard + Load Lock. Renumbered former Sections 9 and 10 as Sections 11 and 12. Revised cross-references in other Sections as necessary.	Applies to software Rev. 3.9.3, which implemented FerroVac support for cryopump-based systems with load-lock valves.	Sept. 27, 2019	IA
E	Added new Section 12 to describe configuration and operation of the heater control function. Renumbered former Section 12 as Section 13. Updated Section 11 to cover UI changes implemented in software Rev. 3.9.5.	Applies to all units with software Rev. 3.9.5, which implemented substrate heater control	February, 2020	IA

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## Terms and Conditions

**1. Delivery.** Unless otherwise stated, shipments of Ferrotec Temescal Electron Beam Gun and Systems products quoted and/or produced at the Livermore, CA factory site will be made Ex-Works, Livermore, CA Incoterms. Shipping date as are approximate and are based on conditions at the time of acceptance and prompt receipt of all necessary information from the Buyer. Pro- Rata payments shall become due as shipments are made. Items held of Buyer shall be at the risk and expense of the Buyer.

**2. Title.**

- A. This subsection applies in jurisdictions where the laws provides a purchase-money security interest, or similar rights, in favor of the seller, including but not limited to the U.S., Canada, and Mexico: Title and risk of loss or damage passes to Buyer when the goods are put into possession of the freight carrier for delivery to Buyer. Seller retains a security interest in the goods to ensure payment in full. Buyer agrees not to take any action with respect to the goods that would interfere with Seller's security interest until the goods are fully paid for.
- B. This sub-section applies in all other jurisdictions: Risk of loss or damage passes to Buyer when the goods are put into possession of the freight carrier for delivery to Buyer. Seller retains sufficient title in the goods to ensure the goods are fully paid for. Buyer agrees not to take any action with respect to the goods that would interfere with Seller's title until the goods are fully paid for.

**3. Delays in Deliveries.** Seller shall not be liable for failure to fill any order when due to: fires; riots; strikes; freight embargoes or transportation delays; shortage of labor; inability to secure fuel, material, supplies or power at current price or on account of shortages thereof; acts of God or of the public enemy; any existing or future laws or acts of the federal or of any state or local government (including specifically but not exclusively any orders, rules or regulations issued by an official or agency of any such government) affecting the conduct of Seller's business with which Seller in its judgment and discretion deems it advisable to comply as a legal or patriotic duty; or to any cause beyond Seller's reasonable control. Seller is not liable for damages attributed to delays in delivery.

**4. Taxes.** Prices quoted herein shall be subject to an additional charge to cover any existing or future Manufacturers, Sales, Use, Value Added or similar tax which may be applicable and any administrative costs for required governmental permits, inspections and the life.

**5. Special Order Equipment.** Where buyer shall furnish special order equipment, Buyer shall bear the cost of alterations made thereon, except such as Seller may make for its own convenience. Buyer shall furnish drawings and specific information as to variations permissible between equipment and drawings. Shipping and crating charges on said equipment to and from Seller's facilities shall be borne by buyer. Seller shall have no responsibility for loss or damage to said equipment, except when due to careless handling or negligence on the part of Seller. Cost of insurance on special orders will be borne by buyer, and same are held at Buyer's risk.

**6. Seller's Warranty.** Seller's standard published warranty in effect at the time of shipment for the particular product shall apply. THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, INCLUDING THE WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Seller's liability shall not in any case exceed the cost of repair or replacement of any defective product as stated in the warranty and upon expiration of the warranty period all such liability shall terminate. Seller shall in no event be liable for consequential damages of any kind.

**7. Changes and Acceptance.** Any changes in drawings specifications or in their Terms and Conditions will require Seller's written approval before they become binding.

**8. Cancellations.** The following schedule of cancellation charges shall apply:

A. Cancellations:

i. For custom/modified products:

<u>When cancellation notice received:</u>	<u>Charge is:</u>
1-30 days prior to shipment	100% of product sales price
31-60 days prior to shipment	75% of product sales price
61-90 days prior to shipment	50% of product sales price
91 days or more prior to shipment	10% of product sales price

ii. For standard products: To be negotiated

B. Reschedules:

- i. For completed custom/modified product rescheduled 1.5% per month x sales price of product
- ii. Incomplete custom/modified product, parts rescheduled 1.5% per month x sales price of products which are stocked or ordered.
- iii. Restocking: Only standard products may be restocked. 25% of dollar value returned to Seller's stock, plus all freight charges. All restocking is subject to Seller's approval and inspection.

**9. Payment.** The terms of payment of items quoted herein shall be: cash in advance or net 30 upon credit approval unless otherwise agreed in writing. If at any time, in the judgment of the Seller, Buyer's credit shall be impaired, Seller shall have the right to demand immediate cash payment and to refuse to make delivery except against payment therefore in cash.

**10. No implied License.** The sale of any product or material quoted herein does not give or imply any right or license to buyer to analyze or manufacture such product or material or to claim Buyer is an authorized re-seller of such material.

**11. Export Licenses.** Items quoted herein may constitute a controlled commodity requiring export licenses from the U.S. Department of Commerce prior to transshipment. Buyer shall be responsible for obtaining any such licenses required.

**12. Exclusive Statement.** The terms and conditions contained in Seller's Order Acknowledgement will be the complete and exclusive statement of the terms of agreement between the parties. If the terms of said Acknowledgement differ in any way from the terms of Buyer's order, the provisions of said Acknowledgement shall prevail and be controlling.

**13. State Laws.** This contract shall be governed in all respects by the laws of the State of New Hampshire and the State of California.

**14. This contract is governed by Incoterms 2010.**

FERROTEC (USA) CORPORATION'S ACCEPTANCE OF THE REFERENCED PURCHASE ORDER IS EXPRESSLY MADE CONDITIONAL ON THE PARTY'S ASSENT (WHO SUBMITTED THE REFERENCED PURCHASE ORDER) TO FERROTEC'S ADDITIONAL OR DIFFERENT TERMS IN THIS ORDER ACKNOWLEDGEMENT. IF NO ANSWER IS RECEIVED FROM THE PARTY SUBMITTING THE REFERENCED PURCHASE ORDER WITHIN A REASONABLE TIME AFTER RECEIPT OF THIS ORDER ACKNOWLEDGEMENT, IT WILL BE ASSUMED THAT THEIR INCLUSION HAS BEEN ASSENTED TO.

## Limited Warranty

1. **Parties Covered.** This limited warranty is given by Ferrotec (USA) Corporation hereinafter called the “Warrantor” to the buyer of the above described item(s) and extends to Buyer only and is not transferable to nor enforceable by any transferee, subsequent purchaser or successor of buyer.
2. **Term of Limited Warranty.** The term of this limited warranty shall be one year from the date of shipment of the above items(s). Warrantor shall not have liability or responsibility under this limited warranty or under any warranties implied by law or otherwise, for defects ensuring or claims asserted after the expiration of the term of this Limited Warranty.
2. **Limitations of warranties.** The only express or implied warranties of Warrantor are those expressed in this instrument.
  - A. WITHOUT LIMITATION, WARRANTOR HEREBY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE EXPRESS WARRANTIES SET FORTH HERIN. THE TERM OF ANY WARRANTY OR WARRANTOR IMPLIED BY LAW SHALL END ON THE TERMINATION DATE OF THIS LIMITED WARRANTY SPECIFIED IN SECTION 2.
  - B. Warranty duration for out of warranty items repaired by Ferrotec shall be ninety (90) days from date of shipment post repair “Ex-works”.
4. **Warranty Coverage.** Subject to the exclusions set forth in Section 5, the item(s) described above is/(are) warranted against defects in material or workmanship. Warrantor shall, at its option, repair or replace at its cost any defective item during the warranty period. Warrantor may repair the item at any of its worldwide service locations.
5. **Exclusions from coverage.** Warrantor expressly disclaims responsibility for any of the following, each of which is expressly EXCLUDED from this limited warranty.
  - A. Ordinary wear and tear, damage or defects due to abuse, misuse, failure to use according to instruction, or exposure to temperatures and conditions in excess of those referred to in the Notes and instructions delivered herewith. If different operating temperatures or conditions are specified in documentation specific to your product, these supersede those on the enclosed Notes and instructions.
  - B. Damage or defects caused by Acts of God, the elements, natural disasters, or by the wrongful or negligent act or omission of anyone other than the Warrantor.
  - C. Damage or defects to any product disassembled, modified, repaired or replaced by any party other than the warrantor or its expressed authorized representative, whether or not damage was caused by said disassembly or modification.
  - D. Incidental, consequential or special damages of any kind.
6. **Claims Procedure.** Buyer shall promptly notify warrantor in writing of a claim under this Limited Warranty or any warranty implied by law. Buyer is responsible for freight charges for shipment of product to Warrantor. Warrantor will pay for the freight charges for shipment of product back to Buyer where the product is found to be defective.
7. **Severability: No Waiver.** In the event any of the provisions hereof shall be invalid, the remainder of the provisions of this Limited Warranty shall remain in full force and effect. No waiver by Warrantor of the provisions hereof at any time shall constitute a waiver of any such provisions at any subsequent time or of any other provisions at any time.

## Safety Instructions for Operating and Service Personnel

Operators and service personnel should always wear safety glasses. Operators shall not enter areas intended for service access only. Only experienced service personnel should enter such areas, and only after taking the preliminary precautions described in paragraphs 1 through 11 below.

### DANGER

**Potentially lethal voltages may exist within this unit, even with the line power switched off. Service should only be attempted by qualified personnel. Failure to observe all safety precautions may result in personal injury.**

This component is designed to operate as part of a system containing high-voltage equipment. Observe the precautions described below when servicing this system, especially when servicing components where high voltages may be present.

1. Before servicing or operating this equipment, read all the component manuals supplied with the system, paying special attention to safety instructions.
2. Post HIGH VOLTAGE WARNING signs in conspicuous locations within the service area.
3. Remove rings, watches, bracelets, and any other metal jewelry before working around high voltage.
4. DO NOT WORK ALONE!
5. Be sure that all equipment is connected to a power receptacle having the correct polarity and grounding, as prescribed by the local electrical codes. Refer to the power supply portion of the documentation to determine the proper electrical ground for high-voltage components.
6. Before servicing any high-voltage component, switch off the electrical power at the component's main power switch. This switch should have a lockout feature. Lock the power off and keep the key with you while you are working on the equipment.
7. Certain electrical parts (e.g., electrolytic capacitors) hold a lethal voltage even after the power is switched off. Before entering any service area, use a grounding hook to discharge such parts. Be sure that these parts are discharged before starting any repairs.
8. DO NOT touch high-voltage leads unless power is off and a grounding hook is connected to the parts to be serviced.
9. The high-voltage components of the system should be equipped with electrical interlocks to protect personnel from injury. DO NOT ATTEMPT TO DEFEAT, OVERRIDE, OR BYPASS THESE PROTECTIVE DEVICES!
10. Never leave loose ends on high-voltage connections.
11. Observe the following warning if the system employs Radio Frequency (RF) power.

### DANGER

**RF radiation—even at modest power levels—can cause serious injury. If any of the RF components (e.g., the RF power supply, the RF matching network, or the RF electrodes or shielding inside the product chamber) are moved or changed in any way, the RF energy may be radiated outside the equipment. Monitor the equipment to assure that external RF radiation is below the levels prescribed by any and all applicable safety codes.**

## **Special Amendment for United Kingdom Users**

### **All Electrical Power Sources: Safety Precautions**

This component is designed to be used in an extra-high-voltage system. Only authorized personnel should be permitted to carry out work on this system.

Prior to any servicing, grounding hooks should be used to short out all high-voltage parts and conductors in both the vacuum system and the high-voltage power supply. Screens protecting extra-high-voltage conductors should be removed only if appropriate action has been taken to ensure that extra-high-voltage conductors are dead and cannot be reenergized inadvertently.

In addition, all personnel should be aware of:

1. The Electricity (Factories Act) Special Regulations (1908 and 1944), in particular, Regulations 18(d) and 28 of the 1980 Regulations, as amended; and
2. The employer's responsibility to set up suitable systems to safeguard the health and safety of employees, according to the Health & Safety at Work etc. Act (1974).



## **User Responsibility**

This equipment will perform in accordance with the instructions and information contained in the user's manual and its referenced documents when such equipment is installed, operated, and maintained in compliance with such instructions. The equipment must be checked periodically. Defective equipment shall not be used. Parts that are broken, missing, plainly worn, distorted, or contaminated, shall be replaced immediately. Should such repair or replacement become necessary, a telephone or written request for service should be made to Temescal, Livermore, CA, a division of Ferrotec (USA) Corp.

The equipment, or any of its parts, shall not be altered without the prior written approval of Temescal. The user and/or purchaser of this equipment shall have the sole responsibility for any malfunction which results from improper use, faulty maintenance, damage, improper repair, or alteration by any party other than Temescal.

## **Guidelines and Good Practices**

1. Follow applicable clean room procedures (smocks, masks, gloves, etc.).
2. Do not expose the vent and purge valves to excessive pressures. The nitrogen line regulator is factory set at 15 psi and must not be adjusted above 20 psi.
3. PRevFnt oil, grease, water, sweat, etc. from getting into the vacuum chamber.
4. Replace the source tray shield correctly to ensure that the ceramic parts or the high voltage feedthroughs are protected from being coated.
5. Clean all mechanical parts and seals with lint-free paper/cloth soaked with isopropyl alcohol (IPA). Dispose all IPA-exposed cleaning paper/cloth in a fireproof container, while ensuring proper safety precautions are being followed.
6. Polish scratched surfaces with Scotch-Brite, taking care not to produce any cross scratches.
7. Shaft seals are all ferromagnetic. No lubrication is required.
8. Check the chamber door's seal and sealing surfaces each time before closing it.
9. Check and clean with IPA the source tray seals and sealing surfaces each time before raising the source tray into place.
10. Train staff by competent personnel. DO NOT allow staff to operate or do maintenance and recovery work on the machine until they are trained by competent personnel.
11. Document all alarms, deviations, breakdowns, and servicings done on either a hardcopy or an electronic equipment-log system.

## Health Hazard

The condensates deposited on the tank walls of a vacuum system are generally in the form of extremely fine particles. The nature, as well as the form, of the materials poses the following potential health hazards:

- a) Inhaling fine particles (powder) may cause damage to the lungs. To help prevent this, wear a protective respirator mask with fine filter that has been approved by the National Institute for Occupational Safety and Health (NIOSH) and the federal Mine Safety and Health Administration (MSHA).
- b) Some substances are toxic and inhaling them should be avoided. Take steps to ascertain whether or not the material being deposited is a known toxic substance. Refer to the Material Safety Data Sheet(s) covering the evaporant(s) in question.
- c) Certain powders (titanium, for instance) can cause flash fires when exposed to oxygen or other oxidizers. Therefore, when opening the chamber door after a deposition cycle, exercise extreme caution and allow time for the coating surface to oxidize. Breakage of some of the more reactive condensates may be hazardous, even when the above precautions are observed. In this situation, fire-protective clothing should be worn.

Certain powders (platinum, for instance) are known to catalyze methyl alcohol vapors upon contact, generating heat in the process and possibly causing a fire to erupt. Therefore, never use methyl alcohol to wipe down or clean any internal tank surfaces of a vacuum system. Use isopropyl alcohol (IPA), instead. Dispose of all IPA-exposed lint-free paper/cloth into a fireproof container, while ensuring all proper safety procedures and precautions are being followed.

# 1

# *Introduction and Product Overview*

---

## **1.1 What's In This Manual?**

This manual is organized into the following sections:

- Section 1: Introduction and Product Overview
- Section 2: Installation and Initial Setup
- Section 3: Operational Overview
- Section 4: Common Configuration Procedures
- Section 5: Onboard Configuration and Operation
- Section 6: Offboard Configuration and Operation
- Section 7: Non-Iso Turbo Configuration and Operation
- Section 8: Diffusion Pump Configuration and Operation
- Section 9: Onboard plus Load Lock Configuration and Operation
- Section 10: Offboard plus Load Lock Configuration and Operation
- Section 11: Implementing Dome Rotation Control
- Section 12: Implementing Substrate Heater Control
- Section 13: Troubleshooting

Section 1 describes the capabilities of the FerroVac vacuum controller and introduces its four operating modes. Section 2 describes installation and initial setup procedures. Section 3 provide an overview of the FerroVac's general operational methods. Section 4 details the configuration procedures that do not vary depending on hi-vac pump selection, while sections 5-10 explain the configuration and operational procedures that are specific to each system type. Sections 11 and 12 describe how to implement dome rotation control and substrate heater control. Section 12 describes how to use the Service mode screens and page 1 of the Details screen to troubleshoot operational problems.

## **1.2 Section Overview**

This section provides a physical description of the FerroVac and an overview of its user interface. The topics covered are:

- Section 1.3 Product Description
  - Section 1.3.1 Applications and Functional Capabilities
  - Section 1.3.2 FerroVac Front and Rear Panel
- Section 1.4 FerroVac Operating Modes
  - Section 1.4.1 Configuration Mode
  - Section 1.4.2 Manual Mode
  - Section 1.4.3 Operations Mode
  - Section 1.4.4 Service Mode
- Section 1.5 FerroVac Screens Accessible in Multiple Operating Modes

## 1.3 Product Description

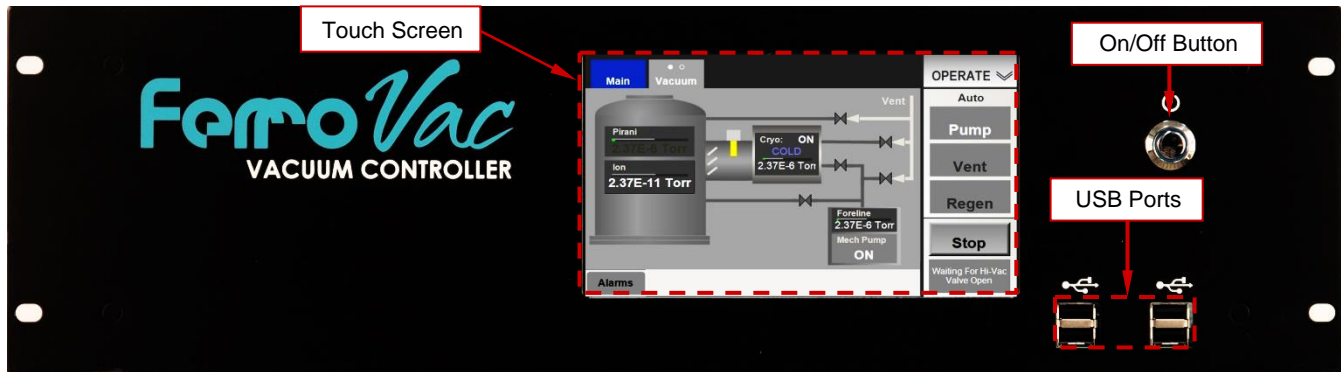
### 1.3.1 Applications and Functional Capabilities

Combining the functions of a vacuum gauge reader with those of a vacuum pump controller/sequencer, the FerroVac offers automated vacuum control for systems currently under manual pumping control. Configurable for on-board and off-board cryopumps as well as non-iso turbo pumps, the FerroVac offers control over the mechanical pump and high-vacuum pumps, up to five vacuum valves, and as many as four vacuum gauges. When configured for a cryopump, the unit also controls the cryo-isolation valve, and it is compatible with any log-linear vacuum gauge.

### 1.3.2 FerroVac Front and Rear Panel

The features on the FerroVac front panel (see Figure 1-1) are the On/Off button, the touch screen, and two USB ports. For an illustration of the rear panel, see Figure 2-2.

Figure 1-1 FerroVac Controller Front Panel



## 1.4 FerroVac Operating Modes

The FerroVac offers four operating modes: Configuration, Manual, Operations, and Service. FerroVac operation in each of these modes is described briefly below. For detailed configuration instructions, see Sections 4-7. For information about FerroVac operation in Manual, Operations, and Service modes, see Sections 5, 6, and 7.

### 1.4.1 Configuration Mode

Figure 1-2 shows the Configuration Mode screens, which enable the user to:

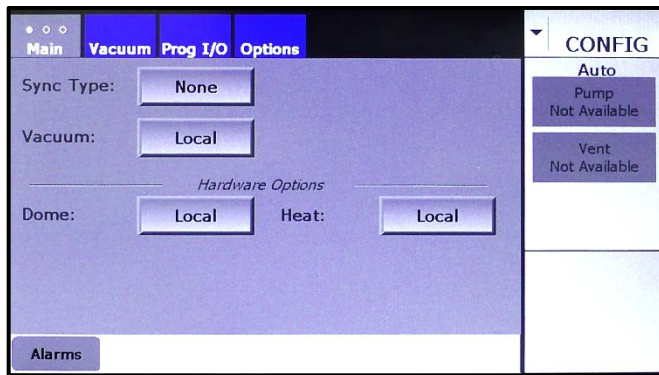
- configure the FerroVac for the system components that it is to control and/or monitor
- enter setpoints for controlled vacuum gauges
- assign triggering conditions for the FerroVac's four programmable outputs
- configure on-screen buttons that enable user control over selected system components
- individually control vacuum gauges, vacuum pumps, and vacuum valves
- implement dome rotation control and substrate heater control
- set the system date and time
- enable the log-in manager and set user passcodes and permissions
- backup and restore user-selected FerroVac files.

For configuration procedures to all FerroVac installations, regardless of hi-vac pump type, see Section 4. For detailed configuration procedures specific to each system type, see:

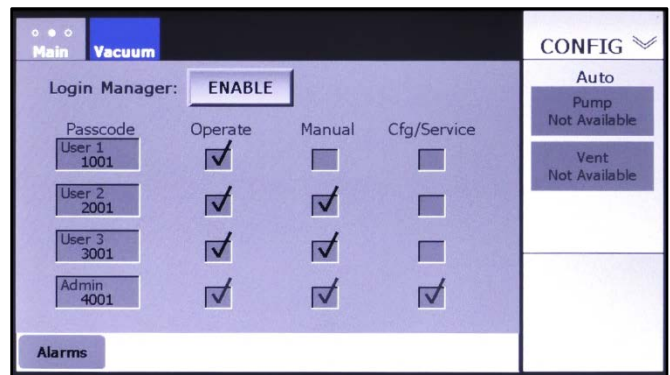
- section 5.2 if the FerroVac is to be used in a system with an Onboard cryopump
- section 6.2 if it is to be used in a system with an Offboard cryopump
- section 7.2 if it is to be used in a system with a non-iso turbo pump
- section 8.2 if it is to be used in a system with a diffusion pump
- section 9.2 if it is to be used in a system with an Onboard cryopump and a load-lock valve
- section 10.2 if it is to be used in a system with an Offboard cryopump and a load-lock valve

**Figure 1-2 Configuration Mode Screens (Unit Configured for an OnBoard Cryopump)**

**Config>Main Screen**



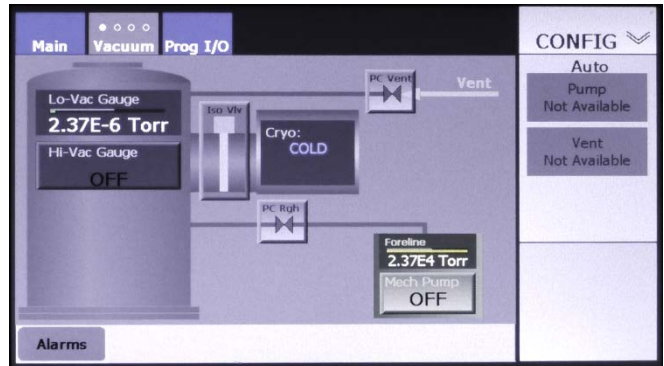
**Login Manager Screen**



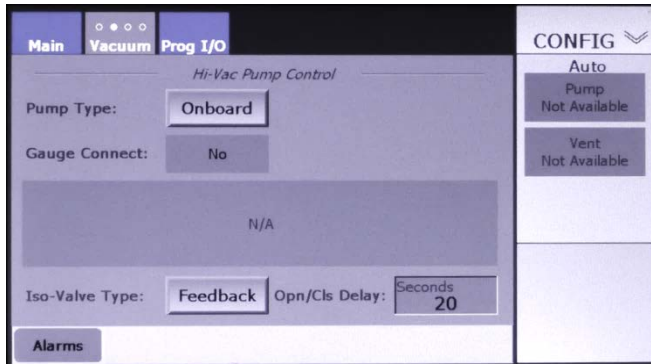
**System Date/Time-Backup/Restore Screen**



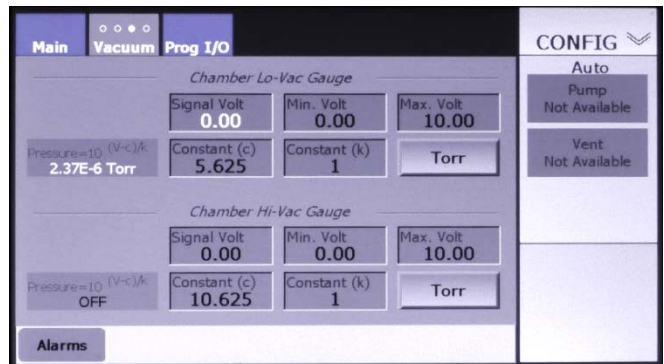
**Config Mode Vacuum Map**

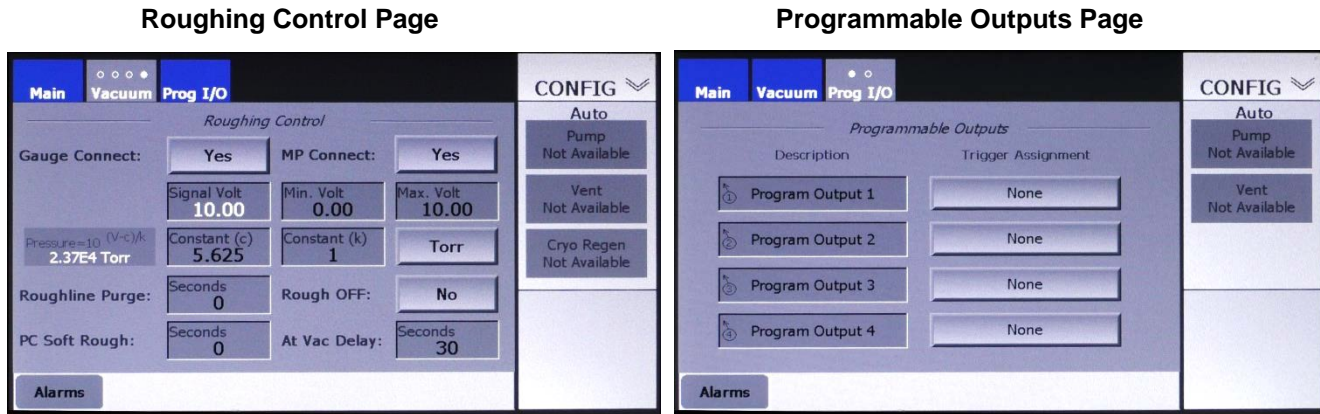


**Hi-Vac Pump Control Page**



**Chamber Vacuum Gauges Page**





## 1.4.2 Manual Mode

Figure 1-3 shows the Manual mode screens when the FerroVac is configured for use with an off-board cryopump. At a general level, Manual mode screens enable the user to:

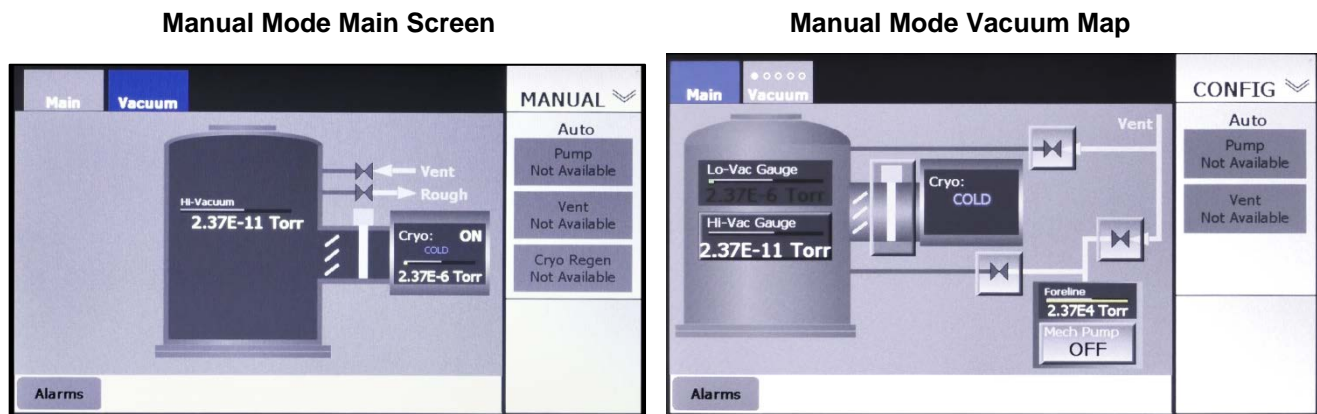
- individually control the connected vacuum pumps, gauges, and valves
- monitor manual and automated vacuum operations in real time

If the unit is configured for use with an off-board cryopump, the Manual>Regen screen (shown in Figure 1-3) enables the user to enter values for parameters governing autoregen operations and to individually control the system components represented on that screen.

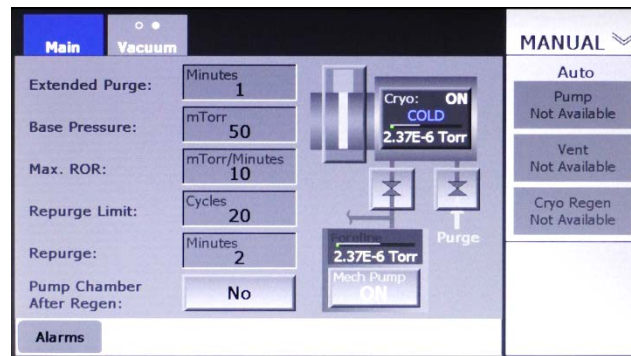
At more detailed level, Manual mode operation varies depending on the selection of the System Type. For specific information on:

- Manual mode operation when the FerroVac is configured for use with an Onboard cryopump, see section 5.3
- Manual mode operation when it is configured for use with an Offboard cryopump, see section 6.3
- Manual mode operation when it is configured for use with a non-iso turbo pump, see section 7.3
- Manual mode operation when it is configured for use a diffusion pump, see section 8.3
- Manual mode operation when it is configured for use an Onboard cryOpump plus a load-lock valve, see section 9.3
- Manual mode operation when it is configured for use an Offboard cryOpump plus a load-lock valve, see section 10.3

Figure 1-3 Manual Mode Screens (Unit Configured for an On-Board Cryopump)



Manual Mode Regen Screen (Appears Only When Unit Is Configured for an Off-Board Cryopump)



### 1.4.3 Operations Mode

Figure 1-4 shows the Operations mode screens the unit is configured for an off-board cryopump. At a general level, Operations Mode screens enable the user to:

- initiate, pause, and abort or resume automated vent and pump operations
- enter values for parameters governing autoregen operations
- monitor autopump and autovent operations in real time

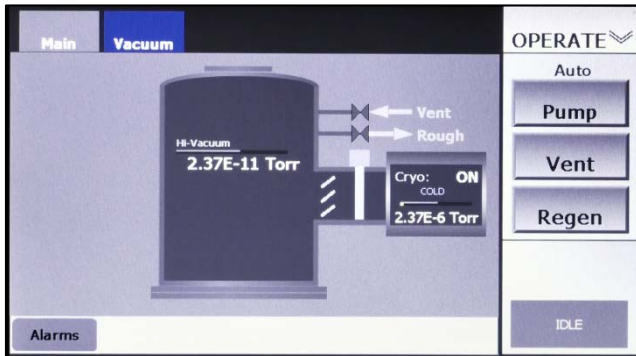
When the FerroVac is configured for use with an off-board cryopump, the Operations>Regen screen shown in Figure 1-4 enables the user to initiate, pause, and abort or resume automated cryo-regen operations and to monitor them in real time. At a more detailed level, FerroVac operation in Operations mode varies depending on the selection of the system type. For specific information on:

- operation in Operations mode when the FerroVac is configured for use with an Onboard cryopump, see section 5.4
- operation in Operations mode when configured for use with an Offboard cryopump, see section 6.4
- operation in Operations mode when configured for use with a non-iso turbo pump, see section 7.4
- operation in Operations mode when configured for use with a diffusion pump, see section 8.4
- operation in Operations mode when configured for use with an Onboard cryopump plus a load-lock valve, see section 9.4

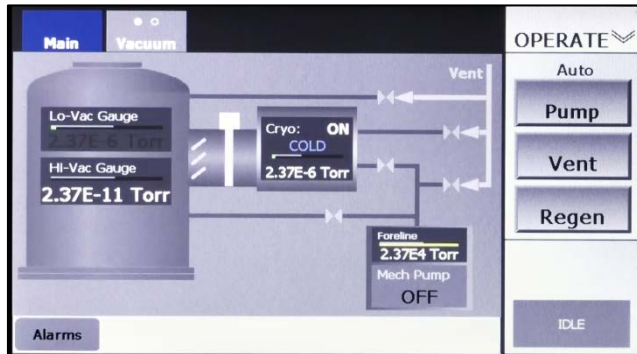
- operation in Operations mode when configured use with for an Offboard cryopump plus a load-lock valve, see section 10.4

**Figure 1-4 Operations Mode Screens (Unit Configured for an Off-Board Cryopump)**

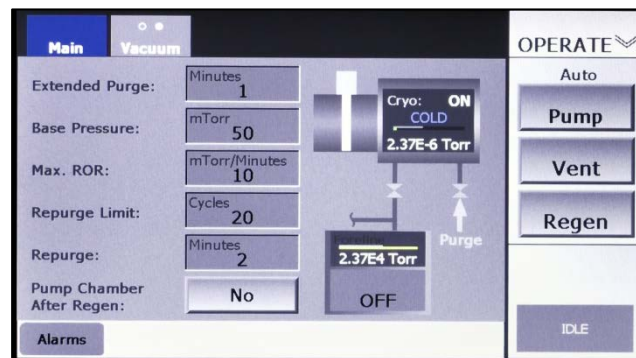
**Operations>Main Screen**



**Operations Mode Vacuum Map**



**Operations Mode Regen Screen**

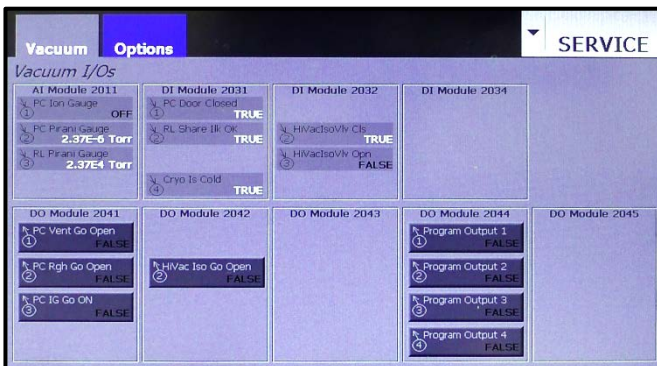


### 1.4.4 Service Mode

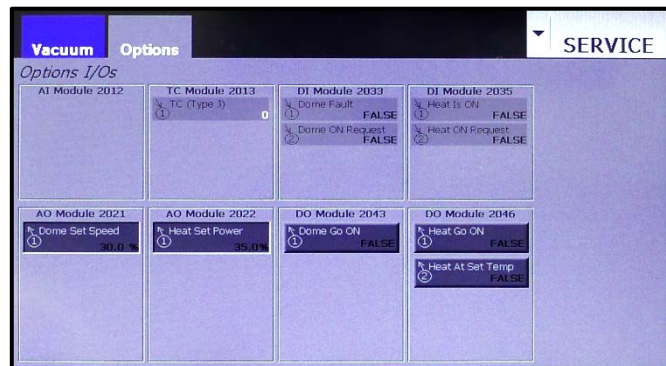
Figure 1-5 shows the Service mode screens. For detailed information about the use of these screens, see section 12.

**Figure 1-5 Service Mode Screens**

**Service>Vacuum I/Os Screen**



**Service>Options I/Os Screen**

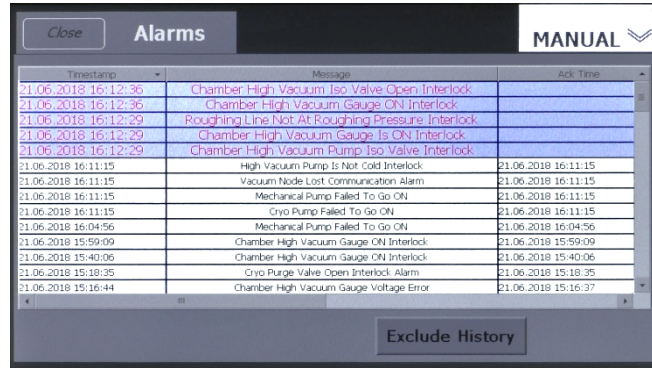




## 1.5 FerroVac Screens Accessible in Multiple Operating Modes

Three FerroVac screens are available in multiple operating modes. These are the Alarms screen (see Figure 1-6) and the two Detail screens (see Figure 1-7).

**Figure 1-6 The Alarms Screen (*Include History Selected*)**

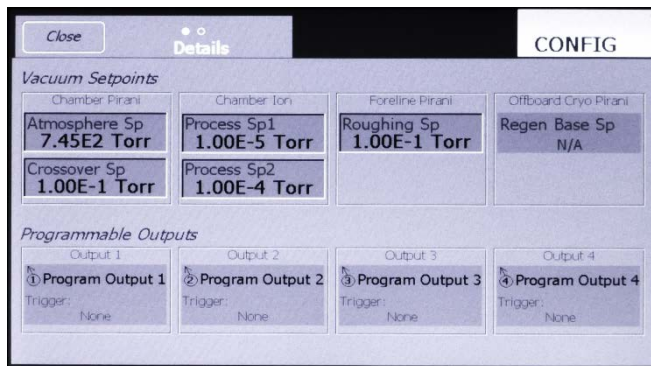


The Alarms screen is accessible in all operating modes except Service mode. The Alarms screen enables the user to acknowledge active alarms and to view active and previously acknowledged alarms. To access this screen from any screen from which it is available, press that screen's **Alarms** button. For detailed information about the Alarms screen and procedures for responding to alarms, see section 3.8.

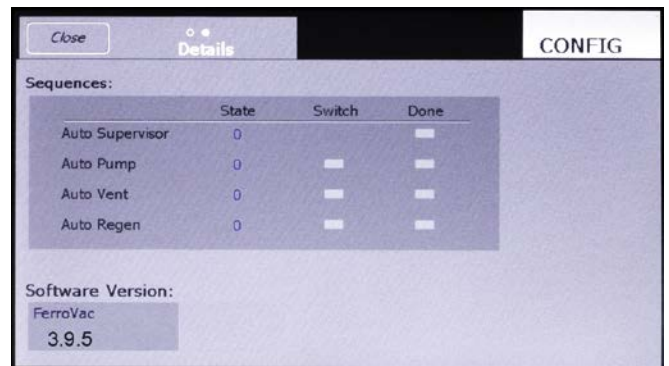
The two-page Details screen is accessible in all modes via the Auxiliary Menu. For information about the use of page 1 of the Details screen in configuration procedures, see section 4.8. For information about the use of page 2 of the Details screen in troubleshooting procedures see section 10.3.

**Figure 1-7 The Details Screen, Pages 1 and 2**

**Details Screen, Page 1**



**Details Screen, Page 2**





# 2 Installation and Initial Setup

## 2.1 Section Overview

This section describes the procedures involved in installing a FerroVac. The topics covered are:

Section 2.2 Unpacking

Section 2.3 Rack Mounting the Controller

Section 2.4 Installing Low-Impedance Grounding Strap

Section 2.5 Installing the I/O Assembly and Making Cable Connections to Controlled/Monitored Components

Section 2.6 Connecting the AC Power Cable and Powering Up the FerroVac

Section 2.7 Initial Setup

Section 2.7.1 Setting the System Date and Time

Section 2.7.2 Enabling the Log-In Manager and Changing User Permissions (Optional)

## 2.2 Unpacking

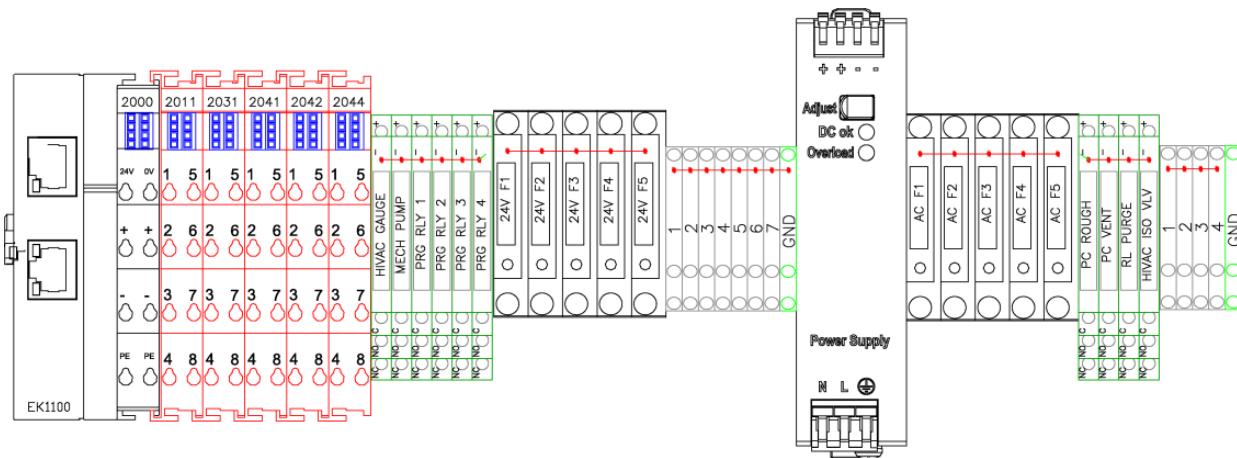
Your package includes the components shown in Figure 2-1:

**Figure 2-1 Items Included in FerroVac Package**



Also provided with the components shown above is an I/O assembly similar to that shown in Figure 2-1.

**Figure 2-2 Typical External I/O Assembly**



The components included in the external I/O assembly vary depending on your system's high-vacuum pump and the options selected.

## 2.3 Rack Mounting the Controller

Using the rack-mounting hardware supplied, install the FerroVac in a standard 19-inch rack.

## 2.4 Installing Low-Impedance Grounding Strap

A coil of .5-in.-wide copper grounding strap (PN 0040-5570-0) is included among the components supplied with the FerroVac. Connect a suitable length of this copper strap to the grounding stud on the FerroVac rear panel (see Figure 2-2) and to the central grounding point of the electronics cabinet in which the unit is installed. This grounding point must be properly connected to a low-impedance ground. For instructions on correctly installing a system low-impedance ground, see sections 2.5.1 and 2.5.2 of your Temescal power supply manual.

## 2.5 Installing the I/O Assembly and Making Cable Connections to Controlled/Monitored Components

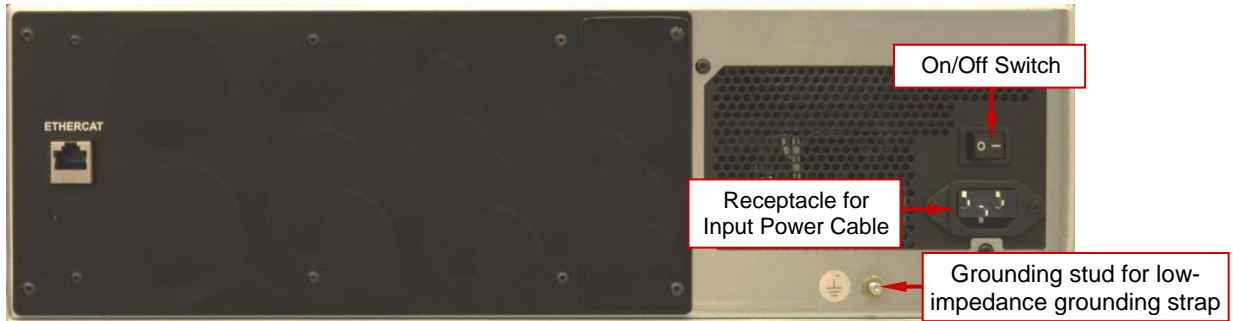
A Temescal Field Service technician will assemble your external I/O assembly, install it in your system, and assist in making connections to the FerroVac controller and to the system components that it controls and monitors, with the exception of the system components connected to the FerroVac through Programmable Relays 1 through 4 (PGM RLY 1 through 4 in Figure 2-1). The customer is responsible for making the latter connections.

## 2.6 Connecting the AC Power Cable and Powering Up the FerroVac

Perform the following procedure to supply AC power to the FerroVac controller.

Step	Action
1	Make sure that the rear-panel On/Off switch (see Figure 2-2) is in the OFF position.

**Figure 2-3 Input Power Cable Receptacle, Rear Panel On/Off Switch, and Low-Z Grounding Stud**

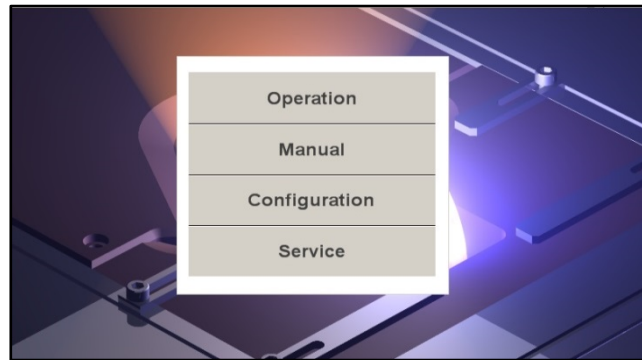


- 2 Plug the unit's power cable into the rear-panel input power receptacle and into a 120 VAC power source.
- 3 Press the rear-panel On/Off switch to put it in the ON position.
- 4 Press the front-panel On/Off button (see Figure 2-3). The unit will then boot up and display the Start screen (see Figure 2-4).

**Figure 2-4 Front Panel On/Off Button**



Figure 2-5 FerroVac Start Screen at Initial Boot-Up



## 2.7 Initial Setup

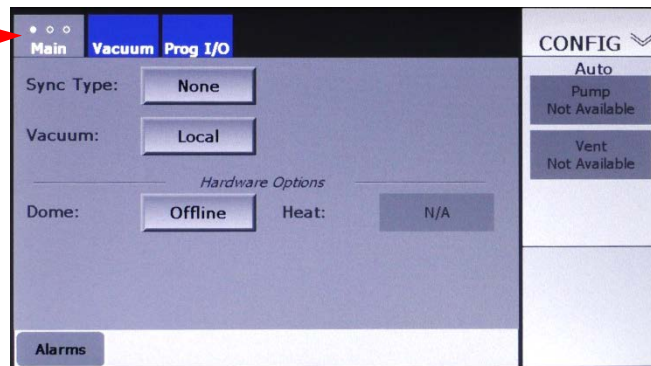
### 2.7.1 Setting the System Date and Time

Perform the following steps to set the system date and time.

- | Step | Action  |
|------|---|
| 1    | Touch the Start screen's <b>Configuration</b> button to display the Config>Main screen, which initially appears as shown in Figure 2-5. |

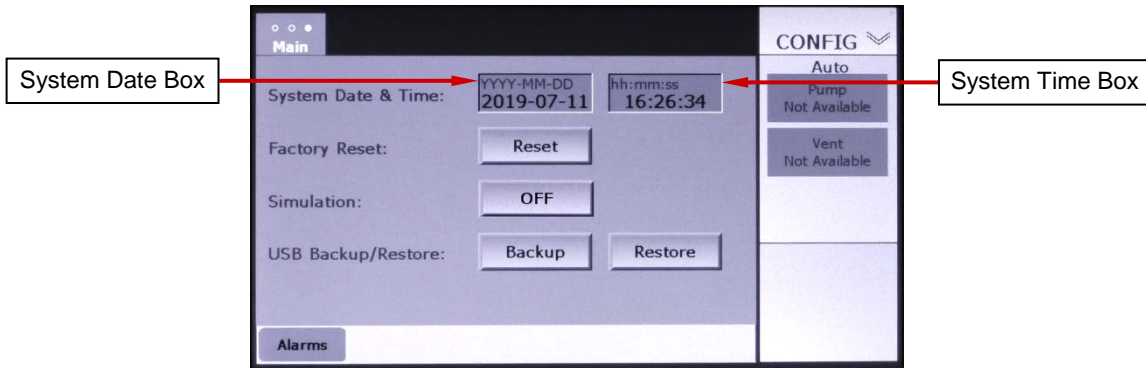
Figure 2-6 Config>Main Screen at Initial Boot-Up

Touch screen tab twice to display the System Date/Time screen.



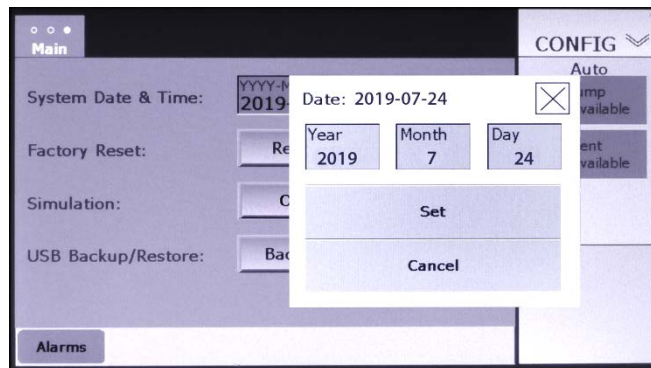
- |   |  |
|---|--|
| 2 | Touch the screen tab twice to display the System Date/Time-Backup/Restore screen (see Figure 2-6). |
|---|--|

Figure 2-7 System Date/Time-Backup/Restore Screen



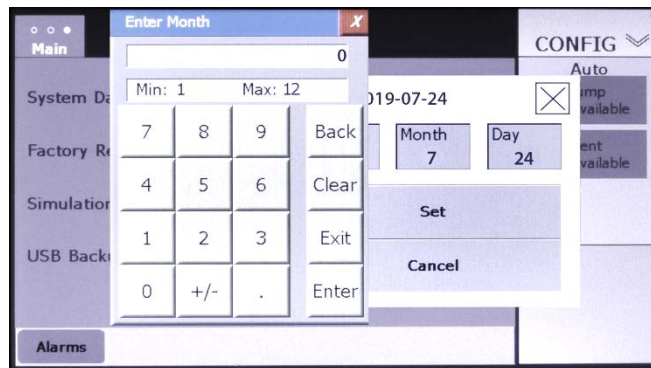
- 3 To change the system date, first touch the recessed System Date box. The unit will then display the popup shown in Figure 2-7.

Figure 2-8 System Date/Time Screen with Date-Change Popup Displayed



- 4 Touch any of the individual boxes labeled **Year**, **Month**, and **Day** to display a numeric keypad similar to the one shown in Figure 2-8.

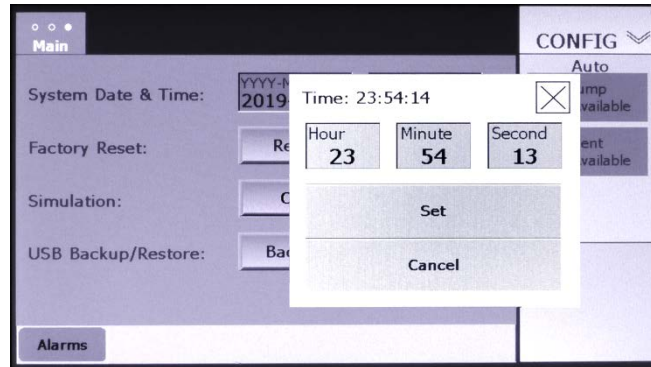
Figure 2-9 System Date/Time Screen Displaying Numeric Keypad for Entry of Month



- 5 Use this numeric keypad to enter the correct number.

- 6 Touch the keypad's Enter button.
- 7 Repeat Steps 4-6 as necessary to complete the correction of the date.
- 8 Touch the popup's **Set** button to close it. The corrected date will then appear in the System Date box.
- 9 To change the system time, first touch the recessed System Time box to display the popup shown in Figure 2-9.

**Figure 2-10 System Date/Time Screen with Time-Change Popup Displayed**



- 10 Touch any of the individual boxes labeled **Hour**, **Minute**, and **Date** to display a numeric keypad similar to that shown in Figure 2-8.
- 11 Use this numeric keypad to enter the correct number.
- 12 Touch the keypad's **Enter** button.
- 13 Repeat Steps 10-12 as necessary to complete the correction of the date.
- 14 Touch the popup's **Set** button. The corrected time will then appear in the System Time box.
- 15 Touch the screen tab to return to the Config>Main screen.

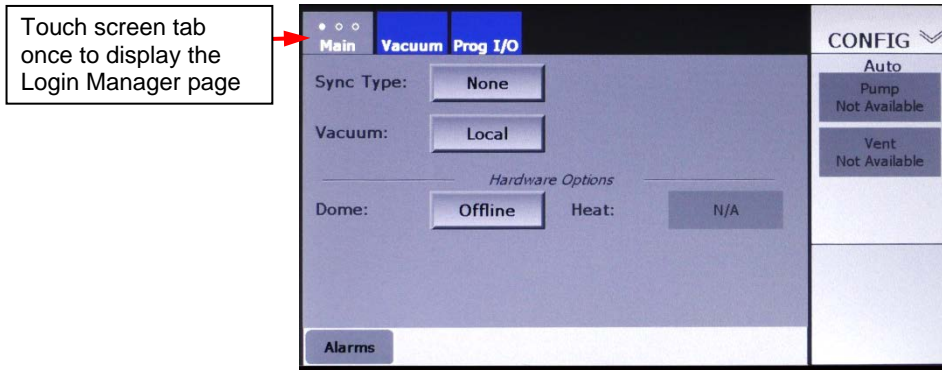
### 2.7.2 Enabling the Log-In Manager and Changing User Permissions (Optional)

To enable the LogIn manager and change user passcodes and user permissions, perform the procedure described below. Note that after the initial configuration is completed and saved, only users with Configuration/Service mode access can enable and disable the LogIn Manager and change user passcodes and permissions.

Step	Action
1	Display the Config>Main screen (see Figure 2-10), if it is not already open.

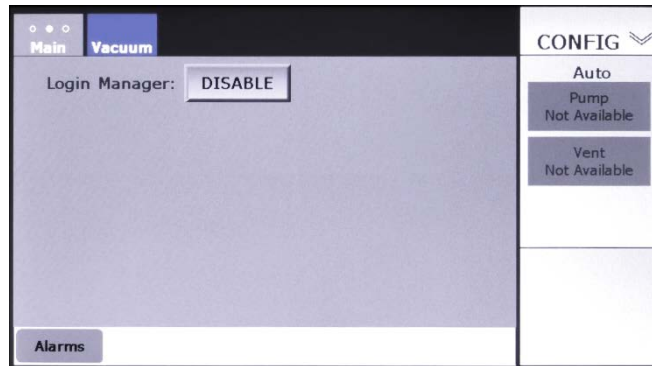


**Figure 2-11 Config>Main Screen at Initial Boot-Up**



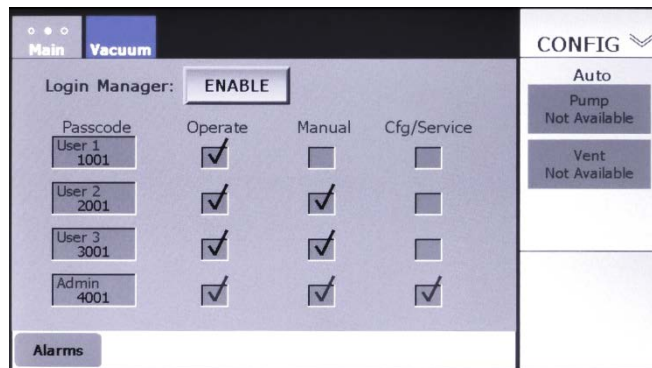
- 2 Touch this screen's tab once. The LogIn screen will then appear as shown in Figure 2-11.

**Figure 2-12 The Login Manager Screen When Initially Displayed**



- 3 Touch the button labeled **DISABLE** to enable the LogIn Manager. The Login Manager screen will then appear as shown in Figure 2-12, with default user passcodes and permissions assigned. The checked boxes indicate which operating modes are available to each user.

**Figure 2-13 Login Manager Screen After User Touches the *DISABLE* Button**



- 4 To change a user password,
  - a) Touch the recessed **Passcode** entry box for the user whose passcode you wish to change.
  - b) Use the numeric keypad that will then appear to enter the desired passcode.
  - c) Touch the keypad's **Enter** button to close it. The new passcode will then appear in the entry box for the target user.
- 5 To change user permissions, touch the **Operation**, **Manual**, and **Cfg/Service** checkboxes as desired as necessary to check or uncheck them.

To disable the Login Manager, simply touch this screen's **ENABLE** button.

# 3

# Operational Overview

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## 3.1 Section Overview

This section describes basic operational procedures and provides detailed information about the FerroVac touchscreen. The topics covered in this section are:

### Section 3.2 Logging In and Logging Out

Section 43.2.1 Entering the System when the LogIn Manager Is Disabled

Section 43.2.2 Logging In When the LogIn Manager Is Enabled

Section 43.2.3 Logging Out

### Section 43.3 Navigating Between Operating Modes

Section 43.4 Navigating Between the Pages of a Multipage Screen

Section 43.5 Overview of the FerroVac Touch Screen

Section 43.5.1 Functional Overview

Section 43.5.2 The Main and Auxiliary Menus

Section 43.6 The Vacuum Map

Section 43.7 The Manual>Main and Operations>Main Screens

Section 43.8 Responding to Alarms

Section 43.9 Backing Up and Restoring Files

Section 43.9.1 Backing up Files

Section 43.9.2 Restoring Backed Up Files

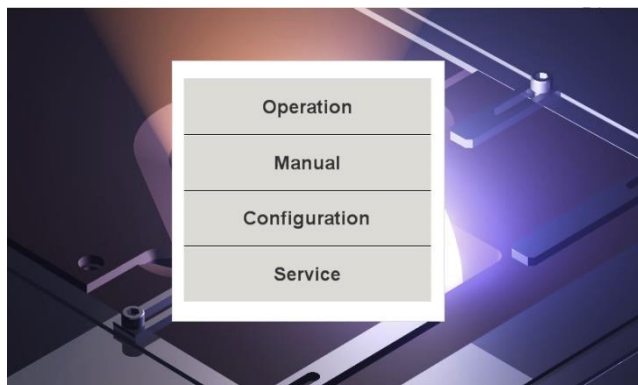
Section 43.9.3 Saving the Log File to a USB Directory

## 3.2 Logging In and Logging Out

### 3.2.1 Entering the System when the LogIn Manager Is Disabled

When the LogIn manager is disabled, it is not necessary to log in. You can enter the desired operating mode by simply touching the appropriate mode-selection button on the Start screen (see Figure 3-1).

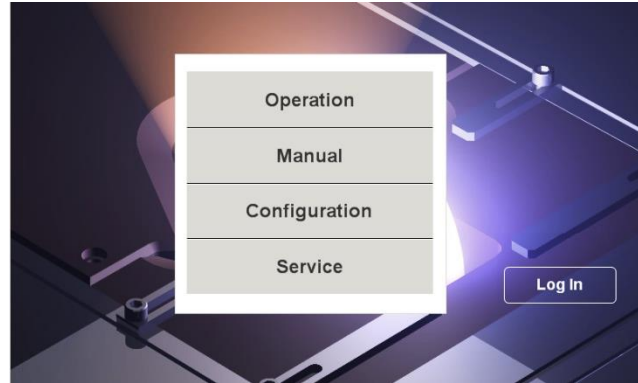
**Figure 3-1 FerroVac Start Screen when LogIn Manager Is not Enabled**



### 3.2.2 Logging In When the LogIn Manager Is Enabled

When the LogIn manager is enabled, the initial Start screen will display a login button, as shown in Figure 3-2.

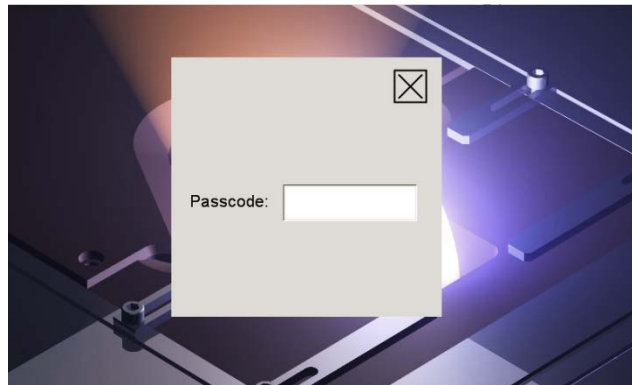
**Figure 3-2 Start Screen with Log In Button Displayed**



To log-in, perform the following procedure.

- | <b>Step</b> | <b>Action</b>  |
|-------------|--|
| 1           | Touch the <b>Log In</b> button. A passcode entry popup will then appear on the Start screen, as shown in Figure 3-3. |

**Figure 3-3 Start Screen with Passcode Entry Popup Displayed**



- |   |  |
|---|--|
| 2 | Enter your passcode and then touch the <b>X</b> in the upper right-hand corner of the popup to close it. |
|---|--|

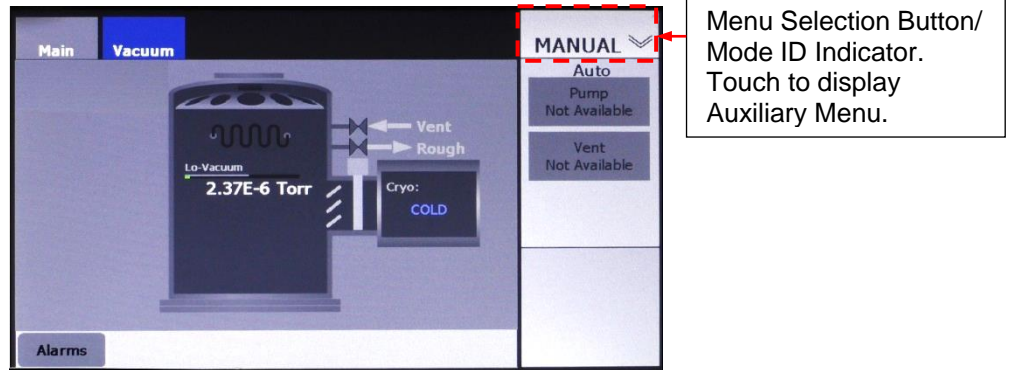
The unit will then display the Start screen as shown in Figure 3-1.

