



On-Board 8F Cryopump for 300mm PVD

Installation, Operation and Maintenance Instructions

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Safety Conventions

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.

Term	Example	Definition
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.
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.
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.

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

Section 1 - On-Board 8F Cryopump for 300mm PVD Description

Introduction

The On-Board 8F Cryopump for 300mm PVD provides fast, clean pumping of all gases in the 10^{-3} to 10^{-9} torr range. Cryopumps operate by condensing gas at low temperatures to achieve low vapor pressures, allowing high pumping speeds and throughputs.

The On-Board 8F Cryopump for 300mm PVD is highly-reliable and requires little maintenance. Since the Cryopump exposes no moving parts, operating fluids, or backing pumps to the vacuum, there is no possibility of system or process contamination from the Cryopump.

Installation, Operation, and Maintenance Instructions

The Installation, Operation, and Maintenance Instructions for the On-Board 8F Cryopump for 300mm PVD provide easily accessible information. All personnel with maintenance responsibilities should become familiar with the contents of these instructions to ensure high performance and safe and reliable operation of the Cryopump.

Microprocessor-Based Control System

The On-Board 8F Cryopump for 300mm PVD is equipped with a microprocessor-based control system that allows both monitoring and control of a wide range of important vacuum system functions.

Refer to the **On-Board 8F Cryopump for 300mm PVD Module Programming and Operation Instructions** CTI-CRYOGENICS P/N 8040511, that came with your cryopump, for a complete description of the numerous operational functions that are available.

Remote Operation Options

The On-Board 8F Cryopump for 300mm PVD can be controlled remotely using an RS-232 protocol. Multiple Cryopumps can be networked using a proprietary BITBUS™ protocol to a Network Terminal (48 VDC). In this configuration, the networked Cryopumps are managed as a group by the Network Terminal (48 VDC), which coordinates group regeneration cycles and provides a standardized communication link to the process tool host controller. The Network Terminal (48 VDC) allows all Cryopumps to be addressed by the host system 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.

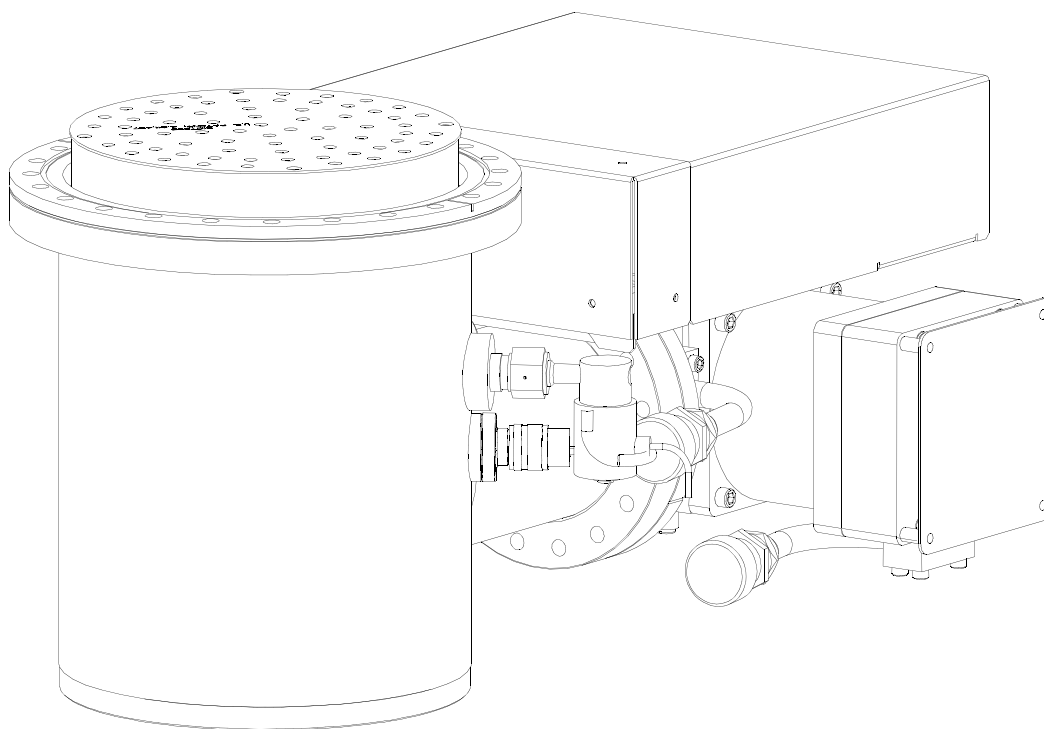


Figure 1-1: On-Board 8F Cryopump for 300mm PVD

Specifications

Table 1-1: On-Board 8F Cryopump for 300mm PVD Specifications

Parameter	Specifications
Rough Pump Connection	NW 25 ISO KF
Integrated Hardware	Roughing Valve Purge Valve Relief Valve Purge Valve Cryopump TC Gauge 1st Stage Diode 2nd Stage Diode 1st Stage Heater 2nd Stage Heater 3 Setpoint Relays RS-232 Interface
Chevron Inlet Array Pump- ing Speeds: Water Nitrogen Hydrogen Argon	4000 liters/sec 1500 liters/sec 2200 liters/sec 1200 liters/sec
Argon Throughput	200 sccm (torr-liters/sec)
FastRegen Capacities: Argon Hydrogen	800 std. liters 12 std. liters @ 5×10^{-6} torr
Crossover	150 torr-liters
Cooldown Time	75 minutes nominal
Dimensions	Refer to Installation/Interface Drawing
Weight	72 lbs.

Theory of Operation

The On-Board 8F Cryopump for 300mm PVD consists of a refrigerator or coldhead, a vacuum vessel, and electronics, valves, and heaters for controlling and monitoring the cryopump.

Cryopumps operate on the principle that gas molecules encountering a sufficiently cold surface (array) will be condensed and held 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 thereby are removed or *pumped* from the vacuum chamber.

The pump has two arrays. The first stage array or inlet array operates at temperatures between 60-120K and is primarily used to pump water vapor. The second stage array operates at temperatures between 10-20K and is used to pump air gasses such as nitrogen, argon, and oxygen. Activated charcoal is attached to the underside of the second stage array, and is used to cryoadsorb hydrogen, helium, and neon. The Cryopump arrays are cooled using a closed cycle, Gifford McMahan refrigeration cycle utilizing compressed gaseous helium as the refrigerant.

Since the Cryopump is a capture pump, it requires a regeneration cycle when it reaches capacity. The On-Board 8F Cryopump for 300mm PVD uses an integrated microprocessor, variable speed motor and heaters to provide a fast and thorough regeneration cycle.

The On-Board 8F Cryopump for 300mm PVD system consists of the cryopump and a remotely located High Capacity Helium Compressor which provides the compressed helium. The High Capacity Helium Compressor can provide helium for multiple Cryopumps through helium supply and return lines. A typical On-Board 8F Cryopump for 300mm PVD system is shown in Figure 1-2.

