Brooks

On-Board® IS 8F Cryopump with Sublime Regeneration
Installation and Operation Instructions

8040737 Revision A

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1 Description

Overview

This chapter provides a brief overview of Brooks Automation Product, highlighting its component features, and specifications.

Chapter Contents

Introduction

The On-Board *IS* Cryopump provides fast, clean pumping of all gases in the 10^{-3} to 10^{-9} torr range by condensing gas at low temperatures to achieve low vapor pressures, allowing high pumping speeds and throughputs. It is driven by a variable speed motor and controlled by an advanced microprocessor, the On-Board *IS* Module.

The On-Board *IS* System consists of the On-Board *IS* Cryopump and a remotely located On-Board *IS* Compressor, which provides the compressed helium for multiple cryopumps through helium supply and return lines. The On-Board *IS* Controller coordinates communications between all of the system components on the Intercomponent Network. See the typical On-Board *IS* System in Figure 10-1 on page 10-5.

For component locations, see Component Description and Facility Requirements on page 1-4.

For component details, see Appendix D: Cryopump Component Details on page 10-8 and Appendix E: Communication Module Component Details on page 10-11.

For more details about how the cryopump operates, see Appendix C: Theory of Cryopump Operation on page 10-4.

To install a cryopump, go to Installation on page 3-1.

For more details about using the cryopump, see Using the Cryopump on page 6-1

NOTE: *All personnel with maintenance responsibilities must become familiar with the contents of these instructions to ensure safe, reliable, and high performance operation of the cryopump.*

Performance Specifications

Table 1-1: On-Board IS 8F Cryopump with Sublime Regeneration Specifications

Parameter		Specifications
Integrated Hardware		Roughing Valve Purge Valve (not used) Cryopump TC Gauge First Stage Diode Second Stage Diode First Stage Heater Second Stage Heater RS-232 Interface
Pumping Speeds	Water	4,000 liters/sec
	Nitrogen	1,500 liters/sec
	Hydrogen	2,200 liters/sec
	Argon	1,200 liters/sec
Argon Throughput at 20K*		250 - 700 sccm (torr-liters/sec)
Capacities	Argon	1000 std. liters @ 5×10^{-6} torr 750 std. liters @ 5×10^{-7} torr (recovery in 30 seconds)
	Hydrogen	12 std. liters @ 5×10^{-6} torr
	Nitrogen	550 std. liters @ 5×10^{-7} torr (recovery in 30 seconds)
Crossover		150 torr
Dimensions		23.86 x 16.19 x 10.39 inches
Weight		67 lbs. (30.39Kg)
*Depends upon system configuration.		

NOTE: *Some regeneration cycles may last for two hours or more, depending on your application.*

Component Description and Facility Requirements

Component Name	Facility Requirement or Specification
1. Vacuum Vessel Mounting Flange	Centering ring and o-ring assembly, and 6 double-claw clamps or 12 single-claw clamps. See Figure 3-2 on page 3-4.
2. Vacuum Vessel	N/A
3. First Stage Array	N/A
4. Multi-Function Valve	See Figure 1-2 on page 1-5.
5. Helium Supply Fitting	For connecting the fittings, use 1 3/16″ and 1″ wrenches. For disconnecting the fittings, use 1 1/8″ and 1 3/16″ wrenches. See Figure 3-3 on page 3-6.
6. Helium Return Fitting	See previous row.
7. Communication Module	See Communication Module Description on page 1-6.

Side View   Front View
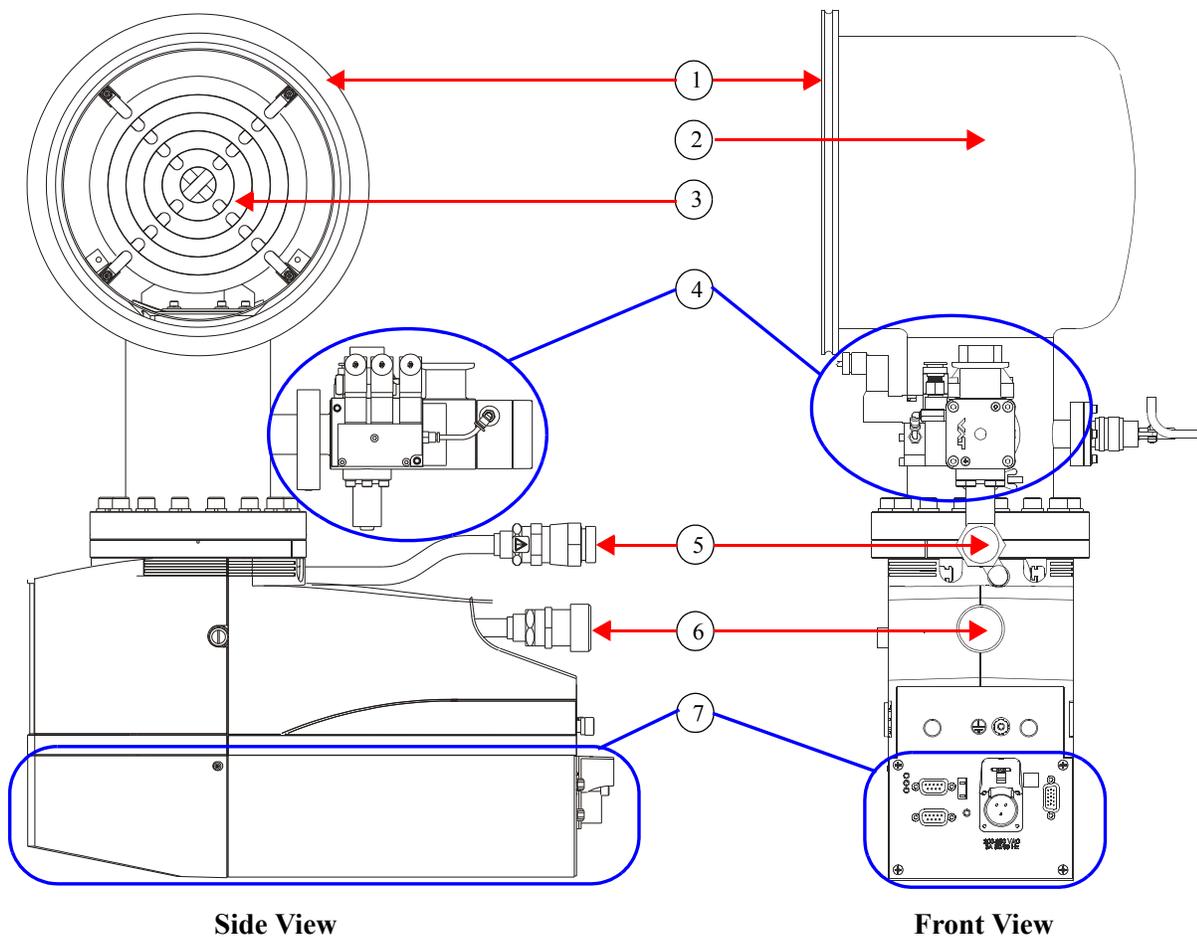
Figure 1-1: Component Identification

Multi-Function Valve Description

The multi-function valve combines the functions of the rough valve, pump purge valve, exhaust purge valve, and relief valve. All valves on the Multi-Function Valve are piloted, except the relief valve, and therefore require high pressure air for operation.
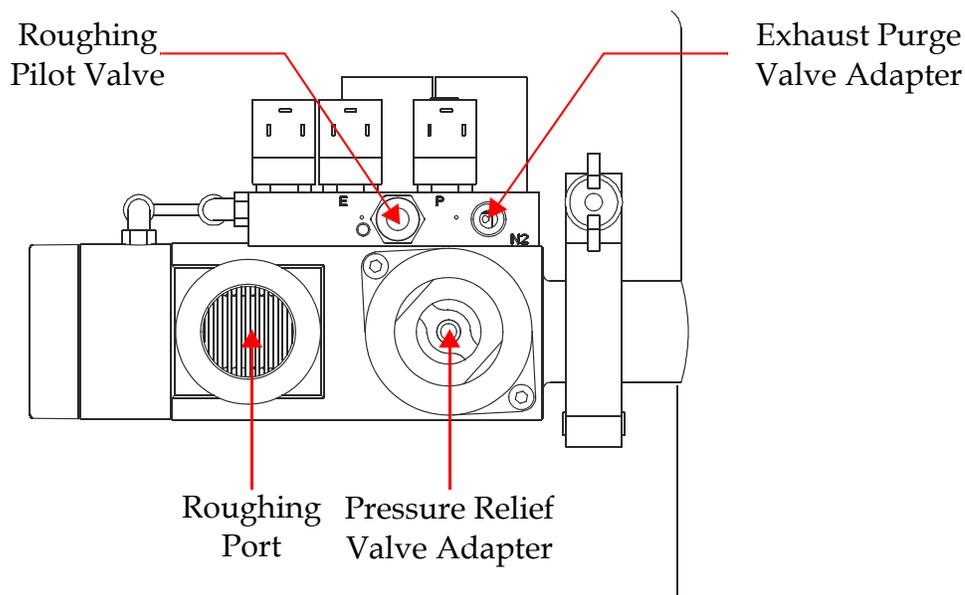
Figure 1-2: Multi-Function Valve Identification, Top View

Component Name	Facility Requirement or Specification	
Roughing Pilot Valve	1/4" one-touch tube connection	60 psig air minimum 80 psig air maximum
Exhaust Purge Valve Adapter	N/A (No Connections)	
Pressure Relief Valve Adapter	1/2" Female NPT	
Roughing Port	N/NW-25 ISO KF flange	10 cfm, minimum roughing speed

Communication Module Description

The On-Board *IS* Module (or Module) controls the operation of the On-Board *IS* Cryopumps, and provides host computer with RS-232 and network communication ports. The following figure shows the Module components.
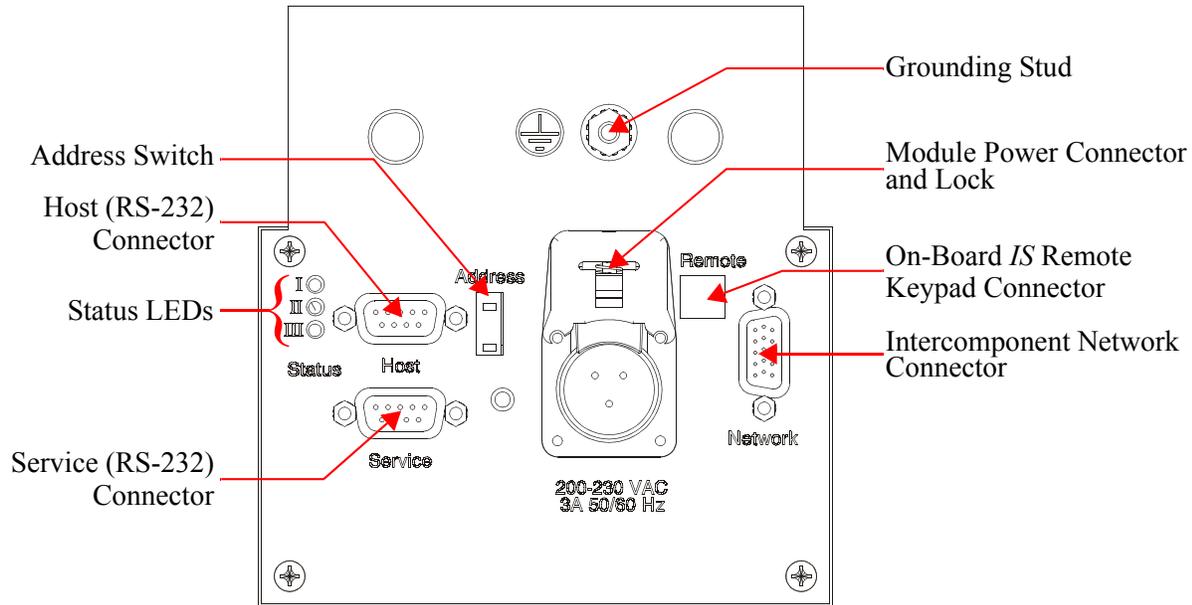
Figure 1-3: Communication Module Component Identification

For more details about the function of each Communication Module component, see Appendix E: Communication Module Component Details on page 10-11.

When you connect the cryopumps to each other, use the standard network cable. For the last cryopump in the chain, use a terminated network cable.

Module Power Connector Specifications

•   208 VAC (range: 180 - 253 VAC)

•   5 amps

•   50/60 Hz

•   Single phase

2 Safety

Overview

This section describes safety conventions for the Brooks Automation Product. All personnel involved in the operation or maintenance of the product must be familiar with the safety precautions outlined in this section.

NOTE: *These safety recommendations are basic guidelines. If the facility where the Product is installed has additional safety guidelines they should be followed as well, along with the applicable national and international safety codes.*

Chapter Contents

Introduction

Follow all safety precautions during installation, normal operation, and when servicing CTI-Cryogenics products.

This chapter explains the safety conventions used throughout this manual. CTI-Cryogenics uses a specific format for cautions and warnings, which includes standard signal words and safety shapes.

See also the *Customer Support* appendix or call your local Customer Support Center for assistance.

Signal Word Descriptions

All cautions and warnings contain signal words, which call attention to safety messages and designate the degree of hazard seriousness. The following table shows the signal words and their meanings that may be used in this document.

Table 2-1: Safety Signal Words

Term	Example	Definition
CAUTION	**CAUTION**	A signal word that indicates a situation or unsafe practice, which if not avoided may result in **equipment damage**. A CAUTION is highlighted in yellow.
CAUTION	⚠ **CAUTION**	A signal word accompanied by a safety shape that indicates a potentially hazardous situation or unsafe practice. If not avoided, the action may result in **minor or moderate personal injury or equipment damage**. A CAUTION is highlighted in yellow.
WARNING	⚠ **WARNING**	A signal word accompanied by a safety shape that indicates indicates a potentially hazardous situation. If not avoided, the action may result in **serious injury or death**. A WARNING is highlighted in orange.

Safety Shape Descriptions

All cautions and warnings contain safety shapes, which have specific safety meanings. The following table shows some of the safety shapes used in this document and their meanings.

Table 2-2: Safety Shapes

Example	Term	Shape Definition
⚠	General Warning	Indicates a general hazard. Details about this hazard appear in the safety notice explanation.
⚡	High Voltage	Indicates a high voltage hazard.
♨	Hot Surface	Indicates a surface is hot enough to cause discomfort or a burn.

References

For more information about safety standards, see the following documents:

•   ISO 7010: 2003(E), Graphic symbols - Safety colours and safety signs - Safety signs used in workplaces and public areas

•   ISO 3864-1: 2002(E), Graphic symbols - Safety colours and safety signs - Part 1: Design principles for safety signs in workplaces and public areas

3 Installation

Overview

This chapter details the installation of the product.

This installation information is intended for all On-Board *IS* 8F Cryopump with Sublime Regeneration system technicians. See Figure 4-1 on page 4-3 for an example of a typical cryopump system.

Chapter Contents

Installation Safety

	⚠ WARNING
	Toxic, Corrosive, or Flammable Gas
	To prevent personal injury, over pressurization, and equipment damage, connect an exhaust system vent line to the On-Board *IS* Cryopump pressure relief valve adapter before pumping toxic, corrosive, or flammable gases.

Use the following precautions with toxic, corrosive, or flammable gases:

• Follow all local, state, and national codes.

• Always vent to a safe location using an inert purge gas.

	⚠ WARNING
	Ignition Hazard
	To prevent flammable gas ignition, do not install a hot filament type vacuum gauge on the high vacuum side of the isolation valve.

	⚠ WARNING
	Ozone Explosion Hazard
	To prevent explosions, be aware of ozone as a by-product of an oxygen process, and use the appropriate precautions.

NOTE: *Changes in process can increase ozone amounts.*

Ozone may be present if the following occurs:

• You hear crackling and popping sounds, such as in electrical arcing, within the first few minutes of regeneration.

• You smell a gas similar to that in arc welding or during an electrical storm.

Use the following precautions in any area that may contain ozone:

• Immediately reduce the oxygen flow rate to the lowest level allowed in the process.

• Shorten the time between regenerations. You may need to perform regeneration daily. Contact Customer Service for assistance.

• Follow all precautions for toxic, corrosive, or flammable gas noted previously.

Attach a Cryopump to Your Vacuum System

You can install an On-Board *IS* Cryopump on the vacuum system in any orientation without affecting its performance.

Before attaching (mounting) the cryopump to the vacuum system, ensure a high-vacuum isolation valve (Hi-Vac valve, or gate valve) is installed between the cryopump and the vacuum chamber to isolate the cryopump from the chamber during roughing, cooldown, and regeneration.

NOTE: *You must provide a centering ring, an o-ring, and a minimum of 6 double-claw clamps or 12 single-claw slamps, depending on your vacuum system.*

Use the following instructions to attach a cryopump to your vacuum system:

1. Remove the protective cover from the cryopump vacuum vessel flange.

2. Clean all sealing surfaces with isopropyl alcohol, or equivalent.

3. Place a centering ring (200 mm) and an o-ring assembly between the vacuum vessel flange and the vacuum system. See the following figure.

Centering Ring
O-Ring
Vaccum Vessel Flange
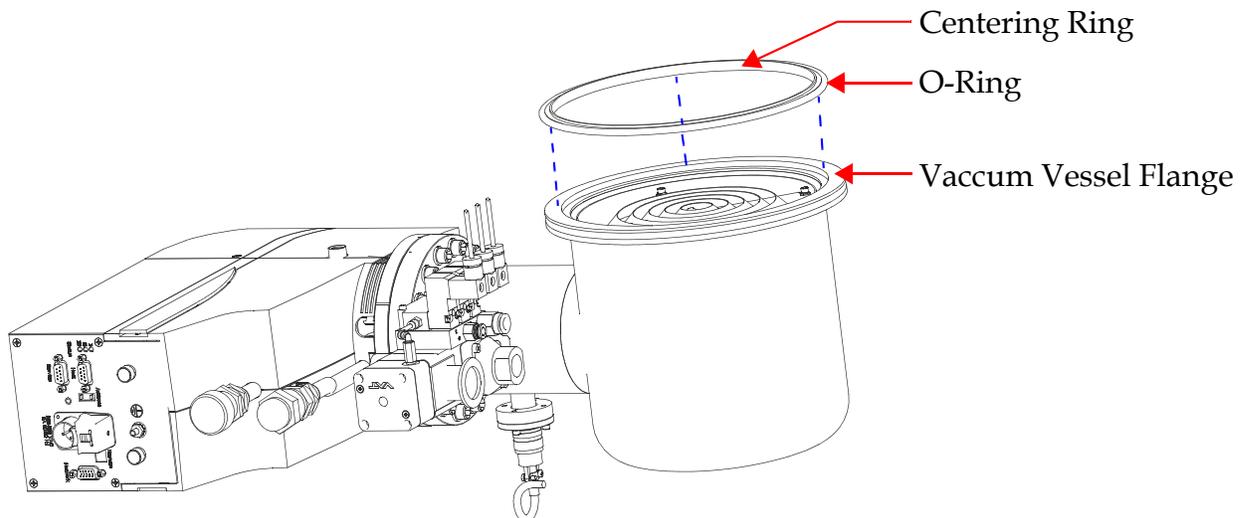
Figure 3-1: Centering Ring and O-Ring for Cryopump Attachment

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⚠️ **CAUTION**
Heavy Object
To avoid injury when installing or removing cryopumps, use a lifting aid and proper lifting techniques.

---

4.   Use a minimum of six (6) double-claw clamps, evenly spaced, to secure the cryopump to the vacuum system.
If you use single-claw clamps, you must use twelve (12), evenly spaced, as shown in the following figure.
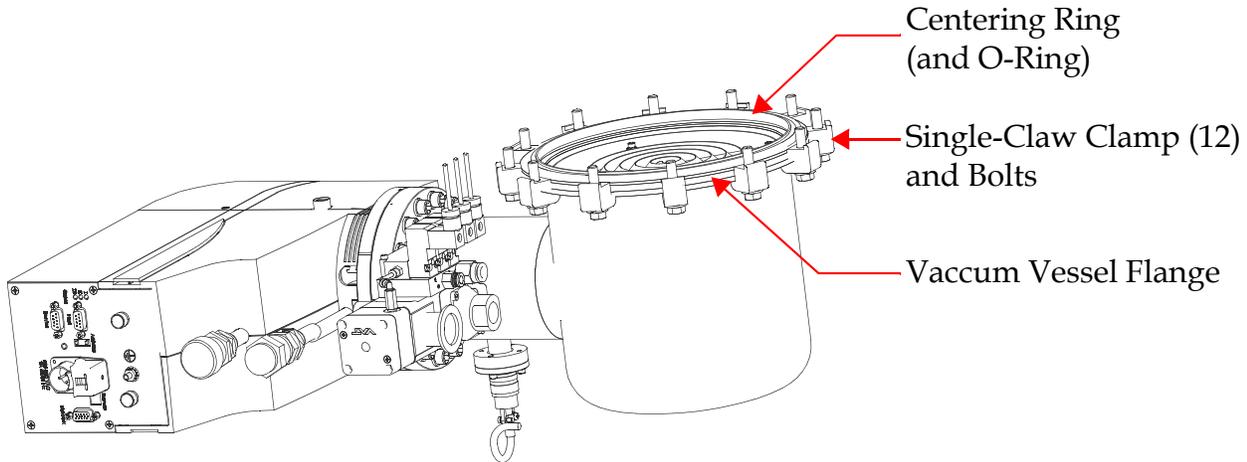
Figure 3-2: Single-Claw Clamps for Cryopump Attachment

NOTE: *The bolt on the single-claw clamps fastens onto your vacuum system (not shown).*

5.   Tighten the clamps to the appropriate specifications.

The cryopump is now attached to your vacuum system.