### 3.2.3 Logging Out

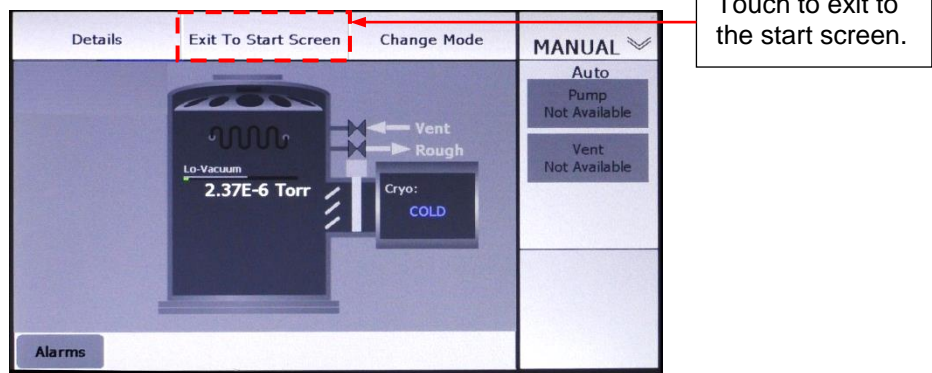
To log out, follow the procedure described below.

- | Step | Action   |
|------|--|
| 1    | Touch the Menu Selection button/Mode ID indicator (see Figure 3-4) to display the Auxiliary Menu bar (see Figure 3-5). |

**Figure 3-4 Operations Vacuum Map with Standard Menu Bar Displayed**

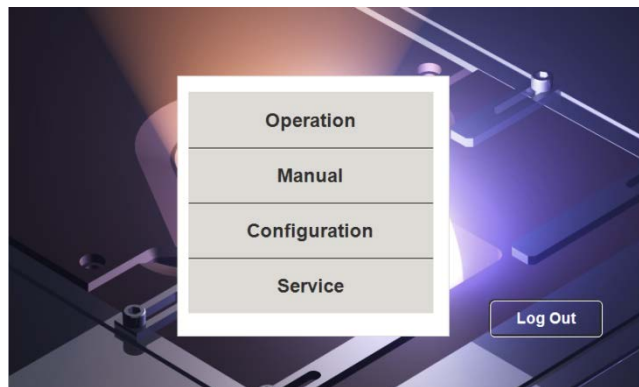


**Figure 3-5 Auxiliary Menu Displayed**



- |   |   |
|---|---|
| 2 | Touch the <b>Exit To Start Screen</b> button. The FerroVac will then display the Start screen with a <b>Log Out</b> button, as shown in Figure 3-6. |
|---|---|

**Figure 3-6 Start Screen Displaying Log Out Button**



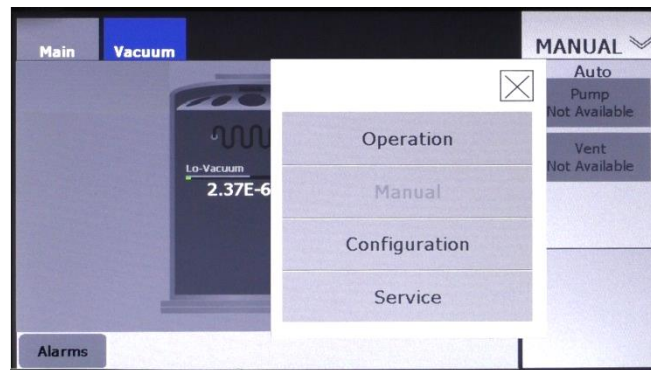
- 3 Touch the **Log Out** button. The Start screen will then appear as shown in Figure 3-2.

### 3.3 Navigating Between Operating Modes

The following procedure describes how to switch from one FerroVac operating mode to any other.

- | Step | Action   |
|------|--|
| 1    | Touch the Menu Selection button/Mode ID indicator (see Figure 3-4) to display the Auxiliary Menu (see Figure 3-5). |
| 2    | Touch that menu's <b>Change Mode</b> button to display the Change Mode warning popup shown in Figure 3-7.          |

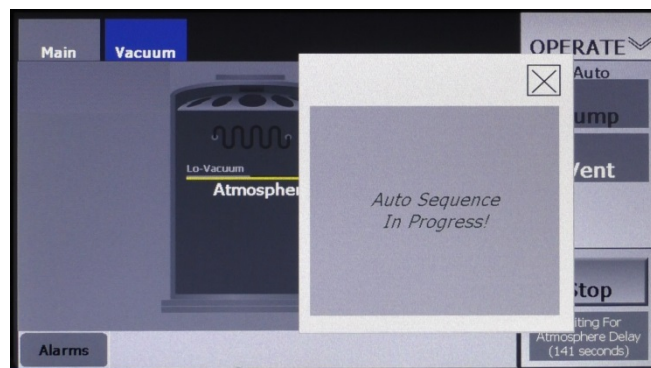
**Figure 3-7 Config>Main Screen with Mode Selection Popup Displayed**



- 3 Touch the button for the desired mode. The FerroVac will then switch to that mode.

The FerroVac will not permit an exit from Operations mode during the execution of an Autopump, Autovent, or Autoregen operation. If the user attempts to do so, the unit will display the message shown in Figure 3-8.

**Figure 3-8 Operations>Main Screen Displaying *Auto Sequence In Progress* Popup**



### 3.4 Navigating Between the Pages of a Multipage Screen

A number of individual FerroVac screens are organized into multiple pages. An example is the four-page Config>Vacuum screen (see Figures 3-9 and **Error! Reference source not found.**). As those screen shots show, the number of pages in a multipage screen is indicated by the number of dots in its screen tab. When the Config-Vacuum screen is first displayed, it opens to Page 1, the Config>Vacuum Map. To display Page 2, the hi-vac pump control page (see Figure 3-9) from Page 1, the user would touch the screen tab once. To open Page 3 (see **Error! Reference source not found.**), the user would touch the screen tab once if starting from Page 2 or twice if starting from Page 1. When Page 4 is displayed, touching the screen tab once opens Page 1.

Figure 3-9 Config>Vacuum Screen, Page 2 (Hi-Vac Pump Control Page)

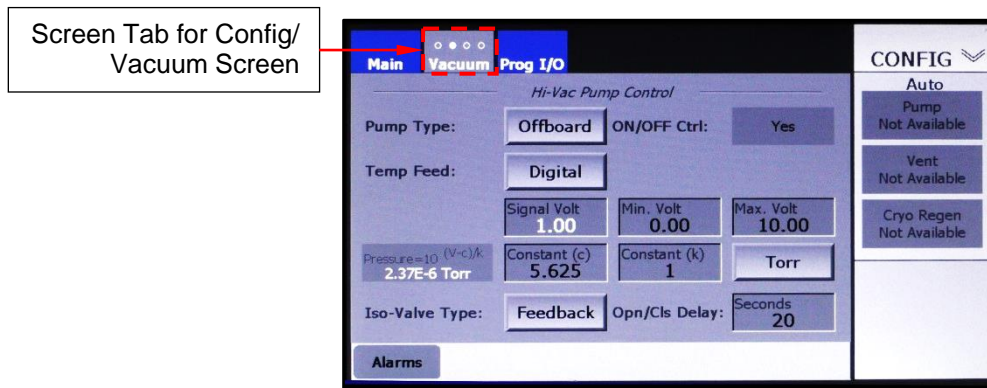


Figure 3-10 User Touching Vacuum Screen Tab

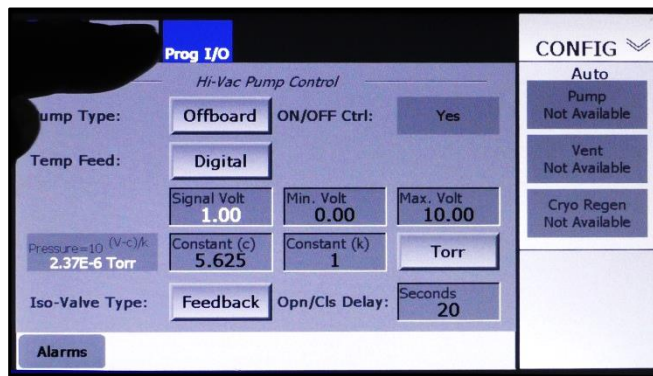


Figure 3-11 Config>Vacuum Screen, Page 3 (Chamber Vacuum Gauges Page)

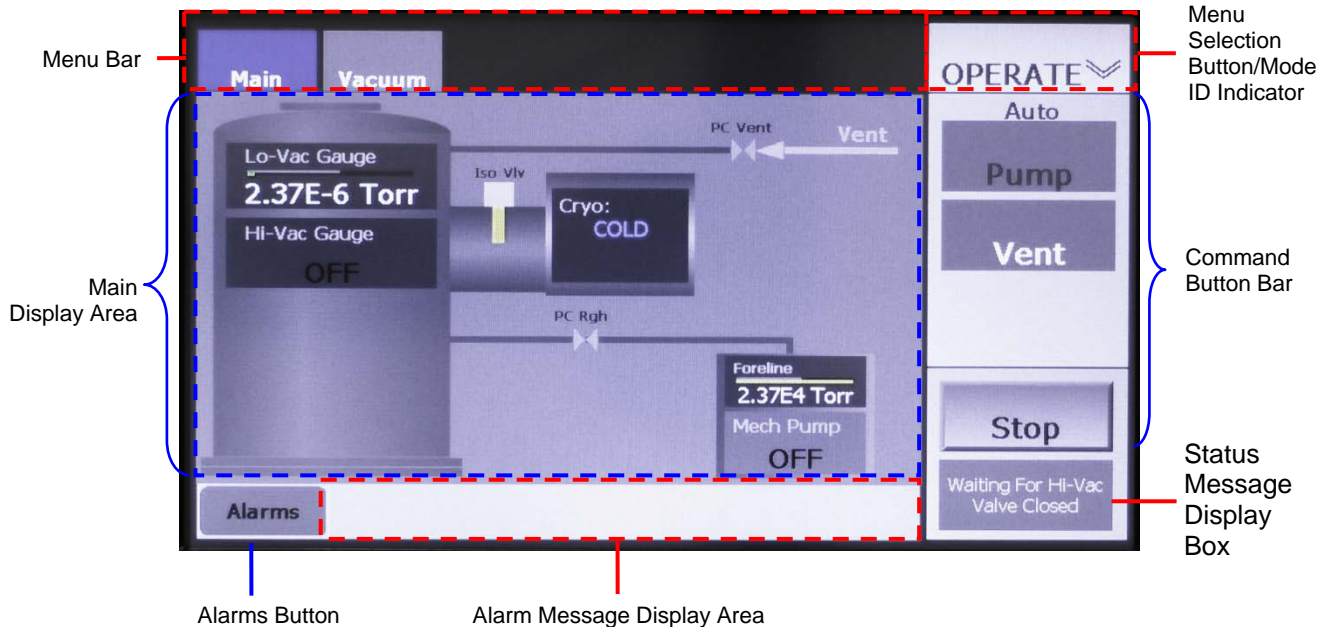


### 3.5 Overview of the FerroVac Touch Screen

#### 3.5.1 Functional Overview

Figure 3-12 identifies the functionally distinct areas of the FerroVac touch screen. Those areas are defined below the illustration.

Figure 3-12 Functional Areas of Main UI Screen



- **Menu Selection Button/Mode ID Indicator:** This button enables the user to select either the Main Menu, as shown in Figure 3-12, or the Auxiliary Menu (see Figure 3-5) for display in the menu bar. The button's label identifies the current operating mode.
- **Menu bar:** Displays either the Main Menu or the Auxiliary Menu.
- **Main Display Area:** This area displays:
  - the features specific to the operating mode currently selected,



- the Alarms and Details screens (see Figures 1-9 and 1-10, respectively),
  - popup windows that enable the user either to change operating modes or to exit to the Start screen
  - numeric keypads that allow the user to enter parameter values.
- **Command Button Bar:** Functions as a button bar only in Operations mode, where it enables the user to initiate, pause, resume, or abort automated operations. When an automated operation is running, a rectangle at the bottom of this button bar displays status messages relating to the execution of that operation.
  - **Status Message Display Box:** During auto operations, status messages are displayed here.
  - **Alarm Message Display Area:** Displays notifications of currently active alarms, as shown in Figure 3-15.
  - **Alarms button:** Touch to display the Alarms screen (see Figure 3-16).

### 3.5.2 The Main and Auxiliary Menus

In all operating modes, the user can display either the Main Menu (see Figure 3-12), or the Auxiliary Menu (see Figure 3-5). The Main Menu allows the user to display the screens specific to the operating mode currently selected. The Auxiliary Menu enables the user to change the operating mode, to exit to the Start screen (see Figure 3-1), or to display the Details screen, page 1 (see Figure 1-7).

## 3.6 The Vacuum Map

### 3.6.1 Control/Display Features on the Vacuum Map

Versions of the Vacuum Map appear in the Configuration, Manual, and Operations modes. Figure 3-13 shows the Vacuum map as it appears in Configuration mode. Functionally identical screens appear in Manual mode. On the Operations mode versions of the Vacuum map, the control buttons shown on the screens below appear as flat icons with no control functionality.

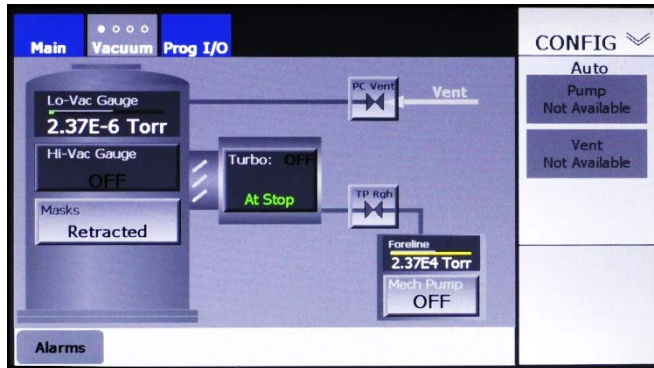
Figure 3-13 Config> Vacuum Map

FerroVac Configured for an On-Board Cryopump

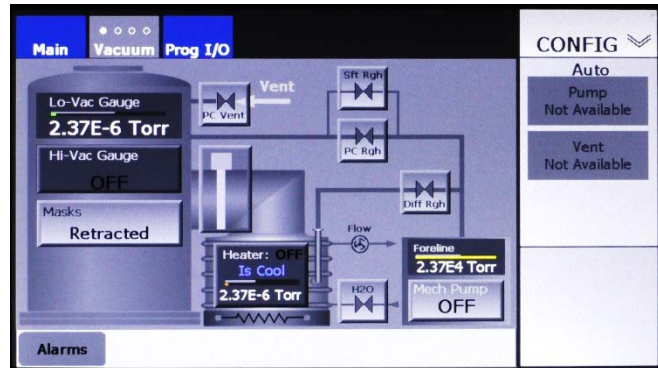
FerroVac Configured for an Off-Board Cryopump



## FerroVac Configured for a Non-Iso Turbopump



## FerroVac Configured for a Diffusion Pump



## 3.6.2 Variations in Appearance of Vacuum Map Depending on Configuration

The features of the Vacuum Map vary depending on the type of hi-vac pump selected as well as other variations in configuration parameters. For illustrations of some of these variations, see section 4.9. For detailed illustrations and explanations of variations based on selection of System type, see:

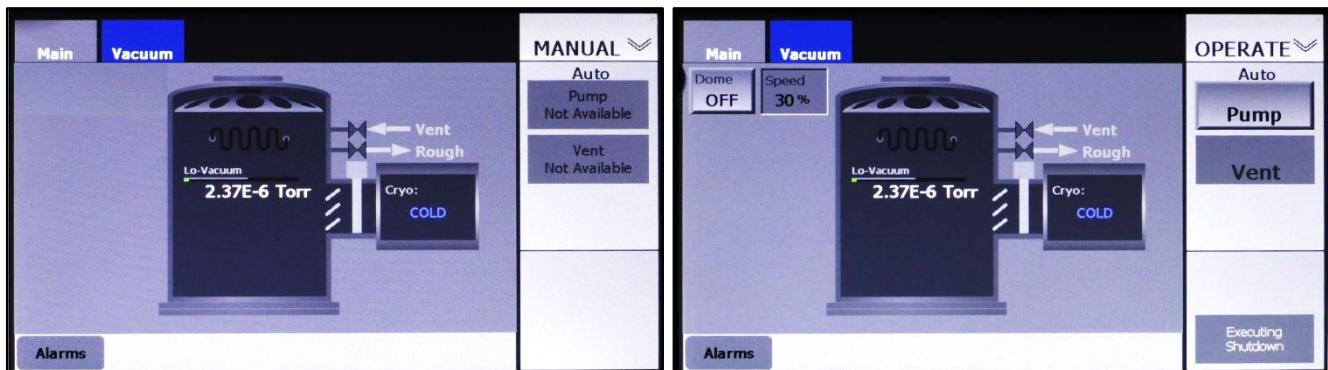
- Figures 5-4 through 5-8 if your FerroVac is configured for use with an Onboard cryopump
- Figures 6-6 through 6-14 if it is configured for use with an Offboard cryopump
- Figures 7-4 through 7-7 if it is configured for use with a non-iso turbo pump
- Figures 8-4 through 8-9 if it is configured for use with a diffusion pump
- Figures 9-6 through 9-12 if configured for use with an Onboard cryopump + load-lock valve
- Figures 10-6 through 10-16 if configured for use with an Onboard cryopump + load-lock valve

## 3.7 The Manual&gt;Main and Operations&gt;Main Screens

## 3.7.1 Display Features on the Main Screen

The Manual>Main and Operations>Main screens (see Figure 3-14) display identical simplified versions of the Vacuum Map. The graphical features displayed on those screens allow the user to monitor system operations but provide no control functionality. However, in Operations mode the buttons on the command button bar enable the user to initiate, pause, abort, and resume automated operations.

Figure 3-14 Manual and Operations Mode Main Screens



### 3.7.2 Variations in Appearance of Main Screens Depending on Configuration

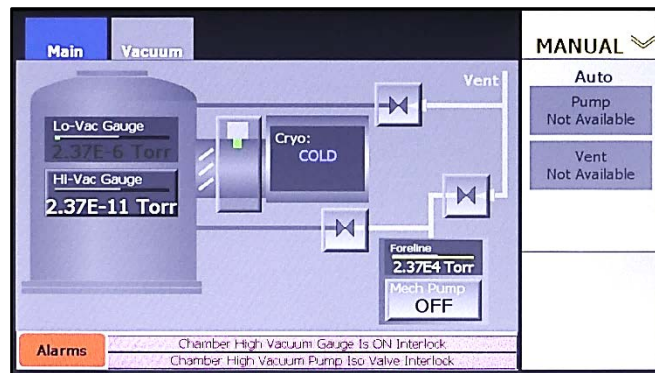
Like the Vacuum Map, the Main screen varies in appearance depending on which System Type is selected. For illustrations of these variations, see:

- Figures 5-3 and 5-9 if your FerroVac is configured for use with an Onboard cryopump
- Figures 6-6 and 6-15 if it is configured for use with an Offboard cryopump
- Figures 7-3 and 7-8 if it is configured for use with a non-iso turbo pump
- Figures 8-3 and 8-10 if it is configured for use with a diffusion pump
- Figures 9-4 and 9-13 if configured for use with an Onboard cryopump plus a load-lock valve
- Figures 10-5 and 10-18 if configured for use with an Offboard cryopump plus a load-lock valve

## 3.8 Responding to Alarms

When an alarm occurs, the touch screen displays a red alarm message, and the **Alarms** button turns red, as shown in Figure 3-15.

**Figure 3-15 Typical FerroVac Screen Displaying Alarm Messages**



To clear an active alarm, first correct the condition that triggered the alarm. Then touch the **Alarms** button to open the Alarms screen. If **Exclude History** was previously selected, the Alarms screen will display only active alarms, as shown in Figure 3-16. If **Include History** was previously selected, the Alarms screen will display active as well as previously acknowledged alarms, as shown in Figure 3-17.

Figure 3-16 Alarm Details Screen Displaying Five Active Alarms, *Exclude History* Selected

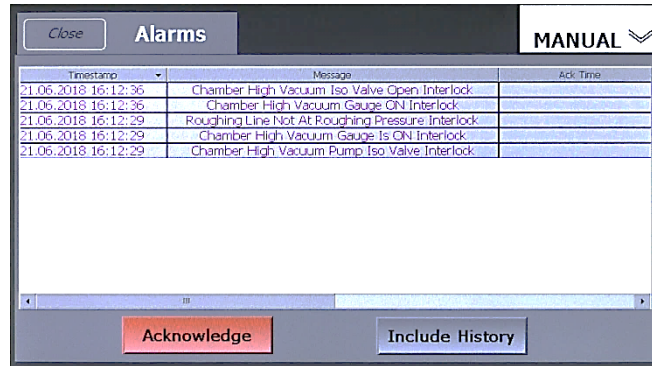
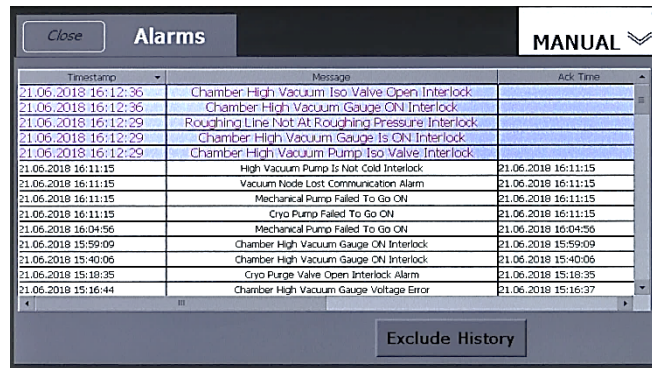


Figure 3-17 Alarm Details Screen Displaying the Same Active Alarms, *Include History* Selected



To acknowledge all active alarms, simply touch the red **Acknowledge** button. If the triggering condition(s) have been corrected and if **Exclude History** was selected, the message will then disappear. If **Include History** was selected, the color of the formerly active alarm message(s) will change from red to gray. Once the active alarms have been acknowledged, touch the **Close** button to close the Alarms screen.

### 3.9 Backing Up and Restoring Files

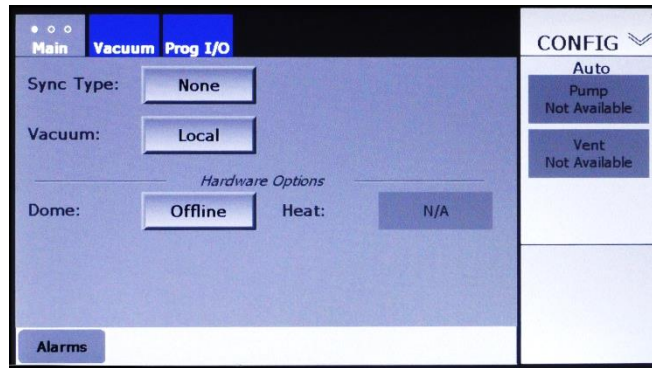
This subsection describes how to back up and restore the unit’s configuration file.

#### 3.9.1 Backing up Files

To back up the unit’s configuration file, perform the procedure described below.

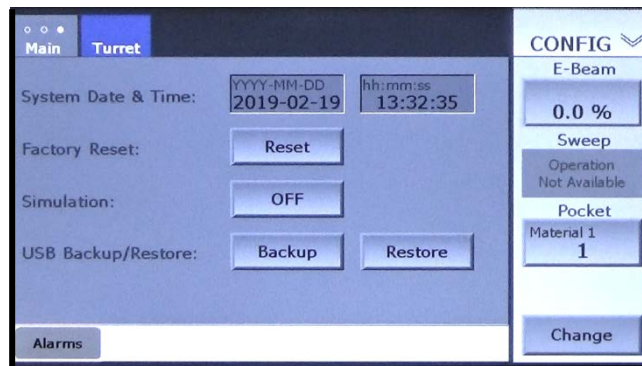
Step	Action
1	Display the Config>Main screen (see Figure 3-18).

**Figure 3-18 Configuration>Main Screen**



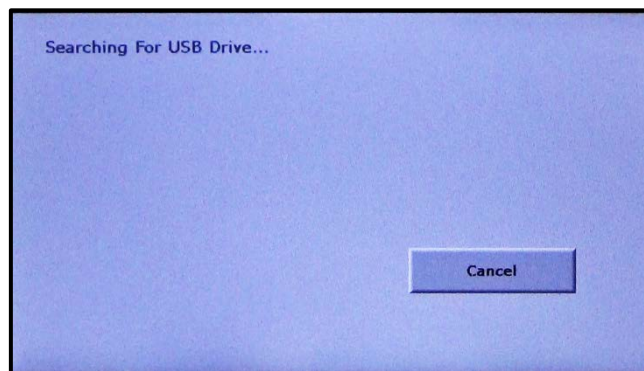
- 2 Press the screen's tab twice to display the Date-Time/Backup-Restore screen (see Figure 3-19).

**Figure 3-19 The Date-Time/Backup-Restore Screen**



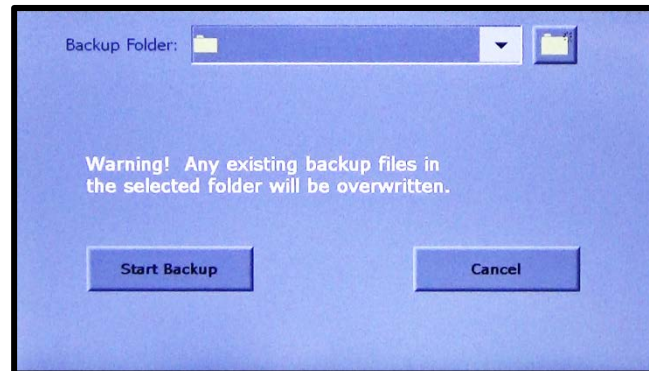
- 3 Touch the **Backup** button. If the USB drive has not been inserted, the FerroVac will display the screen shown below. If so, you will see the screen shown in Figure 3-21.

**Figure 3-20 Initial Backup Screen, USB Drive Not Inserted**



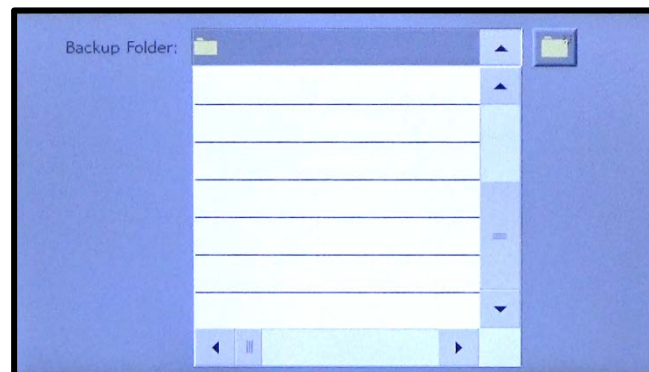
- 4 Insert the USB drive onto which you wish to back up the files. The unit will then display the screen shown below. If you wish to back up the file into the USB drive's root directory, skip ahead to Step 9.

**Figure 3-21 Initial Backup Screen After USB Drive Is Inserted**



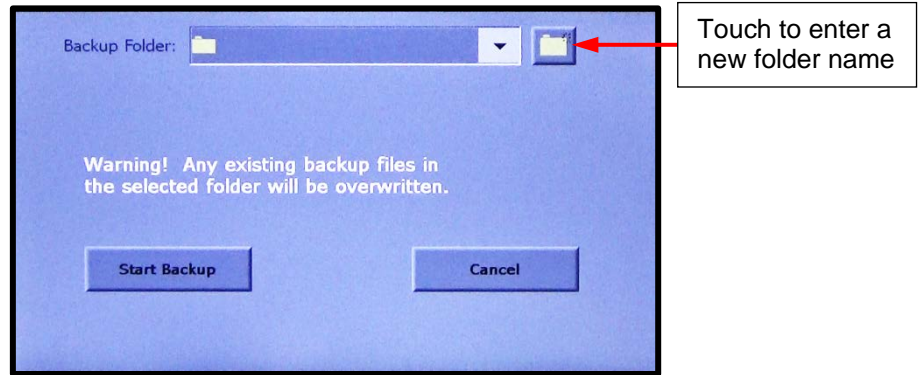
- 5 When the EBC displays the screen shown above, touch the **Backup Folder** entry box to display a list of folders on the USB drive (see Figure 3-22). If you wish to back the files up into the USB drive's root directory, skip ahead to Step 9.

**Figure 3-22 Backup Screen Displaying Folders on USB Drive**

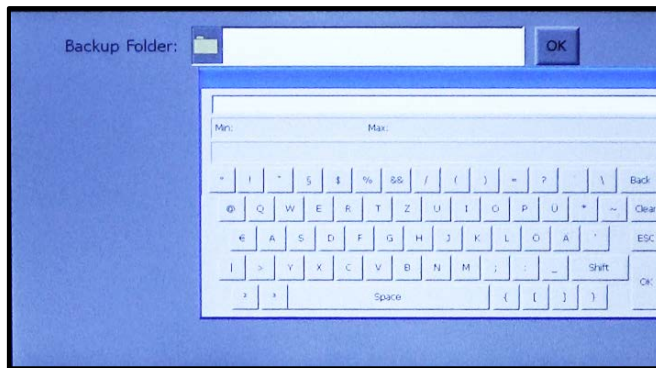


- 6 Either select the folder into which you wish to back up the file or touch the button pointed out below to display the popup keyboard shown in Figure 3-24.

**Figure 3-23 Folder Creation Button on Backup Screen**

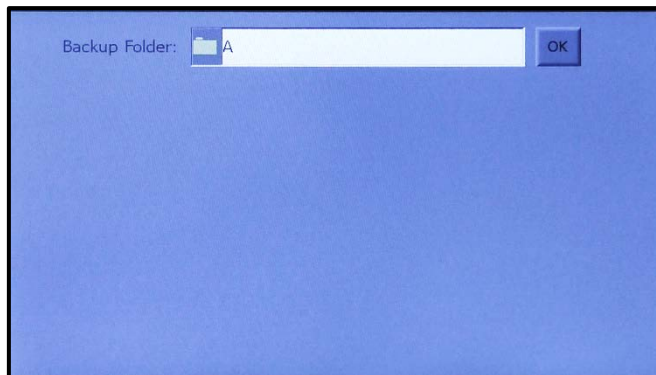


**Figure 3-24 Backup Screen Displaying Popup Keyboard**



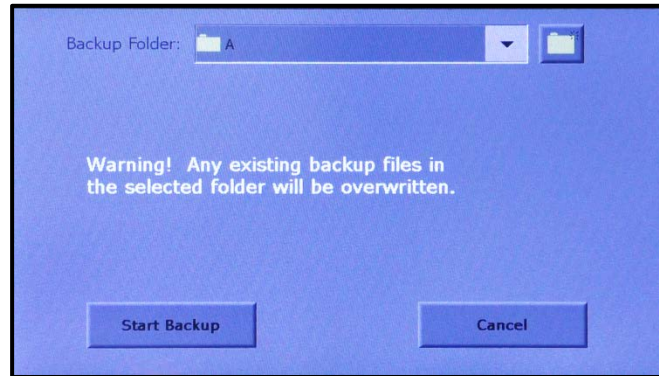
- 7 Use the keyboard to enter the desired folder name. As you do so, the folder name will appear in the **Backup Folder** entry box. After entering the folder name, touch the **OK** button next to that entry box to close the keyboard. The screen will then appear as shown in Figure 3-25.

**Figure 3-25 Backup Screen After User Enters A as Target Folder Name**



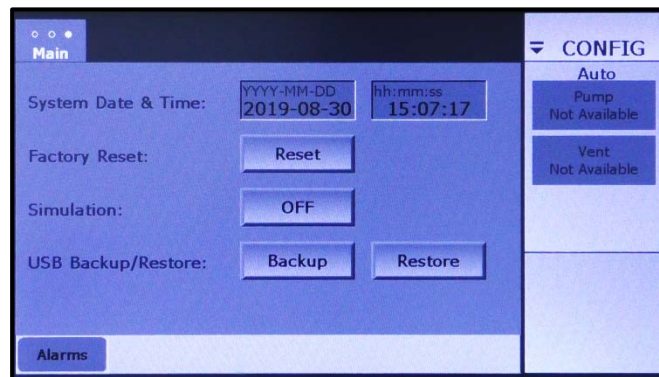
- 8 Then touch the **OK** button next to the entry box. The screen will then shown in Figure 3-26.

**Figure 3-26 Backup Screen Displaying *Start Backup* Button**



- 9 Touch the **Start Backup** button to initiate the backup, which will take only an instant. The FerroVac will redisplay the Date-Time/Backup-Restore screen, as shown below.

**Figure 3-27 Date-Time/Backup-Restore Screen After Backup Is Completed**



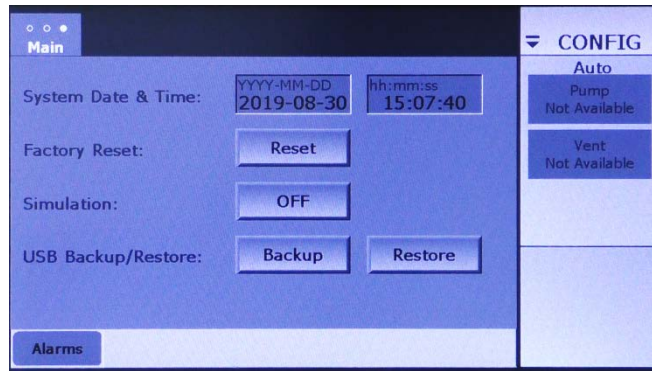
### 3.9.2 Restoring Backed Up Files

To restore backed up files to the EBC, perform the procedure described below.

- | <b>Step</b> | <b>Action</b>  |
|-------------|--|
| 1           | Display the Date-Time/Backup-Restore screen (see Figure 3-28) and touch its <b>Restore</b> button. |

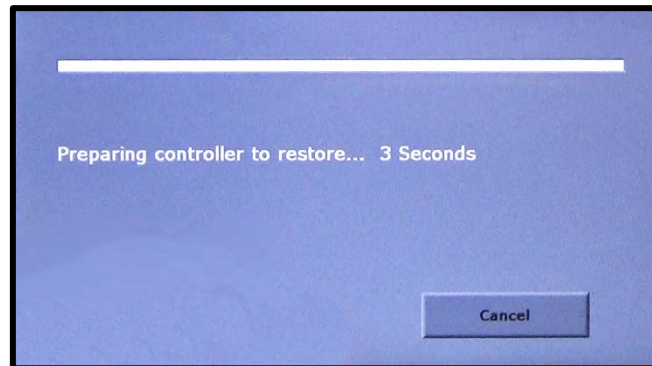


**Figure 3-28 Date-Time/Backup Restore Screen**



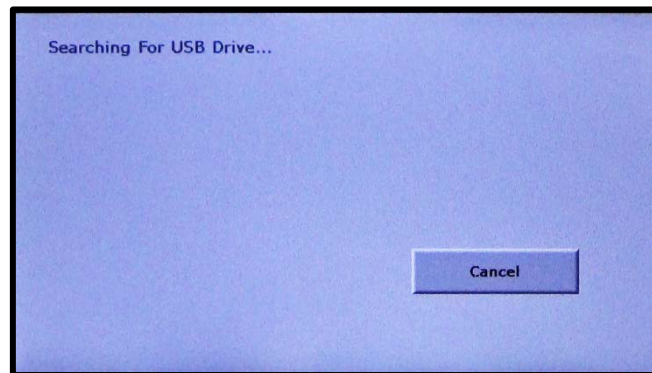
- 2 The unit will then initiate a shutdown while displaying the screen shown below.

**Figure 3-29 Restore Selected**



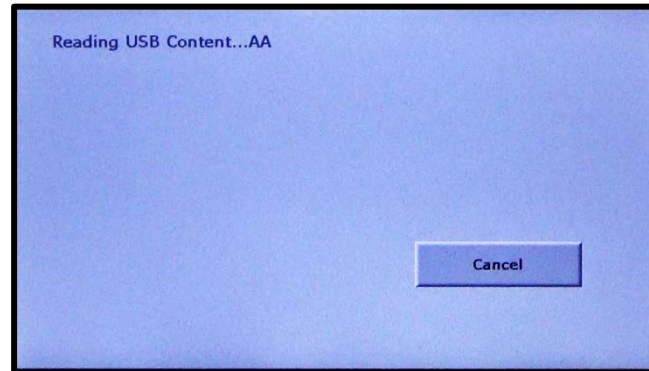
- 3 When the shutdown routine is completed, the unit will display the message shown below if no USB drive is inserted into the unit. In that event, insert the USB drive containing the backed up files.

**Figure 3-30 Screen Displaying 'Insert USB' Prompt**



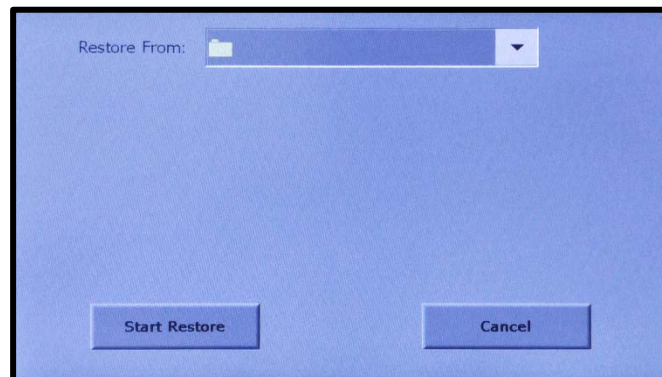
- 4 Once the USB drive is inserted, the screen will display the message shown below, listing the name of each folder on the drive as it reads them.

**Figure 3-31 Screen Displaying Message Reading USB Content**

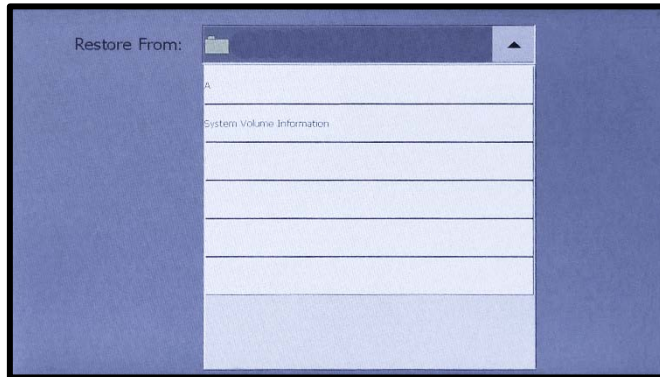


- 5 After the unit finishes reading the USB drive's contents, it will display the screen shown below.

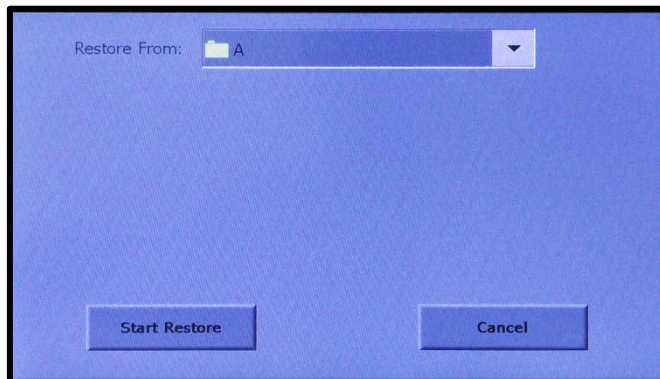
**Figure 3-32 Restore Screen After EBC Has Read Contents of USB Drive**



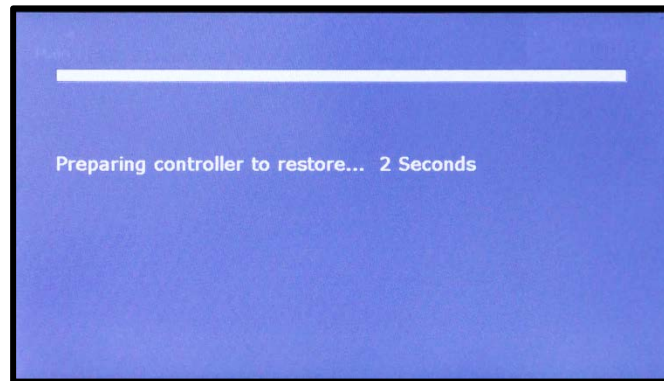
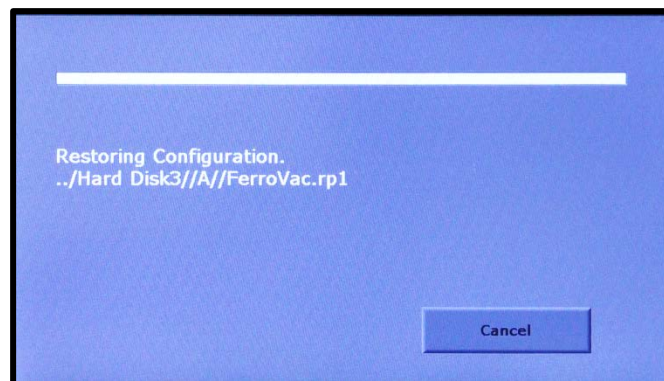
- 6 If you wish to restore from the USB drive's root directory, skip ahead to Step 8. To select a different folder, touch anywhere in the **Restore From** entry box to display a folder directory like the one shown below.

**Figure 3-33 Restore Screen Displaying List of Folders on USB Drive**

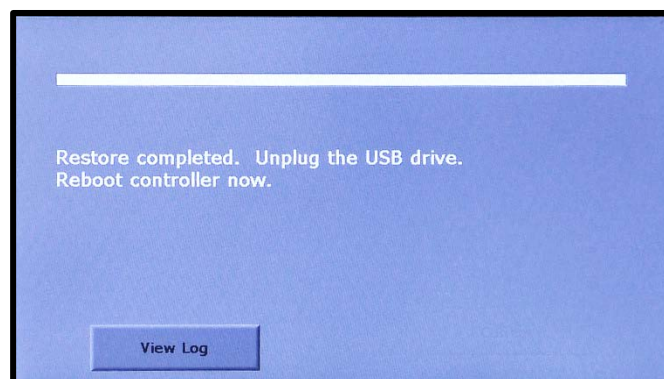
- 7 Touch the name of the folder that contains the files to be restored. That name will then appear in the **Restore From** entry box, as shown in Figure 3-34.

**Figure 3-34 Restore Screen After User Selects the *Restore From* Folder**

- 8 When the desired folder name is displayed, touch the **Start Restore** button. The unit will then display the message shown below, after which it will restore the configuration file, while the screen displays the message shown in Figure 3-36.

**Figure 3-35 Restore Screen After User Touches the *Start Restore* Button****Figure 3-36 Restore Screen, Restoration of Configuration File in Progress**

- 9 When the restoration is completed, the screen will display the message shown in Figure 3-37. At that point, either unplug the USB drive and reboot the EBC or touch the **View Log** button. If you reboot, you can resume normal EBC operation as soon as the reboot is completed. If you touch the **View Log** button, you can save the log file, following the procedure described in section 3.9.3.

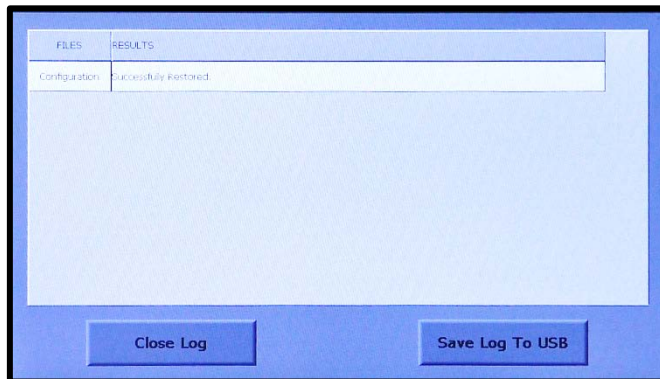
**Figure 3-37 Restoration Completed, User Prompted to Reboot**

### 3.9.3 Saving the Log File to a USB Directory

While performing a restoration, the EBC creates a log file, which can be saved to a directory on the USB drive. The following procedure describes how to save such a log file.

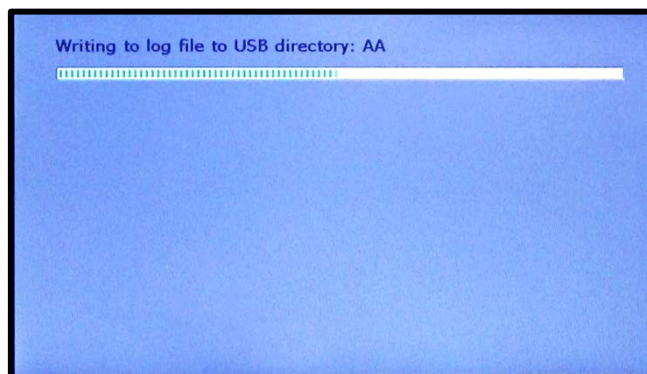
- | Step | Action   |
|------|--|
| 1    | After completing a restoration, you have the option of saving the log file generated by that operation. To do so, first touch the <b>View Log</b> button on the screen shown in Figure 3-37. The screen will then appear as shown below. |

**Figure 3-38 Log Contents Displayed**



- |   |   |
|---|---|
| 2 | If you wish to save the log file to the USB drive, touch the <b>Save Log To USB</b> button. The unit will then save the file, after which it will redisplay the screen shown in . |
|---|---|

**Figure 3-39 FerroVac Writing Log File to USB Drive**



- |   |  |
|---|--|
| 3 | When the log file has been saved, the EBC will again display the messages shown Figure 3-37. When it does so, unplug the USB drive and reboot the EBC. |
|---|--|

Normal EBC operation can then be resumed.



# 4 Common Configuration Procedures

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## 4.1 Section Overview

This section describes the configuration procedures that are common to all FerroVac installations, regardless of system type. These include procedures for configuring the FerroVac for the target system's vacuum gauges and mechanical pump and setting up the unit's four programmable outputs.

The procedures covered in this section assume that the installation and setup procedures described in Section 2 have been correctly completed. Specific topics covered in this section are:

- Section 4.2 Screens Used in Configuration Procedures
  - Section 4.2.1 The Configuration Mode Vacuum Map
- Section 4.3 Making Selections via the Configuration>Main Screen
- Section 4.4 Configuring Parameters on the High-Vac Pump Control Page
- Section 4.5 Configuring the Chamber Lo-Vac and Hi-Vac Gauges
  - Section 4.5.1 Configuring the Chamber Low-Vacuum Gauge
  - Section 4.5.2 Configuring the Chamber High-Vacuum Gauge
- Section 4.6 Configuring Parameters on the Roughing Control Page
  - Section 4.6.1 Connecting and Configuring the Foreline Gauge
  - Section 4.6.2 Connecting the Mechanical Pump
- Section 4.7 Setting Vacuum Setpoints
- Section 4.8 Configuring Programmable Outputs
  - Section 4.8.1 Selecting Triggers for the Programmable Outputs
  - Section 4.8.2 Programming On-Screen Buttons
- Section 4.9 Exiting Configuration Mode and Saving Configuration Changes
- Section 4.10 Variations in Appearance of Vacuum Map Depending on Configuration

## 4.2 Screens Used in Configuration Procedures

In configuring the FerroVac, you will employ the following screens:

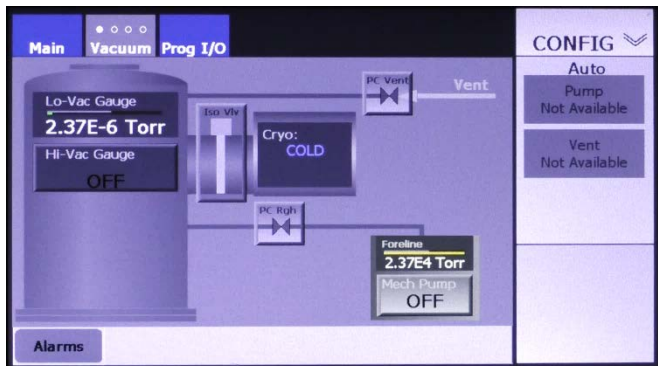
- the Configuration>Main screen (see Figure 4-3)
- the Chamber Vacuum Gauges page (see Figure 4-6)
- the Roughing Control page (see Figure 4-9)
- the Programmable Outputs page (see 4-15)
- Page 1 of the Details screen (see Figure 4-14)

The other key Configuration mode screen is the Configuration mode Vacuum Map (see Figure 4-1), which enables the user to control vacuum pumps, gauges, and valves individually.

### 4.2.1 The Configuration Mode Vacuum Map

Figure 4-1 shows the Configuration mode Vacuum Map when the FerroVac is configured for use with an on-board cryopump. In addition, this FerroVac has been configured to control and monitor a connected foreline gauge and a connected mechanical pump.

**Figure 4-1 The Config>Vacuum Map (Unit Configured for an On-Board Cryopump)**



The Vacuum Map's control/display features vary depending on a number of configuration choices, the most important of which is the choice of the hi-vac pump. For illustrations and an explanation of these Vacuum Map variations, see section 4.9.

## 4.3 Making Selections via the Configuration>Main Screen

The first step in the configuration process is to put the FerroVac on-line and to make other selections via the Configuration>Main screen (see Figure 4-3). To do so, perform the following steps:

- | Step | Action   |
|------|--|
| 1    | When the FerroVac is first booted up, the touch screen displays the Start screen (see Figure 4-2). To begin the configuration procedure, touch that screen's <b>Configuration</b> button. The Configuration>Main screen will then appear as shown in Figure 4-3. |

**Figure 4-2 FerroVac Start Screen**

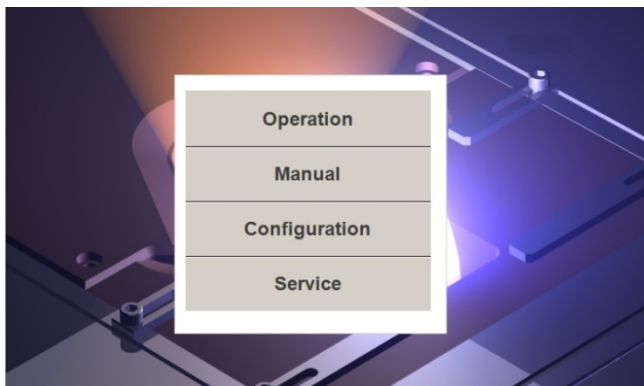
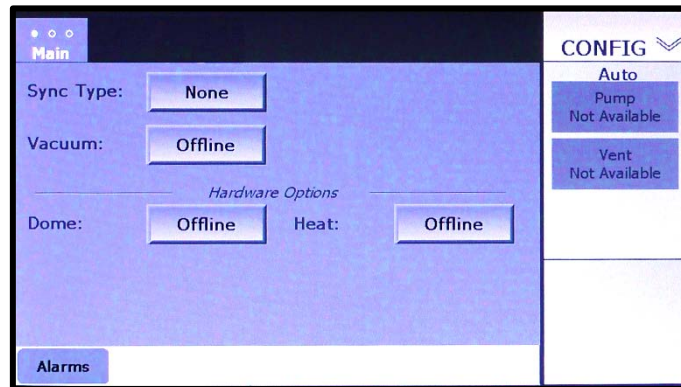
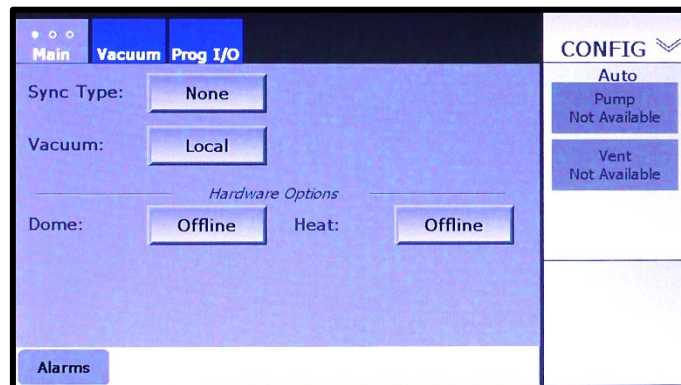




Figure 4-3 Configuration&gt;Main Screen at Initial Boot-Up



- 2 Touch this screen's **Vacuum** button to toggle it from **Offline** to **Local**. Screen tabs labeled **Vacuum** and **Prog I/O** will then appear next to the **Main** screen tab, as shown in Figure 4-4.

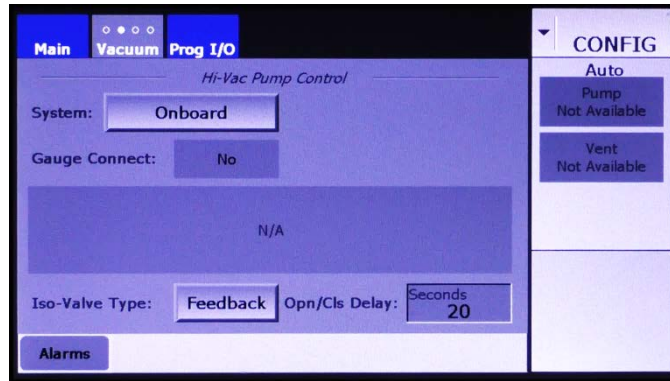
Figure 4-4 Config>Main Screen with *Local* Selected Opposite *Vacuum*

- 3 Leave **None** selected for **Synch Type**.
- 4 If you wish to implement dome rotation control, touch the **Dome** button to toggle it from **Offline** to **Local**. For complete instructions on configuring the Dome Control function, see Section 11.
- 5 If you wish to implement substrate heater control, touch the **Dome** button to toggle it from **Offline** to **Local**. For complete instructions on configuring the Dome Control function, see Section 12.

## 4.4 Configuring Parameters on the High-Vac Pump Control Page

Next touch the **Vacuum** screen tab twice to display the Hi-Vac Pump Control page. Figure 4-5 shows that page as it appears at initial boot-up.

Figure 4-5 Hi-Vac Pump Control Page at Initial Boot-Up



These procedure for configuring the parameters on this page will vary depending on the System type selected (see table below).

For instructions on configuring the FerroVac for use with:	See:
an Onboard cryopump	section 5.2
an Offboard cryopump	section 6.2
a non-iso turbo pump	section 7.2
a diffusion pump	section 8.2
an Onboard cryopump with a load-lock valve	section 9.2
an Offboard cryopump with a load-lock valve	section 10.2

## 4.5 Configuring the Chamber Lo-Vac and Hi-Vac Gauges

### 4.5.1 Configuring the Chamber Low-Vacuum Gauge

Now configure your system’s chamber low-vacuum gauge by performing the procedure described below.

Step	Action
1	To configure the chamber vacuum gauges, first open the Chamber Vacuum Gauges page (see Figure 4-6). To navigate to this screen from the Hi-Vac Pump Control page, touch the <b>Vacuum</b> screen tab once.

Figure 4-6 Chamber Vacuum Gauges Page at Initial Boot-Up



- 2 Referring to the manufacturer's manual for your system's chamber low-vacuum gauge, determine the values of the constants **c** and **k** in the formula

$$\text{Pressure} = 10^{(V-c)/k}$$

where **V** = volts. Note that some vacuum gauge manuals give the formula for pressure in a form they may require some interpretation. For example, at least one gauge manual renders pressure as

$$P = 10^{0.778(U-c)}$$

Where **U** = volts. In this formula, **k** = the inverse of 0.778, or

$$\frac{1}{0.778}$$

- 3 If the applicable value of **c** differs from the default value (5.625), touch the **Constant (c)** entry box to display a numeric keypad and use that keypad enter the appropriate value.
- 4 Likewise, if the applicable value of **k** differs from the default value (1.0), touch the **Constant (k)** entry box to display a numeric keypad, and use that keypad enter the appropriate value.
- 5 If necessary, change the **Min. Volt** entry to the value prescribed in the manual for your chamber's lo-vac gauge. To do so, touch the **Min. Volt** entry box and follow the usual keypad-entry method.
- 6 If necessary, change the **Max. Volt** value, following the procedure outlined in Step 5.
- 7 Finally, if your gauge does not use the unit **Torr** for pressure, touch the **Torr** button to select either **mbar** (for millibars) or **Pa** (for Pascals), as appropriate.

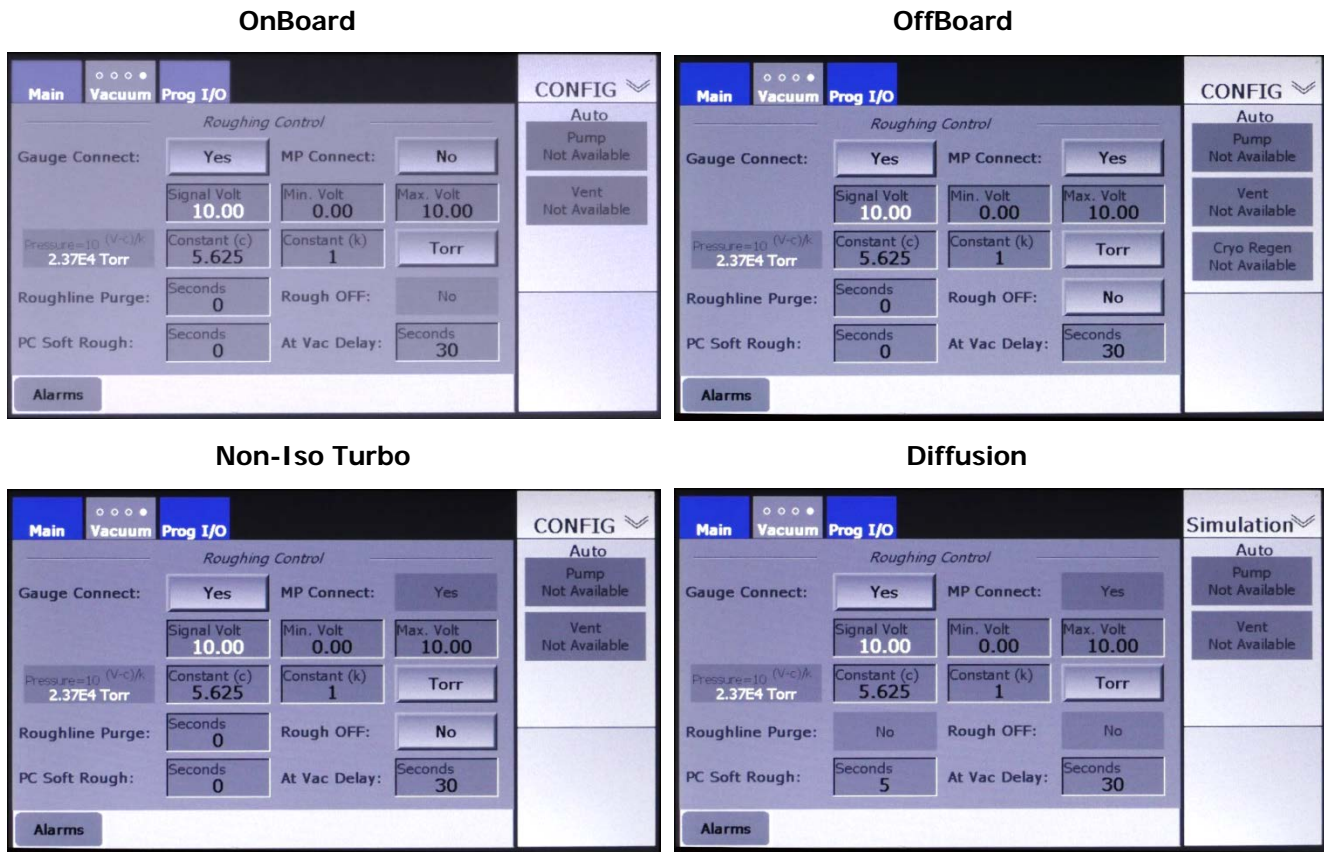
### 4.5.2 Configuring the Chamber High-Vacuum Gauge

Now configure your system's chamber high-vacuum gauge. To do so, refer the manufacturer's manual for that gauge and follow a procedure analogous to that described in section 4.5.1, using the parameter entry boxes and the **Torr** button under the heading *Chamber Hi-Vac Gauge*. Note that in this case, the default value of the constant **c** is 10.625.

## 4.6 Configuring Parameters on the Roughing Control Page

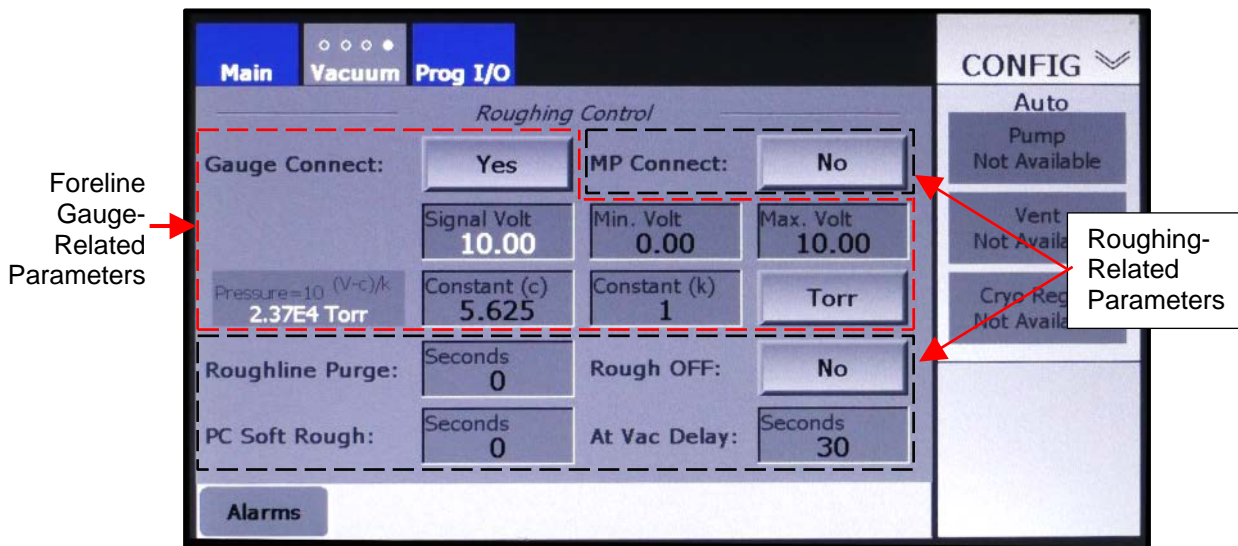
This section describes procedures for configuring parameters that appear on the Roughing Control page. The configurable parameters on that page vary depending on hi-vac pump selection. As Figure 4-7 shows, these variations consist of cases in which a given binary-choice parameter defaults to one of the available choices. Therefore, this section covers all of the parameters shown in the cases without such defaults (see Figure 4-8). If one or more defaults apply to your FerroVac, simply disregard the instructions related to those parameters and proceed to the next instruction.