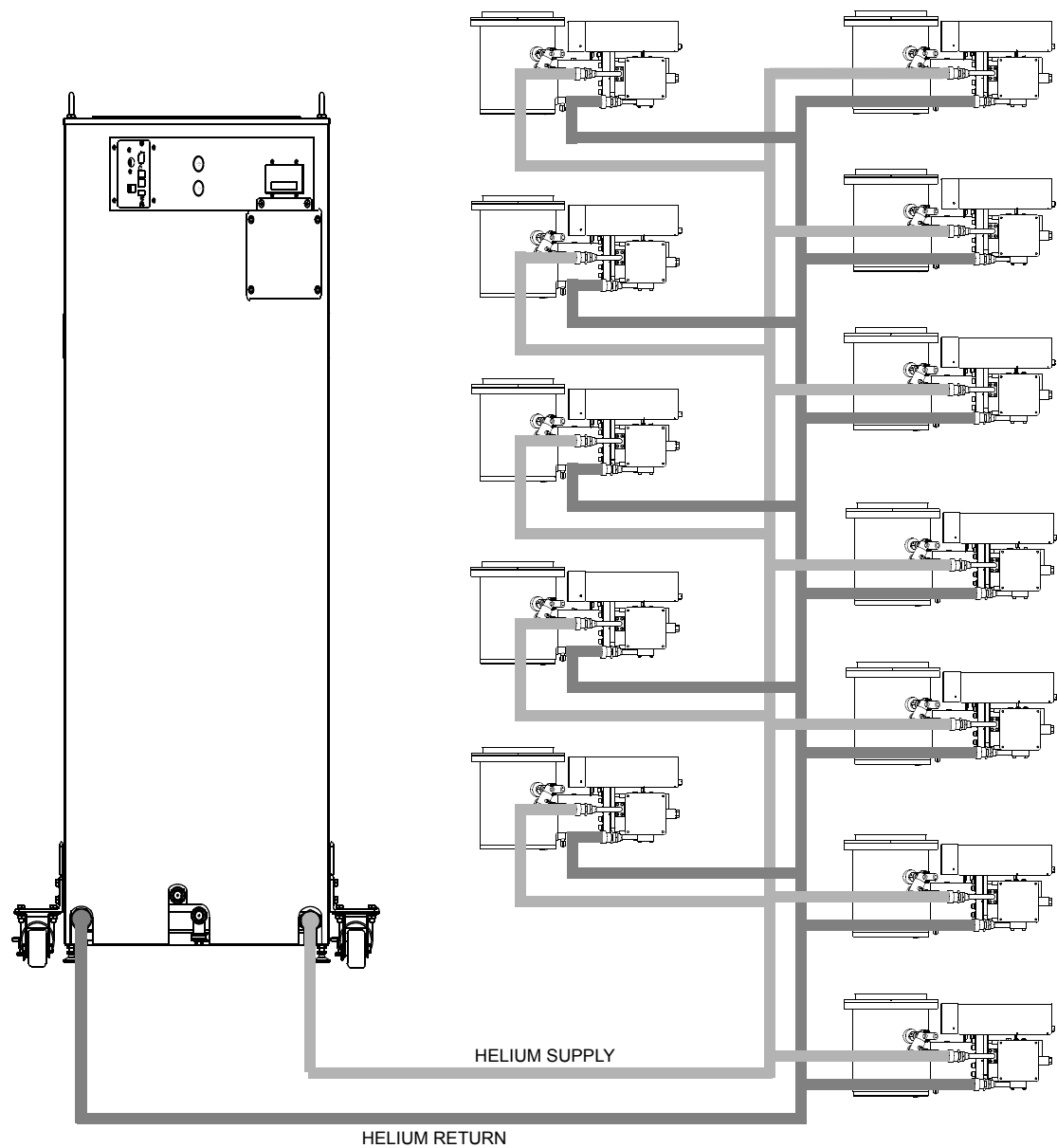


Figure 1-2: Typical On-Board 8F Cryopump for 300mm PVD System

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 40-120 rpm.

The following steps and Figure 1-3 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.

