Thermo Electron Corporation

DSQ II

Hardware Manual

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Thermo
ELECTRON CORPORATION

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DSQ Series refers to both the DSQ II and DSQ mass spectrometers.

INSTRUMENT USAGE: Thermo Electron DSQ II systems operate safely and reliably under carefully controlled environmental conditions. If the equipment is used in a manner not specified by the manufacturer, the protections provided by the equipment may be impaired. If you maintain a system outside the specifications listed in this guide, failures of many types may occur. The repair of such failures is specifically excluded from the standard warranty and service contract coverage.

Technical information contained in this publication is for reference purposes only and is subject to change without notice. Every effort has been made to supply complete and accurate information; however, Thermo Electron assumes no responsibility and will not be liable for any errors, omissions, damage, or loss that might result from any use of this manual or the information contained therein (even if this information is properly followed and problems still arise). This publication is not part of the Agreement of Sale between Thermo Electron and the purchaser of a Thermo Electron system. In the event of any conflict between the provisions of this document and those contained in Thermo Electron's Terms and Conditions, the provisions of the Terms and Conditions shall govern. Reference to System Configuration and Specifications supersede all previous information and are subject to change without notice.

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Preface

This manual contains detailed instructions for operating, maintaining, and troubleshooting your instrument.

Your DSQ II instrument provides you with the highest caliber gas chromatography / mass spectrometry (GC/MS) instrumentation available on today's market.

GC/MS represents a combination of two powerful analytical techniques: GC, which acts as a separation technique, and MS, which acts as a detection technique. Complex mixtures of individual compounds can be injected into the GC, either manually or through the use of an optional autosampler, and then separated for introduction into the MS. The MS will then generate a series of mass spectra of the GC eluent and its components, which can be used for qualitative identification as well as accurate and precise quantification of the individual compounds present in the sample.

IMPORTANT The DSQ II system is designed to optimize both the separation and detection capabilities of GC/MS techniques and combine them in a synergistic fashion to provide high performance analytical capabilities for both research and routine applications. More information on the use of this system can be found in related documentation sources and through the provided contact information.

Regulatory Compliance

We thoroughly test and evaluate our products to ensure full regulatory compliance with applicable domestic and international regulations. Your system (hardware and software) is CE Compliant and meets Electromagnetic Compatibility (EMC) and safety standards.

CAUTION

Instrument Damage. DSQ II systems operate safely and reliably under carefully controlled environmental conditions. If the equipment is used in a manner not specified by the manufacturer, the protections provided by the equipment may be impaired. If you maintain a system outside the specifications listed in this guide, failures of many types may occur. The repair of such failures may be excluded from the documents regarding your standard warranty and service contract coverage.

Certifications

FCC part 15, Class A

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy. If it is not installed and used in accordance with the instruction manual, it may cause harmful interference to radio communication. Operation of this equipment in a residential area is likely to cause harmful interference. In this case, users will be required to correct the interference at their own expense.

DSQ II: EMC - EN 61326-1:1997 + A1:1998 + A2:2001.
Safety - EN 61010-1:2001.

Detailed installation requirements are in the instrument's preinstallation guide:

- DSQ II Preinstallation Guide, PN 120299-0001

Power Ratings

Mass Spectrometer (MS)

- 120 V ac +6/-10%, 50/60 Hz, 1800 VA max power, 15 A
- 230 V ac ±10%, 50/60 Hz, 1800 VA max power, 8 A

Gas Chromatograph (GC)

- 120 V ac +6%/-10%, 50/60 Hz, 2400 VA max power, 20 A
- 230 V ac ±10%, 50/60 Hz, 2400 VA max power, 10 A

Detailed instrument specifications are in the Product Specification or Product Brochure.

Who Uses This Guide

This Hardware Manual is written for users with minimal or no prior experience with the DSQ II or mass spectrometry.

How to Use This Guide

Refer to the chapter containing the instructions you are interested in.

Chapter 1, "Operating Instructions," contains basic operating instructions for using the *DSQ II* Mass Spectrometer Detector.

Chapter 2, "Maintenance Instructions," contains maintenance instructions for essential detector components.

Chapter 3, "DSQ II Troubleshooting," provides quick reference to identify symptoms, causes, and solutions for poor instrument performance or malfunction.

Chapter 4, "Vacuum System and Gas Inlets," contains theory of operations for the vacuum system and gas inlets.

Chapter 5, "Ion Source and Inlet Valve," contains theory of operations for ion source components and the inlet valve.

Chapter 6, "Prefilter and Quadrupole Assembly," contains theory of operations for the prefilter and quadrupole mass filter.

Chapter 7, "Ion Detector Assembly," contains theory of operations for ion detector assembly components.

The Glossary contains brief definitions of terms commonly used in mass spectrometry.

Appendix A, "Replaceable Parts," contains DSQ II drawings and part numbers for replaceable parts and consumables.

Appendix B, "Functional Block Diagrams," contains functional block diagrams for the DSQ II system and its subsystems.

For More Information

Some information refers to the continental USA exclusively. Assurances and specifications might differ in other locations. Specific details are available from your regional Technical Support office. If you have questions, contact the Customer Service office assigned to your area.

Related Documentation

In addition to this guide, Thermo Electron provides the following documents for the DSQ II. We also offer "Print-By-Request" for each manual:

DSQ II Document Set, PN 120299

- DSQ II Preinstallation Guide, PN 120299-0001
- DSQ II Hardware Manual, PN 120299-0002
- DSQ II User's Guide, PN 120299-0003

Instrument Help is available from within the software.

Safety Alerts and Special Notices

In this guide, safety alerts and other special notices appear in boxes.

Safety alerts are a combination of *safety symbols* and *signal words* designed to alert you to protect yourself and/or your instrument.

Please read about the types of safety alerts, signal words, and the safety symbols that are presented in this guide and presented on the instrument.

Safety alerts without the *general warning symbol* (yellow triangle with an exclamation mark) and only the signal word such as CAUTION, NOTICE, and SAFETY INSTRUCTIONS alert you to the potential of property damage and additional safety precautions.

Types of Safety Alerts & Signal Words

Safety alerts that may or may not be associated with the use of this instrument or these instructions are defined as follows:

DANGER

Personal Injury. DANGER safety alerts indicate an imminent hazard exists that WILL result in death or serious personal injury.

WARNING

Personal Injury. WARNING safety alerts indicate a potential hazard exists that COULD result in death or serious personal injury.

CAUTION

Personal Injury. CAUTION safety alerts indicate a potential hazard exists that MAY result in minor or moderate personal injury.

CAUTION

A CAUTION without the general warning symbol (yellow triangle with an exclamation mark) and only a signal word warns against *unsafe practices,* instrument damage, or a practice that could possibly void the manufacturer's warranty.

NOTICE

NOTICE indicates information or a company policy that relates directly or indirectly to the safety of personnel or protection of property. This signal word is not associated directly with a hazard or hazardous situation and is not used in place of 'DANGER,' 'WARNING', or 'CAUTION'.

SAFETY INSTRUCTION

SAFETY INSTRUCTIONS contain specific steps to carry out a safety procedure. For example, if the fire alarm sounds, calmly proceed to the nearest fire exit.

Special Notices

IMPORTANT Highlights information necessary to avoid damage to software, loss of data, invalid test results, or information critical for optimal performance of the system.

Note Highlights information of general interest.

Tip Helpful information that can make a task easier.

What the Safety Symbols Mean

Safety and special notices that may be found on your instrument and in this manual include the following:

The *General Warning* symbol/sign is a triangle with an exclamation mark that is used next to the signal word. In the vocabulary of ANSI Z535 signage this symbol indicates a possible personal injury hazard exists. The ISO 3864-2 standard refers to this as the general warning sign.

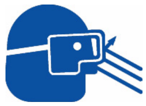
They are followed by signal words such as Danger, Warning, or Caution to indicate the risk of the personal injury. This symbol indicates imminent or potential hazard. When you see this symbol on your instrument, please consult the instrument's operational instructions before proceeding. An improper action *will, could, or may* cause physical injury.

Electrical Shock Hazard. The *Electrical Shock Hazard* symbol indicates that an electrical shock *will*, *could*, or *may* occur.

Burn Hazard. The *Burn Hazard* symbol indicates a hot surface. Make sure the instrument is at room temperature before touching, or else you *will, could,* or *may* incur burn injuries.

Read Manual. The *Read Manual* symbol alerts you to read your instrument's operational instructions before usage to ensure your safety and the instrument's operational ability.

Hand and Chemical Hazard. The *Hand and Chemical Hazard* symbol indicates that chemical damage or physical injury *will, could, or may* occur.



Eye Hazard. The *Eye Hazard*.symbol indicates that eye damage *will, could, or may* occur.

Fire Hazard. The *Fire Hazard* symbol indicates a risk of fire or flammability, or that fire/flammability damage *will, could, or may* occur.

Lifting Hazard. The *Lifting Hazard* symbol indicates that physical injury *will, could, or may* occur.

Instrument Damage. The *Instrument Damage Hazard* symbol indicates that damage to the instrument or module *will*, *could*, or *may* occur. This damage may not be covered under the standard warranty.

Contacting Us

There are several ways to contact Thermo Electron Corporation.

Assistance

For new product updates, technical and application support, and ordering information, contact us in one of the following ways:

Visit Us on the Web

http://www.thermo.com/chromatography

Contact Technical Support

Phone: 1-800-685-9535
Fax: 1-561-688-8736
E-mail: techsupport.finnigan@thermo.com

Download software updates and utilities from
http://mssupport.thermo.com

Or

1. Go to http://www.thermo.com.

2. Type **GC GC/MS Software Updates** in the Search Box.

3. Scroll down to the **Services** heading.

4. Select **GC and GC/MS Software Updates**.

Contact Customer Service

In the US and Canada for ordering information:
Phone: 1-800-532-4752
Fax: 1-561-688-8731

Changes to the Manual and Online Help

To suggest changes to this guide or to the online help, use either of the following methods:

- Fill out a reader survey online at http://www.thermo.com/lcms-techpubs
- Send an e-mail message to the Technical Publications Editor at techpubsaustin@thermo.com

Chapter 1 Operating Instructions

This chapter contains basic operating instructions for using the *DSQ II* mass spectrometer detector. The DSQ II uses quadrupole technology to give analysts, technicians, and technical directors a powerful tool for mass spectrometry and complete control when using the *Xcalibur* software.

In This Chapter

- 1.1 Installing a GC Column pp. 1-18
- 1.2 Starting Up pp. 1-28
- 1.3 Shutting Down pp. 1-30
- 1.4 Removing a GC Column pp. 1-32

1.1 Installing a GC Column

Tools Needed

- Capillary column, 5MS, 15 m, 0.25 mm ID, 0.25 µm (PN 76317-3015)
- Column Measuring Tool (PN 119640-0550)
- Gloves, clean, lint- and powder-free
- Injector ferrule, for 0.25 mm column (PN 290 134 88)
- Leak detector, hand-held electronic (GL Sciences, Inc., model LD-228, or equivalent)
- Magnifying glass
- Methanol or other suitable solvent
- Scoring wafer (or sapphire scribe) to cut capillary column
- Tissue, lint-free
- Transfer line ferrule, 0.4 mm ID (PN A0101-18100)
- Wrench, open-ended, 5/16-in.
- Wrench, open-ended, 6 mm
- Wrench, two, open-ended, 7/16-in.

Frequency

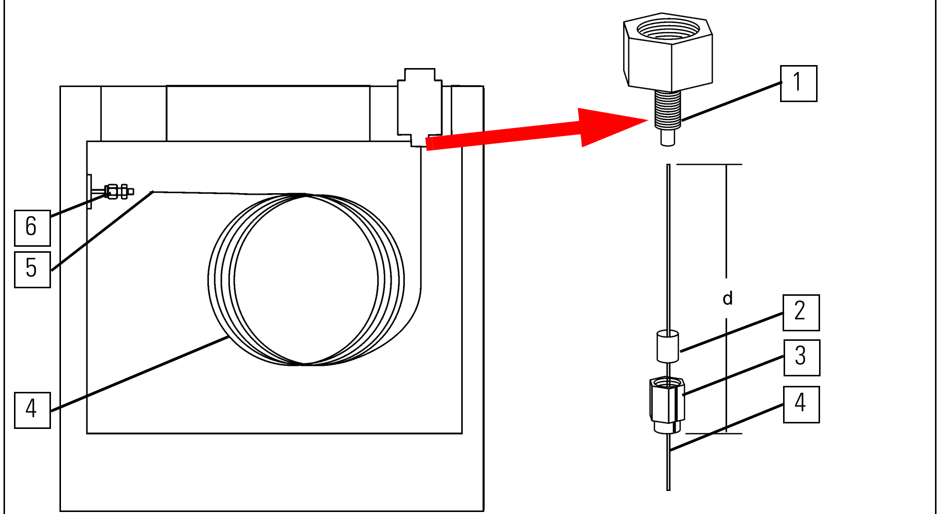
As needed.

For more GC setup information, refer to the documentation supplied with

CAUTION

Burn Hazard. The injector, oven, and transfer line may be hot. Allow them to cool to room temperature before touching them.

1. Connect the Column (4) to the Injector (1).



1	Injector	4	Column
2	Injector Ferrule	5	Column Outlet
3	Injector Nut	6	Transfer Line

Figure 1-1. GC Injector (Front)

Note Wear clean, lint- and powder-free gloves when you handle the Column and Injector Ferrule.

a. Unwind about a half turn of the **Column (4)**.

b. Wipe about 100 mm (4 in.) of the **Column (4)** with a tissue soaked in methanol.

c. Insert the **Column (4)** through the **Injector Nut (3)** and ferrule (open end up). Wipe the **Column (4)** again with a tissue soaked in methanol.

d. Score and then break the **Column (4)** about 2.5 cm (1 in.) from the end with a scoring wafer. With the magnifying glass, check for an even, flat cut. Repeat if necessary.

Note Sliding a septum on the Column before the Injector Nut will help you measure the proper distance between the Nut and the end of the Column.

e. Insert the **Column (4)** into the Injector so that the end of the **Column (4)** is the proper distance from the back of the **Injector Nut (3)**. Proper distances are as follows: splitless = 64 mm, split = 40 mm, PTV = 30 mm.

f. Finger-tighten the **Injector Nut (3)** and then give it an additional quarter turn with the wrench.

g. Score and then break the **Column Outlet (5)** about 2.5 cm (1 in.) from the end with a scoring wafer.

h. Turn on the GC.

2. Set up the GC.

a. Set the oven and **Injector (1)** temperatures to 30 °C.

b. Set the **Injector (1)** flow to 1.0 mL/min.

c. Turn Vacuum Compensation Off (under the Right, or Left Carrier menu).

d. Dip the **Column Outlet (5)** in a small vial of methanol. Bubbles indicate there is flow through the **Column (4)**.

e. Allow the **Column (4)** to purge for at least 10 minutes.

3. Perform Column Characterization.

a. Raise the oven and **Injector (1)** temperatures to 50 °C and allow them to stabilize.

b. Run a Column Evaluation by referring to the GC documentation. Run the Column Characterization program. This takes several minutes.

c. Expect a K factor of about 0.7 – 0.9 for a 15 m, 0.25 mm ID column (1.3 – 2.0 for a 30 m, 0.25 mm ID column). If the column does not report a K factor within this range or within 0.1 units of the previous stored value, check for a leak or broken column using the leak detector. The K factor is a measured resistance for the **Column (4)**. A K factor that is too low may indicate a leak in the system, while a K factor that is too high may indicate a blockage.

d. Raise the oven temperature to 150 °C and allow it to stabilize.

4. **Perform a column Leak Check.**

   a. Run an automated Leak Check by referring to the GC documentation.

   b. If the report indicates a leak, then look for and fix leaks at all the fittings in the GC using the leak detector.

   c. Repeat Column Eval and Leak Check until no leaks are indicated.

CAUTION

Instrument Damage. Do not raise the oven temperature until you are sure the system is leak free. At temperatures above 100 °C, the column will be destroyed if exposed to oxygen.

5. **Condition the Column (4).**

   New columns must be conditioned before they are inserted into the *DSQ II*.

CAUTION

Instrument Damage. The material released from the column (column bleed) during the conditioning will contaminate the ion source if the column is inserted into the transfer line. The ion source must then be cleaned.

   a. Raise the **Injector (1)** temperature to the desired temperature (normally 220 °C).

   b. Run the slow temperature program that is recommended by the manufacturer. For example, hold the **Column (4)** at 40 °C for 15 minutes, then ramp at 10 °C/minute up to 10 °C above the maximum temperature you will operate the **Column (4)** (normally 260+10 °C = 270 °C). Hold the **Column (4)** at this temperature for 2 hours.

CAUTION

Instrument Damage. Never exceed the manufacturer's maximum operating temperature.

6. **Connect the Column (4) to the Transfer Line (6).**

   a. Shut down and vent the *DSQ II* (see "Shutting Down" on page 30).

   b. Lower the oven temperature to 30 °C and allow it to cool before continuing.

CAUTION

Burn Hazard. The oven and Transfer Line may be hot. Allow them to cool to room temperature before touching them. Do not touch the Injector when it is hot.

   c. Unwind about one turn of the **Column (4)** from the **Column Outlet (5)** end.

Note Wear clean, lint- and powder-free gloves when you handle the Column and Transfer Line Ferrule.

   d. Wipe about 300 mm (12 in.) of the **Column (4)** with a tissue soaked in methanol.

   e. Insert the **Column (4)** through the **Septum (5)**, Transfer Line Nut, and ferrule. Wipe the **Column (4)** again with a tissue soaked in methanol.

   f. Score and break the end of the **Column (4)** with a scoring wafer. With a magnifying glass, check for an even, flat cut. Repeat if necessary.

   g. Insert the **Column (4)** into the **Transfer Line (6)** using one of the following methods:

Method One:

> **Note** Sliding a septum on the Column before the Transfer Line Nut will help you measure the proper distance between the Nut and the end of the Column.

If you have the optional inlet valve, follow these steps:

1. **Remove the PolarisQ and DSQ Series front and top covers, so you can get a better view of the Column.**

   You can also use a flashlight to light the interior of the source through the vacuum interlock, if you do not wish to remove the covers.

2. **Using the I/R tool, remove the Ion Volume, as described in "Cleaning the Ion Volume with an Inlet Valve" on page 57.**

3. **Insert the Column into the transfer line and tighten the Transfer Line Nut by hand.**

4. **Push the Column in until you can see it through the Inlet Valve.**

5. **Pull the Column back just far enough that you cannot see it.**

6. **Tighten the Transfer Line Nut and Transfer Line Union.**

7. **Using the I/R tool, replace the Ion Volume, as described in "Cleaning the Ion Volume with an Inlet Valve" on page 57.**

Method Two:

1. **Remove the PolarisQ and DSQ Series front and top covers so you can get a better view of the Column.**

2. **Remove the Vacuum Manifold Cover, as described in "Vacuum Manifold Maintenance" on page 52.**

3. **Remove the Ion Source Assembly, as described in "Ion Source Assembly Maintenance" on page 56.**

4. **Adjust the Column so that it extends 1–2 mm past the end of the Transfer Line.**

5. **Tighten the Transfer Line Nut and Transfer Line Union.**

6. **Replace the Ion Source Assembly, as described in "Vacuum Manifold Maintenance" on page 52.**

7. **Replace the Vacuum Manifold Cover.**

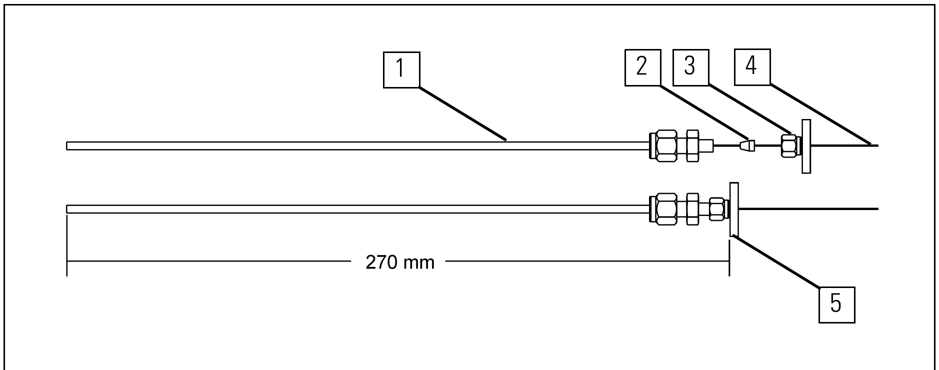
8. **Replace the PolarisQ and DSQ Series front and top covers.**

Method Three:

1. **Screw the Transfer Line Nut (3) onto the Column Measuring Tool (1).**

Note Sliding a septum on the Column before the Transfer Line Nut will help you measure the proper distance between the Nut and the end of the Column.

2. **Push the Column past the end of the Column Measuring Tool (1) and score and break the end of the Column with a scoring wafer. With a magnifying glass, check for an even, flat cut. Repeat if necessary.**



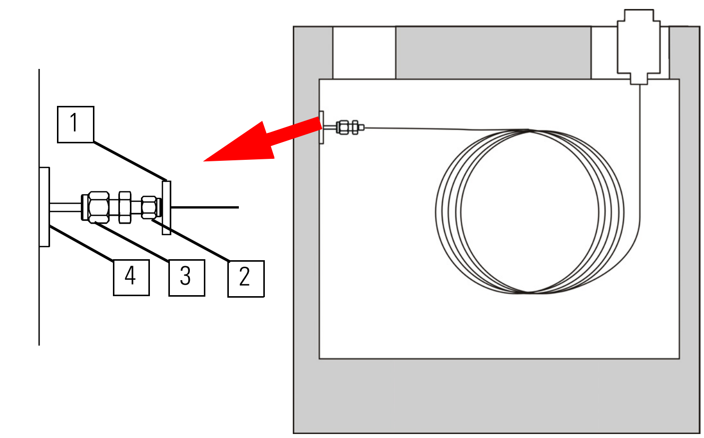
1	Column Measuring Tool	4	Column
2	Transfer Line Ferrule	5	Septum
3	Transfer Line Nut		

Figure 1-2. Column Measuring Tool

a. Pull the Column back so that it is flush with the end of the **Column Measuring Tool (1)**. Tighten the **Transfer Line Nut (2)**.

b. Slide the **Septum (1)** up to the back of the **Transfer Line Nut (2)**.

c. Remove the Column, **Transfer Line Nut (2)** and ferrule from the Column Measuring Tool.



1	Septum	3	Transfer Line Union
2	Transfer Line Nut	4	Transfer Line

Figure 1-3. Transfer Line (Front)

d. Insert the Column into the **Transfer Line (4)**. Be careful not to move the **Septum (1)**.

e. Tighten the **Transfer Line Nut (2)** and the **Transfer Line Union (3)**. For proper operation, the Column must extend approximately 1 mm past the end of the **Transfer Line (4)**.

3. **Condition the Transfer Line (4) ferrule. Graphite/Vespel ferrules like the Transfer Line (4) ferrule require conditioning to ensure a leak tight seal.**

a. Raise the oven temperature to the maximum temperature you will operate the Column (normally 300 °C).

b. Wait 10 minutes.

c. Lower the oven temperature to 30 °C and allow it to cool before continuing.

CAUTION

Burn Hazard. The oven may be hot. Allow it to cool to room temperature before opening it. The Injector will still be hot so do not touch it.

d. Re-tighten the **Transfer Line Nut (2)** and the **Transfer Line Union (3)**.

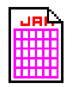
4. Set up the GC.

a. Make sure the Column does not have any sharp bends and that it does not touch any metal objects or walls inside the oven.

b. Raise the oven temperature to the initial temperature you will use (normally 40 °C).

c. Turn Vacuum Compensation on (under the Right, or Left Carrier menu).

1.2 Starting Up

	**Tools Needed** **None**
	**Frequency** As needed after maintenance.

1. Set up the *DSQ II.*

a. Install the GC Column (see 1.1 Installing a GC Column pp. 1-18).

b. Be sure the GC is on and there is carrier gas flowing through the Column into the detector.

CAUTION

Instrument Damage. Damage occurs if you turn on the detector without column flow. This forces air to be drawn through the column, damaging it. This large air leak into the detector will also cause the ion source to require cleaning.

c. Plug in the power cord for the *DSQ II*.

2. Turn on the *DSQ II.*

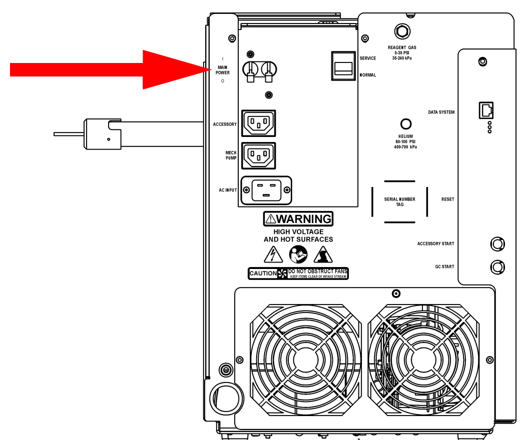


Figure 1-4. Main Circuit Breaker (Rear)

a. Switch the Main Circuit Breaker to **ON** (I). When you do, this occurs:

- Rotary-Vane Pump turns on
- Forepressure reaches the proper operating pressure
- Turbomolecular Pump turns on

b. Set the Transfer Line to the desired operating temperature (normally 250 °C). Select **<Aux>**, **<Temp>**, **<Enter>** on the GC and enter the temperature.

3. Start *Xcalibur*.

a. Check the heater status in the Heater tab of the *DSQ II* Status display. If the Ion Source is not set to the desired temperature (normally 200 °C), change it in Tune.

b. Check the vacuum status in the Vacuum tab of the *DSQ II* Status display. Within 10 minutes of turning on the detector, Vacuum should read **OK**. If it does not, see Chapter 3, DSQ II Troubleshooting, pp. 3-169.

c. Allow the *DSQ II* to stabilize for 30 minutes before running samples.

1.3 Shutting Down

Tools Needed
None

Frequency
To change columns or perform detector maintenance.

1. **Cool the GC.**

   If you do not plan to change the column or perform maintenance on the GC, you do not have to lower the Injector temperature.

   Lower the oven, Injector, and Transfer Line temperatures to 30 °C.

2. **Shut down the *DSQ II*.**

   a. From the Instrument Setup window, click **Tune** to display the Tune window.

   b. Choose **Instrument | Shutdown** to start the automatic shutdown procedure:

   - *Xcalibur* Shut Down screen displays
   - Calibration Gas and CI Reagent Gas are turned off
   - Voltages are turned off to the Ion Source, Quadrupole, and Ion Detector Assembly
   - Ion Source heater turns off
   - Turbomolecular Pump turns off
   - *Xcalibur* counts down ten minutes for the pump to slow down
   - *Xcalibur* waits for the Ion Source to cool to < 175 ^{0}C to prevent oxidizing the hot parts when they are exposed to air

   c. Wait for the Transfer Line to cool to < 175 ^{0}C.

3. **Turn the *DSQ II* off.**

a. Look for a screen to display that it is okay to turn off the main power to the *DSQ II*.

b. Click **OK**.

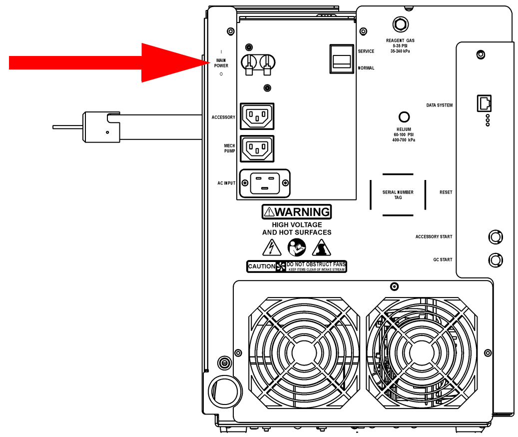


Figure 1-5. Main Circuit Breaker (Rear)

c. Switch the Main Circuit Breaker to **OFF** (0). This turns off the Rotary-Vane Pump. Approximately three seconds later, the vent valve opens and the vacuum manifold vents to atmospheric pressure. This takes approximately three to four minutes.

d. Unplug the *DSQ II* power cord. STOP HERE if you are planning to perform system maintenance on only the *DSQ II* (for example, to clean the ion source). You don't need to turn off the GC, data system, and autosampler. In this case, the shutdown procedure is complete.

4. Wait for the GC oven, Injector, and Transfer Line to cool to room temperature.

5. Turn off all instruments.

a. Turn off the GC using the GC main circuit breaker.

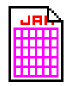
b. Turn off the GC Helium supply at the tank.

c. Turn off the Autosampler (optional) by using the main power on/off switch.

1.4 Removing a GC Column

Tools Needed

- Gloves, clean, lint- and powder-free
- Wrench, open-ended, 5/16-in.
- Wrench, open-ended, 7/16-in.
- Wrench, open-ended, 6 mm



Frequency

As needed for maintenance or column replacement.

1. Shut down the *DSQ II*.

a. Shut down and vent the *DSQ II* (see 1.3 Shutting Down pp. 1-30).

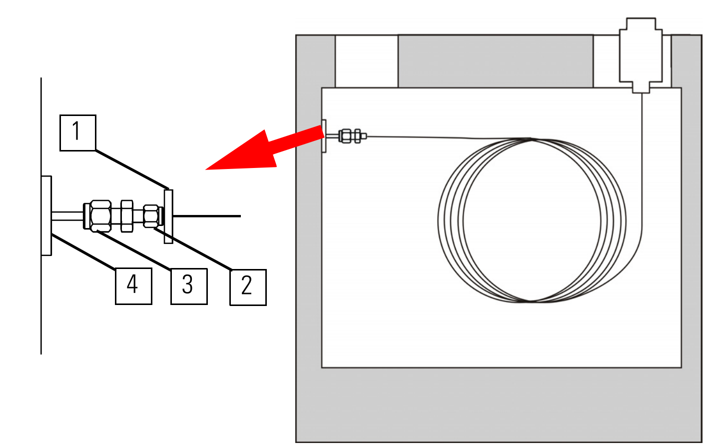
Lower the oven, Injector, and Transfer Line temperatures to 30 °C and allow them to cool before continuing.

CAUTION

Burn Hazard. The oven, injector, and transfer line are hot. Allow them to cool to room temperature before touching them.

b. Once cool, turn off the GC.

2. Remove the Column from the Transfer Line (4).



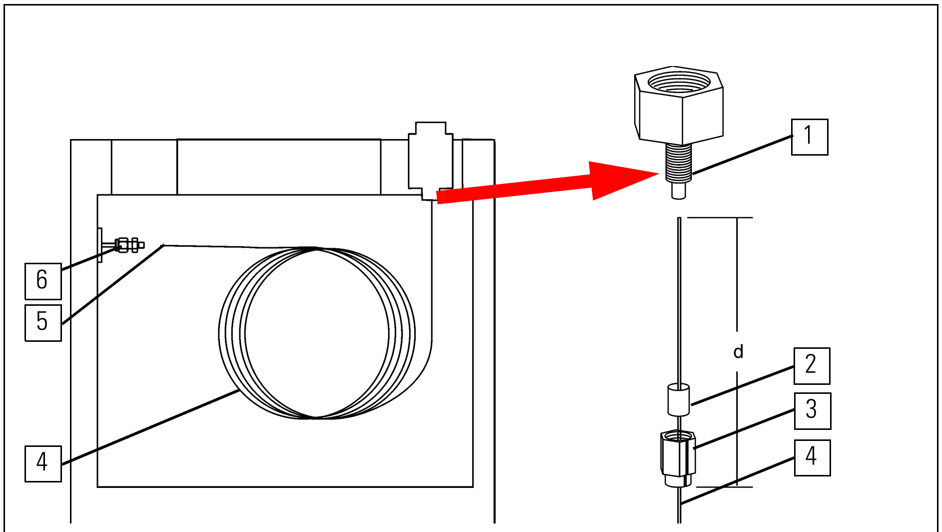
1	Septum	3	Transfer Line Union
2	Transfer Line Nut	4	Transfer Line

Figure 1-6. Transfer Line (Front)

a. Unscrew the **Transfer Line Nut (2)**.

b. Remove the **Column (4)** from the **Transfer Line (4)**.

3. Remove the Column (4) from the Injector (1).



1	Injector	4	Column
2	Injector Ferrule	5	Column Outlet
3	Injector Nut	6	Transfer Line

Figure 1-7. GC Injector (Front)

a. Unscrew the **Injector Nut (3)**.

b. Remove the **Column (4)** from the **Injector (1)**.

Chapter 2 Maintenance Instructions

This chapter contains maintenance instructions for essential detector components. Performing maintenance increases laboratory productivity and helps you get the most out of your instrument.

In This Chapter

- 2.1 Scheduling Maintenance pp. 2-36
- 2.2 Maintaining System Performance pp. 2-38
- 2.3 Vacuum Manifold Maintenance pp. 2-52
- 2.4 Ion Source Assembly Maintenance pp. 2-56
- 2.5 Quadrupole Assembly Maintenance pp. 2-86
- 2.6 Ion Detector Assembly Maintenance pp. 2-87
- 2.7 Turbomolecular Pump Maintenance pp. 2-95
- 2.8 Rotary-Vane Pump Maintenance pp. 2-96
- 2.9 Replacing Parts pp. 2-105

2.1 Scheduling Maintenance

Performing maintenance requires the detector to be disassembled, cleaned, and sometimes replacing worn parts. Table 2.1 is a factory recommended maintenance schedule, based on running multiple samples in an 8-hour day. Adapt the schedules according to how clean your samples are and how many analyses per day. Also, you might find it helpful to keep a maintenance record to identify variations from normal operation and to take corrective action.

Table 2.1. Maintenance Schedule

Procedure	Never/ Replace	1 Month	4 or 6 Months	As Needed *
2.2 Maintaining System Performance pp. 2-38				✔
❑ 2.2 Maintaining System Performance pp. 2-38				✔
❑ 2.2 Maintaining System Performance pp. 2-39				✔
❑ 2.2 Maintaining System Performance pp. 2-43				✔
❑ 2.2 Maintaining System Performance pp. 2-46				✔
❑ 2.2 Maintaining System Performance pp. 2-49				✔
2.3 Vacuum Manifold Maintenance pp. 2-52				
2.4 Ion Source Assembly Maintenance pp. 2-56				✔
❑ 2.4 Ion Source Assembly Maintenance pp. 2-57				✔
❑ 2.4 Ion Source Assembly Maintenance pp. 2-67				✔
❑ 2.4 Ion Source Assembly Maintenance pp. 2-70				✔
❑ 2.4 Ion Source Assembly Maintenance pp. 2-79				✔
❑ 2.6 Ion Detector Assembly Maintenance pp. 2-87				✔
2.5 Quadrupole Assembly Maintenance pp. 2-86				
2.6 Ion Detector Assembly Maintenance pp. 2-87	✔			
❑ 2.6 Ion Detector Assembly Maintenance pp. 2-90				✔
2.7 Turbomolecular Pump Maintenance pp. 2-95				
❑ 2.8 Rotary-Vane Pump Maintenance pp. 2-97		✔		
2.8 Rotary-Vane Pump Maintenance pp. 2-96	✔			
❑ 2.8 Rotary-Vane Pump Maintenance pp. 2-98				✔
❑ 2.8 Rotary-Vane Pump Maintenance pp. 2-100		✔		
❑ 2.8 Rotary-Vane Pump Maintenance pp. 2-102		**	✔**	
2.9 Replacing Parts pp. 2-105				✔

* *As Needed* depends on how close the component is to the sample introduction point. For example, the Ion Volume is closer to the sample introduction point than any other component and requires the most frequent cleaning.

** Perform every month if you use ammonia as a chemical ionization reagent gas.

Figure 2-1 illustrates a sequence of maintenance events to further your understanding of detector disassembly.

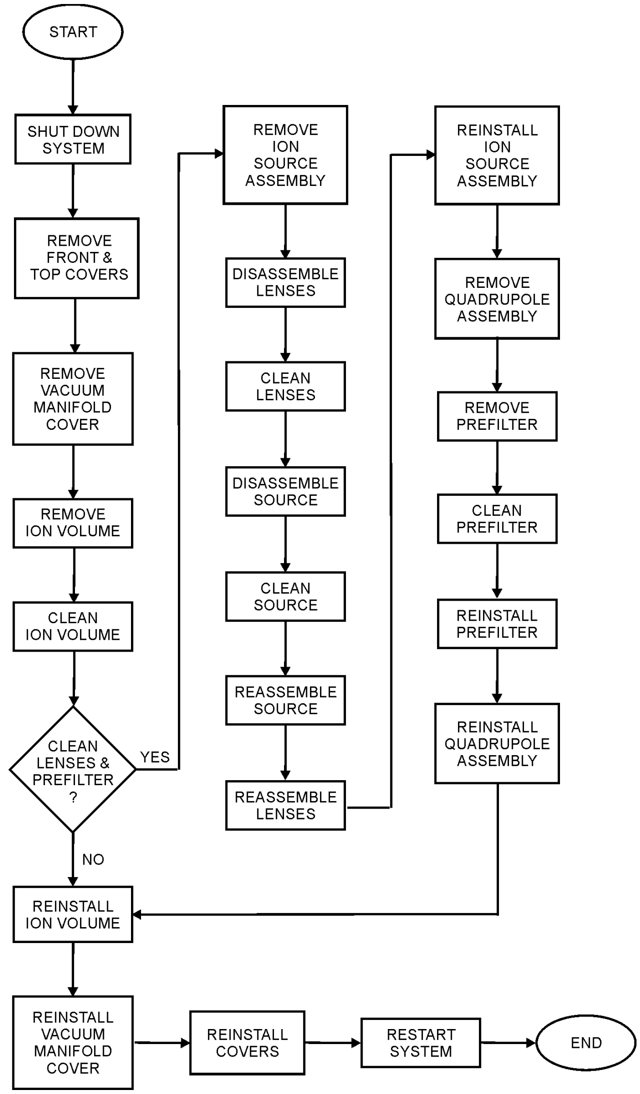


Figure 2-1. Detector Maintenance Schedule Flow Chart

2.2 Maintaining System Performance

System performance depends a large part on making sure the *DSQ II* components are clean and operating correctly. Before you begin cleaning, shut down the system, and remove the covers to get access to the assemblies. If your instrument has an inlet valve, you do not need to shut down the instrument to change the ion volume. Also, please use extra caution when using cleaning procedures, as some components can be damaged by exposure to abrasives, solvents, or heat.

CAUTION

Instrument Damage. Cleaning Guidelines. This section is meant to relate strictly to the parts and components listed in this chapter. Use caution when using these cleaning procedures for other parts. Some components can be damaged by exposure to abrasives, solvents, or heat.

Running Benchmark Tests

When your instrument is clean and in good working order, perform benchmark tests and record the results. For more information, refer to the *DSQ II User's Guide*.

1. **Run a benchmark QC (quality control) test. A good benchmark test is the mixture of octafluoronaphthalene and benzophenone which is included with the instrument.**

2. **Compare the results to previous results.**

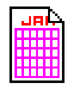
3. **Clean the Ion Volume only when the tested performance of your system decreases significantly from your benchmark test results.**

4. **Run the benchmark test again and compare the results.**

5. **If performance is not restored, clean the Lenses, Ion Source Assembly, and Prefilter. How often you clean the *DSQ II* depends on the types and amounts of samples and solvents you introduce into the instrument. In general, the closer a component is to the sample introduction point, the more rapidly it becomes dirty. For example, you will clean the ion volume more often than other parts. Many parts can be removed and disassembled by hand. Make sure you have**

all items listed in *Tools Needed* before using the procedure. You can purchase items without part numbers at the hardware store.