Figure 4-7 Variations in the Roughing Control Page



As shown in Figure 4-8, the Roughing Control page displays two groups of configurable parameters, one group related to the foreline gauge and the other related to roughing control. For instructions on connecting and configuring a foreline-gauge, see section 4.6.1. For instructions on connecting a mechanical pump and configuring parameters related to roughing control, see section 4.6.2.

Figure 4-8 Configurable Parameters on the Roughing Control Page

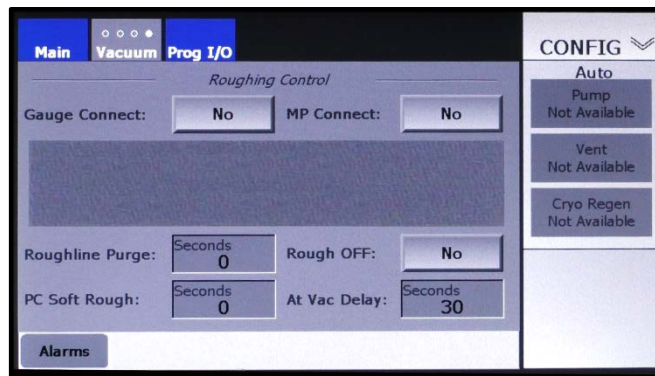


### 4.6.1 Connecting and Configuring the Foreline Gauge

If your system has a foreline gauge that is connected to the FerroVac, perform the following procedure. If not, skip this section and proceed to section 4.6.2.

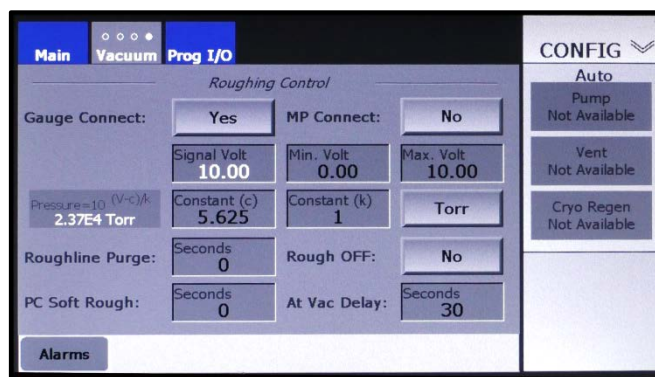
- | Step | Action  |
|------|---|
| 1    | To configure the foreline gauge, first open the Roughing Control page. To navigate to that page from the Chamber Vacuum Gauges page, touch the <b>Vacuum</b> screen tab once. Figure 4-9 shows how this page looks when <b>OffBoard</b> is selected as the hi-vac pump. |

**Figure 4-9 The Roughing Control Page at Initial Boot-Up (Off-Board Cryo Selected)**



- |   |  |
|---|--|
| 2 | If your system's FerroVac is connected to a foreline gauge, touch the <b>Gauge Connect</b> button to toggle it to <b>Yes</b> . The screen will then appear as shown in Figure 4-10 |
|---|--|

**Figure 4-10 Foreline Control Page After User Selects Yes Opposite Gauge Connect**

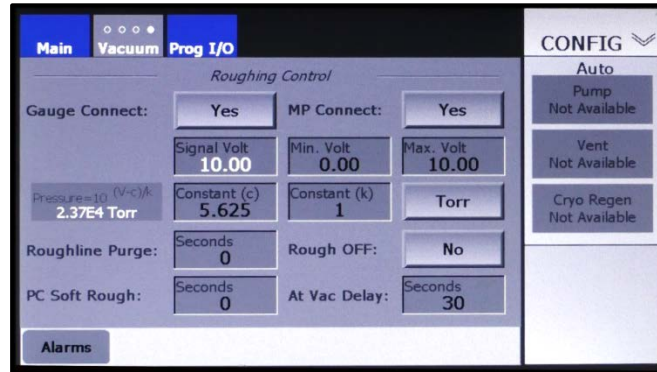


- |   |  |
|---|--|
| 3 | Referring to the manual for your system's foreline gauge, configure the parameters <b>Signal Volt</b> , <b>Min. Volt</b> , <b>Max Volt</b> , <b>Constant (c)</b> , <b>Constant (K)</b> , and <b>Torr</b> , following the procedure described Steps 2-7 of section 4.5.1. |
|---|--|

## 4.6.2 Connecting the Mechanical Pump and Configuring Roughing Parameters

- | Step | Action   |
|------|--|
| 1    | If you have not already done so, display the Foreline Control page (see section 4.6).  |
| 2    | Touch that screen's <b>MP Connect</b> button to toggle it to <b>Yes</b> . The screen will then appear as shown in Figure 4-11. |

**Figure 4-11 The Roughing Control Page After User Selects Yes Opposite *MP Connect***



- 3 If desired, touch the **Rough OFF** button to toggle it to **Yes**. When **Yes** is selected, the mechanical pump is switched off when the controlled/monitored system component reaches the triggering setpoint. For the vacuum chamber, this would be when the chamber Pirani gauge reaches the crossover setpoint entered via page 1 of the Details screen (see Figure 4-14). For the hi-vac pump, this would be when the pump's Pirani gauge reaches the interlock setpoint entered via the same screen.
- 4 If desired, change the values for **Roughline Purge** and **At Vac Delay**. When **Pump Connect** is set to **Yes**, these parameters serve merely to provide flexibility during an AutoPump operation. However, they are mandatory if **No** is left in place for **Pump Connect**. For a more detailed explanation of these parameters and for more detailed instructions, see "Entering Values for *Roughline Purge* and *At Vac Delay*".
- 5 If your system has a chamber soft rough valve, you will probably want to enter a nonzero value for **PC Soft Rough**. When a nonzero value is entered, the Vacuum Map displays an icon labeled **Sft Rgh** below or above the roughing valve icon, plus lines connecting the icon representing **Sft Rgh** valve to the roughing line on either side of the roughing valve icon (see Figure 4-33).

### Entering Values for *Roughline Purge* and *At Vac Delay*

Correct values for **Roughline Purge** and **At Vac Delay** are critical if your system's mechanical pump is not connected to the FerroVac. The **Roughline Purge** parameter is provided for users with wet

mechanical pumps, to ensure that oil is not drawing into the foreline by the inrush of air through the pump after it is switched off. The value entered for that parameter determines how long the foreline vent valve will remain open once it is opened. Therefore, if the mechanical pump is to be switched off manually, it is imperative for the user to first open the foreline vent valve. During autovent and autoregen operations, the foreline vent valve is automatically opened before the mechanical pump is switched off and remains open until the programmed **Roughline Purge** expires.

When a nonzero value is entered for **Roughline Purge**, the Vacuum Map appears as shown in Figure 4-33, displaying an icon for the foreline gauge as well as purge lines connecting that gauge to the foreline. When the **Roughline Purge** value is set to zero, those features do not appear on vacuum maps (see Figure 4-34).

Figure 4-33 shows a system configured for an On-Board cryopump. However, the Roughline Purge function operates identically when the hi-vac pump is either On-board or an Offboard cryopump or a non-iso turbo pump. When **Diffusion** is selected as the hi-vac pump, the **Roughline Purge** option is unavailable, and its entry box is replaced by a flat display rectangle displaying **No** (see Figure 4-7).

The **At Vac Delay** determines how long, during an autopump, a roughing valve will remain open after the pump or chamber being pumped down has reached its crossover setpoint. Values for **Roughline Purge** and **At Vac Delay** must be ascertained by observing of your system's pumping and venting performance. To change those values, perform the procedure described below.

Step	Action
1	To change the <b>Roughline Purge</b> value, first touch the recessed <b>Roughline Purge</b> entry box to open a numerical keypad.
2	Use this keypad to enter the desired purge time, in seconds.
3	Touch the keypad's <b>Enter</b> button to close it. The value you entered will then appear in the <b>Roughline Purge</b> entry box.
4	To change the <b>At Vac Delay</b> value, first touch the recessed <b>At Vac Delay</b> entry box to open a numerical keypad.
5	Enter the desired value via the keypad and touch its <b>Enter</b> button. The value you entered will then appear in the <b>At Vac Delay</b> entry box.

### Vacuum Map Illustrations Showing the Roughline Purge and Soft Rough Valves

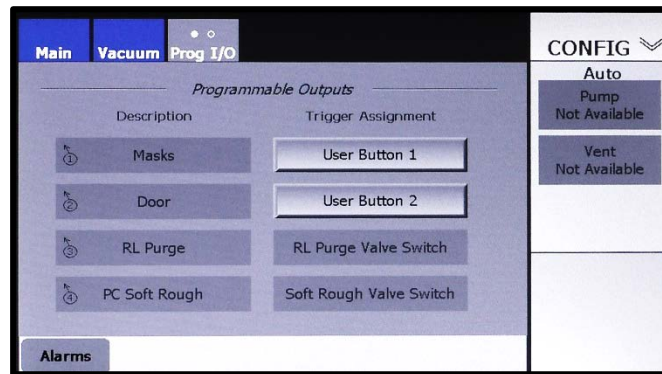
For illustrations showing the Vacuum Map when nonzero values are entered for **Roughline Purge** and **PC Soft Rough**, see:

- Figure 5-5 if your FerroVac is configured for use with an on-board cryopump
- Figure 6-8 if it is configured for use with an off-board cryopump
- Figure 7-5 if it is configured for use with a non-iso turbo pump
- Figure 8-5 if it is configured for use with a diffusion pump.
- Figure 9-6 if it is configured for use on a system with an Onboard cryopump and a load-lock valve
- Figure 10-7 if it is configured for use on a system with an Offboard cryop and a load-lock valve

### Programmable Outputs Dedicated to Roughline Purge and PC Soft Rough

When a nonzero value is entered for **Roughline Purge**, Programmable Output 3 is dedicated to controlling the roughline purge valve's switch. If some other trigger was previously assigned to Programmable Output 3, that assignment is overridden. When a nonzero value is entered for **PC Soft Rough**, Programmable Output 4 is dedicated to controlling the switch for the PC soft rough valve. If some other trigger was previously assigned to Programmable Output 4, that assignment is overridden. Figure 4-12 shows page 1 of the Details screen when nonzero values have been entered for **Roughline Purge** and **PC Soft Rough**.

**Figure 4-12 Page 1 of Prog I/O Screen when Nonzero Values Are Entered for *Roughline Purge* and *PC Soft Rough***



## 4.7 Setting Vacuum Setpoints

Perform the procedure described below to enter or change any of the following setpoints:

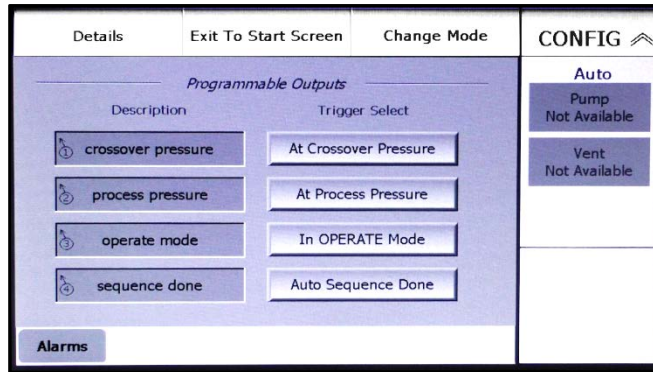
- Chamber Pirani gauge atmosphere setpoint
- Chamber Pirani gauge crossover setpoint
- Chamber ion gauge process setpoints 1 and 2
- Foreline Pirani gauge roughing setpoint
- Base setpoint for the hi-vac pump's Pirani gauge (only when the hi-vac pump is either a diffusion pump or an off-board cryopump; see Figure 4-14)

To change any of these setpoints, perform the following described procedure.

Step	Action
1	Touch the Mode ID/Menu Selection button to display the auxiliary menu (see Figure 4-13).



Figure 4-13 Prog I/O Screen, Page 1, with Auxiliary Menu Displayed

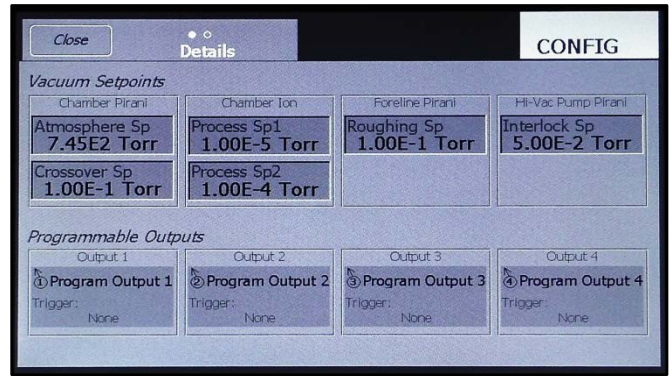
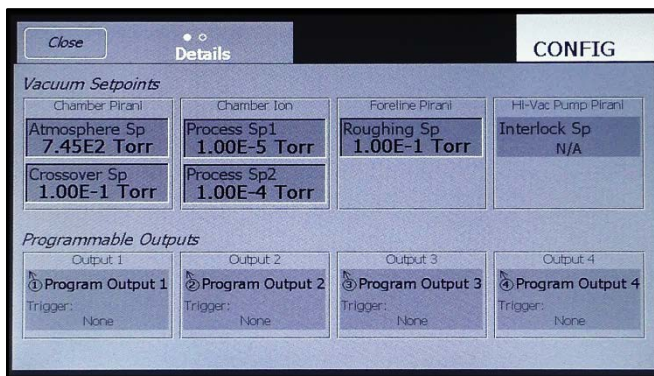


- 2 Touch this menu's **Details** button to display Page 1 of the Details screen (see Figure 4-14).

Figure 4-14 Details Screen, Page 1

Hi-Vac Pump = Either Onboard or Non-Iso Turbo

Hi-Vac Pump = Either Offboard or Diffusion



- 3 To change any of the setpoints displayed on this screen:
  - a) Touch the recessed entry box for the setpoint whose value you wish to change. The unit will then display a numeric keypad.
  - a) Use this keypad to enter the desired value.
  - b) Touch the keypad's **Enter** button to close it. The new value will then appear in the target entry box.
- 4 Repeat Step 3 as needed.
- 5 To return to the screen previously displayed, touch the Details screen's **Close** button.

## 4.8 Configuring Programmable Outputs

### NOTE

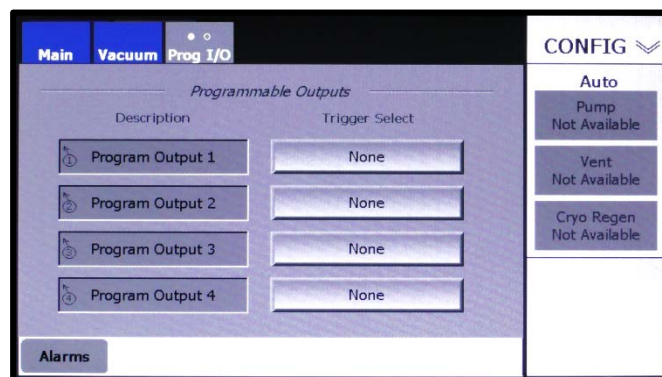
The procedures described below assume that one or more of the relays in the external I/O assembly labeled **PRG RLY 1** through **PRG RLY 4** (see Figure 2-2) have been correctly wired up to the FerroVac and to the system component(s) to be actuated by the programmable output(s) that you wish to configure.

### 4.8.1 Selecting Triggers for the Programmable Outputs

The FerroVac provides four programmable outputs, which are configured via pages 1 and 2 of the Prog I/O screen (see Figures 4-15 and 4-21). To assign triggers and descriptive names to these outputs, perform the procedures described below. If you do not wish to do so, skip this procedure and proceed to section 4.7.

Step	Action
1	To navigate to page 1 of the Prog I/O screen from any other Configuration mode screen, touch the <b>Prog I/O</b> screen tab once. Figure 4-15 shows how that screen appears at initial boot-up.

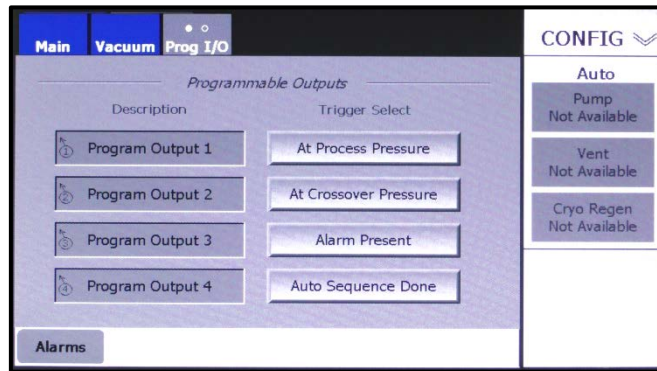
**Figure 4-15 Prog I/O Screen, Page 1, at Initial Boot-Up (No Triggers Selected)**



- To assign a trigger for a given programmable output, touch the adjacent **Trigger Select** button repeatedly until it displays the desired trigger condition. The available triggers are:
  - At Process Pressure
  - At Crossover Pressure
  - Alarm Present
  - Auto Sequence Done
  - Auto Pump Done
  - Auto Vent Done
  - In OPERATE Mode
  - In MANUAL Mode
  - In CONFIG Mode
  - User Button 1
  - User Button 2

Figure 4-16 shows the Programmable Outputs page after the user has selected **At Process Pressure**, **At Crossover Pressure**, **In Operate Mode**, and **Auto Sequence Done** as triggers for Programmable Outputs 1-4, respectively.

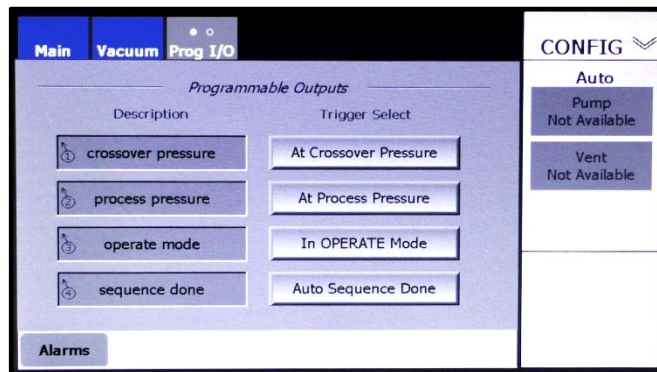
Figure 4-16 Prog I/O Screen, p. 1, when Triggers Are Selected for All Four Outputs

**NOTE**

Step 3 below applies to all triggers except for User Button 1 and User Button 2. For instructions on entering descriptive names for those triggers in the **Description** column, see section 4.7.2.

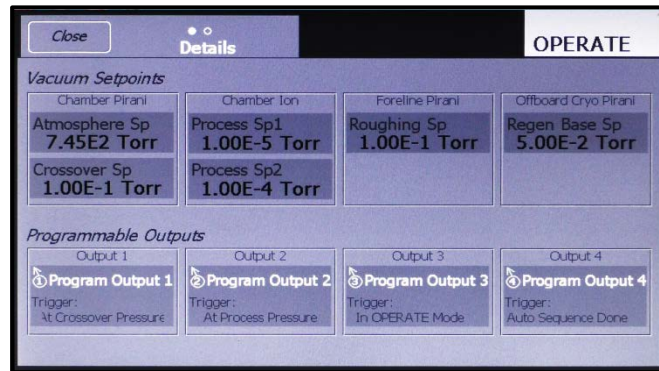
- 3 If desired, enter descriptive names for trigger conditions selected for the four programmable outputs. To do so:
  - a) Touch the recessed entry box labeled **Program Output 1** to display a keyboard popup.
  - b) Use that keyboard to enter the desired description.
  - c) Touch the keyboard's **Enter** button to close it, at which point the description you entered will appear in the entry box for programmable output 1.
  - d) Repeat Steps a) through c) to enter descriptions for the other three programmable outputs. The screen will then appear as shown in Figure 4-17.

Figure 4-17 Prog I/O Screen, p. 1, after Descriptions Are Entered for All Four Outputs



The descriptive names you enter will also appear on page 1 of the Details screen, as shown in Figure 4-18.

Figure 4-18 Details Screen, Page 1: Programmable Outputs Configured as Shown in Figure 4-17



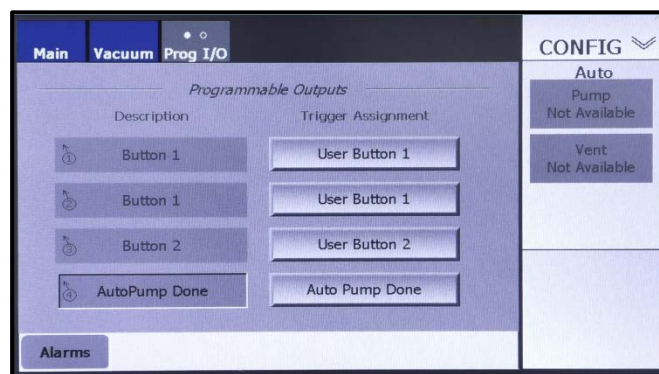
### 4.8.2 Programming On-Screen Buttons

#### Selecting User Button 1 and/or User Button 2 as Triggers

Any of Programmable Outputs 1-4 can be assigned to the triggers User Button 1 and User Button 2. When these triggers are selected, the user can on-screen buttons that activate the programmable outputs to which they are assigned. When configured, these buttons are available in Configuration mode and, depending on how they are configured, in Operations and/or Manual modes.

As shown in Figure 4-19, multiple outputs can be linked to either or both of the User Button triggers. When they are selected as triggers, the labels **Button 1** and **Button 2** appear in the **Description** column. However, the user can change the labels that appear there, as described below.

Figure 4-19 Prog I/O Screen, p. 1: Two Outputs Assigned to User Button 1



#### Configuring User Buttons 1 and 2

To configure User Buttons 1 and 2, touch the **Prog I/O** tab to display page 2 of the Prog I/O screen. Figure 4-20 shows how that page appears when no outputs are assigned to either User Button. Figure 4-21 shows how that screen appears when one or more outputs have been assigned to both buttons but before any button configuration has been performed on that page.

Figure 4-20 Prog I/O Screen, p. 2: Neither Button Assigned to any Output(s)

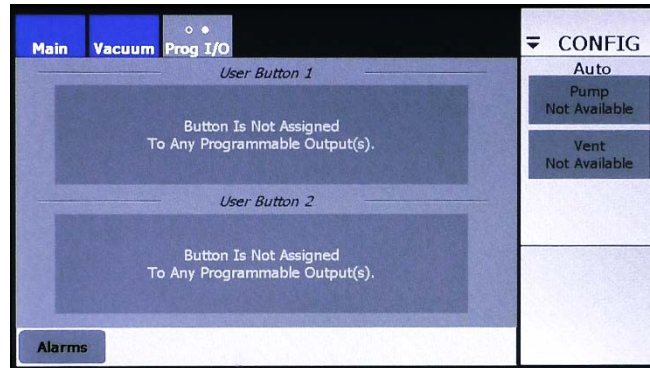


Figure 4-21 Prog I/O Screen, p. 2: Outputs Assigned to Both Buttons, Neither Configured

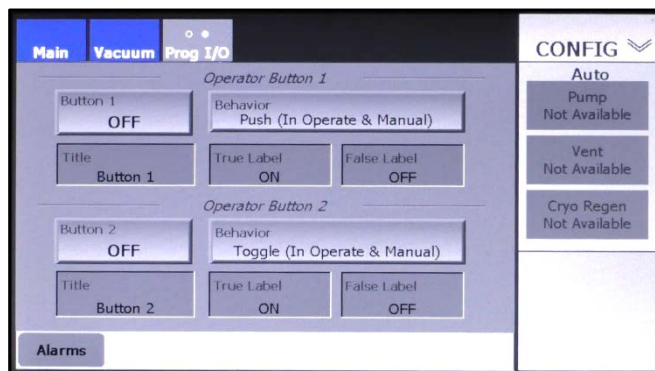


This screen allows you to select any of eight different behaviors for either button and to entering a button title, a True-state label, and a False-state label for each button. Procedures for implementing these configuration options are described below.

### Assigning Button Behaviors

As shown in Figure 4-22, either button can be configured to operate as either a toggle or as a momentary-action push button.

Figure 4-22 Prog I/O Screen, p. 2: Button 1 Set to Push, Button 2 Set to Toggle



In addition, either button can be configured to operate in Operations mode only, in Manual mode only, or in both modes. The complete list of selectable behaviors is:

- Toggle in Operate & Manual
- Push in Operate & Manual
- Toggle in Operate
- Push in Operate
- Toggle in Manual
- Push in Manual

To select the desired behavior, push either **Behavior** button as many times as necessary until that button displays the desired behavior description.

### Assigning Button Titles and Labels

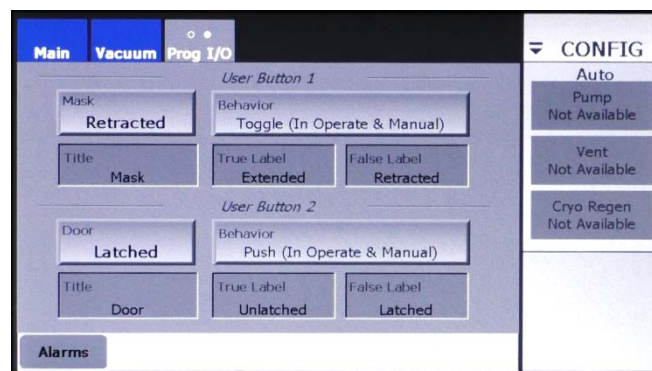
When fully configured, each on-screen button displays a small button title in its upper left-hand corner, while a larger state-label occupies a central position near the bottom of the button (see Figures 4-24 through 4-26). The button title is entered via the recessed **Title** entry box on page 2 of the Prog I/O screen, while the recessed **True Label** and **False Label** entry boxes enable the user to create two alternative labels, one of which will appear on the button, depending on its on/off state.

By default, the title for Button 1 is **Button 1**. To create a different title for that Button, touch its **Title** entry box to display an alphanumeric keyboard. Use that keyboard to enter the desired title. Do the same to create a different title for Button 2.

By default, the True and False labels for the same button are simply **ON** and **OFF**. To create a different label for Button 1's True state, touch the **True Label** entry box to display another keyboard. Use that keyboard to enter the desired label for Button 1's True state. Perform the same procedure to enter the desired label for Button 1's False state as well as Button 2's True and False states.

Figure 4-23 shows how this screen looks after the user has configured Button 1 as a toggle button operational in Operations mode, Button 2 as a Push button operational in that mode, and titles plus True and False labels for both buttons.

**Figure 4-23 Prog I/O Screen, p. 2: Titles and True/False Labels Assigned to Buttons 1 and 2**

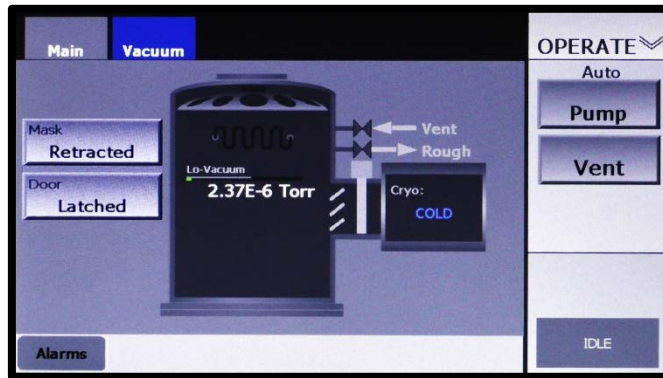


Note that the **Mask** and **Door** buttons on this screen operate in exactly the same fashion as the **Mask** and **Door** buttons shown in Figures 4-24 through 4-26.

### Operation of User-Programmed Buttons in Operations and/or Manual Modes

Figure 4-24 shows the Ops>Main screen as it appears when User Buttons 1 and 2 are configured as shown in Figure 4-23.

**Figure 4-24 Ops>Main Screen Displaying User Buttons Configured to Control Mask and Door**



In Figure 4-25 the user has touched the **Mask** button to toggle it to **Extended**. If Programmable Output 1 is correctly wired to control the masks, they would now be extended.

**Figure 4-25 Ops>Main Screen, User Has Toggled the Mask Button to Extended**

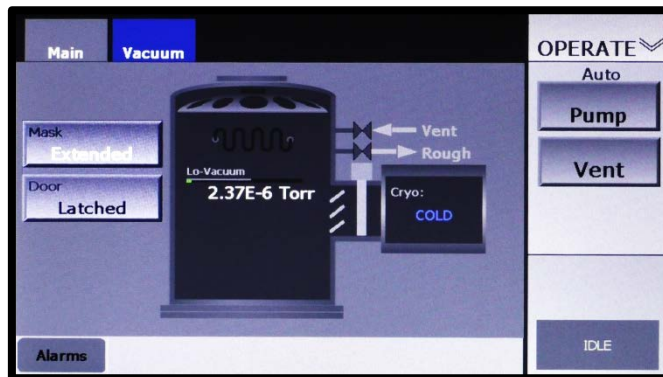
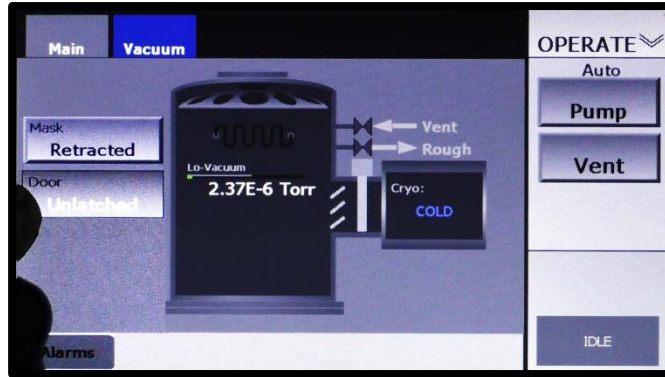


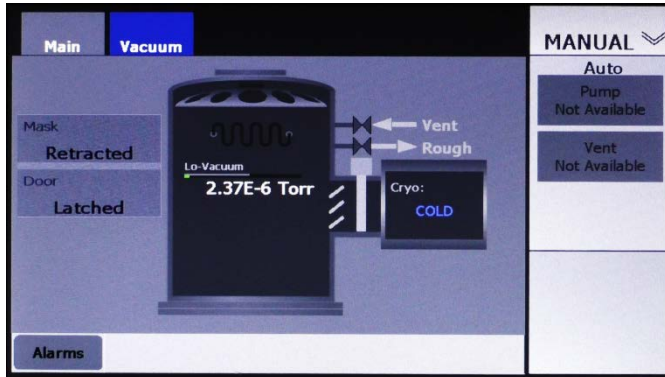
Figure 4-26 shows the user touching the **Door** button. Because the that button is configured as a push button, the button's state label reads **Unlatched** only while the button is depressed. As soon as the user releases that button, the label reverts to **Latched**.

**Figure 4-26 Ops>Main Screen, User Is Pressing the *Door* Button to Select *Unlatched***

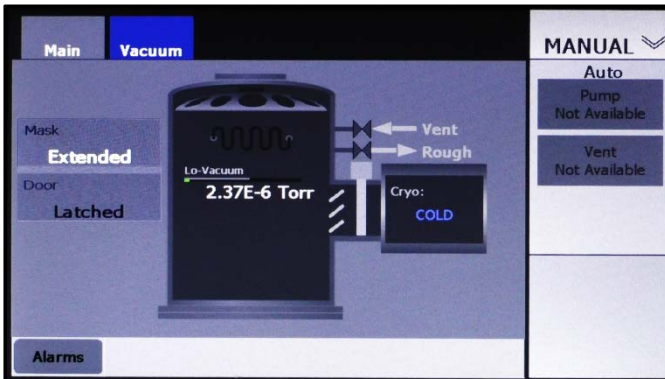


With both buttons configured to operate only in Operations mode, the Manual mode Main screen would display flat display rectangles (see Figure 4-27) in place of the buttons available in Operations mode. The labels in those rectangles would change to reflect state changes made in either Operations or Configurations mode. Figure 4-28 shows the Manual>Main screen after the user has pressed the **Door** button in either Configuration or Operations mode to select **Extended**.

**Figure 4-27 Manual>Main Screen when User Buttons 1 and 2 Are in the State Shown in Figure 4-25 and Configured to Operate only in Operations Mode**



**Figure 4-28 Manual>Main Screen, User Has Pressed Mask Button in Either Configuration or Operations Mode to Select Extended**





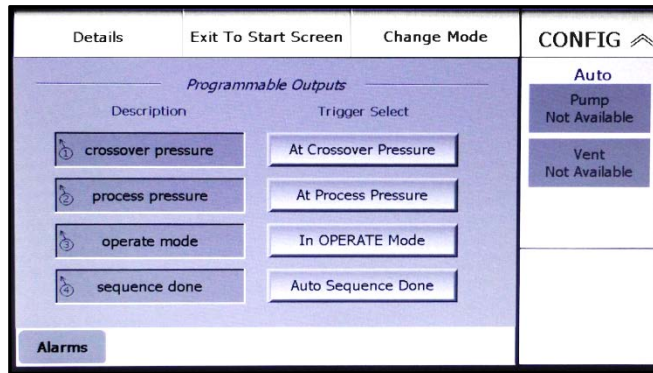
If User Buttons 1 and 2 were configured to operate in Manual mode only or in both Operations and Manual modes, identical buttons would appear on the Manual>Main screen and operate as they do in Operations mode in Figures 4-24 through 4-26. If those buttons were configured to operate only in Manual mode, then on the Operations>Main screen they would be replaced by flat display rectangles like those shown in Figure 4-27.

## 4.9 Exiting Configuration Mode and Saving Configuration Changes

Configuration changes are automatically saved when you exit from Configuration Mode. To do so, follow the procedure described below.

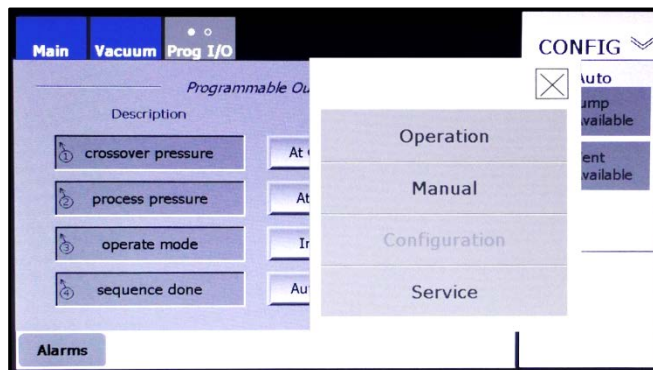
- | Step | Action   |
|------|--|
| 1    | Touch the Mode ID/Menu Selection button to display the Auxiliary Menu (see Figure 4-29). |

**Figure 4-29 Prog I/O Screen, Page 1, Displaying the Auxiliary Menu**



- |   |  |
|---|--|
| 2 | Touch the Auxiliary Menu's <b>Change Mode</b> button to display the popup window shown in Figure 4-30. |
|---|--|

**Figure 4-30 Prog I/O Screen, Page 1, Displaying the Change Mode Button**



- |   |   |
|---|---|
| 3 | Touch the name of the mode you wish to enter. |
|---|---|

If you have completed all the configuration changes you wish to make, the system is now ready for normal operation.

### 2.1.1 Variations in Vacuum Map Features Depending on Configuration

Figures 4-31 through 4-37 show the Configuration mode Vacuum Map in various configuration states. In each case, the Manual mode Vacuum map would contain identical control/display features. In Operations mode, the Vacuum map would display identical icons but no control pushbuttons, other than those on the command button bar.

The appearance of the Vacuum Map in all three modes varies depending on the following configuration selections:

- Foreline gauge connected or not (compare Figures 4-31 and 4-32)
- Mechanical pump connected or not (compare Figures 4-32 and 4-33)
- **Roughline Purge** value on Foreline Control page set to zero seconds (see Figure 4-34)
- the Hi-Vac pump selected (compare Figures 4-33, 4-35, 4-36, and 4-37 )

For detailed illustrations and descriptions of the control/display features of the Manual mode vacuum map, see:

- Section 5.3.1 if your FerroVac is configured for use with an Onboard cryopump
- Section 6.3.1 if it is configured for use with an Offboard cryopump
- Section 7.3.1 if it is configured for use with a non-iso turbo pump
- Section 8.3.1 if it FerroVac is configured for use with a diffusion pump
- Section 9.3.1 if it is configured for use with an Onboard cryopump plus a load-lock valve
- Section 10.3.1 if it is configured for use with an Offboard cryopump plus a load-lock valve

**Figure 4-31 Config>Vacuum Map: On-Board Cryo Selected, No Mech. Pump or Foreline Gauge Connected**

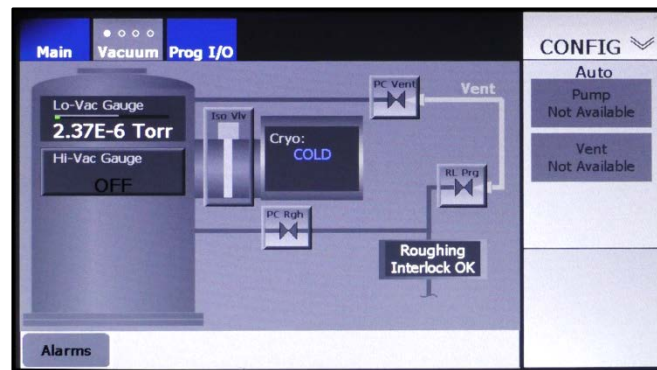


Figure 4-32 Config>Vacuum Map: On-Board Cryo Selected, Mech. Pump Not Connected, Foreline Gauge Connected

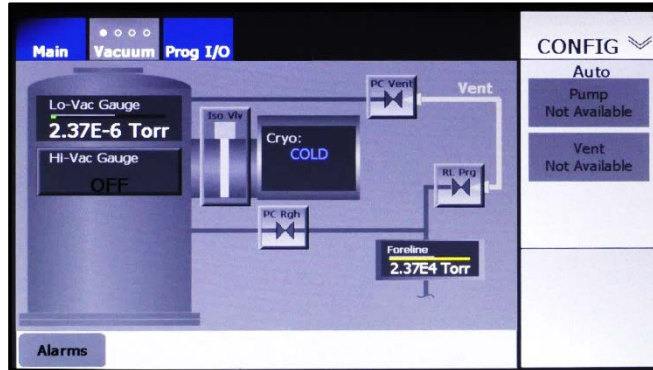


Figure 4-33 Config>Vacuum Map: On-Board Cryopump Selected, Mech. Pump and Foreline Gauge Both Connected, Nonzero Values Entered for *Roughline Purge* and *PC Soft Rough*

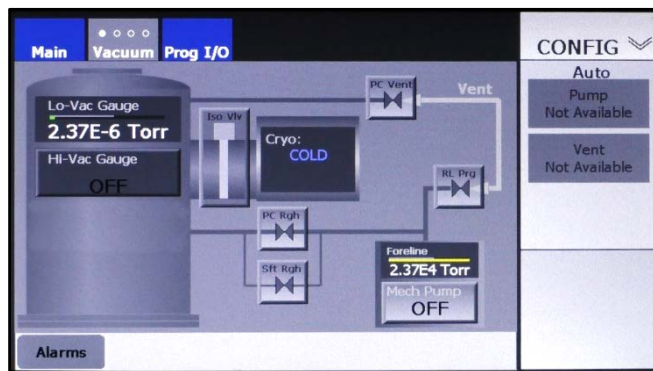


Figure 4-34 Config>Vacuum Map: On-Board Cryo Selected, Mech. Pump and Foreline Gauge Connected, *Roughline Purge* Value Set to Zero Seconds

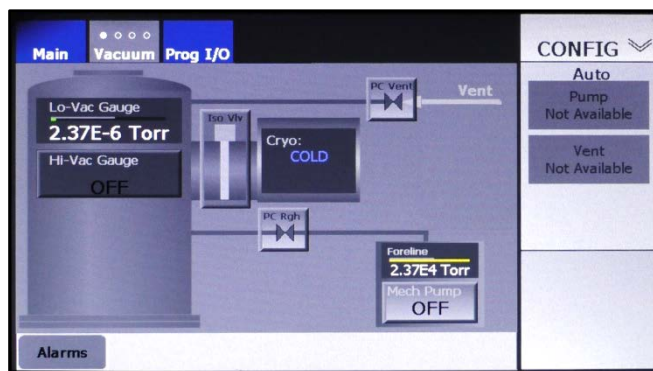


Figure 4-35 Config>Vacuum Map: Off-Board Cryo Selected, Mechanical Pump and Foreline Gauge Both Connected, *Roughline Purge* and *PC Soft Rough* Set to Zero

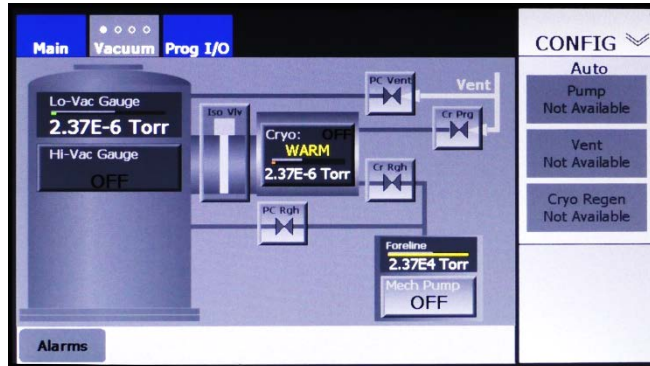
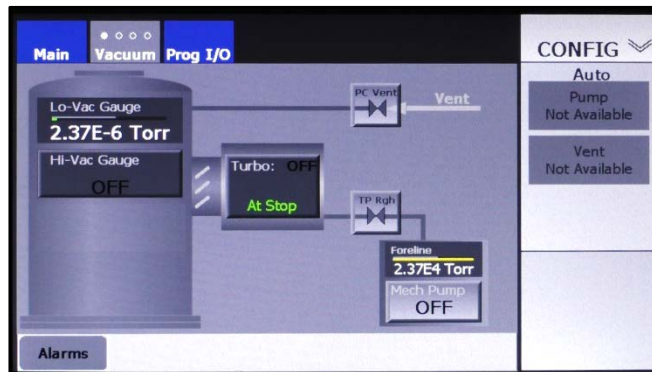


Figure 4-36 Config>Vacuum Map: Non-Iso Turbo Selected, Mechanical Pump and Foreline Gauge Connected, *Roughline Purge* and *PC Soft Rough* Set to Zero



# 5 Onboard Configuration and Operation

## 5.1 Section Overview

This section describes the procedures for configuring the FerroVac the FerroVac for use with an Onboard™ cryopump. These procedures assume that the FerroVac has been correctly installed, cabled up to controlled/monitored components, and powered up. The topics covered below are:

### Section 5.2 Configuration Procedure

Section 5.2.1 Perform Common Configuration Procedures

Section 5.2.2 Configure the Cryopump

Section 5.2.3 Exit Configuration Mode and Save Configuration Changes

### Section 5.3 FerroVac Operation in Manual Mode

Section 5.3.1 Control/Display Features of Manual Mode Screens

### Section 5.4 FerroVac Operation in Operations Mode

Section 5.4.1 Operations Mode Screens

Section 5.4.2 Executing Automated Operations

## 5.2 Configuration Procedure

### 5.2.1 Perform Common Configuration Procedures

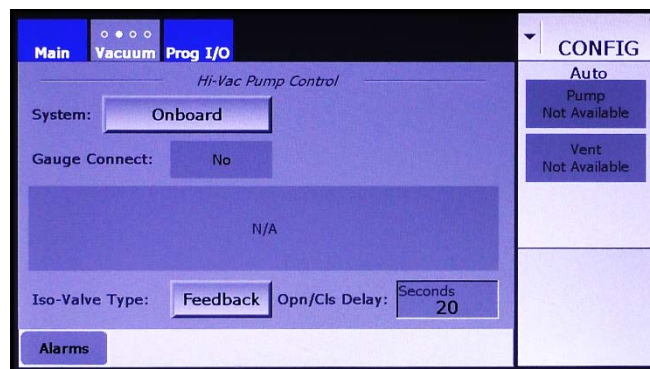
First perform the configuration procedures detailed in Section 4 of this manual. Those procedures apply regardless of hi-vac pump selection.

### 5.2.2 Configure the Cryopump

Next configure the FerroVac for use with your system's cryopump. To do so:

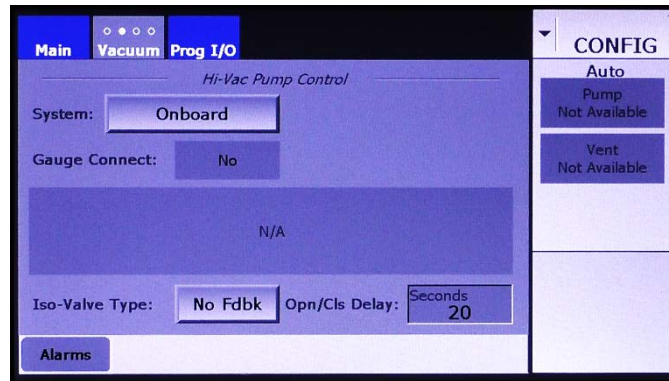
Step	Action
1	Touch the <b>Vacuum</b> screen tab as many times as necessary to display the Hi-Vac Pump Control page (see Figure 5-1).

Figure 5-1 Hi-Vac Pump Control Page at Initial Boot-Up



- 2 If your system's cryo-iso valve provides positional feedback to the FerroVac, skip this step and Step 3. Otherwise, touch the **Iso-Valve Type** button to toggle it from **Feedback** to **No Fdbk**. The screen will then appear as shown in Figure 5-2.

**Figure 5-2 Hi-Vac Pump Control Page After User Selects *No Fdbk***



- 3 Next enter the desired value for the **Open/Close Delay**. When **No Fdbk** is selected, the **Open/Close Delay** must allow sufficient time for the iso-valve to travel between the open and closed positions.. To determine this value, observe the length of time it takes for the cryo-iso valve to open or close after an Open or Close command is issued. To change the **Opn/Cls Delay** value:
  - a) Touch the recessed **Opn/Cls Delay** entry box to display a numeric keypad.
  - b) Use this keypad to enter the desired value.
  - c) Touch the keypad's **Enter** button to close it. The new value will then appear in the **Opn/Cls Delay** entry box.

### 5.2.3 Exit Configuration Mode and Save Configuration Changes

Exit from Configuration Mode, as described in section 4.10. Configuration changes are automatically saved when you do so.

## 5.3 FerroVac Operation in Manual Mode

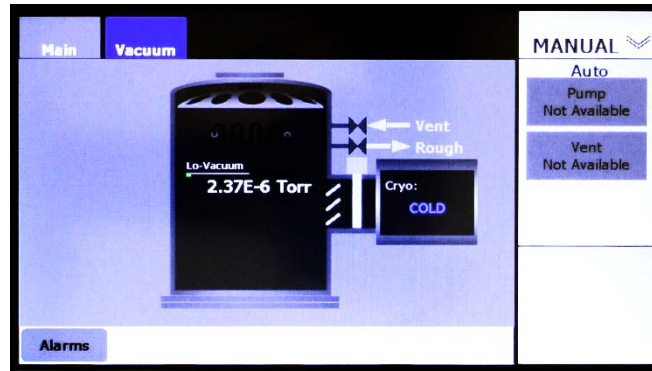
### 5.3.1 Control/Display Features of Manual Mode Screens

Manual mode screens are the Manual>Main screen (see Figure 5-3) and the Manual mode Vacuum map (see Figure 5-4).

### The Manual>Main Screen

The Manual>Main screen (see Figure 5-3) provides a simplified vacuum map and serves only to allow the user to monitor vacuum operations. The screen provides no command functionality over vacuum pumps, valves, or gauges.

**Figure 5-3 Manual>Main Screen**



### The Manual Mode Vacuum Map

Figures 5-4 through 5-8 show the Manual mode Vacuum Map when the FerroVac is in the following configuration state:

- System = Onboard
- (Foreline) Gauge Connect = Yes
- Mechanical Pump Connect = Yes
- Rough Off = No

The control/display features on the Manual mode Vacuum Map are identical to those on the Configuration mode Vacuum Map. Control buttons on both Vacuum maps enable the user to open and close vacuum valves, including the cryo-iso valve, and to switch on/off the mechanical pump, the cryopump, and the chamber ion gauge.

Figure 5-4 and 5-6 and 5-8 show the Manual mode Vacuum Map when **Roughline Purge** and **PC Soft Rough** are both set to zero. Figure 5-5 shows that screen when nonzero values are entered for those parameters. Figures 5-6, 5-7, and 5-8 identify the Vacuum Map's control/display features.

Figure 5-4 Manual Mode Vacuum Map when Values for *Roughline Purge* and *PC Soft Rough* Are Both Zero

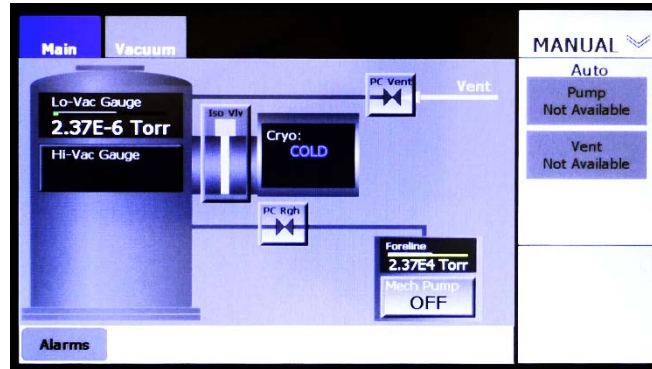


Figure 5-5 Manual Mode Vacuum Map when Nonzero Values Are Entered for *Roughline Purge* and *PC Soft Rough*

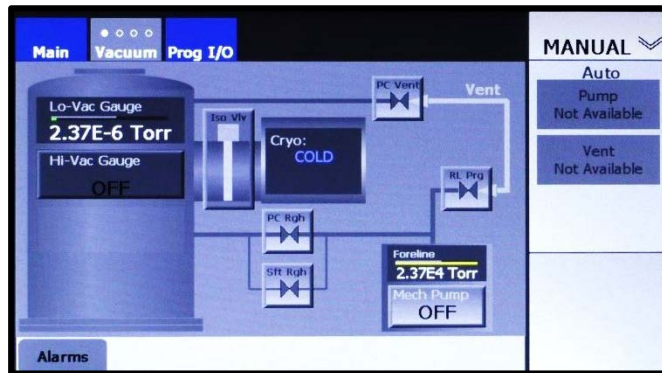


Figure 5-6 Manual Mode Vacuum Map: Control Buttons for Vacuum Valves and Iso-Valve

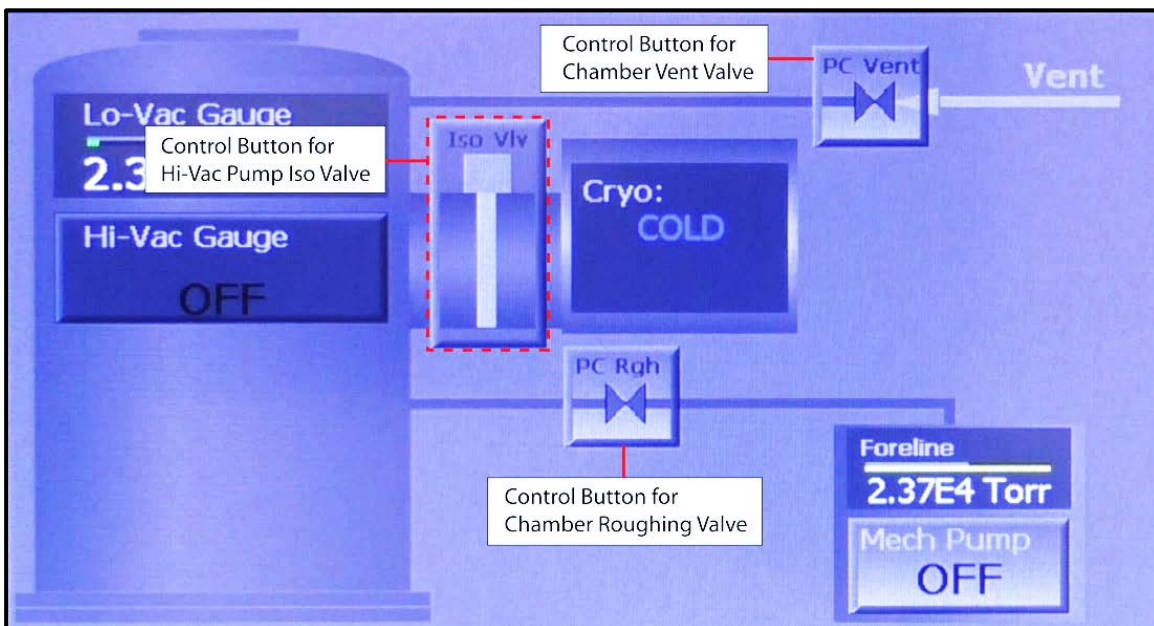




Figure 5-7 Manual Mode Vacuum Map: Control/Display Features Related to Pumps, Foreline Gauge, and Chamber Lo-Vac Gauge

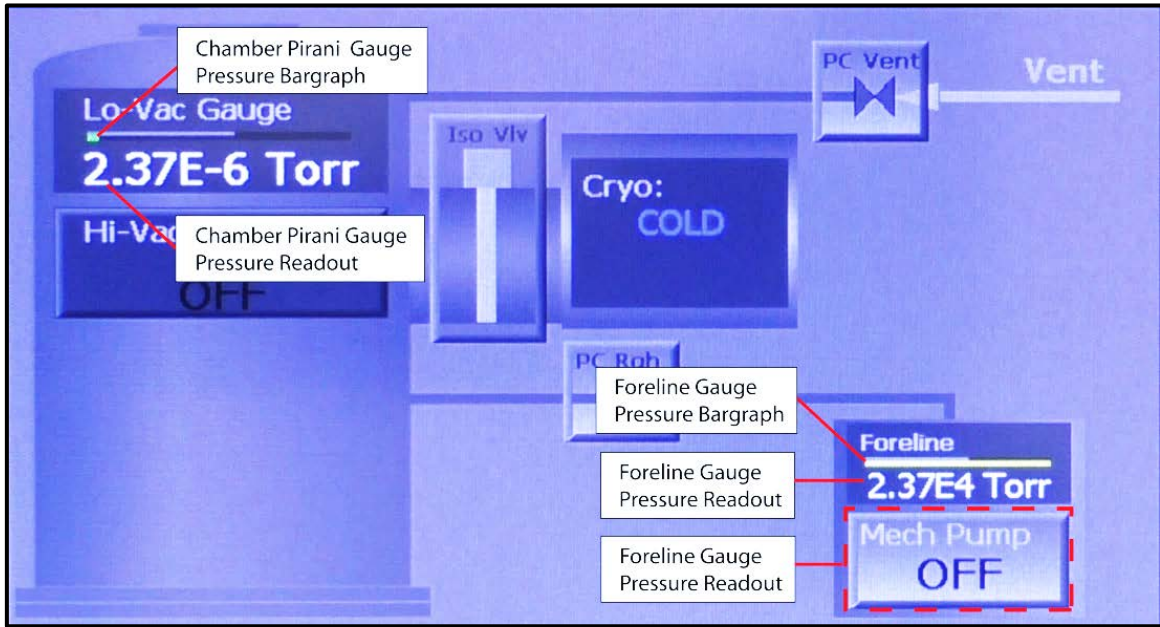
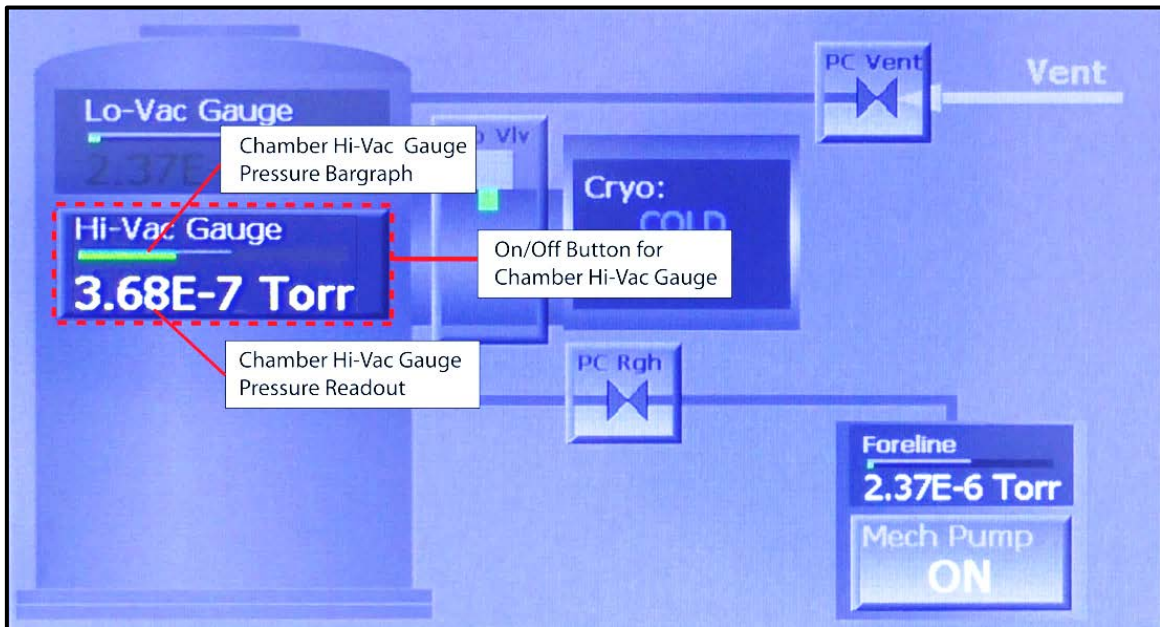


Figure 5-8 Manual Mode Vacuum Map Features Related to Chamber HI-Vac Gauge



## 5.4 FerroVac Operation in Operations Mode

### 5.4.1 Operations Mode Screens

When the unit is configured for an Onboard cryopump, the available automated operations are Auto Pump and Auto Vent. These operations can be initiated by pressing the **Pump** and **Vent** buttons on either the Operations>Main screen (see Figure 5-9) or the Operations mode Vacuum map (see Figure 5-10).

Figure 5-9 Operations>Main Screen

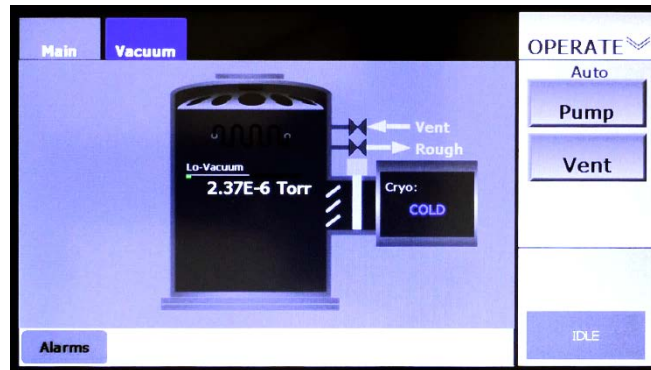
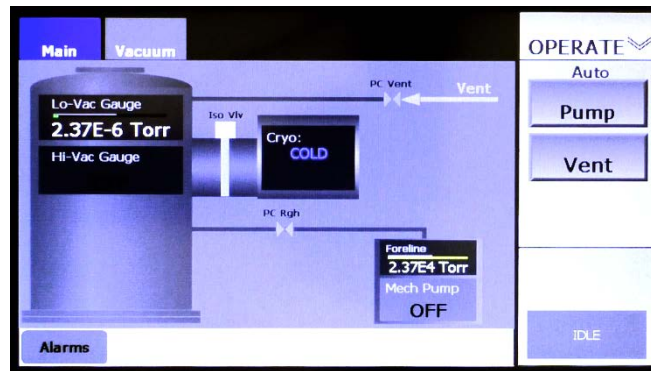


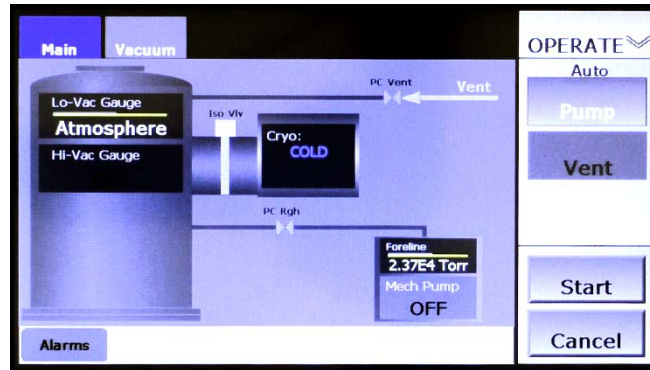
Figure 5-10 Operations Mode Vacuum Map



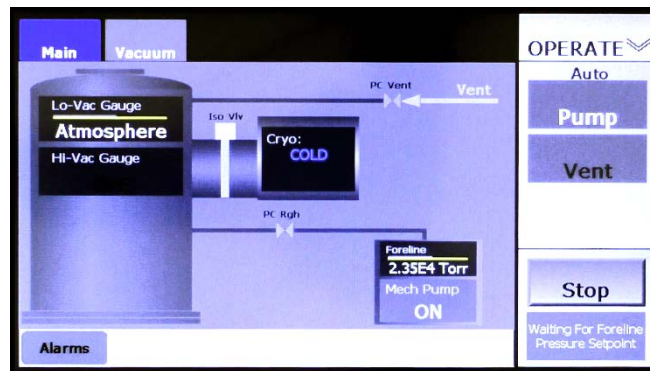
### 5.4.2 Executing Automated Operations

When configured for use with an Onboard cryopump, the FerroVac enables the user to start, pause, abort, and resume Autopump and Autovent operations. The following procedure illustrates these control sequences, using Autopump as an example. However, the example applies equally to Autovent.