Connect and Disconnect the Helium Flex Lines

⚠	**CAUTION** **Equipment Damage** Ensure the helium flex lines are connected and disconnected from the cryopump and compressor appropriately, and as shown in Figure 3-4 on page 3-7. Failure to follow this procedure could damage connector O-ring seals or cause a helium circuit leak.

⚠	**CAUTION** **Compressor Damage** To avoid damaging the compressor, do not connect multiple compressors to a single helium manifold that feeds a common supply and return header. If it becomes necessary to make this connection, contact Brooks Automation for specific instructions.

NOTE: *The number of On-Board* IS *Cryopumps connected to an On-Board* IS *1000 Compressor varies based upon the On-Board* IS *Cryopump models used. Contact your local Brooks Automation Customer Support Center if you need more information about specific applications.*

⚠	**CAUTION** **Equipment Damage** To avoid contamination and damage to equipment, do not open the helium charge.

⚠	**⚠ WARNING** **High Gas Pressure** To avoid injury from propelled particles or parts due to high pressure gas, do not disassemble components charged with helium.

Connecting the Helium Flex Line

NOTE: *Refer to Figure 3-3 and Figure 3-4 on page 3-7 during this procedure.*

1.   Remove all dust plugs and caps from the Gas Supply and Return lines, and the compressor and cryopump Supply and Return connectors.

     Check for the presence of a flat gasket in the male connector, and no gasket in the female connector.

2.   Working quickly to minimize leaking, connect the Gas Return line to the Gas Return connector on the rear of the compressor. Then connect the other end of the Gas Return line to the Gas Return connector on the cryopump or helium manifold. Using two wrenches as shown in Figure 3-4, tighten the connector.

3.   Working quickly to minimize leaking, connect the Gas Supply line to the Gas Supply connector on the rear of the compressor. Then connect the other end of the Gas Supply line to the Gas Supply connector on the cryopump or helium manifold. Using two wrenches as shown in Figure 3-4, tighten the connector.

4.   Attach the Supply and Return line identification labels to each end of the appropriate lines, if available.

5.   Refer to **On-Board *IS* 1000 Compressor Quick Installation Guide**, part number 8040645, to verify proper system ("OFF" Condition) helium charge pressure.

Helium Supply Fitting

Helium Return Fitting
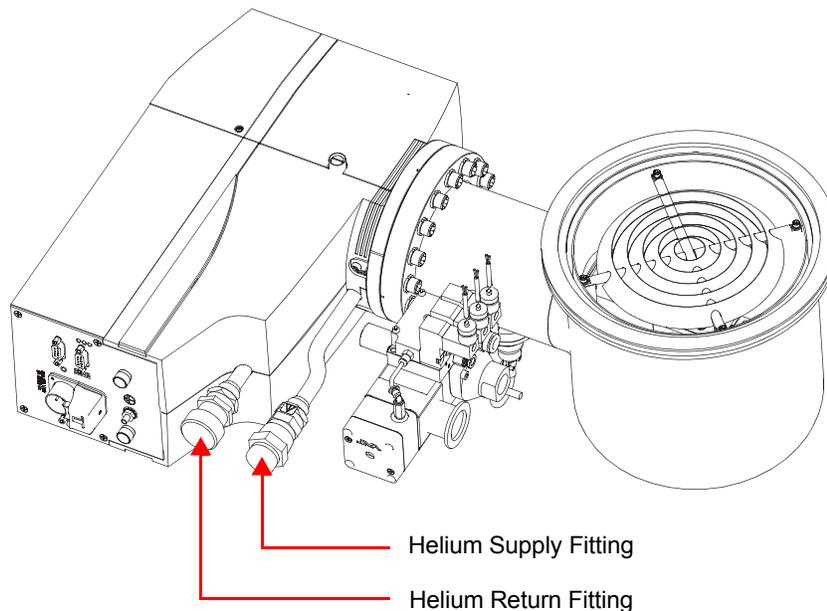
Figure 3-3: Helium Supply and Return Connection Locations

TO TIGHTEN

TURN WITH 1 3/16 INCH WRENCH

HOLD WITH 1 INCH WRENCH

HOLD WITH 1 1/8 INCH WRENCH

TURN WITH 1 3/16 INCH WRENCH

TO LOOSEN
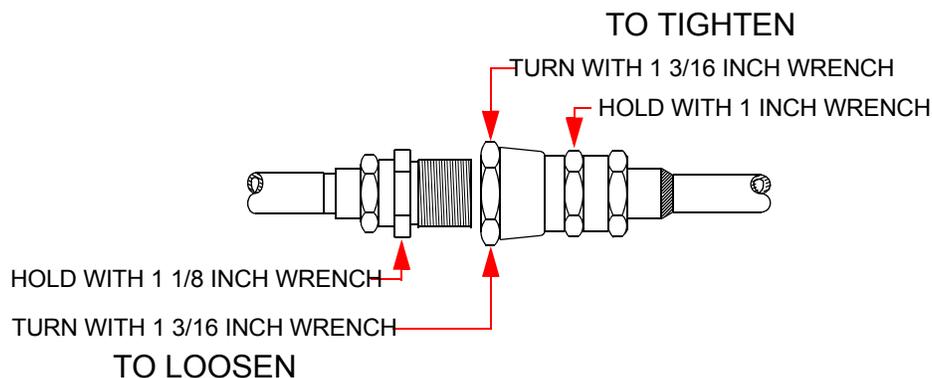
Figure 3-4: Self-Sealing Couplings for Helium Flex Lines

Disconnecting the Helium Flex Line

> **NOTE:** *Refer to Figure 3-3 on page 3-6 and Figure 3-4 during this procedure.*

- Using two wrenches as shown in Figure 3-4, disconnect the Supply and Return self sealing coupling connectors quickly to minimize helium leakage.

Connect the Roughing System

Connect your On-Board *IS* Cryopump to a roughing pump system using a roughing line with the largest inside diameter possible to minimize the roughing time. The roughing pump should have a blank-off pressure of less than 20 microns.

NOTE: *Refer to the following figure for all Roughing System Connections.*

1.   Remove the clamp and plastic cap from the roughing port.

      Save the gasket that is inside the plastic cap and the clamp.

2.   Place the gasket from Step 1 between the roughing line (size KF-25) and the roughing port.

3.   Place the clamp from Step 1 around the roughing line, gasket, and roughing port.

      Tighten the clamp.

4.   Attach a high pressure air tube to the roughing valve.
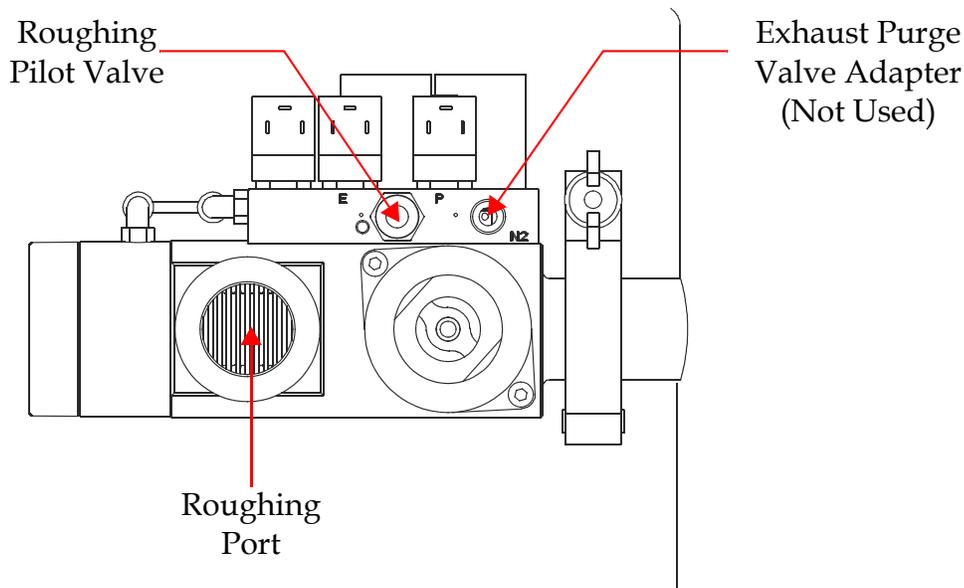
Figure 3-5: Multi-Function Valve, Roughing System Connections

NOTE: *The Multi-Function Valve also contains a Exhaust purge valve, but it may not be applicable to your system. Contact Brooks Automation to determine if your system requires a purge valve connection.*

Connect the Input Power Through the Communication Module

	⚠ **CAUTION**
	Crush Hazard and Equipment Damage
	To avoid dropping the On-Board *IS* Module, do not remove the power cable cap until you are ready to connect the power cord to the On-Board *IS* Cryopump. The power cable clamp assists in securing the On-Board *IS* Module to the cryopump.

1.   Insert a flat blade screwdriver into the power cable clamp slot on the Module as shown in .

2.   Move the screwdriver away from the power cable connector cap in .

   The screwdriver is held in place in the power cable clamp slot.

   The power cable clamp releases the power cable connector cap and the locking tab appears.

3.   Remove the power connector cap.

4.   Connect the input power cable to the input power cable connector on the module, and then rotate the connector collar until tight.

5.   Remove the screwdriver to lower the power cable clamp. This secures the input power cable.

6.   Connect the opposite end of the input power cable to a local 208 VAC, Single-Phase 5 Amp source as shown in .

	⚠ **WARNING**
	High Voltage
	High voltage electric shock could cause severe injury or loss of life.
	To avoid high voltage electric shock, ensure the On-Board *IS* Cryopump Power Cable is connected to a 208 VAC, Single-Phase 5 Amp source, and that you follow all appropriate electrical code requirements.

(Locking Tab Moves Into
Module Housing)

Power Cable Clamp Slot

Power Cable
Connector Cap

**Input Power Cable Connector
And Locking Mechanism**

Input Power
Cable Connector
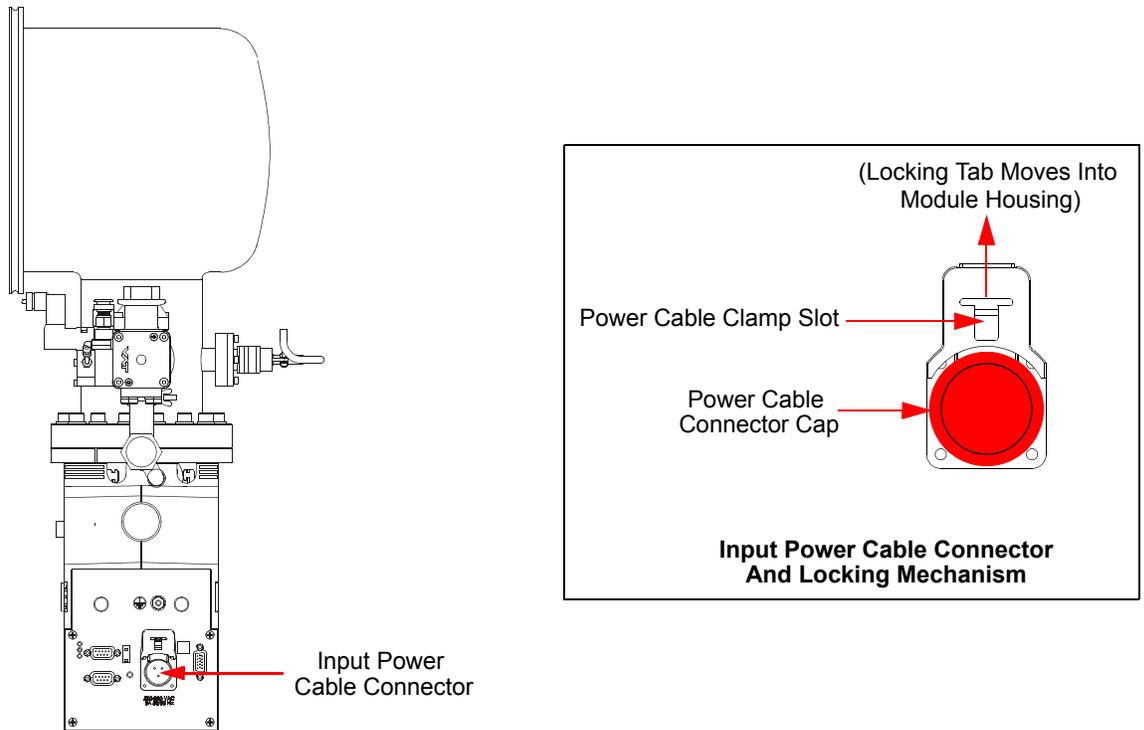
*Figure 3-6: Input Power Cable Connection Point for the
Module Power Connector*

(To Cryopump)   (To Power Source)   J1-A-HOT

J1   J1-B-HOT

J1-C-GROUND
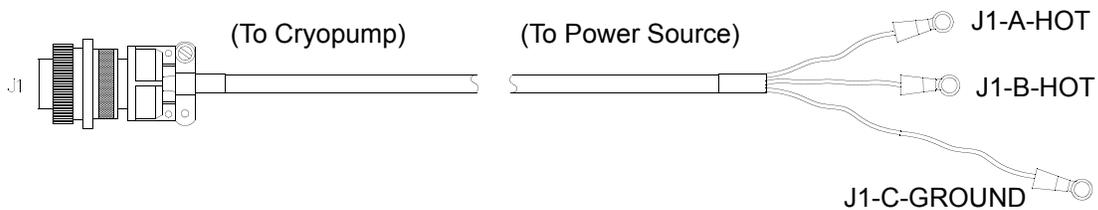
Figure 3-7: Input Power Cable

Connect the Intercomponent Network

When you connect the cryopumps to each other, use the standard network cable. For the last cryopump in the chain, use a terminated network cable. Contact Brooks Automation, if these are applicable to your system.

Refer to the **On-Board *IS* Controller Quick Installation Guide** (8040657) for information on connecting On-Board IS Cryopumps to the Intercomponent Network.

Connecting the On-Board *IS* Remote Keypad (Optional)

You may connect an On-Board *IS* Remote keypad to the On-Board *IS* Cryopump for direct communication with the cryopump. See the ***On-Board IS Remote Quick Installation Guide***, part number 8040664, for information on how to install On-Board *IS* Remote keypad, and .

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4 Starting Cryopump Operation

Overview

This section provides the minimum amount of information you need to begin using a cryopump.

For safety information about this product and safety notice conventions in this manual, see Safety on page 2-1.

For extra information about the cryopump functions, see:

- Appendix C: Theory of Cryopump Operation on page 10-4

- Appendix D: Cryopump Component Details on page 10-8

- Appendix E: Communication Module Component Details on page 10-11

Chapter Contents

Verify Equipment Installation

Ensure that all On-Board *IS* Cryopump System components are installed and connected to the Intercomponent Network before operating the process tool. See Figure 4-1 on page 4-3 for an example of a typical On-Board *IS* System.

NOTE: *Your cryopumps use the 15-pin Intercomponent Connectors, instead of the Bitbus connectors that are shown.*

These are the necessary On-Board *IS* System components:

- On-Board *IS* Cryopumps

  See the previous chapter, Chapter 3: *Installation*.

- On-Board *IS* 1000 Compressors

  Use the directions in the ***On-Board IS 1000 Compressor Quick Installation Guide*** included with each compressor.

- On-Board *IS* Controller

  Use the directions found in either the *Rack Mount* or *Pump Mount* **On-Board IS *Controller Quick Installation Guide*.

- On-Board *IS* Remote Keypad

  Use the directions found in the ***On-Board* IS *Remote Quick Installation Guide***, included with the Remote keypad.

  NOTE: *See 8040744,* On-Board *IS* 8F Cryopump with Sublime Regeneration Command Set Reference *to control the system through the RS-232 interface.*
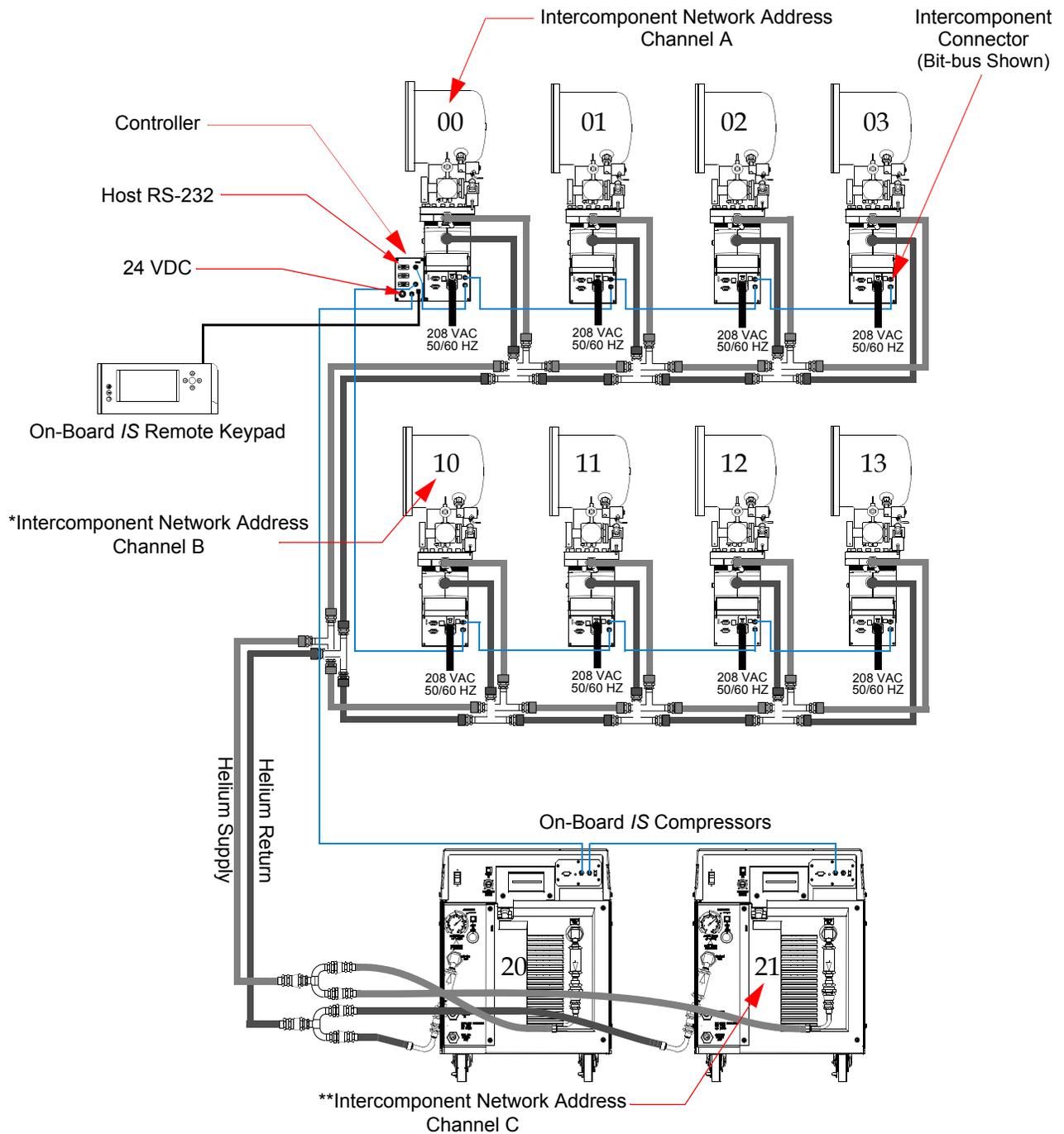
Figure 4-1: Typical On-Board IS System

NOTE: **If the address is set to 0, it appears as 10 on Channel B.
**If the address is set to 0, it appears as 20 on Channel C.*

NOTE: *Your cryopumps use the 15-pin Intercomponent Connectors, instead of the Bitbus connectors that are shown.*

Set the Intercomponent Network Addresses

The Intercomponent Network contains three channels; A, B, and C. After you properly install the system components (cryopumps, compressors, and other parts of the system), set the respective network address for each system component.

See Figure 4-1 on page 4-3 for an example of a typical intercomponent system network.

When you connect the cryopumps to each other, use the standard network cable. For the last cryopump in the chain, use a terminated network cable.

Cryopump Addresses

Set the address switch for each cryopump on channels A or B.

1.   Set the address switch for each On-Board *IS* Cryopump on channel A to the appropriate network address as shown in Figure 4-1 on page 4-3, with the address switch in Figure 4-2.

2.   Set the address switch for each On-Board *IS* Cryopump on channel B to the appropriate network address as shown in Figure 4-1 on page 4-3, with the address switch in Figure 4-2.
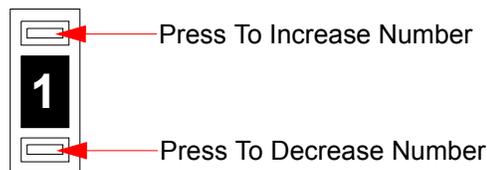
Figure 4-2: Network Address Switch for Cryopumps

3.   Note the address of each cryopump for future use.

Compressor Addresses

NOTE: *If you set the first Channel C address to 0, it appears as 20 on the Remote keypad or Host computer.*

Set the address switch for each compressor on channel C to the appropriate network address as shown in in Figure 4-1 on page 4-3, with the address switch in Figure 4-2.