Removing the Covers

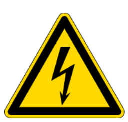
 	**Tools Needed** • Phillips screwdriver, #2 • Wrench, Allen, 2.5 mm **Frequency** As needed to get inside the detector.

In order to get to the components inside the detector, the covers from the detector have to be removed. Because the covers overlap each other they must be removed in this order: Front, Top, Right, and or Left Cover.

Note Covers are specified as right or left as you are looking at the front of the instrument.

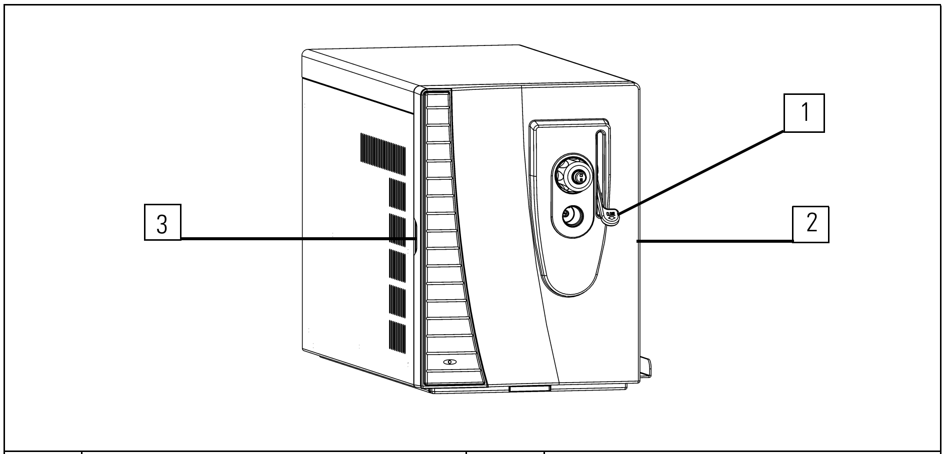
1. **Prepare the DSQ II for maintenance.**

WARNING



Electrical Shock Hazard. Please unplug the detector before proceeding.

   a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).



1	Inlet Valve Lever (if equipped)	3	Left Side Handslot
2	Right Side Handslot		

Figure 2-2. Removing the Front Cover

b. [Upgrade Option] If your system is equipped with an **Inlet Valve**, remove the **Inlet Valve Lever (1)** by pulling it free.

2. **Remove the Front Cover.**

   a. Grasp the cover by the **Left** and **Right Hand Slots (2, 3)**.

   b. Pull the cover toward you. It will snap out of the connectors, which are located on the top and bottom of the detector. Reverse these steps to reinstall the *DSQ II* front cover.

3. **Remove the Top Cover.**

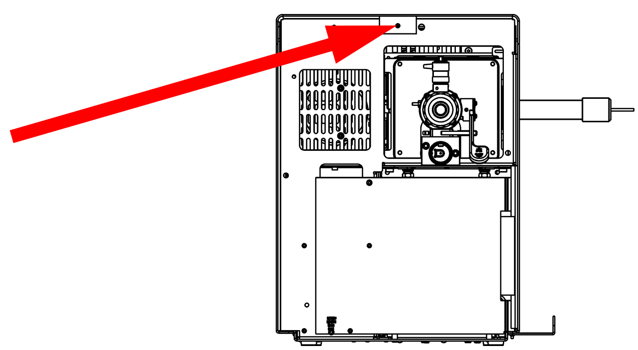


Figure 2-3. Removing the Top Cover

a. Loosen the top fastener.

b. Slide the top cover forward about 2.5 cm (1 in.).

c. Lift the top cover up and away from the *DSQ II*. Reverse these steps to reinstall the *DSQ II* top cover.

4. Remove the Right Cover.

a. Remove the **Column** (see 1.4 Removing a GC Column pp. 1-32).

b. Remove the two screws located at the top of the cover.

c. Slide the cover towards the back of the instrument.

d. Pull the cover away from the *DSQ II*. Reverse these steps to reinstall the *DSQ II* right cover. To install the **Column** see 1.1 Installing a GC Column pp. 1-18.

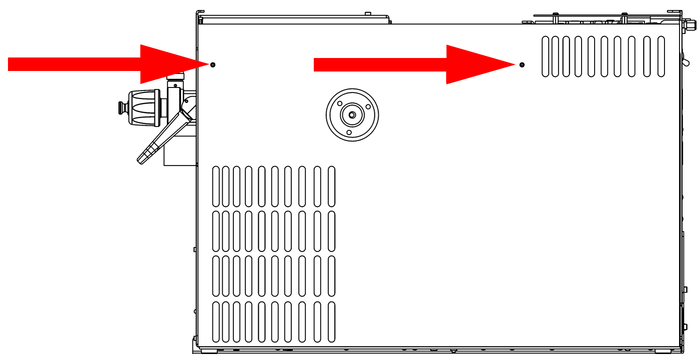


Figure 2-4. Removing the Right Cover

5. Remove the Left Cover.

CAUTION

Instrument Damage. Behind the left cover are the Analog PCB and Digital PCB making this cover significantly heavier. Several cables run from the cover to other parts of the instrument. Please do **NOT** pull the cover too far from the instrument or you will stretch the cables.

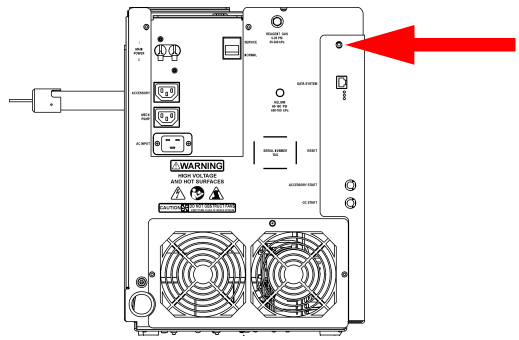


Figure 2-5. Removing the Left Cover

a. Remove the single screw located at the rear of the instrument.

b. Slide the cover toward the rear of the instrument until the tabs come to the end of the grooved slots. Pull the cover away from the instrument. Reverse these steps to reinstall the *DSQ II* left cover.

Cleaning Stainless Steel Parts

Tools Needed

- Acetone, reagent grade (or other suitable polar solvent)
- Aluminum oxide abrasive, number 600 (PN 32000-60340)
- Applicators, cotton-tipped (PN A0301-02000)
- Beaker, 450 mL
- Clean, dry gas
- De-ionized water
- Detergent (Alconox, Micro, or equivalent)
- Dremel rotary tool or equivalent (recommended)
- Foil, aluminum
- Forceps
- Gloves, latex, impermeable
- Gloves, clean, lint- and powder-free
- Glycerol, reagent grade
- Lint-free cloth
- Protective eyewear
- Tap water
- Toothbrush, soft
- Ultrasonic cleaner

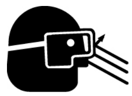
Frequency

As needed to clean *only* stainless steel parts, such as the following:

- Ion Volume Assembly
- Ion Source Block
- Lenses

CAUTION

Instrument Damage. Please do **NOT** use this procedures to clean ceramic, aluminum, or gold-plated parts. Also, this procedure should not be used on the prefilter, electron multiplier, conversion dynode, quadrupole, or anode feedthrough.



WARNING

Eye Hazard. Please wear impermeable laboratory gloves and eye protection when performing cleaning procedures.

1. **Remove contamination from all the surfaces you are cleaning.**

   a. Use a slurry of number 600 aluminum oxide in glycerol and a cleaning brush or cotton-tipped applicator. Contamination appears as dark or discolored areas, but often is not visible. The heaviest contamination is usually found around the apertures - for example, the electron entrance hole on an ion volume.

   b. Clean each part thoroughly, even if no contamination is visible.

   c. Use the wooden end of an applicator cut at an angle to clean the inside corners.

   d. Use a Dremel® tool with the polishing swab at its lowest speed to increase cleaning efficiency, as well as decrease the time required to clean the items. Use care when using the Dremel tool as it is an electrical appliance.

   e. To prevent personal injury, be sure to keep the tool away from possible hazards such as standing water or flammable solvents.

2. **Rinse the parts with clean water. Use a clean applicator or toothbrush to remove the aluminum oxide slurry. Do not let the slurry dry on the metal; dried aluminum oxide is difficult to remove.**

3. **Sonicate the parts in a warm detergent solution.**

   a. Using forceps, place the parts in a beaker containing warm detergent solution.

   b. Place the beaker and contents in an ultrasonic bath for 5 minutes.

   c. Rinse the parts with tap water to remove the detergent.

4. **Sonicate the parts in deionized water.**

   a. Using forceps, place the parts in a beaker containing deionized water.

   b. Place the beaker and contents in an ultrasonic bath for 5 minutes.

   c. If the water is cloudy after sonicating, pour off the water, add fresh water, and place the beaker and its contents in a ultrasonic bath again for 5 minutes. Repeat until the water is clear.

5. **Sonicate the parts in acetone.**

   a. Using forceps, place the parts in a beaker containing acetone.

   b. Place the beaker and contents in an ultrasonic bath for 5 minutes.

   c. Using forceps, transfer the parts to a beaker containing fresh acetone.

   d. Place the beaker and contents in an ultrasonic bath for 5 minutes.

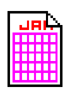
6. **Blow dry the parts immediately. Blow off the acetone from the parts with a clean, dry gas.**

7. **Dry the parts in an oven, set at 100 °C, for 30 minutes. Using forceps, place the parts in an aluminum foil covered beaker in the oven. Allow the parts to cool before putting them back together.**

Cleaning Non-Stainless Steel or Hybrid Parts

Tools Needed

- Acetone, reagent grade (or other suitable polar solvent, such as Methanol or Ethanol)
- Aluminum oxide abrasive, number 600 (PN 32000-60340)
- Applicators, cotton-tipped (PN A0301-02000)
- Beaker, 450 mL
- Clean, dry gas
- De-ionized water
- Detergent (Alconox, Micro, or equivalent)
- Dremel rotary tool or equivalent (recommended)
- Forceps
- Gloves, latex, impermeable
- Gloves, clean, lint- and powder-free
- Lint-free cloth
- Protective eyewear
- Tap water
- Toothbrush, soft



Frequency

As needed to clean non-stainless steel parts (such as aluminum, ceramic, or gold-plated):

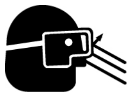
- Lens Holder and Spacers
- Filament Spacer
- Heater Ring

Or, to clean hybrid parts that are partially made of stainless steel:

- Prefilter
- Anode Feedthrough

CAUTION

Instrument Damage. Please do **NOT** use this procedure to clean the electron multiplier, conversion dynode, or quadrupole. Also, acetone must **NOT** be used on polycarbonate parts like the RF feedthrough and conversion dynode feedthrough. Do not use Acetone to clean the prefilters with PEEK insulators. Use Methanol or Ethanol instead of Acetone.



WARNING

Eye Hazard. Please wear impermeable laboratory gloves and eye protection when performing cleaning procedures.

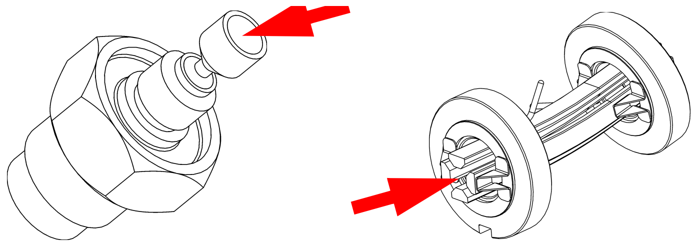


Figure 2-6. Stainless Steel Surfaces to Clean with Aluminum Oxide

1. **Clean inside the cup of the anode feedthrough. On the end of the prefilter closest to the ion source (with the notch), clean the end of the rods and about ½ way down the inside.**

2. **Remove contamination from stainless steel surfaces (Figure 2-6). It is only necessary to clean surface that come in contact with the ion beam.**

   a. Use a slurry of number 600 aluminum oxide in glycerol and a cleaning brush or cotton-tipped applicator. Contamination appears as dark or discolored areas, but often is not visible.

   b. Clean each part thoroughly, even if no contamination is visible.

   c. Use the wooden end of an applicator cut at an angle to clean the inside corners.

   d. Use a Dremel tool with the polishing swab at its lowest speed to increase cleaning efficiency, as well as decrease the time required to clean the items. Use care when using the Dremel tool as it is an electrical appliance.

   e. To prevent personal injury, be sure to keep the tool away from possible hazards such as standing water or flammable solvents.

3. Rinse the parts with clean water. Use a clean applicator or toothbrush to remove the aluminum oxide slurry. Do not let the slurry dry on the metal; dried aluminum oxide is difficult to remove.

4. Scrub all of the parts with a warm detergent solution.

a. Scrub the parts with a toothbrush or clean applicator. Do not soak or sonicate the parts in detergent.

b. Using forceps, rinse the parts thoroughly with tap water to remove the detergent.

CAUTION

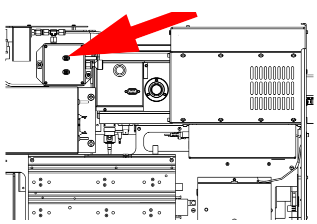
Instrument Damage. Please do not leave aluminum parts like the heater ring in contact with detergent. Basic solutions such as detergent discolor aluminum.

5. **Rinse the parts in deionized water. Using forceps, dip the parts in a beaker of deionized water. Change the water if it becomes cloudy. Do not soak or sonicate the parts.**

6. **Rinse the parts with acetone. Using forceps, dip the parts in a beaker of acetone. Change the acetone if it becomes cloudy. Do not soak or sonicate the parts.**

7. **Blow dry the parts immediately. Blow off the acetone from the parts with a clean, dry gas.**

Refilling Calibration Gas Flow Module



Tools Needed

- FC-43 calibration compound (PN 50010-30059)
- Syringe
- Wrench, open-ended, 9/16-in.

Frequency

When Calibration Compound Vial is empty (about once a year).

Calibration compound is a liquid whose mass spectrum is used to tune and calibrate the detector. The *DSQ II* uses FC-43 as its calibration compound.

You cannot tell by sight whether calibration compound needs to be added. However, during Xcalibur Automatic Tune an error message displays “the intensity of calibration gas ions is too low.” There are many factors that can cause a shortage of calibration gas ions besides a decrease in calibration compound. As a rule, the detector should never require adding calibration compound more than once a year.

1. **Prepare the *DSQ II* for maintenance.**

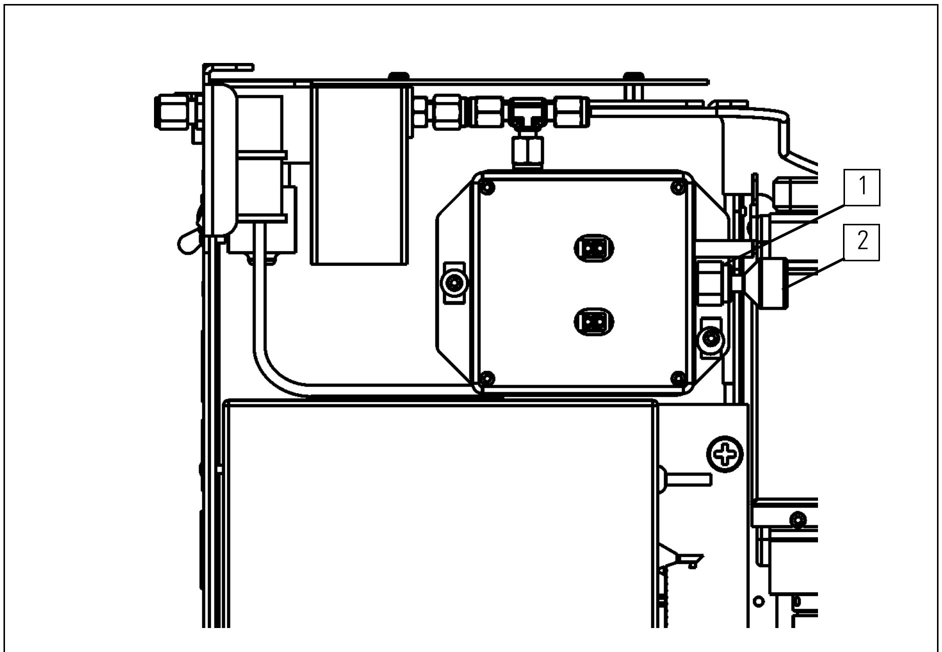
Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

a. Remove the *DSQ II* front, top, and left side covers (see "Removing the Covers" on pp. 39).

2. **Remove the Calibration Gas Vial.**



1	Nut and Ferrule	2	Calibration Compound Vial

Figure 2-7. Calibration Gas Flow Module (Left Side)

a. Unscrew the **Nut and Ferrule (1)**.

b. Remove the **Calibration Compound Vial (2)**.

3. **Fill the Calibration Compound Vial.**

a. Fill a syringe with 0.1 mL of **Calibration Compound**.

b. Insert the syringe into the **Calibration Compound Vial (2)** until you touch the white frit at the bottom of the vial.

c. Inject the **Calibration Compound** into the frit. The frit absorbs the **Calibration Compound**. If you see liquid pooled on top of the frit, pour out the excess liquid according to local environmental regulations.

CAUTION

Instrument Damage. Adding more than 0.1 mL of Calibration Compound can result in damage to the Calibration Gas Flow Module. Be sure liquid does not pour into the module when you install the vial.

4. Replace the Calibration Compound Vial (2). Be sure not to overtighten the Nut and Ferrule (1).

5. To properly tighten the ferrule on the glass tubing of the vial, push the tubing in the bottom of the fitting, then pull back about 1 mm before tightening.

This prevents the ferrule from crushing the end of the glass tubing into the fitting.

6. Restore the *DSQ II* for operation.

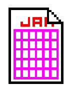
a. Replace the left, top, and front covers of the *DSQ II*.

b. Restart the system.

2.3 Vacuum Manifold Maintenance

Tools Needed

- Clean, dry gas
- Gloves, clean, lint- and powder-free
- Lint-free cloth
- Phillips screwdriver, #2
- Wrench, Allen, 2.5 mm



Frequency

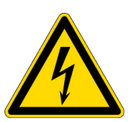
As needed

After removing the DSQ II covers, you must remove the Vacuum Manifold cover to get to the four essential detector assemblies: Ion Source Assembly, Prefilter, Quadrupole Assembly, and the Ion Detector Assembly. We provided operational theory chapters devoted to these assemblies in this manual, to help you better understand how your system operates. Each of these assemblies has specific procedures for cleaning the individual parts.

CAUTION

Instrument Damage. Please replace the Vacuum Manifold cover during maintenance to prevent dust and debris from collecting inside the vacuum manifold. Even small amounts of dust on the electron multiplier, conversion dynode, or quadrupole can cause excessive noise in mass spectra.

1. **Prepare the DSQ II for maintenance.**



WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

   a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

   b. Remove the DSQ II front and top covers (see 2.2 Maintaining System Performance pp. 2-39).

2. Lift off Vacuum Manifold Cover.

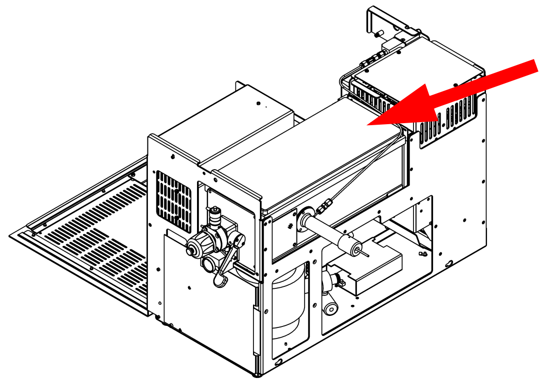
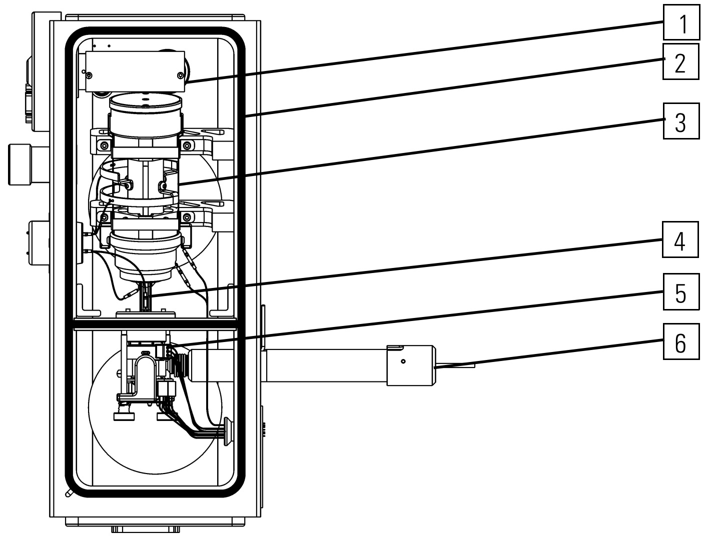


Figure 2-8. Vacuum Manifold Cover

The cover is difficult to remove if the vacuum manifold has not been completely vented to atmospheric pressure. The Vacuum Manifold takes approximately four minutes to reach atmospheric pressure. But, when the vacuum manifold is completely vented, the cover is easy to remove.

Figure 2-9 illustrates where the components are located in the vacuum manifold if you are looking from the front of the detector and after the cover is removed.



1	Ion Detector Assembly	4	Prefilter
2	O-Ring	5	Ion Source Assembly
3	Quadrupole Assembly	6	Transfer Line

Figure 2-9. Vacuum Manifold Components

3. **Go to “Ion Source Assembly Maintenance” on pp. 56 or “Ion Detector Assembly Maintenance” on pp. 87 for further instructions or continue to the next step.**

4. **Spray clean essential components.**

   a. Check the **O-Ring (2)** for signs of wear and tear. The **O-Ring** is the thin, black stripping outlining the top of the **Vacuum Manifold**. Replace if necessary.

Note Even the smallest amount of dust or lint on the electron multiplier, conversion dynode, prefilter, or quadrupole can cause spectral noise.

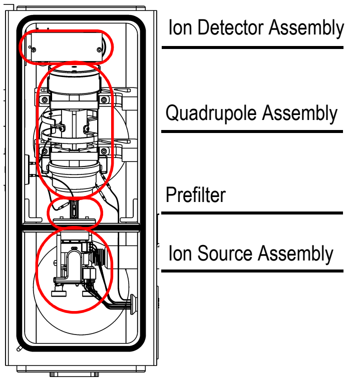
   b. Use the clean, dry gas to clean the **O-Ring (2)**, **Ion Detector Assembly (1)**, **Prefilter (4)**, and **Quadrupole Assembly (3)**.

5. Reassemble the DSQ II

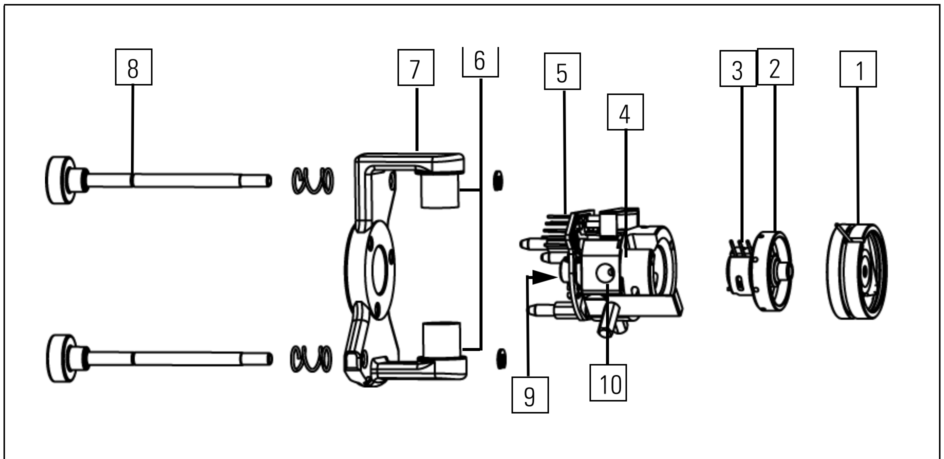
a. Replace the **Vacuum Manifold Cover**, top and front covers.

b. Restart your system.

2.4 Ion Source Assembly Maintenance



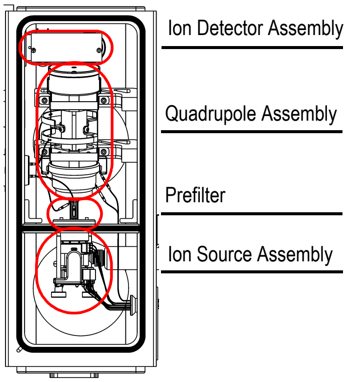
The Ion Source Assembly contains the Ion Volume, Filament Assembly, and Ion Source Lens Assembly. Because the Ion Volume is exposed directly to samples introduced into the detector, it requires the most frequent cleaning to restore the system's performance. You can access the Ion Volume with or without an Inlet Valve.



1	Source Spacer	6	Magnets, 2
2	Lens Assembly	7	Magnet Support
3	3-Pin Lens Connection	8	Thumbscrews, 2
4	Filament Assembly	9	Ion Volume (Inside Ion Source Block)
5	8-Pin Connection	10	Ion Source Block

Figure 2-10. Ion Source Assembly (Right Side)

Cleaning the Ion Volume with an Inlet Valve



Tools Needed

- Cleaning supplies for stainless steel parts
- Gloves, clean, lint- and powder-free
- Insertion/Removal Tool (I/R Tool) and Guide Bar
- Lint-free cloth

Frequency

As needed to restore system performance

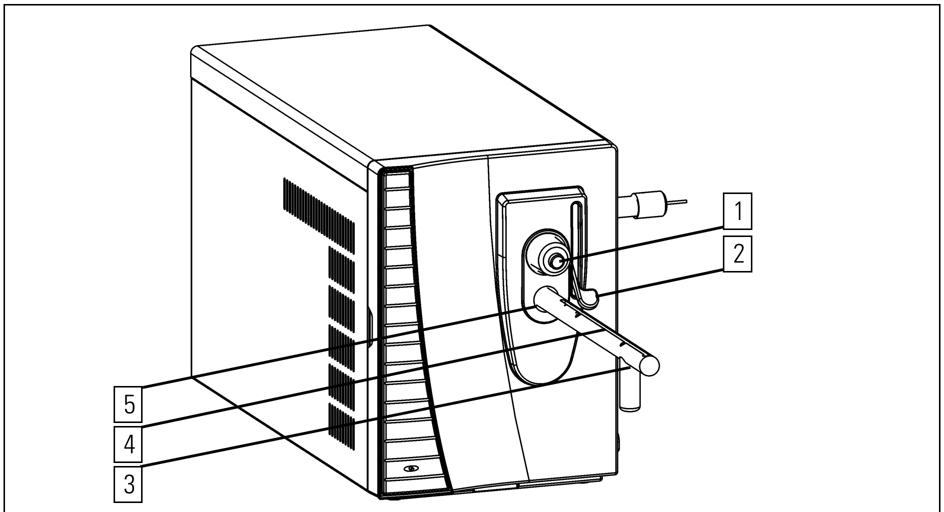
The Ion Volume is where molecules interact with energetic electrons to form ions. Because the Ion Volume is exposed directly to samples introduced into the *DSQ II,* you will clean it more frequently than other parts.

How often you clean the Ion Volume depends on the types and amounts of samples you use. Using an I/R Tool allows you to easily access the Ion Volume by entering the Vacuum Manifold through the Inlet Valve without breaking vacuum, thus saving you from shutting down and disassembling the detector.

1. Open the Insert/Remove Probe Screen.

a. From the *Xcalibur* Home Page, click on ***DSQ II*** located in the **Status** tab.

b. Click on **Insert/Remove Probe** button located on the **Status** tab to display the **Insert/Remove Probe** screen.



1	Inlet Valve Plug	4	Guide Bar Track
2	Inlet Valve Lever	5	Guide Bar Opening
3	Guide Bar		

Figure 2-11. Guide Bar (Front)

2. **Prepare the Inlet Valve.**

   a. With the **Guide Bar Track (4)** facing left, insert the **Guide Bar (3)** into the **Guide Bar Opening (5)**.

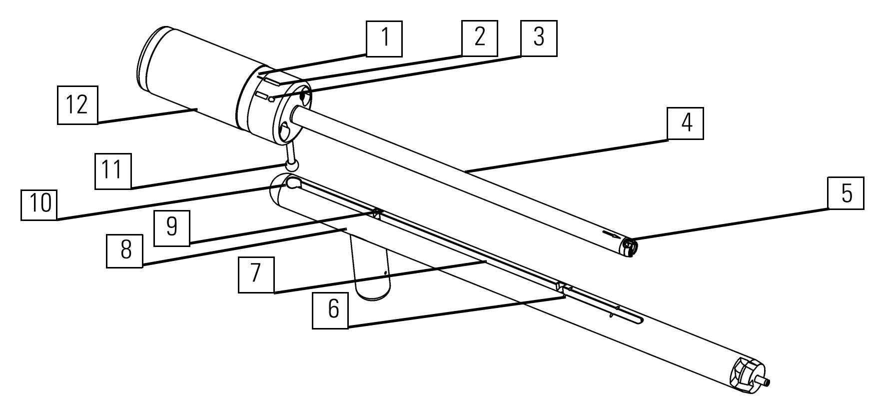
   b. Push the **Guide Bar (3)** in as far as it will go.

   c. Rotate it 90° clockwise to lock it in the opening.

   d. Make sure the **Inlet Valve Lever (2)** is closed (lever is down).

   e. Remove the **Inlet Valve Plug (1)**.

3. Insert the I/R Tool.



1	Alignment Line	7	Guide Bar Track
2	Hold Position	8	Guide Bar
3	Release Position	9	First Stop
4	I/R Tool	10	Guide Ball Hole
5	Bayonet Lock	11	Guide Ball
6	Second Stop	12	Handle

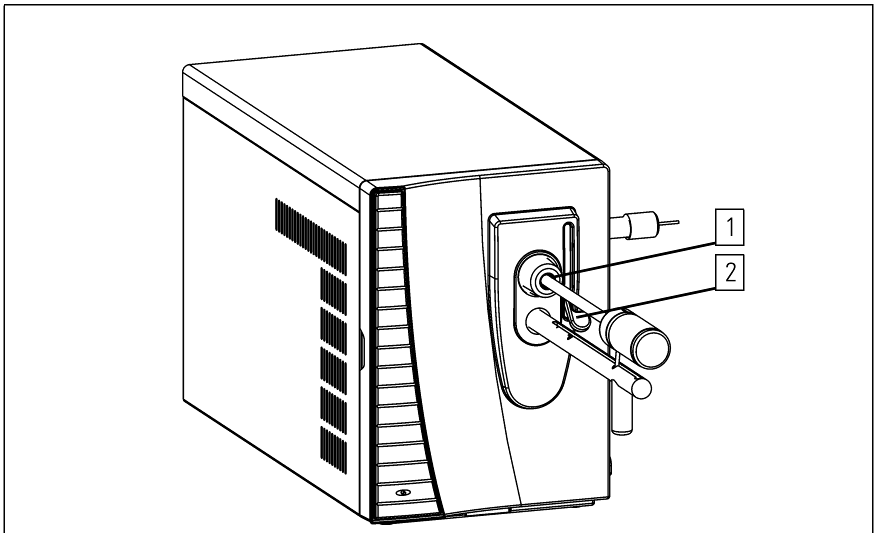
Figure 2-12. I/R Tool and Guide Bar Components

a. Turn the **I/R Tool (4)** to the **Release Position (3)** . This indicates the I/R Tool is in position to accept the **Ion Volume**.

b. Insert the **Guide Ball (11)** into the **Guide Ball Hole (10)**.

c. Slide the **I/R Tool (4)** forward in the **Guide Bar Track (7)** until the **Guide Ball (11)** is at the **First Stop (9)**.

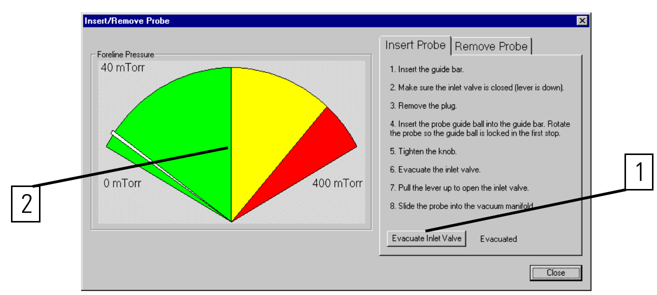
d. Turn the **I/R Tool (4)** so the **Guide Ball (11)** is in the groove at the **First Stop (9)**. This prevents the probe from being pulled forward when the **Inlet Valve** is evacuated.



1	Inlet Valve Knob	2	Inlet Valve Lever

Figure 2-13. I/R Tool Ready to be Inserted

e. Tighten the **Inlet Valve Knob (1)** to ensure a leak tight seal.



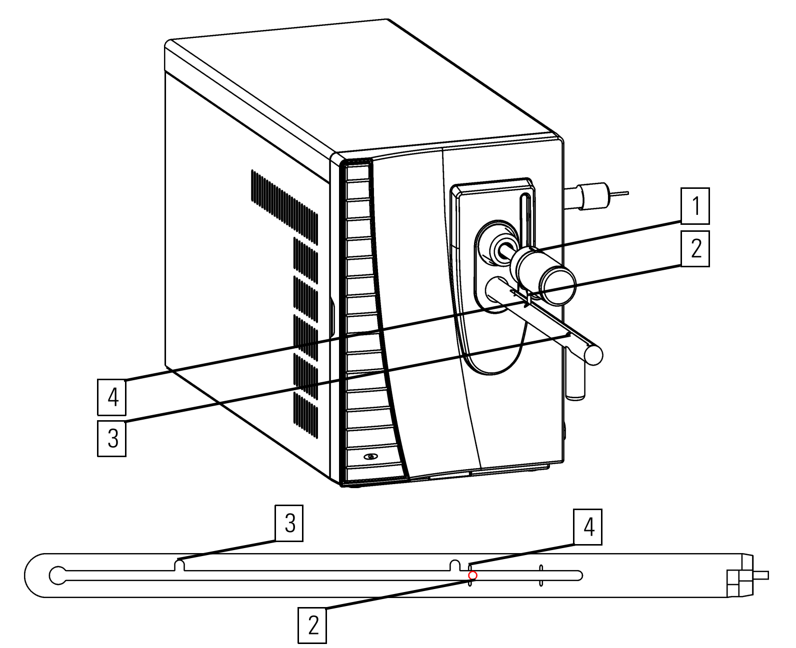
1	Evacuate Inlet Valve	2	Forepressure

Figure 2-14. Insert Probe Screen

f. From the **Insert Probe Screen**, select **Evacuate Inlet Valve (1)**.

g. Monitor the **Forepressure (2)**. The pressure should not remain beyond 350 mTorr. If this occurs, the **Inlet Valve Seal** must be replaced (see "Inlet Valve Seal" on pp. 135).

h. Once evacuation is complete, pull the **Inlet Valve Lever (2)** up to open the **Inlet Valve**.



1	I/R Tool Handle	3	First Stop (Notch)
2	Guide Ball	4	Second Stop (Engraved Line)

Figure 2-15. I/R Tool Inserted into Detector

4. Remove the Ion Volume.

a. Slide the **I/R Tool (1)** until the **Guide Ball (2)** is slightly beyond the **Second Stop (4)**.

Note The Second Stop is the first Engraved Line. The second Engraved Line is for inserting the I/R Tool into a DSQ II detector.

b. Turn the **I/R Tool Handle (1)** counterclockwise to the **Hold Position** .

c. Listen for a "click".

d. Withdraw the **I/R Tool (1)** until the **Guide Ball (2)** reaches the **First Stop (3)**.

e. Push the **Inlet Valve Lever** (Figure 2-13) down to close it.

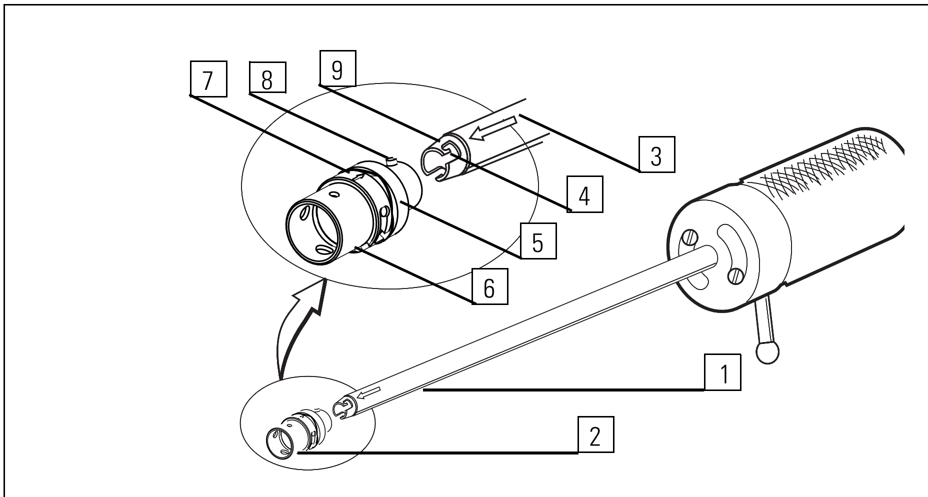
f. Loosen the **Inlet Valve Knob** (Figure 2-13).

g. Completely remove the **I/R Tool**.

5. Clean the Ion Volume.

CAUTION

Burn Hazard. The ion volume may be too hot to touch. Let it cool to room temperature before handling it.



1	I/R Tool	6	Spring Washer
2	Ion Volume	7	Ion Volume Alignment Arrow
3	I/R Tool Alignment Arrow	8	Bayonet Pins
4	Pin Guide	9	Bayonet Lock
5	Ion Volume Holder		

Figure 2-16. Ion Volume and I/R Tool

a. Press the **Ion Volume (2)** forward into the tip of the **I/R Tool (1)** and rotate it to disconnect the **Bayonet Pins (8)** from the **Pin Guides (4)**.

b. Pull the **Ion Volume (2)** out of the **I/R Tool (1)**.

c. Clean the **Ion Volume (2)** using the instructions for 2.2 Maintaining System Performance pp. 2-43. If you are cleaning a CI Ion Volume, be sure to clean out the small electron entrance hole. Aluminum oxide can get trapped in this hole, which can adversely affect sensitivity. Use a dental pick or old syringe needle to clean the hole.

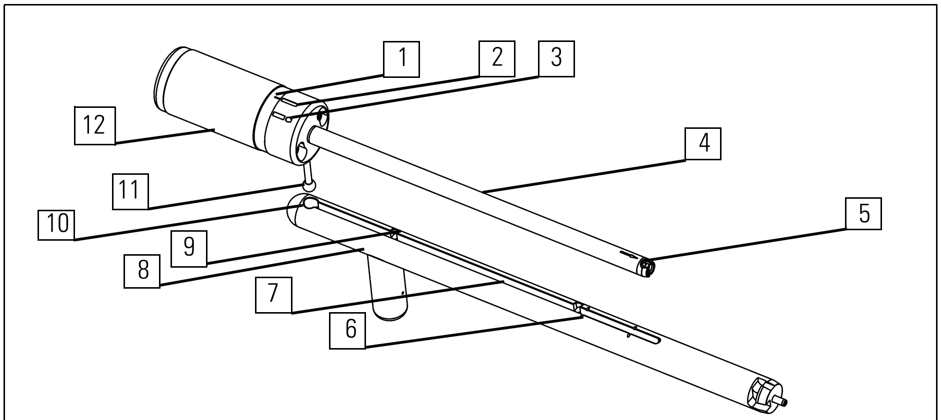
Note Wear clean, lint- and powder-free gloves when you handle parts belonging inside the Vacuum Manifold.

d. Place the **Ion Volume (2)** into the **Bayonet Lock (9)** located on the **I/R Tool (1)**. Make sure the **Alignment Arrows** on the **Ion Volume (7)** and on the **I/R Tool (3)** are facing each other.