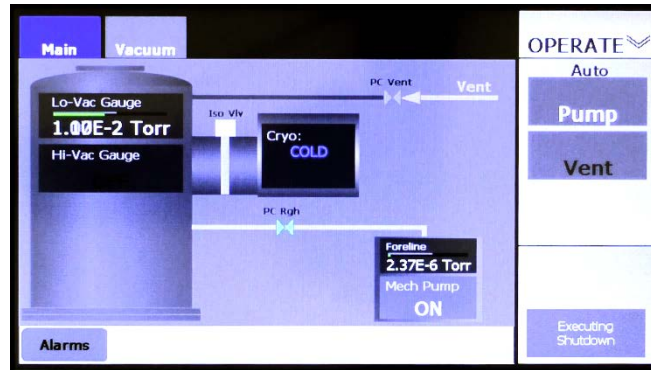
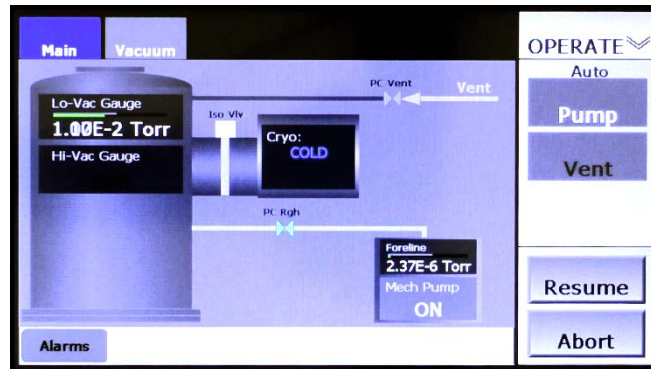
Step	Action
1	Press the <b>Pump</b> button to select Autopump. The command button bar will then display <b>Start</b> and <b>Cancel</b> buttons, as shown in Figure 5-11.

Figure 5-11 Operations>Vacuum Map After User Presses the *Pump* Button

- Next press the **Start** button to initiate the Autopump operation. The command button bar will then display a **Stop** button in place of the **Start** button. A rectangle below the **Stop** button will display status messages relating to the Autopump operation (see Figure 5-12).

Figure 5-12 Operations>Vacuum Map After User Presses *Start*

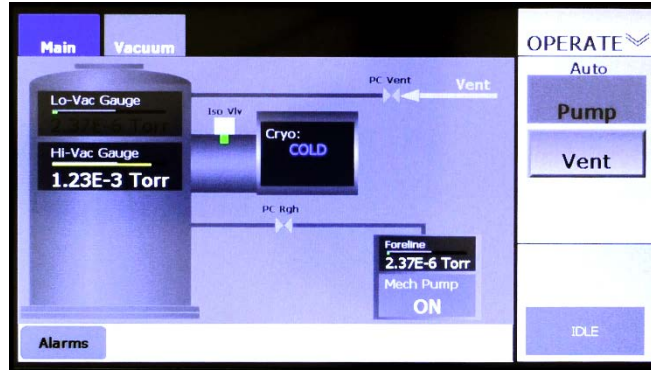
- To pause the Autopump operation, press the **Stop** button. That button will then disappear, and the message **Executing Shutdown** will be briefly displayed, as shown in Figure 5-13. After that shutdown sequence is completed, the command button bar will display **Resume** and **Abort** buttons, as shown in Figure 5-14.

Figure 5-13 Operations>Vacuum Map Immediately After User Presses *Stop*Figure 5-14 Operations>Vacuum Map Displaying *Resume* and *Abort* Buttons

Pressing **Abort** returns the FerroVac to the Idle state, and the screen will appear as shown in Figure 5-10. If **Resume** is pressed, the Autopump operation will re-execute the sequence that was interrupted from its beginning and then proceed through the remainder of the Autopump operation. If **Abort** is pressed, the command button bar will briefly display the message **Executing Shutdown**. When the shutdown sequence is completed, the command button bar will display **Idle**.

At the end of the Autopump operation, the cryo-iso valve will open and the chamber's hi-vac gauge will be switched on, after which a Completion Delay will execute. Upon the completion of that delay, the Autopump is completed, and the screen will appear as shown in Figure 5-15. However, the cryopump will continue to pump the chamber down to its lowest possible pressure.

Figure 5-15 Operations>Vacuum Screen After Completion of Autopump





# 6 *OffBoard Configuration and Operation*

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## 6.1 Section Overview

This section describes the configuration and operational procedures for a FerroVac configured for use in a system with an Offboard cryopump. These procedures assume that the FerroVac has been correctly installed, cabled up to controlled/monitored components, and powered up. Topics covered in this section are:

### Section 6.2 Configuration Procedure

#### Section 6.2.1 Perform Common Configuration Procedures

#### Section 6.2.2 Configure Parameters on the Hi-Vac Pump Control Page

#### Section 6.2.3 Exit Configuration Mode and Save Configuration Changes

### Section 6.3 FerroVac Operation in Manual Mode

#### Section 6.3.1 Control/Display Features on Manual Mode Screens

#### Section 6.3.2 Pumping the Chamber to Hi-Vac When Cryopump Is Warm

### Section 6.4 FerroVac Operation in Operations Mode

#### Section 6.4.1 Available Automated Operations

#### Section 6.4.2 Variations in Cryopump Icon in Vacuum Maps Depending on Configuration

#### Section 6.4.3 Executing Autopump and Autovent Operations

#### Section 6.4.4 Configuring and Executing AutoRegen Operations

## 6.2 Configuration Procedure

### 6.2.1 Perform Common Configuration Procedures

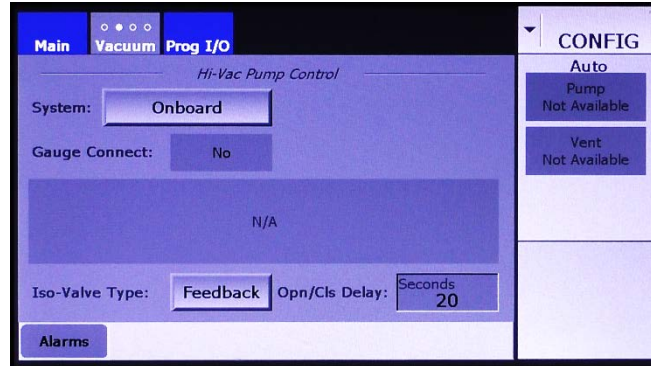
First perform the configuration procedures described in Section 4. Those procedures apply to all FerroVac installations regardless of the hi-vac pump selection.

### 6.2.2 Configure Parameters on the Hi-Vac Pump Control Page

Next configure the parameters on the Hi-Vac Pump Control page. To do so:

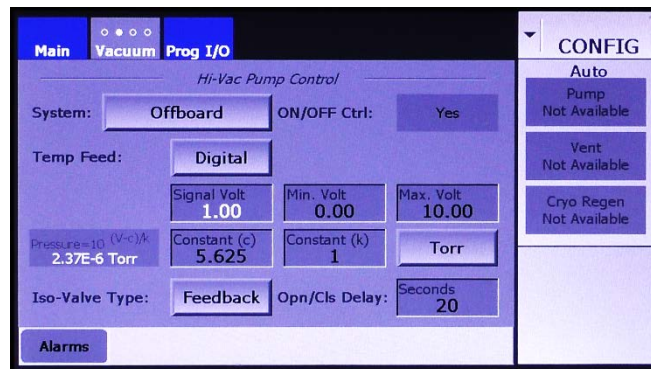
- | Step | Action   |
|------|--|
| 1    | Touch the <b>Vacuum</b> screen tab as many times as necessary to display the Hi-Vac Control page (see Figure 6-1). |

**Figure 6-1 Hi-Vac Pump Control Page at Initial Boot-Up**



- Touch the **System** button once to change its label to **OffBoard**. The screen will then appear as shown in Figure 6-2.

**Figure 6-2 Hi-Vac Pump Control Page After the User Selects *OffBoard* for System**



- Next select the **Temp Feed** option. If your system's cryopump provides temperature feedback to the FerroVac, leave **Digital** selected. If not, press the **Temp Feed** button to toggle it to **None**, as shown in Figure 6-3.

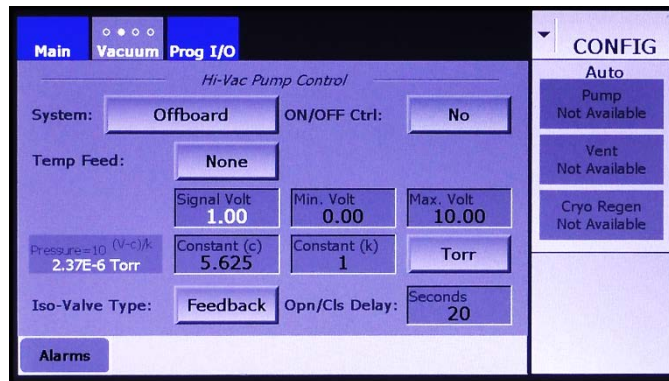
When **Digital** is selected, the Vacuum Map's cryopump icon (see Figure 6-12) displays either **WARM**, **WARMING**, **COOLING**, or **COLD**, depending on the pump's temperature state. In addition, the **On/Off Ctrl.** selection on the Hi-Vac Pump Control page defaults to **Yes**, so the Vacuum Map's cryopump icon functions as an On/Off button for the cryopump, as shown in Figure 6-12.

When **None** is selected for **Temp Feed**, the cryopump icon displays either **ONLINE** or **OFFLINE** to indicate the pump's status, instead of **WARM**, **WARMING**, **COOLING**, or **COLD**, as shown in Figure 6-13.



- 4 If you left the default, **Digital**, selected for **Temp Feed**, skip this step. If you selected **None** for **Temp Feed**, then **Yes/No** toggle button appears opposite **ON/OFF Ctrl**. If you select **Yes**, the Vacuum Map's cryopump icon functions as an On/Off button, as shown in Figure 6-13. If **No** is selected, as shown in Figure 6-3, that button becomes a flat display rectangle, as shown in Figure 6-14.

**Figure 6-3 Hi-Vac Pump Control Page: *None Selected for Temp Feed, No for On/Off Ctrl***



- 5 Next configure the cryopump's Pirani gauge, using the **Signal Volt**, **Max. Volt**, **Min. Volt**, **Constant (c)**, and **Constant (k)** entry boxes. In doing so, follow the procedure described in detail in section 4.5.1.
- 6 If your gauge does not use the unit **Torr** for pressure, touch the **Torr** button to select either **mbar** (for millibars) or **Pa** (for Pascals), as appropriate.
- 7 Next select the **Iso-Valve Type**. If your system's cryo-iso valve is equipped with opened/closed position sensors, leave the default, **Feedback**, in place. If not, select **No Fdbk**.
- 8 Finally, enter a value for the **Opn/Cls Delay**. When **No Fdbk** is selected, the **Opn/Cls Delay** must allow sufficient time for the iso-valve to travel between the open and closed positions. To determine this value, observe the length of time it takes for the cryo-iso valve to open or close after an Open or Close command is issued.

If the default, **Feedback**, is left in place, the **Opn/Cls Delay** period begins when the iso-valve's position sensor indicates that the valve has reached either its open or its closed position. In that case, it is advisable to add an **Opn/Cls Delay**, to ensure that the valve has actually reached its commanded position before the FerroVac actually signals that it has done so.

To change the time entered for the **Opn/Cls Delay**:

- Touch the **Opn/Cls Delay** entry box to display a numeric keypad.
- Use this keypad to enter the desired value.
- Touch the keypad's **Enter** button to close it. The new value will then appear in the **Opn/Cls Delay** entry box.

### 6.2.3 Exit Configuration Mode and Save Configuration Changes

Exit from Configuration Mode, as described in section 4.9. Configuration changes are automatically saved when you do so.

## 6.3 FerroVac Operation in Manual Mode

### 6.3.1 Control/Display Features on Manual Mode Screens

Manual mode screens are the Main screen (see Figures 6-6, 6-7, and 6-9), the Vacuum Map (see 6-7), and the Regen screen (see Figure 6-15).

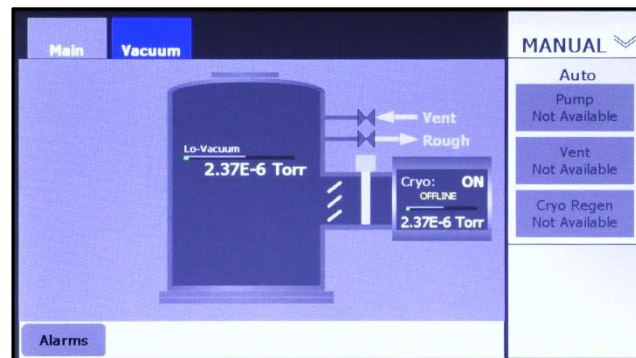
#### The Manual>Main Screen

The Manual>Main screen, which displays a simplified vacuum map, serves only to allow the user to monitor vacuum operations. The screen provides no command functionality over vacuum pumps, valves, or gauges. Figure 6-4 shows that screen as it appears when **Digital** is selected for **Temp Feed**. Figure 6-5 shows how it appears when **None** is selected for **Temp Feed** and **Yes** is selected for **On/Off Ctrl**, and Figure 6-6 shows that screen when **None** is selected for **Temp Feed** and **No** is selected for **On/Off Ctrl**.

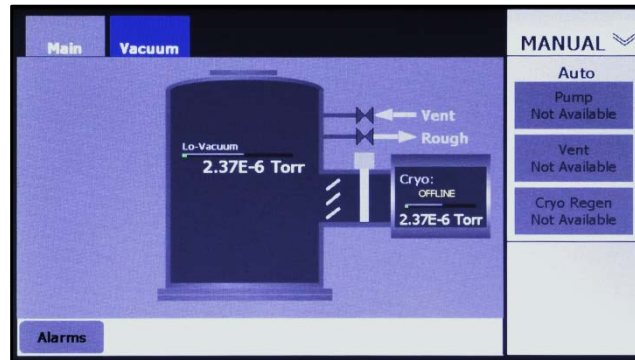
Figure 6-4 Manual>Main Screen when *Digital* Is Selected for *Temp Feed*



Figure 6-5 Manual>Main Screen when *None* Is Selected for *Temp Feed*, *Yes* for *On/Off Ctrl*



**Figure 6-6 Manual>Main Screen when *None* Is Selected for *Temp Feed*, *No* for *On/Off Ctrl***



### The Manual Mode Vacuum Map

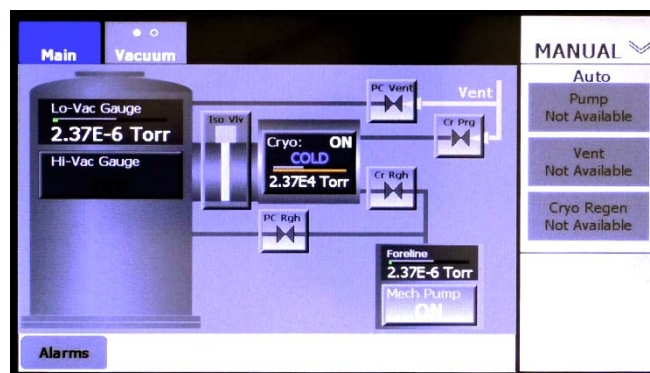
Figures 6-7 and 6-8 show the Manual mode Vacuum Map when the FerroVac is in the following configuration state:

- System = Offboard
- (Foreline) Gauge Connect = Yes
- Mechanical Pump Connect = Yes
- Rough Off = No

The control/display features on the Manual mode Vacuum Map are identical to those on the Configuration mode Vacuum Map. Control buttons on both Vacuum maps enable the user to open and close vacuum valves, including the cryo-iso valve, and to switch on/off the mechanical pump, the cryopump, and the chamber ion gauge.

Figure 6-7 shows the Manual mode Vacuum Map **Roughline Purge** and **PC Soft Rough** are both set to zero. Figure 6-8 shows that screen when nonzero values are entered for those parameters.

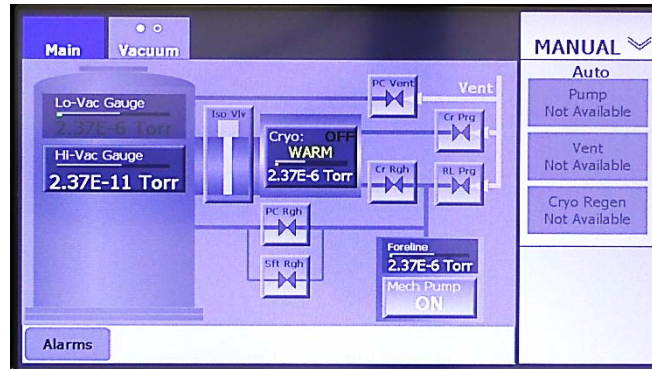
**Figure 6-7 Manual Mode Vacuum Map when Values for *Roughline Purge* and *PC Soft Rough* Are Both Zero**



Figures 6-9 through 6-11 identify the control/display features of the Manual mode Vacuum Map. Those illustrations show how that screen's cryopump icon appears when **Digital** is selected for **Temp Feed** and **Yes** is selected for **On/Off Ctrl**. Figures 6-12 through 6-14 illustrate how the control/display

features on cryopump icon vary depending on which configuration options are selected. In particular, Figure 6-13 shows the Vacuum map's cryopump icon as it appears when **None** is selected for **Temp Feed** and **Yes** is selected for **On/Off Ctrl**. Note that control/display features on the Configuration mode version of the Vacuum Map are identical to those on the Manual mode Vacuum Map.

**Figure 6-8 Manual Mode Vacuum Map when Nonzero Values Are Entered for *Roughline Purge* and *PC Soft Rough***



**Figure 6-9 Manual Mode Vacuum Map: Control Buttons for Vacuum Valves**

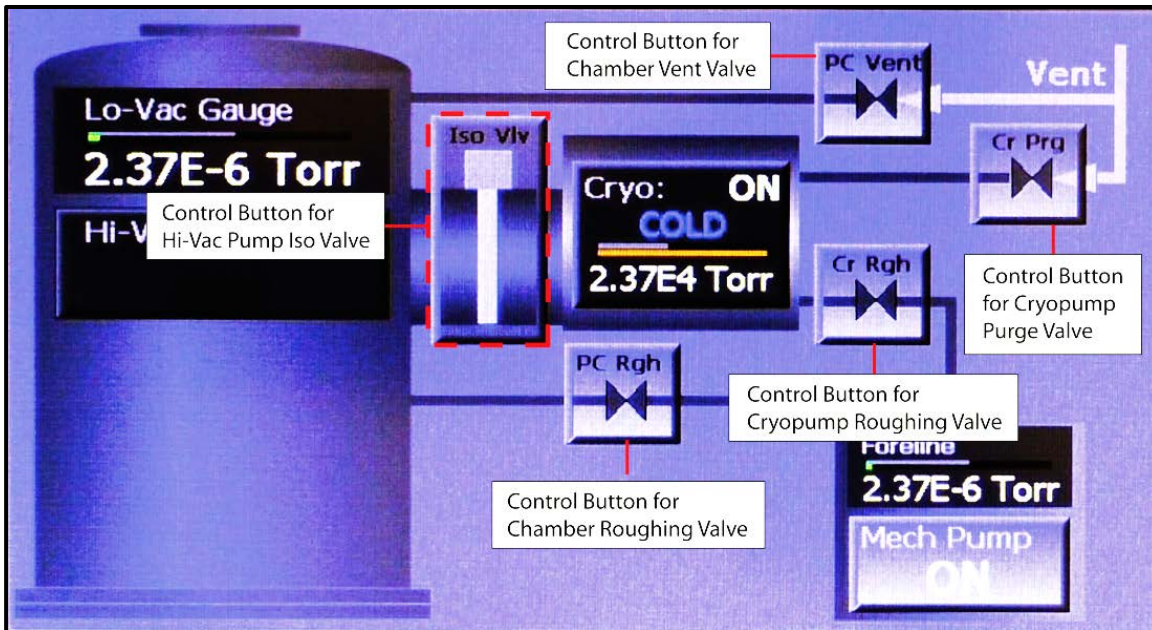


Figure 6-10 Manual Mode Vacuum Map: Mech. Pump, Foreline Gauge, and Chamber Lo-Vac Gauge Detail

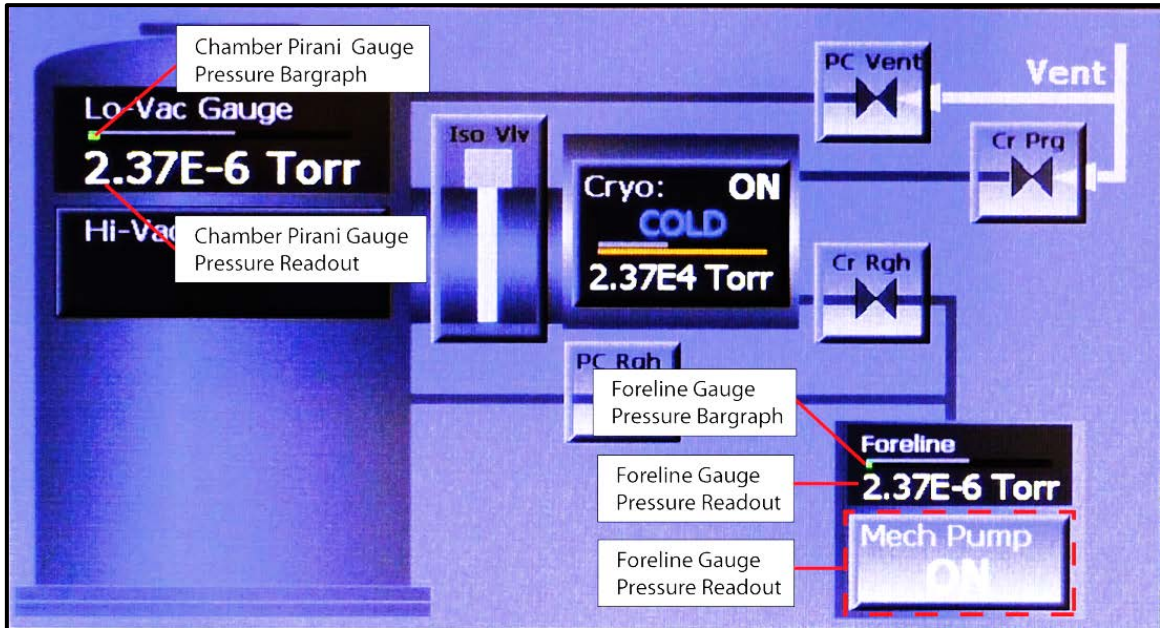
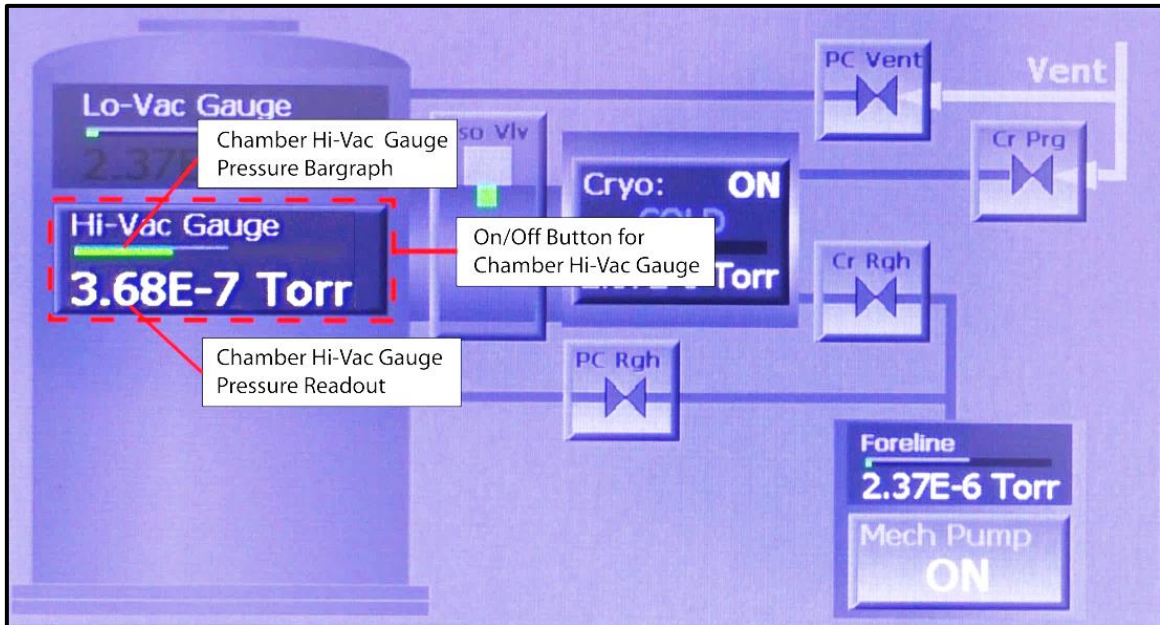


Figure 6-11 Manual Mode Vacuum Map: Control/Display Features for Chamber Hi-Vac Gauge

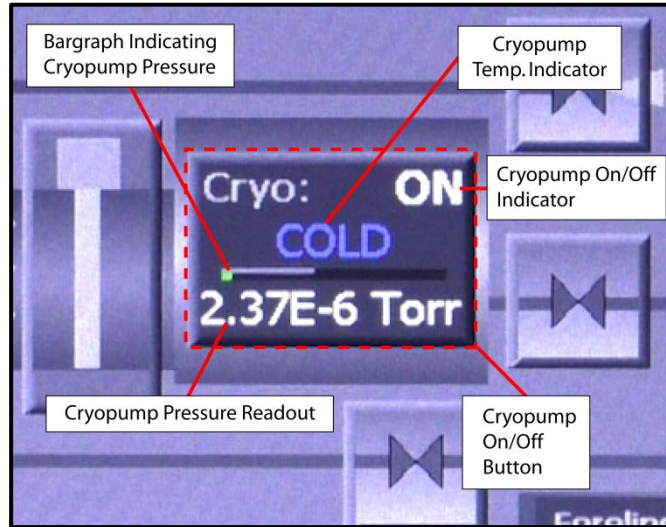


**Variations In the Vacuum Map’s Cryopump Icon Depending on Configuration Options Selected**

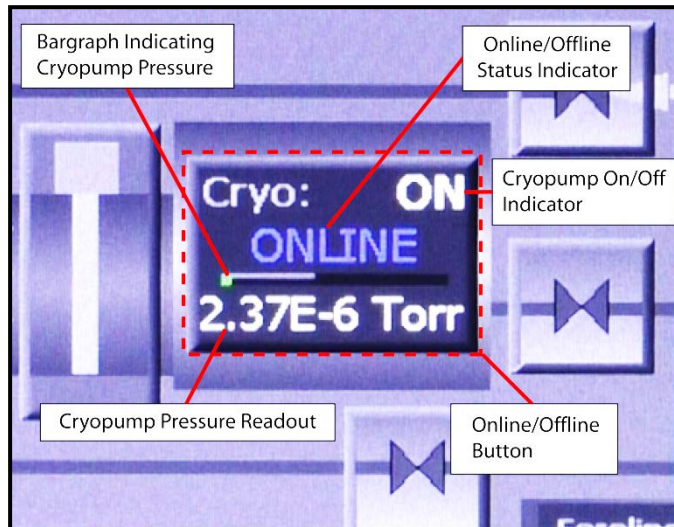
Figures 6-12 through 6-14 illustrate how the control/display features on Vacuum Map’s cryopump icon vary depending on which configuration options are selected. Figure 6-12 shows that icon as it appears when **Digital** is selected for **Temp Feed** on the Hi-Vac Pump Control page, as shown in Figure 6-2.

Figure 6-13 shows how the cryopump icon appears when **None** is selected for **Temp Feed** and **Yes** is selected for **On/Off Ctrl**. Figure 6-14 illustrates its features when **None** is selected for **Temp Feed** and **No** is selected for **On/Off Ctrl**. Note that when **None** is selected for **Temp Feed**, **ONLINE** or **OFFLINE** is displayed in place of **COLD** or **WARM**. When **No** is selected for **On/Off Ctrl**, the cryopump icon becomes a flat display rectangle, instead of an On/Off button.

**Figure 6-12 The Vacuum Map’s Cryopump Icon on when *Digital* Is Selected for *Temp Feedback***



**Figure 6-13 Vacuum Map’s Cryopump Icon when *None* Is Selected for *Temp Feed*, *Yes* for *On/Off Ctrl***



**Figure 6-14 Vacuum Map's Cryopump Icon when *None* Is Selected for *Temp Feed*, *No* for *On/Off Ctrl***



### The Manual Mode Regen Screen

Figure 6-15 shows the Manual mode Regen screen when the FerroVac is configured for an OffBoard cryopump with temperature feedback and On/Off control. When the unit is configured that way, the Manual>Regen screen enables the user to:

- Enter values for user-configurable parameters that govern AutoRegen operations
- Open and close the chamber roughing and vent valves and the cryo-iso valve
- Switch on/off the mechanical pump and the cryopump
- Monitor AutoRegen operations in real time

For detailed information about entering AutoRegen parameters, see section 6.4.4.

**Figure 6-15 Manual Mode Regen Screen, Unit Configured for an OffBoard Cryopump with Temperature Feedback and On/Off Control**

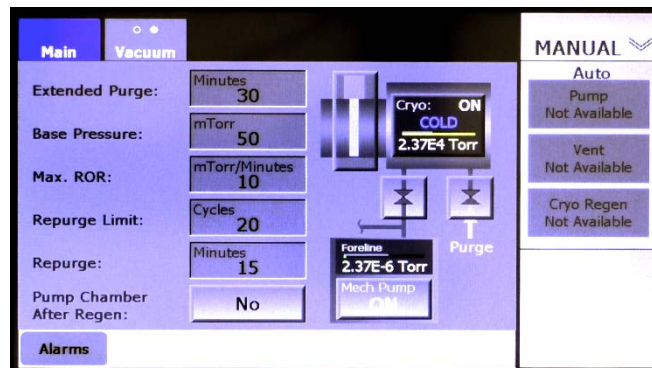


Figure 6-19 shows how this screen's cryopump icon appears when the FerroVac is configured for use with an OffBoard cryo that does not provide temperature feedback.

### 6.3.2 Pumping the Chamber to Hi-Vac When Cryopump Is Warm

Before the chamber can be pumped down below crossover pressure, the cryopump must be cold and switched on. The following procedure describes how to restore a warm cryopump to that operating state.

Step	Action
1	Put the FerroVac into Manual mode, if it is not already in that operating mode.
2	Switch on the mechanical pump, if it's not already on.
3	If necessary, wait for the foreline to reach its pressure setpoint.
4	Then open the cryopump roughing valve.
5	Wait for the cryopump's Pirani gauge to reach its setpoint.
6	Switch on the cryopump and wait for it to reach its <b>COLD</b> state.

You can now initiate an AutoPump cycle. Alternatively, if the chamber is roughed down to its crossover setpoint, you can open the cryo-iso valve and then switch on the chamber ion gauge, using the control buttons on the Manual mode Vacuum Map.

## 6.4 FerroVac Operation in Operations Mode

### 6.4.1 Available Automated Operations

When the unit is configured for an OffBoard cryopump, the available automated operations are Autopump, Autovent and Autoregen. These operations can be initiated by pressing the **Pump**, the **Vent**, or the **Regen** buttons on the Operations>Main screen (see Fig. 6-16), the Operations mode Vacuum map (see Fig. 6-17), or the Operations>Regen screen (see 6-18).

**Figure 6-16 Operations>Main Screen when OffBoard Cryo Is Selected**

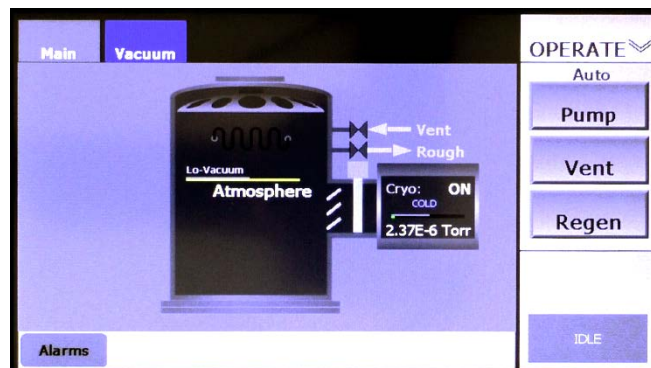




Figure 6-17 Ops Mode Vacuum Map when OffBoard Cryo Is Selected

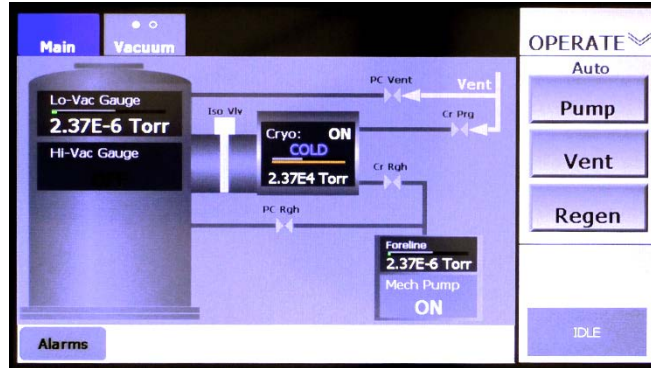
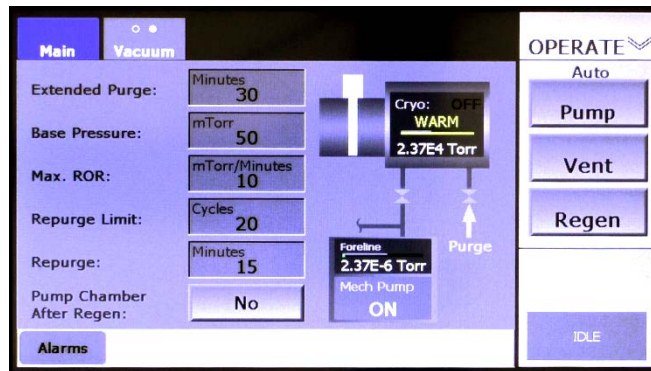


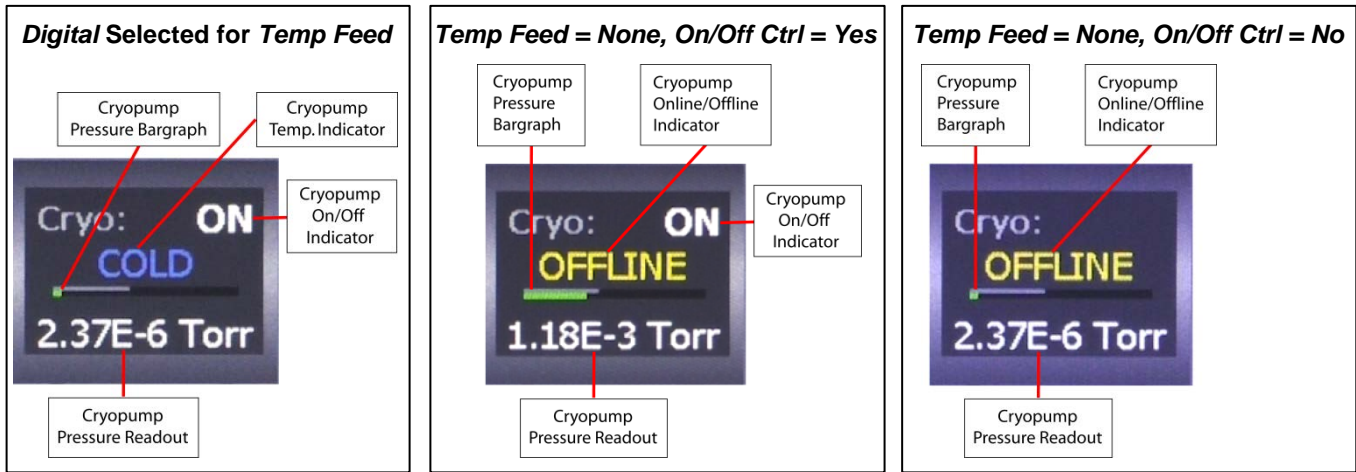
Figure 6-18 Operations>Regen Screen, Unit Configured for an OffBoard Cryopump with Temperature Feedback



### 6.4.2 Variations in Cryopump Icon in Vacuum Maps Depending on Configuration

Figures 6-16 through 6-18 show the Operations mode screens as they appear when **Digital** is selected for **Temp Feed** on the Hi-Vac Pump Control Page (see Figure 6-2). Figure 6-19 illustrates how the identical cryopump icons on these screens vary in appearance depending on the **Temp Feed** selection and, when **None** is selected for **Temp Feed**, whether the user selects **Yes** or **No** for **On/Off Ctrl**.

Figure 6-19 Variations in Cryopump Icon Depending On Configuration Options Selected

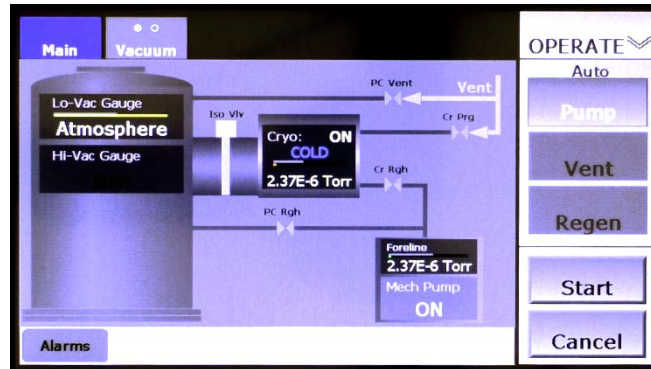


### 6.4.3 Executing Autopump and Autovent Operations

The FerroVac enables the user to start, pause, abort, and resume Autopump, Autovent, and Autoregen operations. The following procedure illustrates these command options, using Autopump as an example. However, the command sequence illustrated below applies equally to Autovent. For details regarding Autoregen operations, see section 6.4.4.

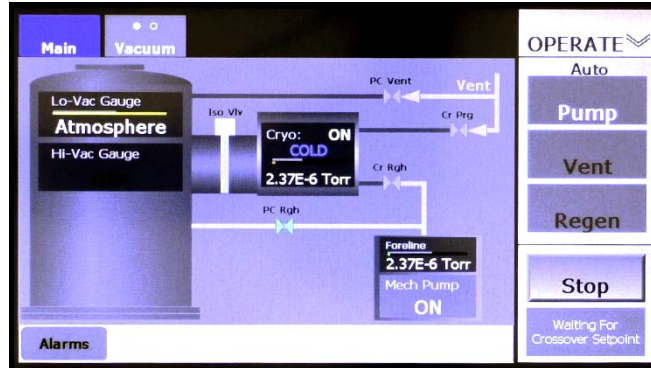
- | Step | Action  |
|------|---|
| 1    | To initiate an Autopump operation, first press the Pump button on the command button bar. The unit will then display <b>Start</b> and <b>Cancel</b> buttons, as shown in Figure 6-20. |

Figure 6-20 Ops Mode Vacuum Map After User Presses the Pump Button



- |   |   |
|---|---|
| 2 | Next press the <b>Start</b> button to initiate the Autopump operation. The command button bar will then display a <b>Stop</b> button in place of the <b>Start</b> button. In addition, a rectangle below the <b>Stop</b> button will display status messages relating to the Autopump operation, as shown in Figure 6-21. |
|---|---|

Figure 6-21 Ops Mode Vacuum Map After User Presses Start, Initiating an Autopump



- To pause the Autopump operation, press the **Stop** button. That button will then disappear, and the message **Executing Shutdown** will be briefly displayed, as shown in Figure 6-22. Upon completion of that shutdown sequence, the command button bar will display the **Resume** and **Abort** buttons shown in Figure 6-23.

Figure 6-22 Ops Mode Vacuum Map Immediately After User Presses Stop

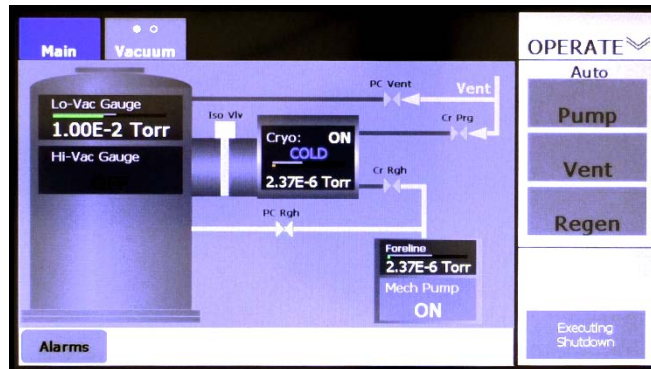
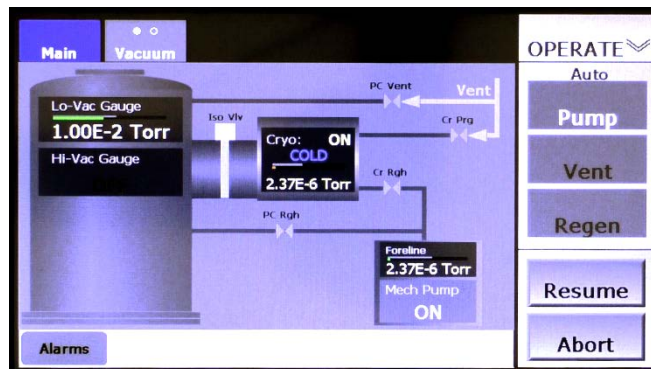


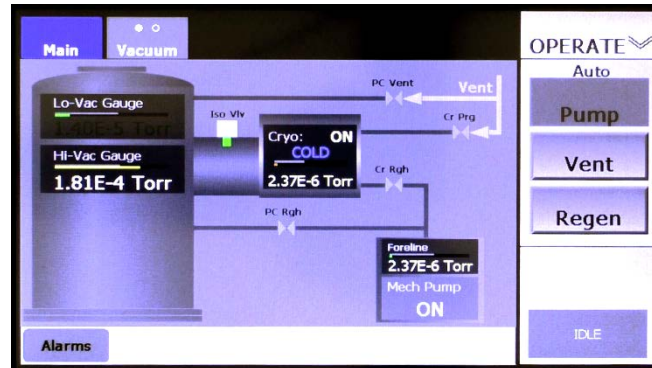
Figure 6-23 Ops Mode Vacuum Map Displaying Resume and Abort Buttons



Pressing **Abort** returns the unit to the Idle state, at which point the screen will appear as shown in Figure 6-17. If **Resume** is pressed, the

Autopump operation will resume from the point at which it was interrupted, and the screen will again appear as shown in Figure 6-21. When the Autopump operation is completed, the screen will appear as shown in Figure 6-24.

**Figure 6-24 Ops Mode Vacuum Screen After Completion of Autopump**



#### 6.4.4 Configuring and Executing AutoRegen Operations

AutoRegen cycles can be configured and monitored from either the Manual>Regen screen (see Figure 6-15) or the Operations>Regen screen (see Figure 6-25) but can be initiated and controlled thereafter from the Operations>Regen screen.

##### Configuring an AutoRegen Operation

The Manual>Regen and Operations>Regen screens have features that enable the user to configure Autoregen operations. These features include the following parameter-entry boxes related to the AutoRegen operation plus a **Pump Chamber After Regen** button:

- **Extended Purge** = the duration, in minutes, of the first purge period
- **Base Pressure** = the target chamber pressure following each purge and 60-second pumpdown. Achieving a chamber pressure lower than this value following those operations allows the AutoRegen cycle to proceed to the next rate of rise (ROR) test.
- **Max. ROR** = the maximum leakdown rate at which the chamber will pass an ROR test.
- **Repurge Limit** = the number of Repurge operations allowed before the regen operation is automatically aborted. NOTE: This counter does not count the initial (i.e., extended) purge.
- **Repurge** = the duration, in minutes, of each Repurge operation (i.e. of purge operations following the first, or Extended Purge, operation)

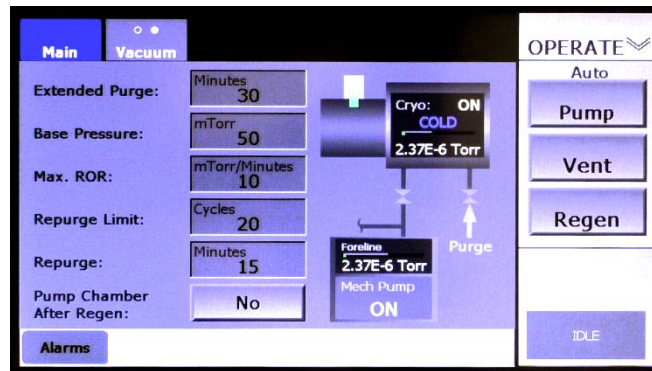
The **Pump Chamber After Regen** button enables the user to determine whether an AutoPump cycle will be executed following successful completion of the AutoRegen operation.

## Regen Procedure for Systems with an On-Board Cryopump with Temperature Feedback

### Initiating the AutoRegen Operation

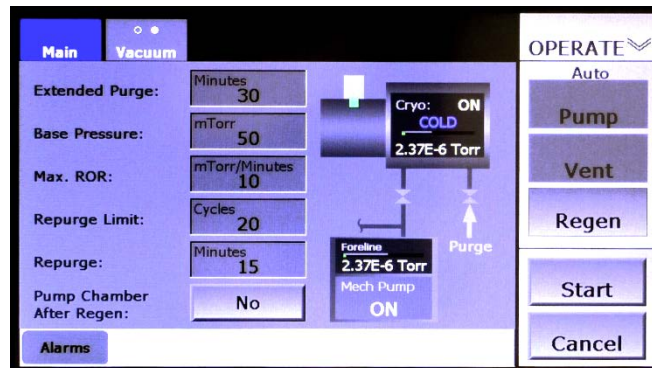
AutoRegen operations are most conveniently initiated and monitored from the Ops>Regen screen (see Figure 6-25). To initiate an AutoRegen cycle on a system with an OffBoard cryopump with temperature feedback, perform the following procedure. For instructions on running an AutoRegen operation on a system with a cryopump that does not provide temperature feedback, see "Regen Procedure for Cryopumps with No Temperature Feedback" at the end of this section.

**Figure 6-25 Operations>Regen Screen When No Automatic Cycle Is Running**



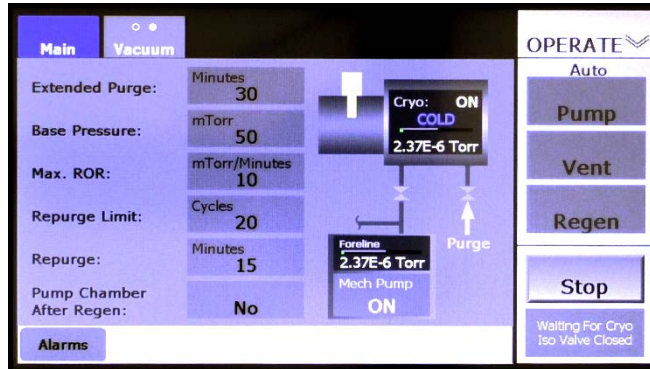
- | Step | Action   |
|------|--|
| 1    | Touch the command button bar's <b>Regen</b> button. <b>Start</b> and <b>Cancel</b> buttons will then appear below the <b>Regen</b> button, as shown in Figure 6-26). |

**Figure 6-26 Ops>Regen Screen After User Touches the Regen Button**



- |   |  |
|---|--|
| 2 | Touch the <b>Start</b> button to initiate the AutoRegen operation. The command button bar will then display a <b>Stop</b> button in place of the <b>Start</b> button. In addition, a rectangle below the <b>Stop</b> button will display status messages relating to the AutoRegen operation, as shown in Figure 6-27. |
|---|--|

Figure 6-27 Ops>Regen Screen After User Touches the *Start* Button, Initiating Autoregen



- To pause the AutoRegen operation, press the **Stop** button. That button will then disappear, and the message **Executing Shutdown** will be briefly displayed, as shown in Figure 6-28. After that shutdown sequence is completed, the command button bar will display **Resume** and **Abort** buttons, as shown in Figure 6-29.

Figure 6-28 Ops>Regen Screen After User Touches the *Stop* Button

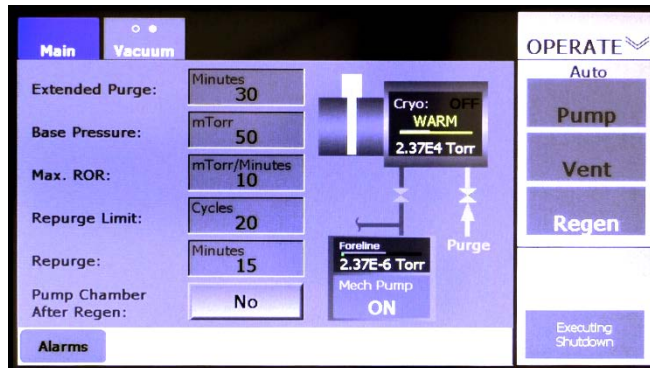
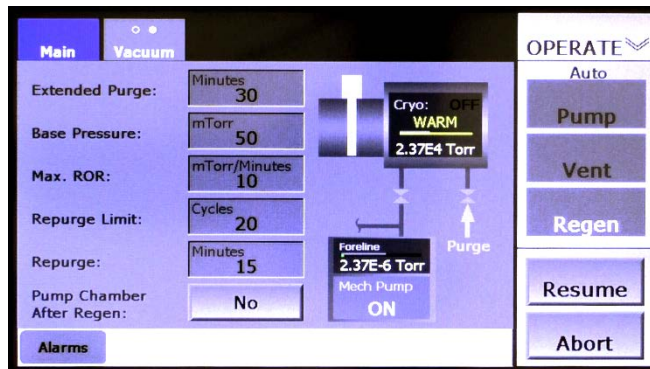
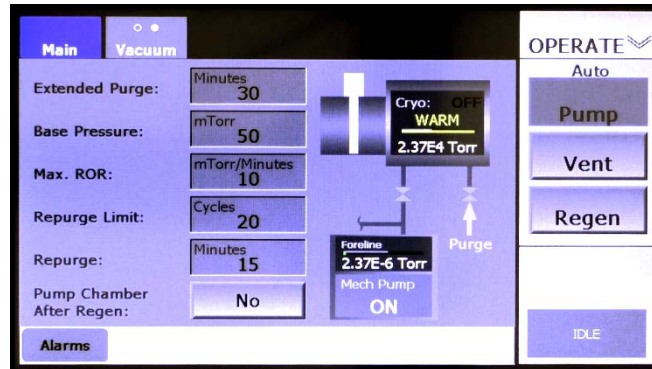


Figure 6-29 Ops>Regen Screen Displaying *Resume* and *Abort* Buttons



Pressing **Abort** returns the unit to the Idle state, and the screen will appear as shown in Figure 6-18. If **Resume** is pressed, the AutoRegen operation will resume from the point at which it was interrupted, and the screen will again appear as shown in Figure 6-36. When the AutoRegen operation is completed, the screen will appear as shown in Figure 6-30.

**Figure 6-30 Ops>Regen Screen After Completion of an AutoRegen Operation**



The flowchart shown in Figure 6-31 illustrates the Autoregen execution sequence.

**NOTE**

The procedure described above and the flowchart shown below apply to Autoregen operations on cryopumps that provide digital temperature feedback. For information on performing an Autoregen operation on a cryopump that does not provide such feedback, see the procedure described below, under the heading "Regen Procedure for Cryopumps with No Temperature Feedback."

Figure 6-31 AutoRegen Sequence for OffBoard Cryopump with Temp. Feedback

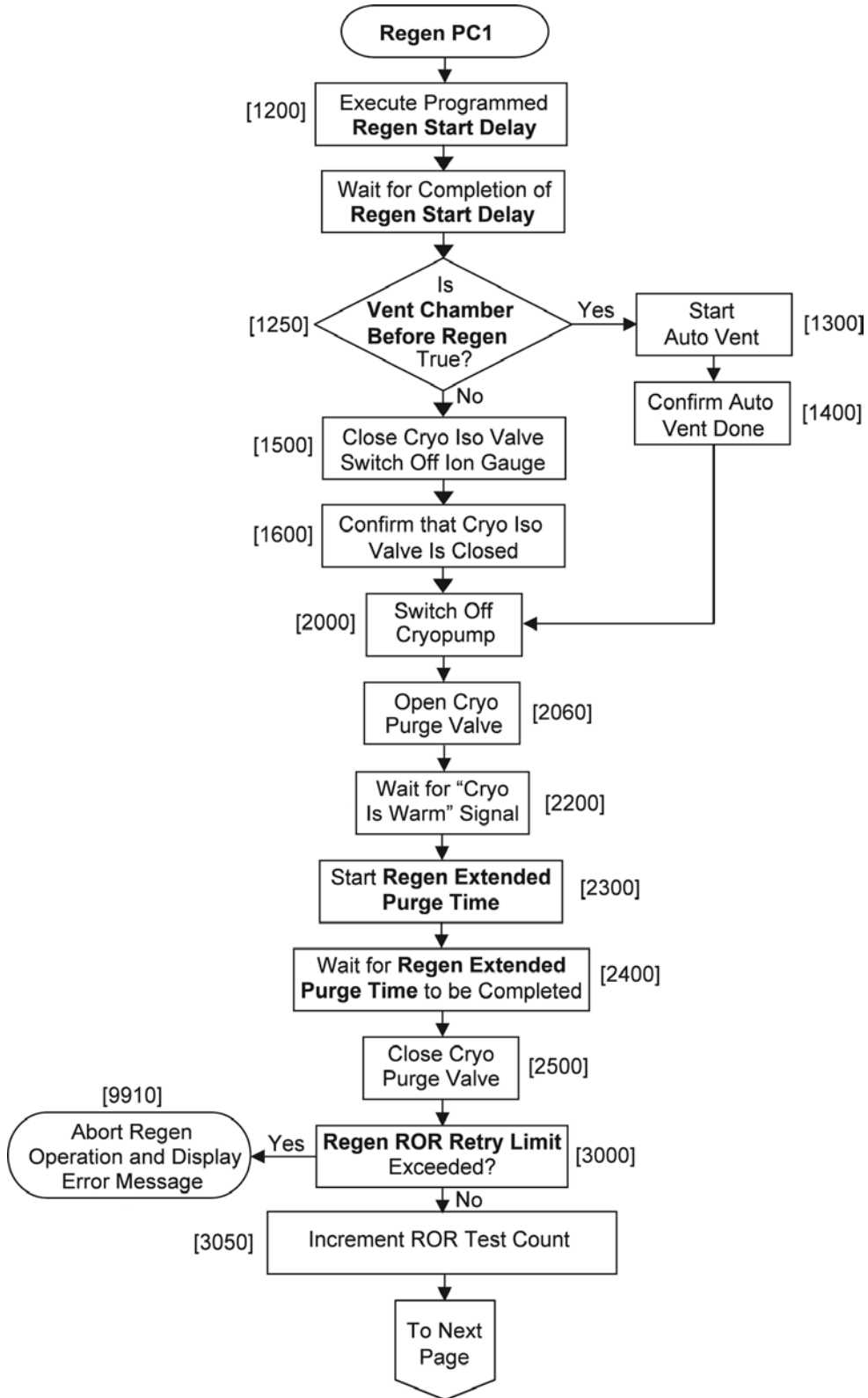




Figure 6-31 (Continued): AutoRegen Sequence for OffBoard Cryopump with Temp. Feedback

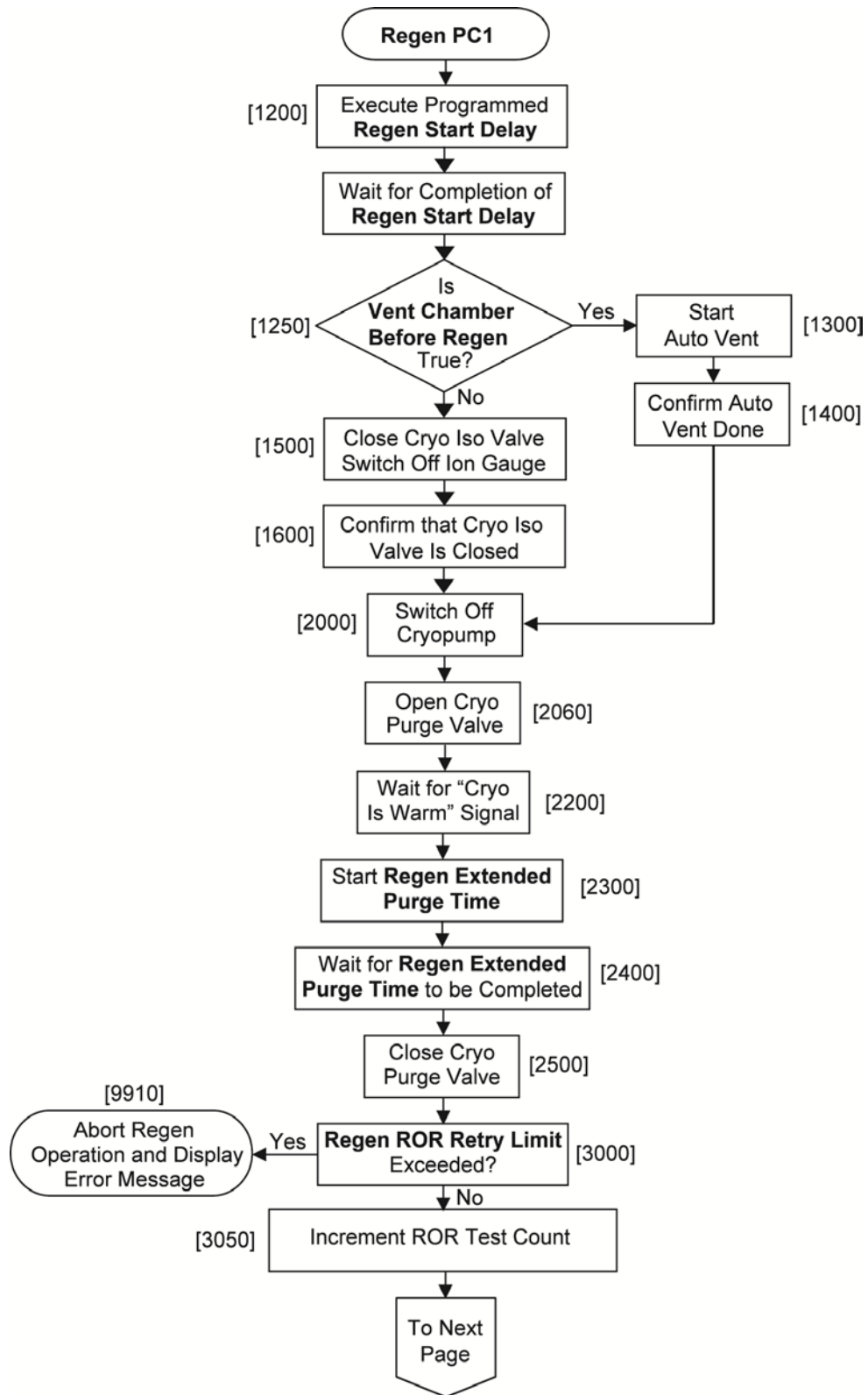


Figure 6-31 (Continued): AutoRegen Sequence for OffBoard Cryopump with Temp. Feedback

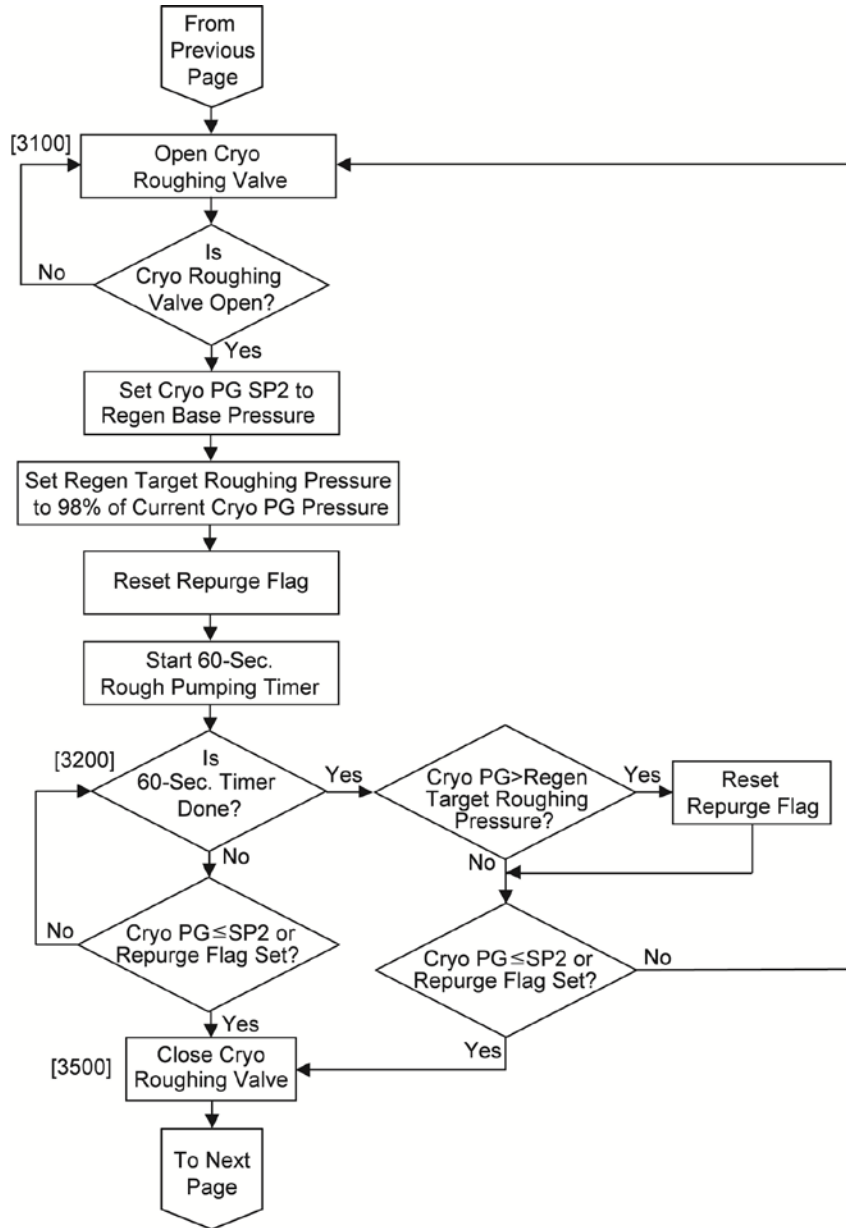
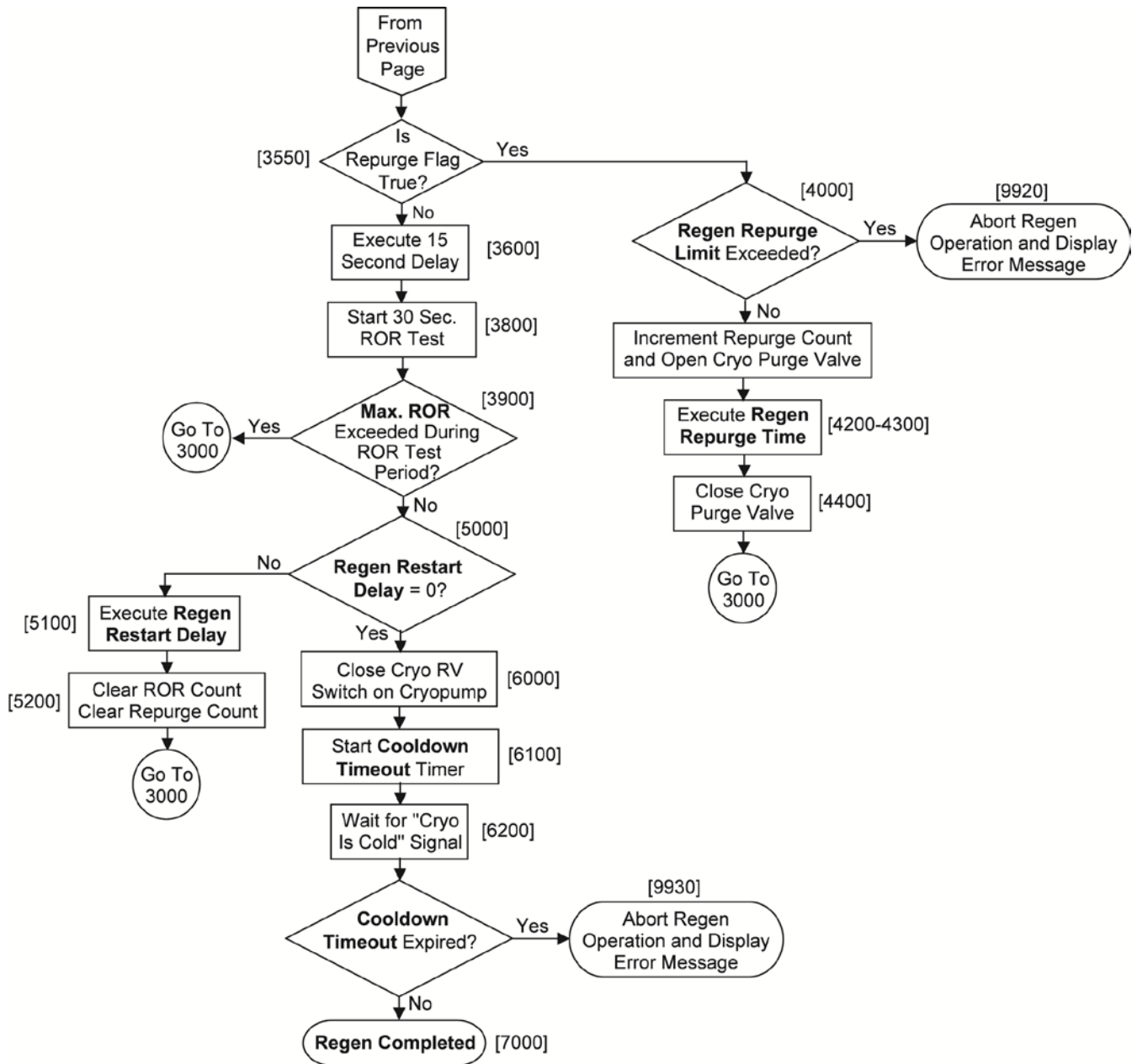


Figure 6-31 (Continued): AutoRegen Sequence for OffBoard Cryopump with Temp. Feedback



**Regen Procedure for Cryopumps Without Temperature Feedback**

Figure 6-32 shows Hi-Vac Pump Control page with **OffBoard** selected for **System**, **None** selected opposite **Temp Feed**, and **No** selected opposite **ON/Off Ctrl**. When **No** is selected opposite **ON/Off Ctrl**, the cryopump icon on the Ops>Regen screen has a flat display rectangle in place of a cryopump On/Off button, as shown in Figure 6-33. In addition, an **ONLINE/OFFLINE** button appears in place of the **Pump Chamber After Regen Button**. As Figure 6-33 shows, this screen's **Regen** button is unavailable when the cryopump is online.