Apply Power to the System

After you set the network addresses, turn power *ON* by doing the following:

1.   Set the Compressor System Circuit Breaker to the *ON* (UP) position.

2.   Set the Compressor Control Circuit Breaker to the *ON* (UP) position.

3.   Set the power switch on the front panel of the Compressors to the *ON* position.

4.   Ensure all the cryopumps are connected to a power source.

5.   Ensure your power source for the system is *ON*.

The system now has power.

Verify Cryopump and Compressor Recognition

After you set the network addresses and apply power to the system, verify that the network recognizes all system components (cryopumps, compressors, and other parts of the system). Perform the steps in this section with the On-Board *IS* Remote keypad (Remote).

For details about using the Remote, see Using the On-Board IS Remote Keypad on page 6-2.

If you do not use the Remote, see 8040744, *On-Board IS Cryopump with Sublime Regeneration Command Set Reference* to control the system through the RS-232 interface.

To verify the system recognizes the cryopump and compressors:

1.   Connect the On-Board *IS* Remote keypad to the On-Board *IS* Controller (Controller) for the system.

See the *On-Board* IS *Remote Quick Installation Guide* for rack and pump mount Controller details.

The *On-Board* IS *Controller* main screen appears.

```
┌─────────────────────────────┐
│        ON-BOARD             │
│      IS CONTROLLER          │
│                             │
│     Monitor                 │
│     Regeneration            │
│   ▶ Access Device           │
│     System Setup            │
│     Controller Info         │
│                             │
└─────────────────────────────┘
```

Figure 4-3: Controller Main Screen

2.   From the *On-Board* IS *Controller* main screen, select *Access Device*.

The *Choose Device* screen appears.

```
┌─────────────────────────────────────┐
│                                      │
│          CHOOSE DEVICE               │
│                                      │
│                                      │
│     ► Pumps              8           │
│       Compressors        2           │
│                                      │
│                                      │
│                                      │
│                                      │
└─────────────────────────────────────┘
```
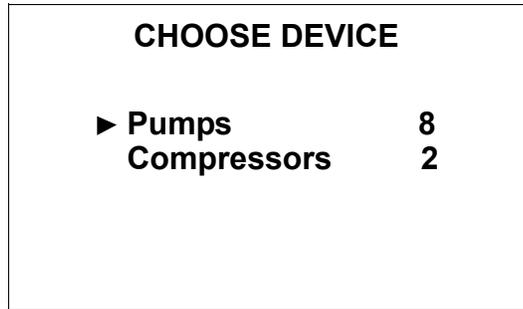
Figure 4-1: Choose Device Screen

3.   Note the number of cryopumps (*Pumps*) and compressors that are recognized by the Controller, and ensure this equals the number of components on the system.

If the number of components on the system does not equal the number in the *Choose Device* screen, check the system installation.

If the number of components on the system equals the number in the *Choose Device* screen, you may configure the Helium Maps.

Configure the Helium Maps

Choose the system components to add to each helium map as shown in Configuring Helium Maps on page 5-1, and then resume Getting Started with the section following this one.

Set the Power Fail Recovery System

After you configure the Helium Maps, you must set the Power Failure Recovery (PFR) system for each cryopump, individually. Use the Remote keypad to perform the steps in this section.

For details about using the Remote keypad, see Using the On-Board IS Remote Keypad on page 6-2.

If you do not use the Remote keypad, see 8040744, *On-Board* IS *Cryopump with Sublime Regeneration Command Set Reference* to control the system through the RS-232 interface.

To set the PFR system for **one** cryopump:

1.   Go to the main On-Board *IS* Cryopump screen on the Remote keypad.

```
┌─────────────────────────────────────┐
│  ON-BOARD IS CRYOPUMP                │
│                                      │
│      Monitor                         │
│      Regeneration                    │
│    ▶ System Setup                    │
│      Control                         │
│      Pump Info                       │
│                                      │
│                                      │
└─────────────────────────────────────┘
```
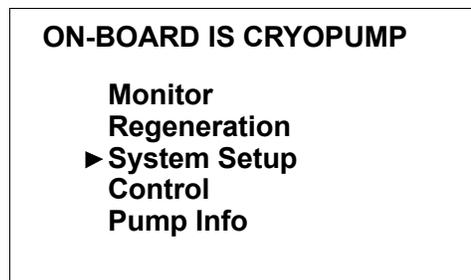
Figure 4-4: Cryopump Main Screen

If the Remote is plugged into the Controller, not a cryopump, see Open a Remote Session from the Controller on page 6-5 to get to this screen.

2.   Choose *System Setup* and press *Enter*.

The *System Setup* screen appears.

```
┌─────────────────────────────┐
│        SYSTEM SETUP         │
│                             │
│     Regeneration            │
│     Security Config         │
│     Communication           │
│   ▶ Power Failure           │
│     Pump Configuration      │
│     Display Setup           │
│                             │
└─────────────────────────────┘
```
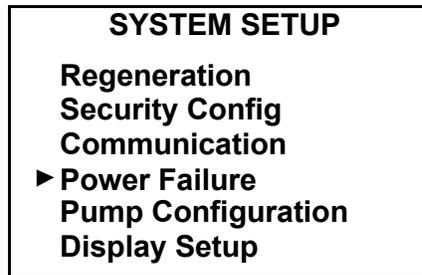
Figure 4-5: System Setup Screen

3.   Choose *Power Failure* and press *Enter*.

The *Power Failure* screen appears.

```
┌─────────────────────────────┐
│       POWER FAILURE         │
│                             │
│   Recovery         ON       │
│   Temperature (K)   260     │
│                             │
│                             │
│                             │
└─────────────────────────────┘
```
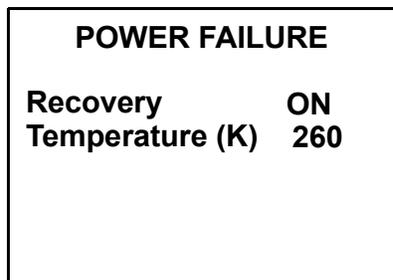
Figure 4-6: Power Failure Screen

4.   Use the arrows keys to change the *Recovery* (mode) and *Temperature* value, if you do not want to use the defaults.

5.   Follow Step 2 through Step 4 for all other cryopumps.

See Power Failure Recovery Parameters on page 7-12 for more information about these settings.

The PFR system is now set.

Start the Cryopump

With the Remote, go to the Cryopump Main screen. See Startup the Cryopump on page 6-10 for specific instructions.

For details about using the Remote, see Using the On-Board IS Remote Keypad on page 6-2.

If you do not use the Remote, see 8040744, *On-Board* IS *Cryopump with Sublime Regeneration Command Set Reference* to control the system through the RS-232 interface.

5 Configuring Helium Maps

Overview

This chapter describes setting and maintaining Helium Maps. For information about Regeneration Maps (if applicable to your system), see About a Group Full Regeneration on page 6-16.

If you configure the Helium Maps as part of the Getting Started process, return to Set the Power Fail Recovery System on page 4-8 after you finish with this chapter.

Chapter Contents

About Helium Maps

Through a Helium Map, the On-Board *IS* Controller manages when each cryopump in the system uses a shared helium manifold and compressor.

You configure maps by adding (assigning) cryopumps and compressors to different maps, or removing them from the maps.

If your system has more than one helium manifold, then you can use more than one Helium Map. You may use up to five maps on a multiple cryopump On-Board *IS* System. See Figure 5-1 for cryopumps grouped together by their corresponding compressors.

In addition to Helium Maps, some systems support Rough and Regeneration Maps. Contact Brooks Automation to determine if your system supports these maps. Also see About a Group Full Regeneration on page 6-16.
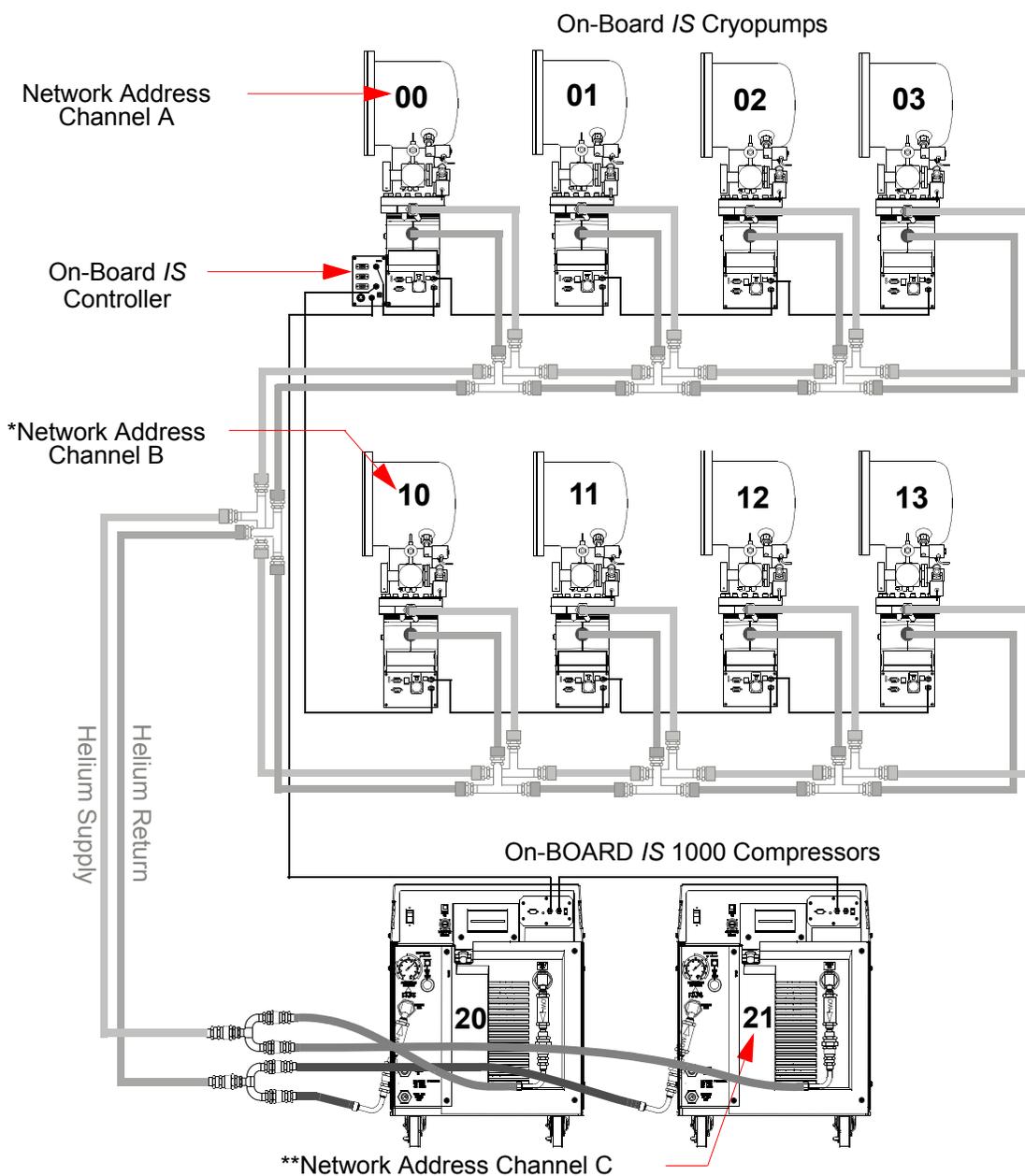
Figure 5-1: Helium Map Configuration Example

NOTE: **If the address is set to 0, it appears as 10 on Channel B.*
**If the address is set to 0, it appears as 20 on Channel C.

View Helium Maps

Before you change the configuration of cryopumps or compressors for a Helium Map, you must see the component in the map. If compnents are not visible in a Helium Map, see Attach a Cryopump to Your Vacuum System on page 3-3 and the appropriate Quick Installation Guide for the compressors.

NOTE: *If you are configuring Helium Maps, follow the steps in Configure Helium Maps on page 5-6.*

1.   Ensure the Remote keypad is connected to the Controller, to which the cryopumps are also connected.

2.   Go to the *On-Board* IS *Controller* main screen.

```
┌─────────────────────────┐
│      ON-BOARD           │
│     IS CONTROLLER       │
│                         │
│  ▶ Monitor              │
│    Regeneration         │
│    Access Device        │
│    System Setup         │
│    Controller Info      │
│                         │
└─────────────────────────┘
```

Figure 5-2: On-Board IS *Controller Main Screen*

3.   Choose *Monitor* and press *Enter*.

The *Monitor Network* screen appears.

```
┌─────────────────────────┐
│   MONITOR NETWORK       │
│                         │
│   Network Status        │
│   Show Devices          │
│   Show Regen Setup      │
│  ▶ Helium               │
│                         │
└─────────────────────────┘
```
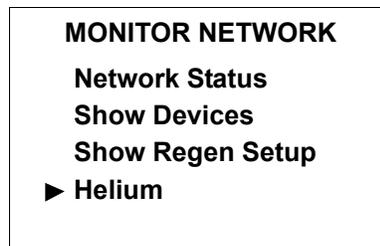
Figure 5-3: Monitor Network Screen

4.   Choose *Helium* and press *Enter*.

The *Helium Management* screen appears.

```
┌─────────────────────────────┐
│  HELIUM MANAGEMENT          │
│                             │
│  ► Show Helium Maps         │
│                             │
│                             │
│                             │
└─────────────────────────────┘
```
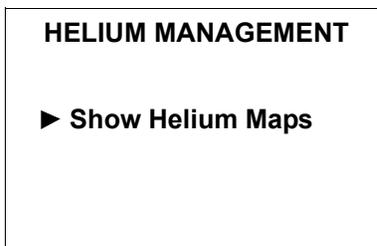
Figure 5-4: Helium Management Screen

5.   Choose *Show Helium Maps* and press *Enter*.

The *Helium Map 1* screen appears.

```
┌─────────────────────────────┐
│      HELIUM MAP 1           │
│  00     02     04     05    │
│  14     15     16     20    │
│  20                         │
│                             │
│       ► Next Map            │
└─────────────────────────────┘
```
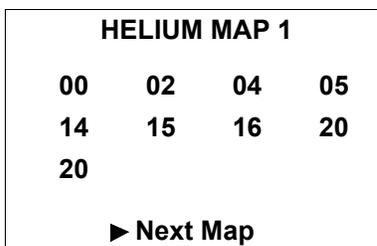
Figure 5-5: Helium Map 1 Screen

6.   Choose *Next Map* and press *Enter* to see Helium Maps 2 through 5, in sequence.

You can use this information to decide which cryopumps and compressors to add or remove from each Helium Map as necessary.

Configure Helium Maps

You can configure Helium Maps by adding or removing cryopumps and compressors from them.

To configure a Helium Map:

1. Note the addresses of the cryopumps and compressors that you want to add or remove from a Helium Map.

2. Ensure the Remote keypad is connected to the Controller, to which the cryopumps are also connected.

3. Go to the *On-Board* IS *Controller* screen.

```
ON-BOARD
IS CONTROLLER

Monitor
Regeneration
Access Device
► System Setup
Controller Info
```

Figure 5-6: On-Board IS *Controller Screen*

4. Choose *System Setup* and press *Enter*.

The *System Setup* screen appears.

```
SYSTEM SETUP
Regeneration
Password
Communication
► Helium
Display Setup
```
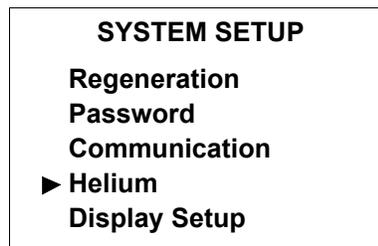
Figure 5-7: System Setup Screen

5.   Choose *Helium* and press *Enter*.

The *Helium* screen appears.

```
┌─────────────────────────────┐
│          HELIUM             │
│                             │
│ ► Helium Map      1         │
│                             │
│                             │
│                             │
│                             │
└─────────────────────────────┘
```
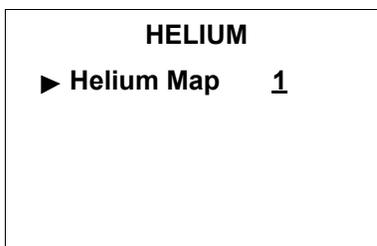
Figure 5-8: Helium Screen

NOTE: *Use the arrow buttons on the Remote keypad to choose any Helium Map number recognized by the system.*

6.   Choose *Helium Map* and press *Enter*.

The *Choose Map Pumps* screen appears.

```
┌─────────────────────────────┐
│     CHOOSE MAP PUMPS        │
│ ►■ 00   □ 01  ■ 02  □ 03    │
│  ■ 04   ■ 05  □ 06  □ 07    │
│  □ 08   ■ 14  ■ 15  ■ 16    │
│  □ 17                       │
│      ACCEPT CHANGE          │
└─────────────────────────────┘
```
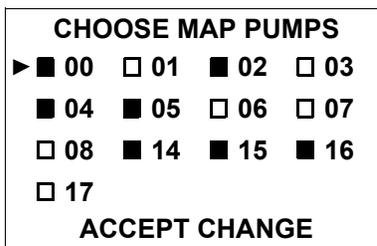
Figure 5-9: Choose Map Pumps Screen

7.   Use the Remote keypad arrow buttons to navigate to the addresses of the cryopumps you want to add or remove from the Helium Map. Use the *Enter* button to mark the boxes of the cryopump addresses.

8. After you mark all the cryopump addresses you want to add or remove from the Helium Map, navigate to *Accept Change*, and press *Enter*.

The *Choose Compressors* screen appears.

```
┌─────────────────────────────┐
│   CHOOSE COMPRESSORS         │
│  ►■ 20   □ 21   ■ 22         │
│                             │
│                             │
│                             │
│       ACCEPT CHANGE         │
└─────────────────────────────┘
```
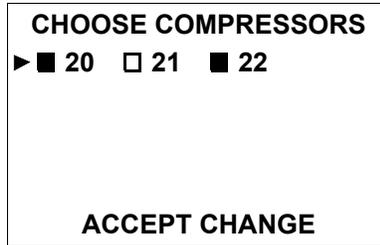
Figure 5-10: Choose Compressors Screen

9. Use the Remote keypad arrow buttons to navigate to the addresses of the compressors you want to add or remove from the Helium Map. Use the *Enter* button to mark the boxes of the compressor addresses.

10. After you mark all the compressor addresses you want to add or remove from the Helium Map, navigate to *Accept Change*, and press *Enter*.

The *Verify Helium Map 1* screen appears.

```
┌─────────────────────────────┐
│  VERIFY HELIUM MAP 1        │
│  Pumps/Compressors:         │
│  00    02    04    05       │
│  14    15    16             │
│  20    22                   │
│  ►ACCEPT CHANGE             │
└─────────────────────────────┘
```
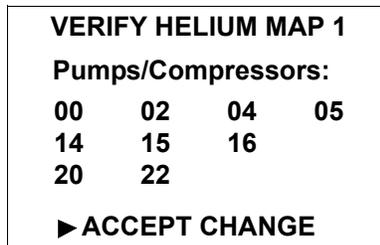
Figure 5-11: Verify Helium Map 1 Screen

This screen shows the cryopumps and compressors that belong to Helium Map 1.

11. If the correct cryopumps are in Helium Map 1, press *Enter*.

If the cryopumps and/or the compressors are not correct in Helium Map 1, press *Back*, and then perform Step 7 through Step 11 again.

You have successfully configured a Helium Map.

6   Using the Cryopump

Overview

This chapter explains how to operate the cryopump through the Remote keypad, and when and why you should perform different types of regeneration.

Chapter Contents

Using the On-Board *IS* Remote Keypad

You can use the On-Board *IS* Remote keypad (Remote) to control the cryopump and other system components individually through the component itself, or system-wide through the On-Board *IS* Controller (Controller).

Plug in the Remote to the component you want to use. See the *On-Board* IS *Remote Quick Installation Guide* for rack and pump mount Controller details.

The Remote screen changes as you choose different menu items with the buttons.
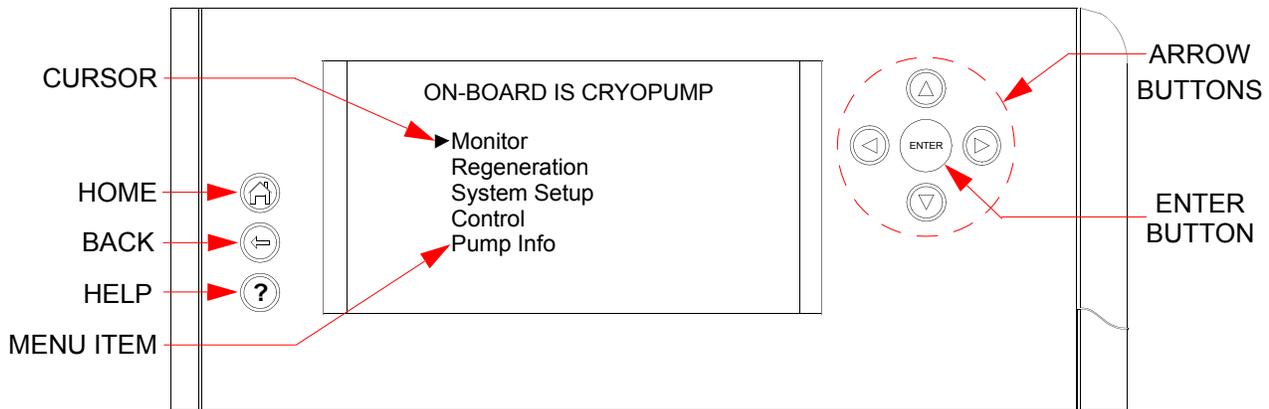
Figure 6-1: On-Board IS *Remote Keypad*

Select Items on the Remote Screen

Select screens and change values the same way for every screen that appears on the Remote (see Figure 6-1). To select a screen and change values:

1.   Use the arrow buttons to move the cursor to an item on the screen.

2.   Press the **ENTER** button to select the item.

The selected screen appears or the action is completed, as appropriate.