CAUTION

Instrument Damage. The arrows on the I/R tool and Ion Volume must be aligned to avoid damage to the source assembly.

6. Reinsert the I/R Tool.



1	Alignment Line	7	Guide Bar Track
2	Hold Position	8	Guide Bar
3	Release Position	9	First Stop
4	I/R Tool	10	Guide Ball Hole
5	Bayonet Lock	11	Guide Ball
6	Second Stop	12	Handle

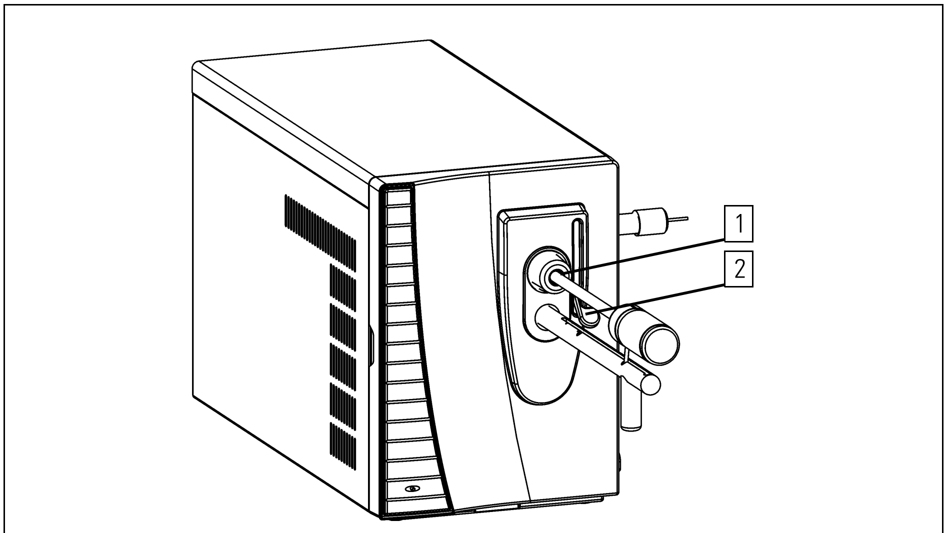
Figure 2-17. I/R Tool and Guide Bar Components

a. Turn the **I/R Tool (4)** to the **Hold Position (2)** .

b. Insert the **Guide Ball (11)** into the **Guide Ball Hole (10)**.

c. Slide the **I/R Tool (4)** forward in the **Guide Bar Track (7)** until the **Guide Ball (11)** is at the **First Stop (9)**.

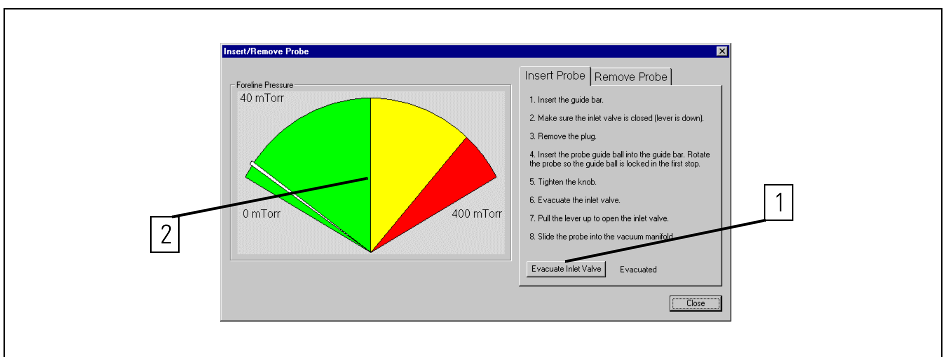
d. Turn the **I/R Tool (4)** so the **Guide Ball (11)** is in the groove at the **First Stop (9)**. This prevents the probe from being pulled forward when the **Inlet Valve** is evacuated.



1	Inlet Valve Knob	2	Inlet Valve Lever

Figure 2-18. I/R Tool Ready to be Inserted

e. Tighten the **Inlet Valve Knob (1)** to ensure a leak tight seal.



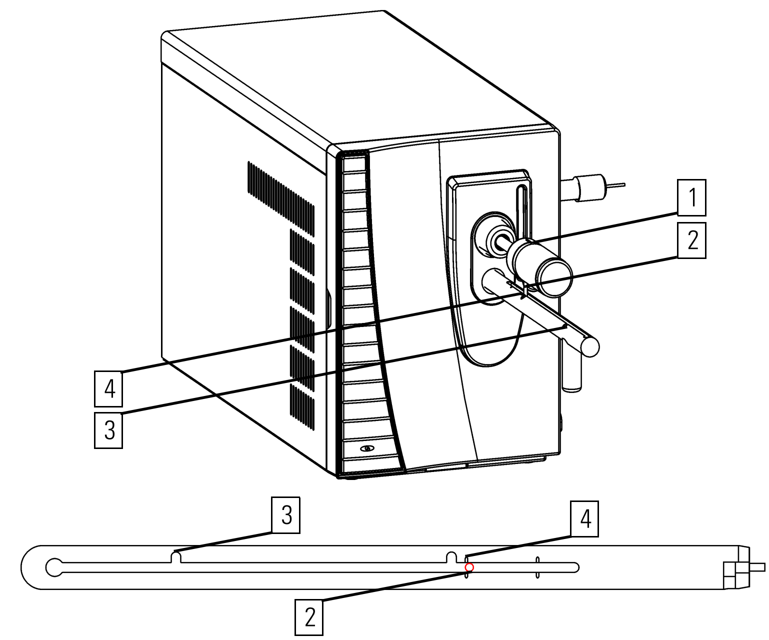
1	Evacuate Inlet Valve	2	Forepressure

Figure 2-19. Insert Probe Screen

f. From the **Insert Probe Screen**, select **Evacuate Inlet Valve (1)**.

g. Monitor the **Forepressure (2)**. The pressure should not remain beyond 350 mTorr. If this occurs, the **Inlet Valve Seal** must be replaced (see “Inlet Valve Seal” on pp. 135).

h. Once evacuation is complete, pull the **Inlet Valve Lever (2)** up to open the **Inlet Valve**.



1	I/R Tool Handle	3	First Stop
2	Guide Ball	4	Second Stop (Engraved Line)

Figure 2-20. I/R Tool Inserted into Detector

7. **Reinsert the Ion Volume.**

a. Slide the **I/R Tool (1)** until the **Guide Ball (2)** is slightly beyond the **Second Stop (4)**.

b. Turn the **I/R Tool Handle (1)** counterclockwise to the **Release Position** . Listen for a “click”.

c. Withdraw the **I/R Tool (1)** away about 2.5 cm (1 in.).

d. Turn the **I/R Tool Handle (1)** to the **Hold Position** .

e. Slide the **I/R Tool (1)** forward until it touches **Ion Volume**. This ensures that the **Ion Volume** is fully inserted.

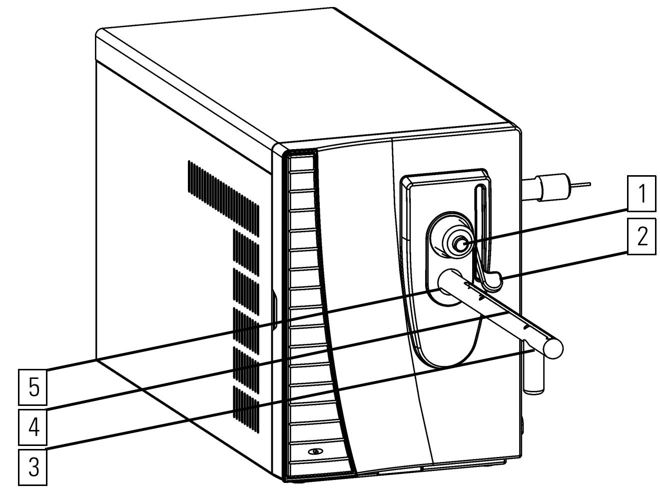
f. Withdraw the **I/R Tool (1)** until the **Guide Ball (2)** reaches the **First Stop (3)**.

g. Push the **Inlet Valve Lever** (Figure 2-18) down to close it.

h. Loosen the **Inlet Valve Knob** (Figure 2-18).

i. Completely remove the **I/R Tool**.

8. Restore the Inlet Valve.



1	Inlet Valve Plug	4	Guide Bar Track
2	Inlet Valve Lever	5	Guide Bar Opening
3	Guide Bar		

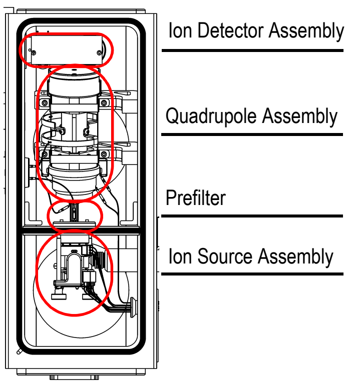
Figure 2-21. Guide Bar (Front)

a. Replace the **Inlet Valve Plug (1)**. Keep **EI** or **CI** label on top to indicate the **Ion Volume** installed. For the **EI/CI Combo Ion Volume**, rotate it in between **EI** and **CI**.

b. Remove the **Guide Bar (3)** by rotating it 90° counter-clockwise and sliding it out of the **Guide Bar Opening (5)**.

9. Close the Insert/Remove Probe Screen. From the Insert/Remove Probe Screen, select Close to return to the *Xcalibur* Home Page.

Cleaning the Ion Volume Without an Inlet Valve



Tools Needed

- Cleaning supplies for stainless steel parts
- Gloves, clean, lint- and powder-free
- Ion Volume Tool (PN 119270-0001)
- Lint-free cloth

Frequency

As needed to restore system performance

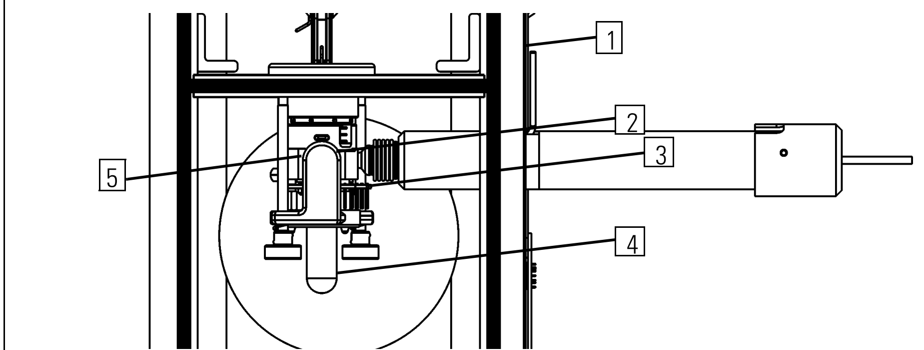
Inside the Ion Volume is where molecules interact with energetic electrons to form ions. Because the Ion Volume is exposed directly to samples introduced into the *DSQ II,* you will clean it more frequently than other parts. How often you clean the Ion Volume assembly will depend on the types and amounts of samples. If you don't have an Inlet Valve you can still access and remove the Ion Volume for cleaning using an Ion Volume Tool.

1. Prepare the *DSQ II* for maintenance.

a. Shut down, vent, and remove the Vacuum Manifold Cover (see "Vacuum Manifold Maintenance" on pp. 52).

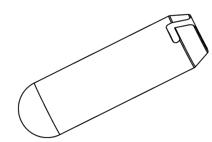
Note Wear clean, lint- and powder-free gloves when you handle parts belonging inside the Vacuum Manifold.

2. Remove the Ion Volume from the Ion Source Assembly.



1	Vacuum Manifold	4	Ion Volume Tool
2	Magnet Support	5	Ion Source Block (Ion Volume inside)
3	Ion Source PCB		

Figure 2-22. Ion Source Assembly with Ion Volume Tool Inserted (Top)



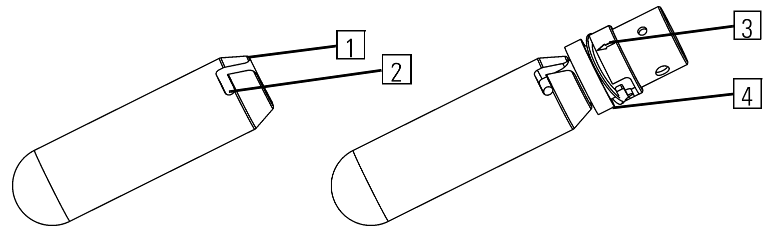
a. Hook the **Ion Volume Tool (4)** on the **Ion Volume** through the opening in the **Ion Source PCB (3)**.

b. Turn the **Ion Volume Tool (4)** counter-clockwise 30° to engage the **Ion Volume**.

c. Pull the **Ion Volume** straight back and through the opening in the **Ion Source PCB (3)**.

3. Clean the Ion Volume (4), as described in "Cleaning Stainless Steel Parts" on pp. 43. If you are cleaning a CI Ion Volume, be sure to clean out the small electron entrance hole. Aluminum oxide can get

trapped in this hole, which can adversely affect sensitivity. Use a dental pick or old syringe needle to clean the hole.



1	Ion Volume Tool	3	Ion Volume Arrow
2	Bayonet Pin Guide/Lock	4	Ion Volume

Figure 2-23. Ion Volume on Ion Volume Tool

a. Rotate the **Ion Volume (4)** to disconnect it from the **Ion Volume Tool (1)**.

b. Clean the **Ion Volume (4)** using the instructions for "Cleaning Stainless Steel Parts" on pp. 43.

4. **Replace the Ion Volume.**

a. Insert the **Ion Volume (4)** onto the end of the **Ion Volume Tool (1)**.

b. Align the **Ion Volume Arrow (3)** so it is facing up.

c. Use the **Ion Volume Tool (1)** to push the **Ion Volume (4)** straight through the opening in the **Ion Source PCB** (Figure 2-22).

d. Push the **Ion Volume** all the way into the **Ion Source Block** and listen for it to snap into place.

e. Turn the **Ion Volume Tool** handle clockwise 30° to disengage the **Ion Volume**.

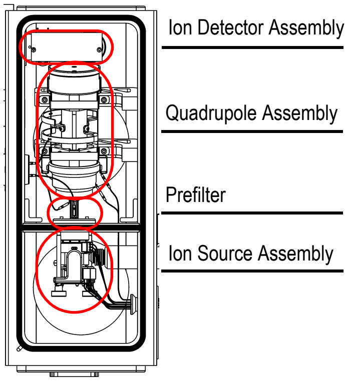
5. **Reassemble the *DSQ II* for operation.**

a. Replace the **Vacuum Manifold Cover**.

b. Replace the *DSQ II* front and top covers.

c. Restart the system.

Cleaning the Ion Source, Lenses, and Prefilter



Tools Needed

- Cleaning supplies for non-stainless steel or hybrid parts
- Cleaning supplies for stainless steel parts
- Forceps
- Gloves, clean, lint- and powder-free
- Lens Alignment Tool (PN 120271-0001)
- Lint-free cloth
- Wrench, Allen, 2.5 mm
- Wrench, Allen, 3.0 mm

Frequency

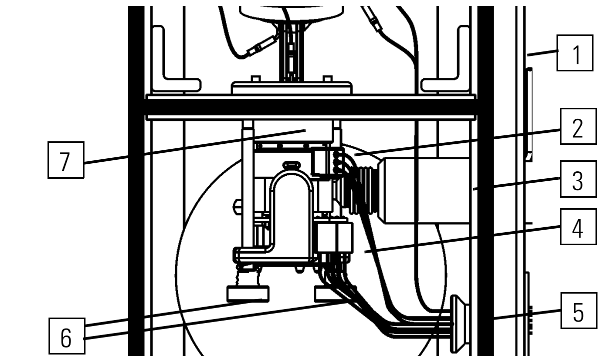
To restore system performance

If cleaning the Ion Volume does not restore system performance, try cleaning the **Ion Source** and **Prefilter**. System Performance is determined by your benchmark tests. See "Running Benchmark Tests" on pp. 38. The Ion Source Lenses (especially **L1**) come in direct contact with samples introduced into the *DSQ II* and need to be cleaned periodically (though not as often as the Ion Volume).

1. **Prepare the *DSQ II* for maintenance.**

   a. Shut down, vent, and remove the Vacuum Manifold Cover (see "Vacuum Manifold Maintenance" on pp. 52).

2. Remove the Ion Source Assembly.



1	Vacuum Manifold	5	12-Pin Connection
2	3-Pin Lens Connection	6	Thumbscrews, 2
3	Transfer Line	7	Source Spacer
4	8-Pin Connection		

Figure 2-24. Ion Source Assembly (Top)

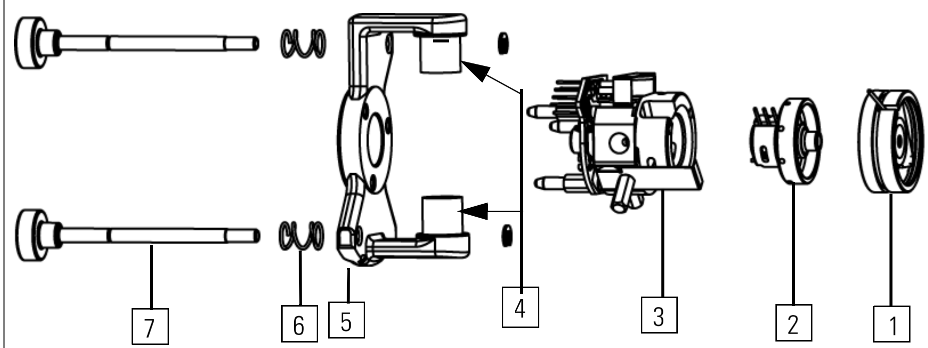
Note Wear clean, lint- and powder-free gloves when you handle parts belonging inside the Vacuum Manifold.

a. Disconnect the **3-pin (2)** and **8-pin Connector (4)** from the **Ion Source Assembly**. Be careful not to pull the connectors by the wires.

b. Loosen the two **Thumbscrews (6)**.

c. Slide the **Source Spacer (7)** slightly to the left, while pulling it slightly toward you (away from the **Prefilter**). Once it is free, carefully slide it left to clear the end of the **Transfer Line (3)**. Be careful not to damage the capillary column extending out of the **Transfer Line**.

3. Disassemble the Ion Source Assembly.



1	Source Spacer, with PreFilter Lens	5	Magnet Support
2	Lens Assembly	6	Spring, 2
3	Ion Source Block Assembly	7	Thumbscrew, 2
4	Magnet, 2		

Figure 2-25. Ion Source Assembly (Right Side)

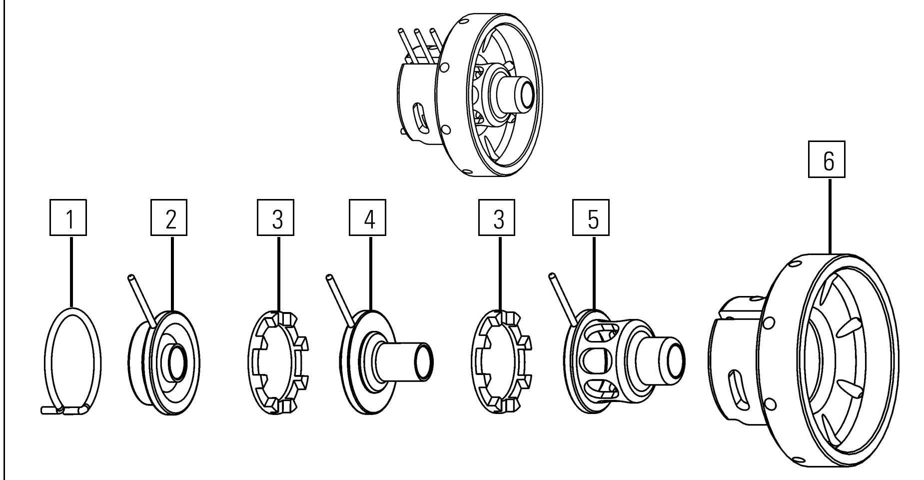
a. Remove the **Source Spacer (1)**.

The source spacer has a prefilter lens held in with a triangular spring clip. Compress the clip with fingers to remove it. Clean the surface and inside diameter of the lens.

b. Remove the **Lens Assembly (2)**.

c. Remove the **Magnet Support (5)**, **Magnets (4)**, and **Thumbscrews (7)**. It is not necessary to disassemble these.

4. Disassemble the Lens Assembly.



1	Lens Clip	4	Lens 2
2	Lens 1	5	Lens 3
3	Lens Spacer, 2	6	Lens Holder

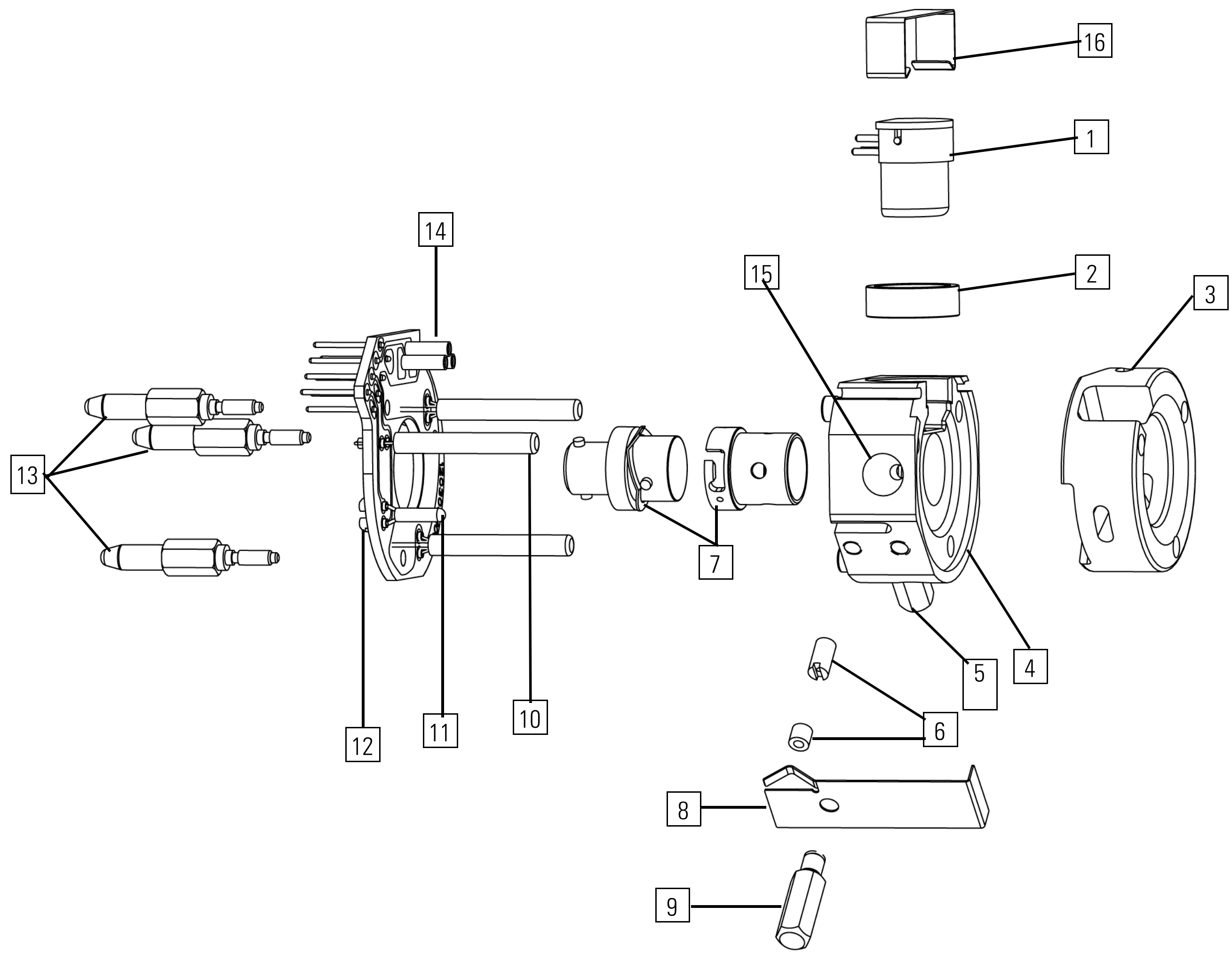
Figure 2-26. Lens Assembly

a. Remove the **Lens Clip (1)** by pinching the ends with your fingers or forceps.

b. Remove the **Lenses (2, 4, 5)** and **Lens Spacers (3)** from the ceramic **Lens Holder (6)**.

5. Clean the Lenses (2, 4, 5). Use the instructions for **"Cleaning Stainless Steel Parts" on pp. 43****. Pay particular attention to the areas inside the tube and around the hole in each lens.**

6. Disassemble the Ion Source Block Assembly.



1	Filament	9	Spring Thumbscrew
2	Filament Spacer	10	Cartridge Heaters, 3
3	Heater Ring	11	Temperature Sensor
4	Ion Source Block	12	Ion Source PCB
5	Alignment Pin/Ion Volume Key Thumbscrew	13	Base-Studs, 3
6	Ion Volume Pin/Set Screw & Ball Plunger	14	3-pin Filament Connector
7	Ion Volume and Holder	15	Sample Inlet Aperture
8	Spring	16	Filament Retainer Clip

Figure 2-27. Ion Source Block Assembly

a. Remove the **Base-Studs (13)**. Be careful not to damage the leads on the **Ion Source PCB (12)**.

Note Do not bend or twist the Cartridge Heaters or the Temperature Sensor.

b. Gently pull the **Ion Source PCB (12)** from the **Ion Source Block (4)** by sliding the **Cartridge Heaters (10)** and **Temperature Sensor (11)** out of the **Ion Source Block** and pulling the **Filament (1)** straight away from the **3-pin Filament Connector (14)** that is located on the **Ion Source PCB (12)**.

c. Remove the **Filament Retainer Clip (16)**.

d. Remove the **Filament (1)** and **Filament Spacer (2)**.

e. Remove the **Ion Volume Key Thumbscrew (5)**.

Note It is not necessary to remove the Ion Volume Pin. If it is removed, it should be reinserted just far enough so the ball will keep an ion volume from falling out. If the ball extends too far, ion volumes will be difficult to remove.

f. Remove the **Spring Thumbscrew (9)** and **Spring (8)**.

7. **Clean the Ion Source Block Assembly. Clean each component by following the instructions for “Cleaning Stainless Steel Parts” on pp. 43 and “Cleaning Non-Stainless Steel or Hybrid Parts” on pp. 46. Thoroughly clean the Ion Source Block where the Filament sits and the well on the opposite side of where the Ion Volume sits. It**

is not necessary to clean the Magnets, Magnet Support, or Thumbscrews.

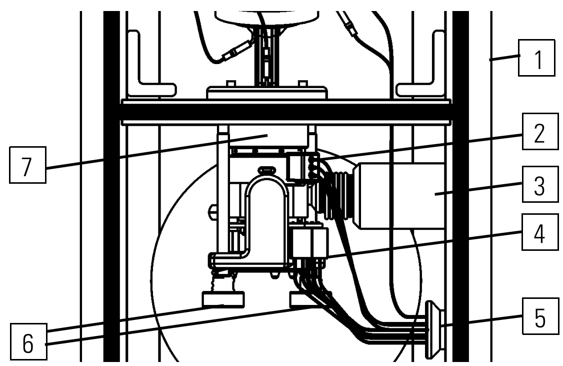
8. **Reassemble the Ion Source Block Assembly.**

9. **Reassemble the Lens Assembly.**

10. **Reassemble the Ion Source Assembly.**

11. **Insert the lens alignment tool through the magnet holder, into the lens assembly to maintain alignment during assembly.**

12. **Install the Ion Source Assembly.**



1	Vacuum Manifold	5	12-Pin Connection
2	3-Pin Lens Connection	6	Thumbscrews, 2
3	Transfer Line	7	Source Spacer
4	8-Pin Connection		

Figure 2-28. Ion Source Assembly (Top)

a. Slip the **Ion Source Assembly** over the end of the **Transfer Line (3)**. Be careful not to damage the capillary column extending out of the **Transfer Line**.

b. Push the **Source Spacer (7)** to the right until it snaps into place.

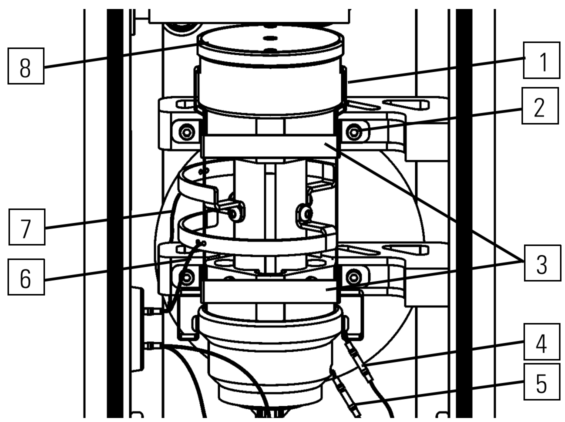
c. Tighten the two **Thumbscrews (6)**.

d. Connect the **3-pin (2)** and **8-pin Connectors (4)**.

e. Be sure the **Ion Source Assembly** is still snapped into place by trying to push it left and right. It should not move. If it is not snapped properly into its groove, system performance will degrade and you will not be able to insert and remove ion volumes using the inlet valve.

f. Remove the lens alignment tool and insert the ion volume.

13. Remove the Quadrupole Assembly.



1	Quadrupole Assembly	5	Entrance Lens Connection, Short Wire
2	Screw Holding Quadrupole Strap, 4	6	Top RF Feedthrough Connection
3	Quadrupole Strap, 2	7	Bottom RF Feedthrough Connection
4	Exit Lens Connection, Long Wire	8	Exit Lens

Figure 2-29. Quadrupole Assembly (Top)

Note Remove the Quadrupole Straps and the Screws together. This makes it easier to remove and reinstall the Screws.

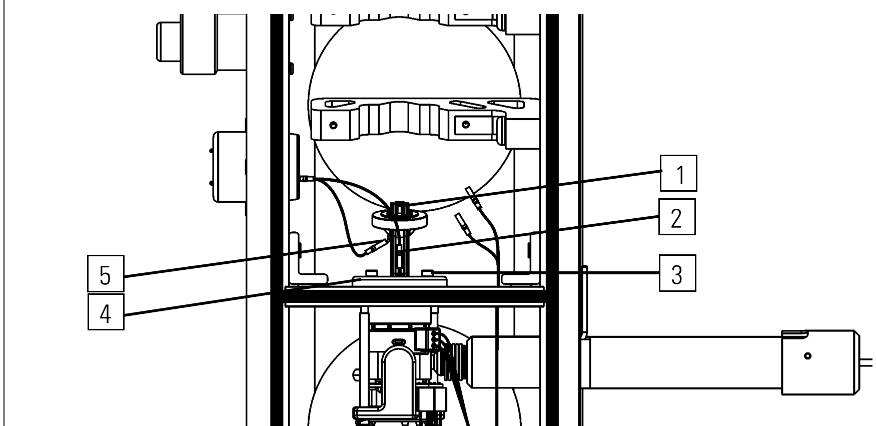
a. Unscrew, but do not remove the four **Screws holding the Quadrupole Straps (2)**.

b. Remove the two **Quadrupole Straps (3)** and the four **Screws (2)**.

c. Disconnect the **Top and Bottom RF Feedthrough Connections (6, 7)** using forceps.

d. Slide the **Quadrupole Assembly (1)** slightly back and lift it out. Stand it on its **Exit Lens (8)** somewhere safe. Do not lay it on its side as this can damage the Quadrupole and loosen the **RF Feedthrough Connections (6, 7)**.

14. Remove the Prefilter.



1	Prefilter	4	Prefilter Clamp
2	Top Prefilter Connection	5	Bottom Prefilter Connection
3	Screw Holding Prefilter Clamp, 4		

Figure 2-30. Prefilter (Top)

a. Disconnect the **Top (2)** and **Bottom Prefilter Connections (5)** from the **Prefilter (1)**.

b. Remove the four **Screws Holding the Prefilter Clamp (3)** on systems with the polycarbonate prefilter clamp. On systems with the metal prefilter clamp, loosen the two thumbscrews and raise the clamp.

c. Remove the **Prefilter (1)**.

15. Clean the Prefilter. Clean the Prefilter, as described in “Cleaning Non-Stainless Steel or Hybrid Parts” on pp. 46. Note that it is only

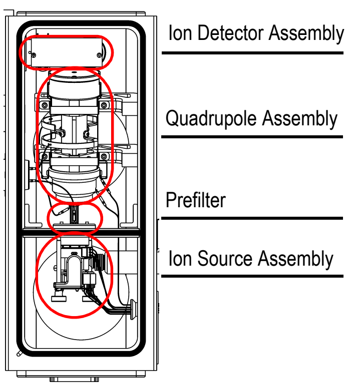
necessary to clean the rods, especially the front end where most of the ions strike. Also, the Prefilter should never be put in an oven.

16. Reinstall the Prefilter.

17. Reinstall the Quadrupole Assembly.

18. Restore the *DSQ II* for operation.

Replacing the Ion Source Filament



Tools Needed

- Filament (PN 120320-0030)
- Gloves, clean, lint- and powder-free
- Lint-free cloth

Frequency

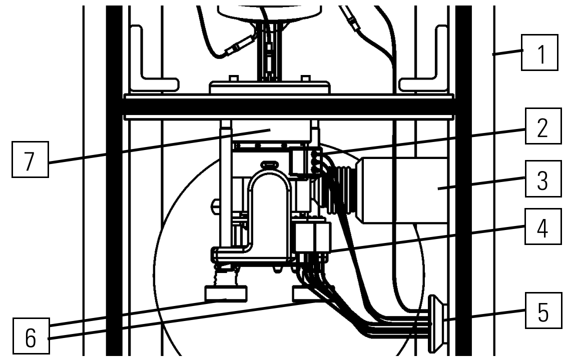
When you notice a lack in ion production and the instrument status indicates the filament is open.

The number of ions produced in the Ion Source is approximately proportional to the filament emission current. If you notice a lack in ion production, then this might indicate the filament has failed and needs to be replaced. If the measured emission current is substantially less than the value that the emission current is set to, or if the measured emission current is decreasing over time, then the filament has failed or is failing, and needs to be replaced.

1. **Prepare the *DSQ II* for maintenance.**

   a. Shut down, vent, and remove the Vacuum Manifold Cover (see “Vacuum Manifold Maintenance” on pp. 52).

2. Remove the Ion Source Assembly from the Vacuum Manifold.



1	Vacuum Manifold	5	12-Pin Connection
2	3-Pin Lens Connection	6	Thumbscrews, 2
3	Transfer Line	7	Source Spacer
4	8-Pin Connection		

Figure 2-31. Ion Source Assembly (Top)

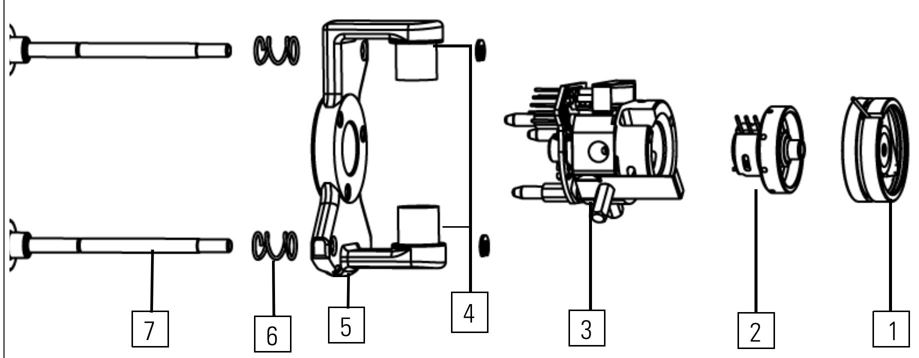
Note Wear clean, lint- and powder-free gloves when you handle parts belonging inside the Vacuum Manifold.

a. Disconnect the **3-pin (2)** and **8-pin Connector (4)** from the **Ion Source Assembly**. Be careful not to pull the connectors by the wires.

b. Loosen the two **Thumbscrews (6)**.

c. Slide the **Source Spacer (7)** slightly to the left, while pulling it slightly toward you (away from the **Prefilter**). Once it is free, carefully slide it left to clear the end of the **Transfer Line (3)**. Be careful not to damage the capillary column extending out of the **Transfer Line**.

3. Disassemble the Ion Source Assembly.



1	Source Spacer, with PreFilter Lens	5	Magnet Support
2	Lens Assembly	6	Spring, 2
3	Ion Source Block Assembly	7	Thumbscrew, 2
4	Magnet, 2		

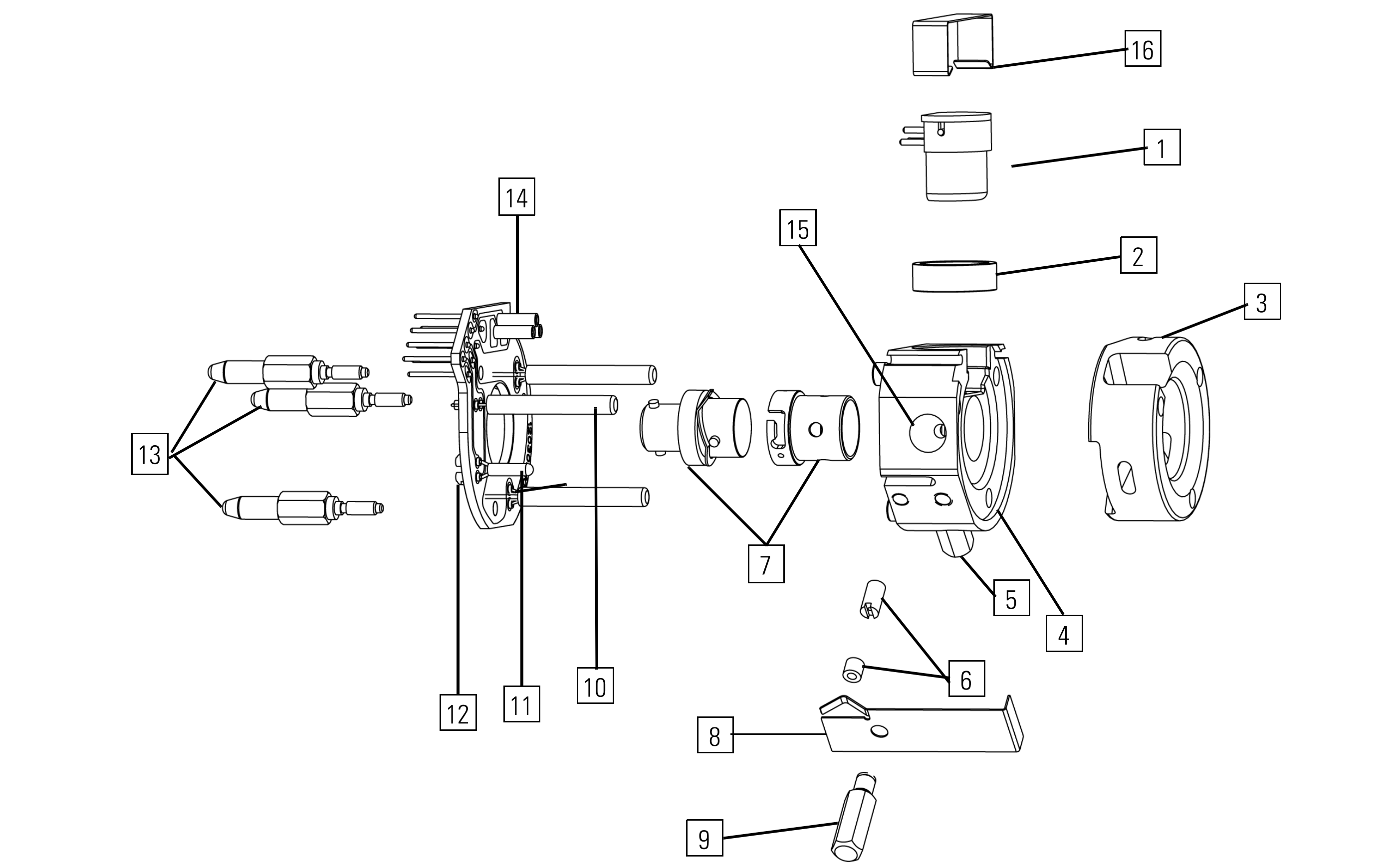
Figure 2-32. Ion Source Assembly (Right Side)

a. Remove the **Source Spacer (1)**.

b. Remove the **Lens Assembly (2)**.

c. Remove the **Magnet Support (5)**, **Magnets (4)**, and **Thumbscrews (7)** as an assembly.