Figure 6-32 Cfg>Hi-Vac Pump Control page: *None Selected for Temp Feed, No for On/Off Ctrl*

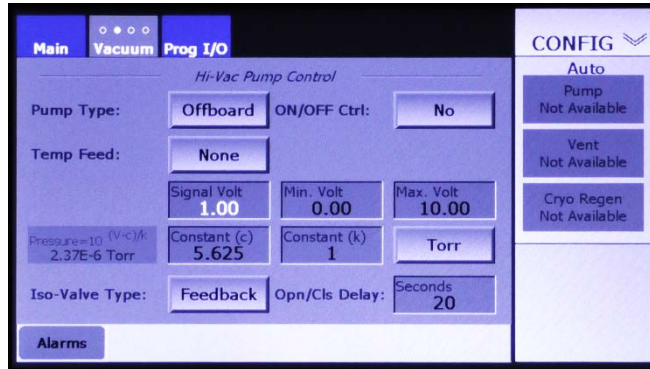
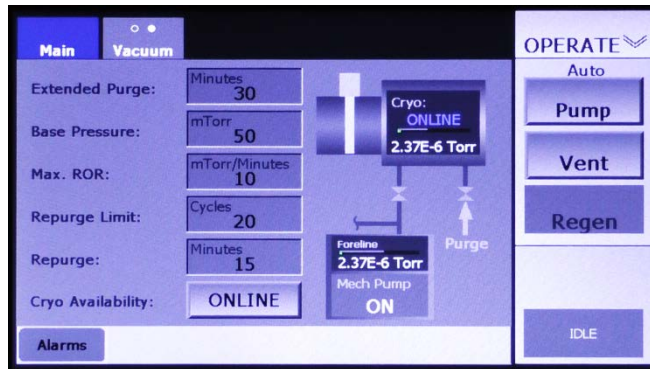


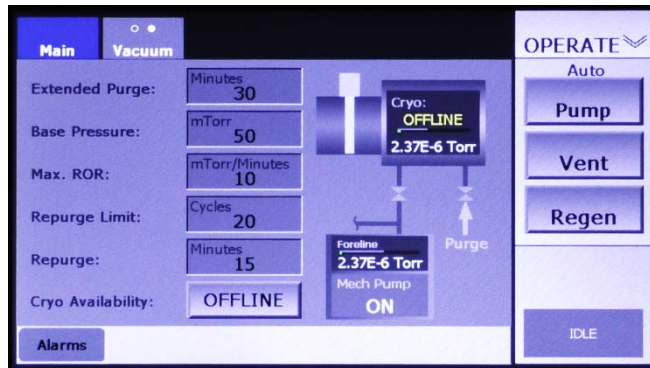
Figure 6-33 Manual>Regen Screen Displaying Cryopump ONLINE/OFFLINE Button



To perform an AutoRegen operation when the unit is configured for an OffBoard cryo without temperature feedback and no cryopump On/Off control, follow the procedure described below.

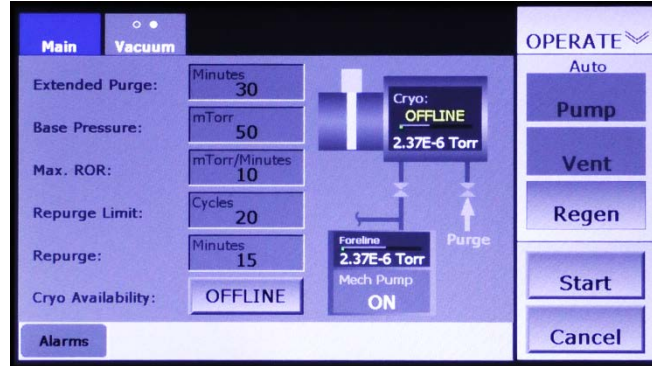
- | Step | Action  |
|------|---|
| 1    | Take the cryopump offline by touching the Regen screen's ONLINE/OFFLINE button. The <b>Regen</b> button in the command button bar will then become active, as shown in Figure 6-34. |

Figure 6-34 Ops>Regen Screen After User Selects *Offline* Opposite *Cryo Availability*



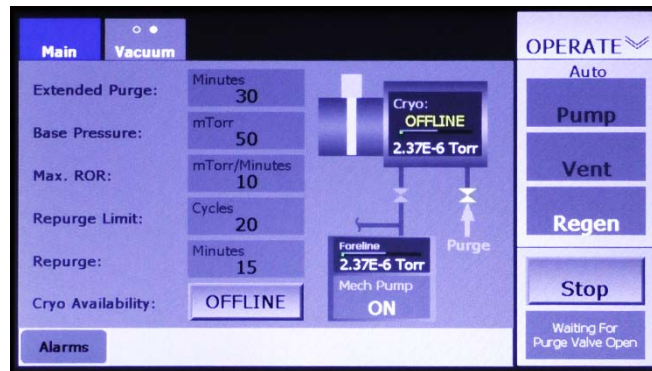
- 2 Touch the **Regen** button to initiate the regen operation. **Start** and **Cancel** buttons will then appear below the **Regen** button, as shown in Figure 6-35.

**Figure 6-35 Ops>Regen Screen After User Presses Regen**



- 3 Touch the **Start** button to initiate the AutoRegen operation. The command button bar will then display a **Stop** button in place of the **Start** button. In addition, a rectangle below the **Stop** button will display status messages relating to the AutoRegen operation, as shown in Figure 6-36.

**Figure 6-36 Ops>Regen Screen After User Presses Start**



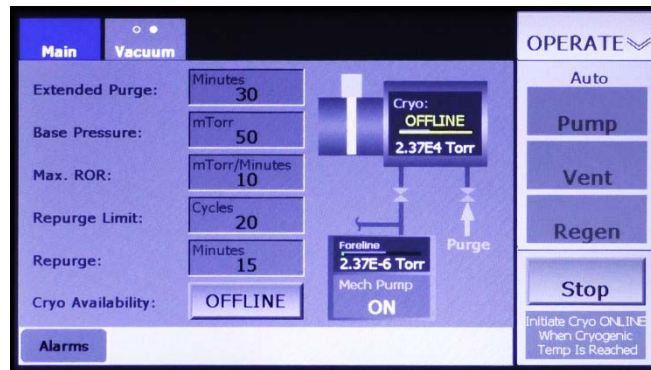
After the Autoregen operation starts, the user has to option to pause the operation, using the **Stop** button, and then to either abort or resume it. For information on the use of the **Stop**, **Abort**, and **Resume** buttons, see the preceding procedure, which is described under the heading "Regen Procedure for Systems with an On-Board Cryopump with Temperature Feedback."

#### **Regen Completed: Putting the Cryopump Back Online**

Following the completion of such an AutoRegen on a cryopump without On/Off control, the user must manually put the cryopump back online, as described below.

- | Step | Action   |
|------|--|
| 1    | Upon completion of the AutoRegen sequence, the Ops>Regen screen will display the message <b>Initiate cryo ONLINE when cryogenic temp is reached</b> , as shown in see Figure 6-37. At that point, check the reading of the cryopump's temperature gauge. |

**Figure 6-37 Ops>Regen Screen Displaying Prompt *Initiate Cryo ONLINE When Cryogenic Temp Is Reached***



- When the temperature reading is in the cryogenic range, touch the Regen screen's **OFFLINE** button to put the pump online. The screen will then appear as shown in Figure 6-33.

# 7 *Non-Iso Turbo Configuration and Operation*

---

## 7.1 Section Overview

This section describes configuration and operational procedures for the FerroVac when it is configured for use in a system with a non-iso turbopump. These procedures assume that the FerroVac has been correctly installed, cabled up to controlled/monitored components, and powered up. Topics covered are:

- Section 7.2 Configuration Procedure
  - Section 7.2.1 Perform Common Configuration Procedures
  - Section 7.2.2 Configure the Turbopump
  - Section 7.2.3 Exit Configuration Mode and Save Configuration Changes
- Section 7.3 FerroVac Operation in Manual Mode
  - Section 7.3.1 Control/Display Features of Manual Mode Screens
- Section 7.4 FerroVac Operation in Operations Mode
  - Section 7.4.1 Operations Mode Screens
  - Section 7.4.2 Executing Automated Operations

## 7.2 Configuration Procedure

### 7.2.1 Perform Common Configuration Procedures

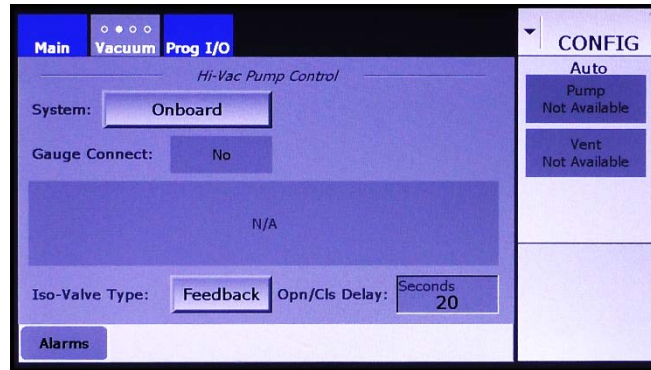
First perform the configuration procedures described in Section 4. Those procedures apply to all FerroVac installations, regardless of the hi-vac pump selection.

### 7.2.2 Configure the Turbopump

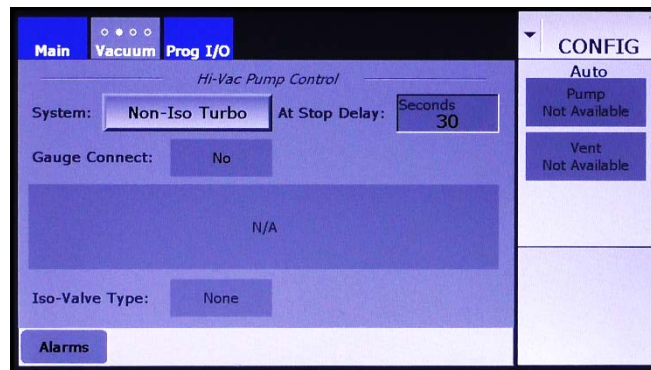
Next configure the FerroVac for use with your system's turbopump. To do so:

Step	Action
1	Touch the <b>Vacuum</b> screen tab as many times as necessary to display the Hi-Vac Control page. At initial boot-up, that page will appear as shown in Figure 7-1.

Figure 7-1 Hi-Vac Pump Control Page at Initial Boot-Up



- 2 Touch the **System** button twice to change the selection to **Non-Iso Turbo**. The screen will then appear as shown in Figure 7-2.

Figure 7-2 Hi-Vac Pump Control Page After the User Selects *Non-Iso Turbo*

- 3 If necessary for your system's turbopump, change the **At Stop Delay** value. To do so:
  - a) Touch the recessed **At Stop Delay** entry box to display a numeric keypad.
  - b) Use this keypad to enter the desired value.
  - c) Touch the keypad's **Enter** button to close it. The new value will then appear in the **At Stop Delay** entry box.

### 7.2.3 Exit Configuration Mode and Save Configuration Changes

Exit from Configuration Mode, as described in section 4.9. Configuration changes are automatically saved when you do so.



## 7.3 FerroVac Operation in Manual Mode

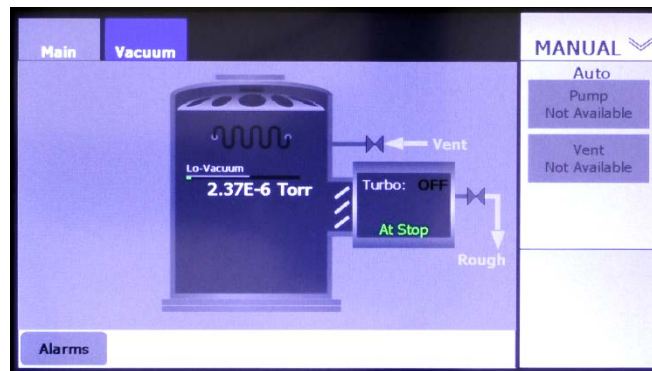
### 7.3.1 Control/Display Features of Manual Mode Screens

The Manual mode screens are the Manual>Main screen (see Figure 7-3) and the Manual mode Vacuum map (see Figure 7-4).

#### The Manual>Main Screen

The Manual>Main screen (see Figure 7-3), which displays a simplified vacuum map, serves only to allow the user to monitor vacuum operations. The screen provides no command functionality over vacuum pumps, valves, or gauges.

**Figure 7-3 Manual>Main Screen**



#### The Manual Mode Vacuum Map

Figures 7-4 through 7-7 show the Manual mode Vacuum Map when the FerroVac is in the following configuration state:

- System = Non-Iso Turbo
- (Foreline) Gauge Connect = Yes
- Mechanical Pump Connect = Yes
- Rough Off = No

The control/display features on the Manual mode Vacuum Map are identical to those on the Configuration mode Vacuum Map. Control buttons on both Vacuum maps enable the user to open and close vacuum valves, including the cryo-iso valve, and to switch on/off the mechanical pump, the cryopump, and the chamber ion gauge.

Figures 7-4, 7-6, and 7-7 shows the Manual mode Vacuum Map when **Roughline Purge** and **PC Soft Rough** are both set to zero. Figure 7-5 shows that Vacuum map when nonzero values are entered for those parameters. Figures 7-6 and 7-7 identify the Vacuum Map's control/display features.

Figure 7-4 Manual Mode Vacuum Map when Values for *Roughline Purge* and *PC Soft Rough* Are Both Zero

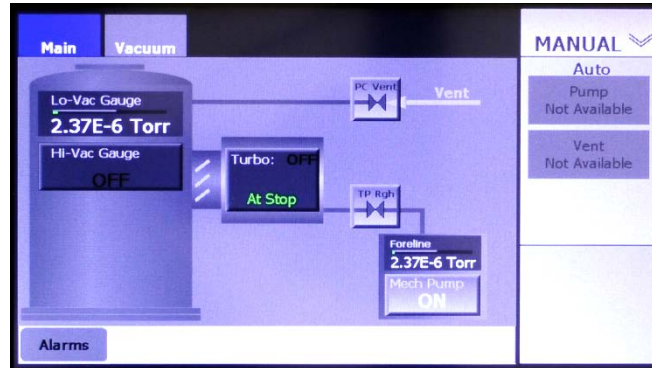


Figure 7-5 Manual Mode Vacuum Map when Nonzero Values Are Entered for *Roughline Purge* and *PC Soft Rough*

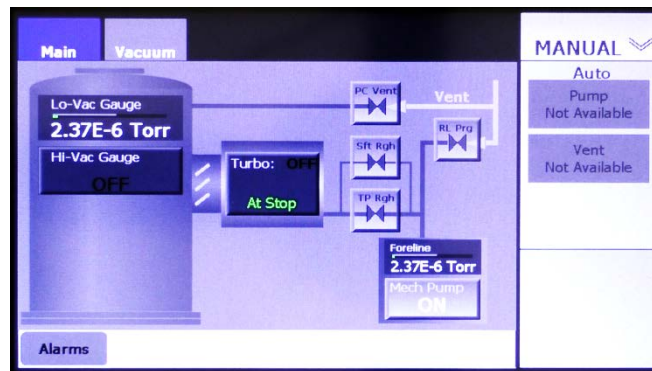


Figure 7-6 Manual Mode Vacuum Map: Control/Display Features for Vacuum Valves, Mech. Pump, Foreline Gauge, and Chamber Lo-Vac Gauge

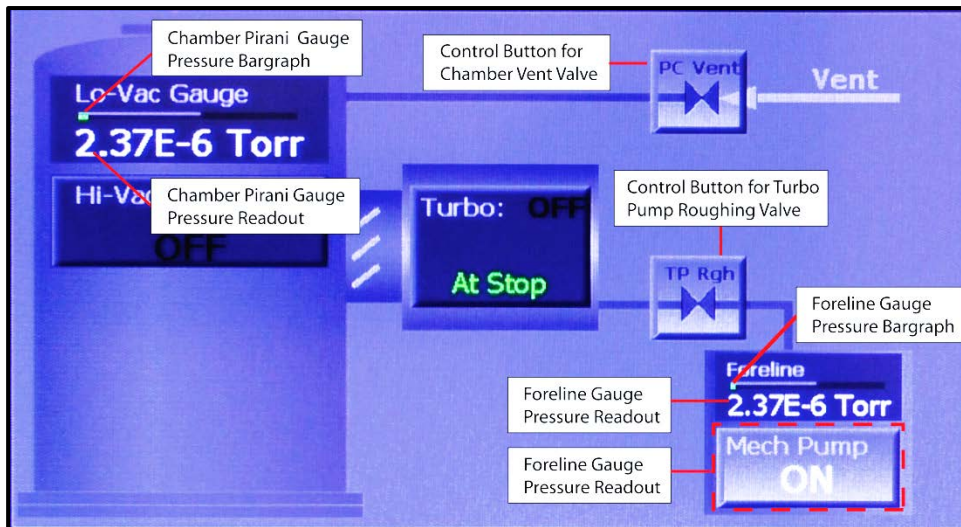
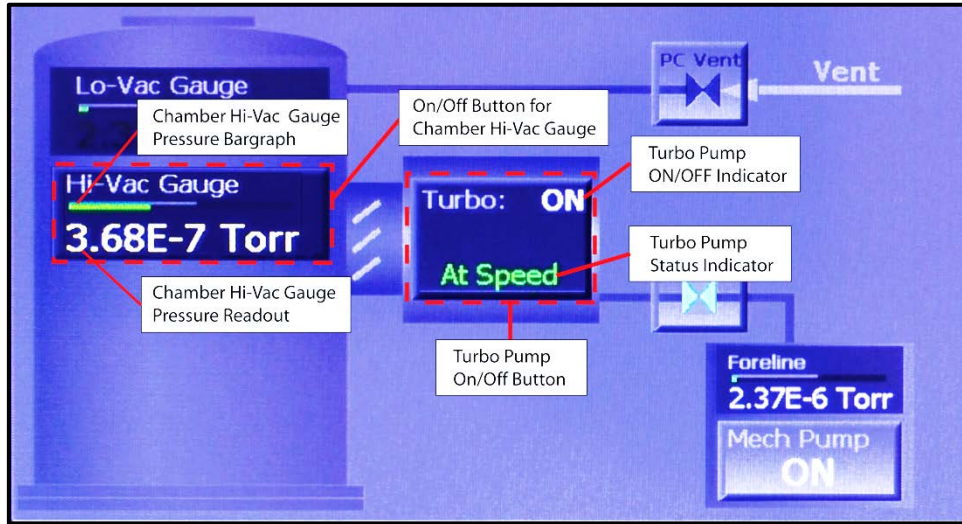


Figure 7-7 Manual Mode Vacuum Map: Turbopump and Hi-Vac Gauge Control/Display Features



## 7.4 FerroVac Operation in Operations Mode

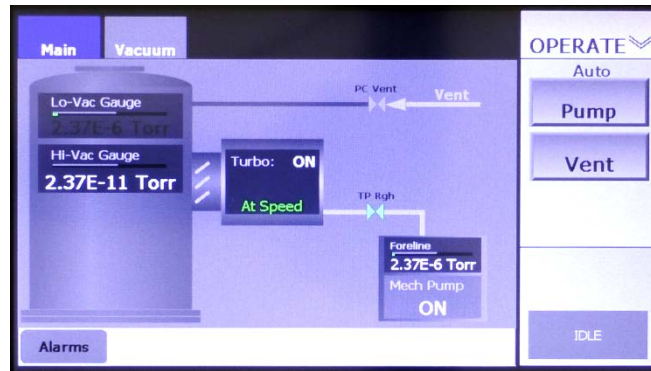
### 7.4.1 Operations Mode Screens

When the unit is configured for a non-iso turbopump, the available automated operations are Auto Pump and Auto Vent. These operations can be initiated by pressing the **Pump** and **Vent** buttons on either the Operations>Main screen (see Fig. 7-8) or the Operations mode Vacuum map (see Fig. 7-9).

Figure 7-8 Operations>Main Screen



Figure 7-9 Operations Mode Vacuum Map

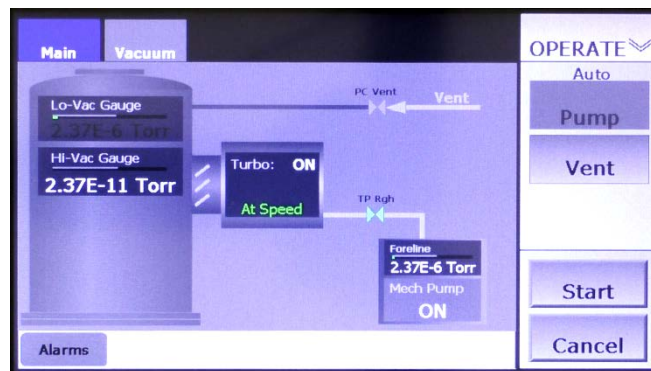


### 7.4.2 Executing Automated Operations

When configured for use with a non-iso turbo pump, the FerroVac enables the user to start, pause, abort, and resume the Autopump and Autovent operations. The following procedure illustrates these command options, using Autopump as an example. However, the example applies identically to Autovent.

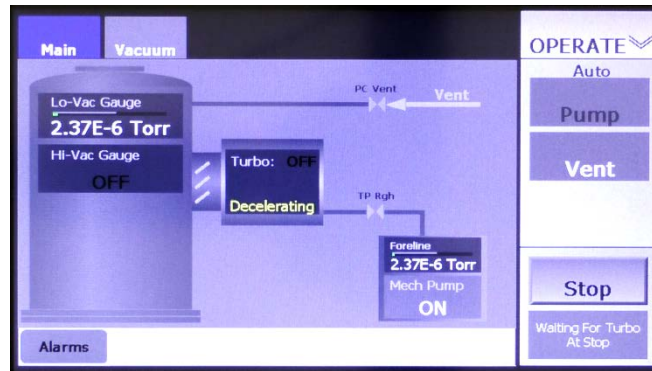
- | Step | Action  |
|------|---|
| 1    | Select Autopump by pressing the <b>Pump</b> button. The unit will then display <b>Start</b> and <b>Cancel</b> buttons, as shown in Figure 7-10. |

Figure 7-10 Ops Mode Vacuum Map After the User Presses the Vent Button



- |   |  |
|---|--|
| 2 | Press the <b>Start</b> button to initiate the Autovent. The command button bar will then display a <b>Stop</b> button in place of the <b>Start</b> button. In addition, a rectangle below the <b>Stop</b> button will display status messages relating to the Autopump operation, as shown in Figure 7-11. |
|---|--|

Figure 7-11 Ops Mode Vacuum Map After User Starts Autovent



- To pause the Autovent operation, press the **Stop** button. That button will then disappear, and the message **Executing Shutdown** will be briefly displayed, as shown in Figure 7-12. Upon completion of that shutdown sequence, the command button bar will display the **Resume** and **Abort** buttons shown in Figure 7-13.

Figure 7-12 Ops Mode Vacuum Map After User Presses Stop

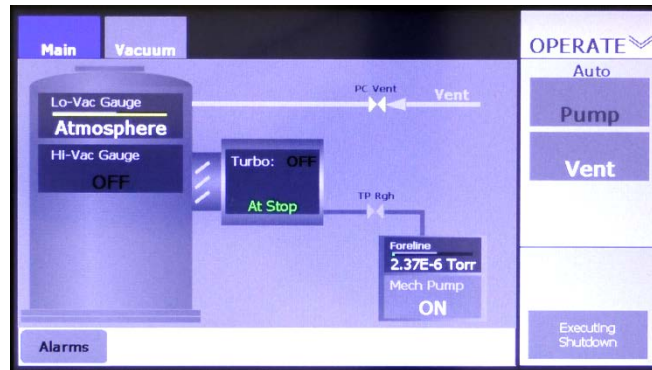
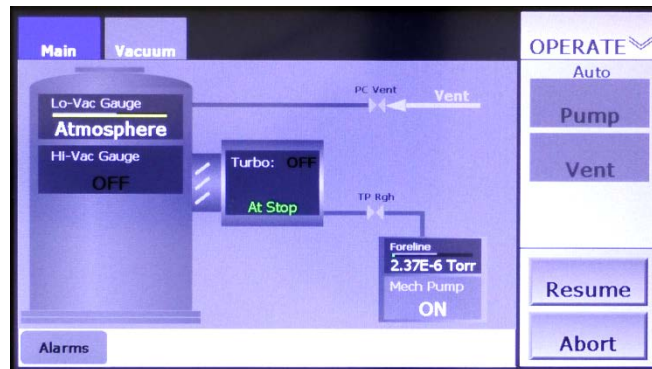
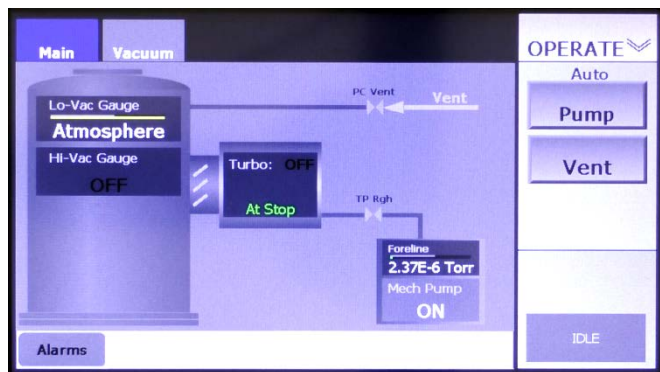


Figure 7-13 Ops Mode Vacuum Map Displaying Resume and Abort Buttons



- 1 Pressing **Abort** returns the unit to the Idle state, at which point the screen will appear as shown in 7-9. If **Resume** is pressed, the Autopump operation resumes from the point at which it was interrupted, and the screen will again appear as shown in Figure 7-11. When the Autopump operation is completed, the screen will appear as shown in Figure 7-14.

**Figure 7-14 Operations Mode Vacuum Screen After Completion of Autovent**



# 8 *Diffusion Pump* *Configuration and Operation*

---

## 8.1 Section Overview

This section describes configuration and operational procedures for the FerroVac when it is configured for use in a system with a diffusion pump. These procedures assume that the FerroVac has been correctly installed, cabled up to controlled/monitored components, and powered up. Topics covered below are:

### Section 8.2 Configuration Procedure

- Section 8.2.1 Perform Common Configuration Procedures

- Section 8.2.2 Configure the Diffusion pump

- Section 8.2.3 Exit Configuration Mode and Save Configuration Changes

### Section 8.3 FerroVac Operation in Manual Mode Operation

- Section 8.3.1 Control/Display Features of Manual Mode Screens

### Section 8.4 FerroVac Operation in Operations Mode

- Section 8.4.1 Operations Mode Screens

- Section 8.4.2 Executing Automated Operations

## 8.2 Configuration Procedure

### 8.2.1 Perform Common Configuration Procedures

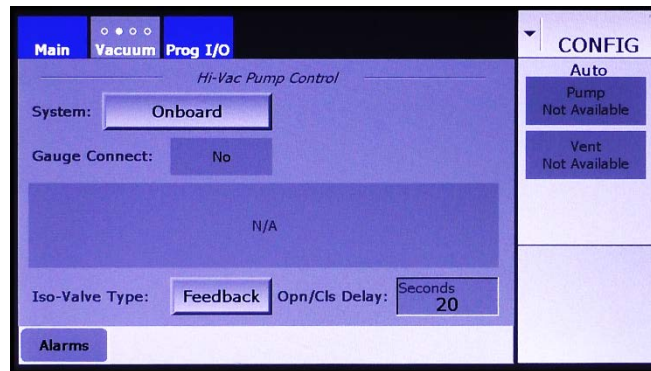
First perform the configuration procedures described in Section 4. Those procedures apply to all FerroVac installations, regardless of the hi-vac pump selection.

### 8.2.2 Configure the Diffusion pump

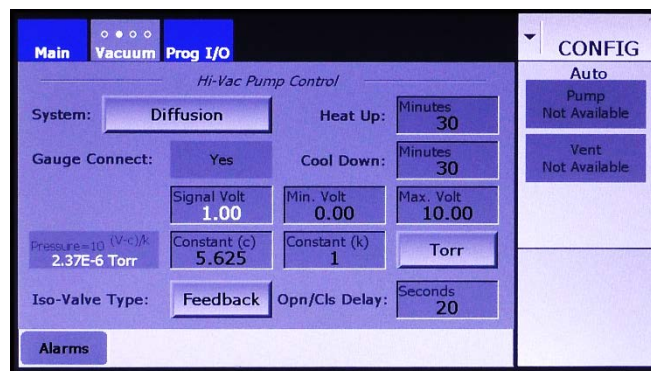
Next configure the FerroVac for use with your system's diffusion pump. To do so:

Step	Action
1	Touch the <b>Vacuum</b> screen tab as many times as necessary to display the Hi-Vac Pump Control page (see Figure 8-1).

Figure 8-1 Hi-Vac Pump Control Page at Initial Boot-Up



- 2 Touch the **System** button three times to select **Diffusion**. The screen will then appear as shown in Figure 8-2.

Figure 8-2 Hi-Vac Control Page After the User Selects *Diffusion* for *System*

- 3 Next enter values for the **Heat Up** and **Cool Down** periods. The timer for the **Heat Up** period begins when the electrical contactor for the pump's heater closes. At the end of that period, the temperature-indicator legend in the Vacuum Map's diffusion pump icon changes from **Is Cool** to **Is Hot**, and the iso-valve is permitted to open, assuming that cooling water is flowing to the pump and that the roughing valve for the diffusion pump is open.

The timer for the **Cool Down** period begins when the heater's electrical contactor opens. When that period ends, the flow of cooling water to the pump is switched off.

- 4 Follow the procedure described in section 4.5.1 to configure the cryopump's Pirani gauge, using the **Signal Volt**, **Max. Volt**, **Min. Volt**, **Constant (c)**, and **Constant (k)** entry boxes.
- 5 If your gauge does not use the unit **Torr** for pressure, touch the **Torr** button to select either **mbar** (for millibars) or **Pa** (for Pascals), as appropriate.



- 6 Now select the **Iso-Valve Type**. If your system's cryo-iso valve is equipped with opened/closed position sensors, leave the default, **Feedback**, in place. If not, select **No Fdbk**.
- 7 Now enter a value for the **Opn/Cls Delay**. If you accepted the default, **Feedback**, for **Temp Feed**, the **Opn/Cls Delay** period begins when the iso-valve's position sensor indicates that the valve has reached either its open or its closed position. In that case, it is advisable to add an **Opn/Cls Delay**, to ensure that the valve has actually reached its commanded position before the FerroVac actually signals that it has done so.

When **No Fdbk** is selected for **Temp Feed**, the **Opn/Cls Delay** must allow sufficient time for the iso-valve to travel between the open and closed positions. To determine this value, observe the length of time it takes for the cryo-iso valve to open or close after an Open or Close command is issued.

To change the time entered for the **Opn/Cls Delay**:

- a) Touch the **Opn/Cls Delay** entry box to display a numeric keypad.
- b) Use this keypad to enter the desired value.
- c) Touch the keypad's **Enter** button to close it. The new value will then appear in the **Opn/Cls Delay** entry box.

### 8.2.3 Exit Configuration Mode and Save Configuration Changes

Exit from Configuration Mode, as described in section 4.9. Configuration changes are automatically saved when you do so.

## 8.3 FerroVac Operation in Manual Mode Operation

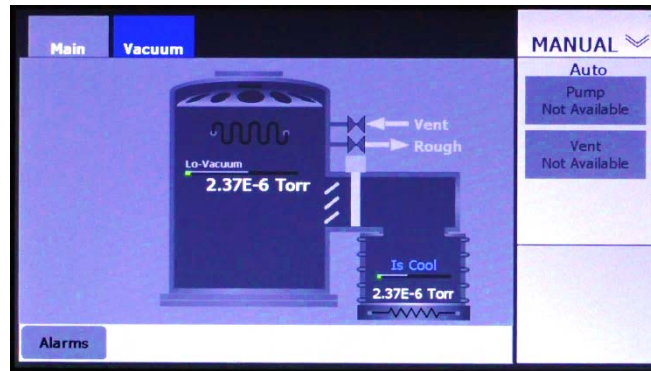
### 8.3.1 Control/Display Features of Manual Mode Screens

The Manual mode screens are the Manual>Main screen (see Figure 8-3) and the Manual mode Vacuum map (see 8-4).

#### The Manual>Main Screen

The Manual>Main screen (see Figure 8-3), which displays a simplified vacuum map, serves only to allow the user to monitor vacuum operations. The screen provides no command functionality over vacuum pumps, valves, or gauges.

Figure 8-3 Manual&gt;Main Screen



### The Manual Mode Vacuum Map

Figures 8-4 through 8-9 show the Manual mode Vacuum Map when the FerroVac is in the following configuration state:

- System = Diffusion
- (Foreline) Gauge Connect = Yes
- Mechanical Pump Connect = Yes
- Rough Off = No

The control/display features on the Manual mode Vacuum Map are identical to those on the Configuration mode Vacuum Map. Control buttons on both screens enable the user to open and close vacuum valves, including the cryo-iso valve, and to switch on/off the mechanical pump, the cryopump, and the chamber ion gauge. Note that the control/display features on the Configuration mode Vacuum Map are identical to those on the Manual mode Vacuum Map.

Figures 8-4 and 8-6 through 8-9 shows the Manual mode Vacuum Map **PC Soft Rough** is set to zero. Figure 8-5 shows that Vacuum map when a nonzero values is entered for that parameters. Figures 8-6 through 8-9 identify the Vacuum Map's control/display features.

**Figure 8-4 Manual Mode Vacuum Map when the *PC Soft Rough* Value Is Zero**

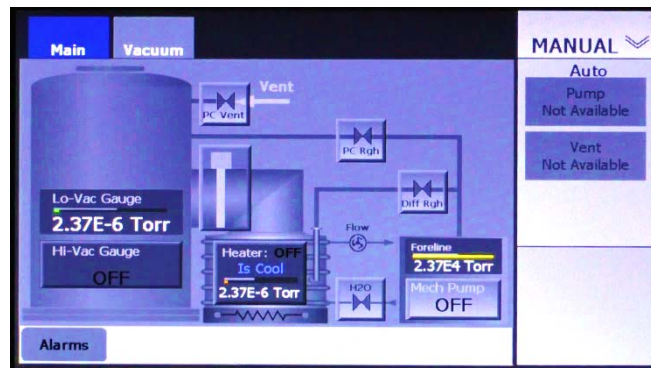


Figure 8-5 Manual Mode Vacuum Map when a Nonzero Values Is Entered for *PC Soft Rough*

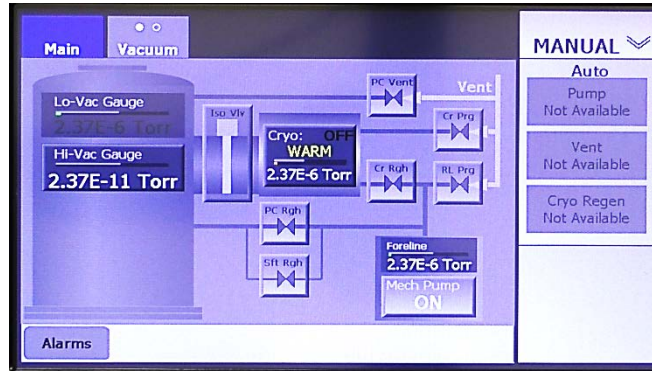
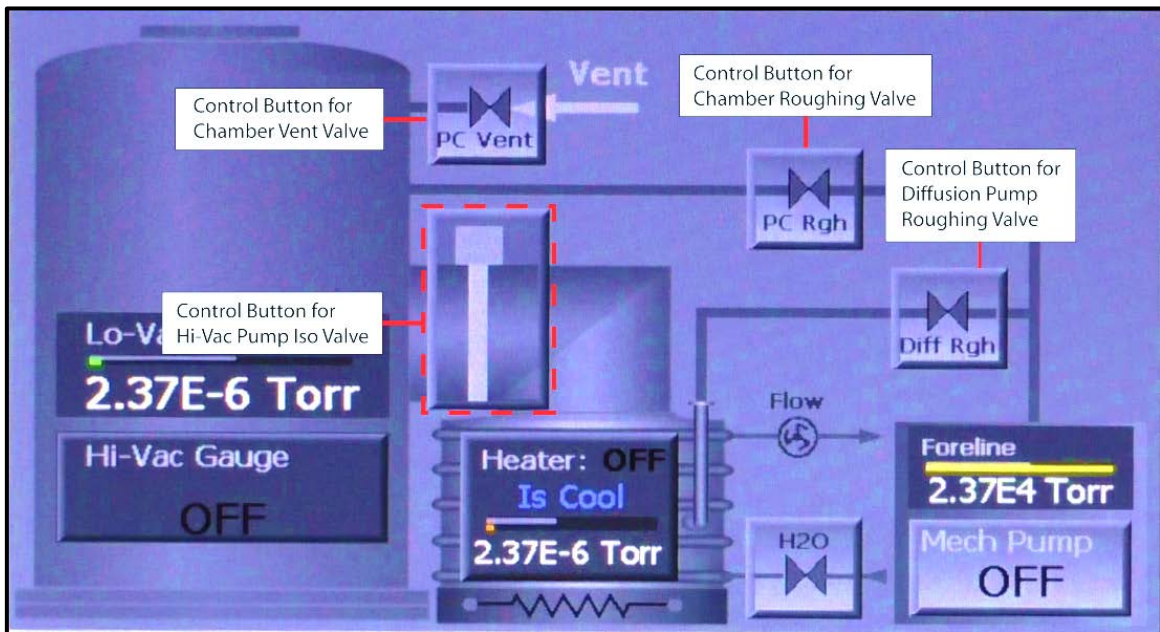
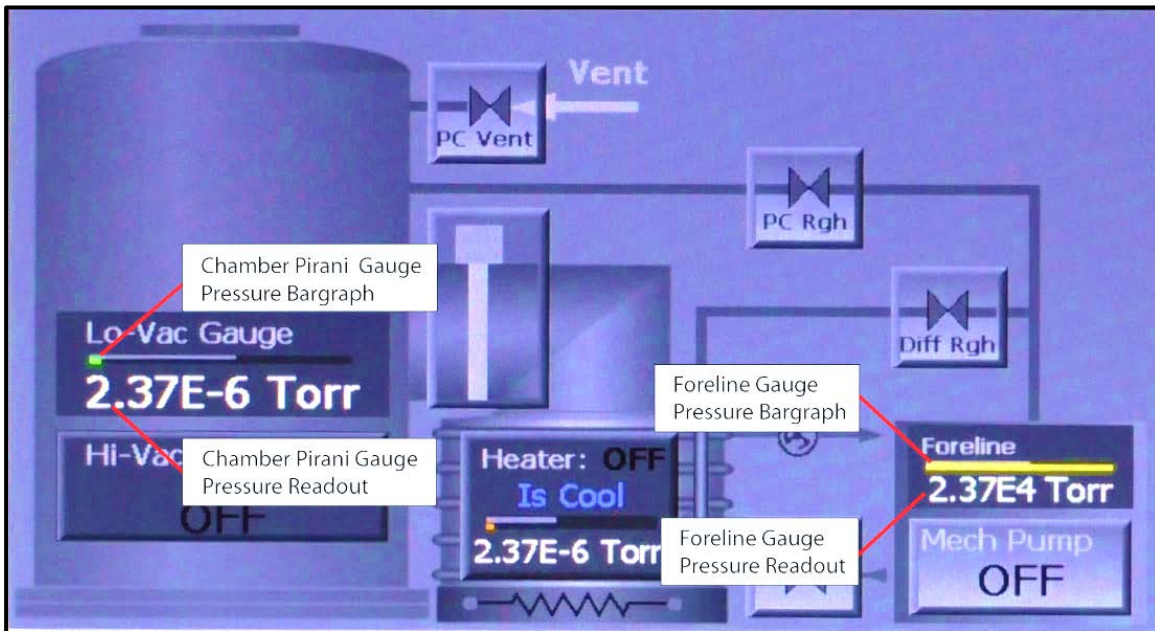


Figure 8-6 Manual Mode Vacuum Map: Control Buttons for Vacuum Valves



**Figure 8-7 Manual Mode Vacuum Map: Control/Display Features for Foreline Gauge and Chamber Lo-Vac Gauge**



**Figure 8-8 Manual Mode Vacuum Map: Control/Display Features for Chamber Hi-Vac Gauge**

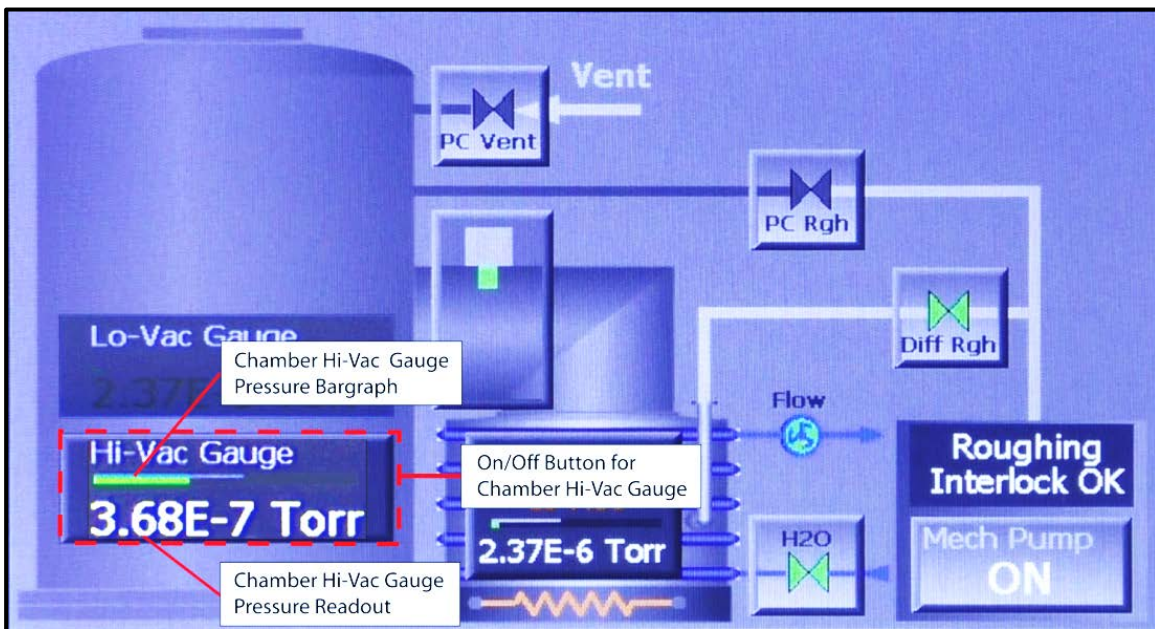
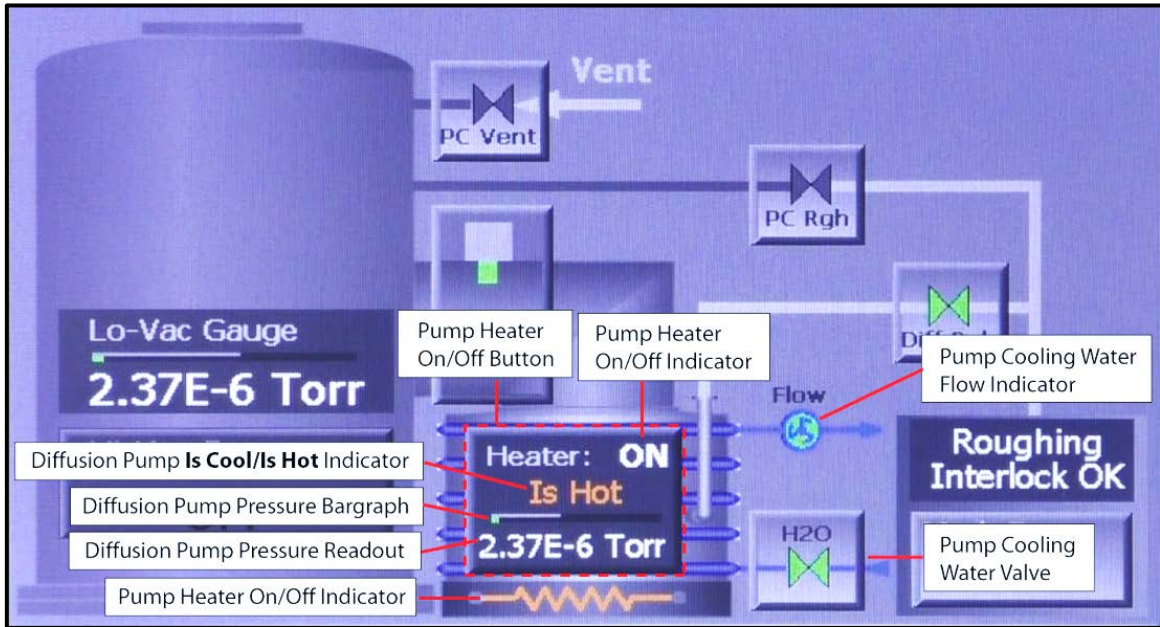


Figure 8-9 Manual Mode Vacuum Map: Control/Display Features for Diffusion Pump and Its Water Supply



## 8.4 FerroVac Operation in Operations Mode

### 8.4.1 Operations Mode Screens

When the unit is configured for a diffusion pump, the available automated operations are Auto Pump and Auto Vent. These operations can be initiated by pressing the **Pump** and **Vent** buttons on either the Operations>Main screen (see Fig. 8-10) or the Operations mode Vacuum map (see Fig. 8-11).

Figure 8-10 Operations>Main Screen

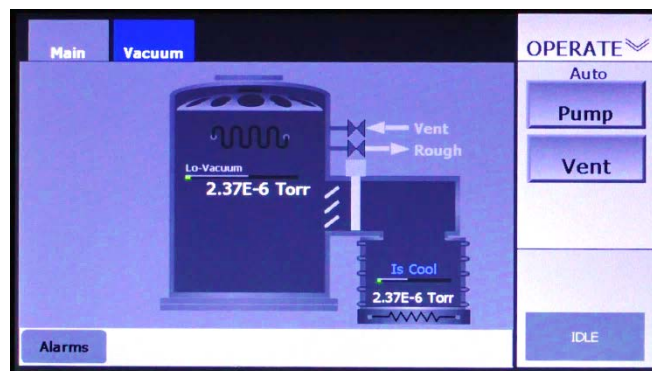
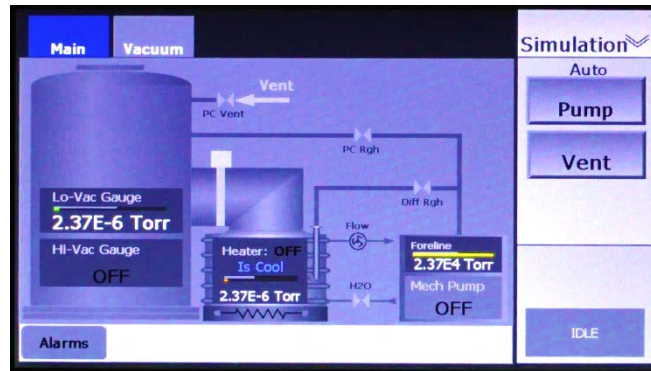


Figure 8-11 Operations Mode Vacuum Map

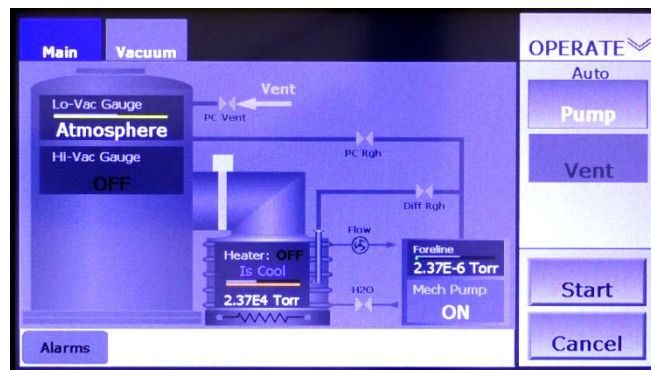


### 8.4.2 Executing Automated Operations

When configured for use with a diffusion pump, the FerroVac enables the user to start, pause, abort, and resume the Autopump and Autovent operations. The following procedure illustrates these command options, using Autopump as an example. However, the example applies identically to Autovent.

- | Step | Action  |
|------|---|
| 1    | Select Autopump by pressing the <b>Pump</b> button. The unit will then display <b>Start</b> and <b>Cancel</b> buttons, as shown in Figure 8-12. |

Figure 8-12 Ops Mode Vacuum Map After the User Presses the *Pump* Button



- |   |  |
|---|--|
| 2 | Press the <b>Start</b> button to initiate the Autovent. The command button bar will then display a <b>Stop</b> button in place of the <b>Start</b> button. In addition, a rectangle below the <b>Stop</b> button will display status messages relating to the Autopump operation, as shown in Figure 8-13. |
|---|--|

Figure 8-13 Ops Mode Vacuum Map After User Starts Autopump



- 3 To pause the Autovent operation, press the **Stop** button. That button will then disappear, and the message **Executing Shutdown** will be briefly displayed, as shown in Figure 8-14. Upon completion of that shutdown sequence, the command button bar will display the **Resume** and **Abort** buttons shown in Figure 8-15.

Figure 8-14 Ops Mode Vacuum Map After User Presses **Stop**

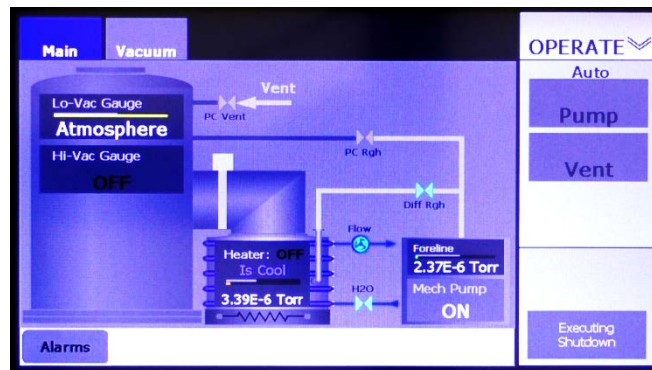
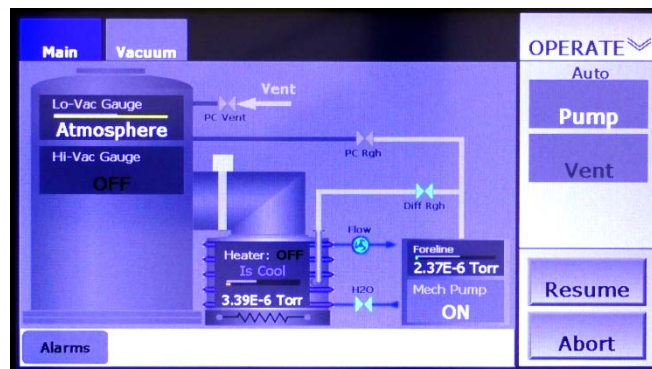
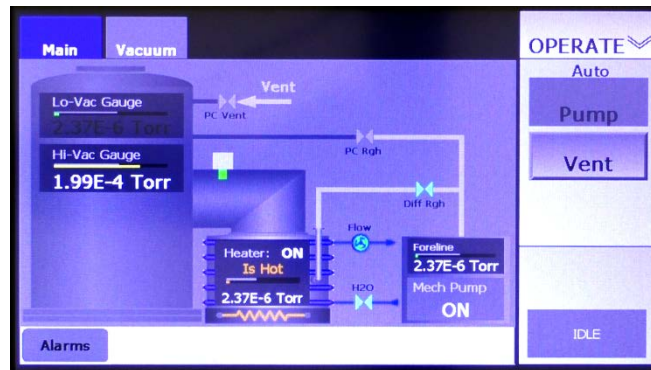


Figure 8-15 Ops Mode Vacuum Map Displaying **Resume** and **Abort** Buttons



- Pressing **Abort** returns the unit to the Idle state, at which point the screen will appear as shown in 8-11. If **Resume** is pressed, the Autopump operation resumes from the point at which it was interrupted, and the screen will again appear as shown in Figure 8-13. When the Autopump operation is completed, the screen will appear as shown in Figure 8-16.

**Figure 8-16 Ops Mode Vacuum Screen After Completion of Autopump**





# 9 *OnBoard with Load Lock Configuration and Operation*

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## 9.1 Section Overview

This section describes the procedures for configuring the FerroVac the FerroVac for use on a system with an OnBoard™ cryopump and a load-lock valve. These procedures assume that the FerroVac has been correctly installed, cabled up to controlled/monitored components, and powered up. The topics covered below are:

- Section 9.2 Configuration Procedure
  - Section 9.2.1 Perform Common Configuration Procedures
  - Section 9.2.2 Configure Parameters on the Hi-Vac Pump Control Page
  - Section 9.2.3 Initialize the Load Lock Valve, if Necessary
  - Section 9.2.4 Exit Configuration Mode and Save Configuration Changes
- Section 9.3 Manual Mode Operation
  - Section 9.3.1 Control/Display Features of Manual Mode Screens
- Section 9.4 FerroVac Operation in Operations Mode
  - Section 9.4.1 Operations Mode Screens
  - Section 9.4.2 Executing AutoPump Operations
  - Section 9.4.3 Executing Vent PC and Vent Sys Operations

## 9.2 Configuration Procedure

### 9.2.1 Perform Common Configuration Procedures

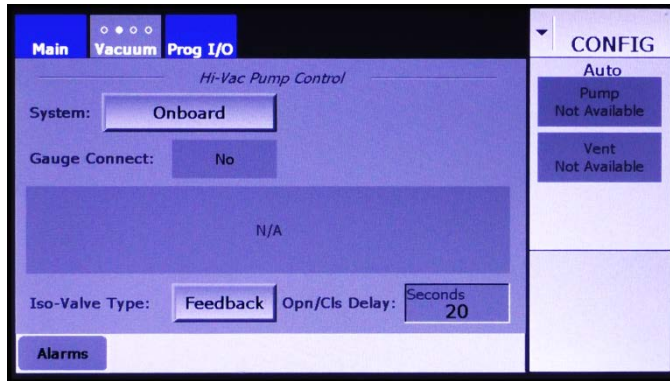
First perform the configuration procedures detailed in Section 4 of this manual. Those procedures apply regardless of which system type is selected.

### 9.2.2 Configure Parameters on the Hi-Vac Pump Control Page

Next configure the parameters on the Config>Hi-Vac Control page. To do so:

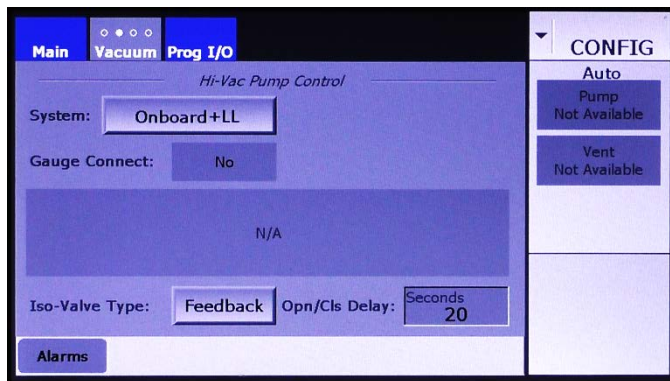
Step	Action
1	Touch the <b>Vacuum</b> screen tab as many times as necessary to display the Hi-Vac Control page. Upon initial boot-up, <b>Onboard</b> is selected by default opposite <b>System</b> , as shown in Figure 9-1.

Figure 9-1 Hi-Vac Control Page at Initial Boot-Up



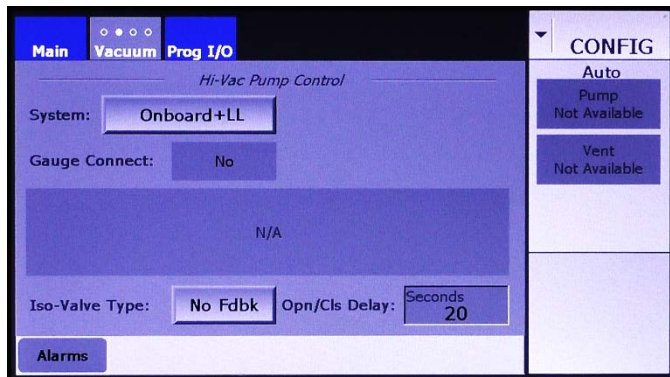
- 2 Press the **System** button four times to select **Onboard + LL**, as shown in Figure 9-2.

Figure 9-2 Hi-Vac Pump Control Page After User Selects *Onboard + LL* Opposite System



- 3 If your system's cryo-iso valve provides positional feedback to the FerroVac, skip this step and proceed to Step 3. Otherwise, touch the **Iso-Valve Type** button to toggle it from **Feedback** to **No Fdbk**. The screen will then appear as shown in Figure 9-3.

Figure 9-3 Hi-Vac Control Page After User Selects *No Fdbk*



- 4 Now enter a value for the **Opn/Cls Delay**. If the default, **Feedback**, is left in place, the **Opn/Cls Delay** period begins when the iso-valve's position sensor indicates that the valve has reached either its open or its closed position. In that case, it is advisable to add an **Opn/Cls Delay**, to ensure that the valve has actually reached its commanded position before the FerroVac actually signals that it has done so.

If No Fdbk is selected for Iso-Valve Type, the Opn/Cls Delay must allow sufficient time for the iso-valve to travel between the open and closed positions. To determine this value, observe the length of time it takes for the cryo-iso valve to open or close after an Open or Close command is issued. To change the **Opn/Cls Delay** value:

- Touch the recessed **Opn/Cls Delay** entry box to display a numeric keypad.
- Use this keypad to enter the desired value.
- Touch the keypad's **Enter** button to close it. The new value will then appear in the **Opn/Cls Delay** entry box.