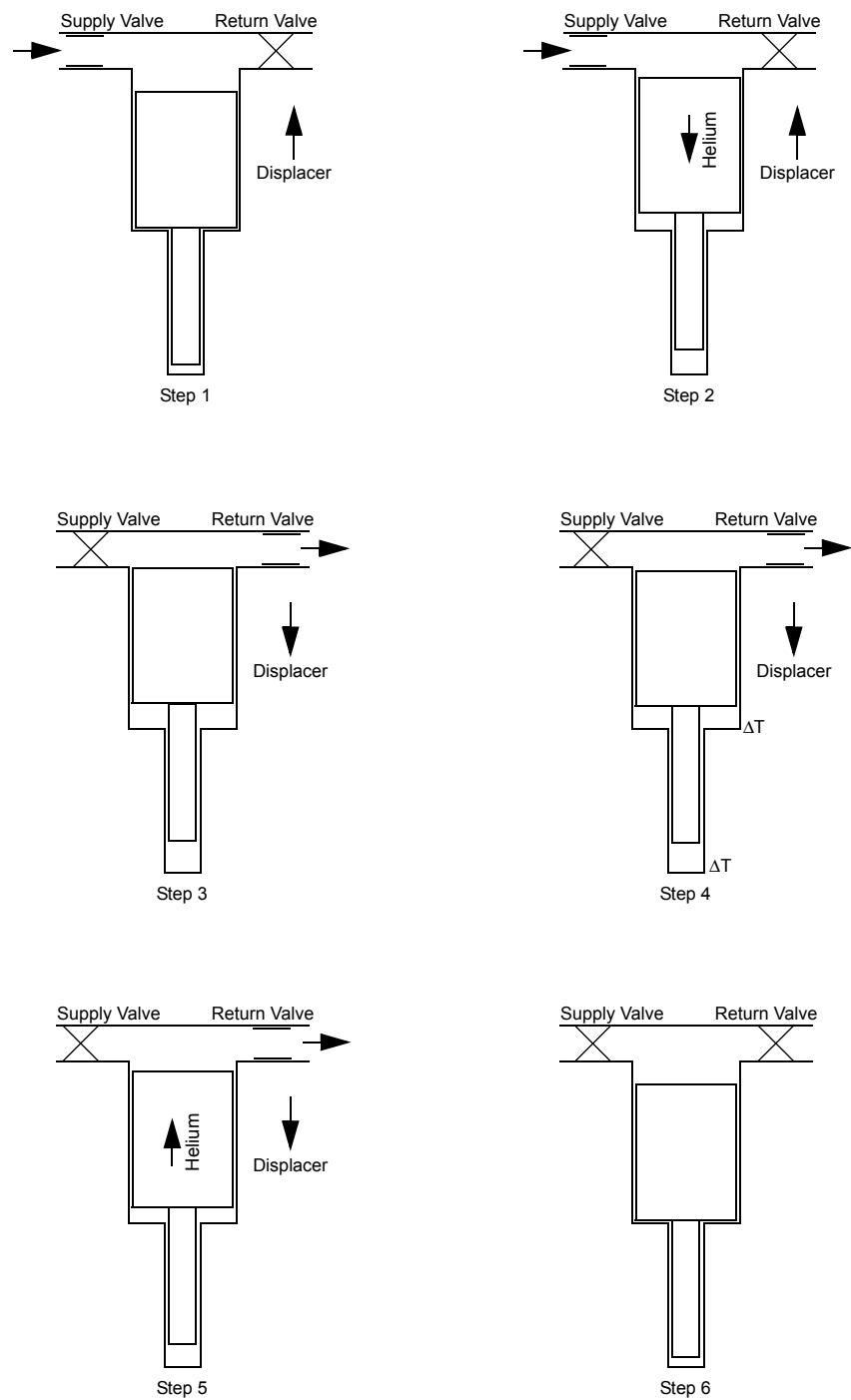


Figure 1-3: Gifford McMahon Refrigeration Cycle

Component Description

The On-Board 8F Cryopump for 300mm PVD, shown in Figure 1-4, is driven by a variable speed DC motor and controlled by an advanced microprocessor On-Board control module. The On-Board 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.

Inlet Port

The Inlet Port is the opening of the vacuum vessel through which process gases enter the cryopump. The Inlet Port is connected to the vacuum chamber via the gate valve.

Vacuum Vessel

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

First Stage Array

The First Stage 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 60 to 120K. The On-Board 8F Cryopump for 300mm PVD utilizes either a chevron array or a sputter plate for the first stage array. The chevron array maximizes the Cryopump pumping speed for all gasses. The sputter plate maximizes the water pumping speed while maintaining reduced process gas pumping speeds.

Second Stage Array

The Second Stage Array condenses gases such as N₂, O₂, Ar, CO₂, and CO and operates at temperatures from 10 to 20K. Activated charcoal is attached to the second stage array which cryoadsorbs H₂, He, and Ne.

Refrigerator

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 60 to 120K for the first stage and 10 to 20K for the second stage, depending on operating conditions.

First and Second Stage Heaters

The first and second stage heaters are mounted to the cold head cylinder and are used to warm the Cryopump during a regeneration cycle.

Thermocouple (TC) Gauge

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

Diode Connector

The Diode Connector is connected to the diodes that are mounted on the first and second stage arrays of the Cryopump. The diodes measure the first and second stage array temperatures. Array temperature information is sent to the On-Board Module.

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.

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 Valve Purge Valve

The Exhaust Valve 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. The exhaust valve purge valve actuates whenever the Cryopump rough valve is actuated.

Helium Supply Fitting

The Helium Supply Fitting provides a connection for high pressure compressed helium from the High Capacity Helium Compressor to the Cryopump.

Helium Return Fitting

The Helium Return Fitting provides a connection to return low pressure

Component Description

helium which has been cycled through the Cryopump to the High Capacity Helium Compressor.

Vacuum Vessel Pressure Relief Exhaust Valve

The Vacuum Vessel Pressure Relief Exhaust Valve is a spring loaded valve which releases process gases during a regeneration cycle. The relief valve opens at approximately 2-3 psig.

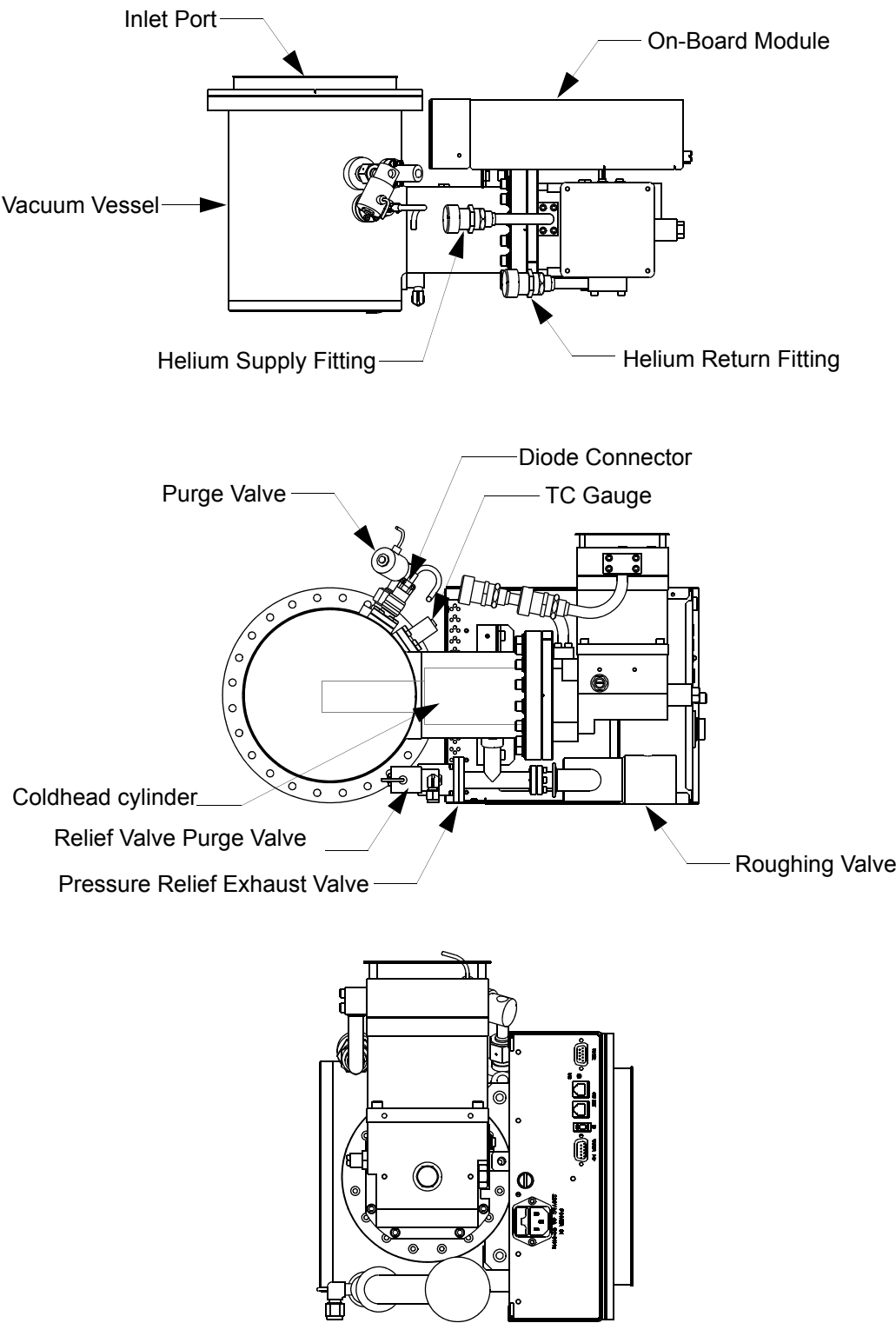


Figure 1-4: On-Board 8F Cryopump for 300mm PVD Component Identification

On-Board Module

The On-Board Module controls the operation of the On-Board 8F Cryopump for 300mm PVD. In addition, the On-Board Module conditions the input power, provides host computer RS-232 and Network communication ports, and setpoint relay outputs. Refer to Figure 1-5 and the following paragraphs for component descriptions.