4. Disassemble the Ion Source Block Assembly.



1	Filament	9	Spring Thumbscrew
2	Filament Spacer	10	Cartridge Heaters, 3
3	Heater Ring	11	Temperature Sensor
4	Ion Source Block	12	Ion Source PCB
5	Alignment Pin/Ion Volume Key Thumbscrew	13	Base-Studs, 3
6	Ion Volume Pin/Set Screw & Ball Plunger	14	3-pin Filament Connector
7	Ion Volume and Holder	15	Sample Inlet Aperture
8	Spring	16	Filament Retainer Clip

Figure 2-33. Ion Source Block Assembly

a. Remove the **Base-Studs (13)**. Be careful not to damage the leads on the **Ion Source PCB (12)**.

Note Do not bend or twist the Cartridge Heaters or the Temperature Sensor.

b. Gently pull the **Ion Source PCB (12)** from the **Ion Source Block (4)** by sliding the **Cartridge Heaters (10)** and **Temperature Sensor (11)** out of the **Ion Source Block** and pulling the **Filament (1)** straight away from the **3-pin Filament Connector (14)** that is located on the **Ion Source PCB (12)**.

c. Remove the **Filament Retainer Clip (16)**.

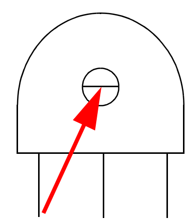
d. Remove the **Filament (1)**.

Note Now is a good time to clean the Ion Volume, Ion Source, and Lenses.

5. Inspect the Filament Wire on the new Filament Assembly.

a. Verify that the **Filament Wire** is centered in the **Electron Lens Hole**.

b. If not, carefully use forceps to adjust the **Filament Wire**.



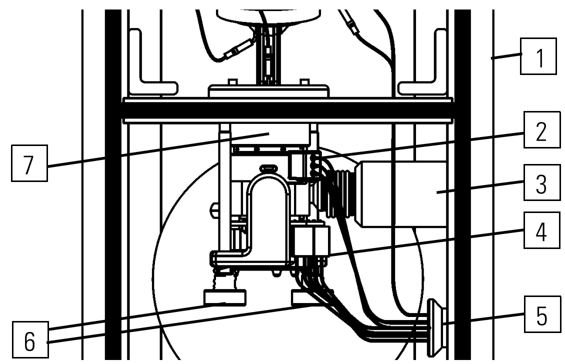
6. Reassemble the Ion Source Block Assembly.
Normally, there is a small gap (about 0.020 in.) between the Filament and the connectors. The gap allows the ceramic Filament

Spacer centering ring to properly position and align the Electron Lens Hole with the Ion Volume.

7. **Inspect the assembly to make sure the bottom of the filament outer shield does not touch the source block.**

8. **Reassemble the Ion Source Assembly.**

9. **Install the Ion Source Assembly.**



1	Vacuum Manifold	5	12-Pin Connection
2	3-Pin Lens Connection	6	Thumbscrews, 2
3	Transfer Line	7	Source Spacer
4	8-Pin Connection		

Figure 2-34. Ion Source Assembly (Top)

a. Slip the **Ion Source Assembly** over the end of the **Transfer Line (3)**. Be careful not to damage the capillary column extending out of the **Transfer Line**.

b. Push the **Source Spacer (7)** to the right until it snaps into place.

c. Tighten the two **Thumbscrews (6)**.

d. Connect the **3-pin (2)** and **8-pin Connectors (4)**.

e. Be sure the **Ion Source Assembly** is still snapped into place by trying to push it left and right. It should not move. If it is not snapped properly into its groove, system performance will degrade and you will not be able to insert and remove ion volumes using the inlet valve.

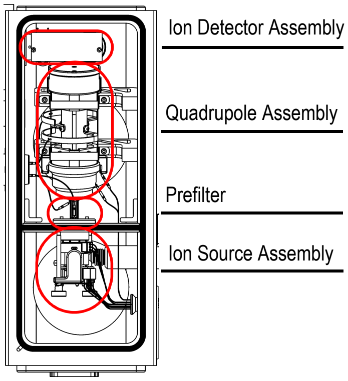
10. Restore the *DSQ II* for operation.

a. Replace the **Vacuum Manifold Cover**.

b. Replace the *DSQ II* front and top covers.

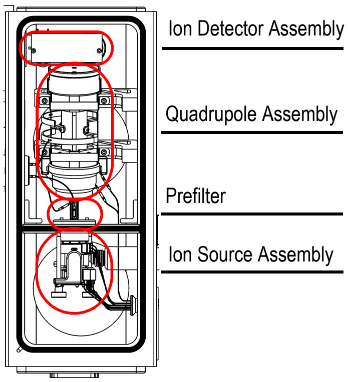
c. Restart the system.

2.5 Quadrupole Assembly Maintenance



The Quadrupole rarely needs maintenance other than keeping it dust-free with a clean, dry gas. It must be kept free of dust because even the smallest amount of lint can cause poor sensitivity and peak shape. The Quadrupole Assembly (also known as the Mass Analyzer) is composed of an Entrance Lens, Quadrupole, and Exit Lens. The Quadrupole is a precision device that should never be disassembled. Contact Customer Service for Quadrupole cleaning.

2.6 Ion Detector Assembly Maintenance



The Ion Detector Assembly has a **Conversion Dynode** and **Electron Multiplier**. It must be kept clean and free of dust, because even the smallest amount of lint on either the **Electron Multiplier** or the **Conversion Dynode** can cause spectral noise or static discharge, which could lead to power supply failure.

Keep these points in mind:

- Clean the **Conversion Dynode** and **Electron Multiplier** with clean dry gas, never liquids or abrasives, each time you remove the **Vacuum Manifold Cover**
- Cover the **Vacuum Manifold** with the **Vacuum Manifold Cover**, if you temporarily step away

CAUTION

Instrument Damage. Do not clean the conversion dynode with aluminum oxide. This may damage the surface. An ion burn on the surface of the conversion dynode is normal and will not adversely affect performance.

Cleaning the Anode

Tools Needed

- Gloves, clean, lint- and powder-free
- Lint-free cloth
- Screwdriver, Phillips #1
- Wrench, Allen, 3 mm
- Wrench, open-ended, 17 mm
- Wrench, open-ended, 9/16-in.

Frequency

Still receiving noise, after spray cleaning the Ion Detector Assembly.

The **Anode** is located on the left side of the **Vacuum Manifold** under the **Electron Multiplier**.

To clean the Anode, follow these steps:

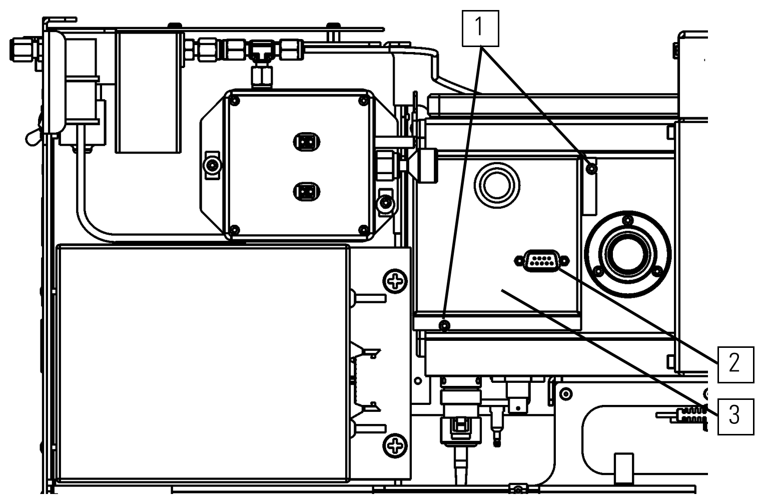
1. **Prepare the *DSQ II* for maintenance.**

a. Shut down and vent the *DSQ II* (see “Vacuum Manifold Maintenance” on pp. 52).

b. Remove the front, top, and left side covers (see “Removing the Covers” on pp. 39).

Note Wear clean, lint- and powder-free gloves when you handle parts belonging inside the Vacuum Manifold.

2. Remove the Electrometer PCB.



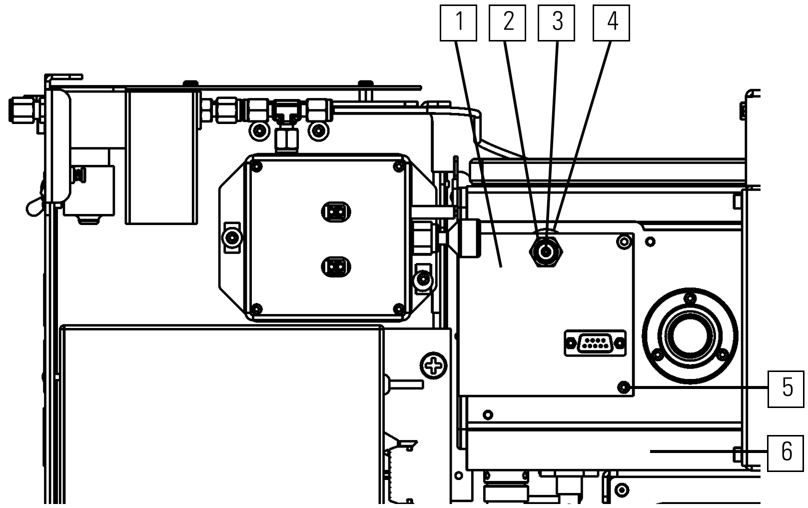
1	Screws holding the Electrometer PCB Cover, 2	3	Electrometer PCB Cover
2	Electrometer PCB Cable		

Figure 2-35. Electrometer PCB (Left Side)

a. Disconnect the **Electrometer PCB Cable (2)** at P1.

b. Remove the two **Screws holding the Electrometer PCB Cover (1)** in place.

c. Remove the two hex bolts on the cable socket and remove the **Electrometer PCB Cover**.



1	Electrometer PCB	4	Anode Feedthrough
2	Nut Holding Electrometer PCB to Anode Feedthrough	5	Screw Holding Electrometer PCB
3	Screw Holding Wire to Anode Feedthrough	6	Vacuum Manifold

Figure 2-36. Electrometer PCB with Cover Removed (Left Side)

d. Remove the **Screw Holding the Wire to the Anode Feedthrough (3)**.

e. Remove the **Nut Holding Electrometer PCB to Anode Feedthrough (2)**.

f. Remove the **Screw Holding Electrometer PCB (5)** and pull the **Electrometer PCB (1)** free.

3. **Remove the Anode Feedthrough (4) by unscrewing it from the Vacuum Manifold.**

4. **Clean the Anode Feedthrough. Clean the Anode Feedthrough as described in “Cleaning Non-Stainless Steel or Hybrid Parts” on pp. 46. Note that it is only necessary to clean the cup part that**

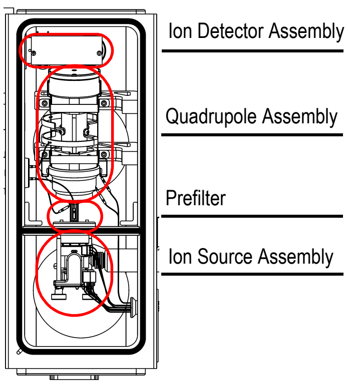
extends into the Vacuum Manifold. Never put the Anode Feedthrough in an oven.

5. **Reinstall the Anode Feedthrough.**

6. **Replace the Electrometer PCB.**

7. **Restore the *DSQ II* for operation.**

Replacing the Electron Multiplier



Tools Needed

- Cathode (A0022-14633)
- Forceps
- Gloves, clean, lint- and powder-free
- Lint-free cloth
- Screwdriver, Flat
- Screwdriver, Phillips #1
- Wrench, Allen, 2.5 mm
- Wrench, Allen, 3 mm

Frequency

Still receiving significant amounts of spectral noise, after cleaning the Anode.

1. **Prepare the *DSQ II* for maintenance.**

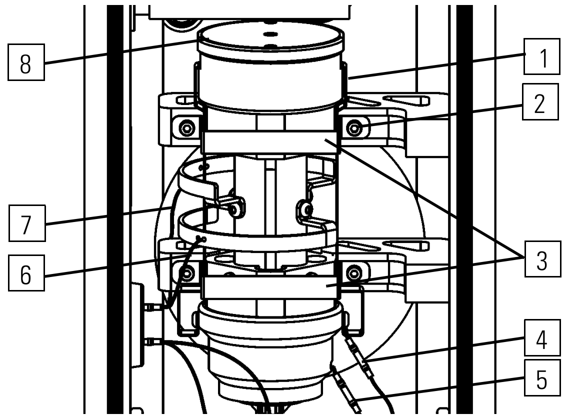
   a. Shut down, vent, and remove the Vacuum Manifold Cover (see "Vacuum Manifold Maintenance" on pp. 52).

Note Wear clean, lint- and powder-free gloves when you handle parts belonging inside the Vacuum Manifold.

The ETP Multiplier can be replaced without removing the quadrupole. The multiplier element is held with spring clips to the top of the rectangular multiplier assembly.

For the DeTech multiplier (a round cylindrical assembly), follow the procedure below.

2. Remove the Quadrupole Assembly.



1	Quadrupole Assembly	5	Entrance Lens Connection, Short Wire
2	Screw Holding Quadrupole Strap, 4	6	Top RF Feedthrough Connection
3	Quadrupole Strap, 2	7	Bottom RF Feedthrough Connection
4	Exit Lens Connection, Long Wire	8	Exit Lens

Figure 2-37. Quadrupole Assembly (Top)

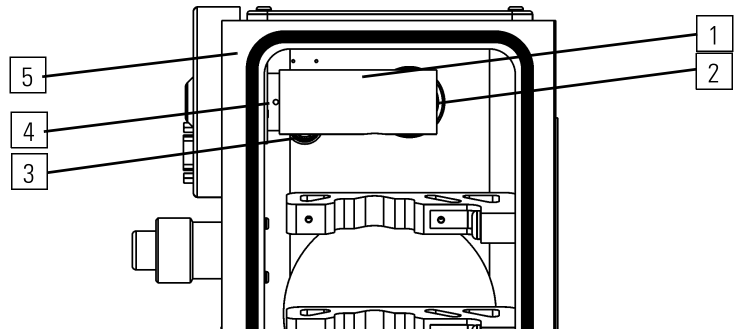
a. Unscrew, but do not remove the four **Screws holding the Quadrupole Straps (2)**.

b. Remove the two **Quadrupole Straps (3)**.

c. Disconnect the **Top and Bottom RF Feedthrough Connections (6, 7)** using forceps.

d. Slide the **Quadrupole Assembly (1)** slightly back and lift it out. Stand it on its **Exit Lens (8)** somewhere safe. Do not lay it on its side as this can damage the Quadrupole and loosen the **RF Feedthrough Connections (6, 7)**.

3. Remove the Ion Detector Assembly.



1	Ion Detector Assembly	4	Screw Holding Ion Detector Assembly, 2
2	Conversion Dynode Connection	5	Vacuum Manifold
3	Electron Multiplier Connection		

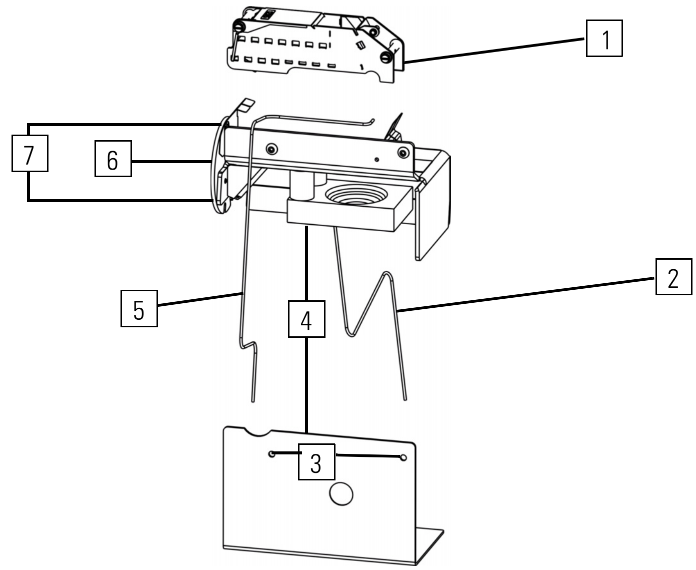
Figure 2-38. Ion Detector Assembly (Top)

a. Disconnect the **Conversion Dynode Connection (2)** from the connector at the bottom of the **Vacuum Manifold (5)**.

b. Disconnect the **Electron Multiplier Connection (3)** from the connector at the bottom of the **Vacuum Manifold (5)**.

c. Remove the two **Screws Holding the Ion Detector Assembly (4)** to the **Vacuum Manifold (5)**.

4. Disassemble Ion Detector.



1	Electron Multiplier Cathode, A0022-14633	5	Electron Multiplier Connection
2	Conversion Dynode Connection	6	Base
3	Screws that hold the Shield, 2	7	Screw that Holds the Base, 2
4	Shield & Conversion Dynode		

Figure 2-39. Ion Detector Assembly, Replacement Detector Assembly (without items 2 & 5)

a. Remove the two **Screws that Hold the Shield (3)**.

b. Remove the two **Screws that Hold the Base (7)**.

c. Disconnect the **Electron Multiplier Connection (5)**.

5. Reinstall the Ion Detector Assembly base to the manifold wall using the two screws that hold the base (7).

Make sure the conversion dynode connector wire is seated properly into the dynode and feed-through.

6. **Reassemble the Ion Detector Assembly.**

   a. Attach the **Shield (4)** with the two **Screws that Hold the Shield (3)**.

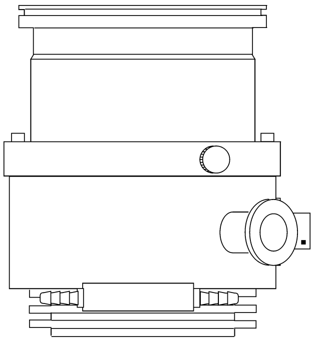
   b. Attach the new **Electron Multiplier Cathode (1)** with the spring clip. Insert the end nearest the manifold mount first, then push the other end into the clip.

   c. Reconnect the **Electron Multiplier Connection (5)**.

7. **Reinstall the Quadrupole Assembly.**

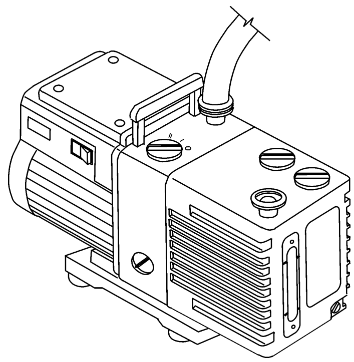
8. **Restore the *DSQ II* for operation.**

2.7 Turbomolecular Pump Maintenance



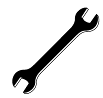
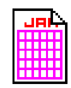
Your *DSQ II* is equipped with either a 70 L/s Turbomolecular Pump, a 250 L/s Turbomolecular Pump, or a 200/200 L/s split-flow Turbomolecular Pump. No maintenance is required. They contain sufficient lubricant to supply the bearings for life. The **Turbomolecular Pump** is located directly under the **Vacuum Manifold** and provides the high vacuum necessary for ion production.

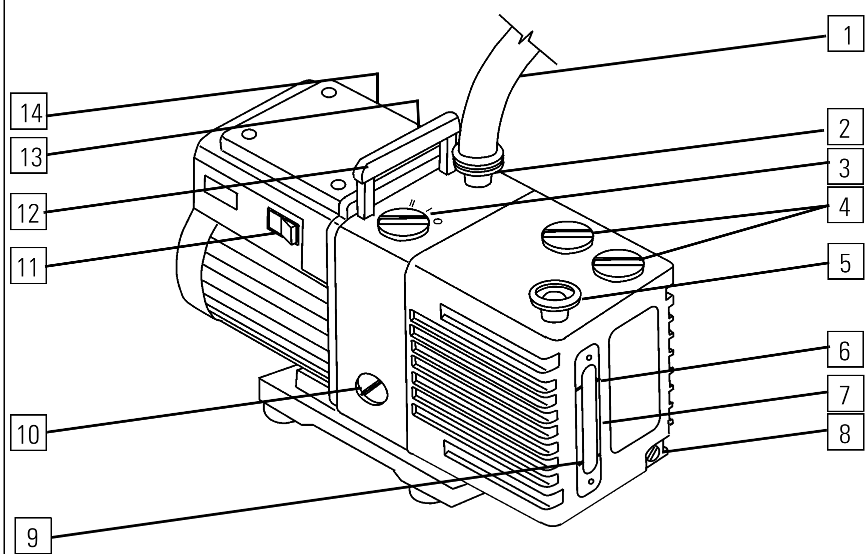
2.8 Rotary-Vane Pump Maintenance



The Rotary-Vane Pump is located under the work table where the *DSQ II* is placed. All you have to do to maintain the rotary-vane pump is add, purge, and change the oil.

Checking the Oil Level

	**Tools Needed** • Rotary-Vane Pump Oil (PN A0301-15101)
	**Frequency** Every week



1	Foreline Vacuum Hose	8	Drain Plug
2	Inlet Port	9	MIN (minimum level mark)
3	Gas-Ballast Control	10	Mode Selector
4	Oil Filler Plugs	11	On/Off Switch
5	Outlet Port	12	Handle
6	MAX (maximum level mark)	13	Voltage Indicator
7	Oil-Level Sight-glass	14	Electrical Inlet Connector

Figure 2-40. Rotary-Vane Pump

> **Note** Set the Mode Selector to High Vacuum mode (turned fully clockwise) and close (position 0) the Gas-Ballast Control for normal operations.

1. **Look into the Oil-Level Sight-Glass (7) to see if the oil level is between the MIN (9) and MAX (6) marks. If the oil level is below**

the MIN (9) mark, add oil (see “Adding Oil to the Rotary-Vane Pump” on pp. 98).

2. **Look for oil that is both light amber in color and clear.**

   a. If the oil is cloudy or discolored, purge the oil to decontaminate dissolved solvents (see “Purging the Rotary-Vane Pump Oil” on pp. 100).

   b. If the pump oil is still discolored, change it (see “Changing the Rotary-Vane Pump Oil” on pp. 102).

Adding Oil to the Rotary-Vane Pump

Tools Needed

- Rotary-vane pump oil (PN A0301-15101)

Frequency

As needed (if the oil level is below the MIN mark on the oil level sight glass).

Use this procedure if the oil level is low. You can check the oil level by looking at the Oil Level Sight Glass (7) Figure 2-40.

1. **Prepare the *DSQ II* for maintenance.**

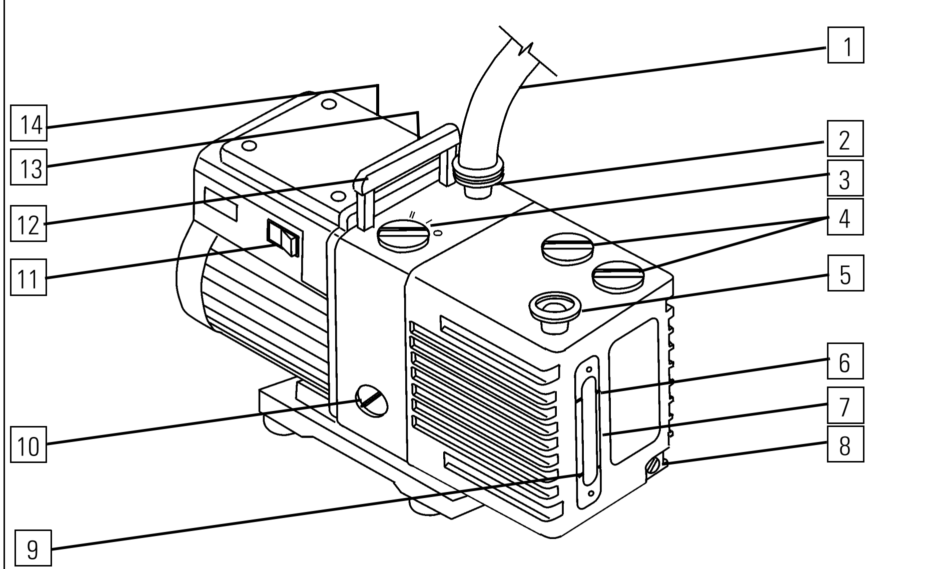
   a. Shut down and vent the DSQ II (see 1.3 Shutting Down pp. 1-30).

Note The pump oil level must be between the MIN and MAX marks on the oil-level sight-glass for the pump to operate properly.

2. Add Oil.

WARNING

Electrical Shock Hazard. Shut down and unplug the detector and Rotary-Vane Pump before adding oil.



1	Foreline Vacuum Hose	8	Drain Plug
2	Inlet Port	9	MIN (minimum level mark)
3	Gas-Ballast Control	10	Mode Selector
4	Oil Filler Plugs	11	On/Off Switch
5	Outlet Port	12	Handle
6	MAX (maximum level mark)	13	Voltage Indicator
7	Oil-Level Sight-glass	14	Electrical Inlet Connector

Figure 2-41. Rotary Vane Pump

a. Remove one of the **Oil Filler Plugs (4)** from the **Rotary-Vane Pump**.

b. Add fresh oil into the reservoir until the oil is half way between the **MIN (9)** and **MAX (6)** Level Marks.

CAUTION

Instrument Damage. Use only factory-approved Rotary-Vane Pump Oil to avoid a decrease in performance and damage to the instrument.

c. If the oil level goes above the **MAX (6)** Level Mark, remove the **Drain Plug (8)** and drain the excess oil into a suitable container.

d. Refit the **Oil Filler Plug (4)**.

3. Plug in both the Rotary-Vane Pump and the *DSQ II*.

4. Restart the system.

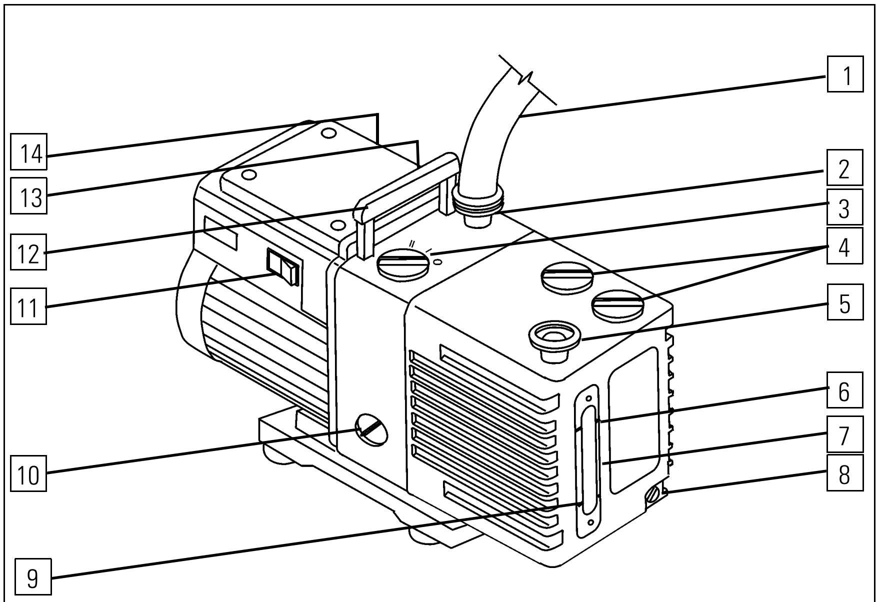
Purging the Rotary-Vane Pump Oil

	Tools Needed None
	Frequency When oil is discolored or cloudy.

Purging (or decontaminating) the oil in the Rotary-Vane Pump removes dissolved gases and low-boiling-point liquids from the pump oil. Purge the pump oil if it is cloudy or discolored. You can purge the pump oil without interrupting system operation. However, do not purge the pump during an **acquisition**, or while the **Electron Multiplier** or **Filament** are on.

1. Make sure you are not in the middle of an Acquisition and the Electron Multiplier and Filament are OFF. Use the Xcalibur Tune window to confirm these items are off.

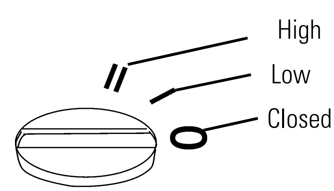
2. Prepare the Rotary-Vane Pump for purging.



1	Foreline Vacuum Hose	8	Drain Plug
2	Inlet Port	9	MIN (minimum level mark)
3	Gas-Ballast Control	10	Mode Selector
4	Oil Filler Plugs	11	On/Off Switch
5	Outlet Port	12	Handle
6	MAX (maximum level mark)	13	Voltage Indicator
7	Oil-Level Sight-glass	14	Electrical Inlet Connector

Figure 2-42. Rotary Vane Pump

a. Set the **Gas-Ballast Control (3)** to **Position I, Low Flow.**



b. Leave it in that position for 10 minutes or until the oil is clear.

c. If the oil remains cloudy or discolored after 10 minutes, change the oil (see “Changing the Rotary-Vane Pump Oil” on pp. 102).

d. Set the **Gas-Ballast Control (3)** to **Position 0, Closed**.

Changing the Rotary-Vane Pump Oil

Tools Needed

- Gloves, latex, impermeable
- Rotary-vane pump oil (PN A0301-15101)
- Suitable container for removing spent oil

Frequency

- 4 months (or 3,000 hours)
- Monthly, if you use ammonia

You should change the rotary vane pump oil every four months (about 3,000 hours of operation). If you use ammonia as a chemical ionization reagent gas you should change the oil every month. Ammonia is highly basic and quickly damages seals in the rotary-vane pump. Purging the oil with the **Gas Ballast** also helps remove dissolved ammonia from the oil.

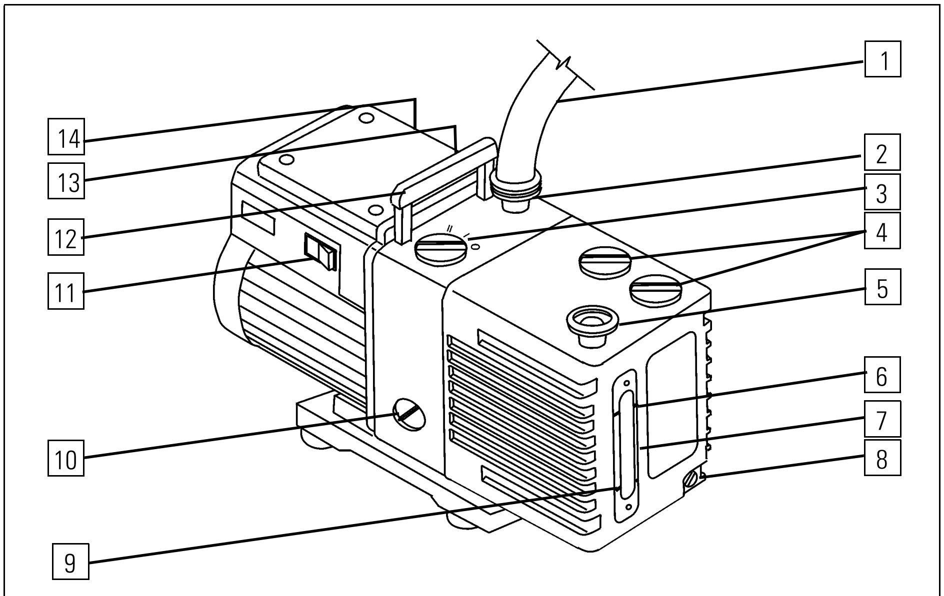
Note For best results, change the oil while the rotary-vane pump is still warm from operation. Be careful as the oil can be very hot if the pump was recently operated.

1. **Prepare the *DSQ II* for maintenance. Shut down and vent the DSQ II (see 1.3 Shutting Down pp. 1-30).**

2. **Unplug the Rotary-Vane Pump.**

WARNING

Electrical Shock Hazard. Shut down and unplug the detector and Rotary-Vane Pump before adding oil.



1	Foreline Vacuum Hose	8	Drain Plug
2	Inlet Port	9	MIN (minimum level mark)
3	Gas-Ballast Control	10	Mode Selector
4	Oil Filler Plugs	11	On/Off Switch
5	Outlet Port	12	Handle
6	MAX (maximum level mark)	13	Voltage Indicator
7	Oil-Level Sight-glass	14	Electrical Inlet Connector

Figure 2-43. Rotary Vane Pump

3. Disconnect the Foreline Vacuum Hose (1).

4. Place the Rotary-Vane Pump on a bench.

⚠ WARNING

Lifting Hazard. Use proper lifting technique with the Rotary-Vane Pump. It weighs approximately 22 kg (50 lbs).

5. Drain the old oil.

a. Remove one of the **Oil Filler Plugs (4)**.

⚠ WARNING

Hand and Chemical Hazard. Please wear impermeable laboratory gloves when changing oil.

b. Using gloves, remove the **Drain Plug (8)**, and allow the oil to drain into a suitable container.

c. Dispose of the spent oil according to local environmental regulations.

d. Replace the **Drain Plug (8)**.

6. Add fresh oil.

a. Add oil to the **Oil Filler Plug (4)** opening half way between the **MIN (9)** and **MAX (6)** level marks.

b. If the oil level goes above the **MAX (6)** level mark**,** remove the **Drain Plug (8)** and drain the excess oil from the pump.

7. Reassemble the Rotary-Vane Pump.

a. Replace the **Oil Filler Plug (4)**.

b. Return the **Rotary-Vane Pump** to the floor.

c. Reconnect the **Foreline Vacuum Hose (1)**.

8. Plug in both the Rotary-Vane Pump and the *DSQ II*.

9. Restart the system.

2.9 Replacing Parts

This section provides instructions for removing and replacing fuses, PCB's, and other assemblies found outside the Vacuum Manifold.

Note Keep the packing materials that come with your instrument shipment for returning defective parts.

Table 2.2 provides a quick reference to the procedures contained in this section.

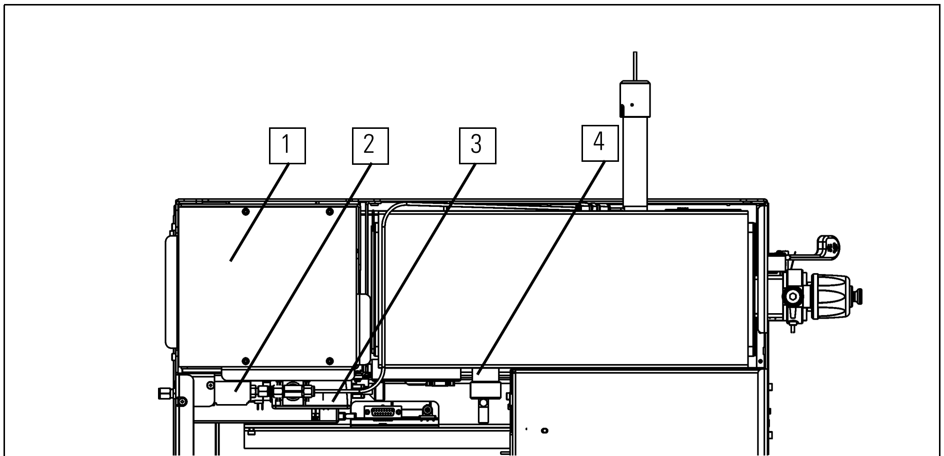
Table 2.2. Replaceable Parts (Listed Alphabetically)

Replaceable Parts
2.9 Replacing Parts pp. 2-110
2.9 Replacing Parts pp. 2-112
2.2 Maintaining System Performance pp. 2-49
2.9 Replacing Parts pp. 2-114
"CI Reagent Gas Flow Module (Upgrade Option)" on pp. 117
"Conversion Dynode/Electron Multiplier Power Supply" on pp. 119
"DC Driver Assembly" on pp. 121
"DC Driver Assembly Fuse" on pp. 124
"Digital PCB" on pp. 127
"Electrometer PCB" on pp. 129
"Forepressure Gauge and Foreline Adapter" on pp. 132
"Inlet Valve Seal" on pp. 135
"Ion Gauge (Upgrade Option)" on pp. 137
"Lens Interface PCB" on pp. 139
"Low Pass Filter PCB" on pp. 141
"Power Module" on pp. 145
"Power Module Fuses" on pp. 147
"Rear Cooling Fans" on pp. 149
"RF Detector PCB" on pp. 152
"RF Generator PCB" on pp. 155
"RF Generator PCB Fuses" on pp. 157
"Transfer Line" on pp. 159
"Turbomolecular Pump Power Supply" on pp. 161
"Vacuum Control PCB" on pp. 163
"Vent Valve Solenoid" on pp. 166

Quick Overview-Parts Located by Covers

The following illustrations give you a quick overview to replaceable parts found beneath the covers or the back of the detector.