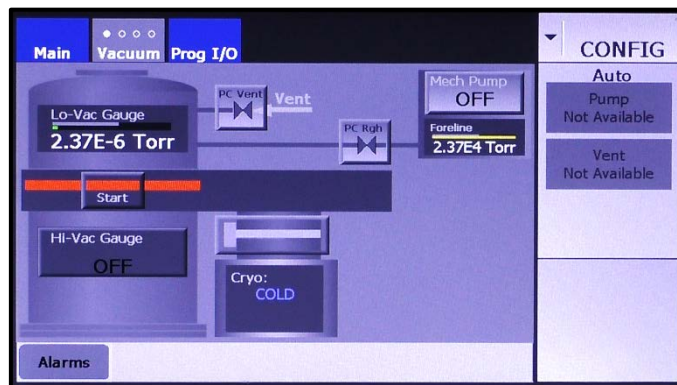
### 9.2.3 Initialize the Load Lock Valve, if Necessary

When the FerroVac is first booted up, the load-lock valve will be in of two states:

- In of the three known positions defined by limit switches (i.e., Open, down-and-closed, and up-and-closed), or
- An unknown position somewhere between two of the positions defined by the limit switches.

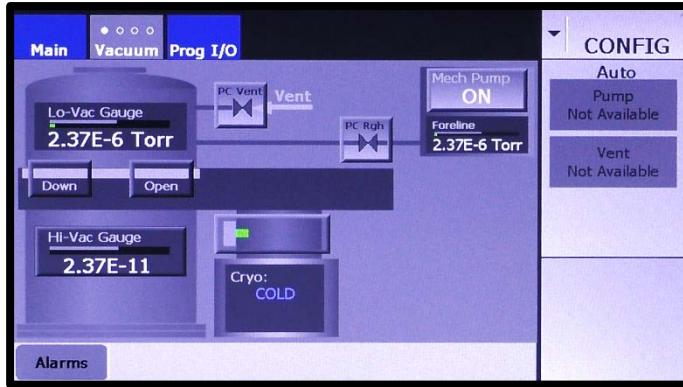
In the first case, it will not be necessary to initialize the load-lock valve, and the Vacuum map will accurately indicate its position. In the second case, and whenever an alarm related to the load-lock valve occurs, the icon representing the load-lock valve will appear as shown in Figure 9-4.

**Figure 9-4 Appearance of Icon for Load-Lock Valve upon Initial Boot-Up**



To enable the load-lock valve when it is in this state, first touch the **Start** button. The load-lock valve will then move to the up-and-closed position, as shown in Figure 9-5.

**Figure 9-5 Load-Lock Icon After It Is Initialized**



**NOTE**  
In order for the load-lock valve to be initialized, the cryo-iso valve must be open.

**9.2.4 Exit Configuration Mode and Save Configuration Changes**

Exit from Configuration Mode, as described in section 4.10. Configuration changes are automatically saved when you do so.

**9.3 Manual Mode Operation**

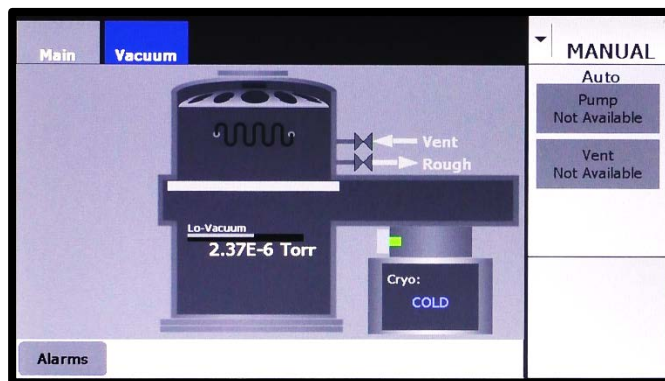
**9.3.1 Control/Display Features of Manual Mode Screens**

Manual mode screens are the Manual>Main screen (see Figure 9-6) and the Manual mode Vacuum map (see Figure 9-7).

**The Manual>Main Screen**

The Manual>Main screen (see Figure 9-6) provides a simplified vacuum map and serves only to allow the user to monitor vacuum operations. The screen provides no command functionality over vacuum pumps, valves, or gauges.

**Figure 9-6 Manual>Main Screen**



### The Manual Mode Vacuum Map

Figures 9-7 through 9-11 show the Manual mode Vacuum Map when the FerroVac is in the following configuration state:

- System = Onboard + Load Lock
- (Foreline) Gauge Connect = Yes
- Mechanical Pump Connect = Yes
- Rough Off = No

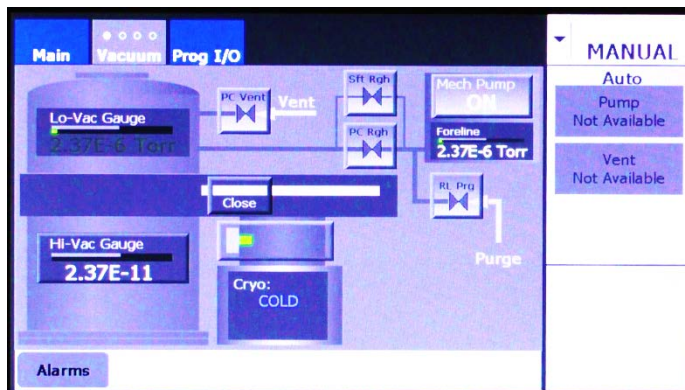
The control/display features on the Manual mode Vacuum Map are identical to those on the Configuration mode Vacuum Map. Control buttons on both Vacuum maps enable the user to open and close vacuum valves, including the load-lock and cryo-iso valves, and to switch on/off the mechanical pump, the cryopump, and the vacuum chamber's ion gauge.

Figures 9-7 and 9-9 through 9-11 show the Manual mode Vacuum map when **Roughline Purge** and **PC Soft Rough** are set to zero seconds. Figure 9-8 shows that Vacuum map when nonzero values are entered for both of those parameters. Figures 9-12 through 9-14 identify the load lock control buttons when that valve is in each of its three possible positions.

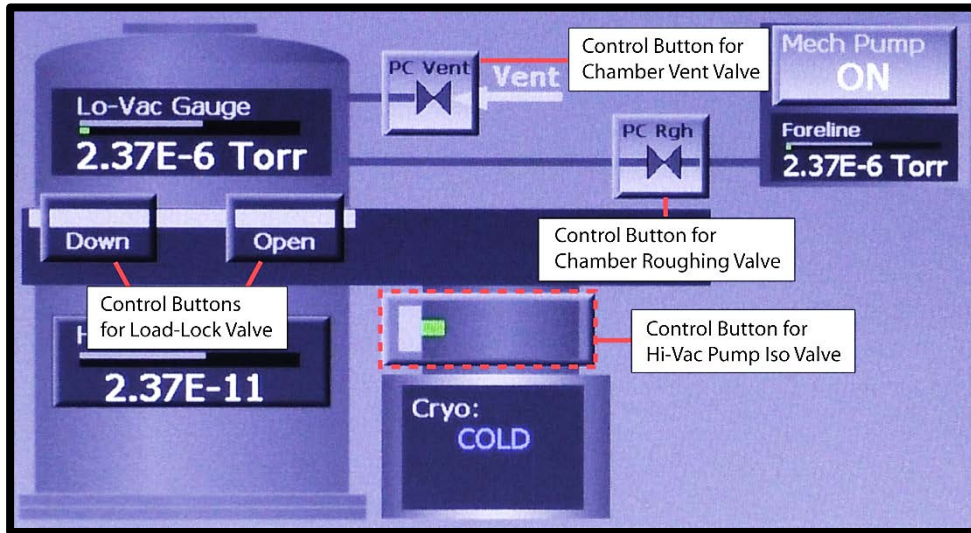
**Figure 9-7 Vacuum Map when Values for *Roughline Purge* and *PC Soft Rough* Are Both Zero**



**Figure 9-8 Vacuum Map when Nonzero Values Are Entered for *Roughline Purge* and *PC Soft Rough***

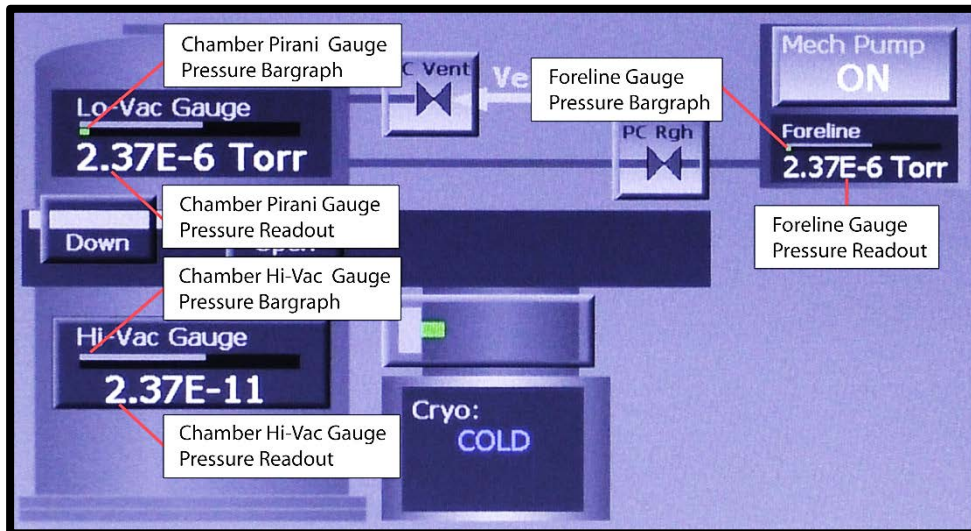


**Figure 9-9 Configuration and Manual Mode Vacuum Map: Control Buttons for Vacuum Valves, Iso-Valve, and Load Lock Valve\***

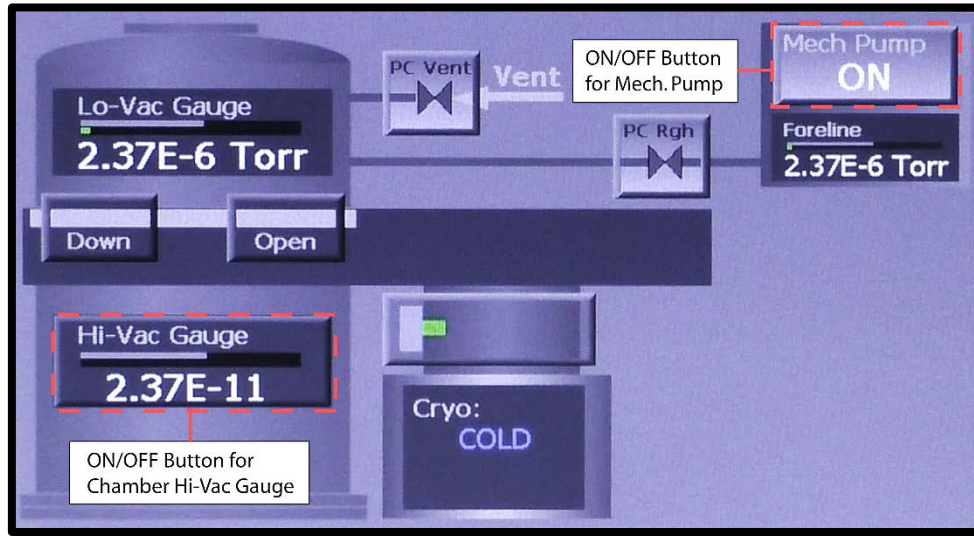


\*For more detailed information about load-lock valve control button, see Figures 9-12 through 9-14.

**Figure 9-10 Configuration and Manual Mode Vacuum Map: Display Features Related to Foreline Gauge and Chamber Vacuum Gauges**

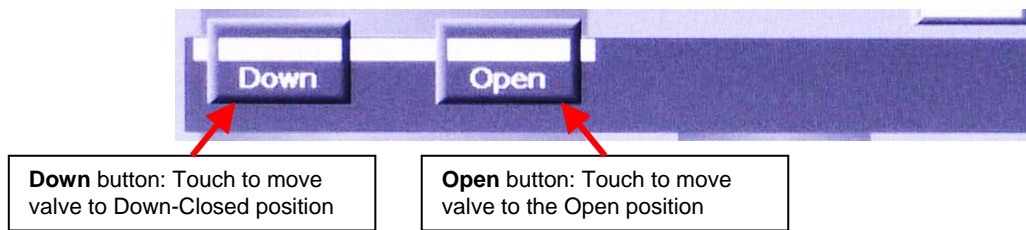


**Figure 9-11 Configuration and Manual Mode Vacuum Map: ON/OFF Buttons for Mech. Pump and Chamber Hi-Vac Gauge**

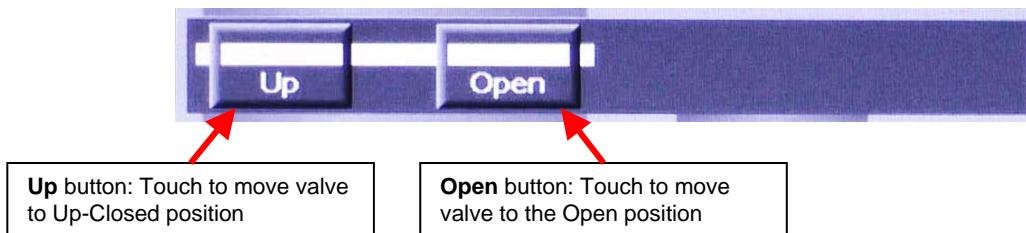


Figures 9-12 through 9-14 identify the load-lock control buttons when the load-lock valve is in each of its three positions. When the valve is in motion toward either the right or the left, it displays a **Stop** button.

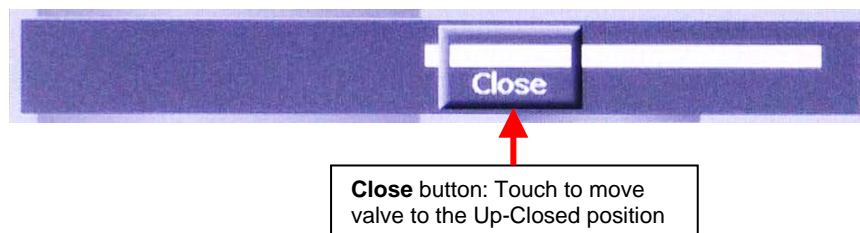
**Figure 9-12 Load-Lock Valve Control Buttons when Valve Is in the Up and Closed Position**



**Figure 9-13 Load-Lock Valve Control Buttons when Valve Is in the Down and Closed Position**



**Figure 9-14 Load-Lock Valve Control Button when Valve Is in the Open Position**



## 9.4 FerroVac Operation in Operations Mode

### 9.4.1 Operations Mode Screens

When the unit is configured for use on a system with an OnBoard cryopump and a load-lock valve, the available automated operations are Auto Pump, Vent PC, and Vent Sys. These operations can be initiated by pressing the **Pump**, **Vent PC**, and **Vent Sys** buttons that appear on the Operations>Main screen (see Figure 9-15) and the Operations mode Vacuum map (see Figure 9-16).

Figure 9-15 Operations>Main Screen

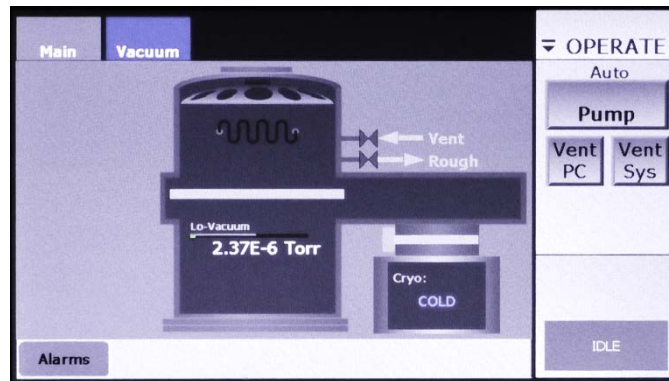
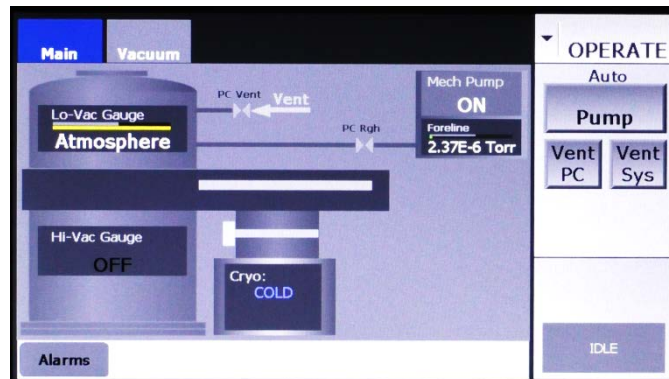


Figure 9-16 Operations Mode Vacuum Map



### 9.4.2 Executing AutoPump Operations

The following procedure illustrates the command options available during an Autopump operation. However, the same command options apply during Vent PC and Vent Sys operations.

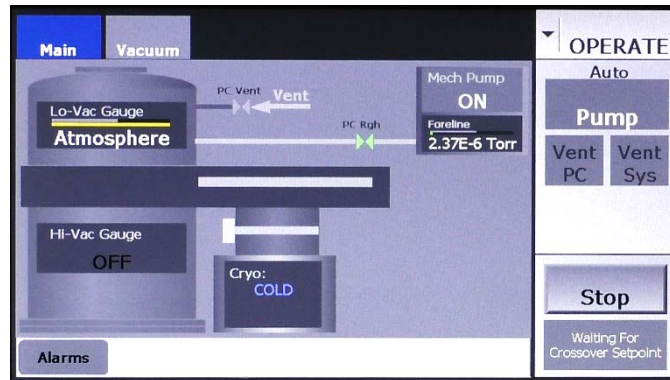
Figures 9-17 through 9-21 show the load-lock valve in the Open position at the beginning of an Autopump operation. However, that valve can be in any position at the start of an Autopump. If the load-lock valve is in the up-and-closed position when the Autopump begins, and if the cryo-iso valve is open, then after the product chamber reaches its crossover point and after a fixed crossover delay executes, the Autopump routine will switch on the chamber's hi-vac gauge and move the load lock valve to the Open position. However, if the cryo-iso valve is closed after the crossover delay completes, the



Autopump routine will not open it. Instead, an error will occur, and the screen will display the Alarm message "Auto Pump, Hi-Vac Isolation Valve Is Not Open Alarm." At that point, the user must abort the Autopump. Note that an Autopump cannot be executed if the cryopump is not switched on and cold.

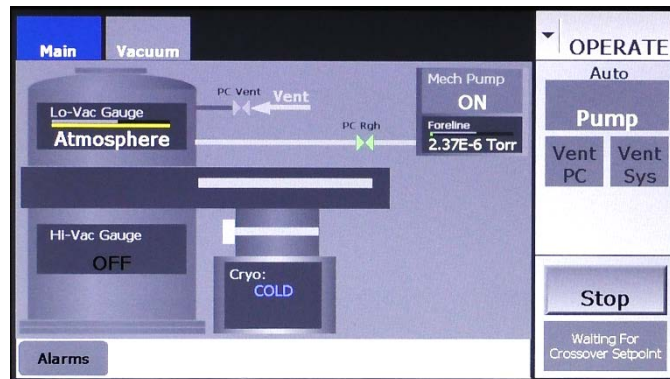
- | Step | Action   |
|------|--|
| 1    | Press the <b>Pump</b> button to select Autopump. The command button bar will then display <b>Start</b> and <b>Cancel</b> buttons, as shown in Figure 9-17. |

**Figure 9-17 Operations Mode Vacuum Map After User Presses the *Pump* Button**



- Next press the **Start** button to initiate the Autopump operation. The command button bar will then display a **Stop** button in place of the **Start** button. A rectangle below the **Stop** button will display status messages relating to the Autopump operation (see Figure 9-18).

**Figure 9-18 Operations Mode Vacuum Map After User Presses *Start***



- To pause the Autopump operation, press the **Stop** button. That button will then disappear, and the message **Executing Shutdown** will be briefly displayed, as shown in Figure 9-19. After that shutdown sequence is completed, the command button bar will display **Resume** and **Abort** buttons, as shown in Figure 9-20.

Figure 9-19 Operations Mode Vacuum Map Immediately After User Presses Stop

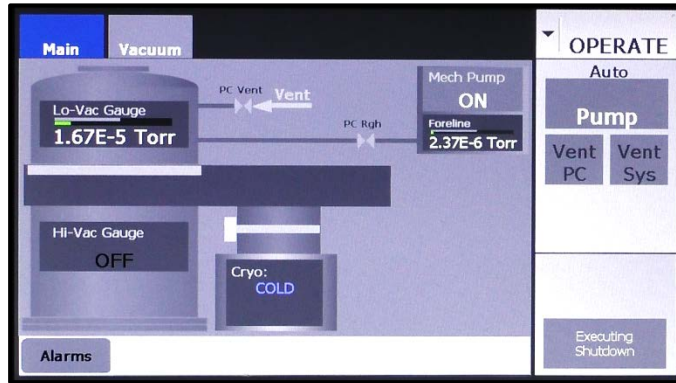
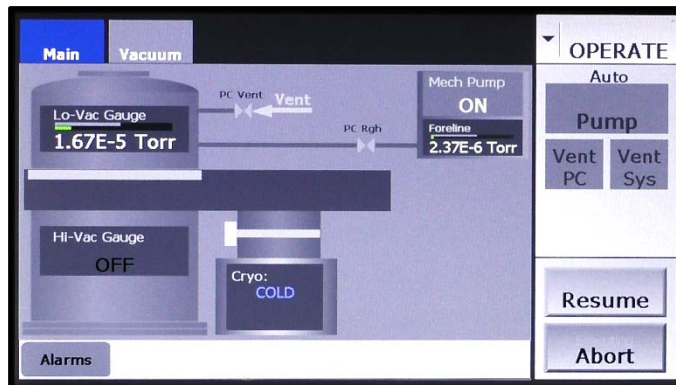
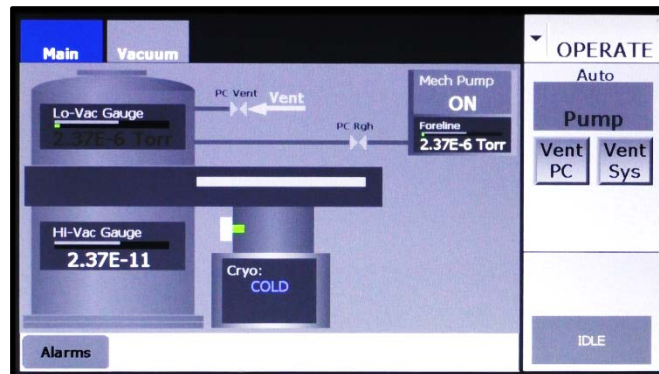


Figure 9-20 Operations Mode Vacuum Map Displaying Resume and Abort Buttons



If **Resume** is pressed, the Autopump operation will re-execute the sequence that was interrupted and then proceed through the remainder of the Autopump operation. If **Abort** is pressed, the command button bar will briefly display the message **Executing Shutdown** and then return the FerroVac to the Idle state. When the shutdown sequence is completed, the command button bar will display **Idle**, as shown in Figure 9-16.

Figure 9-21 Operations Mode Vacuum Map After Completion of Autopump



### 9.4.3 Executing Vent PC and Vent Sys Operations

#### Vent PC Operations

A Vent PC operation can be initiated with the load-lock valve in any position. If started when when the load-lock valve is in the either the Open or the down-and-closed position, the Vent PC routine first moves the load-lock valve to the up-and closed position and then opens the chamber vent valve. Once a Vent PC operation begins, the command options illustrated in Figures 9-17 through 9-20 are available.

#### Vent Sys Operations

The **Vent Sys** button is available only when the vacuum chamber is under vacuum, with the load-lock valve in the Open position. If the load-lock valve is in any other position when the operator desires to initiate a Vent Sys operation, he/she must first enter Manual mode and use the Vacuum map's control buttons to move the load-lock valve to the Open position. The Vent Sys operation can then be started.

If the cryo-iso valve is open when a Vent Sys begins, the Vent Sys routine first switches off the chamber hi-vac gauge and closes that valve. The Vent Sys routine then opens the chamber vent valve. Once a Vent Sys operation begins, the command options illustrated in Figures 9-17 through 9-20 are available.



# 10 *OffBoard with Load Lock Configuration and Operation*

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## 10.1 Section Overview

This section describes the procedures for configuring the FerroVac the FerroVac for use on a system with an OffBoard™ cryopump and a load-lock valve. These procedures assume that the FerroVac has been correctly installed, cabled up to controlled/monitored components, and powered up. The topics covered below are:

- Section 10.2 Configuration Procedure
  - Section 10.2.1 Perform Common Configuration Procedures
  - Section 10.2.2 Configure Parameters on the Hi-Vac Pump Control Page
  - Section 10.2.3 Initialize the Load Lock Valve, if Necessary
  - Section 10.2.4 Exit Configuration Mode and Save Configuration Changes
- Section 10.3 Manual Mode Operation
  - Section 10.3.1 Control/Display Features of Manual Mode Screens
- Section 10.4 FerroVac Operation in Operations Mode
  - Section 10.4.1 Operations Mode Screens
  - Section 10.4.2 Variations in Cryopump Icon in Vacuum Maps Depending on Configuration
  - Section 10.4.3 Executing Autopump Operations
  - Section 10.4.4 Executing Vent PC and Vent Sys Operations
  - Section 10.4.5 Configuring and Executing AutoRegen Operations

## 10.2 Configuration Procedure

### 10.2.1 Perform Common Configuration Procedures

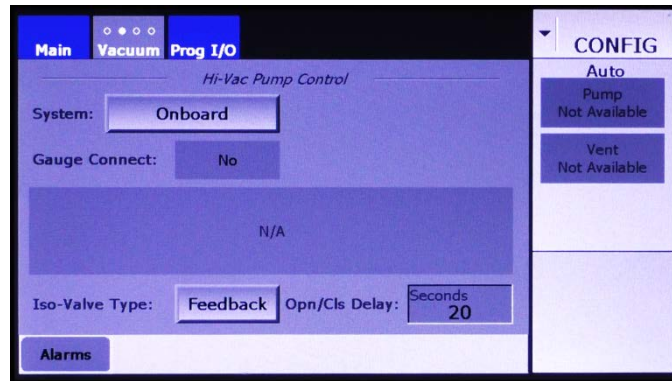
First perform the configuration procedures detailed in Section 4 of this manual. Those procedures apply regardless of which system type is selected.

### 10.2.2 Configure Parameters on the Hi-Vac Pump Control Page

Next configure the parameters on the Config>Hi-Vac Control page. To do so:

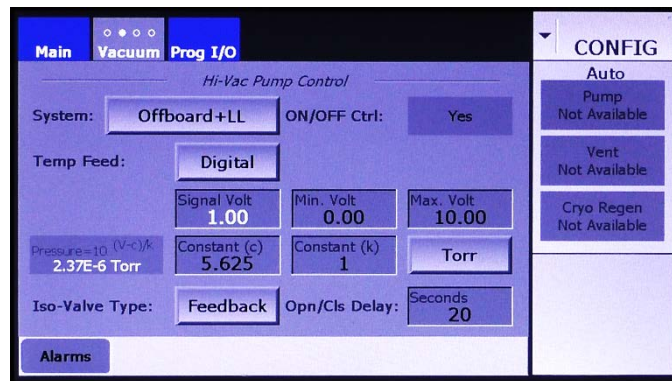
- |             |   |
|-------------|---|
| <b>Step</b> | <b>Action</b>   |
| 1           | Touch the <b>Vacuum</b> screen tab as many times as necessary to display the Hi-Vac Control page. Upon initial boot-up, <b>OnBoard</b> is selected by default opposite <b>System</b> , as shown in Figure 10-1. |

**Figure 10-1 Hi-Vac Control Page at Initial Boot-Up**



- |   |   |
|---|---|
| 2 | Press the <b>System</b> button four times to select <b>OffBoard + LL</b> , as shown in Figure 10-2. |
|---|---|

**Figure 10-2 Hi-Vac Pump Control Page After User Selects OffBoard + LL Opposite System**



- |   |   |
|---|---|
| 3 | Next select the <b>Temp Feed</b> option. If your system's cryopump provides temperature feedback to the FerroVac, leave <b>Digital</b> selected. If not, press the <b>Temp Feed</b> button to toggle it to <b>None</b> , as shown in Figure 10-3. |
|---|---|

When **Digital** is selected, the Vacuum Map's cryopump icon (see Figure 10-16) displays either **WARM**, **WARMING**, **COOLING**, or **COLD**, depending on the pump's temperature state. In addition, the **On/Off Ctrl.** selection on the Hi-Vac Pump Control page defaults to **Yes**, so the Vacuum Map's cryopump icon functions as an On/Off button for the cryopump, as shown in Figure 10-3.

When **None** is selected for **Temp Feed**, the cryopump icon displays either **ONLINE** or **OFFLINE** to indicate the pump's status, as shown in Figure 10-17, instead of **WARM**, **WARMING**, **COOLING**, or **COLD**.

- 4 If you left the default, **Digital**, selected for **Temp Feed**, skip this step. If you selected **None** for **Temp Feed**, then a **Yes/No** toggle button appears opposite **ON/OFF Ctrl**. If you select **Yes**, the Vacuum Map's cryopump icon functions as an On/Off button, as shown in Figure 10-16. If **No** is selected, as shown in Figure 10-3, that button becomes a flat display rectangle (see Figure 10-18).

**Figure 10-3 Hi-Vac Pump Control Page: *None Selected for Temp Feed, No for On/Off Ctrl***



- 5 Next configure the cryopump's Pirani gauge, using the **Signal Volt**, **Max. Volt**, **Min. Volt**, **Constant (c)**, and **Constant (k)** entry boxes. In doing so, follow the procedure described in detail in section 4.5.1.
- 6 If your gauge does not use the unit **Torr** for pressure, touch the **Torr** button to select either **mbar** (for millibars) or **Pa** (for Pascals), as appropriate.
- 7 Next select the **Iso-Valve Type**. If your system's cryo-iso valve provides positional feedback to the FerroVac, skip this step and proceed to Step 0. Otherwise, touch the **Iso-Valve Type** button to toggle it from **Feedback** to **No Fdbk**. The screen will then appear as shown in Figure 10-4

**Figure 10-4 Hi-Vac Control Page After User Selects *No Fdbk***



- 8 Finally, enter a value for the **Opn/Cls Delay**. If the default, **Feedback**, is left in place, the **Opn/Cls Delay** period begins when the iso-valve's position sensor indicates that the valve has reached either its open or its closed position. In that case, it is advisable to add an **Opn/Cls Delay**, to ensure that the valve has actually reached its commanded position before the FerroVac actually signals that it has done so.

If No Fdbk is selected for Iso-Valve Type, the Opn/Cls Delay must allow sufficient time for the iso-valve to travel between the open and closed positions. To determine this value, observe the length of time it takes for the cryo-iso valve to open or close after an Open or Close command is issued.

To change the time entered for the **Opn/Cls Delay**:

- Touch the **Opn/Cls Delay** entry box to display a numeric keypad.
- Use this keypad to enter the desired value.
- Touch the keypad's **Enter** button to close it. The new value will then appear in the **Opn/Cls Delay** entry box.

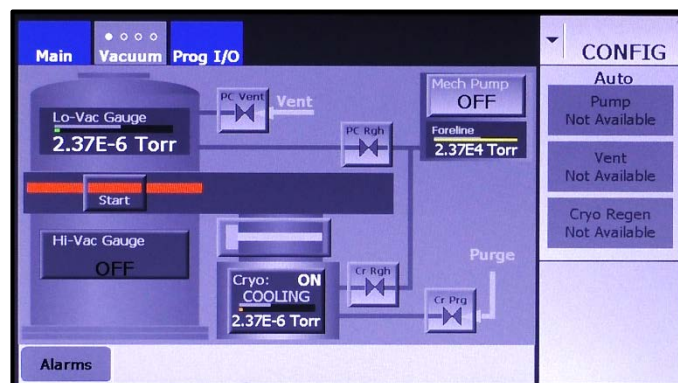
### 10.2.3 Initialize the Load Lock Valve, if Necessary

When the FerroVac is first booted up, the load-lock valve will be in of two states:

- In of the three known positions defined by limit switches (i.e., Open, down-and-closed, and up-and-closed), or
- An unknown position somewhere between two of the positions defined by the limit switches.

In the first case, it will not be necessary to initialize the load-lock valve, and the Vacuum map will accurately indicate its position. In the second case, and whenever an alarm related to the load-lock valve occurs, the icon representing the load-lock valve will appear as shown in Figure 10-5.

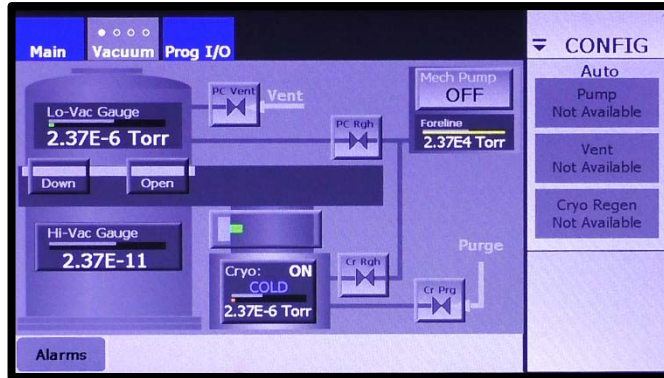
**Figure 10-5 Appearance of Icon for Load-Lock Valve upon Initial Boot-Up**



To enable the load-lock valve when it is in this state, first touch the **Start** button. The load-lock valve will then move to the up-and-closed position, as shown in Figure 10-6.



Figure 10-6 Load-Lock Icon After It Is Initialized



**NOTE**  
In order for the load-lock valve to be enabled, the cryo-iso valve must be open.

### 10.2.4 Exit Configuration Mode and Save Configuration Changes

Exit from Configuration Mode, as described in section 4.10. Configuration changes are automatically saved when you do so.

## 10.3 Manual Mode Operation

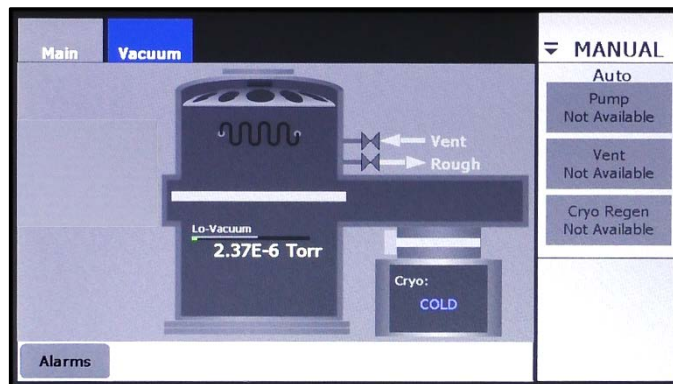
### 10.3.1 Control/Display Features of Manual Mode Screens

Manual mode screens are the Manual>Main screen (see Figure 10-7) and the Manual mode Vacuum map (see Figure 10-8).

#### The Manual>Main Screen

The Manual>Main screen (see Figure 10-7) provides a simplified vacuum map and serves only to allow the user to monitor vacuum operations. The screen provides no command functionality over vacuum pumps, valves, or gauges.

Figure 10-7 Manual>Main Screen



### The Manual Mode Vacuum Map

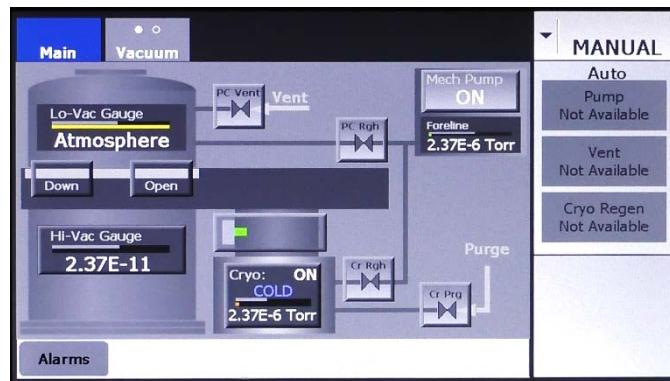
Figures 10-8 through 10-12 show the Manual mode Vacuum Map when the FerroVac is in the following configuration state:

- System = OffBoard + Load Lock
- (Foreline) Gauge Connect = Yes
- Mechanical Pump Connect = Yes
- Rough Off = Yes

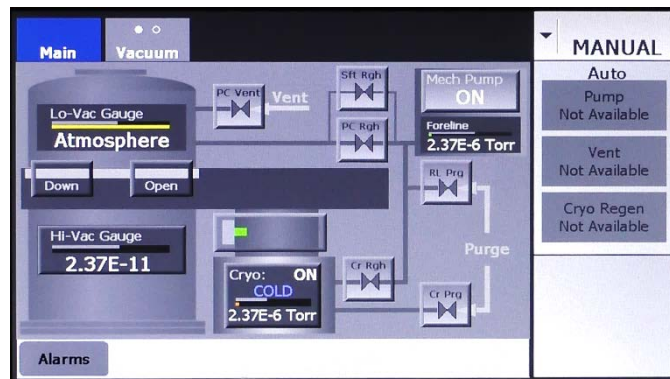
The control/display features on the Manual mode Vacuum Map are identical to those on the Configuration mode Vacuum Map. Control buttons on both Vacuum maps enable the user to open and close vacuum valves, including the load-lock and cryo-iso valves, and to switch on/off the mechanical pump, the cryopump, and the vacuum chamber's ion gauge.

Figures 10-8 and 10-10 through 10-12 show the Manual mode Vacuum map when **Roughline Purge** and **PC Soft Rough** are both set to zero seconds. Figure 10-9 shows that Vacuum map when nonzero values are entered for both of those parameters. Figures 10-13 through 10-15 identify the load-lock control buttons when that valve is in each of its three possible positions.

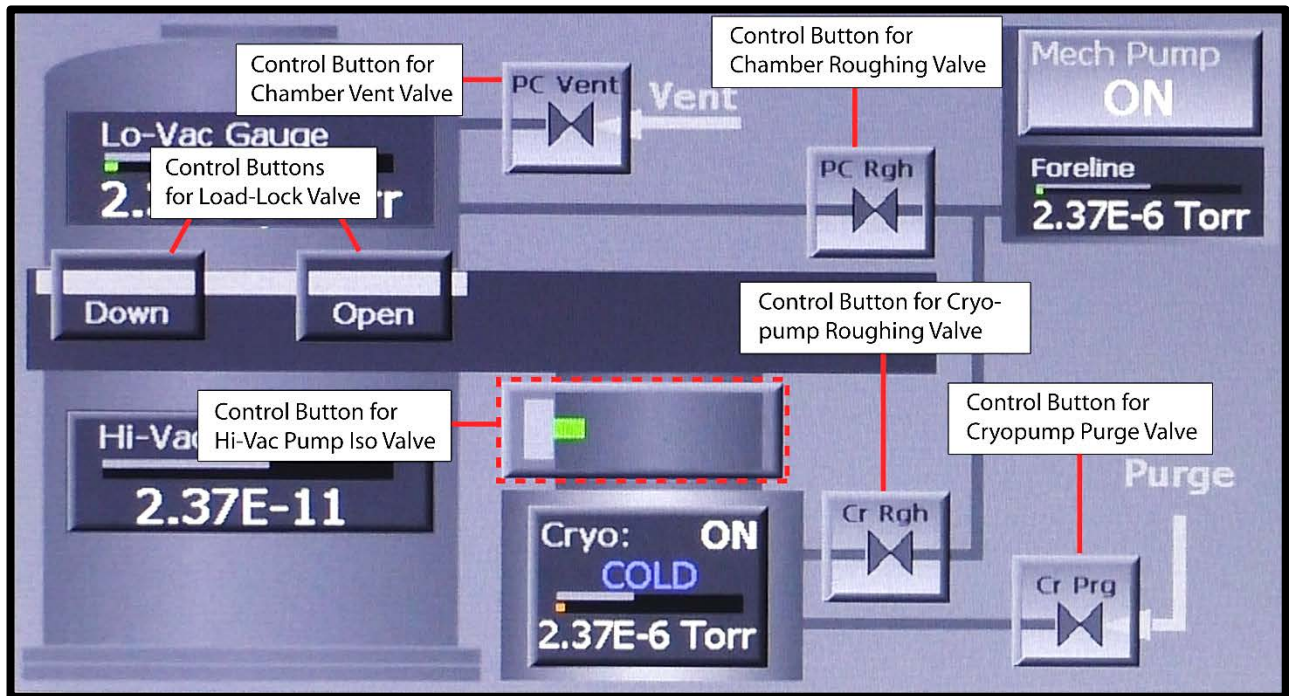
**Figure 10-8 Vacuum Map when Values for *Roughline Purge* and *PC Soft Rough* Are Both Zero**



**Figure 10-9 Vacuum Map when Nonzero Values Are Entered for *Roughline Purge* and *PC Soft Rough***

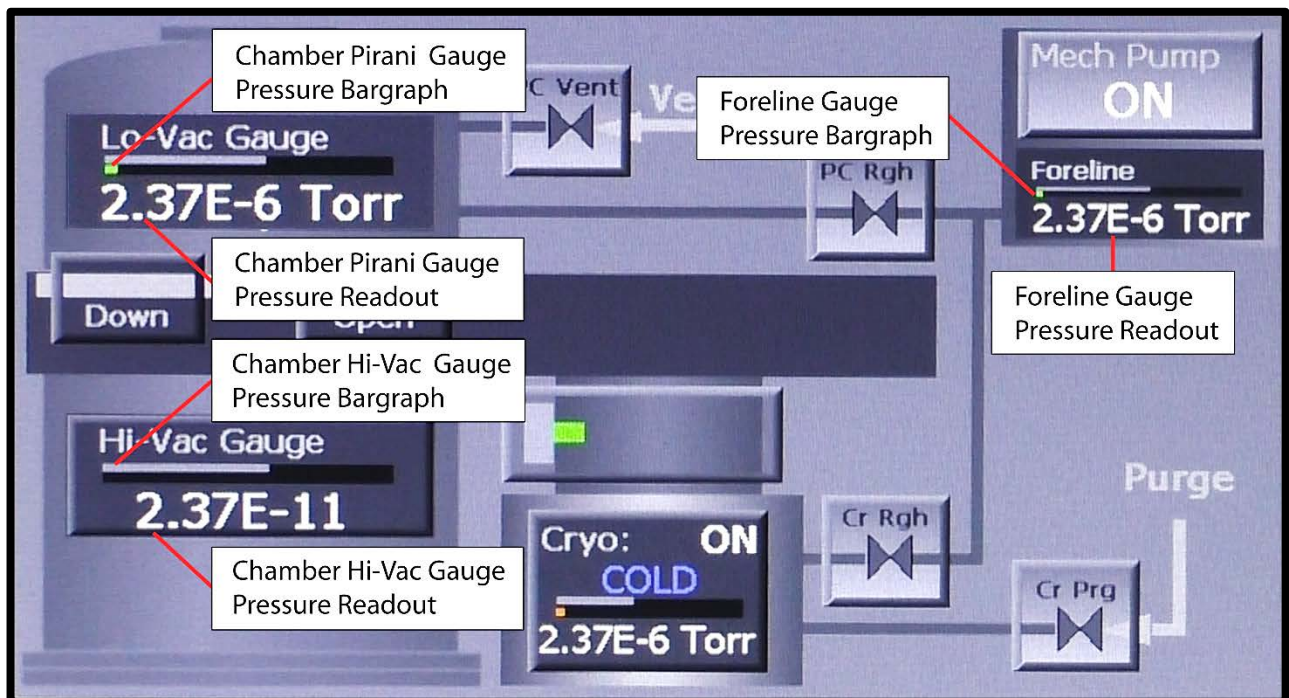


**Figure 10-10 Configuration and Manual Mode Vacuum Map: Control Buttons for Vacuum Valves, Iso-Valve, and Load Lock Valve\***

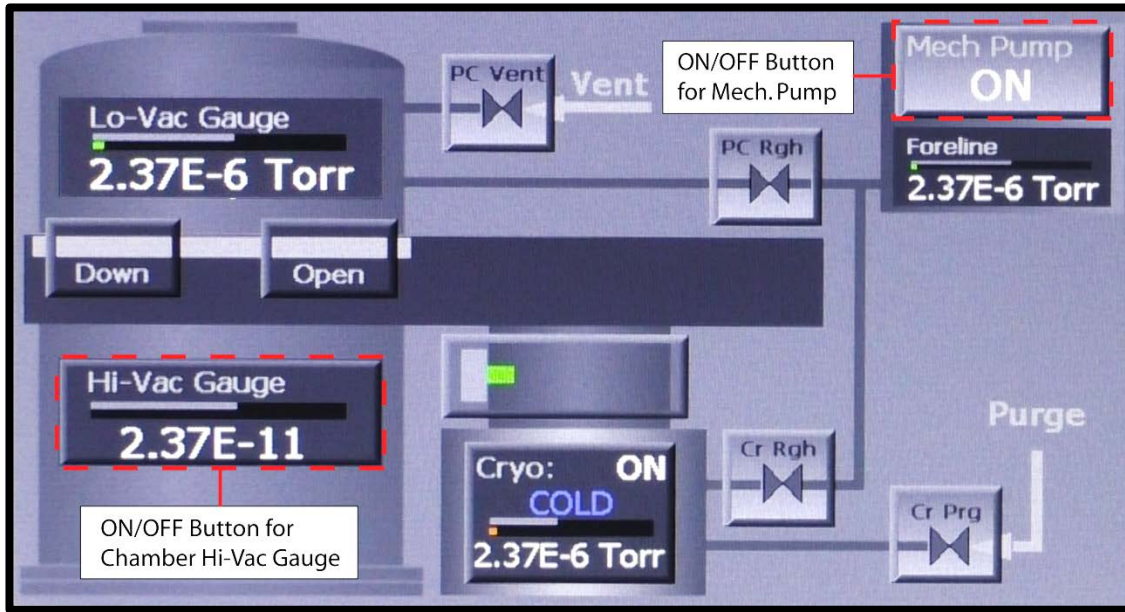


\*For more detailed information about load-lock valve control button, see Figures 10-13 through 10-15.

**Figure 10-11 Configuration and Manual Mode Vacuum Map: Display Features Related to Foreline Gauge and Chamber Vacuum Gauges**

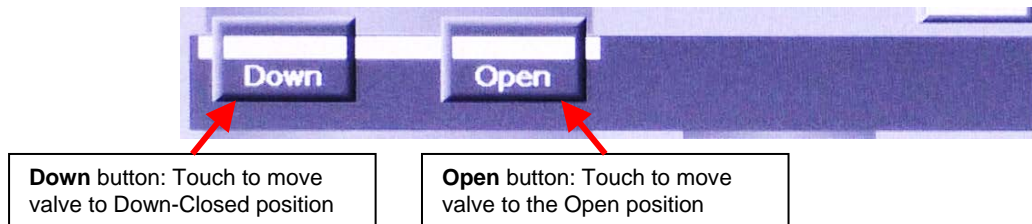


**Figure 10-12 Configuration and Manual Mode Vacuum Map: ON/OFF Buttons for Mech. Pump and Chamber Hi-Vac Gauge**

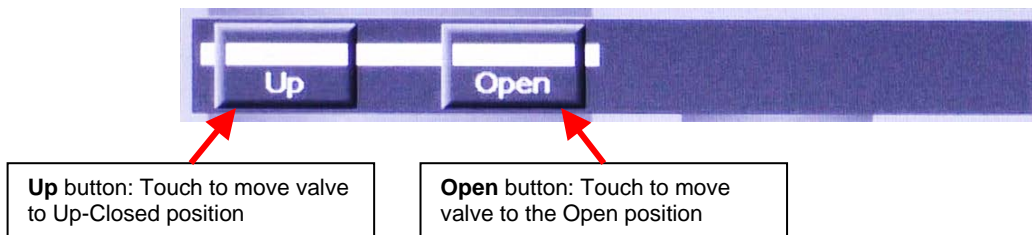


Figures 10-13 through 10-15 identify the load-lock control buttons when the load-lock valve is in each of its three positions. When the valve is in motion toward either the right or the left, it displays a **Stop** button.

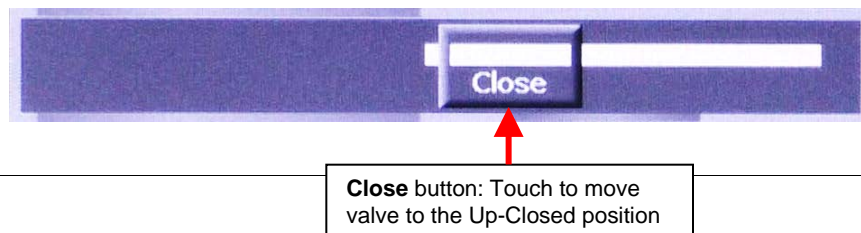
**Figure 10-13 Load-Lock Valve Control Buttons when Valve Is in the Up and Closed Position**



**Figure 10-14 Load-Lock Valve Control Buttons when Valve Is in the Down and Closed Position**



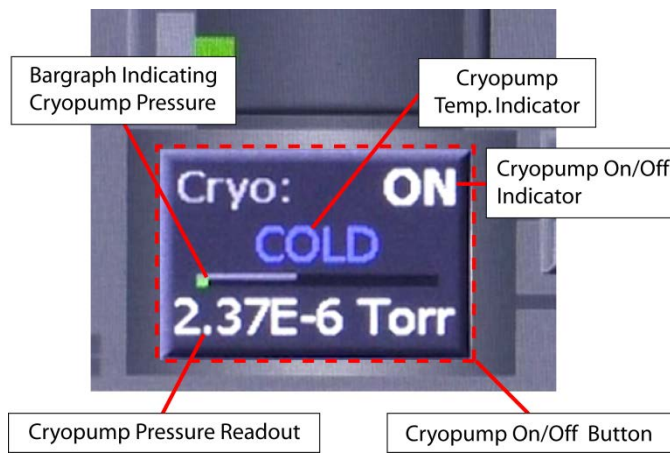
**Figure 10-15 Load-Lock Valve Control Button when Valve Is in the Open Position**



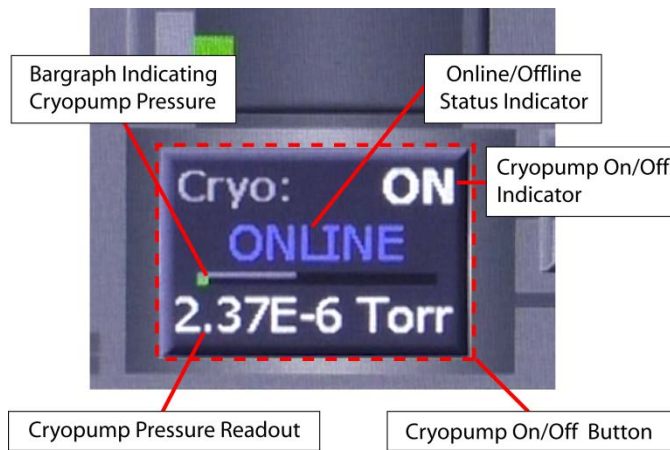
**Variations In the Vacuum Map’s Cryopump Icon Depending on Configuration Options Selected**

Figures 10-16 through 10-18 illustrate how the control/display features on Vacuum Map’s cryopump icon vary depending on which configuration options are selected. Figure 10-16 shows that icon as it appears when **Digital** is selected for **Temp Feed** on the Hi-Vac Pump Control page, as shown in **Error! Reference source not found.** Figure 10-17 shows how the cryopump icon appears when **None** is selected for **Temp Feed** and **Yes** is selected for **On/Off Ctrl**. Figure 10-18 illustrates its features when **None** is selected for **Temp Feed** and **No** is selected for **On/Off Ctrl**. Note that when **None** is selected for **Temp Feed**, **ONLINE** or **OFFLINE** is displayed in place of **COLD** or **WARM**. When **No** is selected for **On/Off Ctrl**, the cryopump icon becomes a flat display rectangle, instead of an On/Off button, as shown in Figure 10-18.

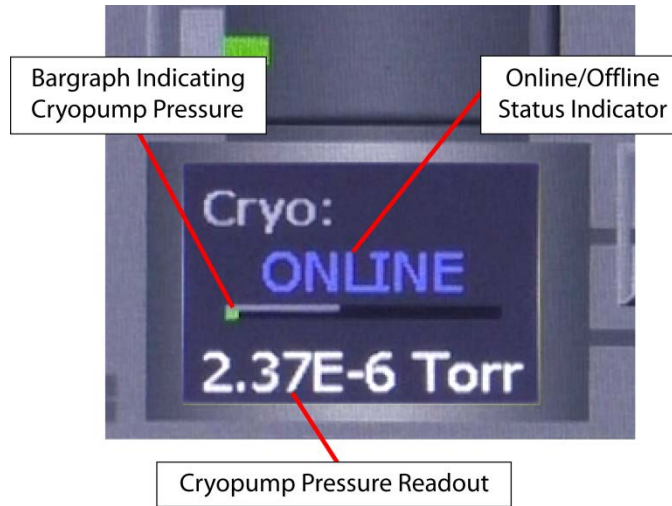
**Figure 10-16 The Vacuum Map’s Cryopump Icon when *Digital* Is Selected for *Temp Feedback***



**Figure 10-17 Cryopump Icon when *None* Is Selected for *Temp Feed*, *YES* for *On/Off Ctrl***



**Figure 10-18 Cryopump Icon when *None* Is Selected for *Temp Feed*, *NO* for *On/Off Ctrl***



**The Manual Mode Regen Screen**

Figure 10-19 shows the Manual mode Regen screen when the FerroVac is configured for use in a system with an OffBoard cryopump with a load-lock valve, temperature feedback, and cryopump On/Off control. When the unit is configured that way, the Manual>Regen screen enables the user to:

- Enter values for user-configurable parameters that govern AutoRegen operations
- Open and close the chamber roughing and vent valves and the cryo-iso valve
- Switch on/off the mechanical pump and the cryopump
- Monitor AutoRegen operations in real time

For detailed information about entering AutoRegen parameters, see section 10.4.5.

**Figure 10-19 Manual Mode Regen Screen, Unit Configured for an OffBoard Cryopump with Load Lock Valve, Temperature Feedback, and On/Off Control**

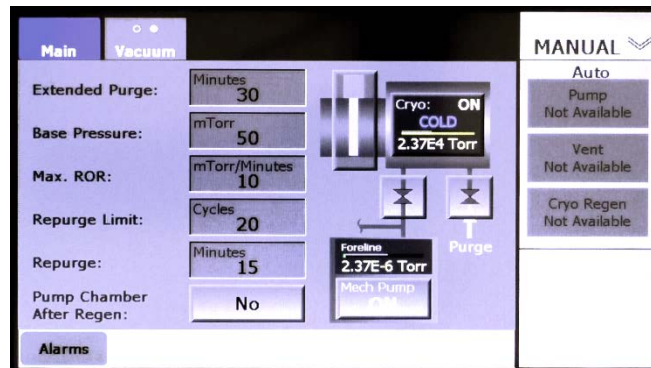


Figure 10-23 shows how this screen’s cryopump icon appears when the FerroVac is configured for use with an OffBoard cryo that does not provide temperature feedback.

## 10.4 FerroVac Operation in Operations Mode

### 10.4.1 Operations Mode Screens

When the unit is configured for use in a system with an OffBoard cryopump and a load-lock valve, the available automated operations are Auto Pump, Vent PC, Vent Sys, and AutoRegen. These operations can be initiated by pressing the **Pump**, **Vent PC**, **Vent Sys**, and **Regen** buttons that appear on the Operations>Main screen (see Figure 10-20), the Operations mode Vacuum map (see Figure 10-21), and the Ops>Regen screen (see Figure 10-22).

Figure 10-20 Operations>Main Screen

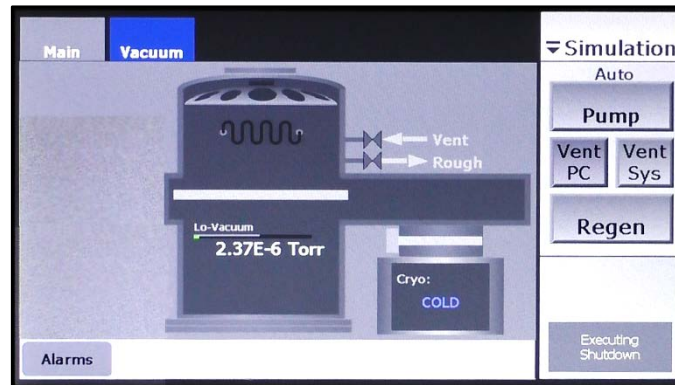
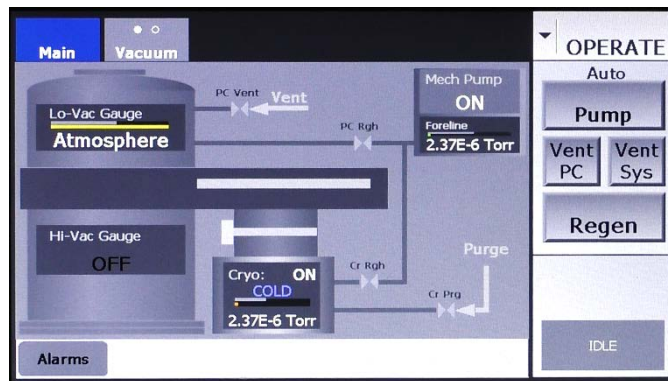
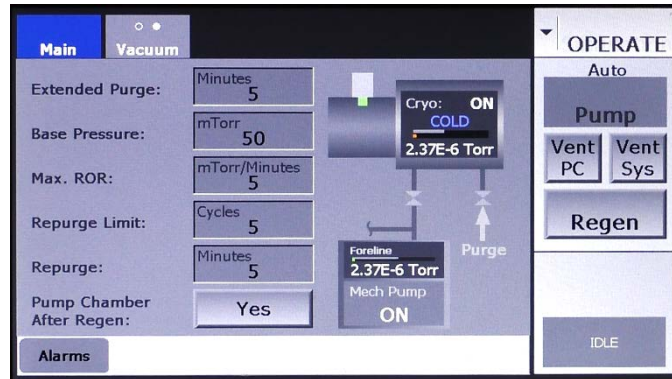


Figure 10-21 Operations Mode Vacuum Map



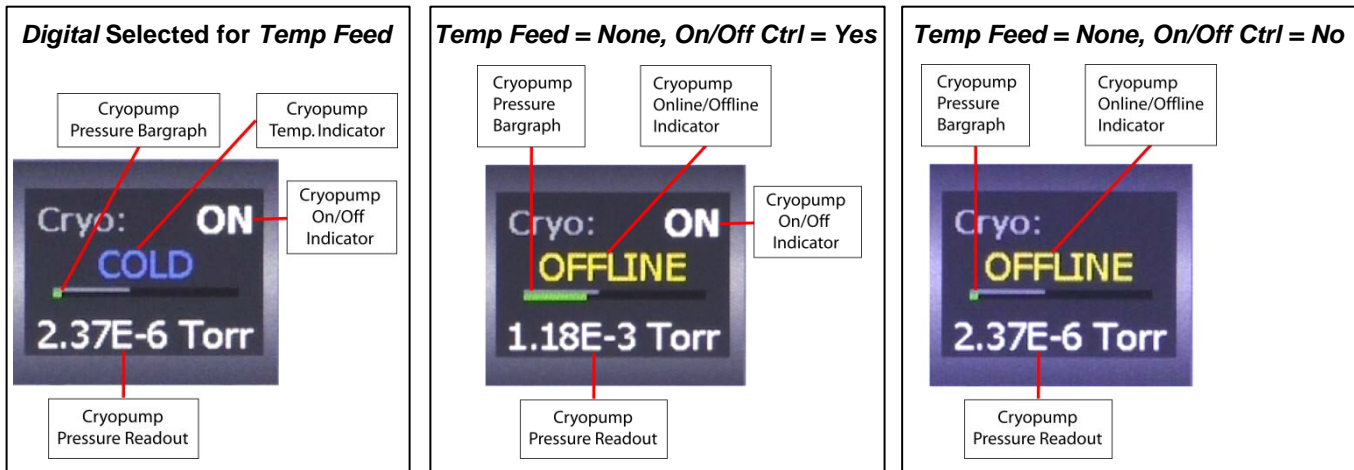
**Figure 10-22 Operations>Regen Screen, Unit Configured for an OffBoard Cryopump with Temperature Feedback**



**10.4.2 Variations in Cryopump Icon in Vacuum Maps Depending on Configuration**

Figures 10-20 through 10-22 show the Operations mode screens as they appear when **Digital** is selected for **Temp Feed** on the Hi-Vac Pump Control Page (see **Error! Reference source not found.**). Figure 10-23 illustrates how the identical cryopump icons on these screens vary in appearance depending on the **Temp Feed** selection and, when **None** is selected for **Temp Feed**, whether the user selects **Yes** or **No** for **On/Off Ctrl**.

**Figure 10-23 Variations in Cryopump Icon Depending On Configuration Options Selected**



**10.4.3 Executing Autopump Operations**

The following procedure illustrates the command options available during an Autopump operation. However, the same command options apply during Vent PC and Vent Sys operations.

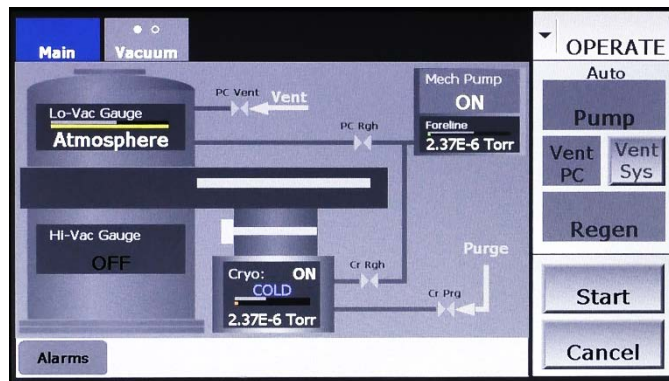
Figures 10-24 through 10-28 show the load-lock valve in the Open position at the beginning of an Autopump operation. However, that valve can be in any position at the start of an Autopump. If the load-lock valve is in the up-and-closed position when the Autopump begins, and if the cryo-iso valve is open, then after the product chamber reaches its crossover point and after a fixed crossover delay executes,



the Autopump routine will switch on the chamber's hi-vac gauge and move the load lock valve to the Open position. However, if the cryo-iso valve is closed after the crossover delay completes, the Autopump routine will not open it. Instead, an error will occur, and the screen will display the Alarm message "Auto Pump, Hi-Vac Isolation Valve Is Not Open Alarm." At that point, the user must abort the Autopump. Note that an Autopump cannot be executed if the cryopump is not switched on and cold.