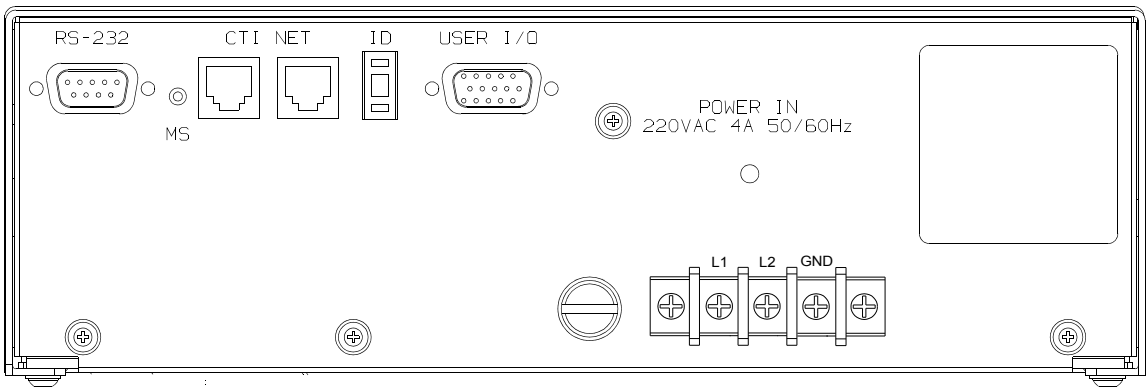


Figure 1-5: On-Board Module Components

RS-232

The RS-232 port allows the On-Board 8F Cryopump for 300mm PVD to communicate with a host computer using the CTI-CRYOGENICS command set. Refer to Table 1-2 for additional information on the communication protocol. Refer to the **On-Board 8F Cryopump for 300mm PVD Module Programming and Operation Instructions** CTI-CRYOGENICS P/N 8040511 for information on RS-232 commands.

Table 1-2: RS-232 Port Information

Parameter	Value
Baud Rate	9.6 kbs
Data Bits	7
Parity	Even
Number of stop Bits	1

NOTE: The RS-232 Cable must be fully shielded through to the outer shell. Use CTI-CRYOGENICS cable P/N 8132157 or equivalent.

MS

The Module Status (MS) LED indicates the operational status of the On-Board 8F Cryopump for 300mm PVD. A constant green LED indicates the Cryopump is ON and functioning properly. A blinking green LED indicates that there is a problem with the electronics module.

CTI Net

The CTI Net port is a BitBus connection that allows the On-Board 8F Cryopump for 300mm PVD to be connected to a Network Terminal (48 VDC).

***NOTE:** The CTI Net cables must have two loops of cable passing through a Ferrite coil. Refer to **Section 2 - Installation** for more information.*

ID Selector Switch

The ID Selector Switch establishes the network address (0 - 9) of the On-Board 8F Cryopump for 300mm PVD on the CTI-CRYOGENICS network.

User I/O

The User I/O port allows connection to the programmable relays in the electronics module. The relays can be used to provide interlocks on the vacuum system. On software integrated systems, the relays typically are not used. The User I/O connector also provides + 24 VDC and optically isolated inputs.

Power In

The Power In connection is the connection point of the input power to the On-Board 8F Cryopump for 300mm PVD. Refer to Table 1-3 for input power requirements.

Table 1-3: Input Power Requirements

Parameter	Value
Voltage*	220 VAC
Current	6.3 amps
Line Frequency	50 or 60 Hz.
Phase	1
* Nominal input voltage. The actual input voltage range is 180 - 253 VAC.	

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Section 2 - Installation

Introduction

Installation information is presented for experienced and non-experienced On-Board 8F Cryopump for 300mm PVD system technicians. The flowchart in Figure 2-1 highlights the major tasks of On-Board 8F Cryopump for 300mm PVD installation.

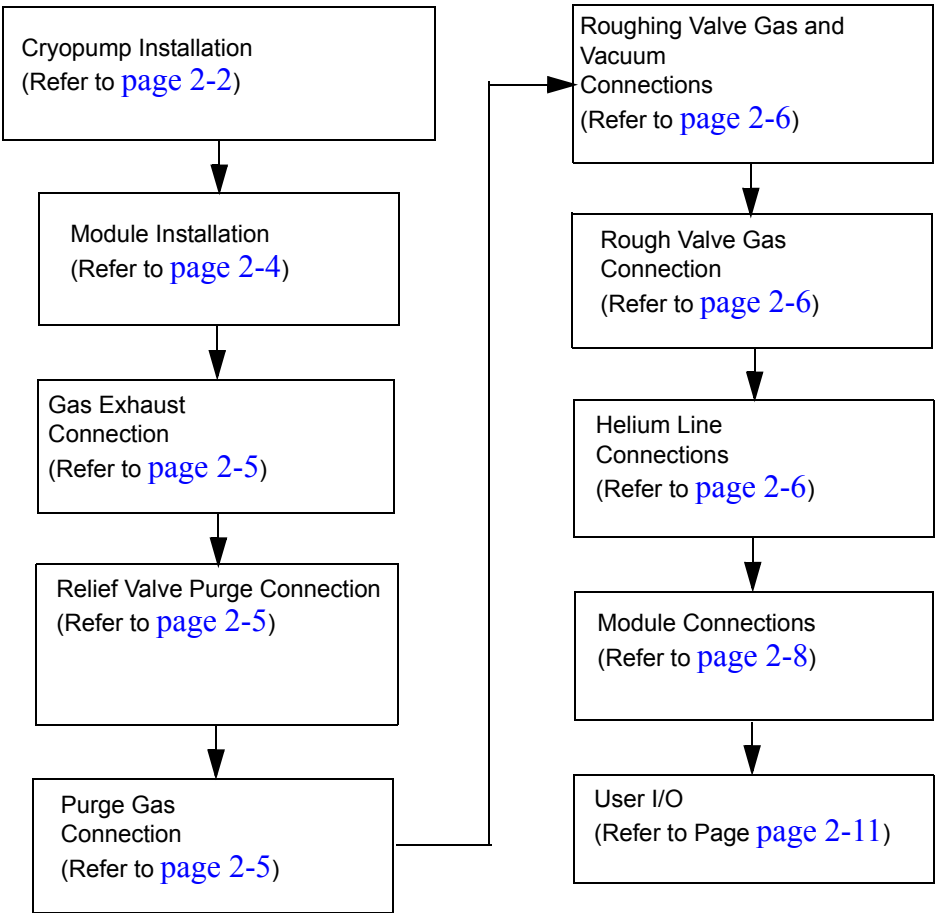


Figure 2-1: On-Board 8F Cryopump for 300mm PVD Installation Block Diagram

Installation

The On-Board 8F Cryopump for 300mm PVD may be installed in any orientation without affecting its performance.