NOTE: *After the Remote is idle for 15 minutes, a screen saver appears, and dims the display to its lowest level of brightness. Press any button on the remote display to turn off the screen saver and return the screen to its normal level of brightness.*

Change Parameters on the Remote

The following instructures are an example of how to change parameters on applicable screens.

1. Use the arrow buttons to move the cursor (an arrow) to a menu item on the screen.

```
┌──────────────────────────────┐
│        SYSTEM SETUP          │
│                              │
│      Regeneration            │
│      Security Config         │
│    ▶ Communication           │
│      Power Failure           │
│      Pump Configuration      │
│      Display Setup           │
└──────────────────────────────┘
```
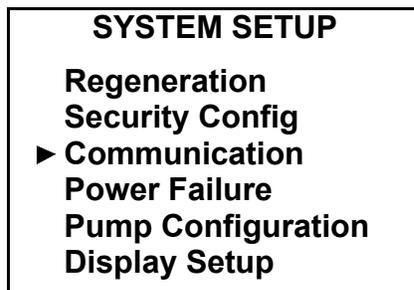
Figure 6-2: Select a Menu Item

2. Press the **ENTER** button to select the menu item.

   The selected screen appears or the action is completed, as appropriate.

```
┌──────────────────────────────┐
│       COMMUNICATION          │
│     Set Port Baud Rate       │
│                              │
│    ▶ Host        9600        │
│      Service     9600        │
│                              │
└──────────────────────────────┘
```
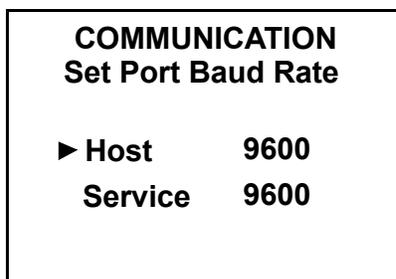
Figure 6-3: Menu Item Screen

3. Use the arrow buttons to move the cursor to the menu item for the value you want to change.

4. Press the **ENTER** button. The value is underlined.

```
┌──────────────────────────────┐
│       COMMUNICATION          │
│     Set Port Baud Rate       │
│                              │
│      Host       9600         │
│      Service    9600         │
│                              │
└──────────────────────────────┘
```
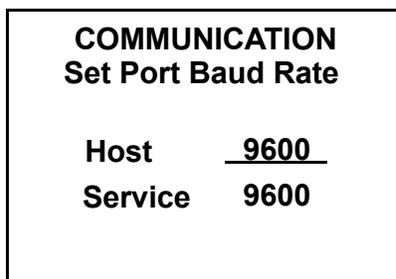
Figure 6-4: Select a Value

5. Use the arrow buttons to change the value.

In this example, each time you press the up or down arrow buttons, the value changes to 2400, 9600, 19200, or 38400.

```
┌─────────────────────────────┐
│        COMMUNICATION        │
│      Set Port Baud Rate     │
│                             │
│     Host        19200       │
│     Service     9600        │
│                             │
│                             │
└─────────────────────────────┘
```

Figure 6-5: Change the Value

6.   Press the **ENTER** button. The new value remains, and the cursor appears to the left of the menu item.

```
┌─────────────────────────────┐
│        COMMUNICATION        │
│      Set Port Baud Rate     │
│                             │
│    ► Host       19200       │
│      Service    9600        │
│                             │
│                             │
└─────────────────────────────┘
```

Figure 6-6: New Value is Set

The new value is now set.

NOTE: *After the Remote is idle for 15 minutes, a screen saver appears, and dims the display to its lowest level of brightness. Press any button on the remote display to turn off the screen saver and return the screen to its normal level of brightness.*

Open a Remote Session from the Controller

You can access an individual cryopump through the Controller by opening a Remote Session with the cryopump.

To open a Remote Session from the Controller for a cryopump:

1.   Note the network address of the cryopump for which you want to open a Remote Session.

2.   Go to the *On-Board* IS *Controller* screen on the Remote keypad.

```
┌─────────────────────────────┐
│         ON-BOARD            │
│       IS CONTROLLER         │
│                             │
│       Monitor               │
│       Regeneration          │
│     ► Access Device         │
│       System Setup          │
│       Controller Info       │
└─────────────────────────────┘
```

Figure 6-7: On-Board IS *Controller Screen*

3.   Choose *Access Device* and press *Enter*.

The *Choose Device* screen appears.

```
┌─────────────────────────────┐
│       CHOOSE DEVICE         │
│                             │
│                             │
│   ► Pumps          8        │
│     Compressors    2        │
│                             │
│                             │
└─────────────────────────────┘
```
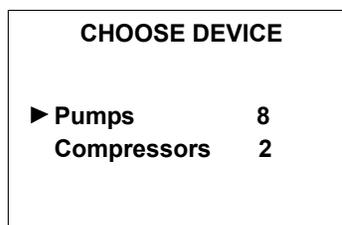
Figure 6-8: Choose Device Screen

4.   Choose *Pumps* and press *Enter*.

The *Network Pumps* screen appears. You can navigate to all cryopump Remote screens from this one.

```
┌─────────────────────────────┐
│    NETWORK PUMPS            │
│                             │
│  ▶ 00  01  02  03  04       │
│    05  06  07  14           │
│                             │
│                             │
│                             │
└─────────────────────────────┘
```
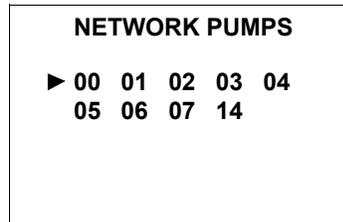
Figure 6-9: Network Pumps Screen

5.   Use the Remote keypad arrows to navigate to the cryopump network address (as noted in Step 1), and press *Enter*.

The *On-Board* IS *Cryopump* screen appears.

```
┌─────────────────────────────┐
│  ON-BOARD IS CRYOPUMP       │
│                             │
│    ▶ Monitor                │
│      Regeneration           │
│      System Setup           │
│      Control                │
│      Pump Info              │
│                             │
└─────────────────────────────┘
```
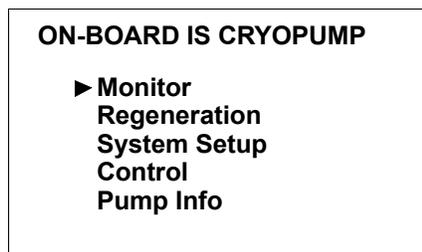
Figure 6-10: On-Board IS *Cryopump Screen*

The Remote Session is now open.

Close a Remote Session from the Controller

To the close the Remote Session:

1.   During a Remote Session, press the Back button on the Remote keypad until you see the following *Close Remote Session* screen.

```
┌─────────────────────────┐
│CLOSE REMOTE SESSION     │
│                         │
│      Are you sure?      │
│                         │
│            No           │
│         ▶ Yes           │
│                         │
│                         │
└─────────────────────────┘
```
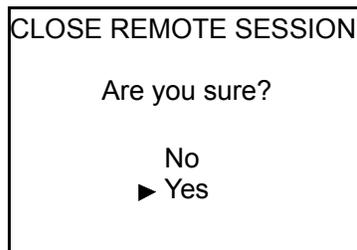
Figure 6-11: Close Remote Session Screen

2.   Choose *Yes*, and press *Enter*.

The cryopump Remote Session closes, and you can use the Controller screens for the system again.

About Regeneration and the Cryopump

The On-Board *IS* Cryopump with Sublime Regeneration is a capture pump; it cryogenically condenses gases (creating frost), then warms and eliminates them from the vacuum system during *regeneration*. Typically, you should plan regeneration to coincide with the routine maintenance of a cryopump system, but you can start regeneration any time.

Regeneration incorporates several parameters that are pre-set at the factory, such as *sublime temperature* (K). For a list of the default regeneration parameters, see Appendix B: Default Parameters (Values) on page 10-3.

> ⚠ **WARNING**
>
> **Toxic Materials**
>
> Internal surfaces of the cryopump may contain process-specific toxic or corrosive materials, even after regeneration is complete. Adhere to all safety protocols as appropriate, and avoid touching internal surfaces.

The On-Board *IS* Cryopump with Sublime Regeneration uses three different regeneration types: Startup, Sublime, and Shutdown. Use each type to complete a specific task or in a specific situation according to the following definitions.

Startup:
The cryopump starts cooling. Use Startup to start the cryopump for the first time or to re-start it after a Shutdown. See Startup the Cryopump on page 6-10 for instructions.

Sublime Regeneration:
The cryopump stops cooling, warms enough to eliminate the frost that was trapped since the last regeneration, remains below atmospheric pressure, and then cools to the operating temperature. See Perform a Regeneration on One Cryopump on page 6-13 for instructions.

Shutdown:
The cryopump starts a Sublime Regeneration. Use Shutdown to stop the cooling and pumping, but maintain pressure as it warms. After the cryopump detects a specific internal pressure, it warms to ambient temperature. See Shutdown the Cryopump on page 6-17 for instructions.

Group Full Regeneration:

NOTE: *On-Board IS Cryopumps with Sublime Regeneration are not included in a Group Full Regeneration, but you can see the option on Remote keypad screens.*

The system starts a Sublime Regeneration. Use a Group Full Regeneration to coordinate rough manifold sharing (if applicable) for all cryopumps on the system that regenerate at the same time. See for instructions.

Group Fast Regeneration:

NOTE: *On-Board IS Cryopumps with Sublime Regeneration are not included in a Group Fast Regeneration, but you can see the option on Remote keypad screens.*

The system starts a Partial Warmup with Cooldown (a regeneration type) and coordinates rough pump and purge valve sharing (if applicable) for all cryopumps on the system that regenerate at the same time.

Startup the Cryopump

Use Startup to start the cryopump for the first time or to re-start it after a Shutdown.

To Startup each cryopump individually:

1.   Go to the *On-Board* IS *Cryopump* screen on the Remote keypad.

```
ON-BOARD IS CRYOPUMP

    Monitor
    Regeneration
    System Setup
  ▶ Control
    Pump Info
```

Figure 6-12: Cryopump Main Screen

If the Remote is plugged into the Controller, see Open a Remote Session from the Controller on page 6-5 to get to this screen.

2.   Choose *Control* and press *Enter*.

The *Control* screen appears.

```
        CONTROL

  ▶ Pump
    Valves
    Temperature
```

Figure 6-13: Control Screen

3.   Choose *Pump* and press *Enter*.

The *Pump Control* screen appears.

```
┌─────────────────────────┐
│     PUMP CONTROL        │
│                         │
│   Motor          OFF    │
│   HFI Status      OK    │
│ ► Startup               │
│   Shutdown              │
│                         │
│                         │
└─────────────────────────┘
```
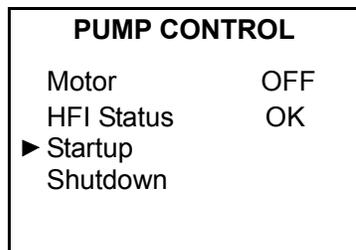
Figure 6-14: Pump Control Screen

4.   Choose *Startup* and press *Enter*.

The *Startup Regeneration* screen appears.

```
┌─────────────────────────┐
│     This will start a   │
│   Startup Regeneration  │
│                         │
│     Do you want to      │
│        proceed?         │
│          No             │
│        ► Yes            │
│                         │
└─────────────────────────┘
```
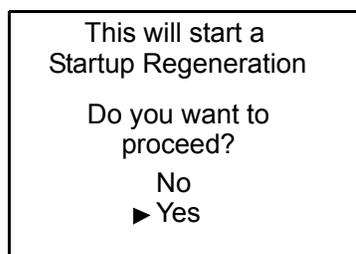
Figure 6-15: Startup Regeneration Screen

5.   Choose *Yes* and press *Enter*.

The *Regeneration Status* screen for *Warmup* appears.

```
┌─────────────────────────┐
│  REGENERATION STATUS    │
│    Startup in Progress  │
│                         │
│  Warmup                 │
│    1st Stage  (K)   290 │
│    Target (K)       310 │
│                         │
│         ABORT           │
└─────────────────────────┘
```
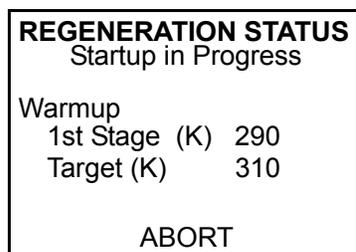
Figure 6-16: Regeneration Status Screen: Warmup

The *Actual* temperature rises until it meets the *Target* First Stage temperature, and then the motor begins cooling the cryopump.

The *Regeneration Status* screen for *Cooldown* appears.

```
REGENERATION STATUS
  Startup in Progress

Cooldown
  2nd Stage  (K)   290
  Target  (K)       18


      ABORT
```

Figure 6-17: Regeneration Status Screen: Cooldown

The *Actual* temperature decreases until it meets the *Target* temperature, then regeneration is idle (finished).

The *Regeneration Status* screen for *Idle* shows when Regeneration is finished.

```
REGENERATION STATUS
      IDLE

  Startup Complete

Pump              ON
2nd Stage (K)     16
```

Figure 6-18: Regeneration Status Screen: Idle

The cryopump starts regular operation.

Perform a Regeneration on One Cryopump

To start a regeneration (Sublime Regeneration):

1.   Go to the *On-Board* IS *Cryopump* screen on the Remote keypad.

```
ON-BOARD IS CRYOPUMP

    Monitor
  ►Regeneration
    System Setup
    Control
    Pump Info
```
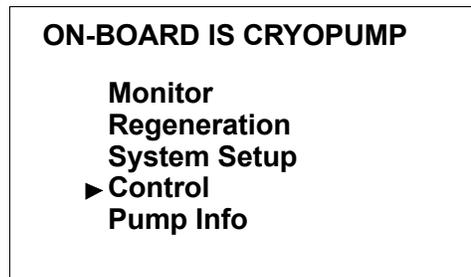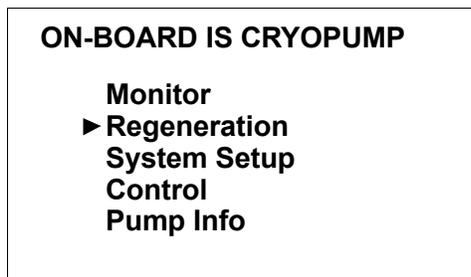
Figure 6-19: Cryopump Main Screen

If the Remote is plugged into the Controller, see Open a Remote Session from the Controller on page 6-5 to get to this screen.

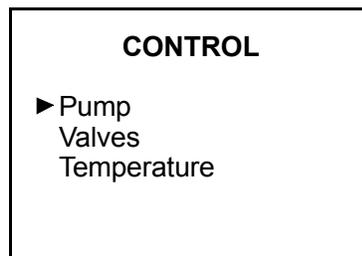2.   Choose *Regeneration* and press *Enter*.

The *Start Sublime Regen* screen appears.

```
START SUBLIME REGEN

    Are you sure?
        No
      ►Yes
```
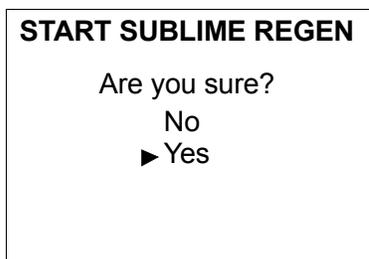
Figure 6-20: Start Sublime Regen Screen

3.   Choose *Yes* and press *Enter*.

The system performs a regeneration, and a *Regeneration Status* screen appears for each regeneration cycle.

NOTE: *Some regeneration cycles may last for two hours or more, depending on your application.*

```
┌─────────────────────────────┐
│   REGENERATION STATUS       │
│    Sublime in Progress      │
│                             │
│ Warmup                      │
│   1st Stage (K)       107   │
│   Target (K)          230   │
│                             │
│                             │
│        ►ABORT               │
└─────────────────────────────┘
```

Figure 6-21: Regeneration Status Screen, Warmup

```
┌─────────────────────────────┐
│   REGENERATION STATUS       │
│    Sublime in Progress      │
│                             │
│ Sublime                     │
│   Actual (u)          100   │
│   Target (u)          200   │
│                             │
│                             │
│        ►ABORT               │
└─────────────────────────────┘
```

Figure 6-22: Regeneration Status Screen, Sublime

```
┌─────────────────────────────┐
│   REGENERATION STATUS       │
│    Sublime in Progress      │
│                             │
│ Roughing                    │
│   Actual (u)         1865   │
│   Target (u)          100   │
│                             │
│                             │
│        ►ABORT               │
└─────────────────────────────┘
```

Figure 6-23: Regeneration Status Screen, Rough

Actual and *Target* values in the previous figure indicate pressure measured in microns.

```
┌─────────────────────────────────┐
│   REGENERATION STATUS           │
│      Sublime in Progress        │
│                                 │
│  Cooldown                       │
│     2nd Stage (K)        230    │
│     Target (K)            18    │
│                                 │
│                                 │
│          ►ABORT                 │
└─────────────────────────────────┘
```
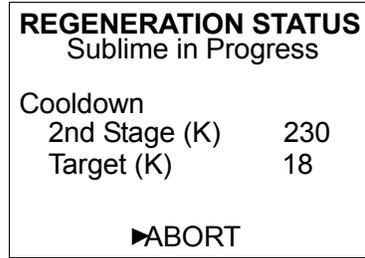
Figure 6-24: Regeneration Status Screen, Cooldown

The *Regeneration Status* screen shows when regeneration is finished.

```
┌─────────────────────────────────┐
│   REGENERATION STATUS           │
│         IDLE                    │
│                                 │
│      Sublime Complete           │
│                                 │
│  Pump                   ON      │
│  2nd Stage (K)          16      │
│                                 │
└─────────────────────────────────┘
```
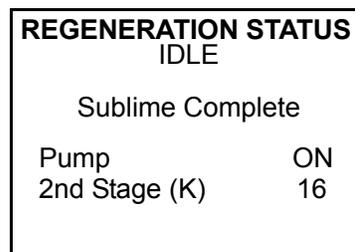
Figure 6-25: Regeneration Status Screen, Idle

The cryopump continues regular operation.

About a Group Full Regeneration

NOTE: *Contact Brooks Automation to determine if your system is capable of a Group Full Regeneration.*

Use a Group Full Regeneration to coordinate rough valve and rough manifold sharing (if applicable) for all cryopumps on the system that regenerate at the same time.

An On-Board *IS* Cryopump System can have up to five Regeneration Groups or Maps. When the regeneration starts, the Controller coordinates the rough manifold for each Regeneration Group and Rough Map.

Shutdown the Cryopump

Use Shutdown to stop the cooling and pumping, but maintain pressure as it warms. After the cryopump detects a specific internal pressure, it warms to ambient temperature.

To Shutdown the cryopump:

1.   Go to the *On-Board* IS *Cryopump* screen on the Remote keypad.

```
ON-BOARD IS CRYOPUMP

    Monitor
    Regeneration
    System Setup
  ► Control
    Pump Info
```

Figure 6-26: Cryopump Main Screen

If the Remote is connected to the Controller, see Open a Remote Session from the Controller on page 6-5 to get to this screen.