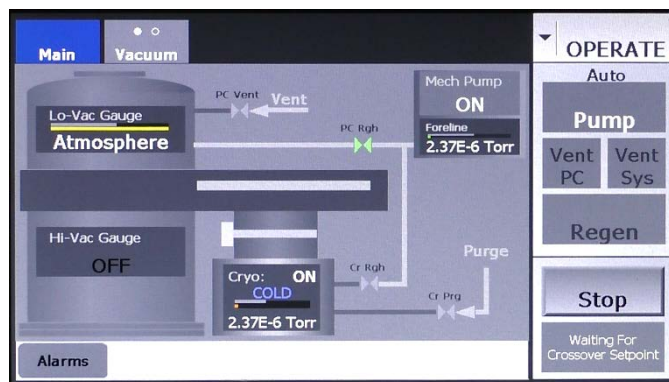
- | Step | Action  |
|------|---|
| 1    | Press the <b>Pump</b> button to select Autopump. The command button bar will then display <b>Start</b> and <b>Cancel</b> buttons, as shown in Figure 10-24. |

**Figure 10-24 Operations Mode Vacuum Map After User Presses the *Pump* Button**



- |   |  |
|---|--|
| 2 | Next press the <b>Start</b> button to initiate the Autopump operation. The command button bar will then display a <b>Stop</b> button in place of the <b>Start</b> button. A rectangle below the <b>Stop</b> button will display status messages relating to the Autopump operation (see Figure 10-25). |
|---|--|

**Figure 10-25 Operations Mode Vacuum Map After User Presses *Start***



- |   |   |
|---|---|
| 3 | To pause the Autopump operation, press the <b>Stop</b> button. That button will then disappear, and the message <b>Executing Shutdown</b> will be briefly displayed, as shown in Figure 10-26. After that shutdown sequence is completed, the command button bar will display <b>Resume</b> and <b>Abort</b> buttons, as shown in Figure 10-27. |
|---|---|

Figure 10-26 Operations Mode Vacuum Map Immediately After User Presses Stop

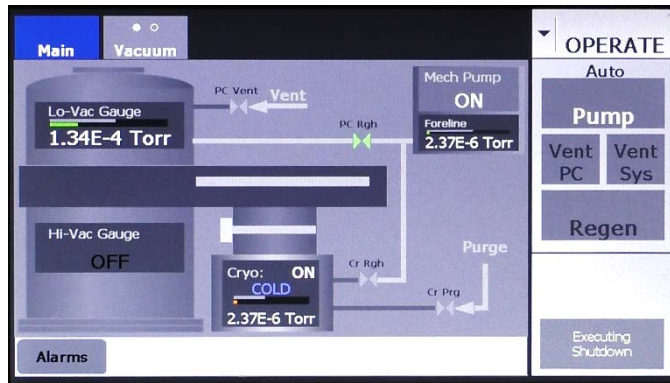
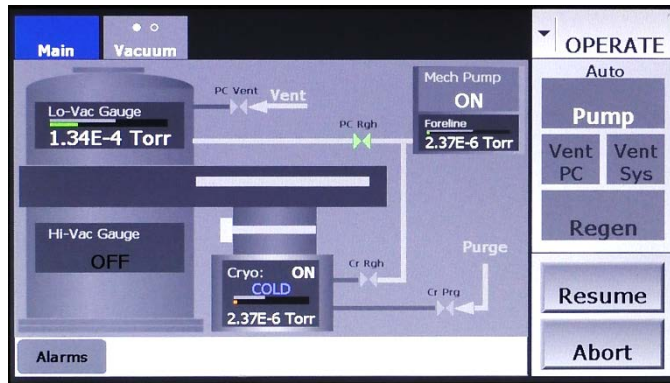
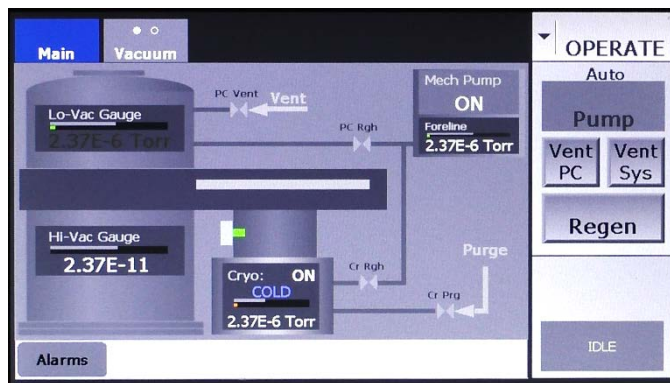


Figure 10-27 Operations Mode Vacuum Map Displaying Resume and Abort Buttons



If **Resume** is pressed, the Autopump sequence that was interrupted will be re-executed, and the remainder of the Autopump operation will execute. Then proceed through the remainder of the Autopump operation. If **Abort** is pressed, the command button bar will briefly display the message **Executing Shutdown** and the return the FerroVac to the Idle state. When the shutdown sequence is completed, the command button bar will display **Idle**, (see Figure 10-21).

Figure 10-28 Operations Mode Vacuum Map After Completion of Autopump



## 10.4.4 Executing Vent PC and Vent Sys Operations

### Vent PC Operations

A Vent PC operation can be initiated with the load-lock valve in any position. If started when the load-lock valve is in either the Open or the down-and-closed position, the Vent PC routine first moves that valve to the up-and-closed position and then opens the chamber vent valve. Once a Vent PC operation begins, the command options illustrated in Figures 10-24 through 10-27 are available.

### Vent Sys Operations

The **Vent Sys** button is available only when the vacuum chamber is under vacuum, with the load-lock valve in the Open position. If the load-lock valve is in any other position when the operator desires to initiate a Vent Sys operation, he/she must first enter Manual mode and use the Vacuum map's control buttons to move the load-lock valve to the Open position. The Vent Sys operation can then be started.

If the cryo-iso valve is open when a Vent Sys begins, the Vent Sys routine first switches off the chamber hi-vac gauge and closes that valve. The Vent Sys routine then opens the chamber vent valve. Once a Vent Sys operation begins, the command options illustrated in Figures 10-24 through 10-27 are available.

## 10.4.5 Configuring and Executing AutoRegen Operations

AutoRegen cycles can be configured and monitored from either the Manual>Regen screen (see Figure 10-19) or the Operations>Regen screen (see Figure 10-22) but can be initiated and controlled only from the Operations>Regen screen.

### Configuring an AutoRegen Operation

The Manual>Regen screen and the Operations>Regen screen both have features that enable the user to configure Autoregen operations. These features include the following parameter-entry boxes related to the AutoRegen operation plus a **Pump Chamber After Regen** button:

- **Extended Purge** = the duration, in minutes, of the first purge period
- **Base Pressure** = the target chamber pressure following each purge and 60-second pumpdown. Achieving a chamber pressure lower than this value following those operations allows the AutoRegen cycle to proceed to the next rate of rise (ROR) test.
- **Max. ROR** = the maximum leakdown rate at which the chamber will pass an ROR test.
- **Repurge Limit** = the number of Repurge operations allowed before the regen operation is automatically aborted. NOTE: This counter does not count the initial (i.e., extended) purge.
- **Repurge** = the duration, in minutes, of each Repurge operation (i.e. of purge operations following the first, or Extended Purge, operation)

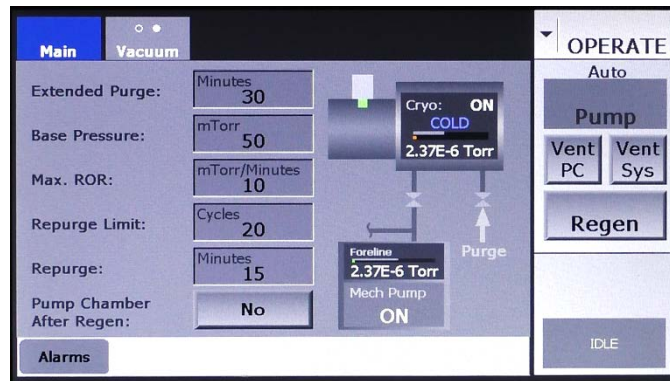
The **Pump Chamber After Regen** button enables the user to determine whether an AutoPump cycle will be executed following successful completion of the AutoRegen operation.

## Regen Procedure for Systems with an On-Board Cryopump with Temperature Feedback

### Initiating the AutoRegen Operation

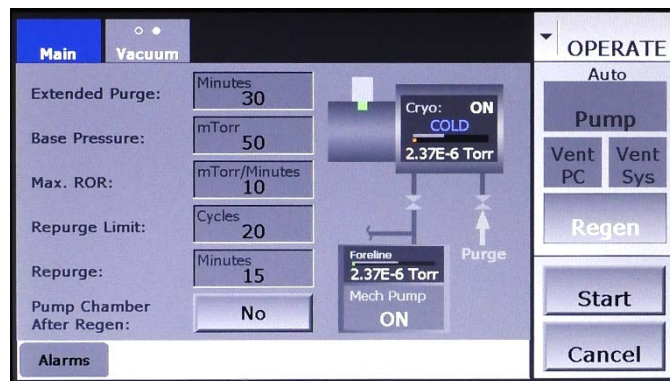
AutoRegen operations are most conveniently initiated and monitored from the Ops>Regen screen (see Figure 10-29). To initiate an AutoRegen cycle on a system with an OffBoard cryopump with temperature feedback, perform the following procedure. For instructions on running an AutoRegen operation on a system with a cryopump that does not provided temperature feedback, see " Regen Procedure for Cryopumps with No Temperature Feedback" at the end of this section.

**Figure 10-29 Operations>Regen Screen When No Automatic Cycle Is Running**

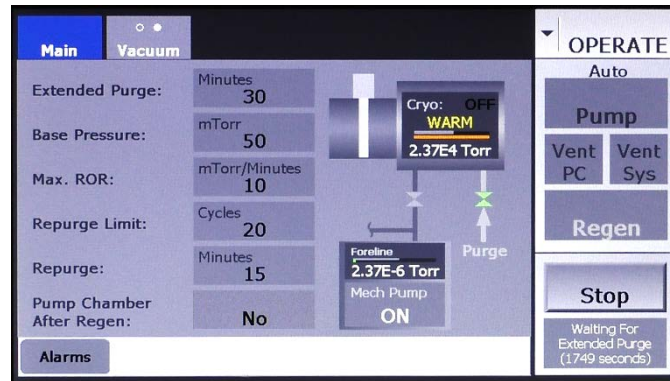


- | Step | Action  |
|------|---|
| 1    | Touch the command button bar's <b>Regen</b> button. <b>Start</b> and <b>Cancel</b> buttons will then appear below the <b>Regen</b> button, as shown in Figure 10-30). |

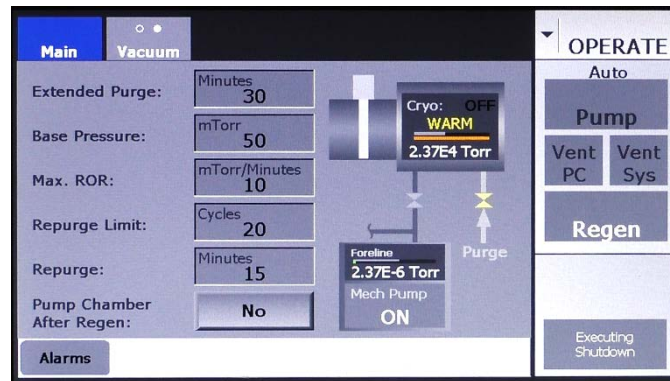
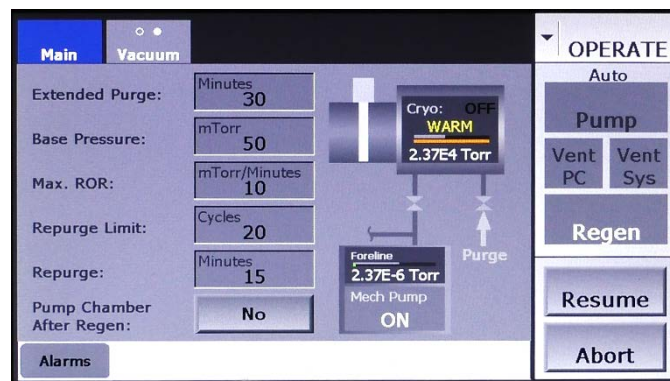
**Figure 10-30 Ops>Regen Screen After User Touches the Regen Button**



- |   |   |
|---|---|
| 2 | Touch the <b>Start</b> button to initiate the AutoRegen operation. The command button bar will then display a <b>Stop</b> button in place of the <b>Start</b> button. In addition, a rectangle below the <b>Stop</b> button will display status messages relating to the AutoRegen operation, as shown in Figure 10-31. |
|---|---|

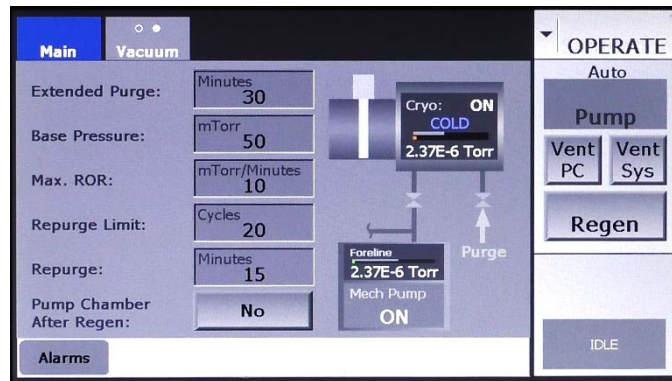
Figure 10-31 Ops>Regen Screen After User Touches the *Start* Button, Initiating Autoregen

- To pause the AutoRegen operation, press the **Stop** button. That button will then disappear, and the message **Executing Shutdown** will be briefly displayed, as shown in Figure 10-32. After that shutdown sequence is completed, the command button bar will display **Resume** and **Abort** buttons, as shown in Figure 10-33.

Figure 10-32 Ops>Regen Screen After User Touches the *Stop* ButtonFigure 10-33 Ops>Regen Screen Displaying *Resume* and *Abort* Buttons

Pressing **Abort** returns the unit to the Idle state, and the screen will appear as shown in Figure **Error! Reference source not found.** If **Resume** is pressed, the AutoRegen operation will resume from the point at which it was interrupted, and the screen will again appear as shown in Figure 10-39. When the AutoRegen operation is completed, the screen will appear as shown in Figure 10-34.

**Figure 10-34 Ops>Regen Screen After Completion of an AutoRegen Operation**



For a flow chart illustrating the AutoRegen sequence, see Figure 6-23.

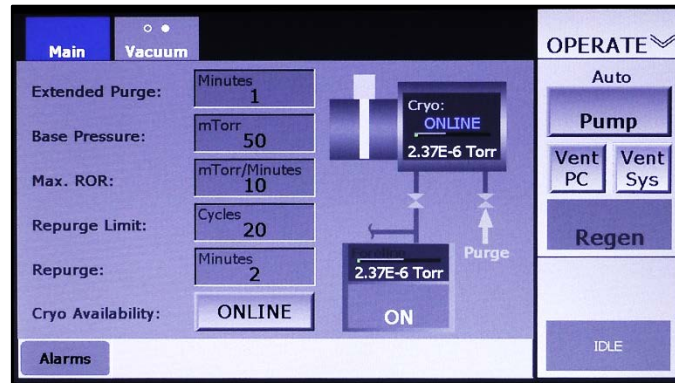
**Regen Procedure for Cryopumps Without Temperature Feedback**

Figure 10-35 shows Hi-Vac Pump Control page with **OffBoard** selected for **Pump Type**, **None** selected opposite **Temp Feed**, and **No** selected opposite **ON/Off Ctrl**. When **No** is selected opposite **ON/Off Ctrl**, the cryopump icon on the Ops>Regen screen has a flat display rectangle in place of a cryopump On/Off button, as shown in Figure 10-36. In addition, an **ONLINE/OFFLINE** button appears in place of the **Pump Chamber After Regen Button**. As Figure 10-36 shows, this screen's **Regen** button is unavailable when the cryopump is online.

**Figure 10-35 Cfg>Hi-Vac Pump Control page: None Selected for Temp Feed, No for On/Off Ctrl**

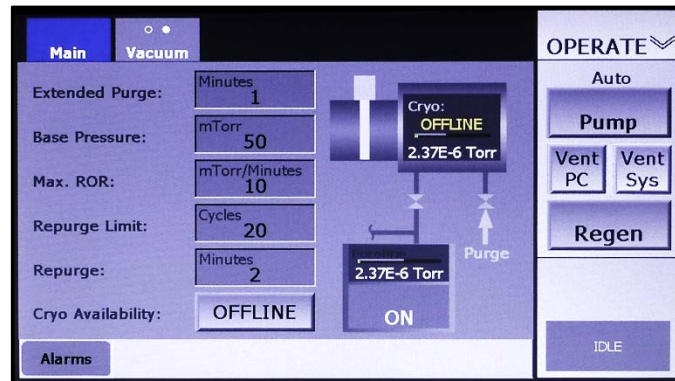


Figure 10-36 Manual&gt;Regen Screen Displaying Cryopump ONLINE/OFFLINE Button

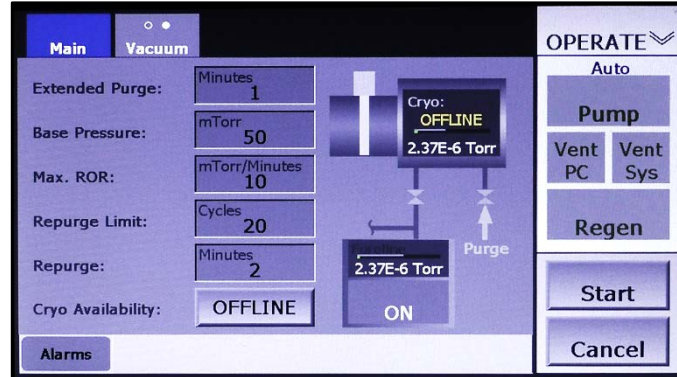


To perform an AutoRegen operation when the unit is configured for an OffBoard cryo without temperature feedback and no cryopump On/Off control, follow the procedure described below.

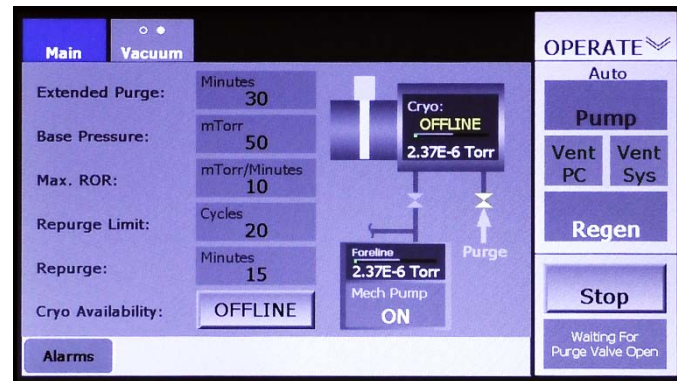
- | Step | Action  |
|------|---|
| 1    | Take the cryopump offline by touching the Regen screen's <b>ONLINE/OFFLINE</b> button, toggling it to <b>OFFLINE</b> . The <b>Regen</b> button in the command button bar will then become active, as shown in Figure 10-37. |

Figure 10-37 Ops>Regen Screen After User Selects *Offline* Opposite *Cryo Availability*

- |   |   |
|---|---|
| 2 | Touch the <b>Regen</b> button to initiate the regen operation. <b>Start</b> and <b>Cancel</b> buttons will then appear below the <b>Regen</b> button, as shown in Figure 10-38. |
|---|---|

Figure 10-38 Ops>Regen Screen After User Presses *Regen*

- 3 Touch the **Start** button to initiate the AutoRegen operation. The command button bar will then display a **Stop** button in place of the **Start** button. In addition, a rectangle below the **Stop** button will display status messages relating to the AutoRegen operation, as shown in Figure 10-39.

Figure 10-39 Ops>Regen Screen After User Presses *Start*

After the Autoregen operation starts, the user has to option to pause the operation, using the **Stop** button, and then to either abort or resume it. For information on the use of the **Stop**, **Abort**, and **Resume** buttons, see the preceding procedure, which is described under the heading "Regen Procedure for Systems with an On-Board Cryopump with Temperature Feedback."

### Regen Completed: Putting the Cryopump Back Online

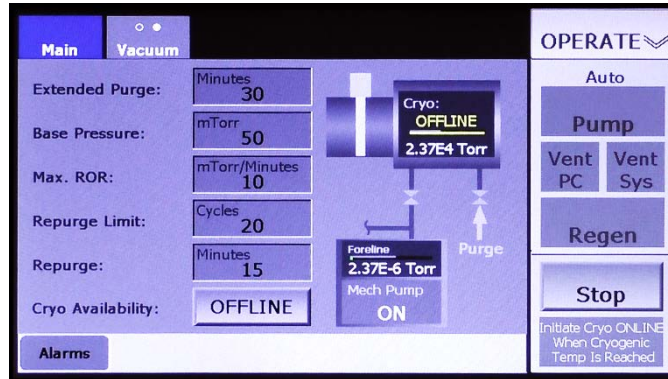
Following the completion of such an AutoRegen on a cryopump without On/Off control, the user must manually put the cryopump back online, as described below.

Step	Action
1	Upon completion of the AutoRegen sequence, the Ops>Regen screen will display the message <b>Initiate cryo ONLINE when cryogenic</b>



**temp is reached**, as shown in see Figure 10-40. At that point, check the reading of the cryopump's temperature gauge.

**Figure 10-40 Ops>Regen Screen Displaying Prompt *Initiate Cryo ONLINE When Cryogenic Temp Is Reached***



- 2 When the temperature reading is in the cryogenic range, touch the Regen screen's **OFFLINE** button to put the pump online. The screen will then appear as shown in Figure 10-36.



# 11

# Implementing Dome Rotation Control

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## 11.1 Section Overview

This section describes how to configure the Rotation Control module and how to operate its control features in all three of the FerroVac's operating modes. Specific topics covered are:

### Section 11.2 Configuration

Section 11.2.1 Configuring the Dome Rotation Module for Local Control

Section 11.2.2 Configuring the Dome Control Module for Remote Control

### Section 11.3 Dome Rotation Control in Manual Mode

### Section 11.4 Dome Rotation Control in Operations Mode

Section 11.4.1 Local Rotation Control in Operations Mode

Section 11.4.2 Remote Rotation Control in Operations Mode

## 11.2 Configuration Procedures

The FerroVac's rotation control module can be configured to operate under either local or remote control. In addition, the Rotation Control page (see Figure 11-3) enables the user to:

- select either an AC or a DC dome motor controller
- set a maximum RPM rate, if the system has an AC dome motor controller
- set the voltage scale for the dome drive controller
- determine whether the system's door interlock will switch rotation off when the door is opened, if the dome is rotating at that point
- enable or disable operator control over acceleration rate in Operations mode
- select from among four possible methods of determining the rotation speed setpoint in Operations mode
- select any of four possible ON/OFF triggers when the Dome Control module is configured for Local control. When it is configured for Remote control, the ON/OFF trigger defaults to Remote Input.

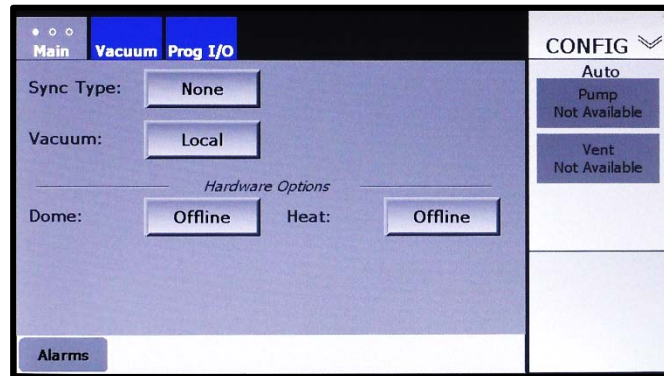
### 11.2.1 Configuring the Dome Rotation Module for Local Control

#### Configuring the Rotation Control Module for Use with an AC Controller

Note: This procedure assumes that you have completed the common configuration procedures described in Section 4 as well as the configuration procedures specific to your system's high-vacuum pump.

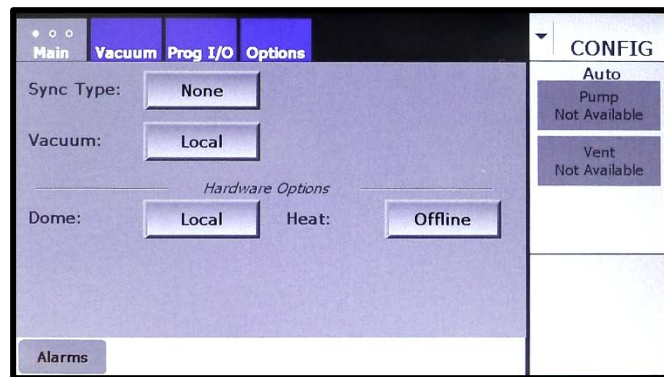
Step	Action
1	Open the Configuration Main screen, which should appear as shown in Figure 11-1.

Figure 11-1 Configuration>Main Screen, *Local* Selected for *Vacuum*, *Dome Offline*



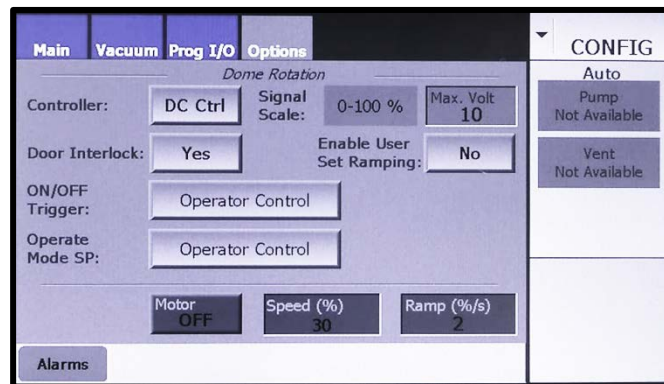
- 2 Touch the Dome button to toggle it to **Local**. The screen will then appear as shown in Figure 11-2.

Figure 11-2 Configuration>Main Screen after User Selects *Local* for *Dome*



- 3 Touch the **Options** screen tab to display the Dome Rotation page, which will appear as shown in Figure 11-3.

Figure 11-3 Dome Rotation Page at its Initial State when *Local* Is Selected



- 4 Configure the parameters on this page as appropriate for your system. The configurable parameters are:

- **Controller** pushbutton: If your system's dome drive motor has a DC motor controller, accept the default **DC Ctrl**, in which case rotation speed and acceleration values are displayed in percentage terms, and rotation control is open-loop with respect to RPM.
- **Max. Volt** entry box: The value displayed here indicates the maximum output, in volts, of the system's dome-drive controller. Maximum allowable value is 15 V, whether the **Controller** selection is **DC Ctrl** or **VFD Ctrl**. To change the **Max. Volts** value, touch this entry box to display a numeric keypad and use it to enter the desired value.
- **Door Interlock** pushbutton: Accepting the default, **No**, means that the system's door interlock will not switch off dome rotation if it is on when the chamber door is opened. If **Yes** is selected, the chamber door interlock will switch off dome rotation if the dome is rotating when the door is opened.
- **Enable User to Set Ramping** pushbutton: If you accept the default, **Yes**, the operator can change the acceleration setpoint in Operations and Manual mode. If you touch the button to select **No**, it will not be possible to do so in either of those modes.
- **ON/OFF Trigger** button: Allows user to determine how rotation is switched on and off in Operations mode. The available selections are:
  - **Operator Control** = Operator can use the **Dome** button on the Operations>Main screen to toggle rotation on/off.
  - **Crossover Vacuum**
  - **Process Vacuum**
  - **Auto Pump/Vent**

For detailed information about how the **Crossover Vacuum**, **Process Vacuum**, and **Auto Pump/Vent** triggers function, see section 11.4.1.

- **Operate Mode SP** button: Selection made via this button determines how the rotation speed setpoint is set in Operations mode. Touch the button to select one of the following:
  - **Operator Control** = Operator can use the **Speed** entry box on the Operations>Main screen to change the rotation-speed setpoint.
  - **Remote Input** = the rotation speed setpoint in Operations mode is determined by an input from a higher-level controller.
  - **To Preset Speed** = the rotation speed setpoint in Operations mode is the value that appears in the adjacent **Speed (%)** entry box (see Figure 11-4).

**Figure 11-4 Rotation Control Page when Operate Mode SP = To Preset Speed**

**DC Ctrl Selected, Rotation ON**

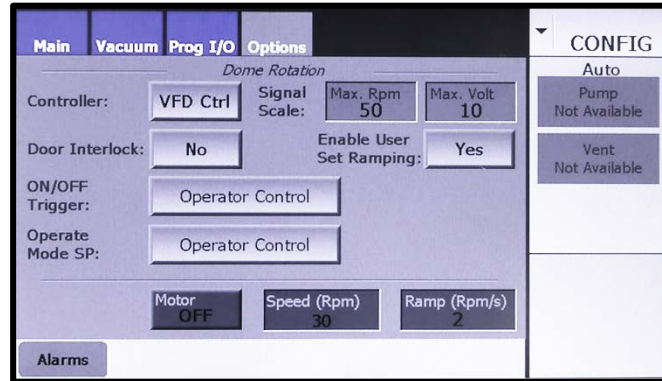
**VFD Ctrl Selected, Rotation OFF**

Parameter	DC Ctrl Selected, Rotation ON	VFD Ctrl Selected, Rotation OFF
Controller	DC Ctrl	VFD Ctrl
Signal Scale	0-100 %	Max. Rpm 50
Max. Volt	10	10
Door Interlock	Yes	Yes
Enable User Set Ramping	No	No
ON/OFF Trigger	Operator Control	Operator Control
Operate Mode SP	To Preset Speed	To Preset Speed
Speed (Setpoint)	30 (%)	30 (Rpm)
Motor Status	ON	OFF
Speed (Display)	21 (%)	30 (Rpm)
Ramp (Setpoint)	2 (%/s)	2 (Rpm/s)

### Configuring the Rotation Control Module for Use with an AC Controller

To configure the rotation control module for use with an AC controller, first perform Steps 1-3 of the procedure described above; then touch the **Controller** button to toggle it to **VFD Ctlr**. At that point, the Dome Rotation will appear as shown in Figure 11-5.

**Figure 11-5 Dome Rotation Page when VFD Ctlr Is Selected for Controller**



When **VFD Ctlr** is selected opposite **Controller**, configurable parameters on this screen are:

- **Controller** pushbutton: Since you have selected **VFD Ctrl**, rotation speed and acceleration are displayed in RPM and RPM/second, respectively, and rotation control is closed-loop with respect to RPM.
- **Max. Rpm** entry box: Value displayed here is the upper limit for the RPM rates that can be entered in any of the FerroVac's three operating modes.
- **Max. Volt** entry box: The value displayed here indicates the maximum output, in volts, of the system's dome-drive controller. Maximum allowable value is 15 V. To change the value, touch this box to display a numeric keypad and use it to enter the desired value.
- **Door Interlock** pushbutton: Accepting the default, **No**, means that the system's door interlock will not switch off dome rotation if it is on when the chamber door is opened. If **Yes** is selected, the chamber door interlock will switch off dome rotation if the dome is rotating when the door is opened.
- **Enable User to Set Ramping** pushbutton: If you accept the default, **Yes**, the operator can change the acceleration setpoint in Operations and Manual mode. If you touch this button to select **No**, it will not be possible to do so in either of those modes.
- **ON/OFF Trigger** button: Allows user to determine how rotation switched on and off in Operations mode. The available selections are:
  - **Operator Control** = Operator can use the **Dome** button on the Operations>Main screen to toggle the dome-drive motor on/off.
  - **Crossover Vacuum**
  - **Process Vacuum**
  - **Auto Pump/Vent**

For detailed information about the **Crossover Vacuum**, **Process Vacuum**, and **Auto Pump/Vent** triggers, see section 11.4.1.

- **Operate Mode SP** button: Selection made via this button determines how the speed setpoint in Operations mode is set. Touch the button to select one of the following:

- **Operator Control** = Operator can use the **Speed** entry box on the Operations>Main screen to change the rotation-speed setpoint.
- **Remote Input** = the rotation speed setpoint in Operations mode is determined by an input from a higher-level controller.
- **To Preset Speed**: When this selection is made, the rotation speed setpoint in Operations mode is the value that appears in the adjacent **Speed (Rpm)** entry box (see Figure 11-4).

### Configuration Mode Rotation Control/Display Features

The rotation control/display features on the Rotation Control page are:

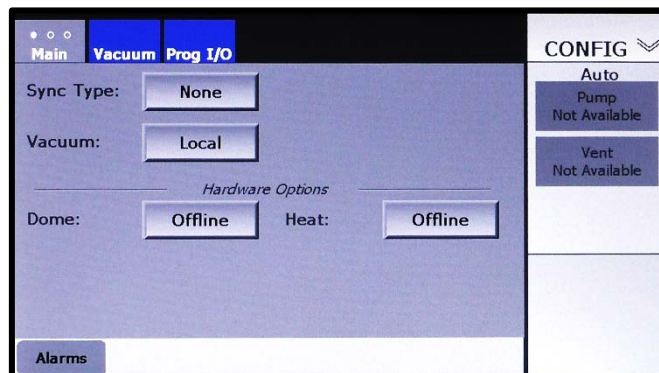
- **Motor ON/OFF** pushbutton: Touch to switch dome rotation on/off.
- **Speed** entry box: Touch to display a numeric keypad, and use it to enter the desired setpoint value, which is expressed as a percentage if **DC Ctrl** is selected or in RPM if **VFD Ctrl** is selected opposite **Controller**.
- **Ramp** entry box: Touch to display a numeric keypad, and use it to enter the desired setpoint value, which determines the acceleration rate for the dome drive. The **Ramp** value is expressed as a percentage if **DC Ctrl** is selected or in RPM if **VFD Ctrl** (i.e., an AC-type controller) is selected.

## 11.2.2 Configuring the Dome Control Module for Remote Control

To configure dome rotation for control by a higher-level controller, follow the instructions provided below. This procedure assumes that you have completed the common configuration procedures described in Section 4, as well as the configuration procedures specific to your system's high-vacuum pump.

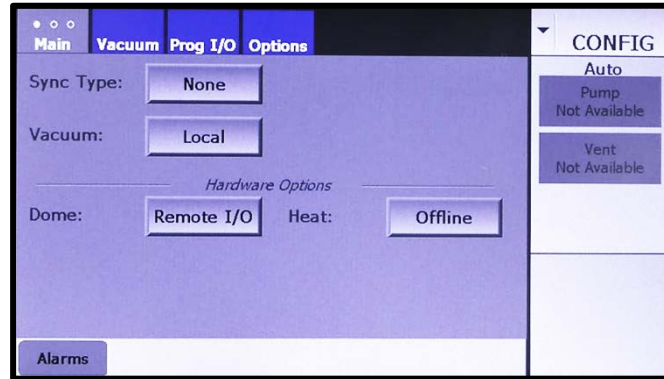
Step	Action
1	Open the Configuration>Main screen, which should appear as shown in Figure 11-5.

**Figure 11-6 Configuration>Main Screen, *Local* Selected for *Vacuum*, Dome Offline**



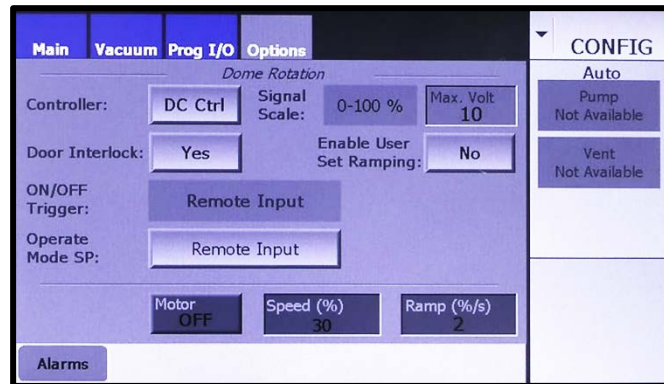
- 2 Touch the **Dome** button twice to select **Remote I/O**. The Config>Main screen will then appear as shown in Figure 11-7.

Figure 11-7 Configuration>Main Screen after User Selects *Remote I/O* Opposite *Dome*



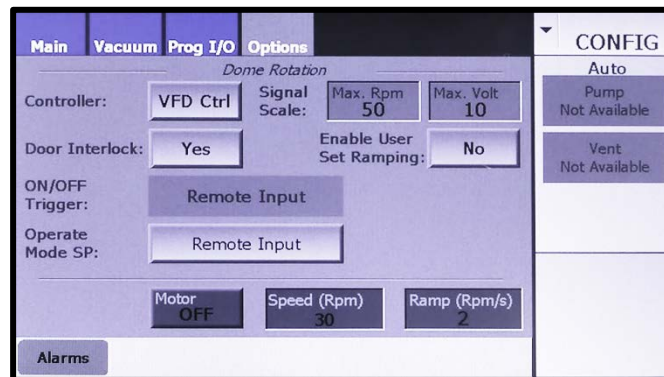
- 3 Touch the **Options** tab to open the **Dome Rotation** page, which will then appear as shown in Figure 11-8.

Figure 11-8 Dome Rotation Page in Its Initial State when *Remote I/O* Is Selected



- 4 If your system's dome drive motor has an AC controller, touch the **Controller** button once select **VFD Ctrl**. The Dome Rotation page will then appear as shown in Figure 11-9.

Figure 11-9 Dome Rotation Page After User Selects *VFD Ctrl* for *Controller*





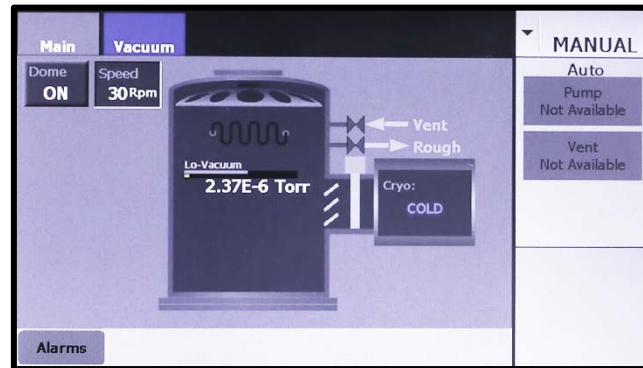
- 5 Proceed to configure the parameters on this page as appropriate for your system. If you accepted the default **Controller** type, **DC Ctrl**, the controls and configurable parameters on this page are as described following Figure 11-3, except that the **ON/OFF Trigger** defaults to **Remote Input** when **Remote I/O** is selected on the Config>Main screen.

If you selected **VFD Ctrl** opposite **Controller**, the controls and configurable parameters on this page are as described following Figure 11-5, except that the **ON/OFF Trigger** defaults to **Remote Input** when **Remote I/O** is selected on the Config>Main screen.

## 11.3 Dome Rotation Control in Manual Mode

Figure 11-10 shows the rotation control/displays features on the Manual>Main screen, a **Dome ON/OFF** button and a **Speed** display/setpoint-entry box.

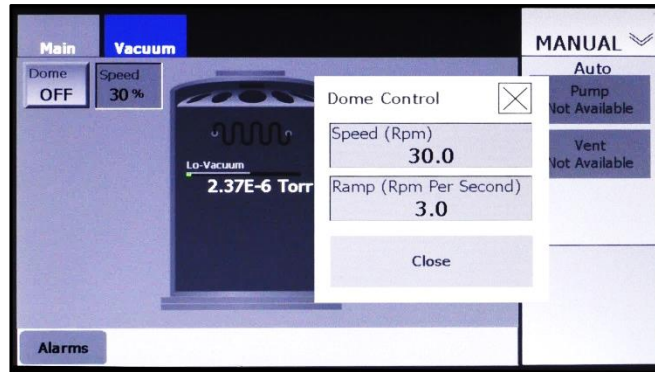
**Figure 11-10 Manual Main Screen Displaying *Dome ON/OFF* Button and *Speed* Entry Box**



If **Yes** is selected for **Enable User Set Ramping** on the Dome Rotation page, you can use the **Speed** entry box to change the rotation speed setpoint as well as the acceleration rate. To change one or both of these values, or both, touch the **Speed** entry box to display the popup shown in Figure 11-11. On that popup, touch either the **Speed** or the **Ramp** entry box to display a numeric keypad and use it to enter the desired value. Then close the keypad and the popup.

Note that you can alter the the speed, the acceleration, or both while the dome is rotating. Note also that if **VFD Ctrl** is selected as the **Controller** on the Dome Rotation page, speed values will be displayed in RPM and acceleration units as RPM/second.

**Figure 11-11 Dome Control Popup as Displayed when *Enable User Set Ramping* = Yes**



If **No** is selected for **Enable User Set Ramping** on the Dome Rotation page, then touching the **Speed** entry box displays the Dome Control popup as shown Figure 11-12.

**Figure 11-12 Dome Control Popup as Displayed when *Enable User Set Ramping* = No**



## 11.4 Dome Rotation Control in Operations Mode

### 11.4.1 Local Rotation Control in Operations Mode

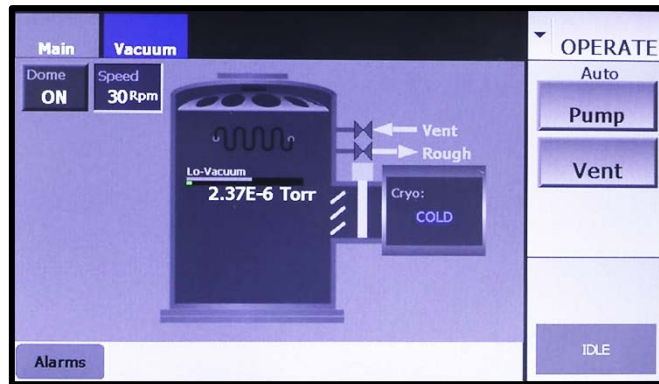
When **Local** is selected on the Config>Main screen, the **ON/OFF Trigger** selected via the Dome Rotation page of the Dome Rotation page determines how rotation is switched on/off in Operations mode. The available **ON/OFF Trigger** selections are:

- **Operator Control** = The operator can use the **Dome ON/OFF** button on the Operations>Main screen to toggle rotation on/off.
- **Crossover Vacuum** = Dome rotation is switched on automatically when the chamber reaches the Crossover setpoint entered via the page 1 of the Details screen. If chamber pressure subsequently rises above that setpoint, dome rotation is switched off.
- **Process Vacuum** = Dome rotation is switched on automatically when the chamber reaches Process SP 1 entered via page 1 of the Details screen. If chamber pressure subsequently rises above Process SP 2, dome rotation is switched off.

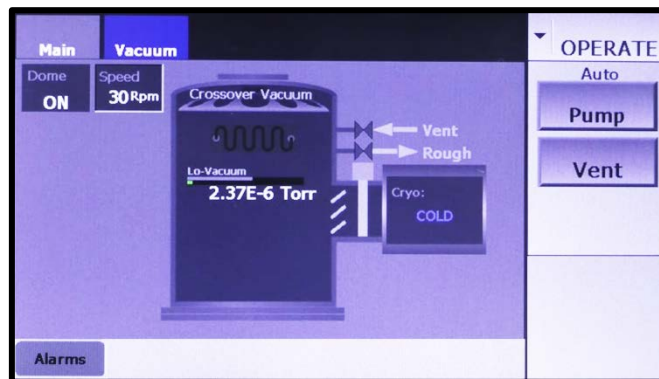
- **Auto Pump/Vent** = Dome rotation is switched on when an AutoPump is initiated, if the dome drive motor is not already operating at that point. If the dome drive motor is on when an AutoVent is initiated, rotation is switched off.

When **Operator Control** is selected as the **ON/OFF Trigger**, the Operations>Main screen displays a **Dome ON/OFF** button, as shown in Figure 11-13. When any of the other three triggers is selected, that button is replaced by a flat display rectangle, as shown in Figure 11-14.

**Figure 11-13 Operations Main Screen when the ON/OFF Trigger Is Operator Control**

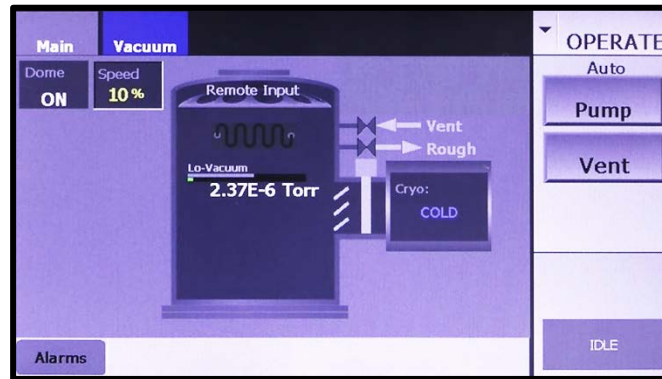


**Figure 11-14 Operations Main Screen when the ON/OFF Trigger Is Crossover Vacuum**



### 11.4.2 Remote Rotation Control in Operations Mode

When **Remote I/O** is selected on the Config>Main screen, the **ON/OFF Trigger** selection on the Rotation Control page defaults to **Remote Input**, as shown in Figure 11-8, and the Operations>Main screen appears as shown in Figure 11-15.

Figure 11-15 Operations>Main Screen when *Remote I/O* Is Selected on the Config>Main Screen

Note that in place of the **Dome ON/OFF** button, when **Local** is selected opposite **Dome** on the Config>Main screen, the Ops>Main screen displays a flat rectangle that indicates the dome-drive's on/off status.

Regardless of whether **Local** or **Remote I/O** is selected, the **Speed** entry/display box on the Ops>Main screen operates with the same variations that apply in Manual mode. Specifically:

- Figure 11-15 shows an active **Speed** entry box, which means that **Operator Control** is selected opposite **Operate Mode SP** on the Dome Rotation page. If either **Remote Input** or **To Preset Speed** is selected, the **Speed** entry box is replaced by a flat rectangle that displays the current rotation setpoint. If **Remote Input** is selected, that setpoint will be the value downloaded from the higher-level controller. If **To Preset Speed** is selected, the setpoint displayed here will be the value that appears in the **Speed** entry box on the Dome Rotation page.
- Assuming that the **Speed** entry box is active, the user can touch that box to display a Dome Control popup. If **Enable User Set Ramping** is set to **Yes** on the Dome Rotation page, that popup can be used to change the rotation setpoint and/or the dome's acceleration rate, as in Figure 11-11. If **Enable User Set Ramping** is set to **No**, that popup will permit only adjustment of the rotation speed setpoint, as in Figure 11-12.
- When **DC Ctlr** is selected opposite **Controller** on the Rotation Control page, the **Speed** value on this page is displayed in percentage terms, as shown in Figure 11-15, and the Dome Control popup displays speed values as percentages and acceleration as %/second. When **VFD Ctlr** is selected for **Controller**, rotation speed values are displayed in RPM, and the acceleration unit is RPM/second.

# 12

# Implementing Substrate Heater Control

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## 12.1 Section Overview

This section describes how to configure the FerroVac's substrate heater control function and how it operates in Configuration, Manual, and Operation modes. The specific topics covered are:

Section 12.2 Overview of Configuration Options for Substrate Heater Control

Section 12.3 Configuration Procedures

Section 12.3.1 Implementing Configuration State 1

Section 12.3.2 Implementing Configuration State 2

Section 12.3.3 Implementing Configuration State 3

Section 12.3.4 Heater Control in Configuration Mode

Section 12.4 Heater Control in Manual Mode

Section 12.4.1 Manual Mode Heater Control: Configuration State 1 Implemented

Section 12.4.2 Manual Mode Heater Control: Configuration State 2 Implemented

Section 12.4.3 Manual Mode Heater Control: Configuration State 3 Implemented

Section 12.5 Heater Control in Operations Mode

Section 12.5.1 Operations Mode Heater Control when Local Control Is Selected

Section 12.5.2 Operations Mode Heater Control when Remote Control Is Selected

Section 12.6 Monitoring Heater Operation

## 12.2 Overview of Configuration Options for Substrate Heater Control

The FerroVac's heater control module offers the following configuration and operational options:

- Operation under local (i.e., operator) or remote control (i.e., control by a higher-level controller, generally either a deposition controller or a PLC-based system controller such as the TCS)
- Operation in systems with or without a heat thermocouple (TC)
- When configured for use on systems with a heat TC, either closed-loop operation based on a temperature setpoint or open-loop operation based on a percent-power setpoint
- When configured for remote control, three different options for determining the heat setpoint in Operations mode.

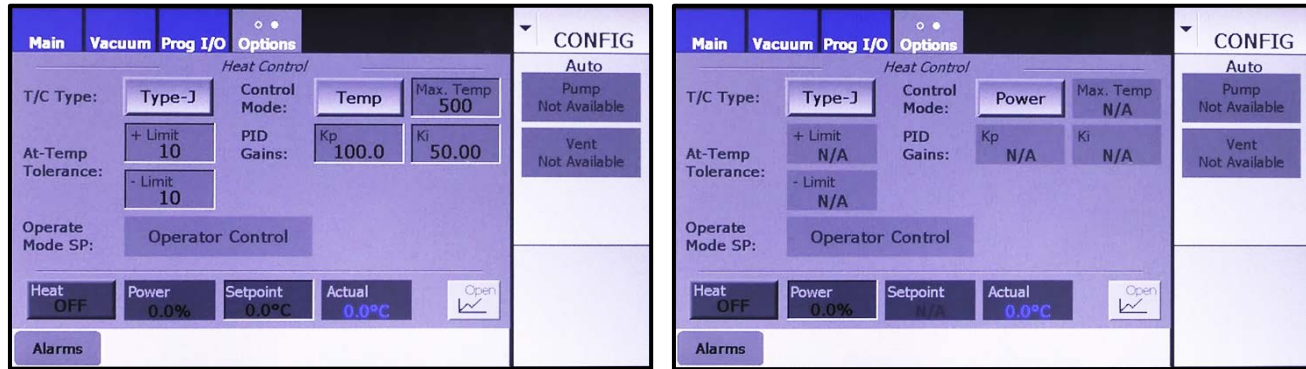
## 12.2.1 The Heat Control Page

Figure 12-1 shows the Configuration mode's Heat Control page.

**Figure 12-1 The Heat Control Page**

**Local + Temp Control Selected**

**Local + Power Control Selected**



The Heat Control page offers the following configuration options:

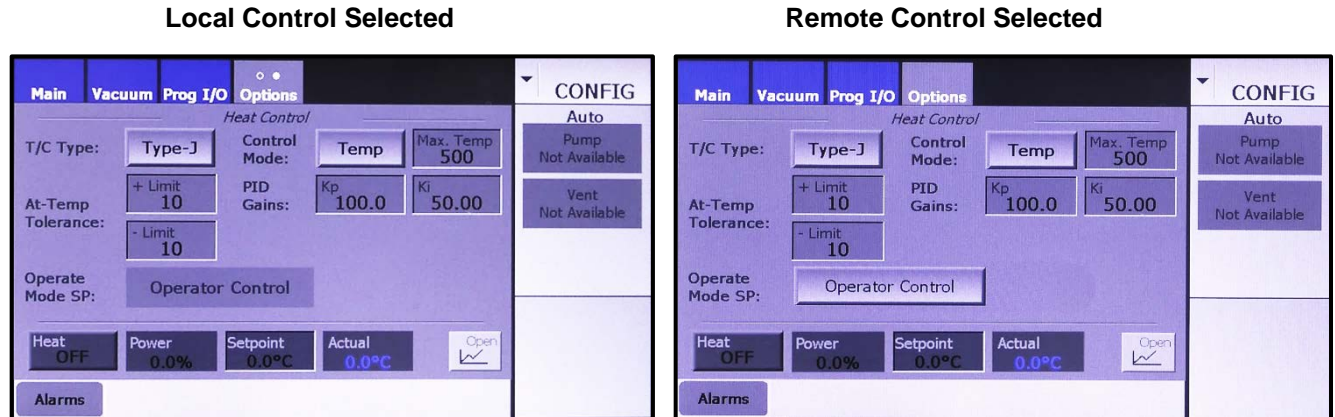
- Under **T/C Type**, operation with either of two types of thermocouples (= either **Type-J** or **Type-K**) or with no thermocouple input (= **None**)
- Two heater-control modes:
  1. **Temp** (= closed-loop control, based on a user-entered temperature setpoint) or
  2. **Power** (= open-loop control, based on a user-entered percent-power setpoint)

When either **Type J** or **Type K** is selected, identical configuration options are available. The user can select either **Temp** or the **Power** as the **Control Mode**, with identical configurable parameters in each case. Therefore, to simplify reference to the available configurations options, the remainder of this section will refer to three basic configuration states:

- Configuration State 1 = a TC (either **Type J** or **Type K**) + **Temp** as **Control Mode**
- Configuration State 2 = a TC (either **Type J** or **Type K**) + **Power** as **Control Mode**
- Configuration State 3 = **None** (i.e., no TC, in which case the **Control Mode** defaults to **Power**)

This basic configuration scheme applies regardless of whether local or remote control is selected. However, as Figure 12-2 shows, selecting remote control introduces an additional configurable parameter onto the Heat Control page. That parameter, **Operate Mode SP**, will be explained in detail in section 12.5.2.

Figure 12-2 Heat Control Page, Local vs. Remote Control Selected



## 12.3 Configuration Procedures

NOTE: The procedures described in sections 12.3.1, 12.3.2, and 12.3.3 assume that you have completed the common configuration procedures described in Section 4 as well as the configuration procedures specific to your system's high-vacuum pump.

### 12.3.1 Implementing Configuration State 1

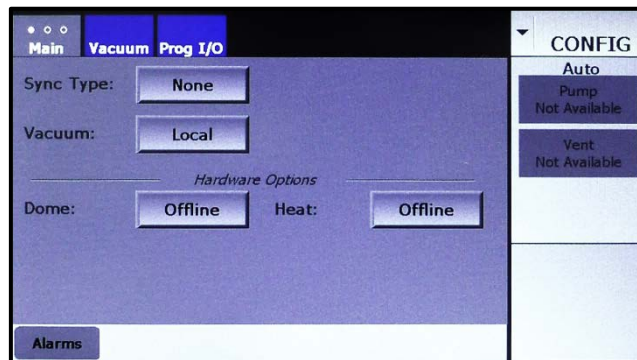
Follow the steps described below to implement Configuration State 1:

- T/C Type = either **Type J** or **Type K**
- **Control Mode** = **Temp**

Step	Action
------	--------

- |   |  |
|---|--|
| 1 | First open the Configuration>Main screen, which will appear as shown in Figure 12-3. |
|---|--|

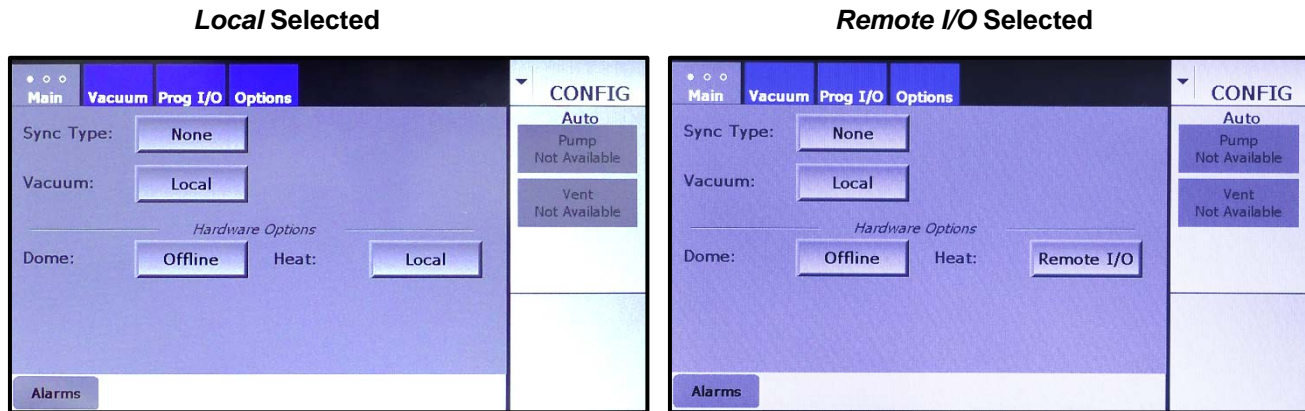
Figure 12-3 Configuration>Main Screen when Heater Control Is Offline



- |   |   |
|---|---|
| 2 | Next use the <b>Heat</b> button under <i>Hardware Options</i> to select either <b>Local</b> (= operator control) or <b>Remote I/O</b> (= remote control by a higher-level controller). Touch the button under once to select <b>Local</b> |
|---|---|

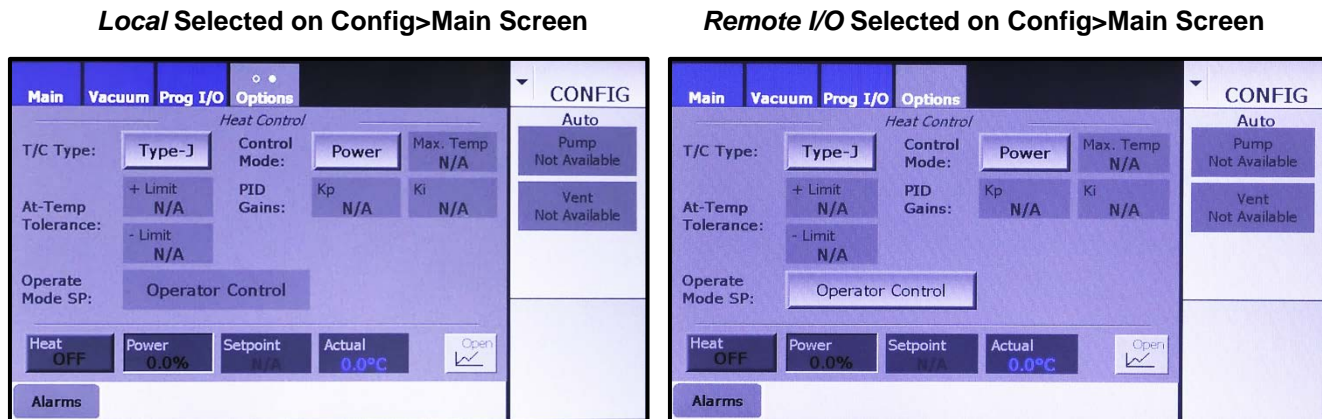
or twice to select **Remote I/O**. After you do so, an **Options** tab will be added to the screen, as shown in Figure 12-4.

**Figure 12-4 Config>Main Screen After User Selects Either *Local* or *Remote I/O* Opposite *Heat***



- 3 Touch the **Options** tab to display the Heat Control page, which will appear as shown in Figure 12-5.

**Figure 12-5 Heat Control Page as Initially Displayed**



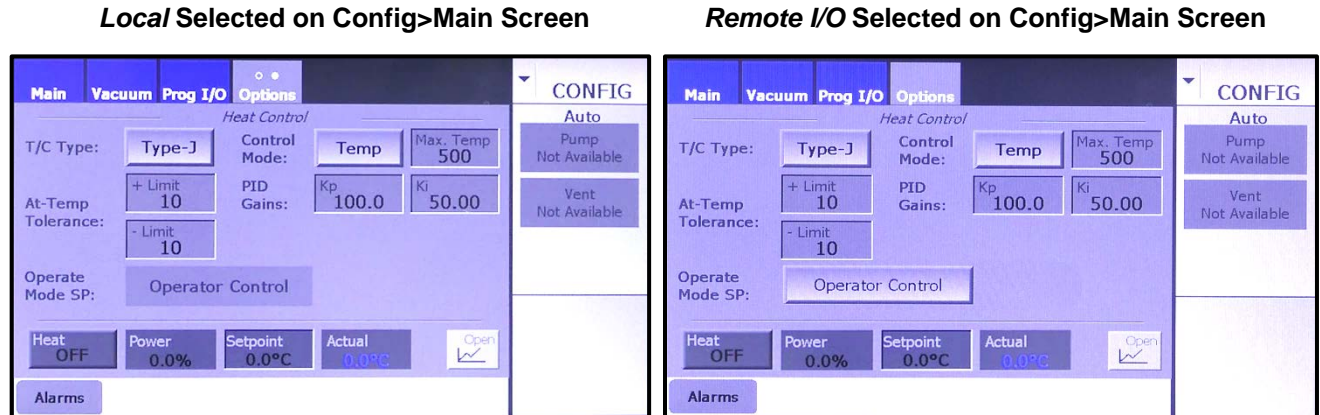
**NOTE**

As shown above, Configuration Case 1 offers identical configurable parameters whether **Local** or **Remote I/O** is selected, with the exception of **Operate Mode SP**. For detailed information about that parameter, see section 12.5.2.

- 4 Now select the **T/C Type**. If your system has a Type-J thermocouple, accept the default selection, **Type-J**. If your system has a Type-K thermocouple, touch the T/C Type button once to select **Type-K**.
- 5 Touch the **Control Mode** button to toggle it from **Power** to **Temp**. The screen will then appear as shown in Figure 12-6.



Figure 12-6 Heat Control Page After User Selects *Temp* for *Control Mode*

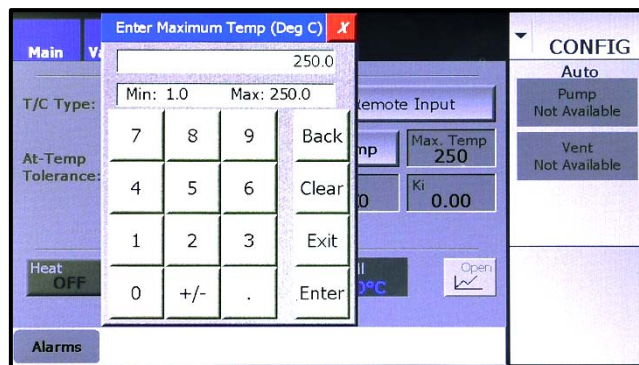


The configurable parameters for systems with Type-J and Type-K thermocouples are identical, so if you have selected **Type-K**, the screen now will appear identical to that shown in Figure 12-5, except that the legend on the **T/C Type** button will be **Type-K**, instead of **Type-J**.