Before mounting the On-Board 8F Cryopump for 300mm PVD to the vacuum system, a high-vacuum isolation valve (Hi-Vac valve) should be installed between the Cryopump and the vacuum chamber to isolate the Cryopump from the chamber during regeneration or chamber maintenance.

Install the On-Board 8F Cryopump for 300mm PVD on the vacuum system as follows:

1. Loosen, but do not remove the two screws on either side of the module base as shown in Figure 2-2.
2. Remove the screw in the end of the module base as shown in Figure 2-2.
3. Slide the module base away from the mounting flange to allow access to the Cryopump mounting flange area.
4. Remove the protective cover from the main flange of the Cryopump.
5. Clean all sealing surfaces and install the metal seal gasket.
6. Install the Cryopump on the Hi-Vac valve or vacuum chamber mounting flange and torque the mounting bolts to the torque specification of the mating flange.
7. Slide the module base toward the Cryopump flange.
8. Reinstall and tighten the screw in the end of the On-Board Module base.
9. Tighten the two side screws that were loosened in step 1.

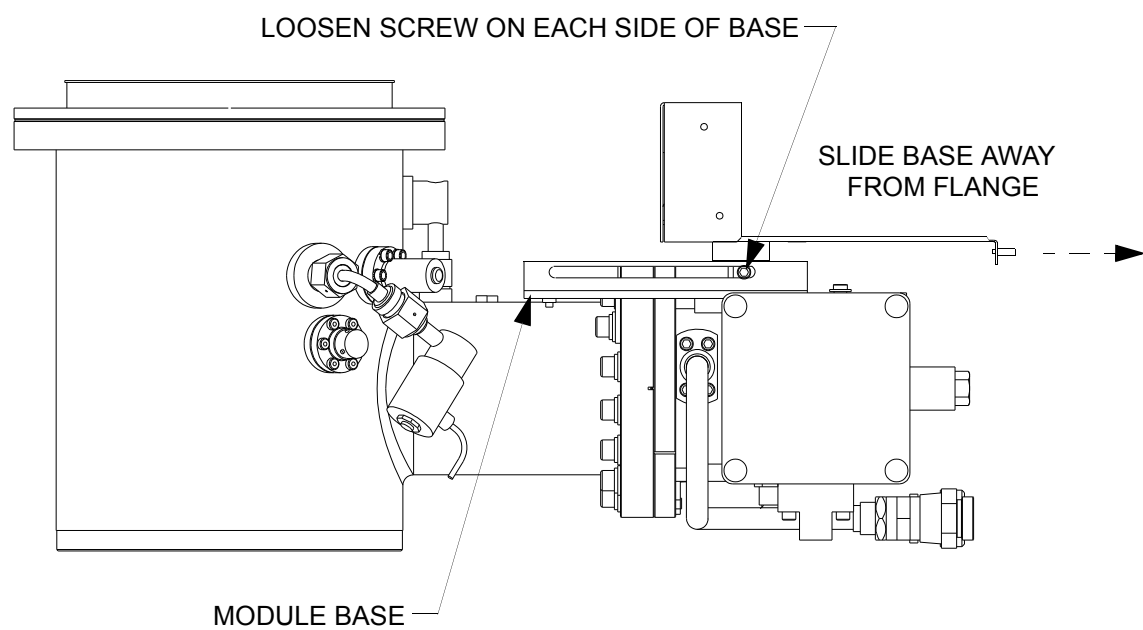


Figure 2-2: Module Base and Screw Locations

Module Installation

1. Remove the terminal box cover from the module as shown in Figure 2-3.
2. Place the module on the base and slide the module on the base until the module contacts the base back plate as shown in Figure 2-3.
3. Tighten the thumb screw.