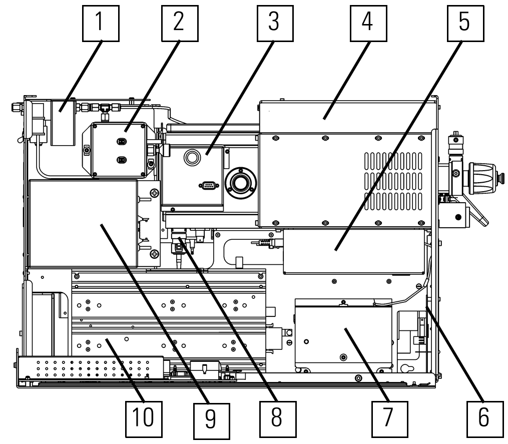
Under the Top Cover



1	Power Module	3	Calibration Gas Flow Module
2	CI Reagent Gas Flow Module (Upgrade Option)	4	Ion Gauge (Upgrade Option)

Figure 2-44. Replaceable Parts (Top)

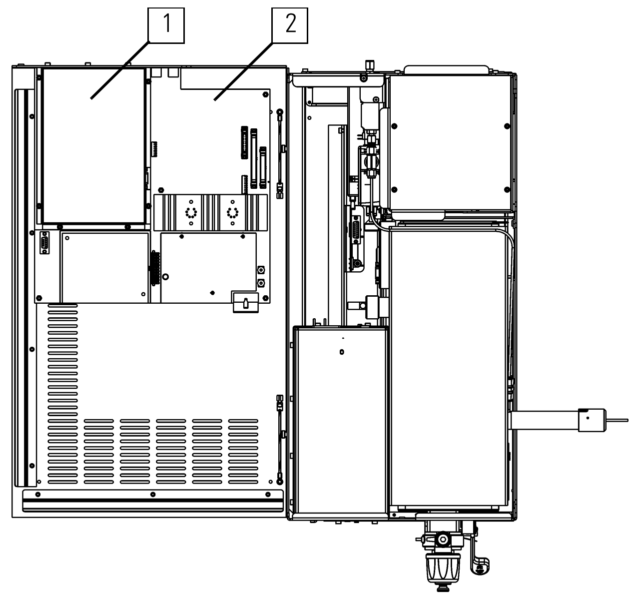
Behind the Left Cover



1	CI Reagent Gas Flow Module	6	Vacuum Control PCB
2	Calibration Gas Flow Module	7	DC Driver Assembly
3	Electrometer PCB	8	Vent Valve Solenoid
4	RF Detector PCB (Covered)	9	Conversion Dynode/Electron Multiplier Power Supply
5	Low Pass Filter PCB (Covered)	10	RF Generator PCB

Figure 2-45. Replaceable Parts (Left Side)

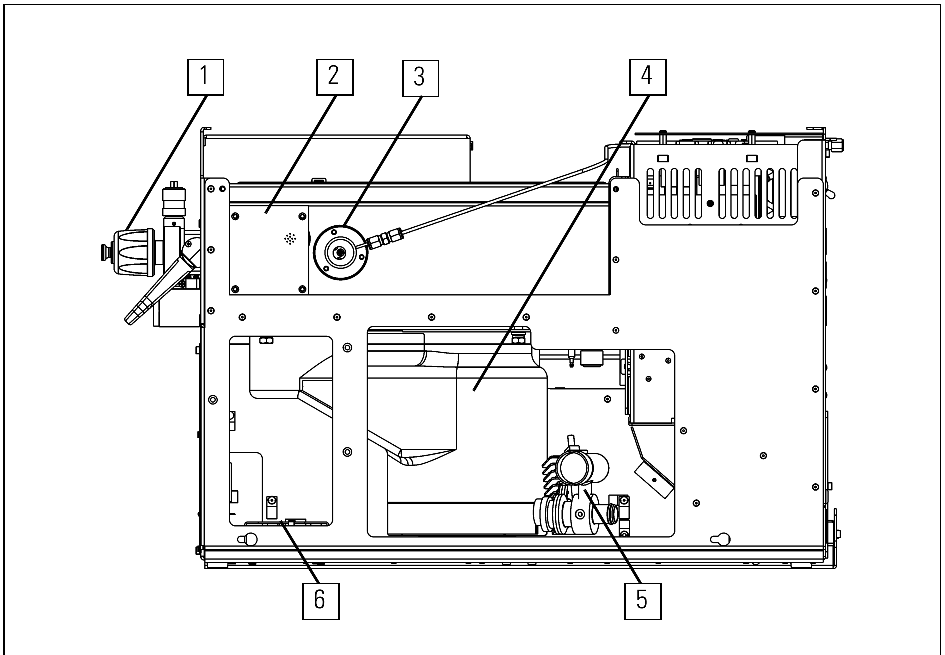
Under the Left Cover



1	Digital PCB	2	Analog PCB

Figure 2-46. Replaceable Parts (Left Side Panel, Top)

Under the Right Cover



1	Inlet Valve	4	High Vacuum Pump
2	Lens Interface PCB	5	Forepressure Gauge and Foreline Adapter
3	Transfer Line	6	Turbomolecular Pump Power Supply

Figure 2-47. Replaceable Parts (Right Side)

Behind the Detector

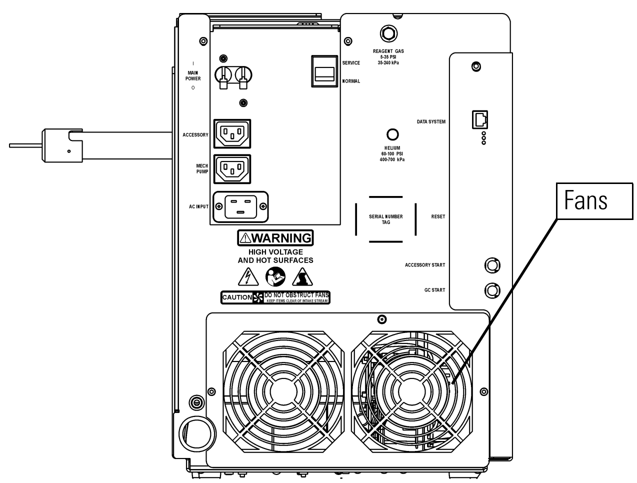
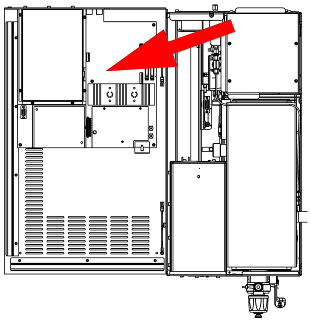
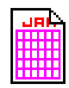


Figure 2-48. Replaceable Parts (Back)

Analog PCB



	**Tools Needed** • Analog PCB (PN 119590-0022) • Nut driver, 5.5 mm • Wrench, Allen, 2.5 mm • Wrench, Allen, 3 mm
	**Frequency** • Only when indicated by Xcalibur Diagnostics, or • Technical Support, or • Field Service Engineers

1. Prepare the *DSQ II* for maintenance.

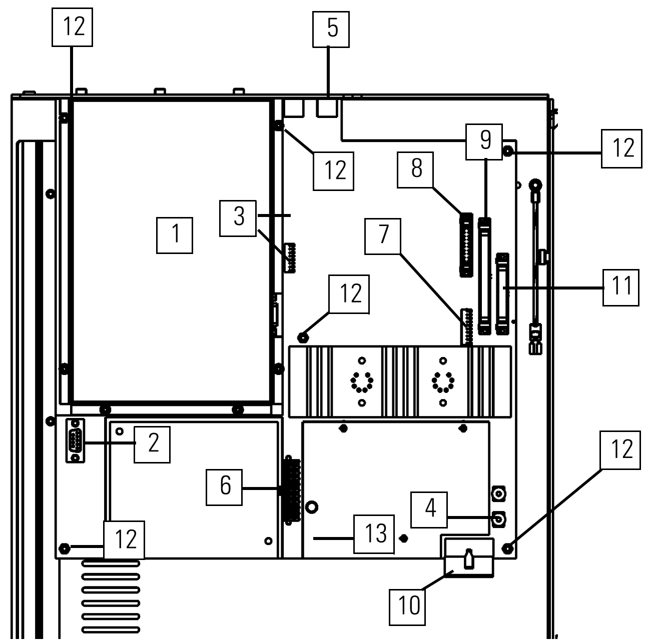
a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

b. Remove the *DSQ II* front, top and left side covers (see “Removing the Covers” on pp. 39).

2. Remove the Analog PCB.



1	Digital PCB	8	Cable P7 (to Electron Multiplier/Conversion Dynode Power Supply)
2	Cable J1 (to RF Control PCB)	9	Cable P8 (to RF Generator PCB)
3	Cables P4/P5 (to DC Driver Assembly)	10	Cable P9 (to Power Module)
4	Cable J3 (to Low Pass Filter PCB)	11	Cable P10 (to Vacuum Control PCB)
5	Cable J5 (to GC)	12	Nuts Holding the PCB
6	Cable P2 (to Lens Interface PCB)	13	Analog PCB
7	Cable P6 (to CI Reagent Gas Flow Module)		

Figure 2-49. Analog PCB Assembly (Left Side Panel, Top)

a. Remove the **Digital PCB (1)** (see "Digital PCB" on pp. 127).

b. Disconnect **Cables (2, 3, 4, 5, 6, 7, 8, 9, 10, 11)**.

c. Remove the six **Nuts Holding the PCB (12)**.

d. Remove the **Analog PCB (13)**.

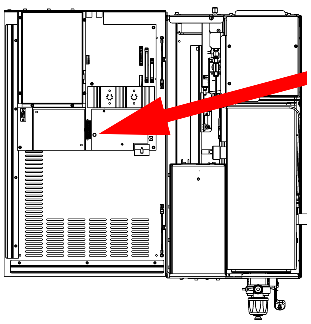
3. Install the new Analog PCB.

4. Restore the *DSQ II* for operation.

a. Replace the left, top, and front covers of the *DSQ II*.

b. Restart the system.

Analog PCB Fuse



	Tools Needed • Analog PCB Fuse F1 (PN 76339-0008; 2 A, very fast microfuse, 125 V)
	Frequency • Only when indicated by Xcalibur Diagnostics, or • Technical Support, or • Field Service Engineers

1. Prepare the *DSQ II* for maintenance.

a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

b. Remove the *DSQ II* front, top and left side covers (see “Removing the Covers” on pp. 39).

2. **Replace the Analog PCB Fuse.**

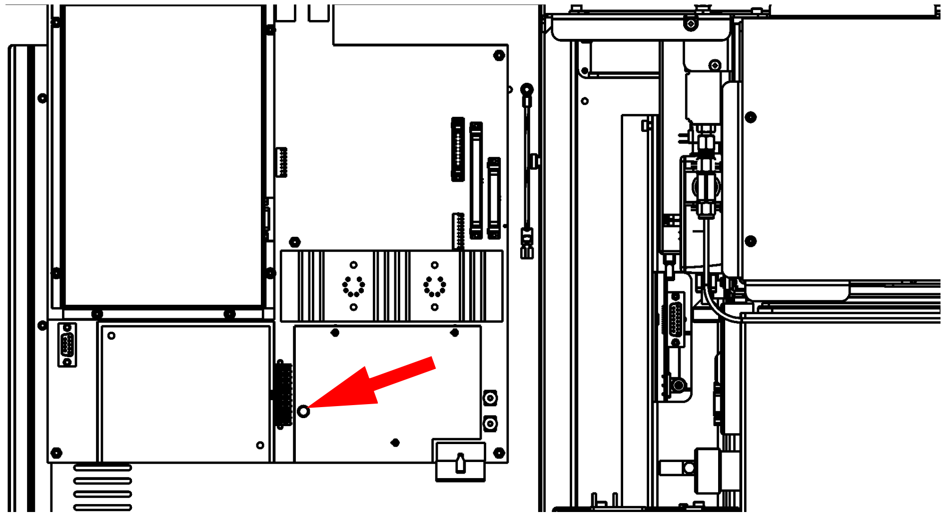


Figure 2-50. Analog PCB Fuse (Left Side Panel, Top)

CAUTION

Instrument Damage. Use only the fuses specified else instrument damage will occur. Never replace a fuse with a fuse of a different type, voltage, or current rating. Also, to prevent damaging the PCBs attach an electrostatic discharge (ESD) strap to your wrist before replacing a fuse.

a. Unplug the **Analog PCB Fuse (2)**.

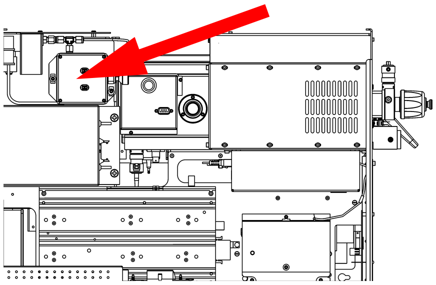
b. Plug in the new **Analog PCB Fuse (2)**. It does not matter which way it is plugged in.

3. **Restore the *DSQ II* for operation.**

a. Replace the left, top, and front covers of the *DSQ II*.

b. Restart the system.

Calibration Gas Flow Module



Tools Needed

- Calibration Gas Flow Module (PN 119246-0001)
- FC-43 calibration compound (PN 50010-30059)
- Syringe
- Wrench, Allen, 3 mm
- Wrench, open-ended, 7/16-in.
- Wrench, open-ended, 9/16-in.

Frequency

- Only when indicated by Xcalibur Diagnostics, or
- Technical Support, or
- Field Service Engineers

1. Prepare the *DSQ II* for maintenance.

a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

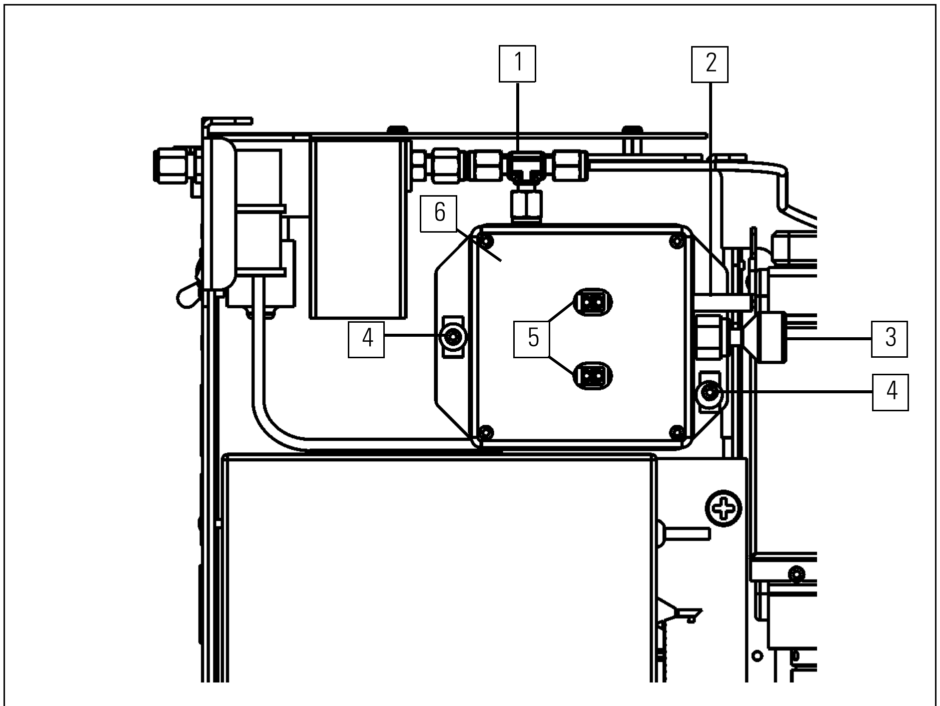
b. Remove the *DSQ II* front, top, left, and right side covers (see "Removing the Covers" on pp. 39).

c. Turn off the **CI Reagent Gas Supply** (if present).

WARNING

Explosive or Corrosive Gas Hazard. CI reagent gases are often flammable or corrosive. You must vent the gas to a fume hood or other suitable exhaust. The CI reagent gas supply line must be leak tight.

2. **Remove the Calibration Gas Flow Module.**



1	Gas Fittings	4	Screws, 2
2	Foreline Adapter Tubing	5	Cables, 4
3	Calibration Compound Vial	6	Calibration Gas Flow Module

Figure 2-51. Calibration Gas Flow Module (Left Side)

a. Disconnect the **Gas Fittings (1)**.

b. Disconnect the **Foreline Adapter Tubing (2)** from the **Foreline Adapter** down by the **High Vacuum Pump**.

c. Disconnect the four **Cables (5)**.

d. Remove the two **Screws (4)**.

e. Remove the **Calibration Gas Flow Module (6)**.

3. Install the new Calibration Gas Flow Module.

4. Add Calibration Compound.

5. Test the Gas Fittings (1) for leaks.

a. Turn on the **CI Reagent Gas Supply**.

b. Use a leak detector to check each fitting for leaks.

CAUTION

Instrument Damage. Do not use liquid soap leak detectors (such as Snoop) to check for leaks. Liquid soap leak detectors may contaminate your system.

c. Correct leaks by tightening or replacing the connections. Continue to check and correct leaks until all connections are leak-free.

6. Restore the *DSQ II* for operation.

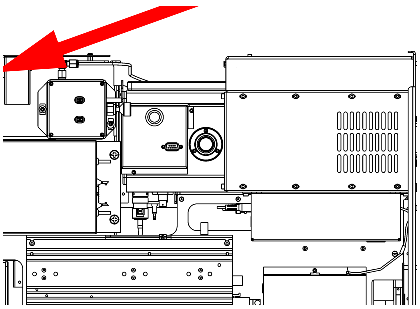
a. Turn on the **CI Reagent Gas Supply** (if present).

b. Replace the right, left, top, and front covers of the *DSQ II*.

c. Restart the system.

d. Once the detector has pumped down and is operational, check for vacuum leaks using the Automatic Tune.

CI Reagent Gas Flow Module (Upgrade Option)



Tools Needed

- CI Reagent Gas Flow Module (PN 23331-0091)
- Electronic Leak Detector (GL Sciences, Inc., model LD-228, or equivalent)
- Screwdriver, Phillips #2
- Wrench, open-ended, 7/16-in. (2)

Frequency

- Only when indicated by Xcalibur Diagnostics, or
- Technical Support, or
- Field Service Engineers

1. Prepare the *DSQ II* for maintenance.

a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

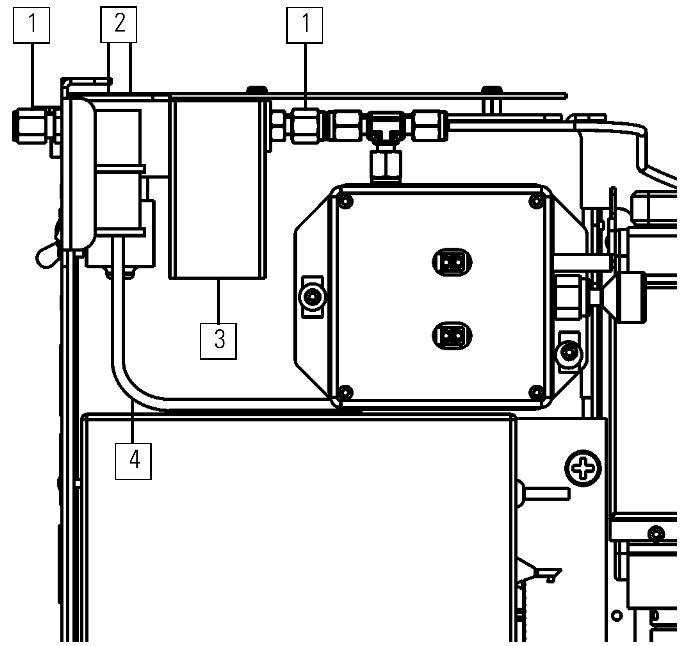
b. Remove the *DSQ II* front, top, left, and right side covers (see “Removing the Covers” on pp. 39).

c. Turn off the **CI Reagent Gas Supply**.

WARNING

Explosive or Corrosive Gas Hazard. CI reagent gases are often flammable or corrosive. You must vent the gas to a fume hood or other suitable exhaust. The CI reagent gas supply line must be leak tight.

2. Remove the CI Reagent Gas Flow Module.



1	Gas Fittings, 2	3	Cable (to Analog PCB)
2	Screws Holding the Module, 2	4	Foreline Adapter Tubing

Figure 2-52. CI Reagent Gas Flow Module (Left Side)

a. Unplug the **Cable (3)**.

b. Disconnect the two **Gas Fittings (1)**.

c. Disconnect the **Foreline Adapter Tubing (4)**.

d. Remove the two **Screws Holding the Module (2)**.

3. Install the new CI Reagent Gas Flow Module.

4. Test the Gas Fittings (1) for leaks.

a. Turn on the **CI Reagent Gas Supply**.

b. Use a detector to check each fitting for leaks.

CAUTION

Instrument Damage. Do not use liquid soap leak detectors (such as Snoop) to check for leaks. Liquid soap leak detectors may contaminate your system.

c. Correct leaks by tightening or replacing the connections. Continue to check and correct leaks until all connections are leak-free.

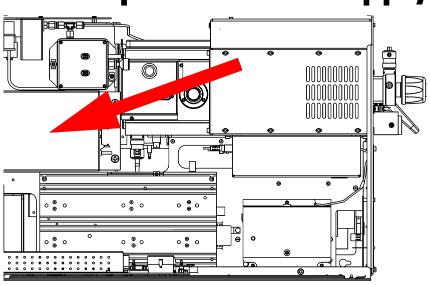
5. Restore the *DSQ II* for operation.

a. Replace the left, top, and front covers of the *DSQ II*.

b. Restart the system.

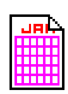
c. Once the detector has pumped down and is operational, check for vacuum leaks using the Automatic Tune.

Conversion Dynode/Electron Multiplier Power Supply



Tools Needed

- Conversion Dynode/Electron Multiplier Power Supply (PN 119377-0001 or 119377-0002 with the PPINICI Upgrade Option)
- Screwdriver, Phillips #2



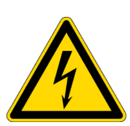
Frequency

- Only when indicated by Xcalibur Diagnostics, or
- Technical Support, or
- Field Service Engineers

1. Prepare the *DSQ II* for maintenance.

a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

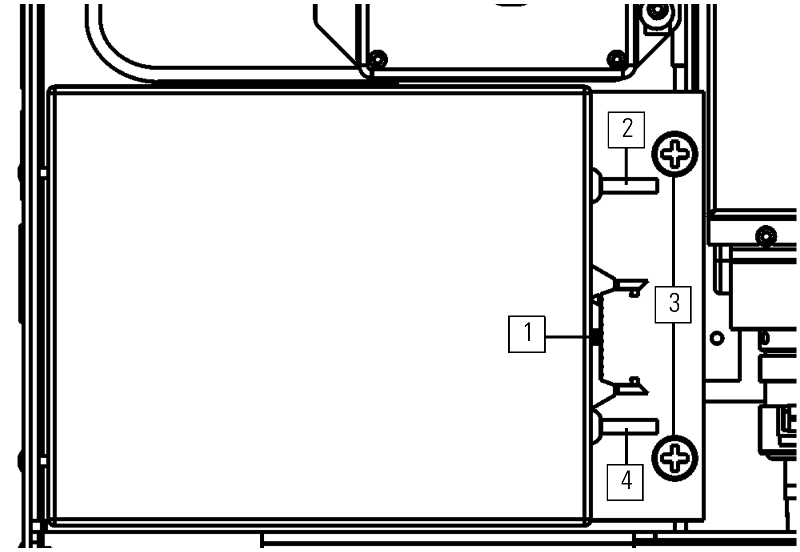
WARNING



Electrical Shock Hazard. Please unplug the detector before proceeding.

b. Remove the *DSQ II* front, top and left side covers (see "Removing the Covers" on pp. 39).

2. Remove the Conversion Dynode/Electron Multiplier Power Supply.



1	Ribbon Cable	3	Screws Holding the Power Supply
2	Electron Multiplier Cable	4	Conversion Dynode Cable

Figure 2-53. Conversion Dynode/Electron Multiplier Power Supply (Left Side)

a. Disconnect the **Ribbon Cable (1)**.

b. Disconnect the **Electron Multiplier Cable (2)** from the bottom of the **Vacuum Manifold**.

c. Disconnect the **Conversion Dynode Cable (4)** from the bottom of the **Vacuum Manifold**.

d. Remove the two large **Screws Holding the Power Supply (3)**. There is double side tape holding the back of the power supply to the chassis. Pull the power supply out to break loose the tape.

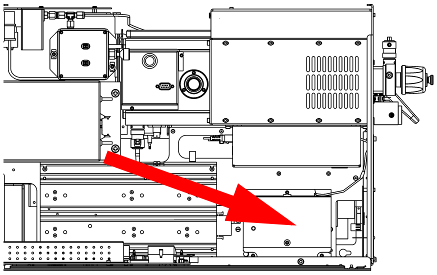
3. Install the new Conversion Dynode/Electron Multiplier Power Supply.

4. Restore the *DSQ II* for operation.

a. Replace the left, top, and front covers of the *DSQ II*.

b. Restart the system.

DC Driver Assembly



Tools Needed

- DC Driver Assembly (PN 120152-1000)
- Wrench, Allen, 2.5 mm

Frequency

- Only when indicated by Xcalibur Diagnostics, or
- Technical Support, or
- Field Service Engineers

1. Prepare the *DSQ II* for maintenance.

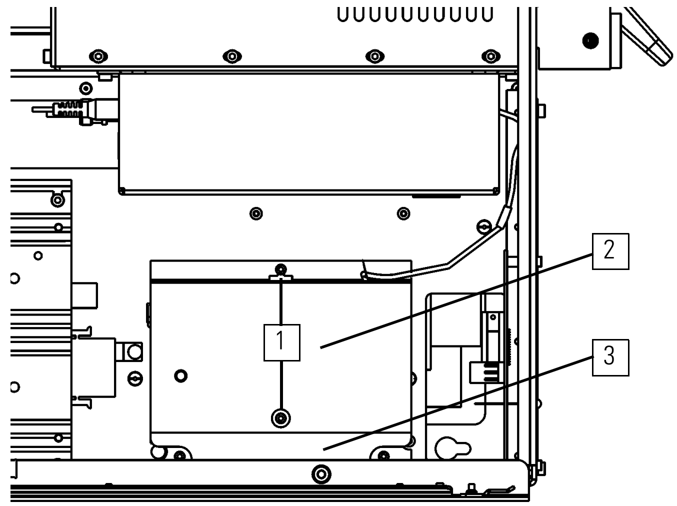
a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

b. Remove the *DSQ II* front, top and left side covers (see “Removing the Covers” on pp. 39).

2. Remove the DC Driver Assembly.



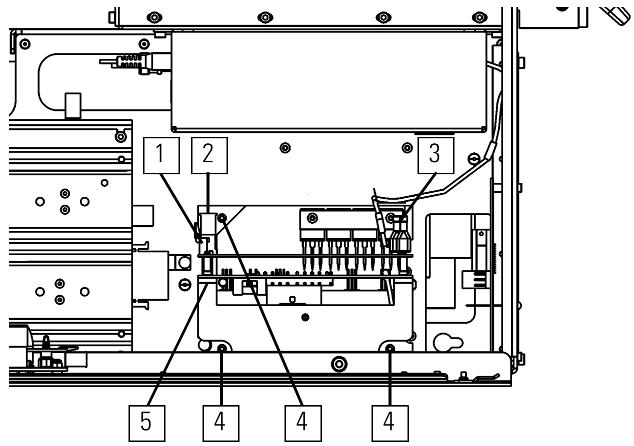
1	Screws Holding the DC Driver Cover, 2	3	DC Driver Assembly
2	DC Driver Cover		

Figure 2-54. DC Driver Assembly (Left Side)

a. Remove the lower screw and only loosen the upper screw **holding the DC Driver Cover (1)**.

b. Slide the cover up off the upper screw to remove it.

c. Remove the **DC Driver Cover (2)**.



1	Cable J8 (to Analog PCB)	4	Screws Holding DC Driver Assembly, 3
2	Cable J2 (to RF Detector PCB)	5	Cable P1 (to Power Module)
3	Cables J3, J4, J7 (to Low Pass Filter PCB)		

Figure 2-55. DC Driver Assembly with Cover Removed (Left Side)

d. Disconnect **Cables (1, 2, 3, 5)**.

e. Remove the three **Screws Holding the DC Driver Assembly (4)**.

3. Install the new DC Driver Assembly.

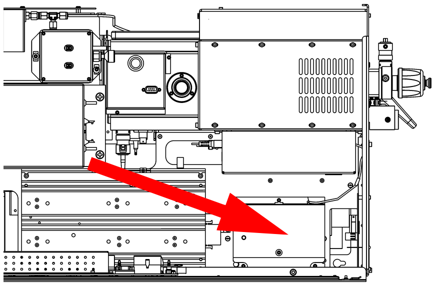
a. Reverse Step 2. The green **Cable** to the DC Driver Assembly goes on the left terminal (J7), black **Cable** goes to J4, and red **Cable** goes to J3.

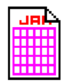
b. Restore the *DSQ II* for operation.

c. Replace the left, top, and front covers of the *DSQ II*.

d. Restart the system.

DC Driver Assembly Fuse



	**Tools Needed** • DC Driver Assembly Fuse F1 (PN 76703-0125;1.25 A, SB, 5 x 20 mm, 250 V) • Wrench, Allen, 2.5 mm
	**Frequency** • Only when indicated by Xcalibur Diagnostics, or • Technical Support, or • Field Service Engineers

1. **Prepare the *DSQ II* for maintenance.**

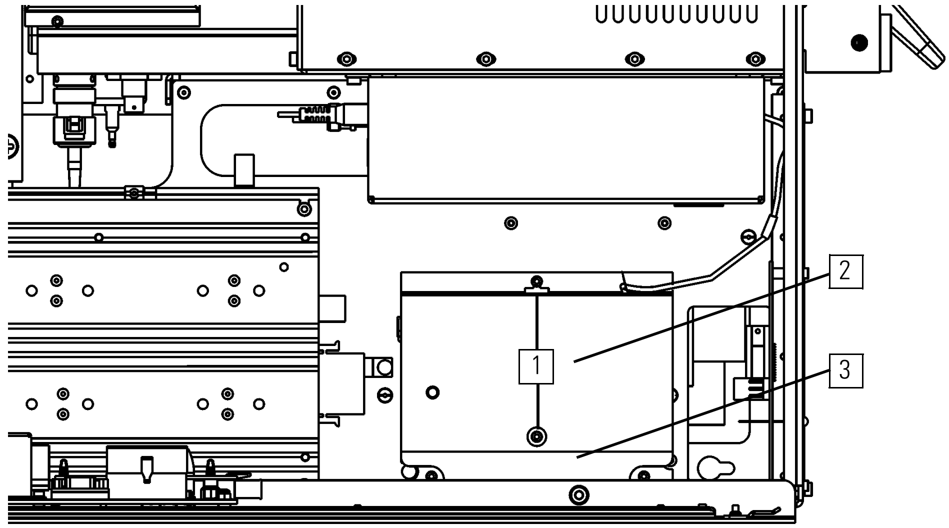
   a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

   b. Remove the *DSQ II* front, top and left side covers (see “Removing the Covers” on pp. 39).

2. Remove the DC Driver Assembly Cover.



1	Screws Holding the DC Driver Cover, 2	3	DC Driver Assembly
2	DC Driver Cover		

Figure 2-56. DC Driver Assembly (Left Side)

a. Remove the lower screw and only loosen the upper screw **holding the DC Driver Cover (1)**.

b. Slide the cover up off the upper screw to remove it.

c. Remove the **DC Driver Cover (2)**.

3. Replace the DC Driver Assembly Fuse.

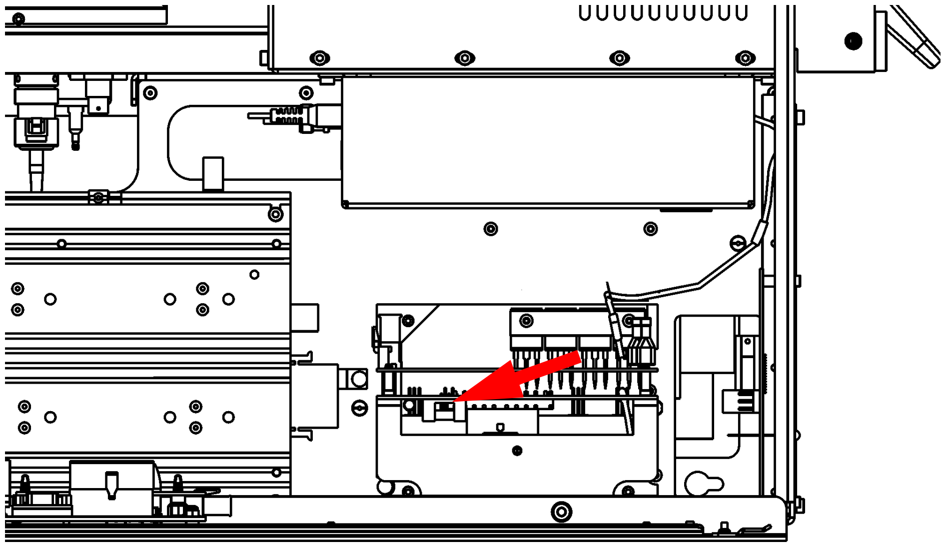
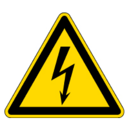


Figure 2-57. DC Driver Assembly Fuse (Left Side)

a. Unplug the **DC Driver Assembly Fuse**.

b. Plug in the new **DC Driver Assembly Fuse**. It does not matter how it is plugged in.



WARNING

Electrical Shock Hazard. Use only the fuses specified else instrument damage will occur. Never replace a fuse with a fuse of a different type, voltage, or current rating. Also, to prevent damaging the PCBs attach an electrostatic discharge (ESD) strap to your wrist before replacing a fuse.

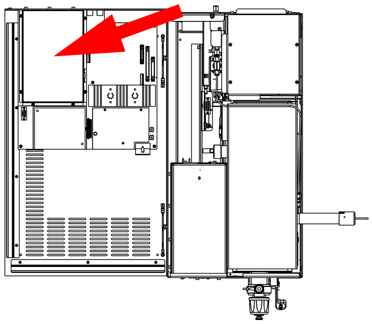
4. Replace the DC Driver Assembly Cover.

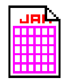
5. Restore the *DSQ II* for operation.

a. Replace the left, top, and front covers of the *DSQ II*.

b. Restart the system.

Digital PCB



	**Tools Needed** • Digital PCB (PN 119590-0010) • Nut driver, 5.5 mm • Wrench, Allen, 2.5 mm • Wrench, Allen, 3 mm
	**Frequency** • Only when indicated by Xcalibur Diagnostics, or • Technical Support, or • Field Service Engineers

1. Prepare the *DSQ II* for maintenance.

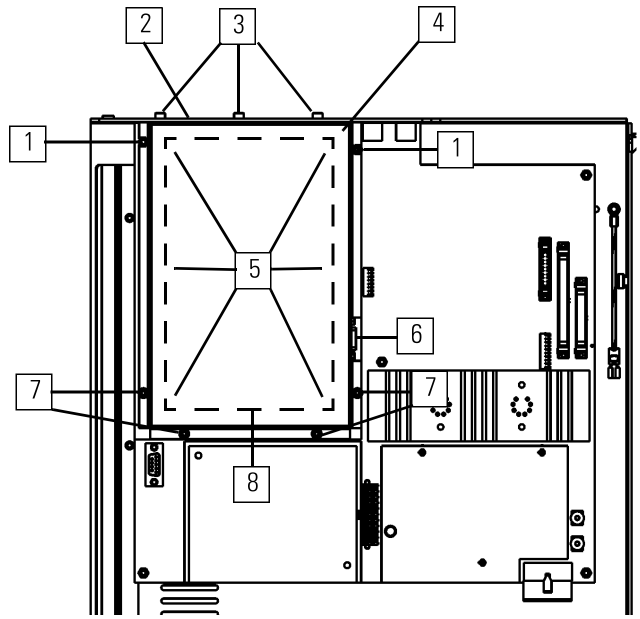
a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

b. Remove the *DSQ II* front, top and left side covers (see “Removing the Covers” on pp. 39).

2. Remove the Digital PCB.



1	Nuts Holding the Digital PCB Cover, 2	5	Nuts Holding the Digital PCB, 6
2	Ethernet Cable (to PC)	6	Cable J3 (to Electrometer PCB)
3	Screws Holding the Digital PCB Cover, 7	7	Screws Holding the Digital PCB Cover, 4
4	Digital PCB Cover	8	Digital PCB

Figure 2-58. Digital PCB (Left Side Panel, Top)

a. Unplug the **Cables (2, 6)**.

b. Remove the seven **Screws Holding the Digital PCB Cover (3)**.

c. Remove the two **Nuts Holding the Digital PCB Cover (1)**.

d. Remove the **Digital PCB Cover (4)**.

e. Remove the six **Nuts Holding the Digital PCB (5)**.

f. Carefully remove the **Digital PCB (8)**.

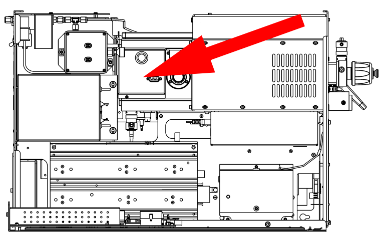
3. Install the new Digital PCB.

4. Restore the *DSQ II* for operation.

a. Replace the left, top, and front covers of the *DSQ II*.

b. Restart the system.

Electrometer PCB



Tools Needed

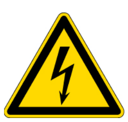
- Electrometer PCB (PN 119590-0500)
- Screwdriver, Phillips #1
- Wrench, Allen, 3 mm
- Wrench, open-ended, 17 mm
- Wrench, open-ended, 9/16-in.

Frequency

- Only when indicated by Xcalibur Diagnostics, or
- Technical Support, or
- Field Service Engineers

1. Prepare the *DSQ II* for maintenance.

a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

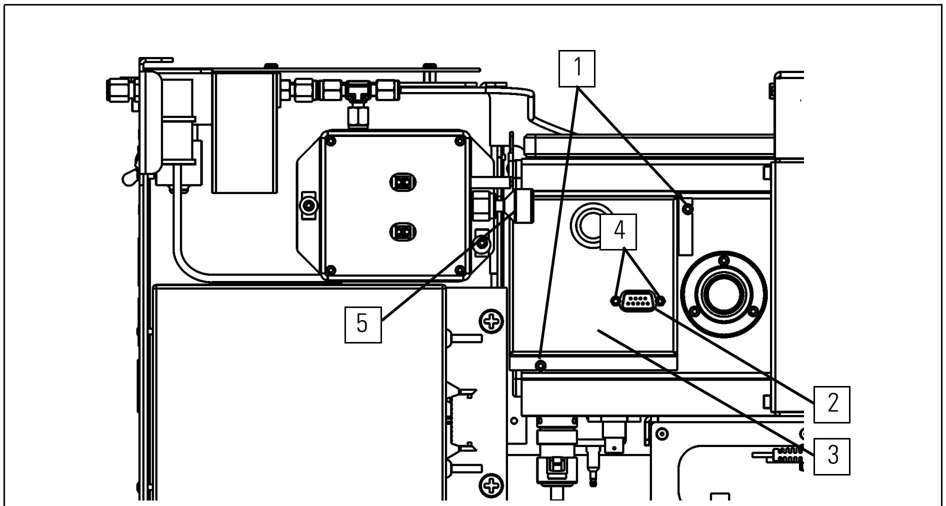


WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

b. Remove the *DSQ II* front, top and left side covers (see “Removing the Covers” on pp. 39).

2. Remove the Electrometer PCB.



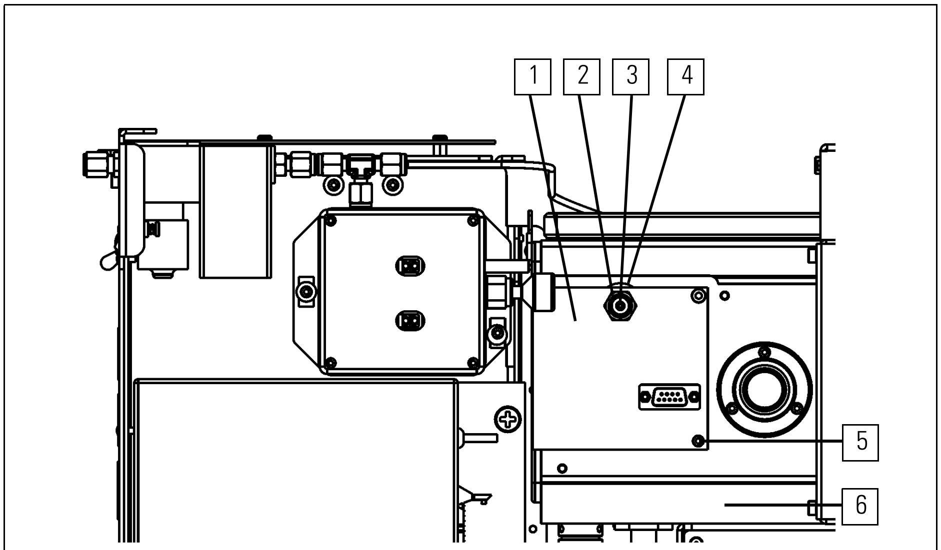
1	Screws Holding the Electrometer PCB Cover, 2	4	(2) Hexbolts holding PCB Cover
2	Cable	5	Cal Gas Vial
3	Electrometer PCB Cover		

Figure 2-59. Electrometer PCB (Left Side)

a. Disconnect the **Cable (2)**.

b. Remove the **Calibration Gas Vial** (5) to allow the cover of the electrometer to be removed.

c. Remove the four **Screws Holding the Electrometer PCB Cover (1), (4)** in place and remove the **Electrometer PCB Cover (3)**.