2.   Choose *Control* and press *Enter*.
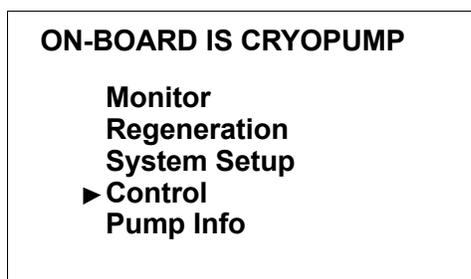
The *Control* screen appears.

```
         CONTROL

  ► Pump
    Valves
    Temperature
```
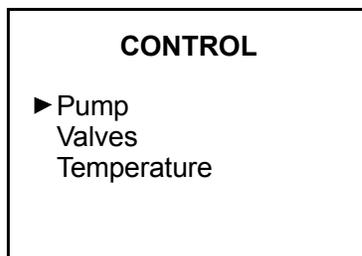
Figure 6-27: Control Screen

3. Choose *Pump* and press *Enter*.

The *Pump Control* screen appears.

```
┌─────────────────────────────┐
│      PUMP CONTROL           │
│                             │
│  Motor            On        │
│  HFI Status       OK        │
│  Startup                    │
│ ▶ Shutdown                  │
│                             │
│                             │
└─────────────────────────────┘
```
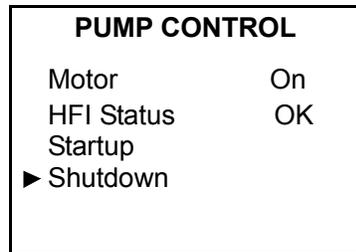
Figure 6-28: Pump Control Screen

4. Choose *Shutdown* and press *Enter*.

The *Sublime Shutdown* screen appears.

```
┌─────────────────────────────┐
│     This will start a       │
│    Sublime Shutdown.        │
│                             │
│     Do you want to          │
│       proceed?              │
│         No                  │
│      ▶ Yes                  │
│                             │
└─────────────────────────────┘
```

Figure 6-29: Sublime Shutdown Screen

5. Choose *Yes* and press *Enter*.

Several different *Regeneration Status* screens appear as the cryopump:

- warms to 230 K

- monitors the pressure

- begins the rough pumping

- warms the first stage

- warms the second stage

The first screen is the *Regeneration Status* screen to *Warmup* to 230K.

```
REGENERATION STATUS
  Shutdown in Progress

Warmup
  1st Stage  (K)    109
  Target (K)        230


      ABORT
```

Figure 6-30: Regeneration Status Screen: Warmup (First)

The *1st Stage* temperature rises until it meets the *Target* temperature, and then the cryopump monitors the pressure for the *Sublime* part of regeneration.
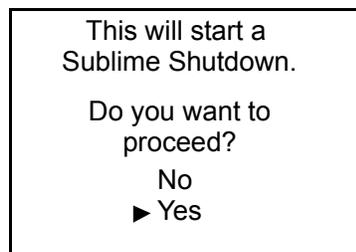
The second screen is the *Regeneration Status* screen to *Sublime*.

```
REGENERATION STATUS
  Shutdown in Progress

Sublime
  Actual  (u)        0
  Target (u)        200


      ABORT
```

Figure 6-31: Regeneration Status Screen: Sublime

The *Actual* pressure falls until it meets the *Target* pressure, and then the cryopump is ready for the rough pump.

The third screen is the *Regeneration Status* screen for *Roughing*.

```
REGENERATION STATUS
  Shutdown in Progress

Roughing
  Actual  (u)       526
  Target  (u)       100


      ABORT
```

Figure 6-32: Regeneration Status Screen: Roughing

The rough pump starts pumping gas out of the cryopump. The *Actual* pressure decreases until it meets the *Target* pressure, and then the cryopump is ready to warm up the first stage.

The fourth screen is the *Regeneration Status* screen to *Warmup* the first stage.

```
┌─────────────────────────────┐
│   REGENERATION STATUS       │
│    Shutdown in Progress     │
│                             │
│ Warmup                      │
│    1st Stage  (K)    230    │
│    Target (K)        310    │
│                             │
│                             │
│        ABORT                │
└─────────────────────────────┘
```

Figure 6-33: Regeneration Status Screen: Warmup (Second)

The *1st Stage* temperature rises until it meets the *Target* temperature, and then the cryopump can warm the second stage.

The fifth screen is the *Regeneration Status* screen to *Warmup* the second stage.

```
┌─────────────────────────────┐
│   REGENERATION STATUS       │
│    Shutdown in Progress     │
│                             │
│ Warmup                      │
│    2nd Stage  (K)    100    │
│    Target (K)        280    │
│                             │
│                             │
│        ABORT                │
└─────────────────────────────┘
```

Figure 6-34: Regeneration Status Screen: Warmup (Third)

The *2nd Stage* temperature rises until it meets the *Target* temperature, and then Regeneration is finished.

The *Regeneration Status* screen shows when Regeneration is finished.

```
┌─────────────────────────────┐
│   REGENERATION STATUS       │
│         IDLE                │
│                             │
│     Shutdown Complete       │
│                             │
│  Pump              OFF      │
│  2nd Stage   (K)   285      │
│                             │
└─────────────────────────────┘
```

Figure 6-35: Regeneration Status Screen, Idle

The cryopump is at ambient pressure and temperature.

7   About Cryopump Remote Screens

Overview

This chapter shows all the Remote screens you can see through the cryopump or the
Controller, using the On-Board *IS* Remote keypad (the Remote).

Chapter Contents

About Local Cryopump Remote Screens

Local Remote screens are specific to one cryopump, as opposed to using system Remote screens for multiple system components.

You can access local Remote screens when you connect the Remote keypad into the Controller (see About the Main Controller Screen and Functions on page 8-3), for individual cryopumps.

See the following sections for descriptions of all cryopump local Remote screens.

About the Cryopump Main Screen and Functions

The following figure shows the cryopump main screen (home screen) after you plug the Remote directly into an On-Board *IS* Cryopump.

```
ON-BOARD IS CRYOPUMP

  ▶ Monitor
    Regeneration
    System Setup
    Control
    Pump Info
```
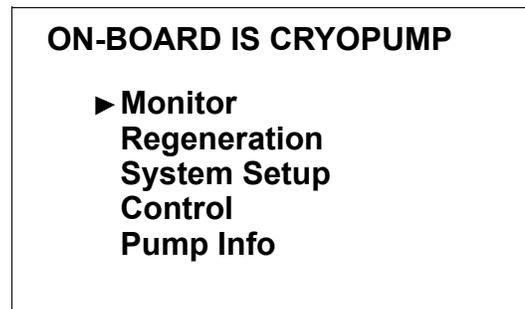
Figure 7-1: Cryopump (Main) Screen

Each function on the main screen leads to other screens, from which you can see the status and re-configure cryopump processes. These are the basic purposes of each cryopump function:

Monitor

Use the Monitor function to view the cryopump data and configuration status of the cryopump. Refer to the Monitor Screens on page 7-4 within this section for more information.

Regeneration

Use the Regeneration function to establish regeneration cycle information. Refer to Regeneration Screens on page 7-7 within this section for more information.

System Setup

Use the System Setup function to change and display the configuration of the cryopump. Refer to System Setup Screens on page 7-9 within this section for more information.

Control

Use the Control function to see the settings for the cryopump, valves, and temperature. You can also clear an HFI trip and initiate a Startup or Shutdown. Refer to Control Screens on page 7-14 within this section for more information.

Pump Info

Use the Pump Info function to see the serial number, address and other information about the cryopump. Refer to Cryopump Information Screen on page 7-17 within this section for more information.

Monitor Screens

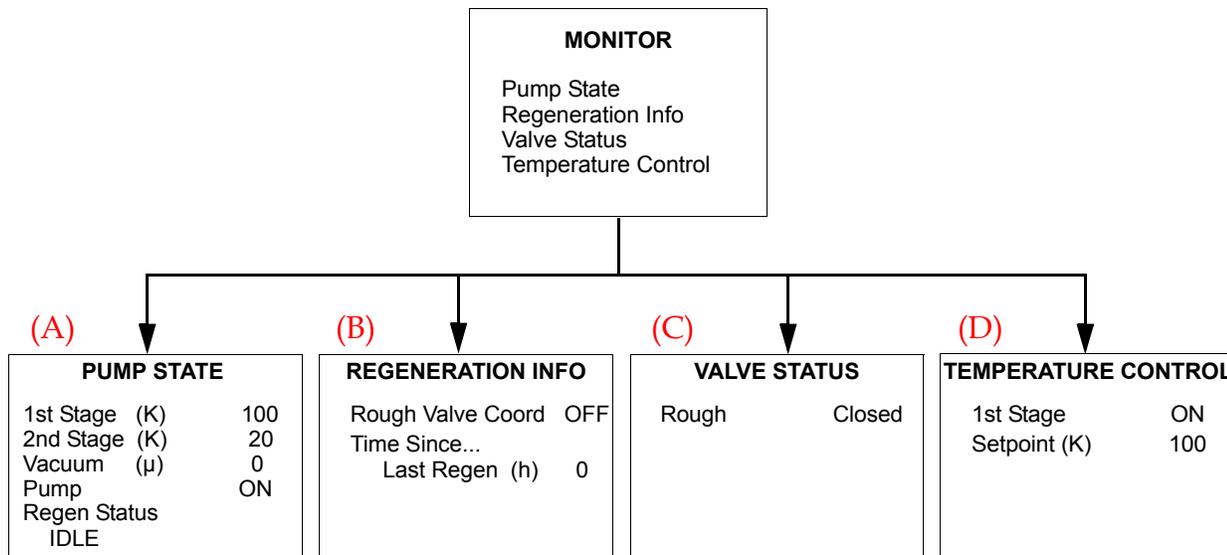To view activity for this cryopump, choose any *Monitor* screen item.

```
                    ┌──────────────────────────┐
                    │         MONITOR          │
                    │                          │
                    │  Pump State              │
                    │  Regeneration Info       │
                    │  Valve Status            │
                    │  Temperature Control     │
                    └──────────────────────────┘
```

(A)　　　　　　　　(B)　　　　　　　　(C)　　　　　　　　(D)

PUMP STATE		REGENERATION INFO		VALVE STATUS		TEMPERATURE CONTROL	
1st Stage (K)	100	Rough Valve Coord	OFF	Rough	Closed	1st Stage	ON
2nd Stage (K)	20	Time Since...				Setpoint (K)	100
Vacuum (µ)	0	Last Regen (h)	0				
Pump	ON						
Regen Status							
IDLE							

Figure 7-2: Cryopump Monitor Screens

NOTE: *You cannot change any settings when you view Monitor screens. They show the current status of the cryopump.*

The following table briefly describes each part of the Monitor screens, including parameters set by the cryopump (system) or parameters set by you (user). The letter preceding the screen name corresponds to the letter above each screen in Figure 7-2.

Table 7-1: Monitor Definitions, by Screen

Screen Name	Screen Component	Set by System or Set by User	*Parameter* and (Explanation)
(A) Pump State	1st Stage (in Kelvin, K)	System	*OPN* (temperature sensor is open) 5K to 350K, actual temperature range *SHO* (temperature sensor is shorted)
	2nd Stage (in Kelvin, K)	System	*OPN* (temperature sensor is open) 5K to 350K, actual temperature range *SHO* (temperature sensor is shorted)
	Vacuum (pressure in microns, μ)	System	0μ to 999μ
	Pump	System	*On* (motor is running and cryopump is operating) *Off* (motor is not running and cryopump is not operating)
	Regen Status	System	*Warmup in progress, Sublime in progress, Shutdown in progress, Idle* (See Perform a Regeneration on One Cryopump on page 6-13.)
(B) Regeneration Info	Rough Valve Coord	System	*On, Off*
	Time Since Last Regen (in hours, h)	System	*[XXX]* (Time since last Startup, Sublime, or Shutdown.)
(C) Valve Status	Rough	System	Open, Closed

Table 7-1: Monitor Definitions, by Screen

Screen Name	Screen Component	Set by System or Set by User	*Parameter* and (Explanation)
(D) Temperature Control	1st Stage	System	On, Off
	Setpoint	System	(Uses setpoint during Temperature Control. See Valve Control and Temperature Control Screens on page 7-16.)

Regeneration Screens

To view and set the Regeneration activities (functions) for this cryopump, use the *Regeneration* screens.

NOTE: *The screen is password protected if the security is set. See Security Parameters on page 7-11 to set a password.*

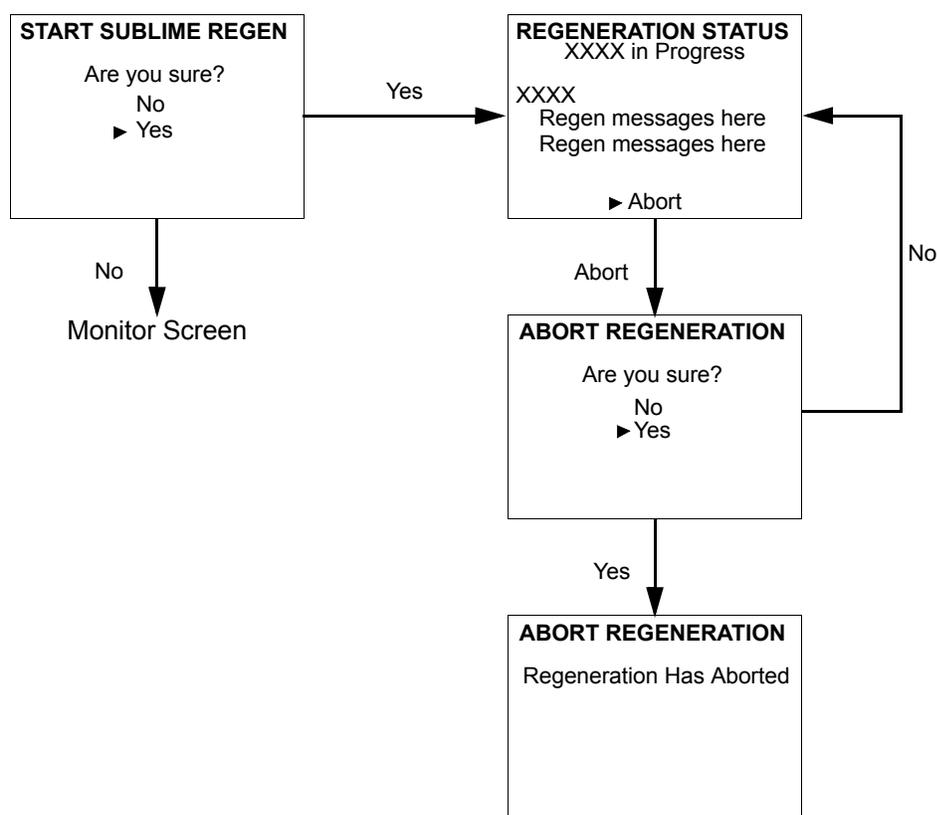If Regeneration is **idle**, If Regeneration is **running**,
then this screen appears: then this screen appears:

Figure 7-3: Cryopump Regeneration Screens

NOTE: *On the screens, XXXX could mean Startup, Sublime, Roughing, Shutdown, or Warmup.*

The following table briefly describes each part of the *Regeneration* screens, including the action that occurs after you choose an item on the screen. The following table corresponds to each screen in Figure 7-3.

Table 7-2: Regeneration Definitions, by Screen

Screen Name	Screen Component Choice	Action
Start Sublime Regen	Yes	Starts regeneration.
	No	Returns to Monitor screen.
Regeneration Status	XXXX in Progress	Continues Regeneration.
	Abort	Gives you the option of stopping the regeneration.
Abort Regeneration	Yes	Stops the regeneration.
	No	Does not stop the regeneration.

System Setup Screens

Through the System Setup, you can manage regeneration, security, communication rates, power failure, and Remote display.
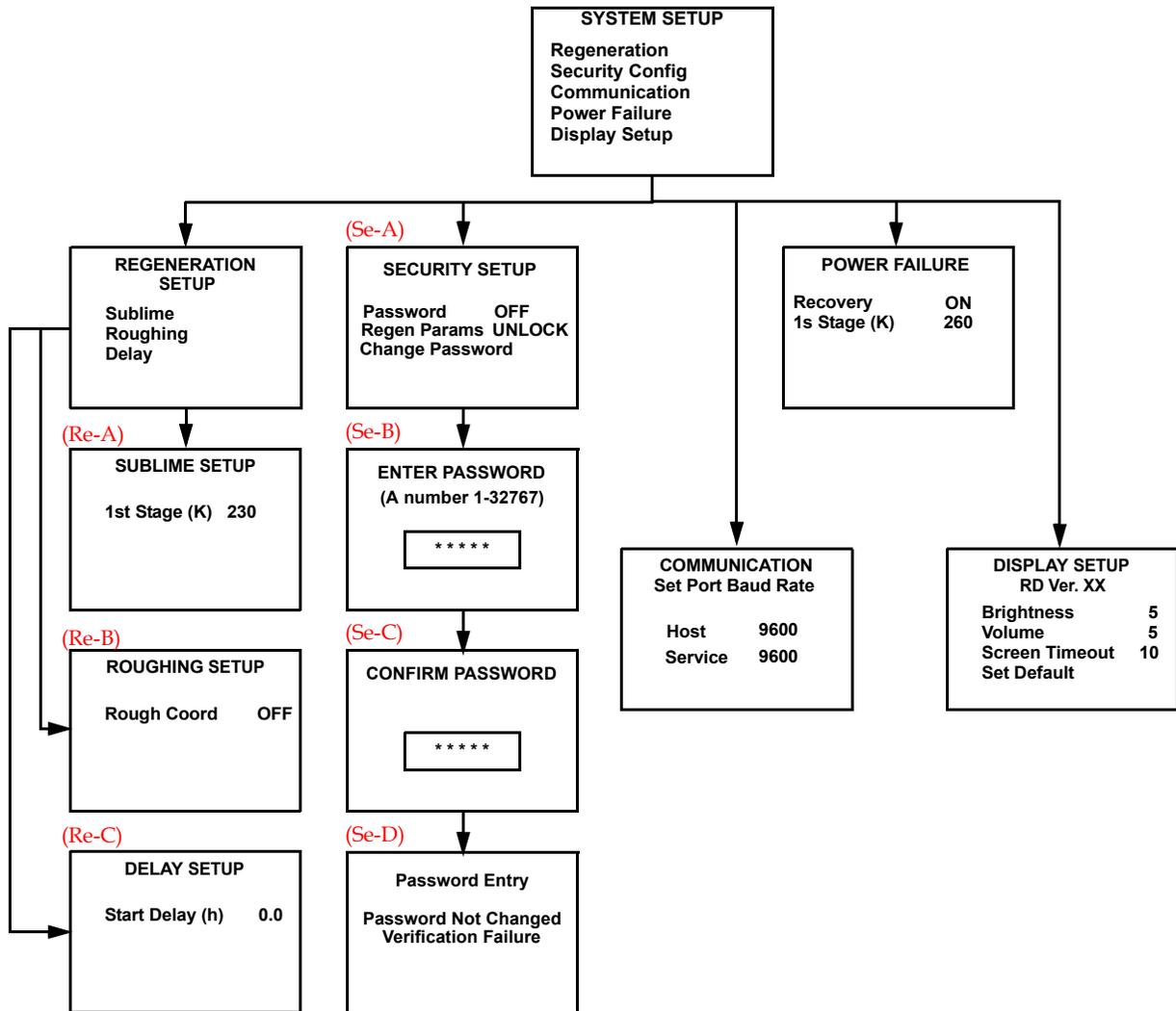

Figure 7-4: Cryopump System Setup Function Screens

The following sections briefly describe each part of the *System Setup* screens, including the action that occurs after you choose an item on the screen, or parameters, if applicable.

Regeneration Parameters

On the *Regeneration Setup* screen, each function you choose brings you to a different screen.

The following table briefly describes each of the *Regeneration Setup* screens, including the action that occurs after you choose an item on the screen or parameters. The letter preceding the screen name in the table corresponds to the letter above each screen in Figure 7-4 on page 7-9.

Table 7-3: System Setup: Regeneration Setup Definitions, by Screen

Screen Name	Screen Component Choice	Set by System or Set by User	*Parameter*, and Action
(Re-A) Sublime Setup	1st Stage (in Kelvin, K)	User	*110 to 250K* Setpoint for all Sublime Regenerations.
(Re-B) Roughing Setup	Rough Coord	User	*On*: Rough coordination is on. *Off*: Rough coordination is off.
(Re-C) Delay Setup	Start Delay (in hours, h)	User	*0 to 99.9 hours* Set a time delay before Regeneration starts.

Security Parameters

The following table briefly describes the *Security Setup* screen, including the action that occurs after you choose an item on the screen or parameters. The letter preceding the screen name in the table corresponds to the letter above each screen in Figure 7-4 on page 7-9.

Table 7-4: System Setup: Security Setup Definitions, by Screen

Screen Name	Screen Component Choice	Set by System or Set by User	*Parameter*, Action, and (Explanation)
(Se-A) Security Setup	Password	User	*On:* All screens except *Monitor* and *Pump Info* require a password. *Off*: No password is required to view any screens.
	Regen Params (Regeneration Parameters)	User	*Lock*: *Regeneration* screens **are** password protected. *Unlock*: *Regeneration* screens **are not** password protected.
	Change Password	N/A	Opens the *Enter Password* screen so that you can change the password.
(Se-B) Enter Password	_ _ _ _ _	User	*1 to 32767* (Arrow keys on the Remote keypad change the password numbers.)
(Se-C) Confirm Password	_ _ _ _ _	User	*1 to 32767, same as you chose in the* Enter Password *screen.* (Arrow keys on the Remote keypad change the password numbers.)
(Se-D) Password Entry	N/A	System	(Press *Back* to return to the *Enter Password* screen.)

Communication Parameters for the RS-232 Ports

The following table briefly describes the *Communication Setup* screens, including the action that occurs after you choose an item on the screen or parameters. See Figure 7-4 on page 7-9 for the actual *Communication Setup* screen.

Table 7-5: System Setup: Communication Setup Definitions, by Screen

Screen Component Choice	Set by System or Set by User	*Parameter* and Action
Host	User	*2400* *9600* *19200* *38400* Sets the baud rate for the host port.
Service	User	*2400* *9600* *19200* *38400* Sets the baud rate for the service port.

Power Failure Recovery Parameters

The following table briefly describes the *Power Failure* screen (see Figure 7-4 on page 7-9), including the action that occurs after you choose an item on the screen or parameters.