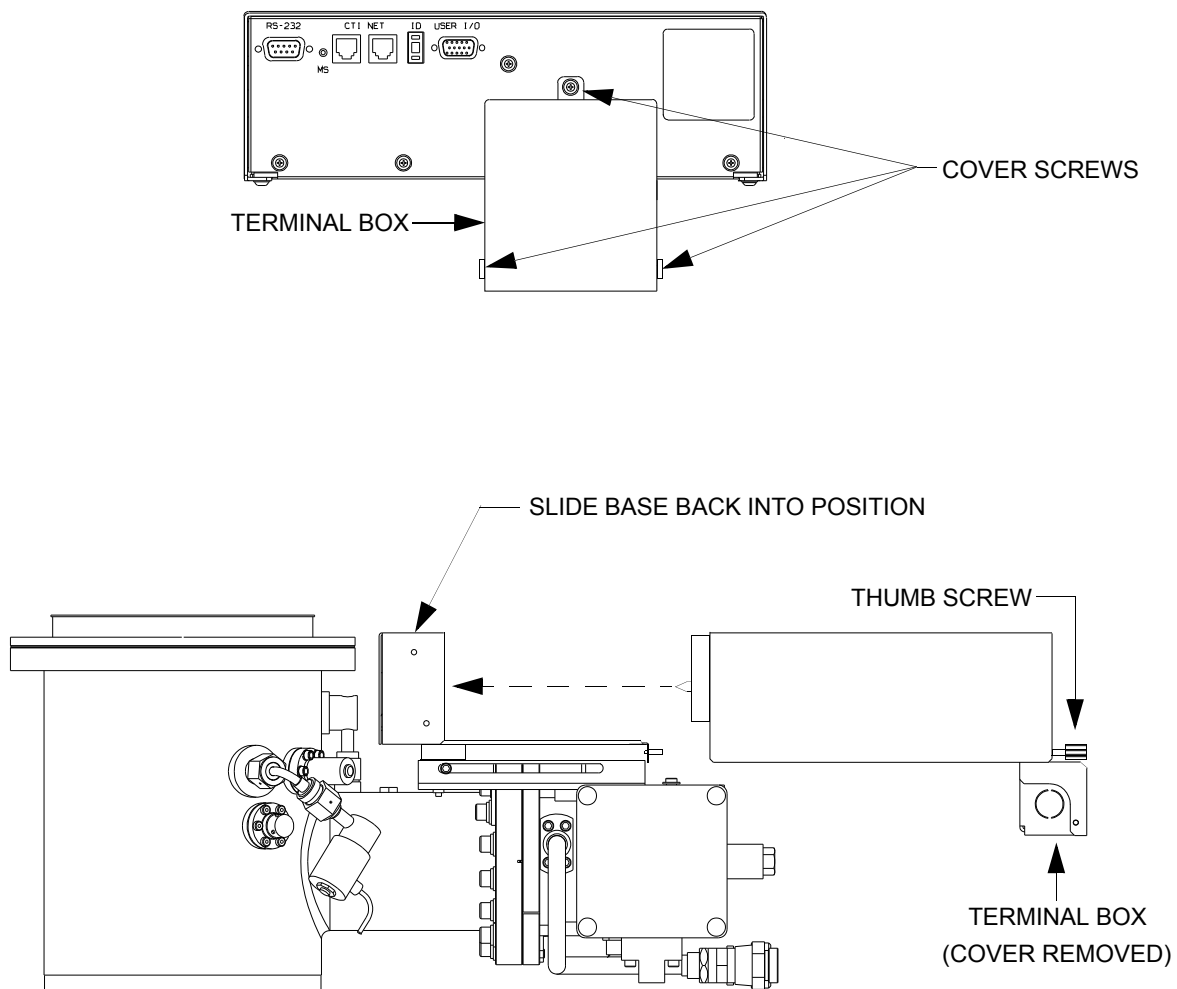


Figure 2-3: Terminal Box Cover Removal and Module Installation

Gas Exhaust Connections

The On-Board 8F Cryopump for 300mm PVD pressure relief valve can be vented directly into the room or can be connected to an exhaust system.

	WARNING If toxic, corrosive, or flammable gases are pumped, the On-Board 8F Cryopump for 300mm PVD relief valve must be connected to an exhaust system.
---	--

Any exhaust line or manifold connected to the cryopump must be sized to be able to handle the gas load that are liberated from the pump. Typically, for a single cryopump and line lengths of approximately 10 feet, the exhaust tubing should be a minimum of 5/8 inch ID.

Relief Valve Purge Connection

1. Connect a nitrogen purge gas line to the FNPT connection on the Relief valve purge valve.
2. Set the nitrogen pressure to 40-80 psi.

NOTE: The Cryopump purge gas can be teed and used for both purging the cryopump and for the relief valve purge.

Purge Gas Connection

NOTE: The On-Board 8F Cryopump for 300mm PVD requires a nitrogen supply capable of providing 40-80 psi, with a flow rate of 1-2 cfm per cryopump

1. Connect a purge gas supply line to the purge valve 1/8 FNPT fitting.
2. Adjust the nitrogen supply pressure to 40-80 psig.

Roughing Valve Gas and Vacuum Connections

NOTE: The roughing system must provide a minimum of 10 cfm pumping speed (measured at atmosphere) per On-Board 8F Cryopump for 300mm PVD to successfully utilize 300mm FastRegen capability. The roughing pump should have a blank-off pressure of less than 20 microns.

1. Connect the On-Board 8F Cryopump for 300mm PVD to a roughing pump system using an NW-25 roughing line and the provided clamp.
2. Tighten the clamp securely.

Rough Valve Gas Connection

1. Attach the gas supply line from a 60-80 psig air supply to the 1/8 FNPT roughing valve fitting. Make sure to attach the air supply line to the solenoid port that has a filter screen in the port.

Helium Flex Line Connections



CAUTION

Make sure that the helium lines are connected and disconnected from the On-Board 8F for 300 mm Compressor using the following procedure. Failure to follow this procedure could damage connector O-ring seals or cause a helium circuit leak.

NOTE: The On-Board 8F Cryopump for 300mm PVD helium lines are gendered such that all Supply helium lines are male, and all return helium lines are female.

Figure 2-4 shows how to connect/disconnect the helium lines.

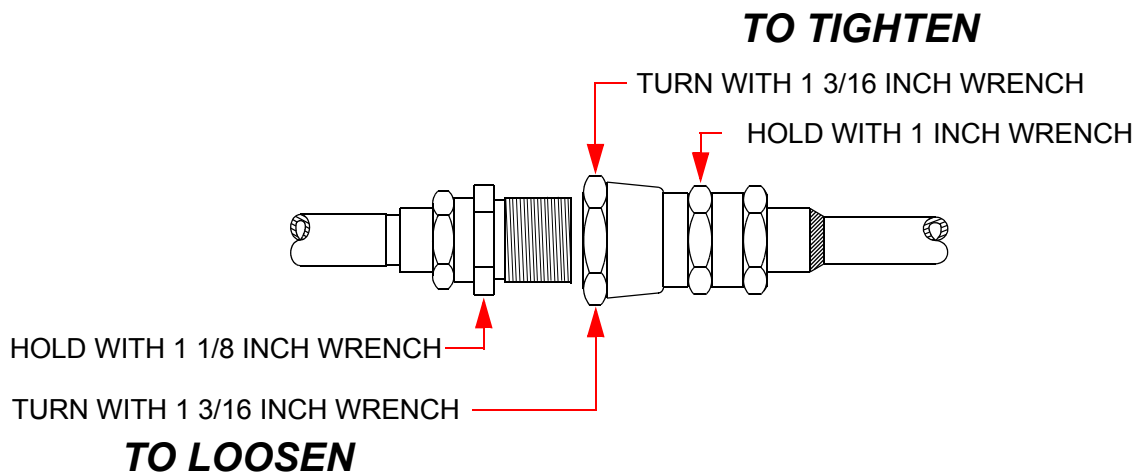


Figure 2-4: Connecting/Disconnecting Helium Line Self Sealing Couplings

Connecting

NOTE: Refer to [Figure 2-4](#) during this procedure.

1. Remove all dust plugs and caps from the Gas Supply and Return lines, and the High Capacity Helium 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. Connect the Gas Return line to the GAS RETURN connector on the rear of the High Capacity Helium Compressor and then to the GAS RETURN connector on the On-Board 8F for 300 mm Cryopump or helium manifold. Using two wrenches as shown in [Figure 2-4](#), tighten the connector.
3. Connect the Gas Supply line to the GAS SUPPLY connector on the rear of the High Capacity Helium Compressor and then to the GAS SUPPLY connector on the On-Board 8F for 300 mm Cryopump or helium manifold. Using two wrenches as shown in [Figure 2-4](#), tighten the connector.
4. Attach the Supply and Return line identification labels to each end of the appropriate lines.
5. Verify proper helium supply static pressure as described in the **High Capacity Helium Compressor Installation, Operation and Maintenance Instructions**, CTI-CRYOGENICS P/N 8040600.

Disconnecting

NOTE: Refer to [Figure 2-4](#) during this procedure.