1	Electrometer PCB	4	Anode Feedthrough
2	Nut Holding Electrometer PCB to Anode Feedthrough	5	Screw Holding Electrometer PCB to Vacuum Manifold
3	Screw Holding Wire to Anode Feedthrough	6	Vacuum Manifold

Figure 2-60. Electrometer PCB with Electrometer PCB Cover Removed (Left Side)

d. Remove the **Screw Holding the Wire to Anode Feedthrough (3)**.

e. Remove the **Nut Holding Electrometer PCB to Anode Feedthrough (2)**.

f. Remove the **Screw Holding Electrometer PCB to Vacuum Manifold (5)** and pull out the **Electrometer PCB (1)**.

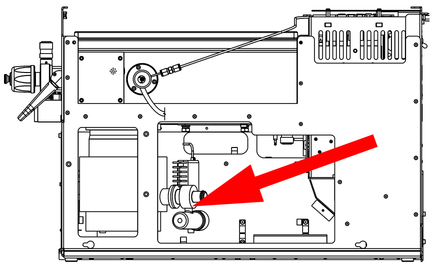
3. Install the new Electrometer PCB.

4. Restore the *DSQ II* for operation.

a. Replace the left, top, and front covers of the *DSQ II*.

b. Restart the system.

Forepressure Gauge and Foreline Adapter



Tools Needed

- Forepressure gauge and foreline adapter - 250 L/s and split-flow turbomolecular pump systems (PN 119259-0002)
- Forepressure gauge and foreline adapter - 70 L/s turbomolecular pump system (PN 119259-0003)
- lint-free paper
- Screwdriver, flat blade
- Wrench, adjustable

Frequency

- Only when indicated by Xcalibur Diagnostics, or
- Technical Support, or
- Field Service Engineers

1. Prepare the *DSQ II* for maintenance.

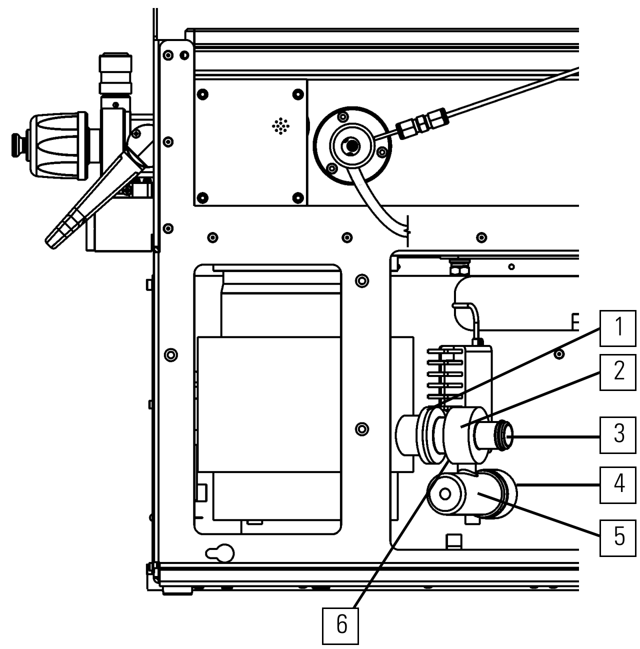
a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

b. Remove the *DSQ II* front, top and right side covers (see “Removing the Covers” on pp. 39).

2. Remove the Forepressure Gauge and Foreline Adapter.



1	Foreline Adapter Clamp and O-Ring (not shown)	4	Forepressure Gauge Cable (not shown)
2	Foreline Adapter	5	Forepressure Gauge
3	Foreline Hose Clamp (not shown)	6	Foreline Tubing (not shown)

Figure 2-61. Forepressure Gauge and Fireline Adapter (Right Side)

a. Disconnect the **Forepressure Gauge Cable (4)** from the **Forepressure Gauge (5)**.

b. Disconnect the **Foreline Tubing (6)** from the Gold Fitting on the **Foreline Adapter (2)**.

c. Remove the **Foreline Adapter Clamp (1)**.

d. Remove the **Foreline Hose Clamp (3)**.

e. Remove the **Forepressure Gauge and Foreline Adapter (2, 5)**.

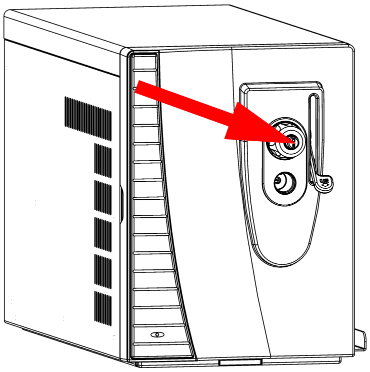
3. Install the new Forepressure Gauge and Foreline Adapter.

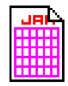
4. Restore the *DSQ II* for operation.

a. Replace the right, top, and front covers of the *DSQ II*.

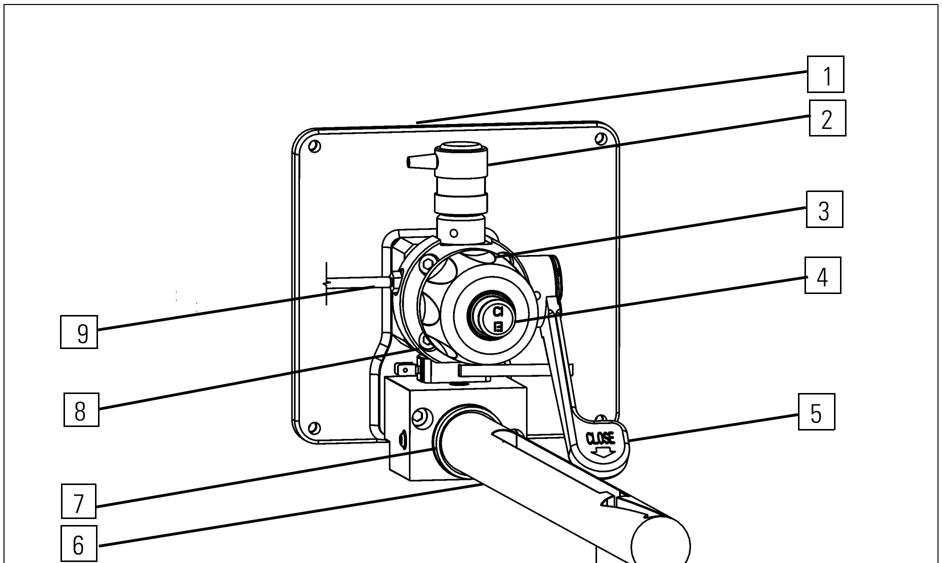
b. Restart the system.

Inlet Valve Seal



 	**Tools Needed** • Inlet Valve Seal Kit, includes: Inlet Valve Seal & Inlet Seal Removal Tool (PN 119265-0003) • Lint-free cloth **Frequency** • When the seal is leaking, indicated by the Xcalibur Insert/Probe graph (the line is not in the Green, but positioned in the Red or Yellow) • Tightening the Seal with the Knob doesn't help • Seal is worn, thin, or cracked

1. Disassemble the Inlet Valve.



1	Vacuum Manifold	6	Guide Bar
2	Inlet Valve Solenoid	7	Guide Bar Entry
3	Inlet Valve Knob (Ferrule inside)	8	Hex Socket Screws, 4
4	Inlet Valve Plug	9	Foreline Hose Connection
5	Inlet Valve Lever		

Figure 2-62. Inlet Valve Components

a. Make sure the **Inlet Valve** is closed (pull down the **Inlet Valve Lever (5)**).

b. Remove the **Inlet Valve Plug (4)**, **Knob (3)**, and **Ferrule (3)**.

2. Remove and Replace the Inlet Valve Seal.

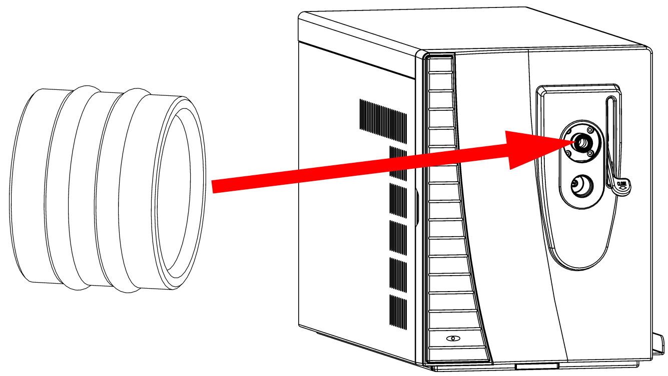
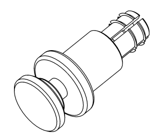


Figure 2-63. Inlet Valve Seal



a. Insert the **Inlet Seal Removal Tool** into the **Inlet Valve**.

b. Press the button on the tool to engage the **Inlet Valve Seal**.

CAUTION

Instrument Damage. Use the supplied Inlet Seal Removal Tool only to keep from scratching the sealing surface.

c. Pull out the **Inlet Valve Seal** and discard it.

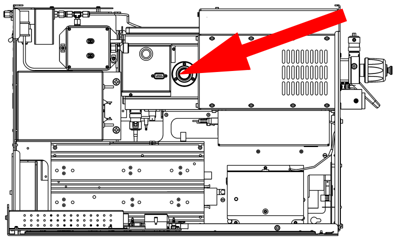
d. Insert a new **Inlet Valve Seal**.

3. Reassemble the Inlet Valve.

a. Put the **Ferrule**, **Knob** and **Plug** back into the **Inlet Valve Opening**.

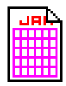
b. The first time you use the **Inlet Valve**, you will need to tighten the **Inlet Valve Knob** more than usual to prevent it from leaking.

Ion Gauge (Upgrade Option)



Tools Needed

- Gloves, clean, lint- and powder-free
- Ion gauge (PN A0105-06003)
- Wrench, Allen, 3 mm



Frequency

- Only when indicated by Xcalibur Diagnostics, or
- Technical Support, or
- Field Service Engineers

1. Prepare the *DSQ II* for maintenance.

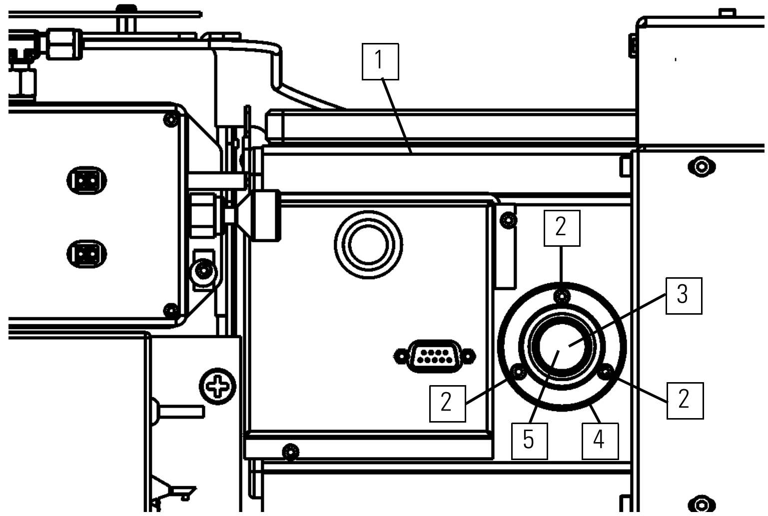
a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

b. Remove the *DSQ II* front, top and left side covers (see “Removing the Covers” on pp. 39).

2. Remove the Ion Gauge.



1	Vacuum Manifold	4	Ion Gauge Collar (flange)
2	Screws Holding the Ion Gauge Collar, 3	5	Ion Gauge and O-Ring
3	Cable (to Ion Gauge Control PCB)		

Figure 2-64. Ion Gauge (Left Side of Vacuum Manifold)

a. Disconnect the **Cable (3)**.

b. Remove the three **Screws Holding the Ion Gauge Collar (2)**.

c. Remove the **Ion Gauge Collar (4)** and **Ion Gauge (5)** together.

d. Pull the **Ion Gauge (5)** out of the **Ion Gauge Collar (4)**. Wearing gloves, hold on to the **O-Ring (5)**.

3. Install the new Ion Gauge.

a. Insert the new **Ion Gauge (5)** into the **Ion Gauge Collar (4)**. Slip the **O-Ring (5)** over the end of the **Ion Gauge (5)**.

b. Push the **Ion Gauge (5)** all the way into the **Vacuum Manifold (1)**. Turn it so the **Cable (3)** will point straight down.

c. Replace the three **Screws Holding the Ion Gauge Collar (2)**.

d. Reconnect the **Cable (3)**.

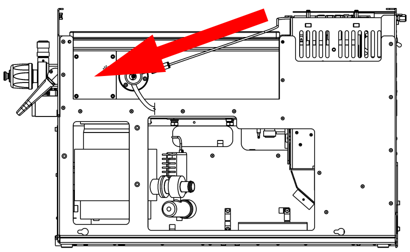
4. Restore the *DSQ II* for operation.

a. Replace the left, top, and front covers of the *DSQ II*.

b. Restart the system.

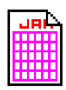
c. Once the detector has pumped down and is operational, check for vacuum leaks using the Automatic Tune.

Lens Interface PCB



Tools Needed

- Lens Interface PCB (PN 119590-0110)
- Wrench, Allen, 3 mm

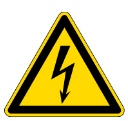


Frequency

- Only when indicated by Xcalibur Diagnostics, or
- Technical Support, or
- Field Service Engineers

1. Prepare the *DSQ II* for maintenance.

a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

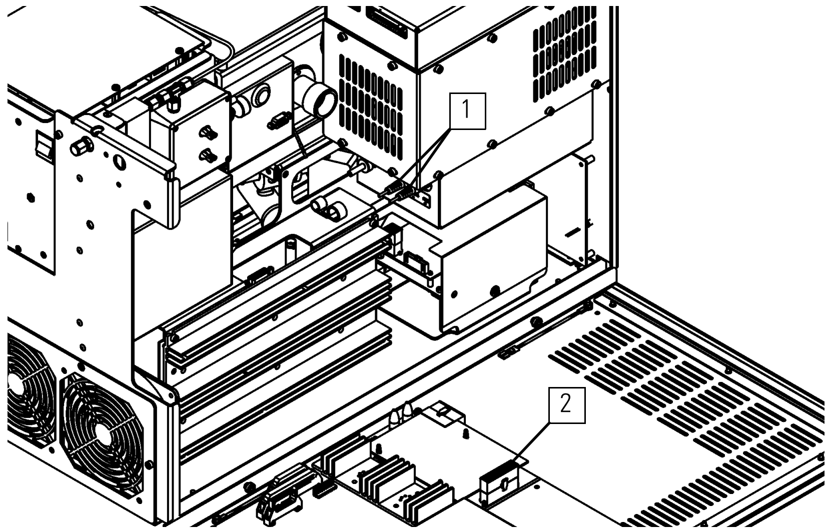


WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

b. Remove the *DSQ II* front, top and left, and right side covers (see “Removing the Covers” on pp. 39).

2. Remove the Lens Interface PCB.

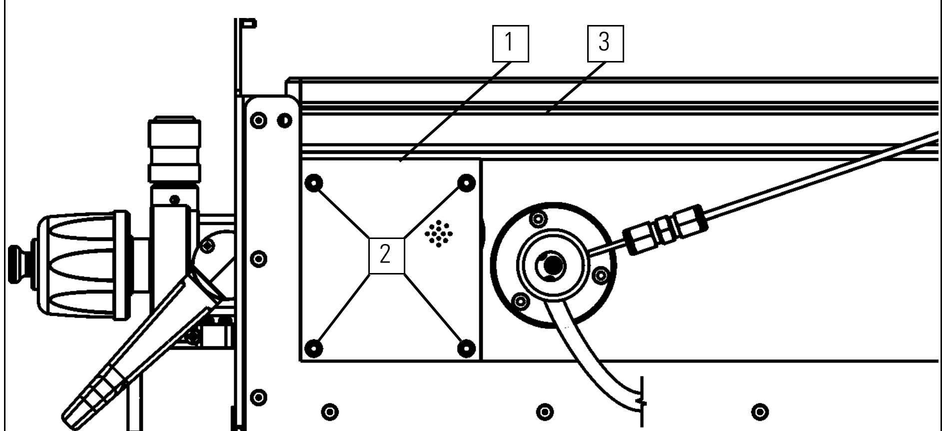


1	Cables to Low Pass Filter PCB	2	Cable to Analog PCB

Figure 2-65. Lens Interface PCB Connections to Analog and Low Pass Filter PCBs (Left Side)

a. Disconnect the **Cables to the Low Pass Filter PCB (1)**.

b. Disconnect the **Cable to the Analog PCB (2)**.



1	Lens Interface PCB	3	Vacuum Manifold
2	Screws Holding the Lens Interface PCB, 4		

Figure 2-66. Lens Interface PCB (Right side)

c. Remove the four **Screws Holding the Lens Interface PCB (2)**.

d. Remove the **Lens Interface PCB (1)**.

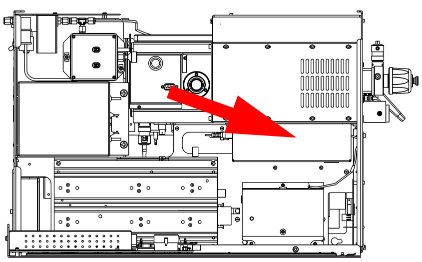
3. Install the new Lens Interface PCB.

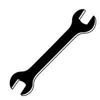
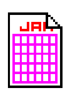
4. Restore the *DSQ II* for operation.

a. Replace the right, left, top, and front covers of the *DSQ II*.

b. Restart the system.

Low Pass Filter PCB

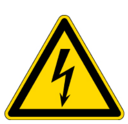


	**Tools Needed** • Forceps • Low Pass Filter PCB (PN 119590-0480) • Screwdriver, Phillips #2 • Wrench, Allen, 2.5 mm • Wrench, Allen, 3 mm
	**Frequency** • Only when indicated by Xcalibur Diagnostics, or • Technical Support, or • Field Service Engineers

1. Prepare the *DSQ II* for maintenance.

a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

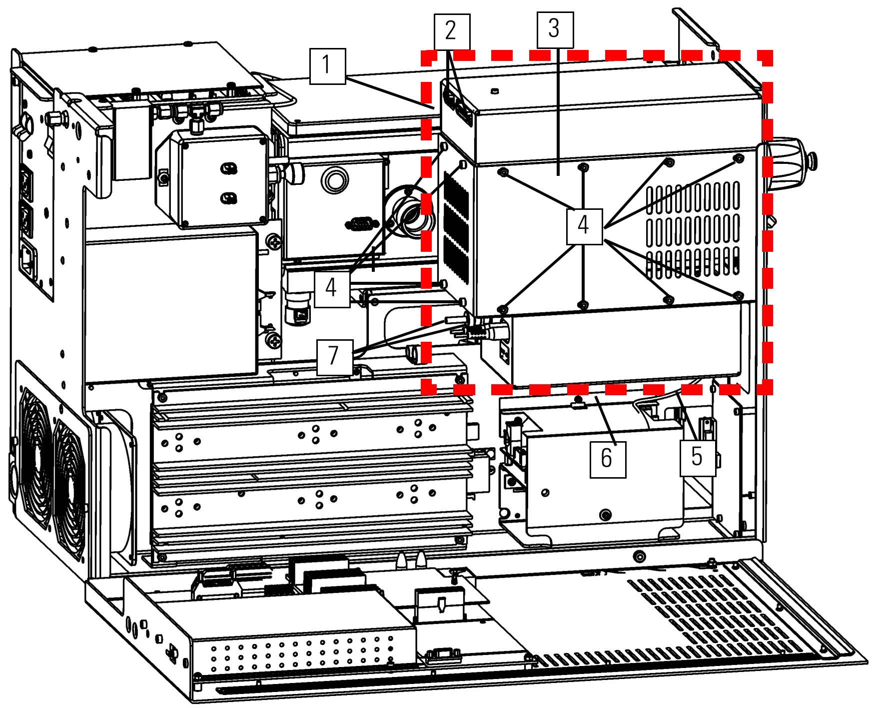
WARNING



Electrical Shock Hazard. Please unplug the detector before proceeding.

b. Remove the *DSQ II* front, top and left side covers (see “Removing the Covers” on pp. 39).

2. Disconnect the RF Module.



1	RF Module	5	Cables to DC Driver Assembly, 3
2	Cables to RF Detector PCB, 2	6	DC Driver Assembly
3	RF Coil Cover	7	Cables to Lens Interface and RF Generator PCB, 3
4	Screws Holding the RF Coil Cover, 12		

Figure 2-67. RF Module (Left Side)

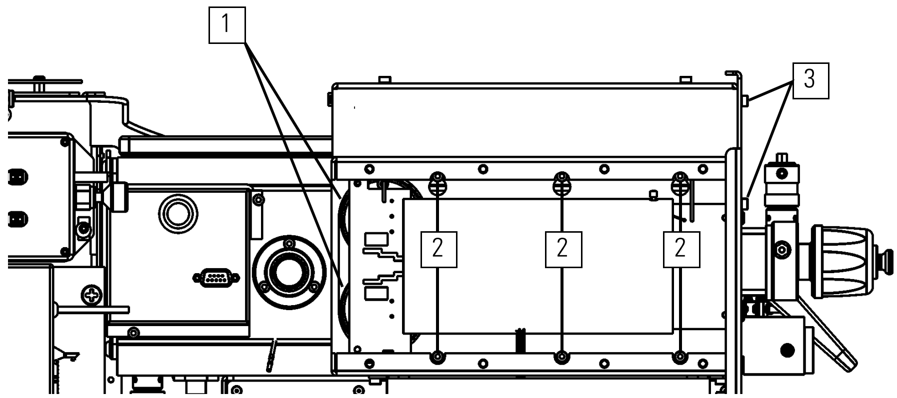
a. Disconnect the five **Cables (2, 7)** from the **RF Module (1)**.

b. Disconnect the three **Cables (5)** from the **DC Driver Assembly (6)**.

3. Remove the RF Module.

a. Remove the twelve **Screws Holding the RF Coil Cover (4)**.

b. Remove the **RF Coil Cover** (3).



1	RF Feedthrough Connections, 4	3	Screws Holding the RF Module, 2
2	Screws Holding the RF Module, 6		

Figure 2-68. RF Module with RF Coil Cover Removed (Left Side)

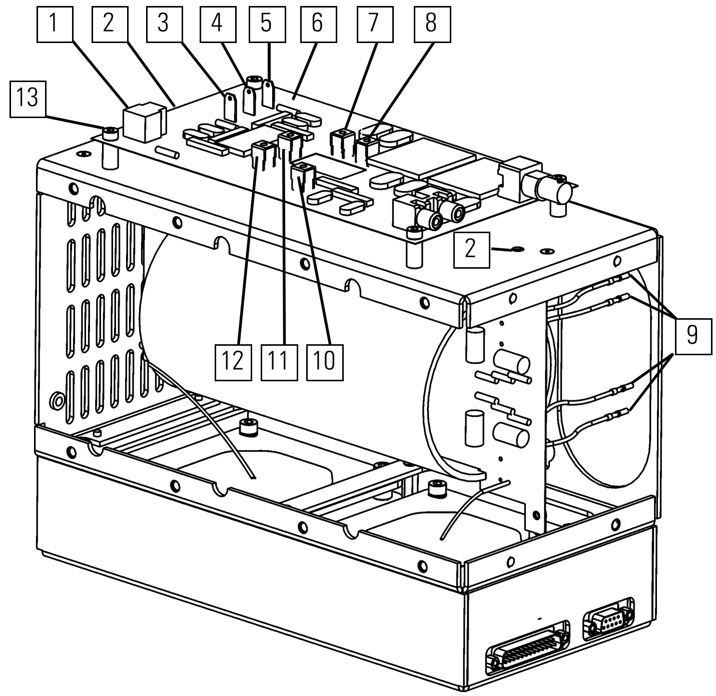
c. Disconnect the four **RF Feedthrough Connections (1)**. Forceps make it easier to reach the connections.

d. Remove the bottom three and loosen the top three **Screws Holding the RF Module (2)**.

e. Remove the two **Screws Holding the RF Module (3)**.

f. Lift the **RF Module** up and out of its slots.

4. Remove the Low Pass Filter PCB.



1	Cable J1	8	Wire J6 (gold)
2	Screws Holding the Low Pass Filter Cover	9	RF Feedthrough Connections, 4
3	Cable P1 (green)	10	Wire J2 (white)
4	Cable P2 (black)	11	Wire J5 (red)
5	Cable P4 (red)	12	Wire J4 (green)
6	Low Pass Filter PCB	13	Screws Holding the Low Pass Filter PCB, 4
7	Wire J7 (gold)		

Figure 2-69. RF Module with Low Pass Filter Uncovered (Upside Down)

a. Turn the **RF Module** over (setting it down on its top), and remove the two **Screws Holding the Low Pass Filter Cover (2)**.

b. Unscrew connectors holding **Wires J2, J4, J5, J6, J7 (10, 12, 11, 8, 7)**.

c. Disconnect **J1 (1)**.

d. Disconnect **Cables P1, P2, P4 (3, 4, 5)**.

e. Remove the four **Screws Holding the Low Pass Filter PCB (13)**.

f. Remove the **Low Pass Filter PCB (6)**.

5. **Install the new Low Pass Filter PCB. Be sure none of the wires touch each other. Slip Cables P1, P2, P4 (3, 4, 5) through the hole in the Low Pass Filter Cover.**

6. **Reinstall the RF Module. The green RF Feedthrough Connections connect to the pins closest to the front of the instrument, red to the pins closest to the back of the instrument. Be sure the wires do not touch each other or the PCB.**

7. **Reconnect the RF Module.**

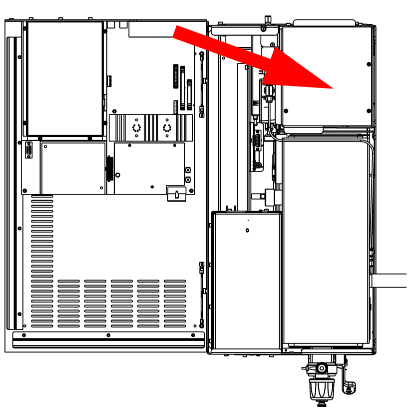
   a. The green **Cable P1** to the DC Driver Assembly goes on the left terminal (J7), black **Cable P2** goes to J4, and red **Cable P4** goes to J3.

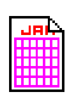
8. **Restore the *DSQ II* for operation.**

   a. Replace the left, top, and front covers of the *DSQ II*.

   b. Restart the system.

Power Module



 	**Tools Needed** • 115 V Power Module (PN 119655-1115) or 230 V Power Module (PN 119655-1230) • Wrench, Allen, 3 mm **Frequency** • Only when indicated by Xcalibur Diagnostics, or • Technical Support, or • Field Service Engineers

1. **Prepare the *DSQ II* for maintenance.**

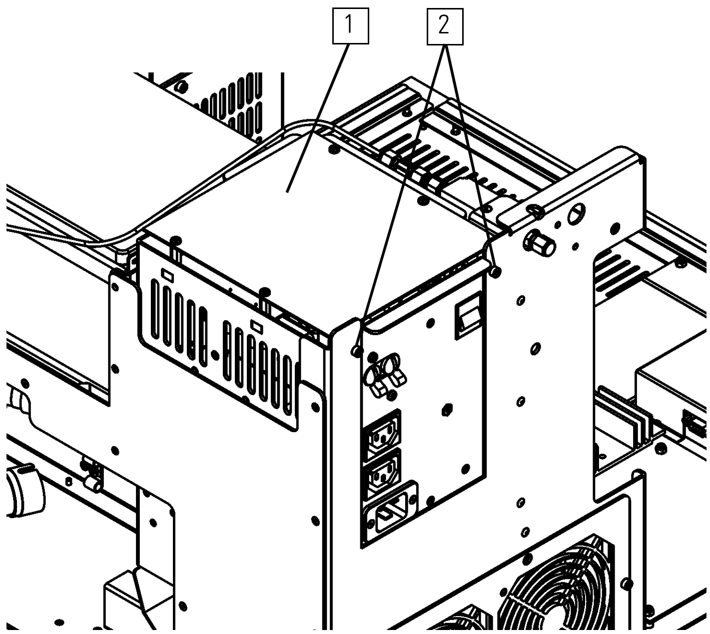
   a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

b. Remove the *DSQ II* front and top covers (see "Removing the Covers" on pp. 39).

2. Remove the Power Module.



1	Power Module	2	Screws Holding the Power Module, 2

Figure 2-70. Power Module (Back)

a. Remove the two **Screws Holding the Power Module (2)**.

b. Lift the **Power Module (1)** straight up.

3. Install the new Power Module.

CAUTION

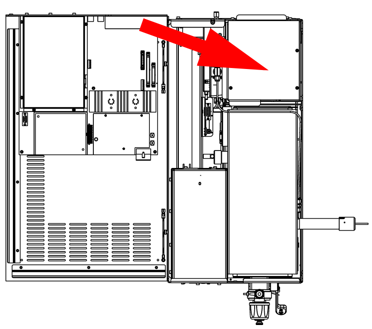
Instrument Damage. The Power Module voltage setting (120 V or 230 V) must match the one that was removed. Otherwise, damage to the instrument and Rotary-Vane Pump will occur. Do not attempt to change the voltage setting of the Power Module. It has been configured at the factory and cannot be changed in the field.

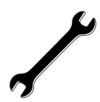
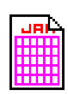
4. Restore the *DSQ II* for operation.

a. Replace the top and front covers of the *DSQ II*.

b. Restart the system.

Power Module Fuses



	**Tools Needed** • Power Module Fuses F1, F2 (PN A0006-04550; 0.315 A, 5 x 20 mm, 250 V) • Power Module Fuse F3 (PN A0006-06075; 800 mA, 5 x 20 mm, 250 V) • Power Module In-line Fuses (PN A0006-10510; 3.15 A, SB, 5 x 20 mm, 250 V) • Screwdriver, Phillips #2 • Wrench, Allen, 3 mm
	**Frequency** • Only when indicated by Xcalibur Diagnostics, or • Technical Support, or • Field Service Engineers

1. Prepare the *DSQ II* for maintenance.

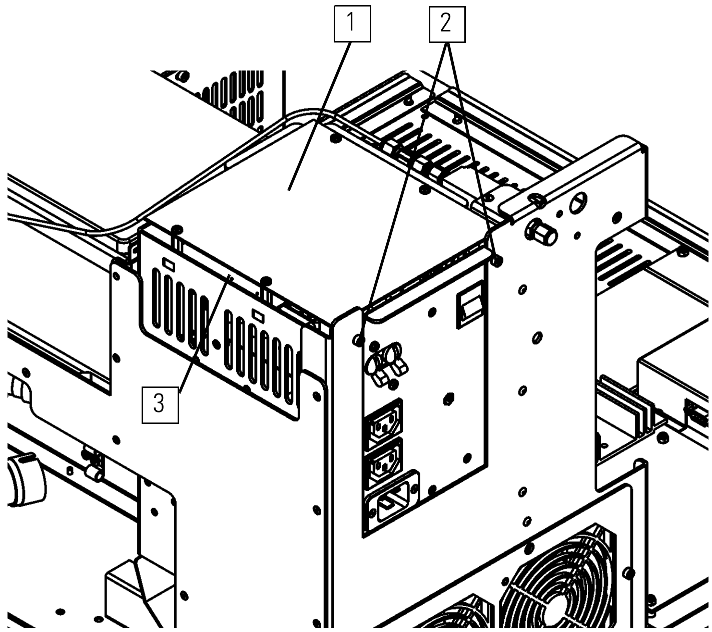
a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

b. Remove the *DSQ II* front and top covers (see "Removing the Covers" on pp. 39).

2. Remove the Power Module.



1	Power Module	3	Power Module Cover
2	Screws Holding the Power Module, 2		

Figure 2-71. Power Module (Back View)

a. Remove the two **Screws Holding the Power Module (2)**.

b. Lift the **Power Module (1)** straight up.

3. Replace the Power Module Fuses.

CAUTION

Instrument Damage. Use only the fuses specified else instrument damage will occur. Never replace a fuse with a fuse of a different type, voltage, or current rating. Also, to prevent damaging the PCBs attach an **electrostatic discharge (ESD) strap** to your wrist before replacing a fuse.

a. Remove the **Power Module Cover (3)**.

b. Unplug the **Power Module Fuses**.

c. Plug in the new **Power Module Fuses**. It does not matter which way they are plugged in.

d. Replace the **Power Module Cover (3)**.

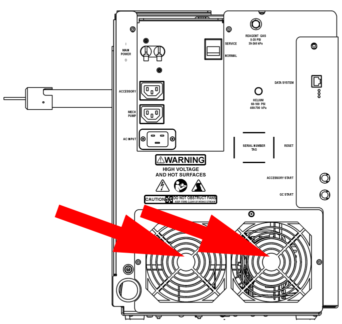
4. Reinstall the Power Module.

5. Restore the *DSQ II* for operation.

a. Replace the top and front covers of the *DSQ II*.

b. Restart the system.

Rear Cooling Fans



	Tools Needed • Rear cooling fan (PN 119253-0001) • Wrench, Allen, 3 mm • Wrench, open-ended, 1/4-in.
	Frequency • Only when indicated by Xcalibur Diagnostics, or • Technical Support, or • Field Service Engineers

The rear cooling fans provide the necessary airflow to keep the *DSQ II* cool. The fans should be cleaned every 4 months by wiping them with a damp cloth. This helps prevent dust from accumulating inside the instrument.

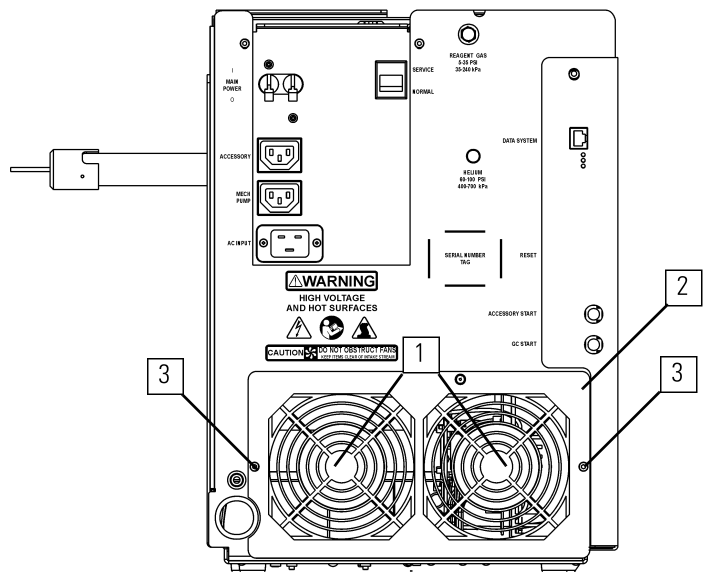
1. Prepare the *DSQ II* for maintenance.

a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

2. Remove the Fan Bracket.



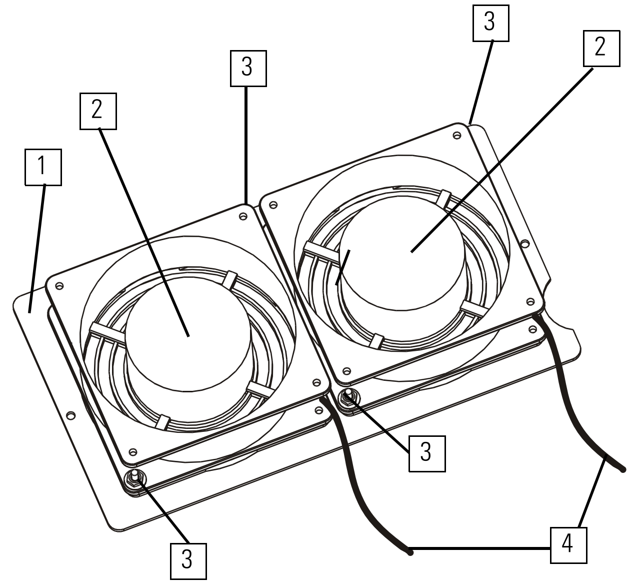
1	Rear Cooling Fans, 2	3	Screws Holding the Fan Bracket, 2
2	Fan Bracket		

Figure 2-72. Rear Cooling Fans (Back View)

a. Remove the two **Screws Holding the Fan Bracket (3)**.

b. Lay the **Fan Bracket (2)** down behind the detector.

3. Remove the Rear Cooling Fans from the Fan Bracket.



1	Fan Bracket	3	Nuts Holding the Rear Cooling Fans, 4
2	Rear Cooling Fan, 2	4	Fan Cable, 2

Figure 2-73. Fan Bracket (Removed)

a. Disconnect the two **Fan Cables (4)**.

b. Remove the four **Nuts Holding the Rear Cooling Fans (3)**.

c. Remove the **Rear Cooling Fans (2)**.

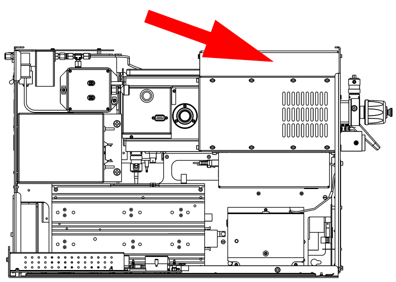
4. Install the new Rear Cooling Fans on the Fan Bracket. Make sure the Airflow Indicator Arrows on the new Rear Cooling Fans point

into the *DSQ II* (away from the Fan Bracket) and the wires are pointing down.

5. **Reinstall the Fan Bracket. Make sure the Fan Cables do not get pinched or touch the fan blades.**

6. **Restart the system.**

RF Detector PCB



Tools Needed

- RF Detector PCB (PN 119590-0270)
- Wrench, Allen, 2.5 mm
- Wrench, Allen, 3 mm

Frequency

- Only when indicated by Xcalibur Diagnostics, or
- Technical Support, or
- Field Service Engineers

1. **Prepare the *DSQ II* for maintenance.**

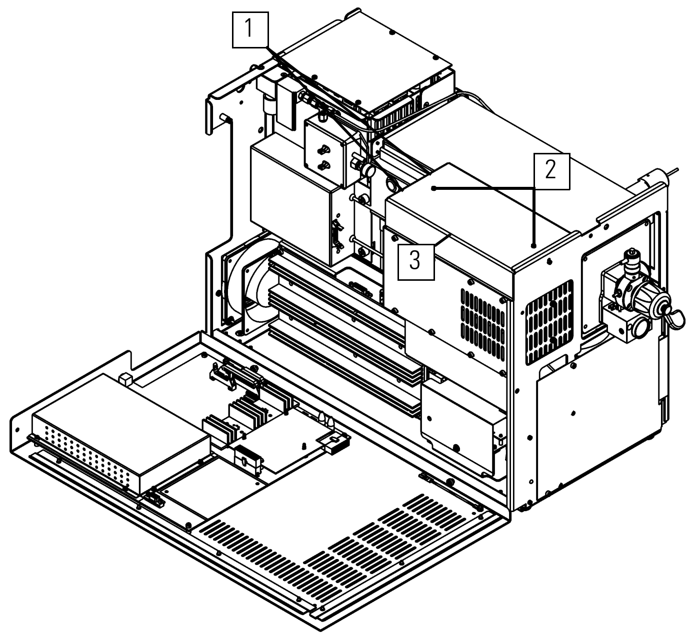
   a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

   b. Remove the *DSQ II* front, top, and left side covers (see “Removing the Covers” on pp. 39).