Table 7-6: System Setup: Power Failure Definitions, by Screen

Screen Component Choice	Set by System or Set by User	*Parameter* and Action
Recovery	User	*On:* A regeneration may start after the power is restored, depending on the cryopump status. *Off*: The cryopump performs no action after a power failure. *Cool*: The cryopump starts cooling if it is below the power failure setpoint.
1st Stage (in Kelvin, K)	User	*110 to 260K* After a power failure, the cryopump uses this setpoint to evaluate its status, and determine which action to perform.

Remote Parameters, Including the Display

The following table briefly describes the *Display Setup* screen (see Figure 7-4 on page 7-9), including the action that occurs after you choose an item on the screen or parameters.

Table 7-7: System Setup: Display Setup Definitions, by Screen

Screen Component Choice	Set by System or Set by User	*Parameter* and Action
Brightness	User	*0 to 15:* The Remote display window increases (to 0) or decreases in brightness (to 15).
Volume	User	*0 to 16*: The volume of the confirmation beep increases (to 16) or decreases (to 0, silence).
Screen Timeout	User	*0 to 60 minutes*: The time of keypad inactivity until the screen saver mode starts.
Set Default	User	Resets cryopump parameters back to the default settings.

Control Screens

```
                              ┌─────────────────────┐
                              │       CONTROL       │
                              │                     │
                              │  ►  Pump            │
                              │     Valves          │
                              │     Temperature     │
                              └─────────────────────┘
```

(A)

```
┌────────────────────────┐   ┌──────────────────────┐   ┌──────────────────────────┐
│     PUMP CONTROL       │   │    VALVE CONTROL     │   │   TEMP CONTROL SETUP     │
│                        │   │                      │   │                          │
│ ►Motor          ON     │   │ ►Rough Valve  CLOSED │   │ ►1st Stage        ON     │
│  HFI Status     OK     │   │                      │   │  Setpoint (K)     100    │
│  Startup               │   │                      │   │                          │
│  Shutdown              │   │                      │   │                          │
└────────────────────────┘   └──────────────────────┘   └──────────────────────────┘
```

HFI Status: Trip   Startup   Shutdown

(B)
```
┌────────────────────────┐
│ This will clear the    │
│    HFI Trip Status     │
│                        │
│   Do you want to       │
│      proceed?          │
│       No               │
│      ►Yes              │
└────────────────────────┘
```

(C)
```
              ┌──────────────────────┐
     No       │ This will start a    │
  *Pump*      │ Startup Regeneration │
  *Control*   │                      │
  Screen      │   Do you want to     │
              │      proceed?        │
 Yes          │       No             │
              │      ►Yes            │
              └──────────────────────┘
```

(D)
```
                              ┌──────────────────────┐
                              │ This will start a    │
                              │ Sublime Shutdown     │
                              │                      │
                              │   Do you want to     │
                              │      proceed?        │
                              │       No             │
                              │      ►Yes            │
                              └──────────────────────┘
```

```
┌────────────────────────┐
│                        │
│   HFI Already Set      │
│                        │
└────────────────────────┘
```

```
              No    *Pump Control Screen*
            Yes
┌──────────────────────────┐
│  REGENERATION STATUS     │
│   Startup in Progress    │
│                          │
│ Warmup                   │
│   1st Stage (K)    290   │
│   Target (K)       310   │
│                          │
│        ►ABORT            │
└──────────────────────────┘
```

```
                      No    *Pump Control Screen*
                    Yes
┌──────────────────────────┐
│  REGENERATION STATUS     │
│   Shutdown in Progress   │
│                          │
│ Warmup                   │
│   Actual (K)      109    │
│   Target (K)      230    │
│                          │
│       ► ABORT            │
└──────────────────────────┘
```

Figure 7-5: Cryopump Control Function Screens

Pump Control Screens

The following table briefly describes each of the *Pump Control* screens, including the action that occurs after you choose an item on the screen or parameters. The letter preceding the screen name in the table corresponds to the letter above each screen in Figure 7-5.

Table 7-8: Control: Pump Control Definitions, by Screen

Screen Name	Screen Component Choice	Set by System or Set by User	*Parameter*, Action, and (Explanation)
(A) Pump Control	Motor	System	*On*: Cryopump motor is on and cooling. *Off*: Cryopump motor is off, and the cryopump is warm or warming.
	HFI Status	User	*OK*: Opens a screen to notify you that the HFI is already set. (Circuit is complete and does not need to be reset.) *Trip*: Opens the *Clear HFI Trip Status* screen. (Circuit must be cleared.)
	Startup	N/A	Opens the *Regeneration* screen.
	Shutdown	N/A	Opens the *Sublime Shutdown* screen.
(B) Clear HFI Trip Status	No	N/A	Opens the *Pump Control* screen.
	Yes	N/A	Resets HFI status to Ok.
(C) Start a Startup Regeneration	No	N/A	Opens the *Pump Control* screen.
	Yes	N/A	Starts a Startup Regeneration. Opens the *Regeneration Status* screen.
(D) Start a Sublime Shutdown Regeneration	No	N/A	Opens the *Pump Control* screen.
	Yes	N/A	Starts a Shutdown. Opens the *Regeneration Status* screen.

Valve Control and Temperature Control Screens

The following table briefly describes the *Valve Control* screen and the *Temperature Control* screen (see), including the action that occurs after you choose an item on the screen or parameters.

Table 7-9: Control: Valve and Temperature Control Definitions, by Screen

Screen Name	Screen Component Choice	Set by System or Set by User	*Parameter* and Action
Valve Control	Rough	User	*Open*: Rough valve is open. *Closed*: Rough valve is closed.
Temperature Control	1st Stage	User	*On*: Temperature control is on. System maintains temperature at control setpoint. *Off*: Temperature control is off.
	Setpoint	User	*0, 65 to 120, or 320 K* Default = 100K Sets the temperature to which the cryopump cools.

Cryopump Information Screen

```
┌─────────────────────────────┐
│      PUMP INFO              │
│                             │
│  S/N          XXXXXX        │
│  Address          01        │
│  Oper. Time      999        │
│  Soft. Rev    SXxx.xx       │
│                             │
└─────────────────────────────┘
```

Figure 7-6: Cryopump Information Screen

The following table briefly describes the *Pump Info* screen.

Table 7-10: Pump Info Definitions, by Screen

Screen Component Choice	Set by System or Set by User	*Parameter* and Explanation
S/N (Serial Number)	System	The serial number of the cryopump.
Address	System	The network address of the cryopump.
Oper. Time (Operating Time)	System	The total time (in hours) the cryopump motor has been on.
Soft. Rev (Software Revision)	System	The current version number of the software for the cryopump.

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8   About Controller Remote Screens

Overview

This chapter shows all the Remote screens you can see through the On-Board IS Controller (Controller), using the On-Board *IS* Remote keypad (the Remote).

Chapter Contents

About Cryopump System (Controller) Screens

You can use the On-Board *IS* Remote keypad to control the cryopump and other system components individually through the component itself, or system-wide through the On-Board *IS* Controller (Controller).

Connect the Remote keypad into the Controller for the system. See the *On-Board* IS *Remote Quick Installation Guide* for rack and pump mount Controller details.

For more information about how to use the Remote, see .

You can also access local cryopump screens through the Controller (see). For more information about these screens, see .

This chapter also shows the Controller screens that are applicable to the cryopump in these sections:

About the Main Controller Screen and Functions

After you plug the Remote into the Controller, the *On-Board* IS *Controller* Screen appears:

```
┌─────────────────────────────┐
│         ON-BOARD            │
│      IS CONTROLLER          │
│                             │
│      Monitor                │
│      Regeneration           │
│      Access Device          │
│      System Setup           │
│      Controller Info        │
└─────────────────────────────┘
```

Figure 8-1: On-Board IS *Controller (Main) Screen*

Monitor

Use this menu item to access the *Monitor Network* screen, through which you can:

- View the network status; cryopump temperatures and compressor pressures
- View the network addresses of system components (network devices)
- View the regeneration rough pump and power fail coordination options
- View the cryopumps on each helium map

Regeneration

Use this menu item to access the *Regeneration* screen, through which you can:

- Start and control Group Full Regeneration
- Configure the Group Full Regeneration map

Access Device

Use this menu item to access the *Choose Device* screen, through which you can:

- Check the status of compressors and cryopumps
- Open a Remote Session with individual cryopumps; see Open a Remote Session from the Controller on page 6-5.

System Setup

Use this menu item to access the *System Setup* screen, through which you can:

- Set the regeneration rough pump coordination and power fail coordination
- Set the cryopumps and compressors on each helium map
- Set or change a password for the Remote
- Set the Controller communication values

Controller Info

Use this menu item to access the *Controller Info* screen, through which you can view the serial number and software revision number.

Monitor Screens

To view network activity for the system, choose any *Monitor* screen item.
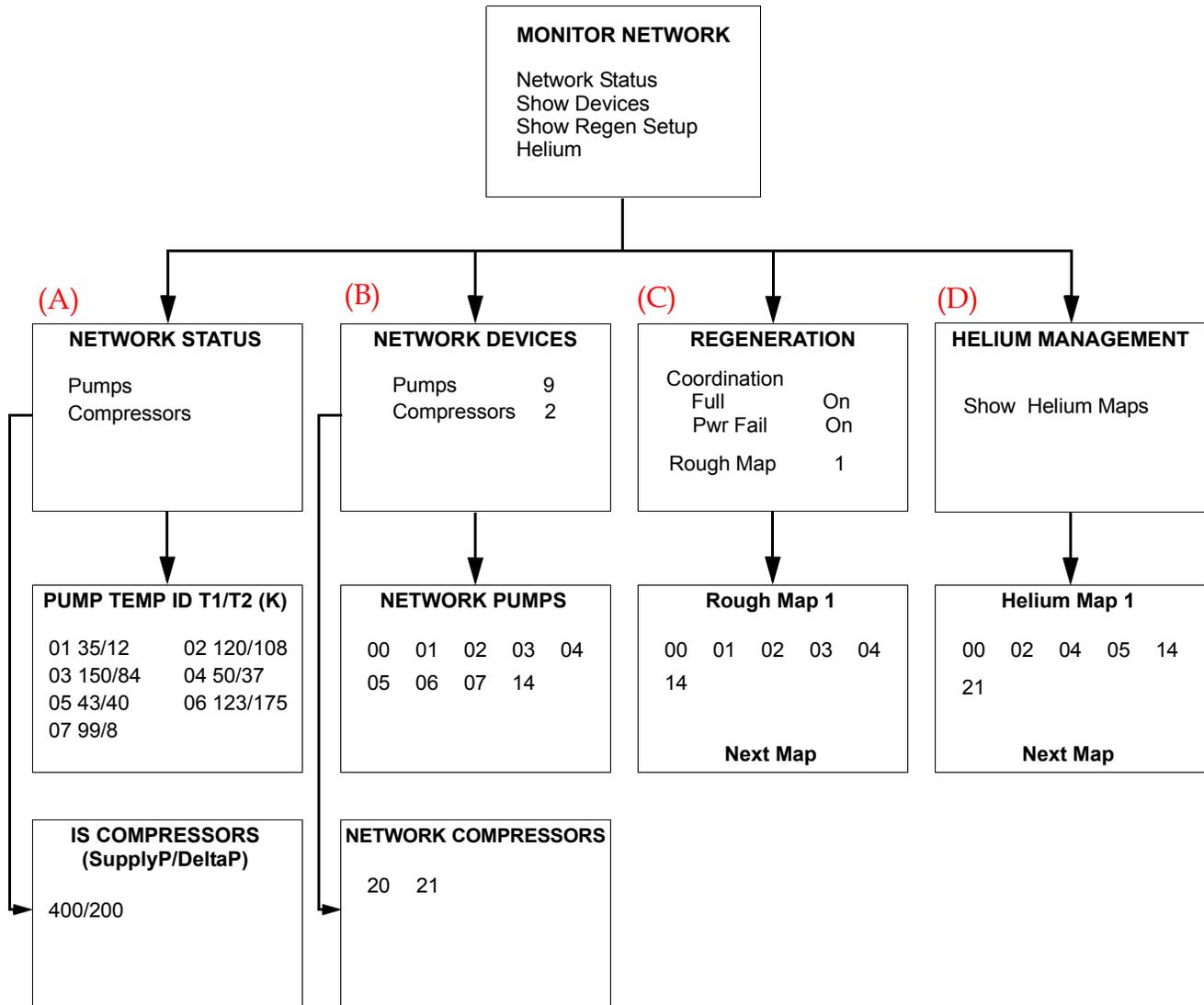
Figure 8-2: Controller Monitor Network Screens

NOTE: *You cannot change any settings when you view Monitor screens. They show the current status of the cryopump.*

The following table briefly describes each part of the Monitor screens, including parameters automatically set by the system or parameters set by you (User). The letter preceding the screen name corresponds to the letter above each screen in Figure 8-2.

Table 8-1: Monitor Definitions, by Screen

Screen Name	Screen Component	Set by System or User	Parameter and (Explanation)
(A) Network Status	Pump Temp ID T1/T2 (K)	System	Cryopump address Stage 1 temperature / Stage 2 temperature
	IS Compressors (SupplyP/DeltaP)	System	Compressor address Helium supply pressure / Difference in pressure
(B) Network Devices	Network Pumps	System	Crypump addresses.
	Network Compressors	System	Compressor addresses.
(C) Regeneration	Coordination: Full	System	On, Off (Full Group Roughing capabilities are on or off.)
	Coordination: Pwr Fail	System	On, Off (Power Fail recovery capabilities are on or off.)
	Rough Map	System	1, 2, 3, 4, 5 (Choose the Rough Map number to see which cryopumps belong to a specific rough map.)
Rough Map 1	N/A	System	Cryopump addresses for cryopumps assigned to this rough map.
(D) Helium Management	Show Helium Maps	System	(Cryopump and Compressor addresses for this Helium Map.)

Regeneration Screens

To configure and control Group Full Regeneration, use the *Regeneration* screens. See
About Regeneration and the Cryopump on page 6-8.
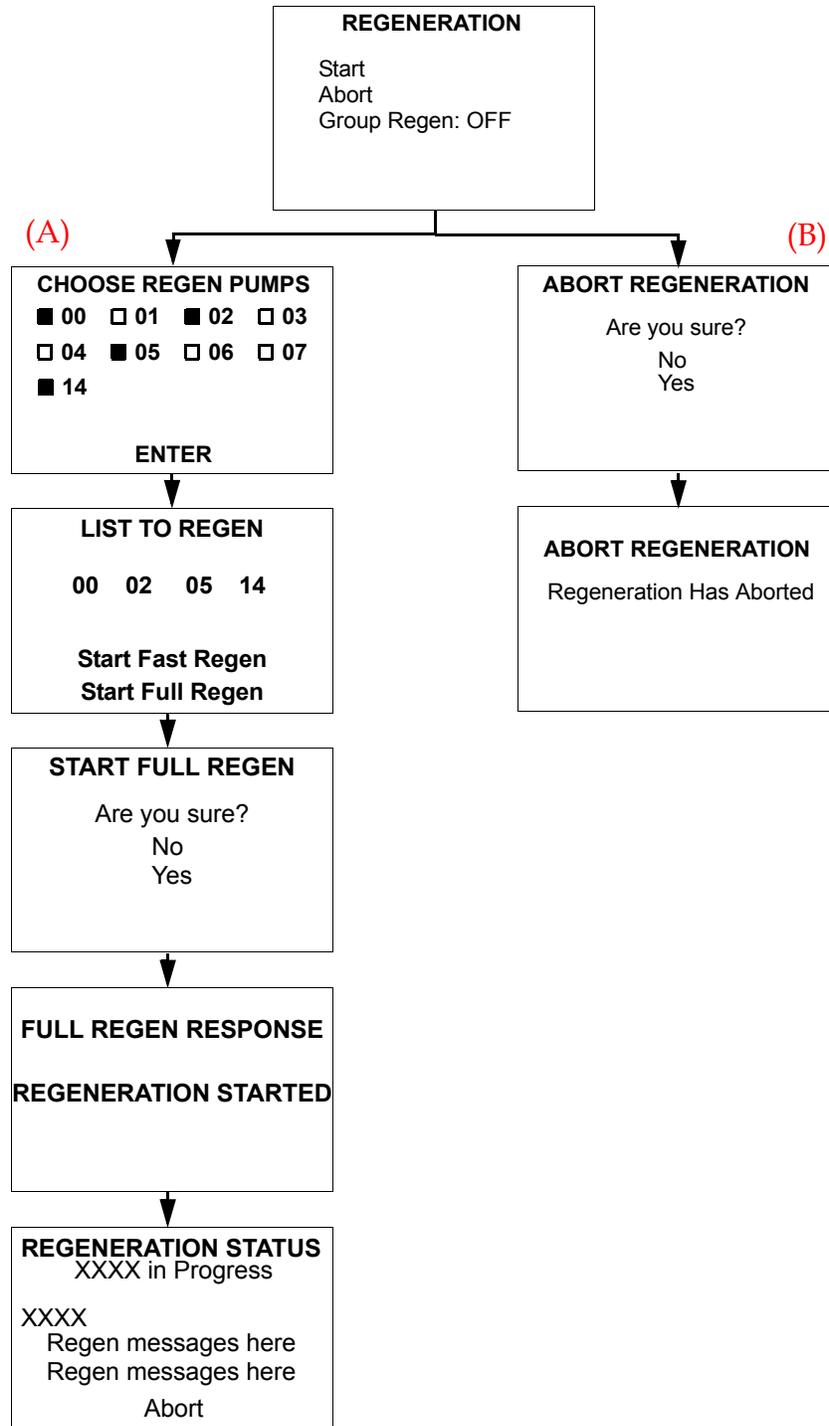
Figure 8-3: Controller Regeneration Screens

NOTE: *On the screens, XXXX could mean Startup, Sublime, Roughing, Shutdown, or Warmup.*

The following table briefly describes each part of the Regeneration screens, including the action that occurs after you choose an item on the screen. The letter preceding the screen name in the table corresponds to the letter above each screen in Figure 8-3. For more information, see About Regeneration and the Cryopump on page 6-8, and especially the definitions of Group Full Regeneration and Group Fast Regeneration.

Table 8-2: Regeneration Definitions, by Screen

Screen Name	Screen Component Choice	*Parameter*, Action, and (Explanation)
Regeneration	Start	Opens the next screen in the sequence to start a regeneration.
	Abort	Opens the next screen in the sequence to stop a regeneration.
	Group Regen	*On, Off* (Group Regeneration capabilities are on or off.)
(A) Choose Regen Pumps	(Cryopump Addresses)	Choose the cryopumps, by address, that you want included in a Group Full Regeneration.
List to Regen	Start Fast Regen	N/A (A cryopump cannot perform a Fast Regen, and is excluded if you choose it.)
	Start Full Regen	All cryopumps you choose start a Group Full Regeneration.
Start Full Regen	Yes	Starts the Regeneration.
	No	Does not start the Regeneration.
Regeneration Status	N/A	Updates the state of regeneration, based on the regeneration type.
(B) Abort Regeneration	Yes	Stops the Regeneration.
	No	Does not stop the Regeneration.
Abort Regeneration	N/A	Regeneration stops.

Access Device Screens

To view complete information about individual system components, or open a Remote session, use the *Access Device* screens.
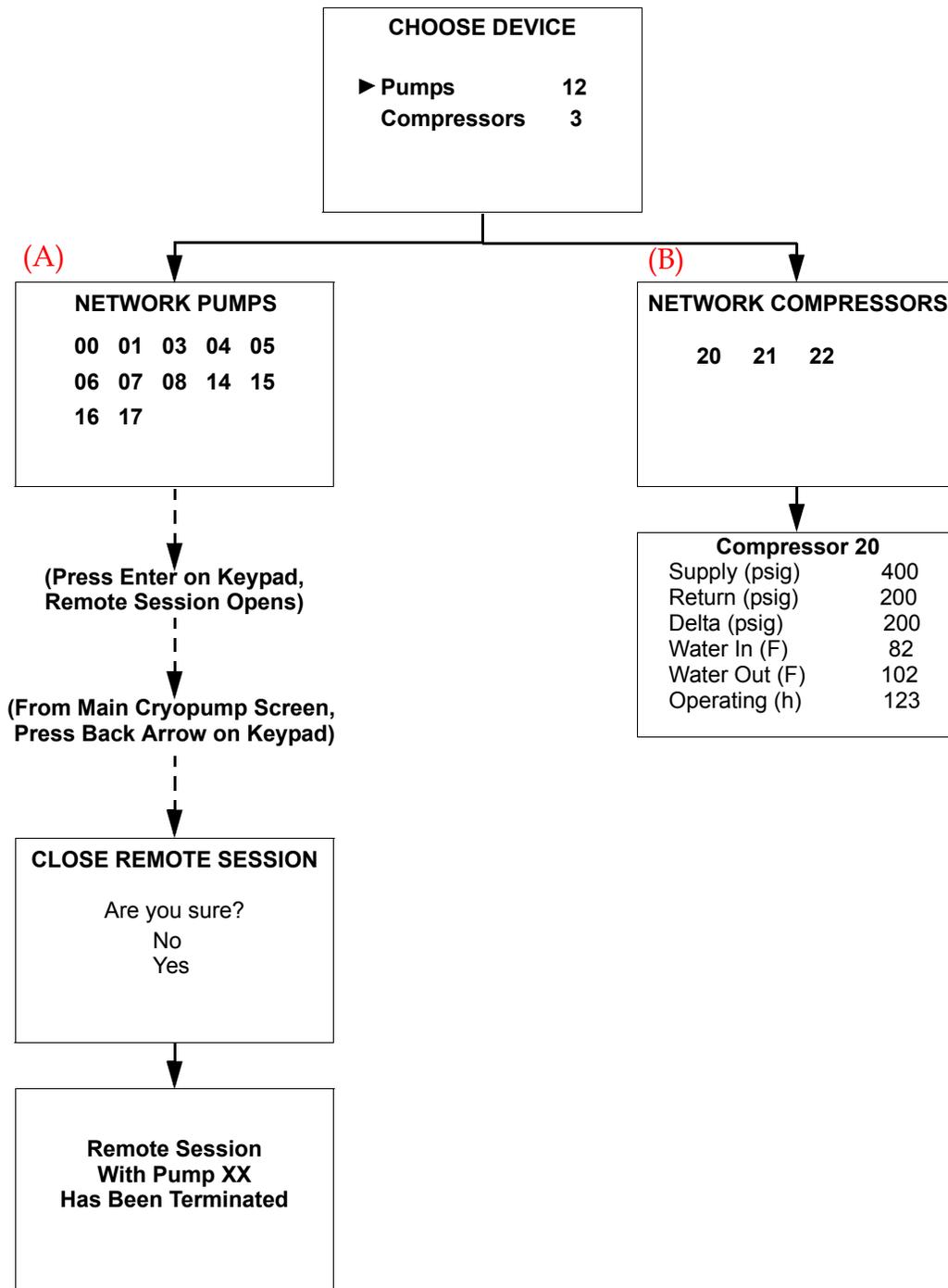
Figure 8-4: Controller Choose Device (Access Device) Screens

The following table briefly describes each part of the *Access Device* screens, including the action that occurs after you choose an item on the screen. The letter preceding the screen name in the table corresponds to the letter above each screen in Figure 8-4.