1. Using two wrenches as shown in [Figure 2-4](#), disconnect the two self sealing coupling connectors quickly to minimize helium leakage.
2. Connect the helium-return line from the gas-return connector on the rear of the compressor to the gas-return connector on the On-Board 8F for 300 mm Cryopump.
3. Connect the helium supply line from the supply connector on the cartridge to the gas-supply connector on the On-Board 8F for 300 mm Cryopump.
4. Attach the supply and return line identification decals (CTI-CRYOGENICS supplied) to their respective connectors.

Module Connections

Power Cable Installation

The following procedure provides information for making single phase (220 VAC) electrical connections to the On-Board 8F Cryopump for 300mm PVD.



WARNING

Follow all local high voltage safety precautions when performing this procedure to reduce the possibility of electrical shock. Make sure all electrical power is OFF before proceeding with this procedure.

CAUTION

The customer supplied cable used for making the On-Board 8F Cryopump for 300mm PVD power cable must be 16 gauge, 2 conductor cable with ground, rated at 600 VAC with non-locking plug.

1. Make sure the process tool circuit breaker which supplies power to the On-Board 8F Cryopump for 300mm PVD power circuit has been set to the OFF position.
2. Cut a 16 AWG (1.3 mm²), 2 conductor cable with ground to an appropriate length.
3. Strip the cable jacket back 4.0 inches (100 mm).
4. Strip the insulation back 0.25 inches (12 mm) on each conductor.

5. Install a #6 ring tongue terminal on the end of each power conductor and the primary ground conductor using the appropriate size double crimping tool.
6. Install a #10 ring tongue terminal on the end of the ground conductor using the appropriate size double crimping tool.
7. Make sure the terminal box cover has been removed as shown in Figure 2-3.

NOTE: The knockout hole diameter is 0.875 inches (14.96 mm) nominal.

8. Remove one of the three available knockouts (items 1, 2, or 3 as shown in Figure 2-5) from the terminal box to provide access for the input power.

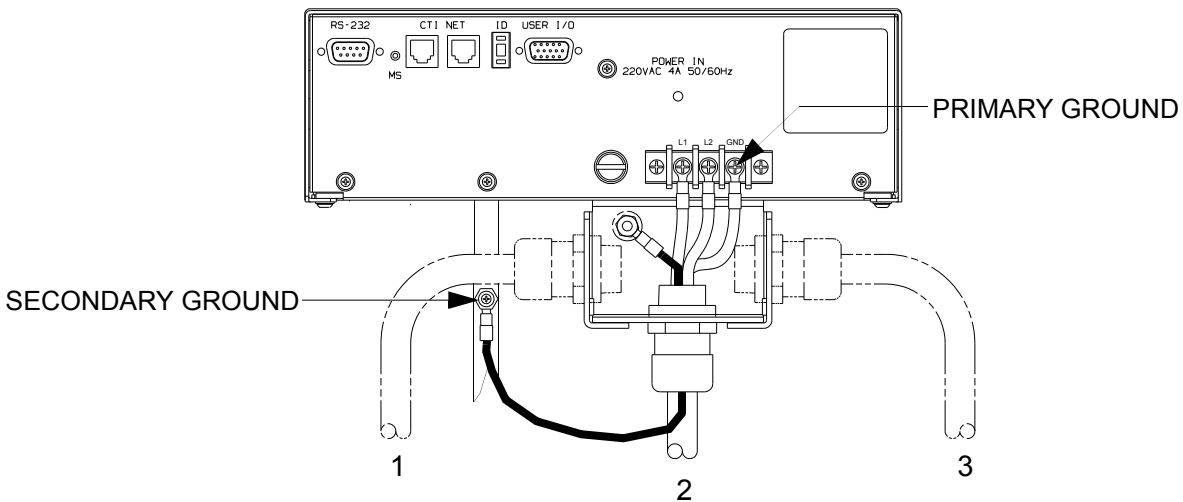


Figure 2-5: On-Board 8F Cryopump for 300mm PVD Power Cable Installation (Terminal Cover Removed)

9. Install a strain relief fitting into the knockout hole and tighten the nut.

NOTE: Allow enough cable to stay in the electrical enclosure to prevent strain on the electrical connections.

10. Install the cable into the strain relief fitting and tighten the cable clamp.
11. Connect the secondary ground wire to the ground stud on the Cryopump frame as shown in Figure 2-5.
12. Install the ground stud nut and tighten to 18 in.-lbs (0.21 m-kg).
13. Remove the screws from L1, L2 and GND on the Cryopump terminal strip as shown in Figure 2-5.

14. Install the power wire terminal lugs to terminals L1 and L2 as shown in Figure 2-5.
15. Connect the primary ground wire to GND as shown in Figure 2-5.
16. Torque the screws to 12 in.-lbs (0.14 m-kg).
17. Install the terminal box cover.
18. Install the non-locking plug on the end of the power cable according to local electrical codes.
19. Connect the non-locking plug to the power source.

CTI NET Cable Connections

Use the following procedure to connect the On-Board 8F Cryopump for 300mm PVD to the On-Board Network.

NOTE: To meet regulatory compliance, the customer provided RS-232 cable must be fully shielded through to the connector shell. Use cable CTI-CRYOGENICS P/N 8132157GXXX or equivalent.

1. Connect the CTI NET cables to the CTI NET connectors on the On-Board Cryopump Module.
2. Connect the opposite end of the CTI NET cables to their respective On-Board Network connections.

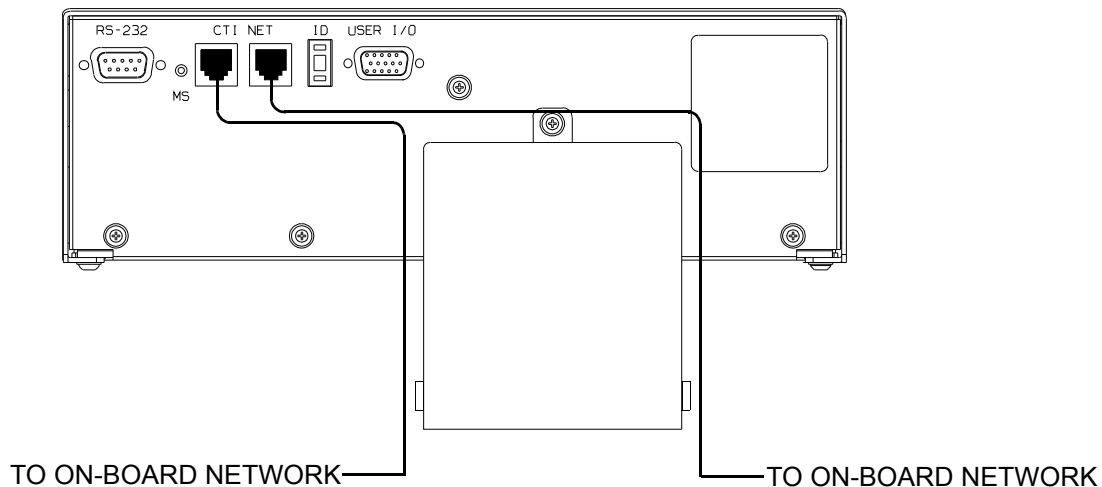


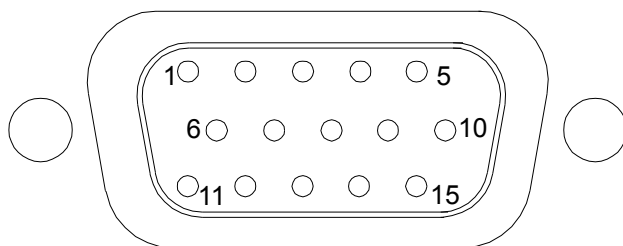
Figure 2-6: CTI NET Cable Installation

User I/O (Setpoint Relays)

The setpoint relays are three mechanical relays that are incorporated into the On-Board 8F Cryopump for 300mm PVD. The Relays can be programmed to actuate based on various conditions of the cryopump. The outputs from the relay can be used for providing interlocks with the vacuum system. Typically these relays are not used for software integrated vacuum systems.