2. Remove the RF Detector PCB.



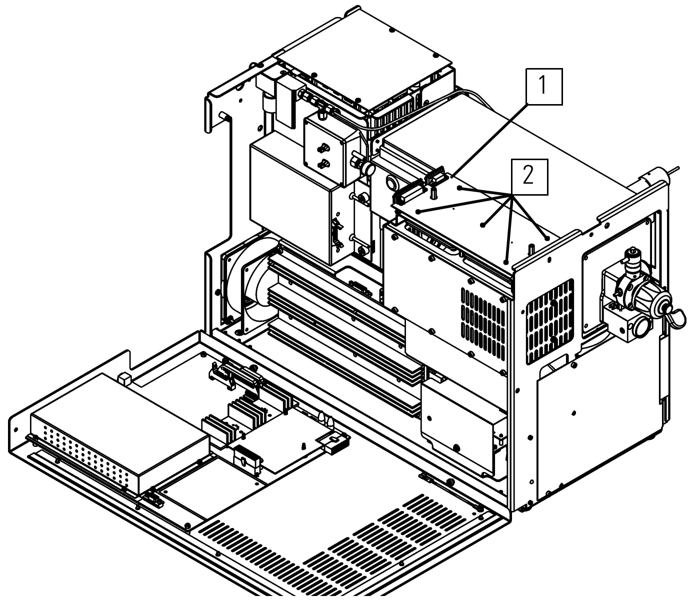
1	Cables, 2	3	RF Detector PCB Cover
2	Screws Holding the RF Detector PCB Cover, 2		

Figure 2-74. RF Detector PCB Cover (Left Side)

a. Disconnect the two **Cables (1)**.

b. Remove the two **Screws Holding the RF Detector PCB Cover (2)**.

c. Remove the **RF Detector PCB Cover (3)**.



1	RF Detector PCB	2	Screws Holding the RF Detector PCB, 5

Figure 2-75. RF Detector PCB Uncovered (Left Side)

d. Remove the five **Screws Holding the RF Detector PCB (2)**.

e. Remove the **RF Detector PCB (1)**.

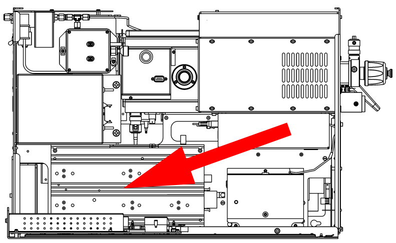
3. Install the new RF Detector PCB.

4. Restore the *DSQ II* for operation.

a. Replace the left, top, and front covers of the *DSQ II*.

b. Restart the system.

RF Generator PCB



Tools Needed

- RF Generator PCB (PN 119590-0060)
- Wrench, Allen, 3 mm

Frequency

- Only when indicated by Xcalibur Diagnostics, or
- Technical Support, or
- Field Service Engineers

1. Prepare the *DSQ II* for maintenance.

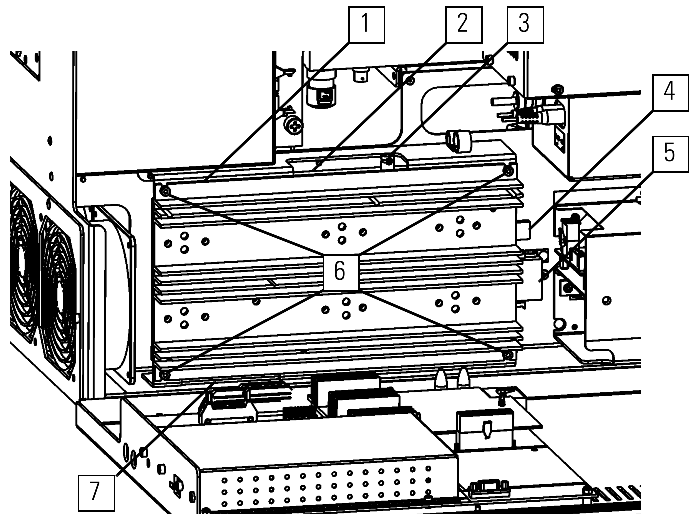
a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

b. Remove the *DSQ II* front, top, and left side covers (see “Removing the Covers” on pp. 39).

2. Remove the RF Generator PCB.



1	RF Generator PCB	5	Cable J3 (to Power Module)
2	Cable P1 (to RF Detector PCB)	6	Screws Holding the RF Generator PCB, 4
3	Cable J1 (to Low Pass Filter PCB)	7	Cable P2 (to Analog PCB)
4	Cable J2 (to Power Module)		

Figure 2-76. RF Generator PCB (Left Side)

a. Disconnect **Cables (2, 3, 4, 5)**.

b. Remove the top two, and loosen the bottom two, **Screws Holding the RF Generator PCB (6)**.

c. Lift out the **RF Generator PCB (1)**.

d. Disconnect **Cable P2 (7)**.

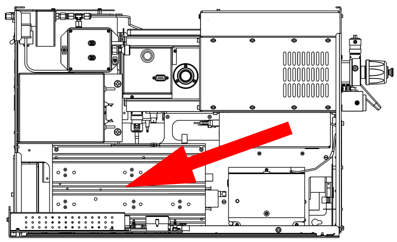
3. Install the new RF Generator PCB.

4. Restore the *DSQ II* for operation.

a. Replace the left, top, and front covers of the *DSQ II*.

b. Restart the system.

RF Generator PCB Fuses



Tools Needed

- RF Generator PCB Fuse F1 (PN A0006-07608; 0.5 A, Quick Act, 5 x 20 mm, 250 V)
- RF Generator PCB Fuse F2 (PN A0006-07610; 1.0 A, Quick Act, 5 x 20 mm, 250 V)
- Wrench, Allen, 3 mm

Frequency

- Only when indicated by Xcalibur Diagnostics, or
- Technical Support, or
- Field Service Engineers

1. Prepare the *DSQ II* for maintenance.

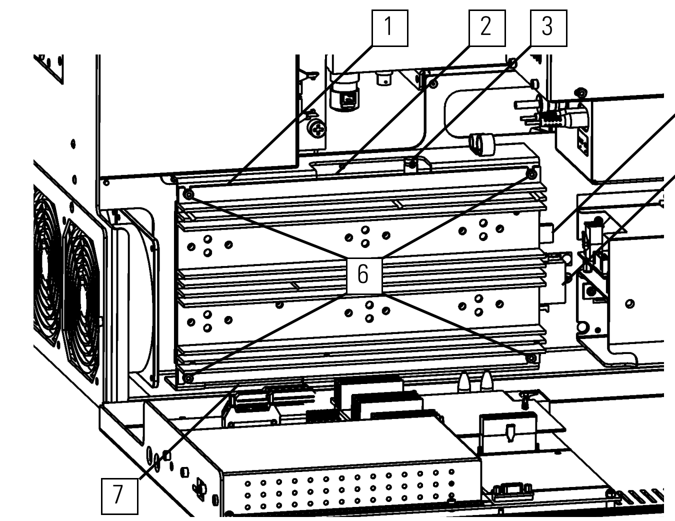
a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

b. Remove the *DSQ II* front, top, and left side covers (see “Removing the Covers” on pp. 39).

2. Remove the RF Generator PCB.



1	RF Generator PCB	5	Cable J3 (to Power Module)
2	Cable P1 (to RF Detector PCB)	6	Screws Holding the RF Generator PCB, 4
3	Cable J1 (to Low Pass Filter PCB)	7	Cable P2 (to Analog PCB)
4	Cable J2 (to Power Module)		

Figure 2-77. RF Generator PCB (Left Side)

a. Disconnect **Cables (2, 3, 4, 5)**.

b. Remove the top two and loosen the bottom two **Screws Holding the RF Generator PCB (6)**.

c. Lift the **RF Generator PCB (1)** out.

d. Disconnect **Cable P2 (7)**.

CAUTION

Instrument Damage. Use only the fuses specified else instrument damage will occur. Never replace a fuse with a fuse of a different type, voltage, or current rating. Also, to prevent damaging the PCBs attach an electrostatic discharge (ESD) strap to your wrist before replacing a fuse.

3. Replace the RF Generator PCB Fuses.

a. Unplug the **RF Generator Fuses.**

b. Plug in the new **RF Generator Fuses**. It does not matter which way they are plugged in.

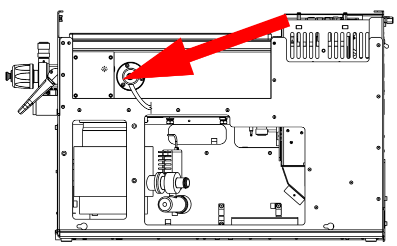
4. Reinstall the RF Generator PCB.

5. Restore the *DSQ II* for operation.

a. Replace the left, top, and front covers of the *DSQ II*.

b. Restart the system.

Transfer Line



Tools Needed

- Gloves, clean, lint- and powder-free
- Transfer line (PN 119640-1050)
- Wrench, Allen, 3 mm
- Wrench, open-ended, 5/16-in.
- Wrench, two, open-ended, 7/16-in.

Frequency

- Only when indicated by Xcalibur Diagnostics, or
- Technical Support, or
- Field Service Engineers

1. Prepare the *DSQ II* for maintenance.

a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

b. Shut down the TRACE GC.

WARNING

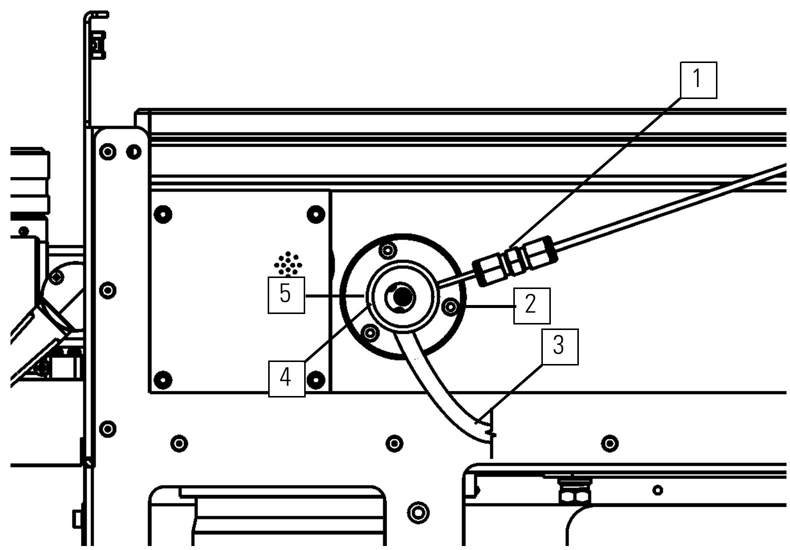
Electrical Shock Hazard. Please unplug the detector before proceeding.

CAUTION

Burn Hazard. The transfer line may be hot. Allow it to cool to room temperature before touching it.

c. Remove the *DSQ II* front, top, and right side covers (see "Removing the Covers" on pp. 39).

2. **Remove the Transfer Line.**



1	Transfer Line Gas Fitting	4	Transfer Line
2	Screws Holding the Transfer Line, 3	5	O-Ring (not shown)
3	Transfer Line Cable		

Figure 2-78. Transfer Line (Right Side)

a. Disconnect the **Transfer Line Cable (3)** from the left side of the GC.

b. Loosen the **Transfer Line Gas Fitting (1)**.

c. Remove the three **Screws Holding the Transfer Line (2)**.

d. Remove **Transfer Line (4)**.

3. Install the new Transfer Line.

4. Restore the *DSQ II* for operation.

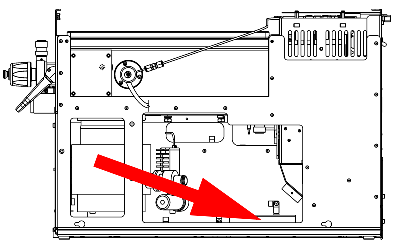
a. Replace the right, top, and front covers of the *DSQ II*.

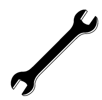
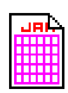
b. Restart the GC.

c. Restart the system.

d. Once the detector has pumped down and is operational, check for vacuum leaks using the Automatic Tune.

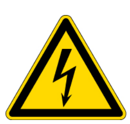
Turbomolecular Pump Power Supply



	**Tools Needed** • Screwdriver, Phillips #2 • Turbomolecular Pump Power Supply (PN 76330-0230)
	**Frequency** • Only when indicated by Xcalibur Diagnostics, or • Technical Support, or • Field Service Engineers

1. Prepare the *DSQ II* for maintenance.

a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

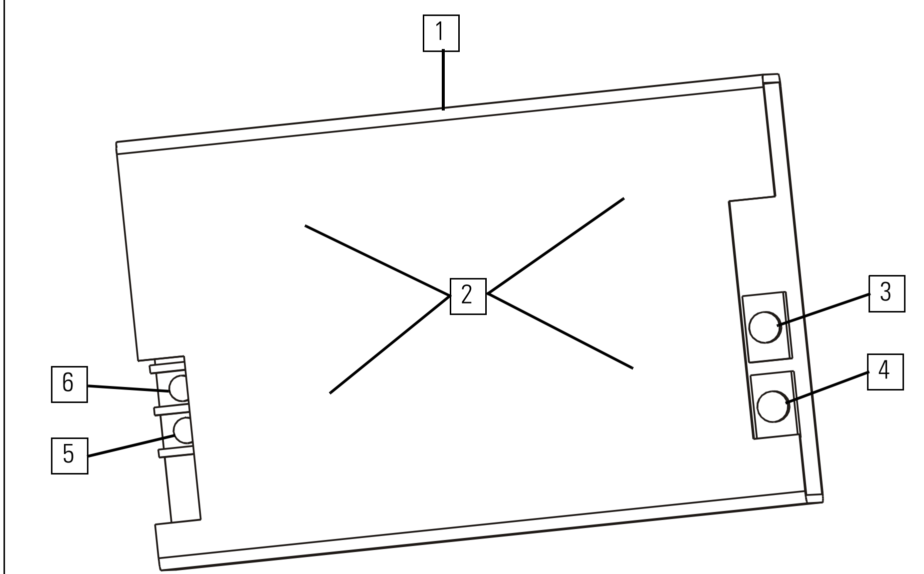


WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

b. Remove the *DSQ II* front, top, and right side covers (see “Removing the Covers” on pp. 39).

2. Remove the Turbomolecular Pump Power Supply.



1	Turbomolecular Pump Power Supply	4	Cable P2-2 (+), red wire
2	Screws Holding the Turbomolecular Pump Power Supply, 4	5	Cable P1-2L, brown wire
3	Cable P2-1 (-), black wire	6	Cable P1-2N, blue wire

Figure 2-79. Turbomolecular Pump Power Supply (Top View)

a. Disconnect the four **Cables (3, 4, 5, 6)**.

b. From the bottom of the detector, remove the four **Screws Holding the Turbomolecular Power Supply (2)**.

c. Remove the **Turbomolecular Pump Power Supply (1)**.

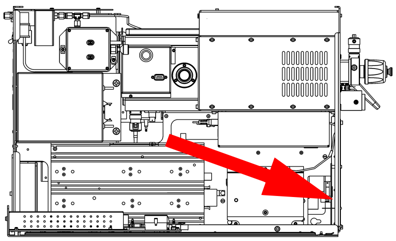
3. Install the new Turbomolecular Pump Power Supply.

4. Restore the *DSQ II* for operation.

a. Replace the right, top, and front covers of the *DSQ II*.

b. Restart the system.

Vacuum Control PCB



Tools Needed

- Vacuum Control PCB (PN 119590-0031)
- Wrench, Allen, 2.5 mm

Frequency

- Only when indicated by Xcalibur Diagnostics, or
- Technical Support, or
- Field Service Engineers

1. Prepare the *DSQ II* for maintenance.

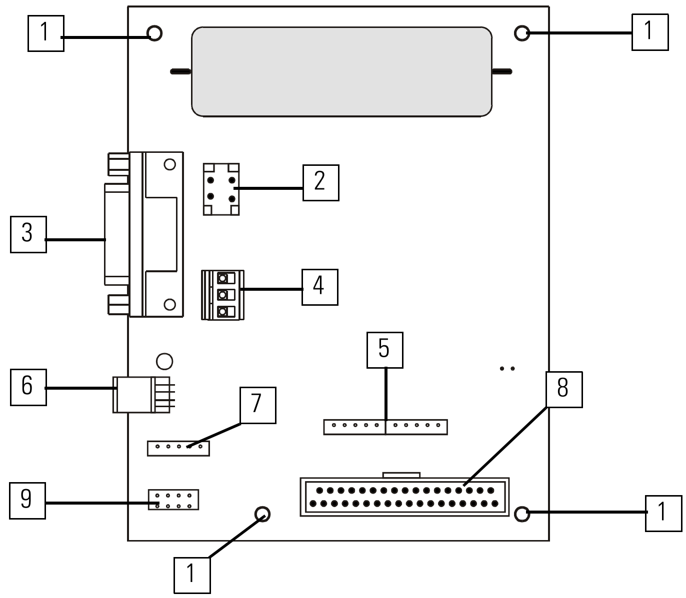
a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

b. Remove the *DSQ II* front, top, and left side covers (see “Removing the Covers” on pp. 39).

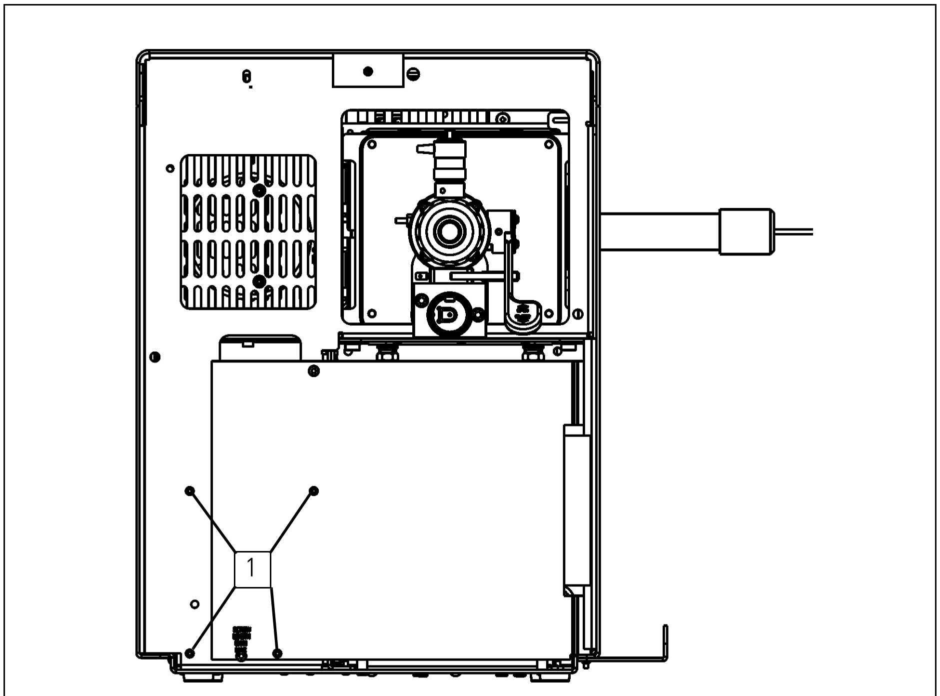
2. **Remove the Vacuum Control PCB.**



1	Screws Holding the Vacuum Control PCB, 4	6	Cable J3 (to Turbomolecular Pump Power Supply)
2	Cable J1 (to Forepressure Gauge)	7	Cable P2 (to Inlet Valve Solenoid)
3	Cable J2 (to Turbomolecular Pump Controller)	8	Cable P4 (to Analog PCB)
4	Cable P1 (to Power Module)	9	Cable P5 (to Calibration Gas Flow Module and Vent Valve Solenoid)
5	Cable P3 (to Ion Gauge Control PCB)		

Figure 2-80. Vacuum Control PCB

a. Disconnect all of the **Cables (2, 3, 4, 5, 6, 7, 8, 9)**.



1	Screws Holding the Vacuum Control PCB, 4

Figure 2-81. Vacuum Control PCB Mounting Screws (Front View)

b. Remove the four **Screws Holding the Vacuum Control PCB (1)**.

c. Remove the **Vacuum Control PCB**.

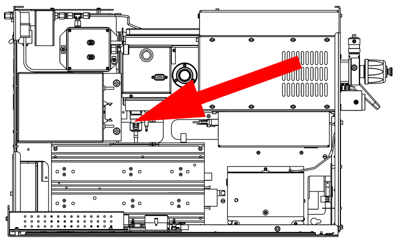
3. Install the new Vacuum Control PCB.

4. Restore the *DSQ II* for operation.

a. Replace the left, top, and front covers of the *DSQ II*.

b. Restart the system.

Vent Valve Solenoid



Tools Needed

- Adjustable wrench
- Lint-free cloth
- Vent valve solenoid (76461-1003)

Frequency

- Only when indicated by Xcalibur Diagnostics, or
- Technical Support, or
- Field Service Engineers

1. Prepare the *DSQ II* for maintenance.

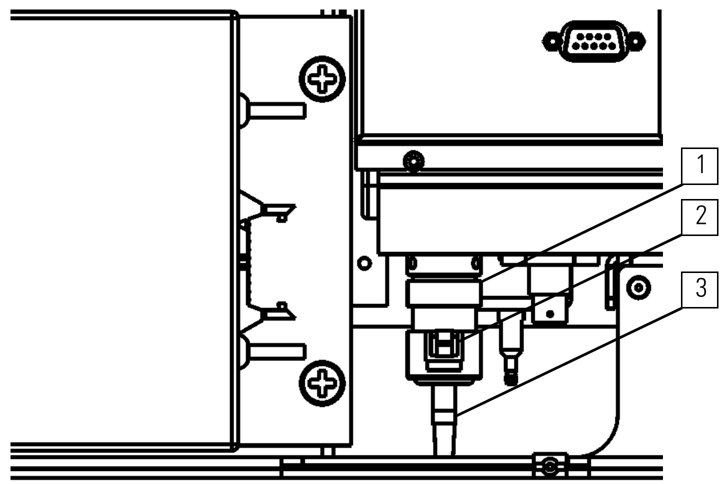
a. Shut down and vent the system (see 1.3 Shutting Down pp. 1-30).

WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

b. Remove the *DSQ II* front, top, and left side covers (see 2.2 Maintaining System Performance pp. 2-39).

2. Remove the Vent Valve Solenoid.



1	Vent Valve Solenoid	3	Vent Valve Filter
2	Cable		

Figure 2-82. Vent Valve Solenoid (Left Side View)

a. Disconnect the **Cable (2)**.

b. Unscrew the **Vent Valve Solenoid (1)** and remove it.

c. Unscrew the **Vent Valve Filter (3)**.

3. Install the new Vent Valve Solenoid. On the Cable (2), the orientation of the two plugs does not matter.

4. Restore the *DSQ II* for operation.

a. Replace the left, top, and front covers of the *DSQ II*.

b. Restart the system.

c. Once the detector has pumped down and is operational, check for vacuum leaks using the Automatic Tune.

Chapter 3 DSQ II Troubleshooting

This chapter provides quick reference to identify symptoms, causes, and solutions for poor instrument performance or malfunction.

Typically, *Xcalibur* Diagnostics will display a failure readback on the instrument Status tab, then using this chapter you locate the matching diagnosis and solution. If the material in this chapter is not able to help you troubleshoot the problem, contact Technical Support.

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3.1 Diagnostics

If your instrument is running poorly or suspiciously, *Xcalibur* Diagnostics will most likely detect the problem and recommend a solution. Diagnostics tests electronic circuits and reports whether the circuits pass or fail.

However, problems in sensitivity due to misalignment, dirty components, or improper tuning are not detected by Diagnostics.

Before running the Diagnostics, refer to the flowchart (Figure 3-1) to determine solutions outside of *Xcalibur* Diagnostics.

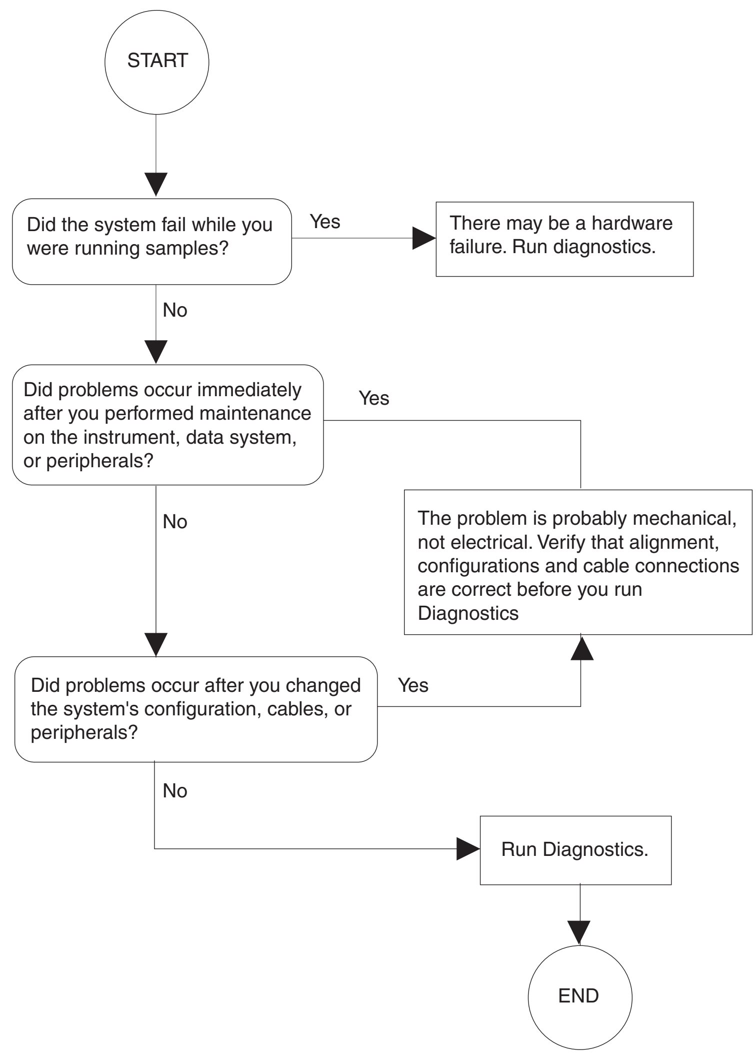


Figure 3-1. Diagnostics Flowchart

Running Xcalibur Diagnostics

1. **Navigate to the Diagnostics screen.**

   a. From the *Xcalibur* Home Page select **Instrument Setup**.

   b. Open the *DSQ II* Method Editor then click the **Tune** button.

   c. From Tune, select **Diagnostics | Run Tests** to display the Diagnostics screen.

2. **Run Diagnostics by clicking on the test you wish to run.**

3.2 Communication Symptoms

Communication symptoms likely involve links between the data system and the mass spectrometer, the gas chromatograph, and the autosampler. This section does not address communication issues with other devices.

Communication symptoms may occur during:

- Data transfer between the mass spectrometer and the data system
- Mass spectrometer, gas chromatograph and autosampler current status readbacks
- Instrument control, method downloading and uploading
- Start, stop, pause and initialize functions
- Error messages

How does the detector communication work?

The flow of digital information in the *DSQ II* system is bi-directional; the data system downloads analytical methods to the instrument and activates functions to start, stop, shutdown, startup, and initialize. The *DSQ II* reports its readiness state and current tasks, various voltages, heated zones, and pressure readings. It also delivers a steady stream of mass spectral data during acquisition.

Why does the detector have communication symptoms?

Some communication symptoms are due to mechanical faults—for instance, a cable may be unplugged, or a device may be turned off. In other cases, the instrument method could be incorrect for *DSQ II* operations. Less common communication symptoms are due to defective electronic hardware components.

How do I detect communication symptoms?

Communication symptoms may be detected from an error message delivered by the data system, or they may be noticed from the failure to perform some expected task.

Symptom: Data system cannot initialize communication with *DSQ II*.

Possible Solution

The software is not configured correctly. Select the *DSQ II* from the Instrument Configuration window.

Possible Solution

The ethernet cable is unplugged.

- Verify that the ethernet cable is connected to the data system port on the *DSQ II*.

Possible Solution

The Xcalibur software has locked up.

- Use Task Manager to end HomePage, AcquServer, QuadTune, and QuadInst. Or, reboot the computer.

Possible Solution

The digital PCB has locked up.

- Press the reset button on the back of the instrument.

Possible Solution

The communication circuits on the digital PCB are faulty.

- Check connections to digital PCB. Replace if necessary.

Possible Solution

The ethernet card in the PC is not configured or is faulty.

- Check TCP/IP configuration (compare to the settings shown in the README.DOC file). Replace the card if necessary.

Possible Solution

The system is in service mode.

- Check if green power LED on front cover is flashing; return service switch to normal position if necessary.

Possible Solution

The incorrect ethernet cable is used for the detector.

- Use the supplied 10 Base-T Category 5 crossover cable. The length of the ethernet cable may be extended by plugging a standard Category 5 cable in series with the supplied crossover cable.

Symptom: Computer loses communication with *DSQ II* intermittently.

Possible Solution

The ethernet cable is loose or damaged.

- Inspect cable and replace if necessary.

Possible Solution

The communication circuits on the digital PCB are faulty.

- Check connections to Digital PCB. Replace if necessary.

Symptom: Cannot download methods to *DSQ II*.

Possible Solution

The software is not properly configured.

- Verify correct settings in Instrument Configuration.

Symptom: Unable to start a GC temperature program even though all devices are ready. "NOT RDY - Waiting for Inhibit RDY Signal" displays on the TRACE GC status menu.

Possible Solution

Check the GC and/or autosampler remote start cables for loose or faulty connections.

1. **GC remote start cable (8-pin) plugs into the GC** (Generic/HS **port) and connects to the DSQ II** (GC Start **port). Or,**

2. **Autosampler remote start cable plugs into GC** (Autosampler **port) and connects to the autosampler controller (GC port).**

3. **More detailed information is listed in the TRACE GC Operating Manual.**

Possible Solution

Configure the Inhibit Ready parameter on the TRACE GC. The TRACE GC Handshaking parameter needs to be configured to allow the GC to become ready to run a temperature program. Configure the GC as follows:

1. **Press** <CONFIG> **to display the Configure menu.**

2. **Press the down arrow key to Handshaking and press** <ENTER> **to display the Config Handshaking menu.**

3. **Press the down arrow key to Inhibit ready in and press** <ENTER> **to display the Inhibit Ready menu.**

4. **Specify the** Inhibit Ready **parameter. The default setting is** When high**. This allows normal operation of the *DSQ II* system. If the GC method has not been downloaded from** *Xcalibur***, the GC may not have received a signal from the DSQ II allowing it to become ready. In this case you can either send the GC method from** *Xcalibur* **or select** When low **or** Do not inhibit **as the Inhibit Ready parameter.**

Symptom: Detector acquisition does not start as expected.

Possible Solution

The *DSQ II* start mode is not properly configured.

- Verify that instrument is configured properly. Refer to *Xcalibur* online help.

Possible Solution

The *DSQ II* Instrument Setup file has incorrect settings.

- Check start time in *DSQ II* Instrument Setup file.

Possible Solution

The forepressure is too high due to solvent peak.

- Reduce injection volume or extend filament/multiplier delay time until after solvent peak. See 3.6 High Vacuum Symptoms pp. 3-187.

Possible Solution

The remote start cable to the GC is disconnected.

- Connect remote start cable.

Possible Solution

The GC did not start.

- Verify GC methods and configuration.Verify connection between autosampler and GC.

Possible Solution

The autosampler did not start.

- Verify autosampler methods and configuration. Verify that the sample is present.

Possible Solution

A heated zone setpoint is not attained.

- Refer to 3.5 Heated Zone Symptoms pp. 3-184.

Symptom: Unstable instrument readback.

Possible Solution

There is a faulty cable connection.

- Check connections to the Analog PCB.

Possible Solution

The Digital PCB is faulty.

- Reseat connector between Analog and Digital PCB; replace if necessary.

Possible Solution

The Analog PCB is faulty.

- Check connections to the Analog PCB; replace if necessary.

Symptom: Acquisition terminates unexpectedly.

Possible Solution

The End Run time in the *DSQ II* Instrument Setup file is incorrect.

- Check the Instrument Setup files for the GC and the MS.

Possible Solution

The data system is out of disk space.

- Check disk space; back up and remove files.

Symptom: Cannot initialize GC.

Possible Solution

The GC is not turned on.

- Turn on the GC.

Possible Solution

The GC is not configured properly in *Xcalibur* software.

- Check Instrument Configuration.

Possible Solution

The cable between COM1 and GC is disconnected.

- Verify connection.

Possible Solution

COM1 is not configured properly.

- Verify COM port configuration.

Possible Solution

GC communications malfunction.

- Contact Technical Support.

Symptom: Cannot download methods to GC.

Possible Solution

There is a discrepancy between method and configuration.

- Verify consistency between method and instrument configuration.

Possible Solution

COM1 is not configured properly.

- Verify COM port configuration.

Possible Solution

GC communications malfunction.

- Contact Technical Support.

Symptom: Cannot initialize Autosampler.

Possible Solution

Autosampler not turned on.

- Turn on Autosampler.

Possible Solution

Autosampler not configured properly in *Xcalibur* software.

- Check Instrument Configuration

Possible Solution

Disconnected cable between GC and autosampler.

- Verify connection.

Possible Solution

Autosampler Instrument Configuration not set for “Connected through TRACE”

- Verify configuration.

Possible Solution

Autosampler communications malfunction.

- Contact Technical Support.

Symptom: Cannot download methods to Autosampler.

Possible Solution

Discrepancy between method and configuration.

- Verify consistency between method and instrument configuration.

Possible Solution

Autosampler communications malfunction.

- Contact Technical Support.

3.3 Contamination Symptoms

Chemical noise is always present in any mass spectrometer. Additionally, the spectra shown in *Xcalibur* Tune and Real-Time Display are auto-normalized, which can make the background appear high when it really is not.

Some chemical noise does present itself, such as septum bleed after a series of injections, vial sample bleed (which occurs if more than one injection is made from a sample vial), and Siloxane peaks that appear in the chromatogram at regular intervals from focusing at the head of the column or in the injector.

Other possible contamination sources include hydrocarbon contamination of the carrier gas, rotary-vane pump, or instrument cleaning solvents.

Always wear clean, lint- and powder-free gloves when handling parts inside the vacuum manifold, and assure that the carrier gas filter, carrier gas lines, and gas regulators are free of contamination and leaks.

Symptom: There is excessive chemical background due to column bleed (*m/z* 429, 355, 281).

Possible Solution

Capillary column has not been properly conditioned.

- Condition the capillary column.

Possible Solution

Capillary column is damaged as a result of exposure to oxygen.

- Find the source of the oxygen in the carrier gas or air leak. Recondition or replace the capillary column.

Possible Solution

Capillary column is broken off in ion volume.

- Remove broken pieces from ion volume.

Symptom: There is excessive injection port septum bleed (Typical *m/z* 207, 429, 355, 281).

Possible Solution

The septum is worn out or damaged.

- Replace the septum.

Possible Solution

Small pieces of septum are in the injection port liner.

- Replace the injection port liner, condition the capillary column.

Symptom: There is phthalate background manifest in chromatograms (m/z 149, 167, 279).

Possible Solution

Phthalate contamination has occurred due to sample handling or solvent contamination. Phthalates may be observed from packaging materials.

- Isolate source of phthalates such as vial lids or plastic solvent containers and remedy.

Symptom: There is excessive hydrocarbon contamination manifest in chromatograms (Typical ions are m/z 43, 57, 71, 85, 99...)

Possible Solution

Carrier gas tubing is contaminated.

- Isolate source of hydrocarbon contamination and remedy.
- Replace carrier gas tubing. Change carrier gas filters.

Symptom: There is chemical background due to rhenium oxide (m/z 185/187, 201/203, 217/219, 233/235, 250/252).

Possible Solution

These series of rhenium oxide ions come from oxidation of the rhenium filament wire due to the introduction of air into the ion source while the filament is on.

- Check for air leaks and remedy. See 3.6 High Vacuum Symptoms pp. 3-187.

Symptom: Spectra are observed due to solvents:

Possible Solution

Solvents
Methanol (m/z 31, 32)
Acetone (m/z 43, 58, 59)
Methylene chloride (m/z 84/83)
Hexane (m/z 41, 43, 56, 57, 58, 85, 86)
Toluene (m/z 91, 92)
Xylene (m/z 105, 106)
Trichloroethane (m/z 151, 153)

Possible Solution

There is residual solvent from a cleaning procedure or laboratory background contamination.

- When you finish performing a cleaning procedure, allow cleaned components to dry thoroughly. Warm parts in the GC oven to drive off residual solvent.

Possible Solution

The observed compounds have been introduced through sample injection. Ultimate source is either a sample solvent or the autosampler rinsing solvent.

- Optimize GC method to separate solvent peak from area of interest in the chromatogram.

3.4 Filament and Lens Control Symptoms

The lifetime of a filament depends on its exposure to oxygen and solvent vapors. The filament assembly protects the filament and increases its lifetime for many months.

Xcalibur Diagnostics tests the filament for continuity and current regulation. Testing the filament for continuity before each acquisition ensures that an open filament condition will stop an autosampler sequence and generate an error message.

Diagnostics tests the lenses of the *DSQ II*. A flat line, which represents voltage readback versus the predicted voltage ramp, indicates a lens or other control fault. Contamination causes lens performance to deteriorate over time; the amount of time depends on what type of sample and ionization mode you are using.

Symptom: Diagnostics indicate filament is open.

Possible Solution

The filament is open.

- Vent the system and remove the filament. Normal resistance is 1.0 Ω. Replace if open.

Symptom: Inspection shows filament is good, but diagnostics still indicate filament is open.

Possible Solution

There is a fault in the ion source PCB.

- Replace the ion source PCB.

Possible Solution

The connection between the analog and lens interface PCB is defective.

- Check the connection.

Possible Solution

There is a problem with the analog PCB.

- Replace if necessary.

Symptom: Emission current is unstable.

Possible Solution

The filament is near the end of its life span.

- Replace the filament.

Possible Solution

There is a fault in the ion source PCB.

- Replace the ion source PCB.

Possible Solution

There is a problem with the analog PCB.

- Replace if necessary.

Symptom: Short filament lifetime.

Possible Solution

There is an air leak contributing to short filament lifetime.

- Check for leaks; repair if any are found. See 3.6 High Vacuum Symptoms pp. 3-187.

Possible Solution

The filament is on during solvent peak.

- Increase filament/multiplier delay time until solvent peak has passed.

Possible Solution

High emission current is being used.

- Use lower emission current to extend lifetime.

Symptom: Diagnostics indicate flat lens response.

Possible Solution

The power supply to the lens has a fault.

- Check regulator PCB in the power module; replace if necessary.

Possible Solution

There is a fault with the lens drivers.

- Replace the analog PCB.