Table 8-3: Access Device Definitions, by Screen

Screen Name	Screen Component Choice	Action and Explanation
Choose Device	Pumps	Shows total number of cryopumps connected to the Controller. Choose *Pumps* to see a list of cryopump addresses.
	Compressors	Shows total number of compressors connected to the Controller. Choose *Compressors* to see a list of compressor addresses.
(A) Network Pumps	(Cryopump Addresses)	Choose a cryopump, by address, for which you want to open a remote session.
(Remote Session Opens)	(Main screen for component)	See About the Main Controller Screen and Functions on page 8-3.
Close Remote Session	Yes	Remote session closes, and confirmation screen appears.
	No	Remote session continues, main screen for component appears.
(B) Network Compressors	(Compressor Addresses)	Choose a compressor, by address, for which you want to see the current statistics.
Compressor XX	N/A	Shows the statistics for a compressor

System Setup Screens

Through the *System Setup* screens, you can manage Regeneration Maps (i applicable), security, communication with the RS-232 port, Helium Maps, and the keypad display options.
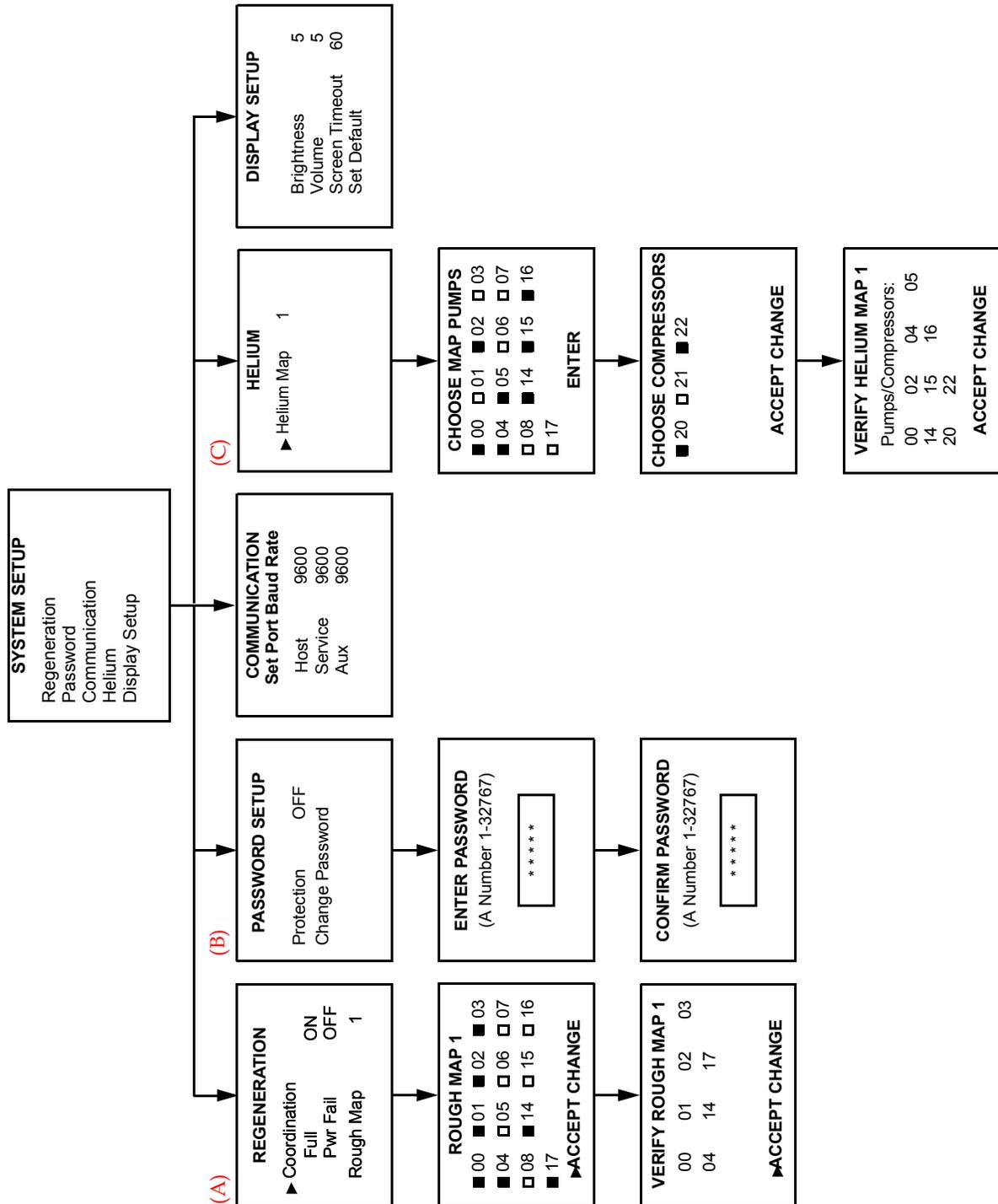
Figure 8-5: Controller System Setup Screens

The following sections briefly describe each part of the *System Setup* screens, including the action that occurs after you choose an item on the screen or parameters, if applicable.

Regeneration

On the *Regeneration Setup* screen, each function you choose brings you to a different screen.

The following table briefly describes each of the Regeneration Setup screens, including the action that occurs after you choose an item on the screen or parameters. The letter preceding the screen name in the table corresponds to the letter above each screen in Figure 8-5 on page 8-11.

Table 8-4: System Setup: Regeneration Setup Definitions, by Screen

Screen Name	Screen Component Choice	Set by System or User	*Parameter*, Action, and (Explanation)
(A) Regeneration Setup	Coordination: Full	User	*On, Off* (Group roughing capabilities are on or off.)
	Coordination: Pwr Fail	User	*On, Off* (Power Fail recovery capabilities are on or off.)
	Rough Map 1	User	1, 2, 3, 4, 5 Choose the Rough Map number to assign the cryopumps to a specific rough map.
Rough Map 1	(Cryopump Addresses)	User	Cryopumps that you want to include in a Rough Map.
Verify Rough Map 1	(Cryopump Addresses)	System (information from previous screen)	Choose *Accept Change* or press the *Back* button.

Password

The following table briefly describes the Security Setup screen, including the action that occurs after you choose an item on the screen or parameters. The letter preceding the screen name in the table corresponds to the letter above each screen in Figure 8-5 on page 8-11.

Table 8-5: System Setup: Password Definitions, by Screen

Screen Name	Screen Component Choice	Set by System or User	*Parameter*, Action, and (Explanation)
(B) Security Setup	Password	User	*On:* All screens except *Monitor* and *Pump Info* require a password. *Off*: No password is required to view any screens.
	Change Password	N/A	Opens the *Enter Password* screen so that you can change the password.
Enter Password	_ _ _ _ _	User	*1 to 32767* (Arrow keys on the Remote keypad change the password numbers.)
Confirm Password	_ _ _ _ _	User	*1 to 3277, same as you chose in the* Enter Password *screen.* (Arrow keys on the Remote keypad change the password numbers.)

Communication for the RS-232 Ports

The following table briefly describes the *Communication Setup* screens, including the action that occurs after you choose an item on the screen or parameters. See Figure 8-5 on page 8-11 for the actual *Communication Setup* screen.

Table 8-6: System Setup: Communication Definitions, by Screen

Screen Component Choice	Set by System or User	*Parameter*, and Action
Host	User	*2400* *9600* *19200* *38400* Sets the baud rate for the host port.
Service	User	*2400* *9600* *19200* *38400* Sets the baud rate for the service port.
Aux	User	*2400* *9600* *19200* *38400* Sets the baud rate for the auxiliary port.

Helium Maps

The following table briefly describes the *Helium* screens, including the action that occurs after you choose an item on the screen or parameters. See Figure 8-5 on page 8-11 for the actual *Helium* screen.

Table 8-7: System Setup: Helium Definitions, by Screen

Screen Name	Screen Component Choice	Set by System or User	*Parameter*, and Action
(C) Helium	Helium Map 1	User	*1, 2, 3, 4, 5* Choose the Helium Map number to assign the cryopumps and compressors to a specific helium map.
Choose Map Pumps	(Cryopump Addresses)	User	Cryopumps that you want to include in a helium map
Choose Compressors	(Compressor Addresses)	User	Compressors that you want to include in a helium map
Verify Helium Map 1	(Cryopump and Compressor Addresses)	System (information from previous two screens)	Choose *Accept Change* or press the *Back* button.

Remote Display

The following table briefly describes the *Display Setup* screen (see Figure 8-5 on page 8-11), including the action that occurs after you choose an item on the screen or parameters.

Table 8-8: System Setup: Display Setup Definitions, by Screen

Screen Component Choice	Set by System or User	*Parameter* and Action
Brightness	User	*0 to 15:* The Remote display window increases (to 0) or decreases in brightness (to 15).
Volume	User	*0 to 16*: The volume of the confirmation beep increases (to 16) or decreases (to 0, silence).
Screen Timeout	User	*0 to 60 minutes*: The time of keypad inactivity until the screen saver mode starts.
Set Default	User	Resets cryopump parameters back to the default settings.

Controller Info Screen

On the *Controller Info* screen, you can view the serial number and software revision number of the Controller.

```
            CONTROLLER INFO

       S/N           XXXXXX
       Soft. Rev     VAxx.xx
```

Figure 8-6: Controller Info Screen

The following table briefly describes each part of the Controller Info screen.

Table 8-9: Controller Info Definitions, by Screen

Screen Component Choice	Set by System or User	Explanation
S/N (Serial Number)	System	The serial number of the Controller.
Soft. Rev (Software Revision)	System	The current version number of the software for the Controller.

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9 Troubleshooting

Overview

This chapter provides troubleshooting procedures. Only trained, qualified persons should attempt to troubleshoot the product.

Chapter Contents

Record a Normal Operation Log

Maintaining a log of certain parameters during normal operation can be a valuable tool in troubleshooting vacuum problems. The log may contain many parameters. However, the following minimum parameters should be included:

- chamber base pressure

- chamber pump down time

- chamber rate of rise

In addition, a baseline chamber RGA scan is useful for system troubleshooting.

Assess Basic Trouble

The primary indication of trouble in a vacuum pumping system is a rise in base pressure of the vacuum chamber. A rise in the base pressure may be caused by the following:

- a leak in the vacuum system

- the cryopump reaching capacity

- the cryopump running too warm

Typically a high base pressure is caused by an air-to-vacuum leak in the system.

If a leak in the vacuum system is suspected, do the following:

1. Isolate the On-Board *IS* Cryopump by closing the Hi-Vac valve and leak check the vacuum chamber.

2. Leak check all potential sources of leaks such as:

    - through process gas valves

    - chamber rough valves

    - chamber cooling lines

If no leaks are found, a leak may be present on the cryopump side of the Hi-Vac valve.

Leak checking on the cryopump side of the Hi-Vac valve should be performed with the On-Board *IS* Cryopump shut off and at room temperature after a *Shutdown*.

Leak checking while the On-Board *IS* Cryopump is cold may mask leaks that are present (due to the ability of the cryopump to pump helium). If no leak is found, refer to the cryopump troubleshooting procedures summarized in Table 9-1.

Understanding Specific Causes and Corrective Actions

The problems presented in Table 9-1 are followed by possible causes and corrective actions. The causes and corresponding actions are listed in their order of probability of occurrence.

Table 9-1: On-Board IS Cryopump Troubleshooting Basic Causes and Actions

Problem	Possible Cause	Corrective Action
High vacuum system base pressure, and a cryopump temperature *below* 20K.	1.Air-to-vacuum leak in vacuum system or in cryopump.	1.Check vacuum chamber and Hi-Vac valve for leaks. Check cryopump side of Hi-vac valve for leaks.
	2.High partial pressure of noncondensables (helium, hydrogen, or neon) within the cryopump because the Second Stage array reaches full capacity.	2.Regenerate the cryopump as described in the Perform a Regeneration on One Cryopump on page 6-13.
High base pressure of vacuum system, and a cryopump temperature *above* 20K.	1.Low helium pressure.	1.Check compressor helium pressure. If the helium return pressure gauge reads below the normal operating pressure, add gas as described in the ***On-Board IS 1000 Compressor*** Installation, Operation, and Maintenance Instructions part number 8040597.
	2.High partial pressure of non-condensables (helium, hydrogen, or neon) within the cryopump because the Second Stage array reaches full capacity.	2.Regenerate the cryopump as described in the appropriate Perform a Regeneration on One Cryopump on page 6-13.
	3.Excessive thermal load on frontal array.	3.Look for new sources of thermal loads on the cryopump.
	4.Helium gas line contamination.	4.See part number (document) 8040720 for more information about helium circuit decontamination.

Table 9-1: On-Board IS Cryopump Troubleshooting Basic Causes and Actions

Problem	Possible Cause	Corrective Action
Cryopump fails to cool down to the required operating temperature or takes too long to reach that temperature (20K).	1.Low helium pressure.	1.Add gas as described in the ***On-Board IS 1000 Compressor Installation, Operation and Maintenance Instructions*** part number 8040597.
	2.Loose or disconnected helium self sealing couplings.	2.Fully connect all helium self sealing couplings.
	3.Compressor problems.	3.Refer to the ***On-Board IS 1000 Compressor Installation, Operation and Maintenance Instructions*** part number 8040597.
	4.Leak in vacuum system or cryopump.	4.Check vacuum chamber and Hi-Vac valve for leaks. Check cryopump side of Hi-Vac valve for leaks.
	5.Helium gas line contamination.	5.See part number (document) 8040720 for more information about helium circuit decontamination.
Status LED III is not illuminated.	Network cable is disconnected from the On-Board *IS* Module.	Reconnect network cable to the On-Board *IS* Module. See Component Description and Facility Requirements on page 1-4 for component locations.
Status LED III is Amber.	On-Board *IS* Cryopump Heater Failure	Refer to Appendix A: Customer Brooks Automation Technical Support Information on page 10-2 for customer support information and contact Brooks Technology Corporation for assistance.
Rough valve clicks but does not open and close.	Too little or no air pressure to drive valve.	Increase air pressure to 60 to 80 psig.

Technical Inquiries

NOTE: *Refer to Appendix A: Customer Brooks Automation Technical Support Information on page 10-2 for customer support information and assistance.*

Intercomponent Network Potential Problems

Refer to the following table if you are experiencing Intercomponent Network communication problems.

Table 9-2: Intercomponent Network Potential Problems

Problem	Possible Cause	Corrective Action
1. Cryopumps are not visible on Controller screens.	1a. The cryopump is connected to channel C.	1a. Disconnect the cryopump from channel C and connect it to channels A or B.
	1b. Defective network cable.	1b. Replace network cable.
	1c. Remote keypad cable is not connected.	1c. Connect Remote keypad cable.
2. Compressors are not visible on Controller screens.	2a. The compressor is connected to channels A or B.	2a. Disconnect the compressor from channels A or B and connect it to channel C.
	2b. Defective network cable.	2b. Replace network cable.
	2c. Remote keypad cable is not connected.	2c. Connect Remote keypad cable.
3. Status LED III on the Controller is amber, and is *not* blinking.	3a. Channel A, B or C network cable is disconnected from controller.	3a. Connect the network cable(s) to the controller.
	3b. Defective network cable.	3b. Replace network cable.

Cryopump Operation Potential Problems

Refer to the following table if you are experiencing problems operating the cryopump.

Table 9-3: Cryopump Operation Potential Problems

Problem	Possible Cause	Corrective Action
Received this message on the Remote: **FAST REGEN RESPONSE** **Regen Did Not Start Reason:** **Problem Pump List**	Tried to start a Fast Regeneration with a cryopump in a Group.	Remove the cryopump from the Regeneration Map. See About a Group Full Regeneration on page 6-16.
Cryopumps do not warm to target regeneration temperature due to heaters not starting.	The HFI is tripped.	See Control Screens on page 7-14 to clear the HFI trip status.

10 Appendices

Overview

The following appendices are included to provide the user with a single location for specific information related to the Brooks Automation Product.

Contents

Appendix A: Customer Brooks Automation Technical Support Information

When contacting Brooks Automation for Technical Support, please have the following information available.

1.   Record the part number and serial number from the equipment.

2.   Provide the installed location of the equipment.

3.   Provide name, e-mail address, and telephone number of the person to contact.

4.   List any error codes received during the failure.

5.   Prepare a detailed description of the events relating to the error.

   • Time that the equipment has been in operation

   • Work that was done on the equipment prior to the error

   • Functions that the equipment was performing when the error occurred

   • Actions taken after the error and the results of those actions

   • Other information that may assist the Specialist

6.   Contact Brooks Automation Technical Support at these numbers:

Brooks Location	GUTS® Contact Number
North America	1-800-FOR-GUTS (1-800-367-4887) US/Canada +1-978-262-2900
Europe	+49 1804 CALL GUTS (+49 1804 2255 4887)
Japan	+81-45-477-5980
China	+86-21-5131-7066
Taiwan	+886-3-552-5225
Korea	+82-31-288-2500
Singapore	+65-6464-1481

For additional contact information, please go to the Brooks Automation web site at www.brooks.com or send an E-mail to techsupport@brooks.com.

Appendix B: Default Parameters (Values)

The following table shows the default values for regeneration and purges.

Table 10-1: Default Process Values and Parameters

Part of Process	Default Value	Parameter
Power fail recovery	OFF	ON/OFF/*COOL
Power fail recovery temperature	260K	110 - 260K
Rough coordination	OFF	ON/OFF
Start delay time	0	0 - 99.9 hours
Sublime maximum temperature	230K	110 - 250K
Timed Sublime maximum rough time	30 minutes	0 - 600 minutes
*Not a parameter set by a user.		

Appendix C: Theory of Cryopump Operation

On-Board *IS* Cryopumps operate on the principle that gas molecules encountering a sufficiently cold surface (an array) will condense and be held (captured) at an extremely low vapor pressure, effectively trapping the molecules and preventing them from returning to the vacuum chamber. Gas molecules that travel into a cryopump are condensed or adsorbed on the cryogenically-cooled arrays and are then removed or pumped from the vacuum chamber.

The On-Board *IS* Cryopump contains two arrays, and they are cooled using a closed cycle, Gifford McMahan refrigeration cycle, which uses compressed gaseous helium as the refrigerant.

The first stage array (or inlet array) normally operates at temperatures between 65 - 120K and is primarily used to pump water vapor, but may be used for other applications.

The second stage array operates at temperatures between 10-20K and captures air gases such as nitrogen, argon, and oxygen. Activated charcoal is attached to the second stage array, and is used to cryoadsorb hydrogen, helium, and neon.

Most molecules trapped on the arrays usually solidify into frost or ice. Eventually, the ice must be melted or sublimated during regeneration to ensure the cryopump functions properly. The On-Board *IS* Cryopump uses an integrated microprocessor, variable speed motor, and heaters to provide a fast and thorough regeneration.

The On-Board *IS* Cryopump is driven by a variable speed motor and controlled by an advanced microprocessor the On-Board *IS* Module. The On-Board *IS* Module conditions the input power and provides RS-232 and Bitbus communication capability. The communication protocol and commands are compatible with all On-Board RS-232 and Bitbus network commands.

The On-Board *IS* Cryopump system consists of the cryopump and a remotely located On-Board *IS* Compressor which provides the compressed helium. The On-Board *IS* Compressor can provide helium for multiple Cryopumps through helium supply and return lines. The Controller coordinates all Intercomponent Network communications. A typical On-Board *IS* Cryopump system is shown in .