When the setpoint relays are used, connection to the relays (R1, R2, and R3) is made through the 15-pin D connector labeled (USER I/O) on the connector plate of the On-Board Module. The relay contacts are rated at 1 amp at 25V AC/DC. The relays have both normally-open and normally-closed contacts. If your Cryopump configuration requires the use of the setpoint relays, refer to Figure 2-6 and proceed as follows:

1. Referring to Figure 2-6, wire the system interlock cable to the User I/O mating connector according to your equipment requirements.
2. Connect the system interlock cable to the USER I/O connector on the On-Board Module.
3. Refer to the appropriate **On-Board 8F Cryopump for 300mm PVD Module Programming and Operation Instructions** CTI-CRYOGENICS P/N 8040511 for instructions on programming the setpoint relays.



PIN 1 - RELAY 1 - NORMALLY CLOSED (N.C.)
 PIN 2 - RELAY 1 - NORMALLY OPEN (N.O.)
 PIN 3 - SETPOINT - COMMON
 PIN 4 - RELAY 2 - COMMON
 PIN 5 - RELAY 2 - (N.C.)
 PIN 6 - (+) 24 VDC
 PIN 7 - RELAY 1 - COMMON

PIN 8 - SET POINT 3
 PIN 9 - (+) 5VDC
 PIN 10 - RELAY 2 (N.O.)
 PIN 11 - SETPOINT 1
 PIN 12 - RELAY 3 (N.C.)
 PIN 13 - RELAY 3 (N.O.)
 PIN 14 - RELAY 3 - COMMON
 PIN 15 - SETPOINT 2

Figure 2-7: User I/O (Setpoint Relays) Connection and Pin Identification

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Section 3 - Troubleshooting

Introduction

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 a leak in the vacuum system, the cryopump reaching capacity, or by 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, isolate the On-Board 8F Cryopump for 300mm PVD by closing the Hi-Vac valve and leak check the vacuum chamber. Be sure to 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 8F Cryopump for 300mm PVD shut off and at room temperature. Leak checking while the On-Board 8F Cryopump for 300mm PVD 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 3-1.

The problems presented in Table 3-1 are followed by possible causes and corrective actions. The causes and corresponding actions are listed in their order of probability of occurrence.

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 pumpdown time, chamber rate of rise. In addition, a baseline chamber RGA scan is very useful for system troubleshooting

The cryopump regeneration history can also be useful for troubleshooting refrigeration related problems. The history of the last ten regenerations are stored in the module on the cryopump and can be accessed from On-Board Central Control software or possibly from the process system software.

Technical Inquiries

Please refer to **Appendix A** of this manual for a complete list of the CTI-CRYOGENICS' world wide customer support centers.

Table 3-1: On-Board 8F Cryopump for 300mm PVD Troubleshooting Procedures

Problem	Possible Cause	Corrective Action
High vacuum system base pressure, and a cryopump temperature <i>below</i> 20K.	1. Air-to-vacuum leak in vacuum system or in cryopump. 2. High partial pressure of non-condensables (helium, hydrogen, or neon) within the cryopump because the Second Stage array has reached full capacity.	1a. Check vacuum chamber and Hi-Vac valve for leaks. 1b. Check cryopump side of high vac valve for leaks. 2. Regenerate the cryopump as described in the On-Board 8F Cryopump for 300mm PVD Module Programming and Operation Instructions CTI-CRYOGENICS P/N 8040511.
High base pressure of vacuum system, and a cryopump temperature <i>above</i> 20K.	1. Low Helium Pressure 2. High partial pressure of non-condensables (helium, hydrogen, or neon) within the cryopump because the Second Stage array has reached full capacity. 3. Excessive thermal load on frontal array.	1. Check compressor Helium pressure. If the helium return pressure gauge reads below the normal operating pressure, add gas as described in the High Capacity Helium Compressor Installation, Operation, and Maintenance Instructions CTI-CRYOGENICS P/N 8040529. 2. Regenerate the cryopump as described in the appropriate On-Board 8F Cryopump for 300mm PVD Module Programming and Operation Instructions CTI-CRYOGENICS P/N 8040511. 3. Look for new sources of thermal loads on the cryopump.

Table 3-1: On-Board 8F Cryopump for 300mm PVD Troubleshooting Procedures

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. 2. Loose or disconnected helium self sealing couplings. 3. Compressor problems. 4. Leak in vacuum system or cryopump.	1. Add gas as described in the High Capacity Helium Compressor Installation, Operation, and Maintenance Instructions CTI-CRYOGENICS P/N 8040529. 2. Fully connect all helium self sealing couplings. 3. Refer to the High Capacity Helium Compressor Installation, Operation, and Maintenance Instructions CTI-CRYOGENICS P/N 8040529. 4a. Check vacuum chamber and Hi-Vac valve for leaks. 4b. Check cryopump side of Hi-Vac valve for leaks.
LED on module is flashing.	Module logic needs to be reset.	Turn cryopump input power OFF then ON.
LED on module is not illuminated.	No power to On-Board 8F Cryopump for 300mm PVD.	Verify that cryopump input power is within spec. See Table 1-3.
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.

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Appendix A - Customer Support Information

Customer Support Center Locations

To locate a Customer Support Center near you, please visit our website ***www.helixtechnology.com*** on the world wide web and select *CONTACT* on the home page.

Guaranteed Up-Time Support (GUTS®)

For 24-hour, 7-day per week Guaranteed Up-Time Support (GUTS) dial:

1 800-367-4887 - Inside the United States of America

+1 508-337-5599 - Outside the United States of America

Product Information

Please have the following information available when calling so that we may assist you:

- Product Part Number
- Product Serial Number
- Product Application
- Specific Problem Area
- Hours of Operation
- Equipment Type
- Vacuum System Brand/Model/Date of Manufacture

E-mail

For your convenience, you may also e-mail us at:

techsupport@helixtechnology.com

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