- 6 Finally, enter the desired values for the numerical parameters:
  - **Max. Temp**,
  - **At Temp Tolerance** (+ and – Limits), and
  - **PID Gains**

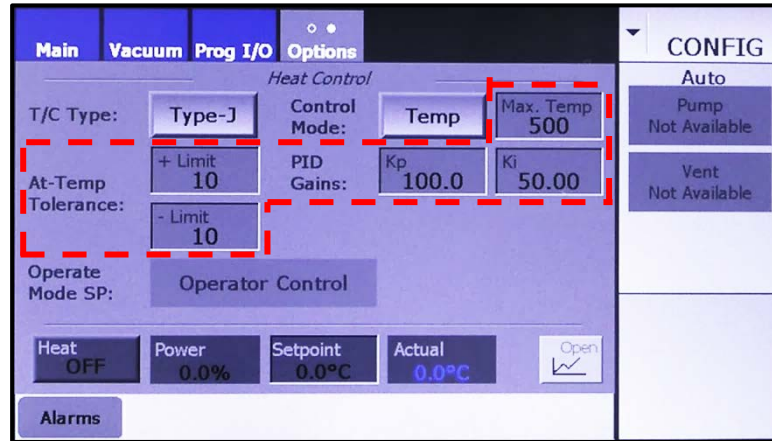
Detailed definitions of these parameters appear following Figure 12-7. To change a parameter value, touch its recessed entry box to display a numeric keypad (see Figure 12-7) and use it to enter the desired value. After you touch the keypad's **Enter** button to close it, the value you entered will appear in the parameter-entry box in question.

Figure 12-7 Heat Control Page Displaying a Parameter Entry Keypad



**Numerical Parameters To Be Configured when *Control Mode* = *Temp***

Figure 12-8 outlines the numeric parameters that on the Heat Control page when **Temp** is selected as the **Control Mode**. Definitions of those parameters appear below the illustration.

Figure 12-8 Numeric Parameter To Be Configured when *Temp* Is Selected for *Control Mode*

**Max. Temp** = The maximum temperature for the vacuum chamber.

**PID Gains** = The Integral and Proportional gain values governing the PID loop. **Kp** is the Proportional gain value, which is multiplied by a constant times 1,000. **Ki** is the Integral gain value, which is also multiplied by a constant times 1,000.

**At-Temp Tolerance** = The values entered in the **+Limit** and **- Limit** entry boxes define a range above and below the temperature setpoint within which the temperature is desired to be maintained. However, the heaters are not switched off if the temperature varies outside these limits. Nor does the FerroVac display an error or warning message in that event. The only consequence of a temperature variation outside these limits is that the status indicator on the **Heat at Set Temp** button on the Service>Options I/O page will read **False** instead of **True**.

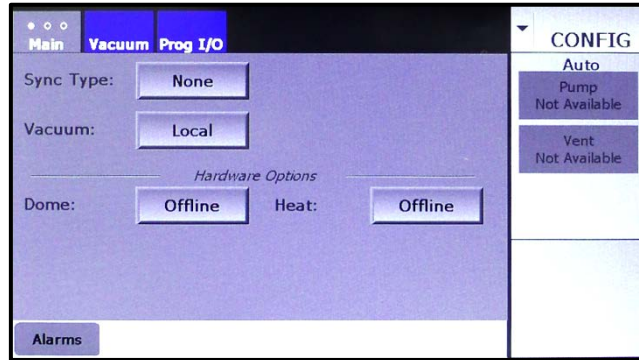
### 12.3.2 Implementing Configuration State 2

Follow the steps described below to implement Configuration State 2:

- **T/C Type** = either **Type J** or **Type K**
- **Control Mode** = **Power**

Step	Action
1	First open the Configuration>Main screen, which will appear as shown in Figure 12-9.

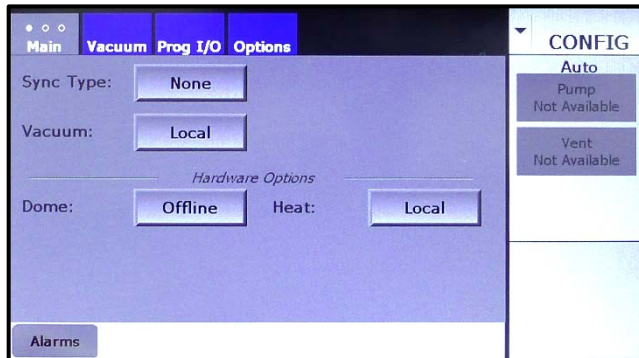
Figure 12-9 Configuration>Main Screen when Heater Control Is Offline



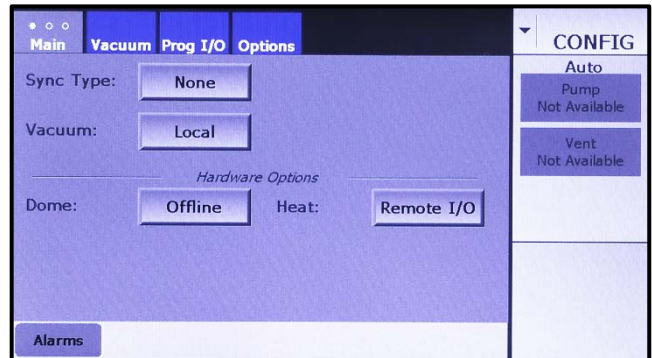
- Next use the **Heat** button under *Hardware Options* to select either **Local** (= operator control) or **Remote I/O** (= remote control by a higher-level controller). Touch the button under once to select **Local** or twice to select **Remote I/O**. After you do so, an **Options** tab will be added to the screen, as shown in Figure 12-10.

Figure 12-10 Config>Main Screen After User Selects Either *Local* or *Remote I/O* Opposite *Heat*

Local Selected



Remote I/O Selected

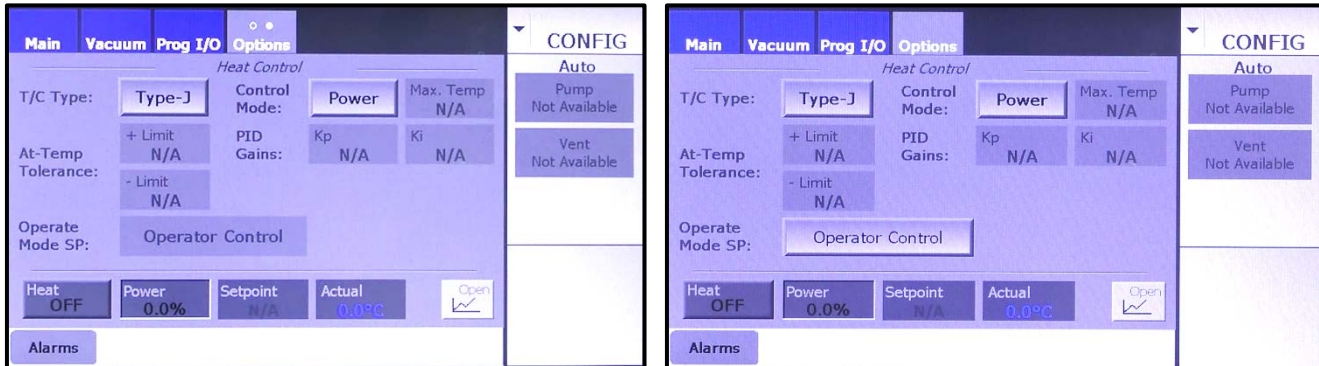


- Now touch the **Options** tab to display the Heat Control page, which will appear as shown in Figure 12-11.

Figure 12-11 Heat Control Page as Initially Displayed

Local Selected on Config>Main Screen

Remote I/O Selected on Config>Main Screen



**NOTE**

As shown above, Configuration Case 2 offers identical configurable parameters whether **Local** or **Remote I/O** is selected, with the exception of **Operate Mode SP**. For detailed information about that parameter, see section 12.5.2.

- 4 Finally, select the **T/C Type**. If your system has a Type-J thermocouple, accept the default selection, **Type-J**. If your system has a Type-K thermocouple, touch the **T/C Type** button once to select **Type-K**.

**12.3.3 Implementing Configuration State 3**

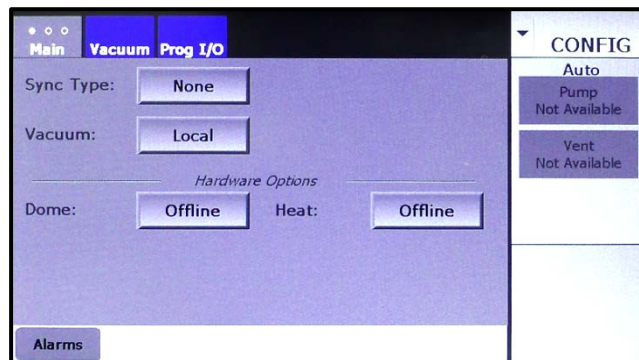
Follow the steps described below to implement Configuration State 3:

- **T/C Type = None (Control Mode selection defaults to Power)**

**Step Action**

- 1 First open the Configuration>Main screen, which will appear as shown in Figure 12-12.

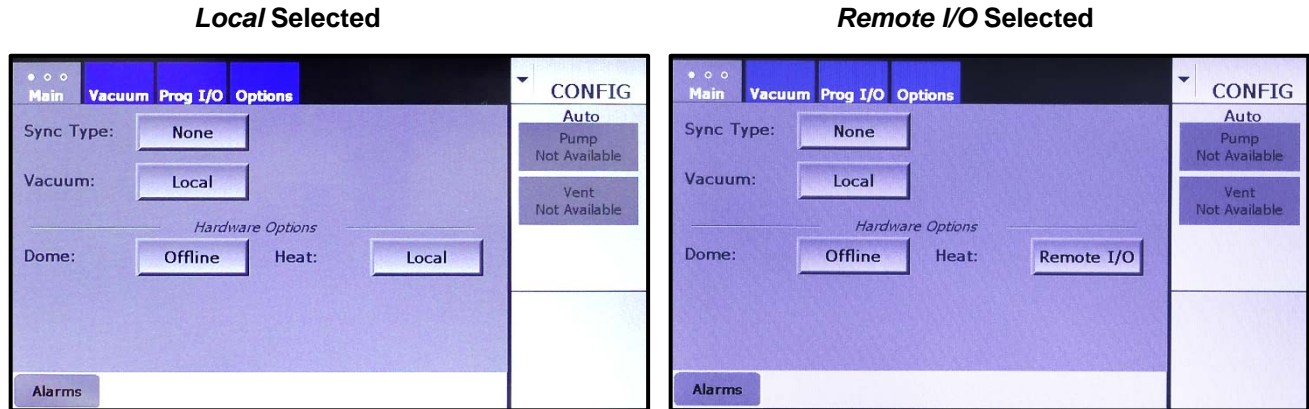
Figure 12-12 Configuration>Main Screen when Heater Control Is Offline



- 2 Next use the **Heat** button under *Hardware Options* to select either **Local** (= operator control) or **Remote I/O** (= remote control by a higher-level controller). Touch the button under once to select **Local**

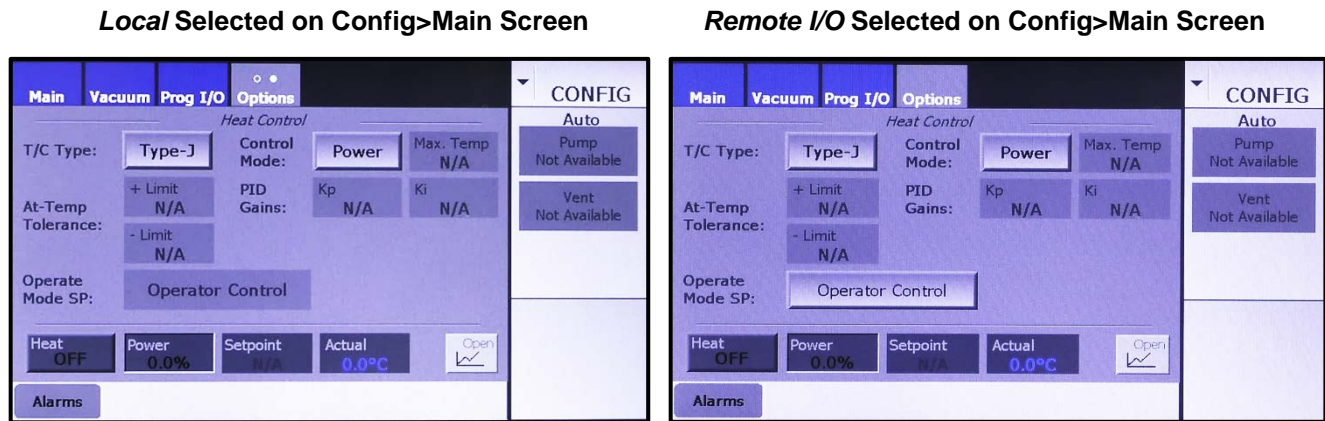
or twice to select **Remote I/O**. After you do so, an **Options** tab will be added to the screen, as shown in Figure 12-13.

**Figure 12-13 Config>Main Screen After User Selects Either *Local* or *Remote I/O* Opposite *Heat***



- 3 Now touch the Options tab to display the Heat Control page, which will appear as shown in Figure 12-14.

**Figure 12-14 Heat Control Page as Initially Displayed**



**NOTE**

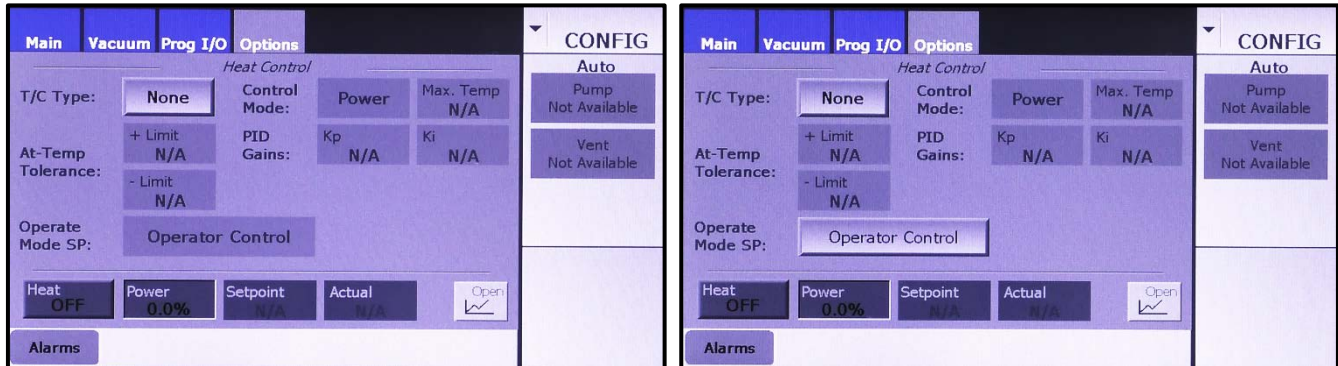
As shown above, Configuration State 3 offers identical configurable parameters whether **Local** or **Remote I/O** is selected, with the exception of **Operate Mode SP**. For detailed information about that parameter, see section 12.5.2.

- 4 Finally, select **None** opposite **T/C Type**. The Heat Control page will then appear as shown in Figure 12-15.

Figure 12-15 Heat Control Page with *None* Selected as the *T/C Type*

Local Selected on Config>Main Screen

Remote I/O Selected on Config>Main Screen



### 12.3.4 Heater Control in Configuration Mode

#### Configuration Mode Heater Control when Configuration State 1 Is Implemented

Figure 12-16 shows on the Heat Control page in Configuration State 1:

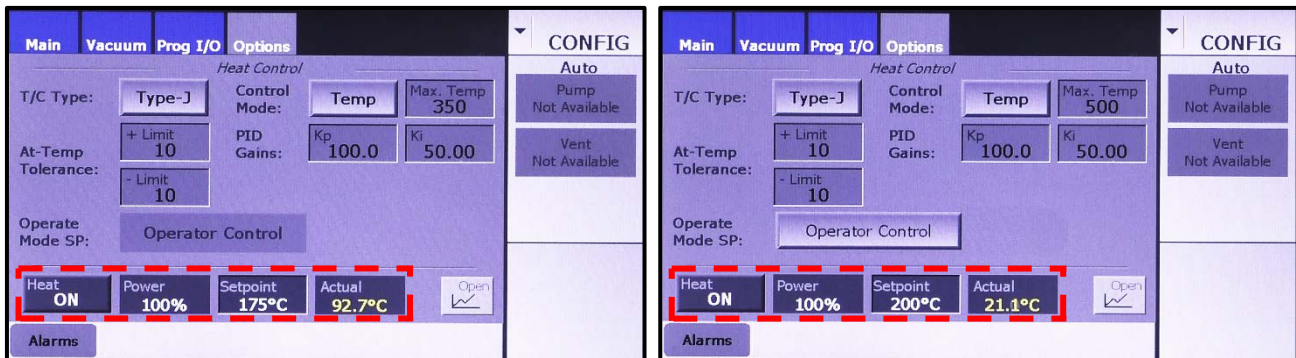
- **T/C Type** = either **Type J** or **Type K**
- **Control Mode** = **Temp**

The heater control/display features on that page are outlined in Figure 12-16 and defined below the illustration.

Figure 12-16 Heat Control Page: Heater Control/Display Features when *Control Mode = Temp*

Local Selected on Config>Main Screen

Remote I/O Selected on Config>Main Screen



**Heat ON/OFF** button: Touch to toggle the heaters on/off.

**Power** display box: Displays the power level, in percentage terms, at which the heaters are operating.

**Setpoint** entry box: To enter a temperature setpoint, touch this box to display a numeric keypad. Use that keypad to enter the desired value. After you touch the keypad's **Enter** button to close it, the value you entered will appear in this box.

**Actual** display box: Displays chamber's current temperature, as detected by the thermocouple.

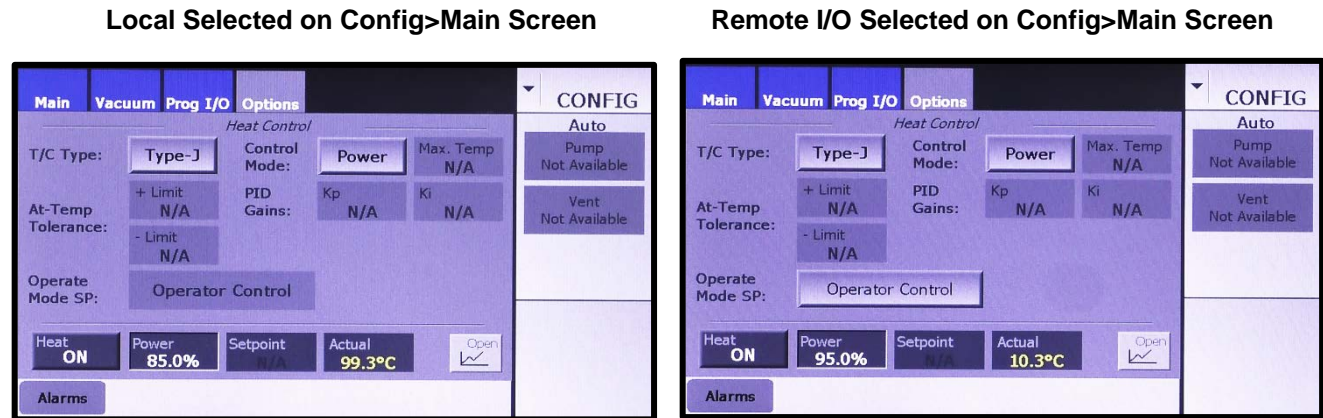
### Configuration Mode Heater Control when Configuration State 2 Is Implemented

Figure 12-17 shows the Heat Control page when in Configuration State 2:

- **T/C Type** = either **Type J** or **Type K**
- **Control Mode** = **Power**

The heater control/display features on that page are defined below the illustration.

**Figure 12-17 Heat Control Page: Heater Control/Display Features when *Control Mode = Power***



**Heat ON/OFF** button: Touch to toggle the heaters on/off.

**Power** entry box: To enter a power setpoint, touch this box to display a numeric keypad. Use that keypad to enter the desired value. After you touch the keypad's **Enter** button to close it, the value you entered will appear in this box.

**Setpoint** display box: Not active when **Power** is selected as the **Control Mode**.

**Actual** display box: Displays chamber's current temperature, as detected by the thermocouple.

### Configuration Mode Heater Control when Configuration State 3 Is Implemented

Figure 12-18 shows the Heat Control page in Configuration State 3:

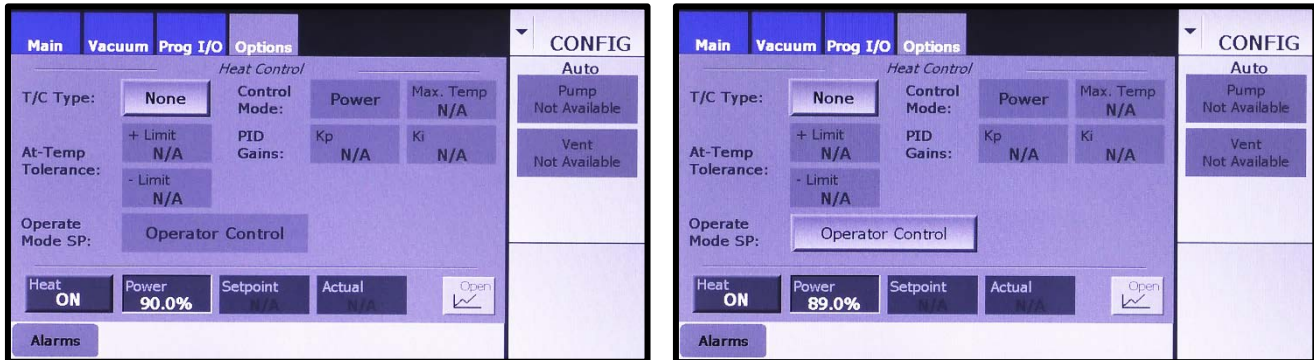
- **T/C Type** = **None** (**Control Mode** selection defaults to **Power**)

The heater control/display features on that page are defined below the illustration.

Figure 12-18 Heat Control Page: Heater Control/Display Features when T/C Type = None

Local Selected on Config>Main Screen

Remote I/O Selected on Config>Main Screen



**Heat ON/OFF** button: Touch to toggle the heaters on/off.

**Power** entry box: To enter a temperature setpoint, touch this box to display a numeric keypad. Use that keypad to enter the desired value. After you touch the keypad's **Enter** button to close it, the value you entered will appear in this box.

**Setpoint** display box: Not active when **Power** is selected as the **Control Mode**.

**Actual** display box: Not active when **Power** is selected as the **Control Mode**.

## 12.4 Heater Control in Manual Mode

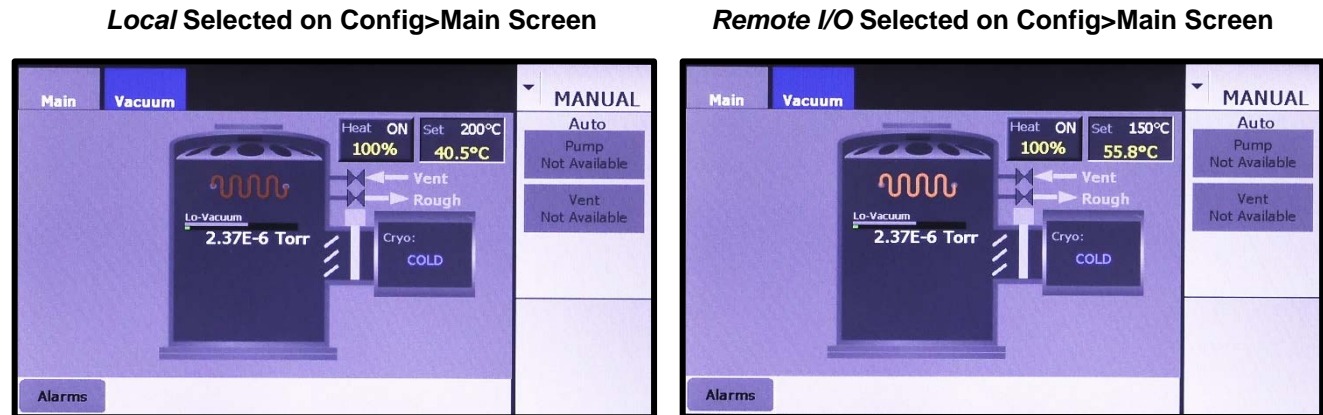
### 12.4.1 Manual Mode Heater Control: Configuration State 1 Implemented

Figure 12-19 shows the Manual>Main screen when the Heat Control page is in Configuration State 1:

- **T/C Type** = either **Type J** or **Type K**
- **Control Mode** = **Temp**

As Figure 12-19 shows, under those configuration conditions the heater control/display features on the Manual>Main screen are the same whether **Local** or **Remote I/O** is selected on the Configuration>Main screen. Those features are defined below the illustration.



Figure 12-19 Manual Mode Heater Control/Display Features when *Control Mode = Temp*

**Heat ON/OFF** button: Touch to toggle the heaters on/off. When Heaters are ON, this button displays the percent-power level at which they are operating.

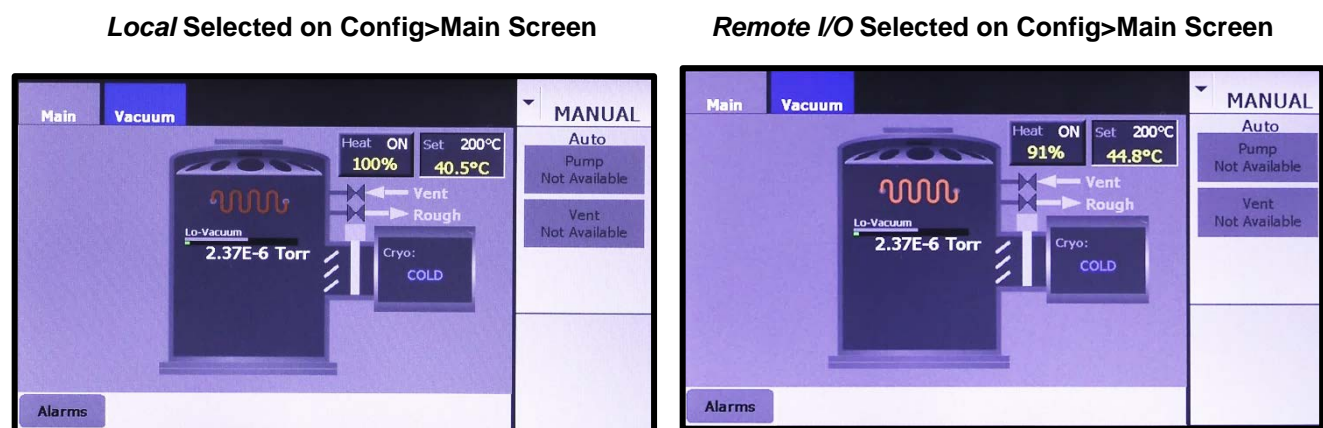
**Set** entry box: To enter a temperature setpoint, touch this box to display a numerical keypad and use it to enter the desired value. After you touch the keypad's **Enter** button, the value you entered will appear in upper part of the **Set** box. When the heaters are on, that box also displays the actual chamber temperature, as indicated by the heat TC.

### 12.4.2 Manual Mode Heater Control: Configuration State 2 Implemented

Figure 12-20 shows the Manual>Main screen when the Heat Control page is in Configuration State 2:

- **T/C Type** = either **Type J** or **Type K**
- **Control Mode** = **Power**

As Figure 12-20 shows, under those configuration conditions the heater control/display features on the Manual>Main screen are the same whether **Local** or **Remote I/O** is selected on the Configuration>Main screen. Those features are defined below the illustration

Figure 12-20 Manual Mode Heater Control/Display Features when *Control Mode = Power*

**Heat ON/OFF** button: Touch to toggle the heaters on/off. When the Heaters are ON, this button displays the percent-power level at which they are operating.

**Set** entry box: To enter a power setpoint, touch this box to display a numerical keypad and use it to enter the desired value. After you touch the keypad's **Enter** button, the value you entered will appear in upper part of the **Set** box. When the heaters are on, that box also displays the actual chamber temperature, as indicated by the heat TC.

### 12.4.3 Manual Mode Heater Control: Configuration State 3 Implemented

Figure 12-21 shows the Manual>Main screen when the Heat Control page is in Configuration State 3:

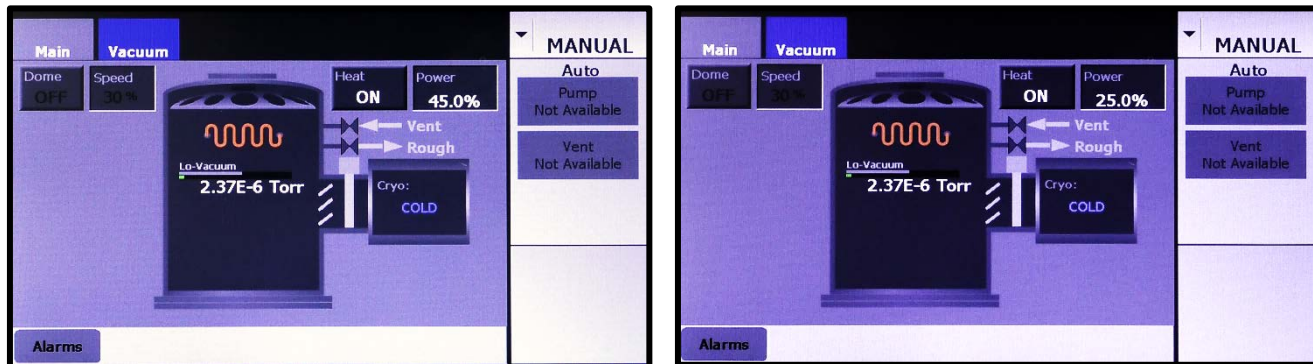
- **T/C Type = None** (**Control Mode** selection defaults to **Power**)

As Figure 12-21 shows, under those configuration conditions the heater control/display features on the Manual>Main screen are the same whether **Local** or **Remote I/O** is selected on the Configuration>Main screen. Those features are defined below the illustration.

**Figure 12-21 Manual Mode Heater Control/Display Features when T/C Type = None**

*Local Selected on Config>Main Screen*

*Remote I/O Selected on Config>Main Screen*



**Heat ON/OFF** button: Touch to toggle the heaters on/off.

**Set** entry box: To enter a power setpoint, touch this box to display a numerical keypad and use it to enter the desired value. When the Heaters are ON, this button displays the percent-power level at which they are operating.

## 12.5 Heater Control in Operations Mode

### 12.5.1 Operations Mode Heater Control when Local Control Is Selected

When **Local control** is selected on the Configuration>Main screen, the control/display features on the Operations main screen are identical to those that appear on the Manual>Main screen in a given configuration state. Specifically:

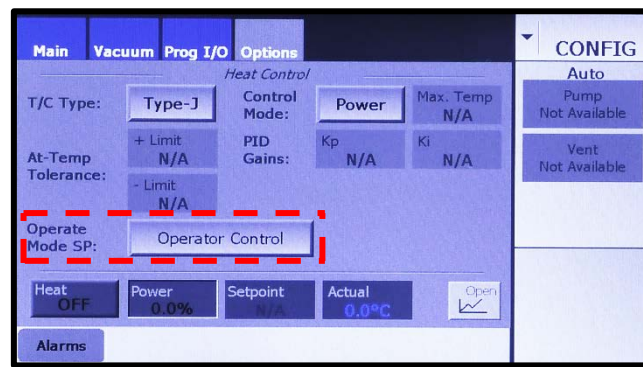
- When the **Control Mode = Temp**, heater control/display features on the Ops>Main screen are identical to those shown in Figure 12-22.

- When the **Control Mode = Power**, heater control/display features on the Ops>Main screen are identical to those shown in Figure 12-20.
- When **T/C Type = None**, heater control/display features on the Ops>Main screen are identical to those shown in Figure 12-23.

### 12.5.2 Operations Mode Heater Control when Remote Control Is Selected

Selecting **Remote I/O** on the Configuration>Main screen introduces additional variation into the control/display features on the Ops>Main screen. These additional variations are a function of the **Operate Mode SP** button which appears on the Heat Control page when **Remote I/O** is selected (see Figure 12-24).

**Figure 12-24 Heat Control Page with the Operate Mode SP Button Outlined**



The **Operate Mode SP** button offers four possible selections:

- **Operator Control**
- **Remote Input**
- **To Preset Temp**, when **Temp** is selected as the **Control Mode**,
- **To Preset Power**, when **Power** is selected as the **Control Mode**.

These **Operate Mode** options determine how the **Pwr** setpoint on the Operations>Screen is controlled:

- If **Operator Control** is selected, the user can enter the Ops mode power setpoint via the **Pwr** entry box on the Operations>Main screen.
- If **Remote Input** is selected, the Ops mode power setpoint equals the percent-power value transmitted by the higher-level controller.
- If **To Preset Temp** is selected, the Ops mode power setpoint defaults to the value entered in the **% Pwr** entry box adjacent to the **To Operate Mode** button (see Figure 12-25).
- If **To Preset Power** is selected, the Ops mode power setpoint defaults to the value entered in the **% Pwr** entry box adjacent to the **To Operate Mode** button (see Figure 12-26).

Figure 12-25 Heat Control Page, To Preset Temp Selected Opposite Operate Mode SP

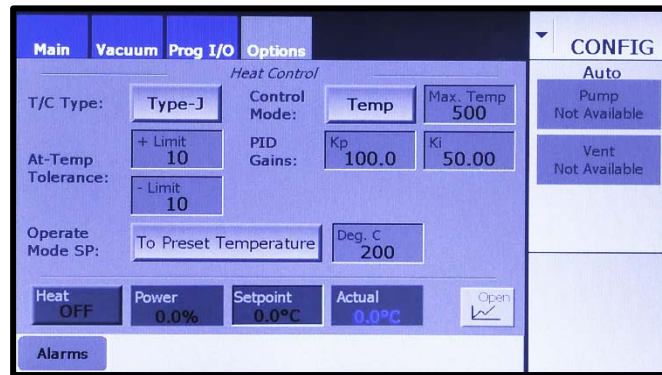
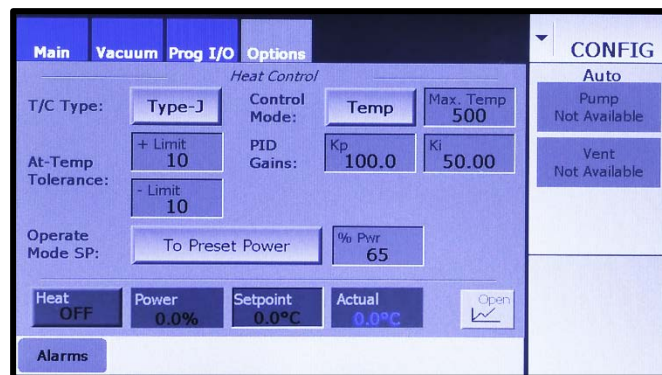


Figure 12-26 Heat Control Page, To Preset Power Selected Opposite Operate Mode SP



For each of the three basic configuration states, the heater control/display features on the Operations>Main screen can appear in two different states, depending on the **Operate Mode SP** selection:

1. When the **Operate Mode SP** selection is **Operator Control**
2. When the **Operate Mode SP** selection is either **Remote Input, To Preset Temp**, or **To Preset Power**.

Figures 12-27 through 12-32 show how the heater control/display features on the Operations>Main screen vary depending on the Configuration State and the **Operate Mode SP** Selection.

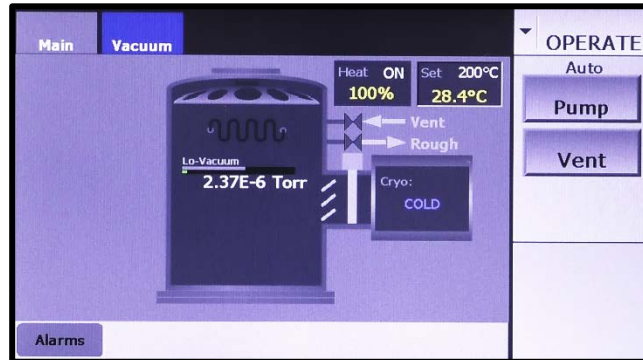
#### Operations Mode Heater Control when Configuration State 1 Is Implemented

Figures 12-27 and 12-28 show the Operations>Main screen when the Heat Control page is in Configuration State 1:

- **T/C Type** = either **Type J** or **Type K**
- **Control Mode** = **Temp**

Figure 12-27 shows the heater control/display features on the Ops>Main screen when Configuration 1 is implemented and **Operator Control** is selected for **Operate Mode SP**. Figure 12-28 shows the heater control/display features on the same screen when Configuration 1 is implemented and **Operate Mode SP** = either **Remote Input**, **To Preset Temperature**, or **To Preset Power**. In each case, the heat control/display features are defined below the illustration.

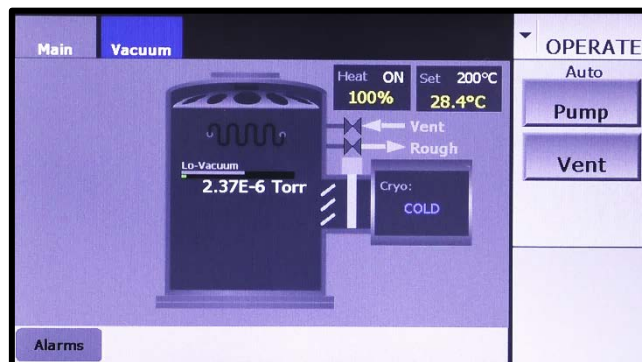
**Figure 12-27 Ops>Main Screen: Configuration State 1 Implemented, Operate Mode SP = Operator Control**



**Heat** status display rectangle: Displays the heaters' ON/OFF status and the percent-power level at which they are operating.

**Set** parameter-entry box: Touch to display a numeric keypad and use that keypad to enter the desired temperature setpoint value. After you enter the desired value and touch the keypad's **Enter** button to close it, this box will display the value you entered. When the heaters are on, it also displays the actual chamber temperature, as indicated by the heat TC.

**Figure 12-28 Ops>Main Screen: Configuration State 1 Implemented, Operate Mode SP = Remote Input, To Preset Temperature, or To Preset Power**



**Heat** status-display rectangle: Displays the heaters' ON/OFF status and the percent-power level at which they are operating.

**Set** status-display rectangle: Displays the current percent-power setpoint and, when the heaters are ON, the actual chamber temperature, as indicated by the heat TC.

### Operations Mode Heater Control when Configuration State 2 Is Implemented

Figures 12-29 and 12-30 show the Operations>Main screen when the Heat Control page is in Configuration State 2:

- **T/C Type** = either **Type J** or **Type K**
- **Control Mode** = **Power**

Figure 12-29 shows the heater control/display features on the Ops>Main screen when Configuration 2 is implemented and **Operator Control** is selected for **Operate Mode SP**. Figure 12-30 shows the heater control/display features on the same screen when Configuration 2 is implemented and **Operate Mode SP** = either **Remote Input**, **To Preset Temperature**, or **To Preset Power**. In each case, the heat control/display features are defined below the illustration.

**Figure 12-29 Ops>Main Screen: Configuration State 2 Implemented, Operate Mode SP = Operator Control**



**Heat** status display rectangle: Displays the heaters' ON/OFF status and the percent-power level at which they are operating.

**Set** parameter-entry box: Touch to display a numeric keypad and use that keypad to enter the desired percent-power setpoint value. After you enter the desired value and touch the keypad's **Enter** button to close it, this box will display the value you entered. When the heaters are on, it also displays the actual chamber temperature, as indicated by the heat TC.

**Figure 12-30 Ops>Main Screen: Configuration State 2 Implemented, Operate Mode SP = Remote Input, To Preset Temperature, or To Preset Power**



**Heat** status-display rectangle: Displays the heaters' ON/OFF status and the percent-power level at which they are operating.

**Set** status-display rectangle: Displays the current percent-power setpoint and, when the heaters are ON, the actual chamber temperature, as indicated by the heat TC.

### Operations Mode Heater Control when Configuration State 2 Is Implemented

Figures 12-31 and 12-32 show the Operations>Main screen when the Heat Control page is in Configuration State 3:

- **T/C Type = None**

Figure 12-31 shows the heater control/display features on the Ops>Main screen when Configuration 3 is implemented and **Operator Control** is selected for **Operate Mode SP**. Figure 12-32 shows the heater control/display features on the same screen when Configuration 3 is implemented and **Operate Mode SP** = either **Remote Input**, **To Preset Temperature**, or **To Preset Power**. In each case, the heat control/display features are defined below the illustration.

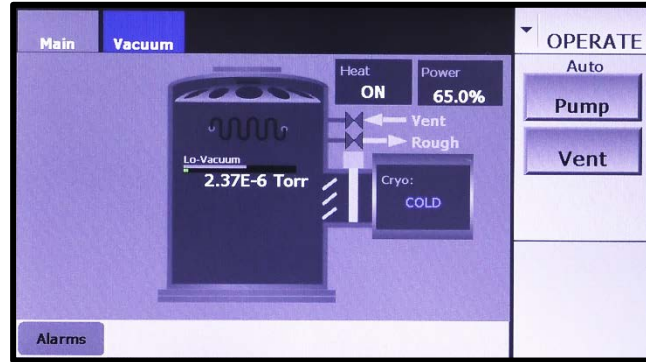
**Figure 12-31 Ops>Main Screen: Configuration State 3 Implemented, Operate Mode SP = Operator Control**



**Heat** status display rectangle: Displays the heaters' ON/OFF status.

**Set** parameter-entry box: Touch to display a numeric keypad and use that keypad to enter the desired percent-power setpoint value. After you enter the desired value and touch the keypad's **Enter** button to close it, this box will display the value you entered.

**Figure 12-32 Ops>Main Screen: Configuration State 3 Implemented, Operate Mode SP = Remote Input, To Preset Temperature, or To Preset Power**



**Heat** status-display rectangle: Displays the heaters’ ON/OFF status and the percent-power level at which they are operating.

**Set** status-display rectangle: Displays the current percent-power setpoint.

## 12.6 Monitoring Heater Operation

Figures 12-34 and 12-33 show how the Heat Graph page can be used to monitor heater operation. In Figure 12-33, **Power** has been selected as the **Control Mode**. When that selection is made, changes in both temperature and power are charted on the graph. In Figure 12-34, the user has selected **Temp** as the **Control Mode**, so only temperature change is charted on the graph.

**Figure 12-33 The Heat Graph Page when Power Is Selected as the Control Mode**

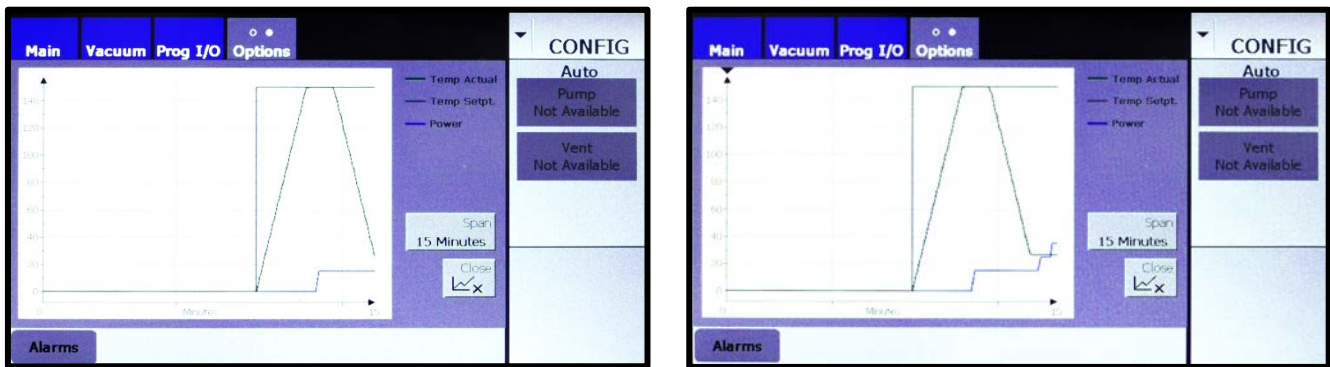
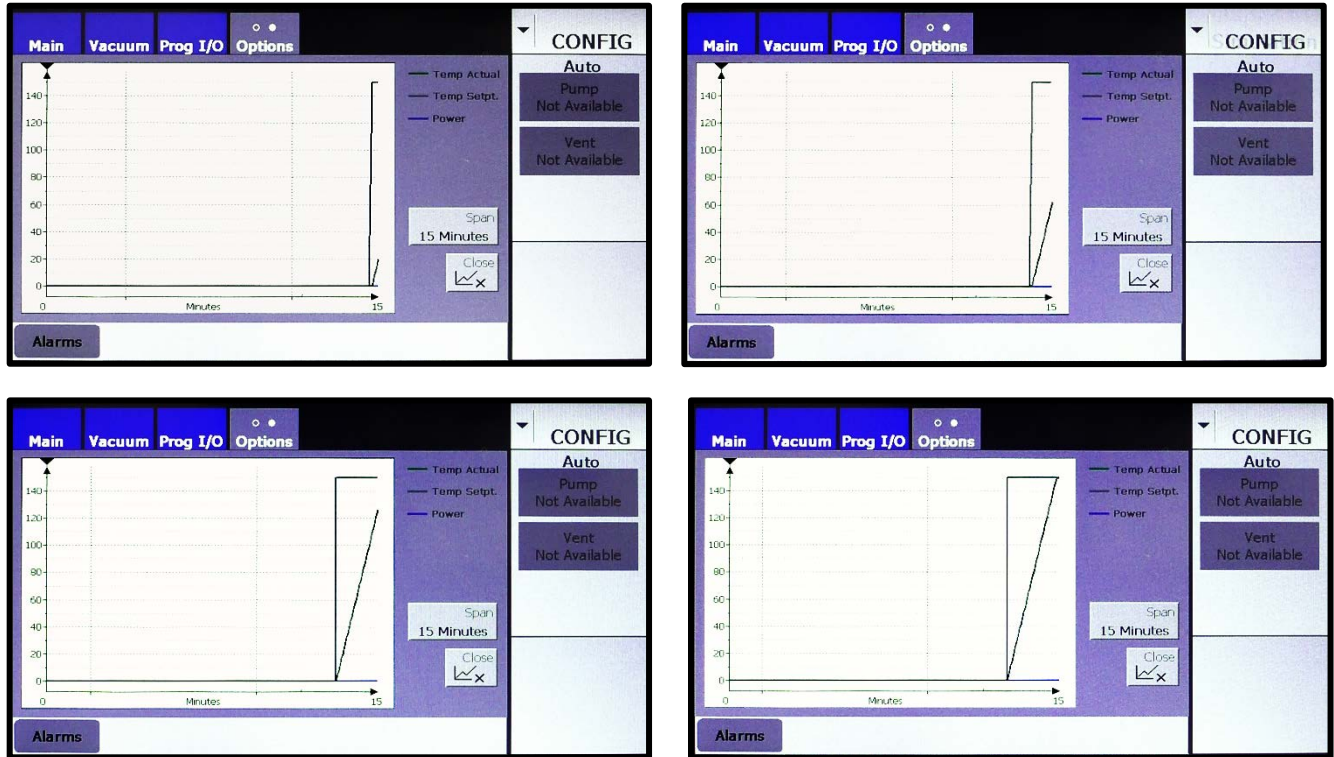




Figure 12-34 The Heat Graph Page when Temp Is Selected as the Control Mode





## 13.1 Section Overview

This section describes the use of Service mode screens and Page 2 of the Details screen for troubleshooting purposes. The topics covered are:

Section 13.2 Tracking I/O Status Using Service Mode Screens

Section 13.3 Tracking the Status of Automated Operations Using Page 2 of the Details Screen

## 13.2 Tracking I/O Status Using Service Mode Screens

Figures 13-1 and 13-2 show examples of Service>Analog I/O and Service Digital I/O screens. Together, those screens indicate status for all I/Os. The I/Os displayed vary depending on the hi-vac pump selection and the standard features and options that are installed and activated. Therefore, the screens shown below may or may not resemble the Analog I/O and Digital I/O screens as they appear on your FerroVac.

The Service>Analog I/O screen (see Figure 13-1) identifies each analog input by name, and inputs are numbered 0-3 within each input module. A real-time pressure readout is displayed for each input that is currently active, and inactive inputs are labeled **OFF**. Similar information is provided for any installed analog output modules.

**Figure 13-1 Service Vacuum I/O Screen**

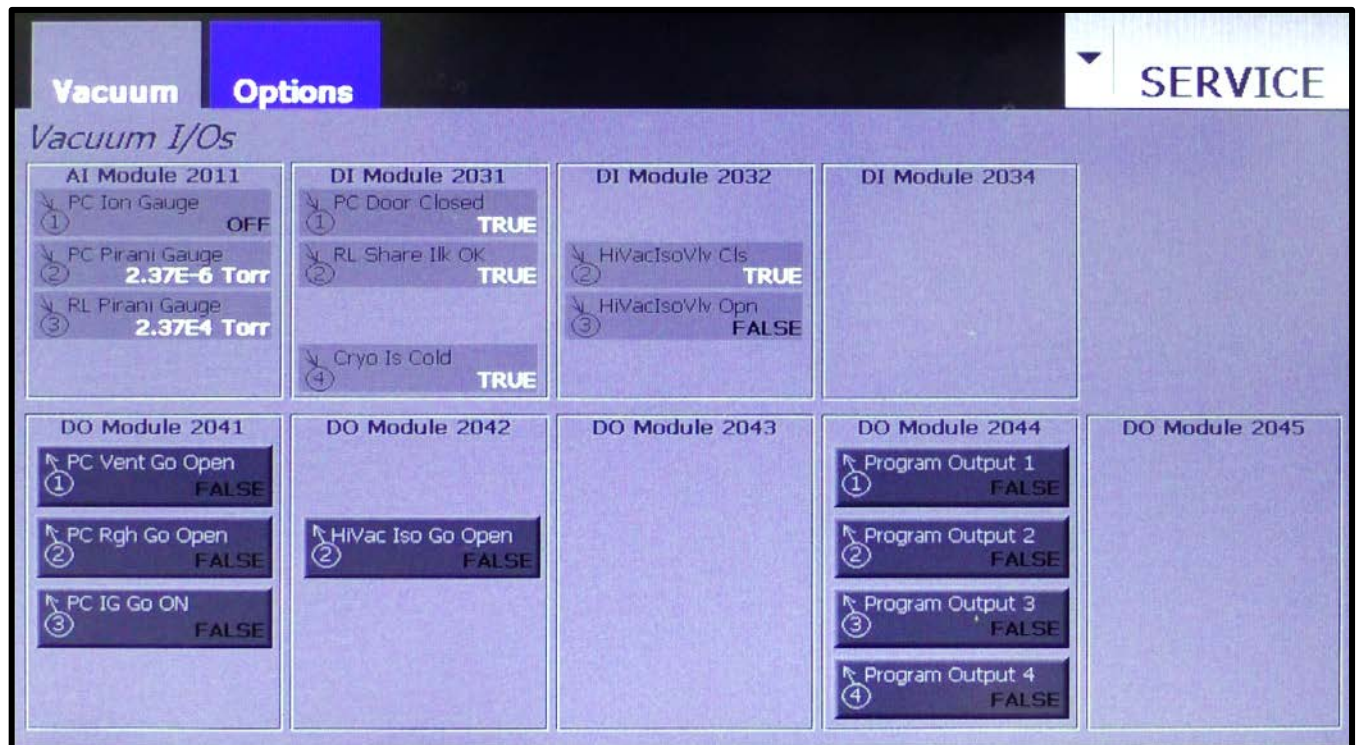


Figure 13-2 The Service *Options I/Os* Screen

The Service Digital I/O screen (see Figure 13-2) identifies each digital I/O by name, and I/Os are numbered 0-3 within each input or output module. A TRUE/FALSE indicator shows the active/inactive status of each I/O. Similar information is provided for outputs, and each output's identifier/status indicator is a button that enables the user to toggle that output on and off.

### 13.3 Tracking the Status of Automated Operations Using Page 2 of the Details Screen

With the assistance of a Temescal Field Service engineer or other Temescal consultant, Page 2 of the Details screen (see Figure 13-3) can aid in troubleshooting automated operations, generally. As Figures 13-3 through 13-6 illustrate, the indicators in the **Switch** column are lit when a given automated operation has been commanded to start, and those in the **Done** column are lit upon completion of the automated operation in question. Referring to the numbers in the **State** column, a Temescal Field Service representative or consultant can determine the point of failure in an execution sequence.

Figure 13-3 Details Screen, Page 2, when No Auto Sequence Is Running

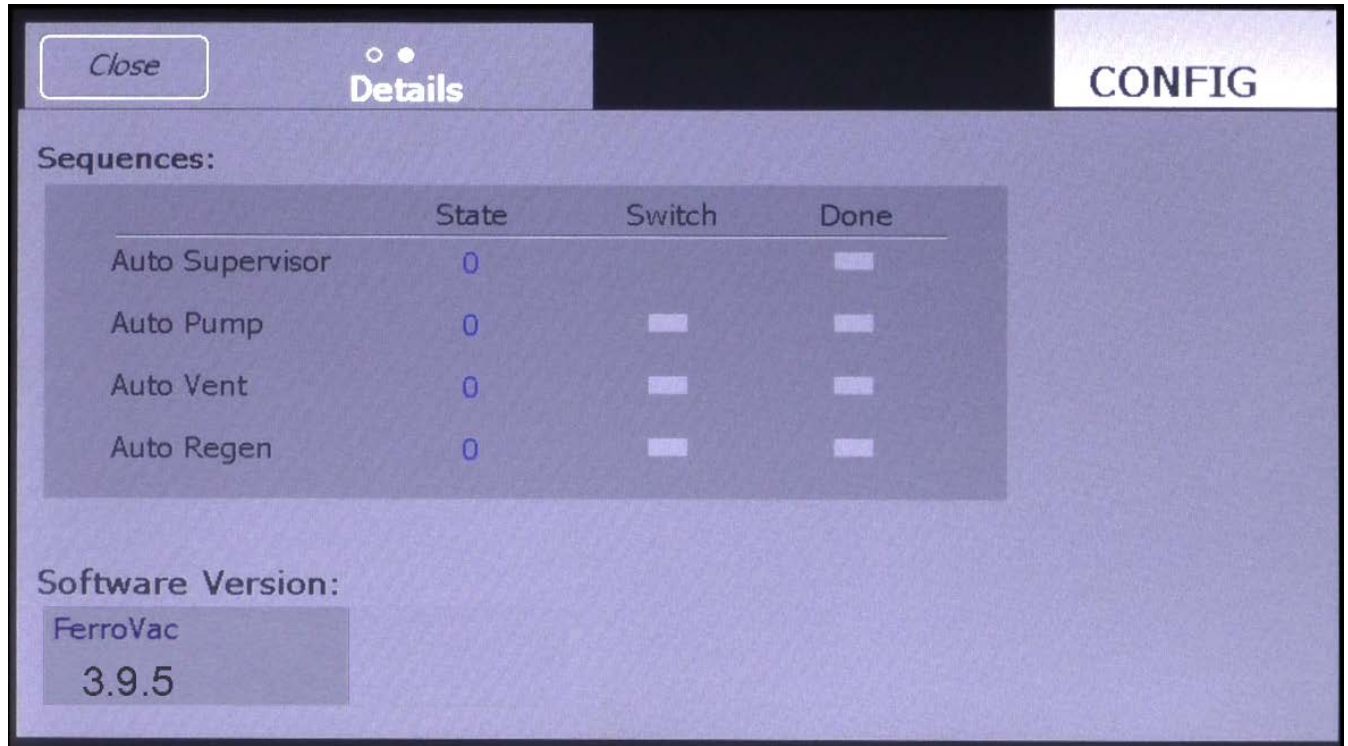


Figure 13-4 Details Screen, Page 2, After User Selects AutoPump

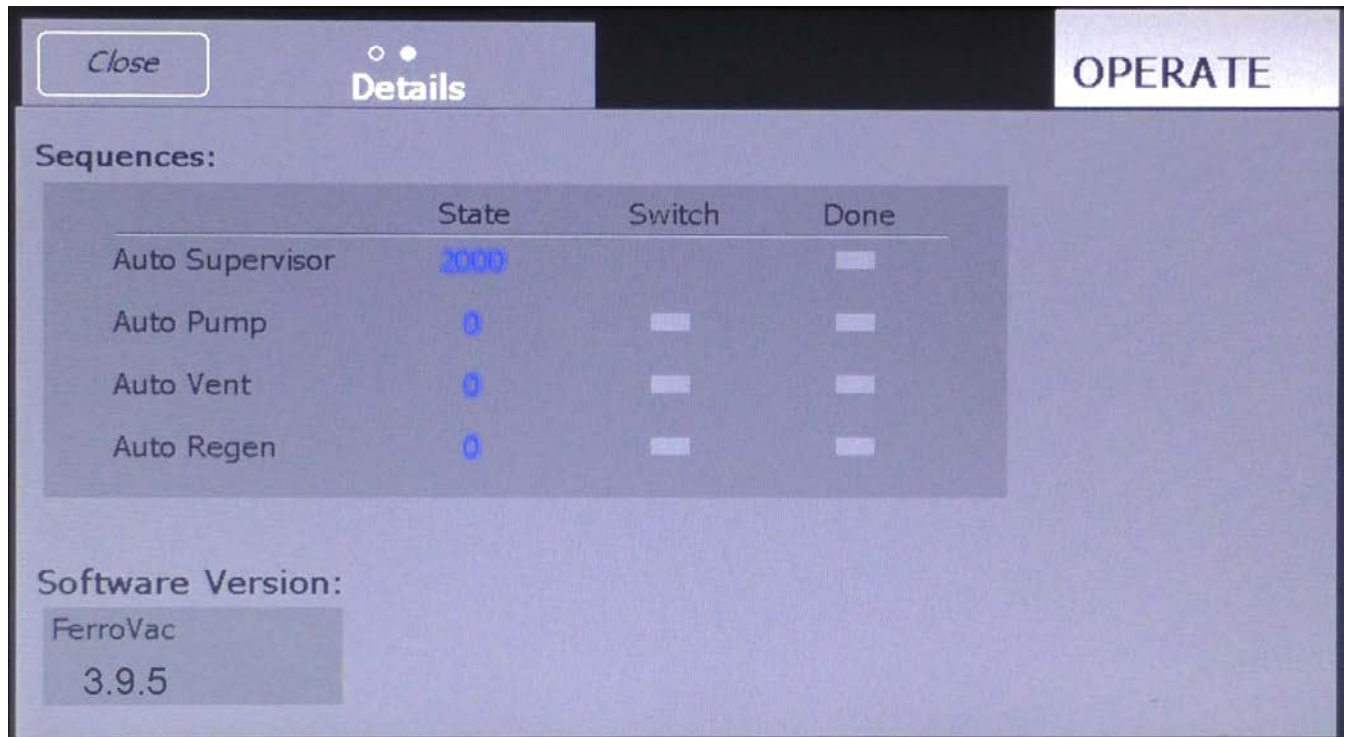


Figure 13-5 Details Screen, Page 2, After AutoPump Begins Execution

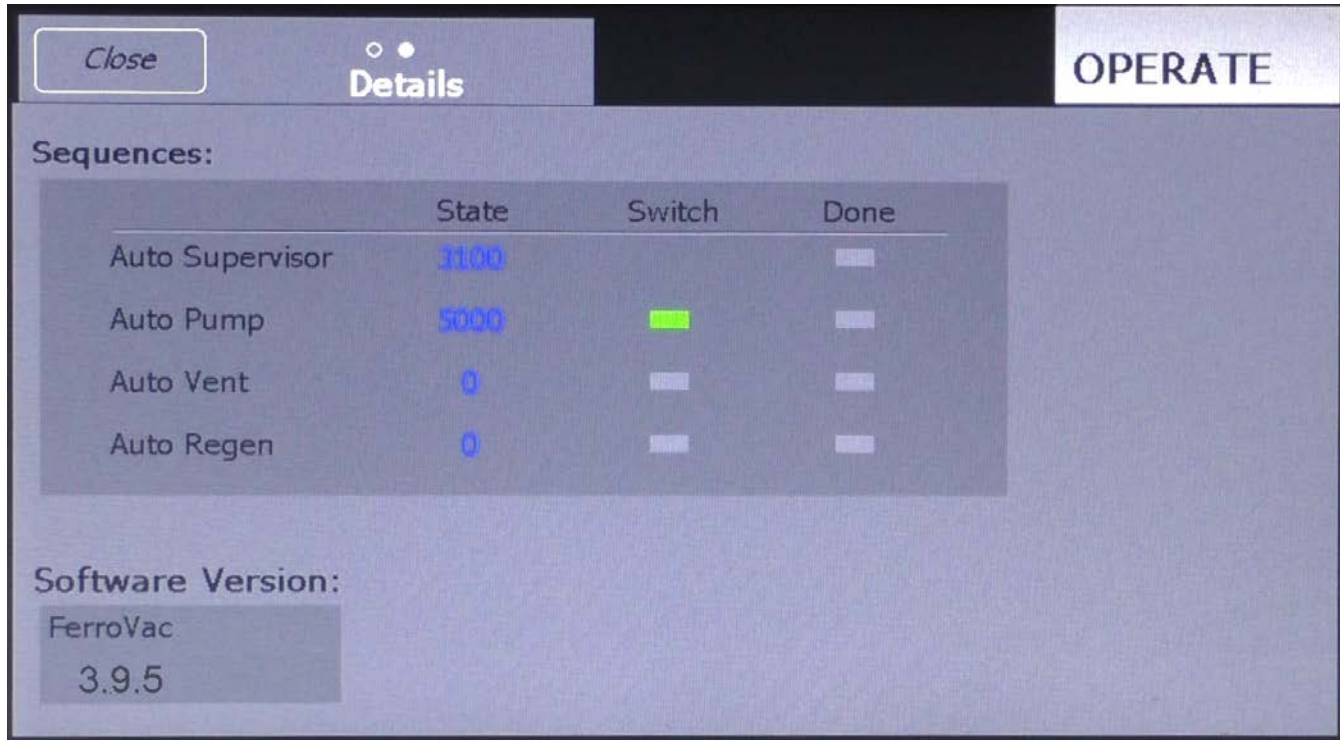


Figure 13-6 Details Screen, Page 2, when AutoPump Execution Is Completed