Remote Operation Options with the On-Board *IS* Controller

The On-Board *IS* Cryopump can be controlled remotely using an RS-232 protocol. Multiple cryopumps can be networked using a proprietary Bitbus protocol to an On-Board *IS* Controller, or a Controller. In this configuration, the networked cryopumps are managed as a group by the Controller, which coordinates group regeneration cycles and provides a standardized communication link to the process tool host com-

puter. The Controller allows the host system to address all cryopumps through a single RS-232 port. Using this approach, control of the networked cryopumps can be fully integrated with the process tool control through RS-232 communication.
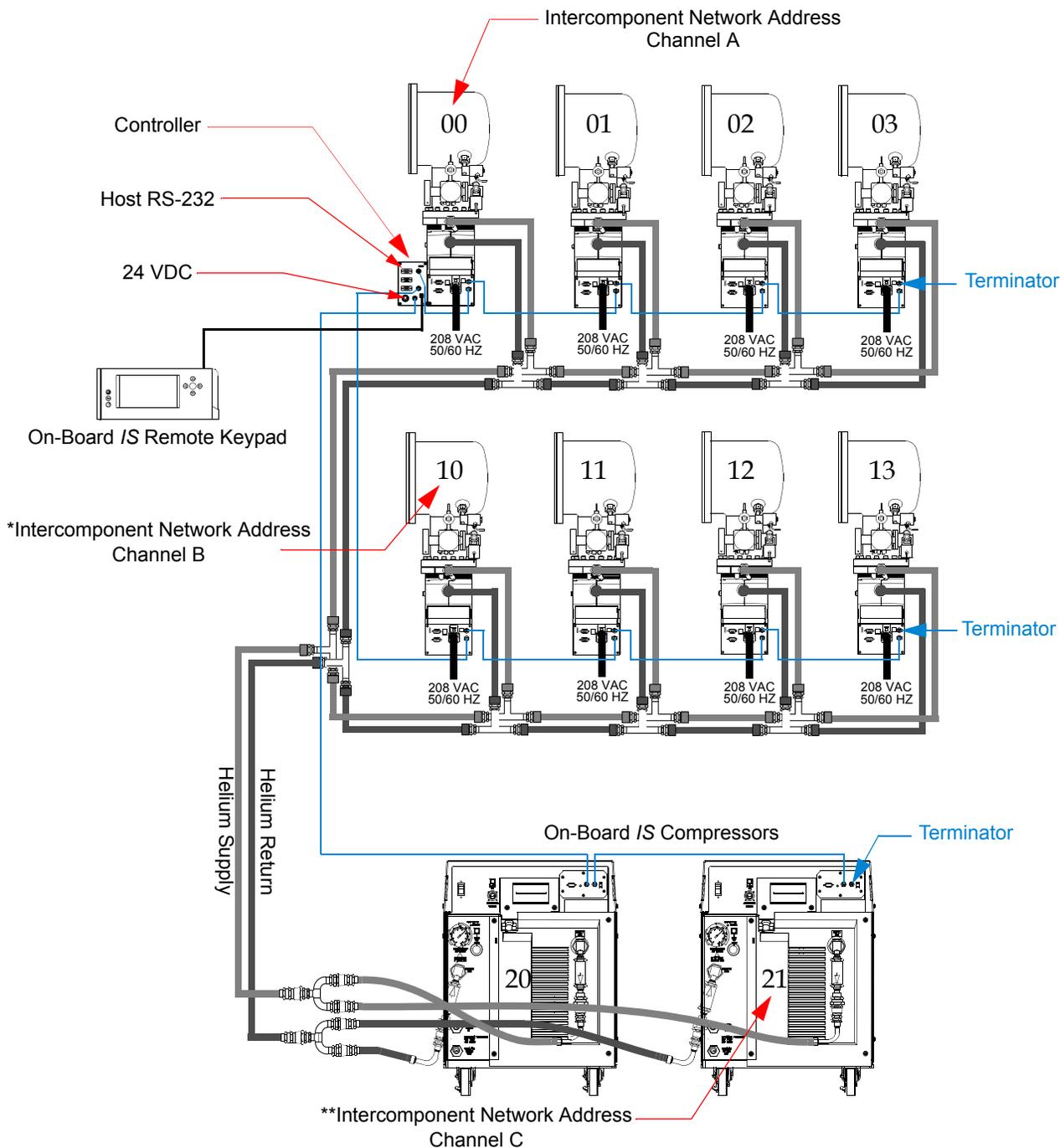
Figure 10-1: Typical On-Board IS Cryopump System

NOTE: *If the address is set to 0, it appears as 10 on Channel B.*
If the address is set to 0, it appears as 20 on Channel C.

About the Cold Head

The cold head consists of a motor, helium supply and return valves, first and second stage displacer assembly and a cylinder. The cylinder is a welded stainless steel cylinder that is installed in the Cryopump vacuum vessel. The first and second stage arrays are secured to the cylinder inside the Cryopump vacuum vessel.

The displacer assembly is made up of a first and second stage displacer. The displacers are packed with a heat exchange matrix that is used as a thermal reservoir. Each displacer has a seal that causes the helium to flow through the heat exchange matrix inside the displacers rather than between the displacer and the cylinder wall.

Within the coldhead, the motor cycles the displacer assembly up and down the cylinder and actuates the helium supply and return valves. The motor is a direct-drive variable-speed motor, operating between 40-144 rpm.

The following steps and Figure 10-2 on page 10-7 describe the Gifford McMahan refrigeration cycle:

1.   When the displacer is at the bottom of the cylinder, the helium supply valve opens allowing high pressure helium to fill the cylinder.

2.   As the displacer rises, the helium flows through the matrix in the displacers to the bottom of the cylinder.

3.   When the displacer reaches the top of the cylinder, the supply valve closes, and the return valve opens allowing the gas to expand and cool.

4.   The temperature drop in the expanded helium cools the heat stations, cooling the cryopump arrays.

5.   The cooled helium passes out through the return valve, cooling the matrix in the displacers as the displacers move toward the bottom of the cylinder.

6.   Steps 1-5 are repeated continuously. With each cycle, the incoming helium is pre-cooled by the matrix as it flows through the displacers, providing an additional increment of refrigeration.
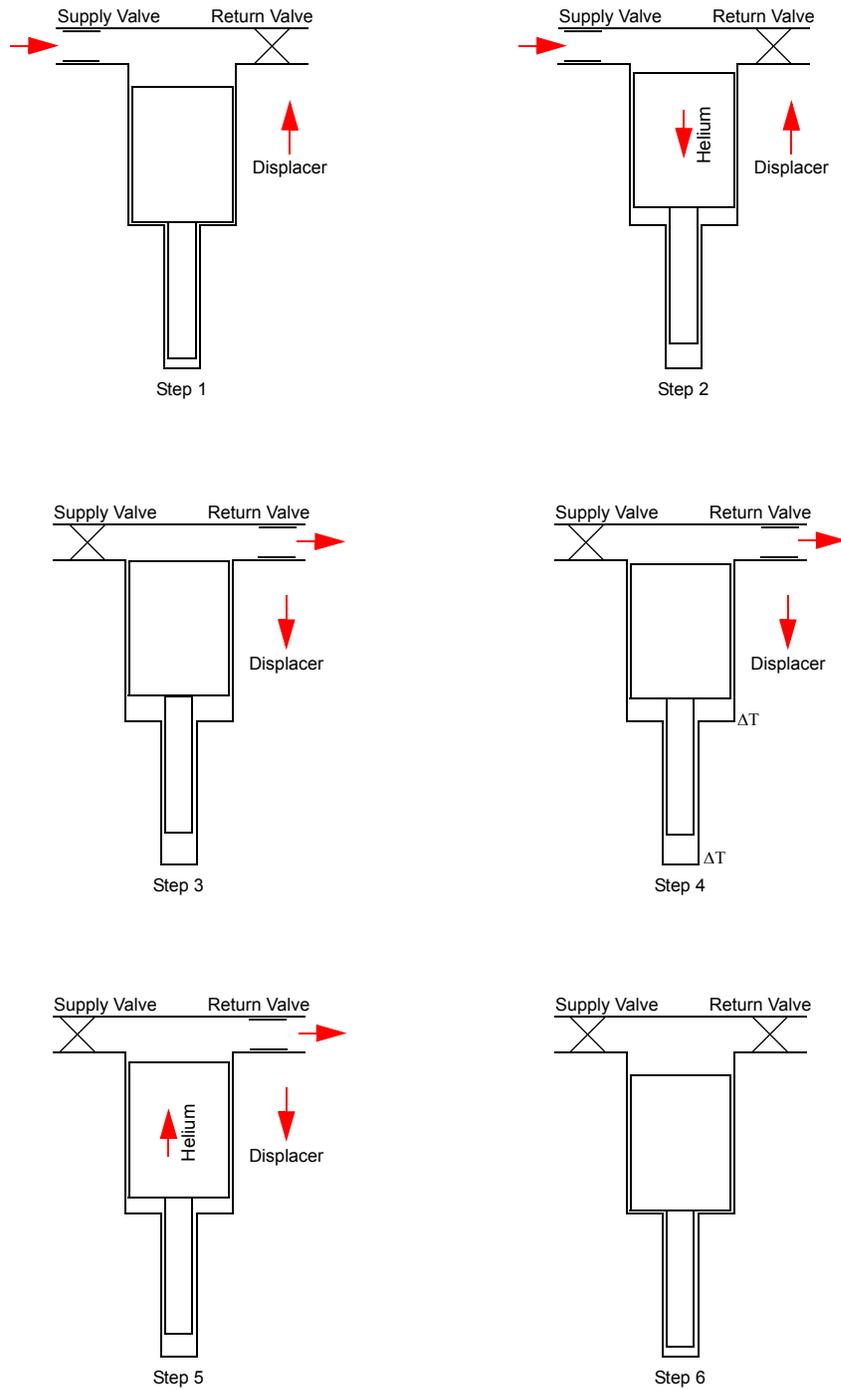
Figure 10-2: Gifford McMahan Refrigeration Cycle

Appendix D: Cryopump Component Details

The On-Board *IS* Cryopumps basically consist of the component detailed in this section.

For compenents specifications, see Component Description and Facility Requirements on page 1-4.

The components are listed according to their reference number in the following figure.

Side View   **Front View**
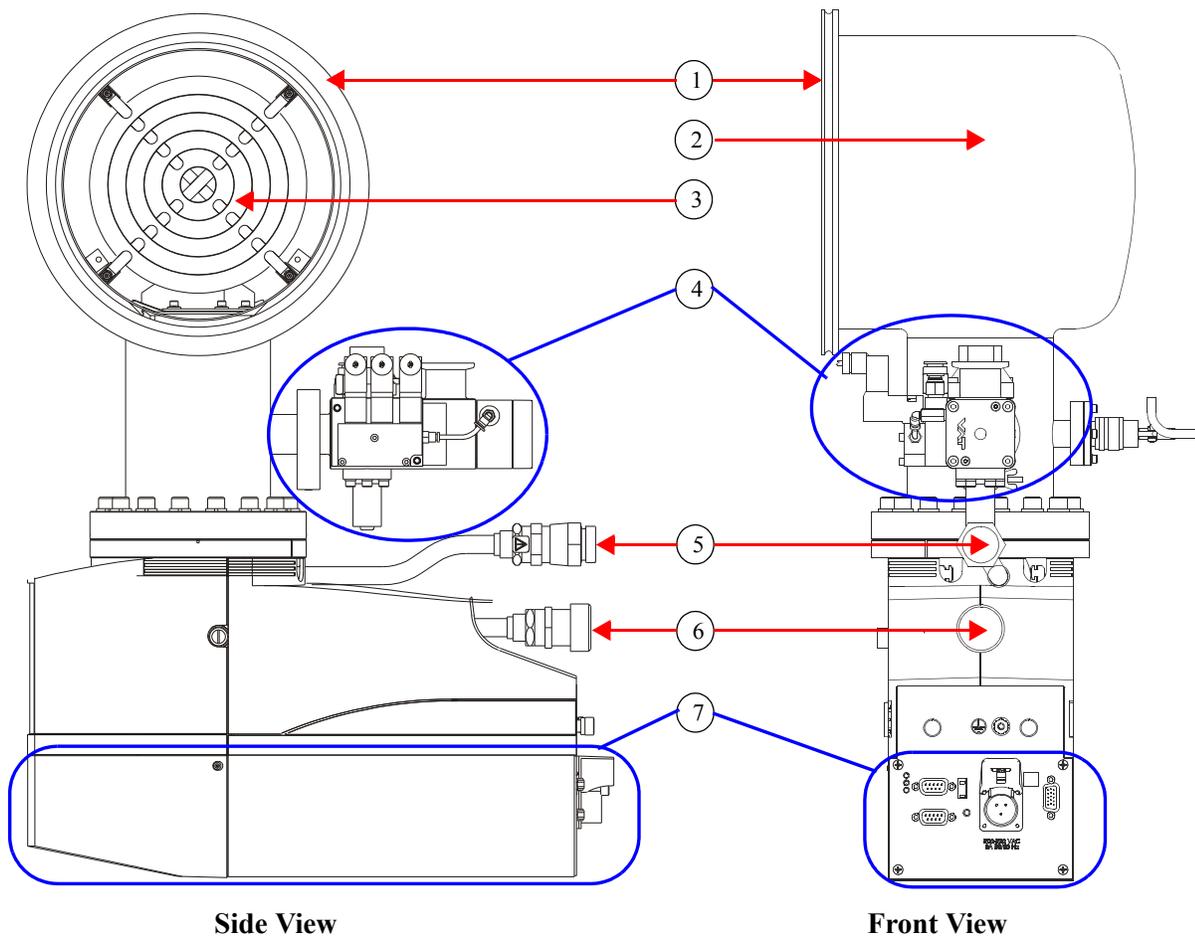
Figure 10-3: On-Board IS Cryopump, Side and Front Views

1.   Inlet Port

The Inlet Port is the opening of the vacuum vessel through which process gases enter the cryopump.

2.   **Vacuum Vessel**

The Vacuum Vessel contains the first and second stage condensing arrays which are cooled to condense process gases.

3.   **First Stage Array**

The First Stage Array (a chevron array) is the first condensing array that a process gas molecule encounters within the cryopump. Gases such as water vapor and hydrocarbons are condensed onto the first stage array which operates at 65 to 120K.

Refrigerator (not visible)

The refrigerator consists of a two-stage cylinder (part of the vacuum vessel) and a coldhead assembly, that together produce closed-cycle refrigeration at temperatures that range from 65 to 120K for the first stage and 10 to 20K for the second stage, depending on operating conditions.

Second Stage Array (not visible)

The Second Stage Array is inside the cryopump, and downstream from the First Stage Array in Figure 10-3 on page 10-8. It condenses gases such as N_2, O_2, Ar, CO_2, and CO and operates at temperatures from 10 to 20K. Activated charcoal is attached to the second stage array which cryoadsorbs H_2, He, and Ne.

First and Second Stage Heaters (not visible)

The first and second stage heaters are mounted to the coldhead cylinder, and are used to warm the cryopump during regeneration. They also help maintain array temperature settings.

4.   **Diode Connector**

The Diode Connector is connected to the diodes that measure the first and second stage array temperatures. Array temperature information is sent to the On-Board *IS* Module.

5.   **Multi-Function Valve**

The Multi-function Valve combines the functions of the rough valve, pump purge valve, exhaust purge valve, and relief valve. The basic functions as described previously also apply, except that all valves on the Multi-Function valve are piloted except for the relief valve, and require high pressure air for operation. For specifications, see Multi-Function Valve Description on page 1-5.

Purge Valve

The purge valve controls the flow of nitrogen to the cryopump vessel. During a regeneration cycle, the purge valve opens and allows nitrogen to flow through the vessel to dilute and remove the cryopumped gases, if applicable.

Roughing Valve

The roughing valve connects to a system rough pump or dry pump. The rough valve is used during the cryopump regeneration cycle to rough the cryopump to rough vacuum (approximately 50-100 microns) before the cryopump begins to cool down.

Exhaust Purge Valve

The Exhaust Purge Valve purges room temperature nitrogen across the O-ring of the cryopump relief valve to prevent the O-ring from getting too cold during regeneration.

Thermocouple (TC) Gauge

The TC Gauge measures cryopump pressure during a regeneration cycle and sends pressure information to the On-Board *IS* Module.

6. **Helium Supply Fitting**

The Helium Supply Fitting provides a connection for high pressure compressed helium from the On-Board *IS* 1000 Compressor to the cryopump.

7. **Helium Return Fitting**

The Helium Return Fitting provides a connection to return low pressure helium which has been cycled through the cryopump to the On-Board *IS* Compressor.

8. **Communication Module**

Appendix E: Communication Module Component Details

The On-Board *IS* Module (or Module) controls the operation of the On-Board *IS* Cryopumps, conditions the input power, and provides host computer RS-232 and network communication ports. The following figure shows the Module components.
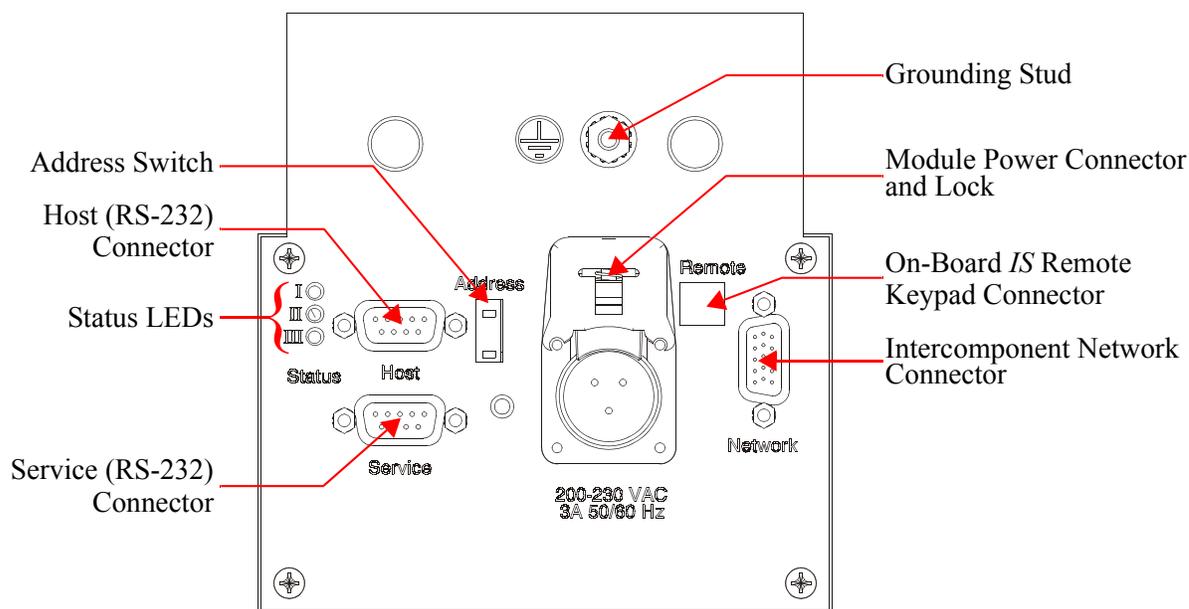
Figure 10-4: Communication Module Component Identification

Service (RS-232) Connector

Used by Brooks Personnel to connect diagnostic equipment.

Status LEDs

Use the Status LEDs to monitor cryopump regeneration cycles and network communications status. The following table describes the LEDs states and meanings.

Table 10-2: Module Status LED Description

LED	Purpose	LED States		
		OFF	**Amber**	**Green**
I	Cryopump Status	Motor OFF	1st and/or 2nd stage temperature control is OFF	Motor ON and 1st and 2nd stage temperature control ON.
II	Regen Status	Normal Operation	Fast Regeneration Cycle in progress	Full regeneration cycle in progress.
III	Network Communication Status	No network communication	Heater Fault Interrupt	Blinking LED - normal network communication.

Host (RS-232) Connector

Use the Host connector to enable communication between a cryopump and a process tool host computer. This requires the the CTI-Cryogenics command set. See Appendix A: Customer Brooks Automation Technical Support Information on page 10-2 and call the Customer Support Center to request a copy of the *On-Board* IS *Cryopump with Sublime Regeneration Command Set Reference*, part number 8040744.

The following table shows On-Board *IS* System communicaiton information.

Table 10-3: RS-232 Communication Information

Parameter	Value
Baud Rate	9.6 kbps
Data Bits	7
Parity	Even
Number of Stop Bits	1

NOTE: *The RS-232 Communication Cable must be fully shielded through to the outer shell. Use cable part number 8132157 or equivalent.*

Address Switch

Use the Address Switch to set the network address (0 - 9) of the cryopump on the Intercomponent Network. Use channel B to access cryopumps 10 - 19 (0 - 9 on the switch, but using channel B).

Module Power Connector and Lock

Use the Module Power Connector to connect 208 VAC directly to the cryopump. See Performance Specifications on page 1-3 for input power specifications.

The Lock holds the input power cable in place. See Connect the Input Power Through the Communication Module on page 3-9 for instructions.

Remote Keypad Connector

Use the Remote keypad to communicate directly with the On-Board *IS* Controller. See About Cryopump Remote Screens on page 7-1 for more information.

Intercomponent Network Connector

Use the Network Connector to connect the cryopump to the Intercomponent Network.

Grounding Stud, #10

Use the Grounding Stud to attach a grounding wire.

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