3.5 Heated Zone Symptoms

The ion source and transfer line are heated zones related to the *DSQ II*. The ion source heater is controlled by the *DSQ II* and the transfer line heater is controlled by the Aux1 heated zone of the TRACE or FOCUS GC.

Often, a heated zone problem is the result of downloading a method to the *DSQ II* that has a different setpoint from the current setting, causing a delay while the heated zone heats or cools.

Component failures are less common, but can occur. These are usually related to open circuits in heater cartridges or faulty temperature sensors.

Heated zones in the gas chromatograph are not discussed in this manual.

Symptom: Excessive chromatographic peak tailing.

Possible Solution

The ion source and/or transfer line are not hot enough.

- Increase the transfer line temperature. It should be at least as hot as the highest GC oven temperature. Then, try increasing the ion source temperature.

Possible Solution

Sample analyte is absorbing in the GC injector.

- Clean and deactivate the injection liner. You can also try liners made of different materials.

Possible Solution

GC oven is not ramped to high enough temperature.

- Extend upper oven temperature.

Possible Solution

GC column needs to be replaced or does not have the appropriate stationary phase for your application.

- Change GC column.

Possible Solution

GC column does not extend 1 mm past the end of the transfer line tip.

- Insert GC column in transfer line so it extends 1 mm past the end of the tip. If the end of the column is inside the tip, an excessive amount of GC effluent will contact the inside wall of the tip.

Symptom: Ion source heater will not heat.

Possible Solution

The cartridge heaters are not connected.

- Check connections between the analog and lens interface PCBs and lens interface PCB and ion source PCB.

Possible Solution

Ion source heater fuse (F1) is blown on the analog PCB.

- Replace the ion source heater fuse on the analog PCB.

Possible Solution

The 24 V power supply is not operable.

- Replace power module if necessary.

Possible Solution

One or more heater cartridges on the ion source PCB is defective.

- Vent the system and check that the resistance of the heater circuit ≅ 24 Ω. Replace the ion source PCB if necessary.

Possible Solution

The ion source temperature sensor (RTD) is defective.

- Vent the system and check the resistance of the RTD (108 Ω at 20 °C, 176 Ω at 200 °C). Replace the ion source PCB if necessary.

Possible Solution

There is a problem with the analog PCB.

- Contact Technical Support.

Symptom: Ion source heater overheats.

Possible Solution

The ion source temperature sensor (RTD) is defective.

- Vent the system and check the resistance of the RTD (108 Ω at 20 °C, 176 Ω at 200 °C). Replace the ion source PCB if necessary.

Possible Solution

There is a problem with the analog PCB.

- Replace if necessary.

Symptom: Transfer line will not heat.

Possible Solution

Aux1 zone of GC is not configured for MS Transfer Line.

- Configure Aux1 zone of GC and set transfer line temperature in GC Method Editor.

Possible Solution

Transfer line heater elements are defective.

1. **Turn off the GC. Unplug the transfer line connector. Measure the heater resistance between the following pins:**

PINS
2-3 ≅ 360 Ω
2-4 ≅ 180 Ω
3-4 ≅ 180 Ω

2. **Replace the transfer line if resistance is incorrect.**

Possible Solution

The transfer line temperature sensor (RTD) is defective.

- Measure resistance of RTD across pins 5-6 (108 Ω at 20 °C, 204 Ω at 275 °C). Replace transfer line if necessary.

Symptom: Transfer Line overheats.

Possible Solution

The transfer line temperature sensor is defective.

1. **Turn off the GC.**

2. **Unplug the transfer line connector.**

3. **Measure resistance of RTD across pins 5-6 (108 Ω at 20 °C, 204 Ω at 275 °C).**

4. **Replace transfer line if necessary.**

Possible Solution

There is a problem with the Aux1 zone of the GC.

- Contact Technical Support.

3.6 High Vacuum Symptoms

High Vacuum problems can manifest themselves in two ways. First, an intermittent vacuum condition (the vacuum pressure in the vacuum manifold fluxuates intermittently) can cause chromatographic signals to drop out, or, if the pressures exceed the maximum allowed pressures by *Xcalibur*, then the MS can automatically shut down. Second, if the vacuum is consistent enough to where it does not exceed the maximum allowed pressure and avoids the *Xcalibur* automatic shutdown, non-reproducible false chromatographic peaks can be generated in the chromatogram.

Typical forepressure readbacks are 30-40 mTorr (in EI mode), and typical manifold pressure (ion gauge readback) is 1-5 x 10^{-5} Torr. For CI mode, forepressure is usually 60-90 mTorr, with manifold pressures no greater than 9 x 10^{-4} Torr.

The leak check in the Automatic Tune is a good way to check for leaks. You can also find vacuum leaks by spraying a gas around the vacuum manifold and looking for the characteristics ions in full-scan EI. Argon produces *m/z* 40. Alternatively, compressed electronic dusting spray containing an HFC can be used. For example, Falcon® Dust-Off® and MicroCare® Micro-Blast™ contain tetrafluoroethane, which produce ions at *m/z* 69 and 83.

Symptom: Automatic Tune reports “Air leak has been detected”.

Possible Solution

There may be an air leak. Use the procedure described above for finding the leak. The most common leaks are caused by:

- Loose transfer line nut or union
- Dust or debris on the top cover o-ring
- No helium flow from the GC. This causes the detector to suck air through the column.

Symptom: Rotary-vane pump will not turn on.

Possible Solution

The rotary-vane pump is off.

- Check the rotary-vane pump switch.

Possible Solution

The rotary-vane pump power cable from the *DSQ II* is not connected.

- Connect the power cable.

Possible Solution

The rotary-vane pump is configured for incorrect line voltage.

- Configure the rotary-vane pump for proper line voltage.

Possible Solution

The Rotary-Vane Pump is faulty.

- Replace the Rotary-Vane Pump.

Symptom: Rotary-vane pump turns on but will not pump down.

Possible Solution

The oil level in the rotary-vane pump is insufficient.

- Check oil level; add if necessary.

Possible Solution

The foreline is leaking.

- Check the clamps and connectors. Replace the foreline hose if a hole is found.

Possible Solution

The vacuum manifold top cover is leaking.

- Press down on the top cover to make sure it is seated properly.

Possible Solution

The rotary-vane pump is faulty.

- Replace the rotary-vane pump.

Possible Solution

The cable from the fore pressure gauge to the vacuum control PCB is faulty.

- Check the cable.

Symptom: Turbomolecular pump will not turn on.

Possible Solution

The fore pressure is not low enough.

- Check the rotary-vane pump and foreline plumbing for leaks and proper operation.

Possible Solution

Ready is not transmitted by the vacuum control PCB.

- Check cable connections between vacuum control PCB and turbomolecular pump controller; replace if necessary.

Possible Solution

The laboratory environment is too hot.

- Bring laboratory environment to within *DSQ II* specifications.

Possible Solution

Line voltage is out of tolerance.

- Check line voltage; correct as necessary.

Symptom: Turbomolecular pump shuts off during operation.

Possible Solution

The fore pressure is too high.

- Check for leaks in the foreline.

Possible Solution

The cable connection between the turbomolecular pump and vacuum control PCB is faulty.

- Check connections.

Possible Solution

The turbomolecular pump controller is faulty.

- Replace or repair as necessary.

Possible Solution

The turbomolecular pump power supply is faulty.

- Replace or repair as necessary.

Possible Solution

The turbomolecular pump is faulty.

- Replace the turbomolecular pump.

Symptom: Unexpected full ventilation occurs.

Possible Solution

A gross leak is present.

- Check for leaks.

Possible Solution

The system was vented through the inlet valve, there was a GC column break at the transfer line, the foreline was cut.

- Shut off the *DSQ II* main circuit breaker. Allow system to vent and cool to room temperature.

Symptom: Vacuum Fault.

Possible Solution

A gross leak is present.

- Check for leaks.

Possible Solution

The ion gauge must be on (if you have one) and the pressure below $1x10^{-3}$ Torr.

- Turn on ion gauge from Tune.

3.7 Linearity Symptoms

Linearity symptoms are when a plot of intensity versus concentration of a known compound are not uniform throughout the curve, or vary from their expected peaks. Poor instrument operating conditions can cause linearity problems. Additionally, certain compounds do not give a desired linear response due to chromatographic activity.

A well-maintained instrument will provide good linear response over a wide range of concentration for most compounds. Like any instrument, however, the *DSQ II* has a saturation point.

Perform routine injector and column maintenance to minimize linearity problems. Usually, a hardware fault that affects linearity will show different symptoms than those which might be attributed to linearity.

Symptom: Calibration plots not sufficiently linear.

Possible Solution

High-end standards are too concentrated.

- Use split injection technique to decrease amount of sample, lower emission current to reduce sensitivity, or lower detector gain.

Possible Solution

Ion volume, lenses, or prefilter are dirty.

- Clean ion volume, lenses, and prefilter.

Possible Solution

Detector gain is too high.

- Run Automatic Tune to calibrate detector gain. Select a lower gain setting like $1x10^5$.

Possible Solution

Injection port liner or capillary column is dirty.

- Change the injection port liner and trim the capillary column.

Possible Solution

Capillary column stationary phase is too thin for high concentration samples.

- Use a higher capacity capillary column with a thicker stationary phase.
- Use split injection technique.

Possible Solution

The capillary column is bad.

- Replace capillary column.

3.8 Power Supply Symptoms

Xcalibur Diagnostics detects most power supply symptoms. Power supply problems often involve a blown fuse, faulty electronic components, or even something as simple as a disconnected cable. Use extreme care when you replace a fuse or electronic component. Turn the *DSQ II* off and unplug the instrument before removing the covers.

WARNING

Electrical Shock Hazard. Please unplug the detector before proceeding.

Symptom: *DSQ II* will not turn on.

Possible Solution

Disconnected power cord.

- Verify that the power cord is plugged in.

Possible Solution

Voltage not coming from the electrical outlet.

- Verify that the electrical outlet is operational.

Possible Solution

Improper voltage at the electrical outlet.

- Verify that the outlet is using the correct voltage for your system.

Possible Solution

Faulty power module.

- Replace power module.

Symptom: *DSQ II* turns on, but circuit breaker trips.

Possible Solution

Faulty power module.

- Replace power module.

Possible Solution

Rotary-vane pump causes circuit breaker to trip.

- Check rotary-vane pump voltage setting; replace if necessary.

Symptom: *DSQ II* turns on, but there are no voltages available.

Possible Solution

No +5, +/- 15, +24 V power.

- Check power module. In-line fuse F1 may be blown or power supply 1 may be faulty. Replace if necessary.

Possible Solution

No +28 V power.

- Check fuse on RF generator PCB; replace if necessary. If fuse blows again after replacement, replace RF generator PCB.

Possible Solution

No +/- 150 V power

- Check regulator PCB in power module; replace if necessary.

Possible Solution

No 28 V current.

- Check connections to RF generator PCB, RF control PCB, RF coil, and RF feedthroughs.

Possible Solution

No +28 V current, -28 V, or +36 V (system is off).

- Turn system on from Tune.

Symptom: +28 V current is below acceptable range.

Possible Solution

There is a bad connection in the RF circuit.

- Check connection sequences between RF generator PCB, low pass filter, DC driver, RF coil, RF control PCB, RF feedthroughs, quadrupole, and prefilter.

Symptom: +28 V current is higher than acceptable range.

Possible Solution

The RF frequency is not calibrated.

- Calibrate the RF frequency using Automatic Tune.

Possible Solution

The RF generator PCB overheated.

1. **Check fans on back of *DSQ II*; clean or replace as necessary.**

2. **Verify adequate ventilation around *DSQ II*.**

3. Verify that lab temperature is within operating limits of *DSQ II*.

4. Verify that the RF frequency is calibrated using Automatic Tune.

Possible Solution

The RF generator PCB is faulty.

- Replace the RF generator PCB.

Possible Solution

The RF detector capacitors are faulty.

- Check capacitor plate for high-voltage arcing; replace if necessary.

Possible Solution

There is a short circuit to ground in an RF feedthrough.

- Replace RF feedthrough.

Possible Solution

There is a short circuit in the RF coil.

- Replace the RF coil.

Symptom: ±550 V is outside the acceptable range.

Possible Solution

The DC driver assembly is faulty or the +36 V is missing.

- Make sure the DC driver assembly is plugged in and the +36 V power supply is working correctly.

3.9 RF and DC Control Symptoms

Automatic RF frequency calibration or RF dip and gain problems can be caused by several things. Begin troubleshooting control problems by using *Xcalibur* Diagnostics.

Diagnostics helps you identify whether the fault is due to a power supply problem, a break in the RF signal path, or a faulty component. Figure 3-1 is an excellent resource to begin troubleshooting RF control problems.

If the symptom is observed after performing work on the instrument, it points to mechanical issues; if the symptom arises suddenly during operation of the instrument, it indicates a fault condition.

Symptom: RF Dip Calibration shows random noise instead of a smooth RF Dip.

Possible Solution

There is a loose cable.

- Check these cables:

Analog to Low Pass Filter PCB (PN 119378-0039)
Analog to RF Detector PCB (PN 119378-0004)
Analog to RF Generator PCB (PN 119378-0002)
Cables from DC Driver to Low Pass Filter PCB (PN 119378-0036)
Cables from RF Coil to RF Detector Capacitor or RF feedthroughs
Lens Interface to Low Pass Filter PCB
RF Detector to DC Driver and RF Generator PCB (PN 119378-0038)
RF Generator to Low Pass Filter PCB (PN 119378-0013)

Possible Solution

Quadrupole mass filter is not connected to RF feedthroughs.

- Vent the system and check the two connections. The two wires from the quadrupole mass filter should be connected to the top and bottom RF feedthroughs on the rear pins. Or, the connections to the quadrupole mass filter are loose.

Possible Solution

Prefilter is not connected to RF feedthroughs.

- Vent the system and check the two connections. The two wires from the prefilter should be connected to the top and bottom RF feedthroughs on the front pins.

Possible Solution

There is high voltage arcing.

- Vent the system and check the quadrupole mass filter and prefilter. Also, check the wires inside the RF coil box. Make sure the four wires going to the RF feedthroughs are far from any surface and especially each other. Check for burn marks or evidence of arcing. Clean components if necessary. Replace the components if problems persist.

Symptom: RF Dip Calibration shows random noise instead of a smooth RF Dip.

Possible Solution

There is high voltage arcing.

- Vent the system and check the quadrupole mass filter and prefilter. Also, check the wires inside the RF coil box. Make sure the four wires going to the RF feedthroughs are far from any surface and especially each other. Check for burn marks or evidence of arcing. Clean components if necessary. Replace the components if problems persist.

Possible Solution

There is a fault with RF Generator PCB power supply (28 V power supply).

- Check the fuse on the RF Generator PCB; replace if necessary.

Possible Solution

The RF Generator is faulty.

- Replace the RF Generator PCB.

Symptom: RF Dip is present, but outside acceptable range.

Possible Solution

There is a fault with the RF coil or the RF detector PCB.

- Contact Technical Support for assistance.

Possible Solution

There is high voltage arcing.

1. **Vent the system and check the quadrupole mass filter and prefilter.**

2. **Also, check the wires inside the RF coil box.**

3. **Make sure the four wires going to the RF feedthroughs are far from any surface and especially each other.**

4. **Check for burn marks or evidence of arcing.**

5. **Clean components if necessary.**

6. **Replace the components if problems persist.**

Symptom: The Det RF line (RF Gain Calibration screen) is not a smooth, straight line out to *m/z* 1050.

Possible Solution

The RF Generator gain is not adjusted.

- Contact Technical Support for assistance.

Possible Solution

There is high voltage arcing.

1. **Vent the system and check the quadrupole mass filter and prefilter.**

2. **Also, check the wires inside the RF coil box.**

3. **Make sure the four wires going to the RF feedthroughs are far from any surface and especially each other.**

4. **Check for burn marks or evidence of arcing.**

5. **Clean components if necessary.**

6. **Replace the components if problems persist.**

Symptom: The Det RF and RF Mod lines are erratic.

Possible Solution

There is a loose cable.

- Check these cables:

Analog to RF Detector PCB (PN 119378-0004)
RF Detector to DC Driver and RF Generator PCB (PN 119378-0038)
Lens Interface to Low Pass Filter PCB
Analog to Low Pass Filter PCB (PN 119378-0039)
RF Generator to Low Pass Filter PCB (PN 119378-0013)
Cables from RF Coil to RF Detector Capacitor or RF feedthroughs
Cables from DC Driver to Low Pass Filter PCB (PN 119378-0036)
Analog to RF Generator PCB (PN 119378-0002)

Possible Solution

There is a problem with the RF control PCB, low pass filter PCB, the RF generator PCB, or the RF coil.

- Contact Technical Support.

Possible Solution

There is high voltage arcing.

1. **Vent the system and check the quadrupole mass filter and prefilter.**

2. **Also, check the wires inside the RF coil box.**

3. **Make sure the four wires going to the RF feedthroughs are far from any surface and especially each other.**

4. **Check for burn marks or evidence of arcing.**

5. **Clean components if necessary.**

6. **Replace the components if problems persist.**

Symptom: Rod DC diagnostic fails.

Possible Solution

If all tests fail, the DC driver is unplugged or faulty.

- Check all cables to the DC driver assembly. Replace the assembly if necessary.

Possible Solution

If A Rod DC and B Rod DC fail but Average DC passes, RF dip, RF gain, or RF null may be adjusted incorrectly.

1. **Check RF dip and RF gain calibrations. The RF may not be working properly or the DC driver assembly is unplugged or faulty.**

2. **Check the RF null (see the *DSQ II* *User's Guide*).**

3.10 Sensitivity Symptoms

If you observe a drop in instrument sensitivity, you should determine if the sensitivity drop was sudden or if it occurred gradually. A sudden loss of sensitivity can be the result of sudden component failure or an unnoticed change in the analytical method. Simple errors such as a plugged autosampler syringe or too low sample level in the sample vial can give the appearance of instrument failure.

Gradual drops in sensitivity are usually the result of ion source, lens, or prefilter contamination, and are easily remedied by cleaning the ion volume, lenses, and prefilter.

The electron multiplier influences sensitivity and has a limited lifetime. Eventually it will need to be replaced.

Improper GC maintenance is another cause of diminished sensitivity. It is important to establish a routine maintenance program for the GC. See your *TRACE or FOCUS GC Maintenance Manual* for more information on establishing a maintenance program.

Symptom: Poor sensitivity or sudden loss in sensitivity.

Possible Solution

The wrong type of ion volume is installed.

- EI and CI require different ion volumes. They may not be used interchangeably.

Possible Solution

The ion volume is incorrectly positioned.

- Position the ion volume properly by removing and reinserting it.

Possible Solution

There is a large air leak.

- Run Leak Check in Automatic Tune or look for m/z 28 as base peak in full scan. See 3.6 High Vacuum Symptoms pp. 3-187.

Possible Solution

The injector or septum is leaking.

- Replace septum and perform leak check on GC.

Possible Solution

GC column is not inserted beyond end of transfer line or GC column is broken off in ion source.

- Check column installation.

Possible Solution

The ion volume, lenses, or prefilter are dirty.

- Clean the ion volume, lenses, and prefilter.

Possible Solution

Prefilter is misaligned, or broken.

- Check alignment of prefilter.

Possible Solution

Cables are loose incorrectly installed or missing

- If some ions are present, make sure entrance lens is plugged in and make sure cables for P1 and P2 are plugged in correctly on the Low Pass Filter PCB.

Possible Solution

The instrument is out of tune, or tune file is incorrect.

- Select correct tune file for the method or run Automatic Tune.

Possible Solution

The magnets above and below the ion source are installed incorrectly.

- Position both magnets so the south pole is on top. Electrons will not be focused into the ion volume if one magnet is upside down.

Possible Solution

Emission current is set too low.

- Check the setting listed for the emission current. See Tune | Manual and select the Controls tab.

Possible Solution

Cable J3 on the analog PCB is plugged into J4.

- Check the cable and correct if necessary.

Possible Solution

There is a problem with filament or lens control.

- See 3.4 Filament and Lens Control Symptoms pp. 3-182.

Possible Solution

The ion source PCB is faulty, allowing emission current to leak to ground.

- Replace the ion source PCB.

Possible Solution

Reagent gas is leaking into the analyzer, suppressing EI signal.

- Check for presence of CI reagent ions in spectrum. Replace CI gas flow module if necessary.

Possible Solution

Incorrectly matched syringe, injection port liner, and column depth in injector.

- See TRACE GC documentation for correct combination.

Possible Solution

Insufficient sample delivery due to plugged syringe needle.

- Clean or replace syringe.

Possible Solution

The injection port liner is contaminated.

- Clean or replace injection port liner.

Possible Solution

Graphite or septa particles contaminate the injection port.

- Clean the injection port.

Possible Solution

The capillary column is at the end of its life span.

- Replace capillary column.

Possible Solution

Dust has collected in the electron multiplier or on the conversion dynode.

- Dust the electron multiplier and conversion dynode with clean, dry gas.

Possible Solution

Method development problems are present.

- Contact Technical Support.

Symptom: Sensitivity is unstable or shows decrease with repeated injections.

Possible Solution

GC temperature ramp does not continue to a high enough temperature to elute high boiling point compounds. Multiple injections cause these compounds to accumulate in column, reducing sensitivity.

- Extend upper temperature or time at upper temperature in GC oven ramp.

Possible Solution

The ion volume, lenses, or prefilter are dirty.

- Clean the ion volume, lenses, and prefilter.

Possible Solution

The ion source temperature is too low and cause it to contaminate too quickly.

- Clean the ion volume, lenses, and prefilter and then raise the ion source temperature.

Possible Solution

There is a problem with the filament emission current control.

- See 3.4 Filament and Lens Control Symptoms pp. 3-182.

Possible Solution

The electron multiplier is faulty.

- See 3.12 Tuning Symptoms pp. 3-208.

Possible Solution

The injection port liner or capillary column are contaminated.

- Replace the injection port liner and trim the capillary column.

Symptom: No ions are visible in Tune after selecting Restore Default Calibration.

Possible Solution

Instrument is not calibrated.

- Run Full Automatic Tune with all calibrations selected.

Possible Solution

No high m/z ion intensity because the RF is not tuned correctly.

- See 3.9 RF and DC Control Symptoms pp. 3-195.

Symptom: Poor high mass response.

Possible Solution

No high m/z ion intensity because the RF is not tuned correctly.

- See 3.9 RF and DC Control Symptoms pp. 3-195.

Possible Solution

The ion volume, lenses, or prefilter are dirty.

- Clean the ion volume, lenses, and prefilter.

Possible Solution

Poor high m/z ion ratios because the ion source temperature is too high.

- Reduce the ion source temperature to reduce the amount of thermal decomposition and fragmentation of your analyte.

Possible Solution

The conversion dynode is unplugged or faulty.

- Check the cable or replace the electron multiplier/conversion dynode power supply.

Possible Solution

Reagent gas is leaking into the analyzer, suppressing EI signal.

- Check for presence of CI reagent ions in spectrum. Replace CI reagent gas flow module if necessary.

Symptom: Poor low mass sensitivity or m/z 219 is base peak for calibration gas.

Possible Solution

Prefilter offset voltage is too negative.

- Adjust prefilter offset.

Possible Solution

The ion volume, lenses, or prefilter are dirty.

- Clean the ion volume, lenses, and prefilter.

Possible Solution

Prefilter is misaligned or broken.

- Check alignment of prefilter.

Possible Solution

Lens voltages are incorrect.

- Select Restore Default Tune.

Symptom: Isotopes are missing or isotope ratios are incorrect.

Possible Solution

Masses are not resolved.

- Adjust Resolution and/or Ion Offset in Tune | Manual Tune View | Resolution Tab.

Possible Solution

Detector gain is too low.

- Increase detector gain.

Symptom: Irregular ion ratios.

Possible Solution

The wrong type of ion volume is installed.

- EI and CI require different ion volumes. They may not be used interchangeably.

Possible Solution

Lens voltages or prefilter offset voltage are incorrect.

- Select Restore Default Tune.

Possible Solution

Prefilter is misaligned, or broken.

- Check alignment of prefilter.

Possible Solution

The ion volume, lenses, or prefilter are dirty.

- Clean the ion volume, lenses, and prefilter.

Possible Solution

GC column is not inserted beyond end of transfer line or GC column is broken off in ion source.

- Check column installation.

Possible Solution

There is a large air leak.

- Run Leak Check in Automatic Tune or look for m/z 28 as base peak in full scan. See 3.6 High Vacuum Symptoms pp. 3-187.

Possible Solution

Cables are loose incorrectly installed or missing

- If some ions are present, make sure entrance lens is plugged in and make sure cables for P1 and P2 are plugged in correctly on the Low Pass Filter PCB.

Symptom: Weak Signal.

Possible Solution

The ion volume, lenses, or prefilter are dirty.

- Clean the ion volume, lenses, and prefilter.

Possible Solution

The detector gain is set too low.

- Run Detector Gain Calibration in Automatic Tune. Try a higher gain setting. A multiplier >2-3 years old may be too noisy for the Detector Gain Calibration to accurately set the voltage. The multiplier may need to be replaced.

Possible Solution

The wrong type of ion volume is installed.

- EI and CI require different ion volumes. They may not be used interchangeably.

Possible Solution

The ion volume is absent or incorrectly positioned.

- Verify that the ion volume is positioned correctly by removing and reinserting it.

Possible Solution

There is a filament or lens control problem.

- See 3.4 Filament and Lens Control Symptoms pp. 3-182.

Symptom: Poor sensitivity in CI mode.

Possible Solution

- An EI Ion Volume is installed. Install a CI Ion Volume.
- The small hole in the CI Ion Volume is plugged. Use a dental pick or old syringe needle to clear it.
- The Filament is not aligned. Remove the Ion Volume and check if the ion burn is centered around the small electron entrance hole. Be sure the Filament is properly inserted into the connector. Carefully bend the Filament wire to better align it with the Ion Volume.
- The Ion Volume is not inserted properly. While running the instrument, you can push on the Ion Volume with the I/R Tool. Be sure to monitor the pressure to ensure that you get a good seal around the I/R Tool. Otherwise, you may damage the Filament. An increase in signal for the calibration gas as you push on the Ion Volume usually indicates that the Filament is not aligned properly.

3.11 Stability Symptoms

Stability problem symptoms are concerned with consistent instrument precision and the reproducibility of accurate results. Good operating conditions for the mass spectrometer, gas chromatograph, and autosampler contribute to instrument stability.

Sample preparation, spiking errors, sample injection errors, and lack of routine maintenance on the instruments may cause false stability symptoms.

When hardware faults affect instrument stability, investigate simple solutions first, such as cleaning the ion volume and lenses, or checking for air leaks. Usually, a hardware fault that affects stability will show different symptoms than those which might be attributed to stability.

Symptom: Mass assignment is unstable.

Possible Solution

The RF and DC have not stabilized.

- Allow the instrument to scan for about 1 min.

Possible Solution

There is a problem with the RF or DC.

- See 3.9 RF and DC Control Symptoms pp. 3-195.

Symptom: Signal response is unstable or shows unexpected drop-out.

Possible Solution

Autosampler rinse vials have septum pieces in them, which can clog or change the amount of sample in the syringe. Use aluminum foil instead of septa for the rinse vials. Special Teflon caps are also available for the AI/AS 3000 (PN 31301103) and the Tri-Plus (PN 38610030).

Possible Solution

There is a problem with filament or lens control.

- See 3.4 Filament and Lens Control Symptoms pp. 3-182.

Possible Solution

There is an air leak.

- Check for leaks. See 3.6 High Vacuum Symptoms pp. 3-187.

Possible Solution

There is a high vacuum problem.

- See 3.6 High Vacuum Symptoms pp. 3-187.

Possible Solution

There is a communication problem.

- See 3.2 Communication Symptoms pp. 3-174.

Possible Solution

Dust has collected in the electron multiplier or on the Conversion Dynode.

- Dust the electron multiplier and conversion dynode with clean, dry gas.

3.12 Tuning Symptoms

Symptoms when tuning may be the result of a misadjusted manual control parameter.

Suspect a tuning problem when *Xcalibur* Autotune fails. Autotune performs several functions, and symptoms or error messages indicate different problems.

A tuning symptom can usually be found in Diagnostics.

Symptom: Automatic Tune reports "Cannot perform RF frequency calibration".

Possible Solution

There is a problem with the RF control system.

- See 3.9 RF and DC Control Symptoms pp. 3-195.

Symptom: Automatic Tune reports "Cannot find calibration gas peaks".

Possible Solution

There is a mechanical problem with the ion source or lenses.

- Verify that an EI ion volume is installed.
- Verify correct orientation and cleanliness of ion volume.
- Verify cleanliness and correct operation of lenses.

Possible Solution

There is a problem with the RF or DC.

- See 3.9 RF and DC Control Symptoms pp. 3-195.

Possible Solution

The calibration gas vial is empty.

- Add 100 µL (max) to calibration gas vial.

Symptom: Automatic Tune reports "Mass Calibration or Resolution Calibration should be run".

Possible Solution

Instrument has not been given sufficient time to stabilize.

- Allow instrument to stabilize power supplies while scanning m/z 50 to 650 for 1 minute.

Possible Solution

Instrument requires calibration.

- Select Mass Calibration or Resolution Calibration in Automatic Tune.

Symptom: Automatic Tune reports "Cannot perform detector gain calibration".

Possible Solution

The electron multiplier has not been given sufficient time to outgas since venting.

- Allow more time to pump out.

Possible Solution

The GC column flow is too high.

- Lower it to1 mL/min.

Possible Solution

Dust on conversion dynode or electron multiplier.

- Remove dust with dry gas.

Possible Solution

The multiplier anode is dirty or leaking.

- Inspect and clean the anode.

Possible Solution

Mass and resolution are not calibrated.

- Adjust detector gain in Tune to see background ions and run resolution and mass calibrations in Automatic Tune.

Possible Solution

The calibration gas vial is empty.

- Add 100 µL (max) to calibration gas vial.

Possible Solution

The electron multiplier is near the end of its lifetime.

- Multipliers typically last about 2-3 years before they are too noisy for the gain to be set accurately. Replace the electron multiplier.

Possible Solution

The electrometer PCB is noisy.

- Replace electrometer PCB.

Possible Solution

The electron multiplier power supply is faulty.

- Replace electron multiplier power supply.

Possible Solution

The filament is the source of too much background noise.

- See 3.4 Filament and Lens Control Symptoms pp. 3-182.

Possible Solution

Chemical background in the manifold is elevated.

- Remedy leaks or sources of water contamination in carrier gas. See 3.6 High Vacuum Symptoms pp. 3-187.

Symptom: Automatic Tune reports "Cannot calibrate resolution".

Possible Solution

Contaminant ions interfere with *m/z* 100 or *m/z* 502.

- Allow contaminants to pump away.

Possible Solution

Calibration gas ions (*m/z* 69, 131, 264) are present but more than ±12.5% or ±20 u off, whichever is smaller.

1. **Adjust mass calibration manually by configuring Tune to display Manual Calibration in the Instrument Configuration Service tab.**

2. **Enter the observed m/z for calibration gas ions in Manual Calibration and select Mass Calibrate.**

Possible Solution

The calibration gas vial is empty.

- Add 100 µL (max) to calibration gas vial.

Possible Solution

DC/RF gain is set incorrectly.

- Contact Technical Support.

Symptom: Automatic Tune reports "Cannot perform mass calibration".

Possible Solution

Resolution is not calibrated.

- Calibrate resolution by running Automatic Tune.

Possible Solution

Contaminant ions interfere with calibration gas ions.

- Allow contaminants to pump away.

Possible Solution

Calibration gas ions (*m/z* 69, 131, 264) are present but more than ±12.5% or ±20 u off, whichever is smaller.

1. **Adjust mass calibration manually by configuring Tune to display Manual Calibration in the Instrument Configuration Service tab.**

2. **Enter the observed m/z for calibration gas ions in Manual Calibration and select Mass Calibrate.**

Possible Solution

The calibration gas vial is empty.

- Add 100 µL (max) to calibration gas vial.

Symptom: Automatic Tune reports "An air leak has been detected".

Possible Solution

There may be an air leak.

- See 3.6 High Vacuum Symptoms pp. 3-187.

Symptom: Tune reports an error while saving a Tune file.

Possible Solution

A file with the same name already exists with read-only attributes.

- Change the existing file's attributes so it can be overwritten.

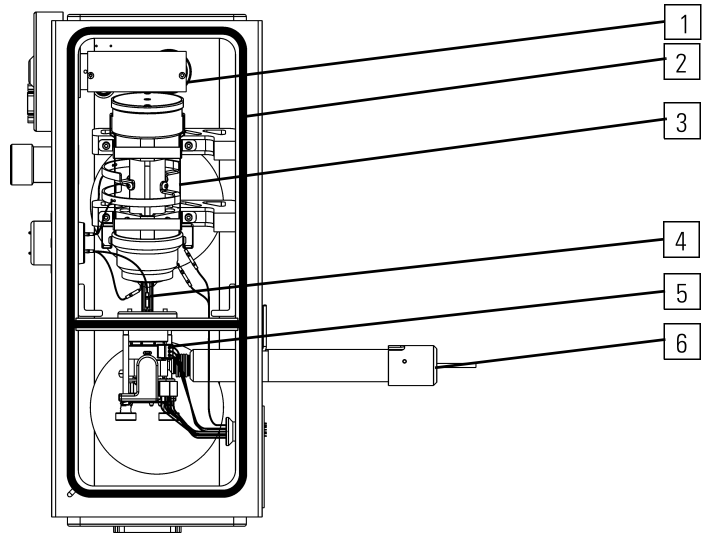
Chapter 4 Vacuum System and Gas Inlets

This chapter contains theory of operations for the vacuum system and gas inlets.

In This Chapter

- 4.1 Vacuum System Components pp. 4-214
- 4.2 Description pp. 4-215
- 4.3 Theory of Operations pp. 4-216
- 4.4 Gas Inlets Components pp. 4-221
- 4.5 Description pp. 4-222
- 4.6 Theory of Operations pp. 4-223

4.1 Vacuum System Components



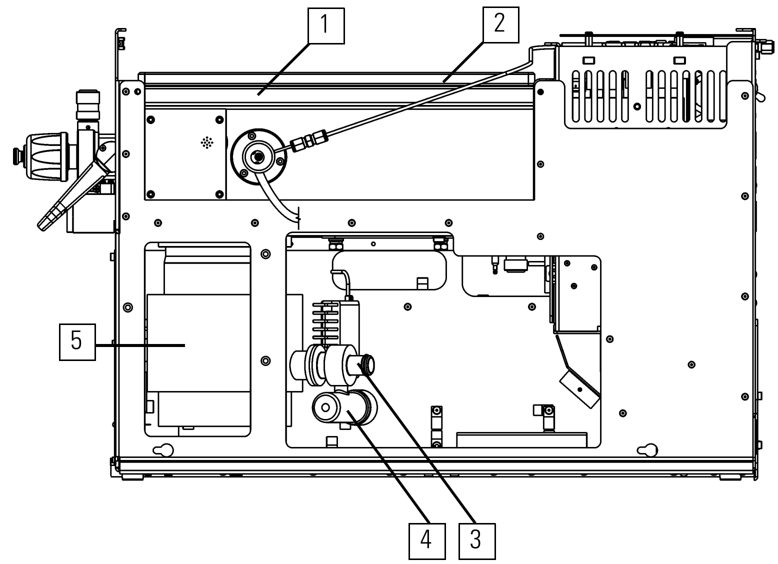
1	Ion Detector Assembly	4	Prefilter
2	O-Ring	5	Ion Source Assembly
3	Quadrupole Assembly	6	Transfer Line

Figure 4-1. Vacuum Manifold Components

Vacuum System primary components:

- Forepressure Gauge
- High Vacuum Pump (Turbomolecular)
- Ion Gauge (Upgrade Option)
- Rotary-Vane Pump
- Vacuum Manifold

4.2 Description



1	Vacuum Manifold	4	Forepressure Gauge
2	Ion Gauge (on Left Side of Vacuum Manifold)	5	High Vacuum Pump
3	Foreline Adapter (Connects the Foreline Hose to the Rotary-Vane Pump		

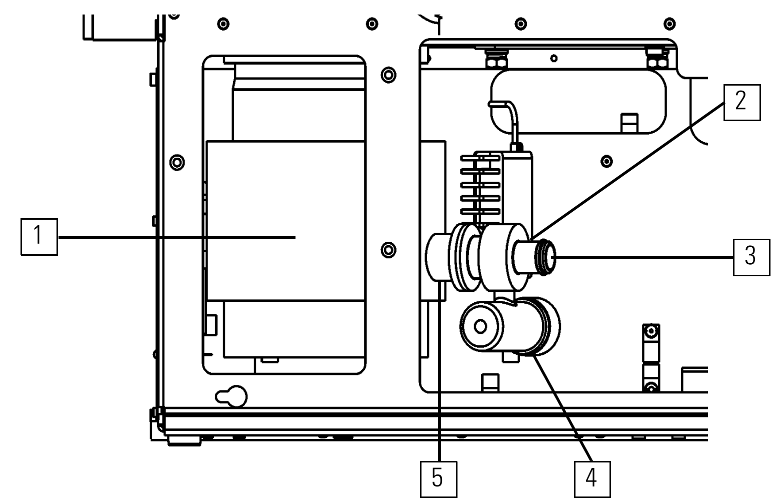
Figure 4-2. Vacuum System Components (Right Side)

Vacuum system components lower the pressure within the *DSQ II*. The principal components include: the Forepressure Gauge, High Vacuum Pump, Ion Gauge, Rotary-Vane Pump, and the Vacuum Manifold. This also includes valves, gauges, and associated control devices. All but the Rotary-Vane Pump are located around the vacuum manifold.

4.3 Theory of Operations

These components maintain the low pressure necessary for the Ion Source, Quadrupole, and Ion Detector Assembly to operate properly. The Vacuum Manifold, which houses the Ion Source, Quadrupole, and Ion Detector Assembly, is pumped (or evacuated) by the High Vacuum Pump.

Forepressure Gauge and Foreline Adapter



1	High Vacuum Pump	4	Forepressure Gauge
2	Foreline Adapter	5	High Vacuum Pump Outlet
3	Foreline Hose Outlet		

Figure 4-3. Forepressure Gauge and Foreline Adapter (Right Side)

The Forepressure Gauge and Foreline Adapter are connected to the outlet of the High Vacuum Pump. The Forepressure Gauge measures the pressure in the foreline. If the pressure inside become too high, the Vacuum Control PCB removes power to the High Vacuum Pump to prevent damage.

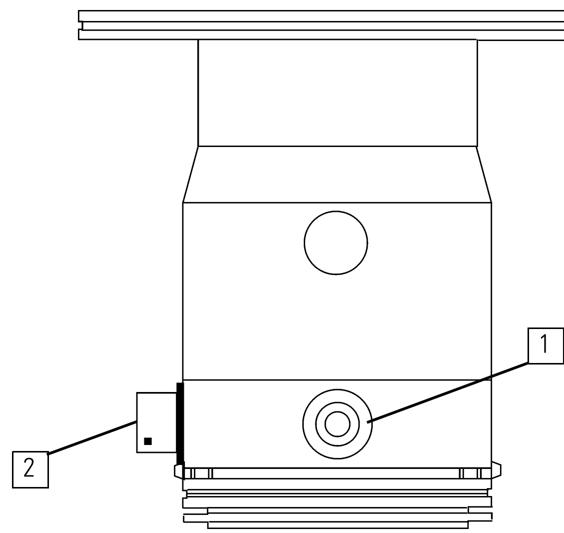
The Foreline Adapter connects the Foreline Hose from the Rotary-Vane Pump inlet to the High Vacuum Pump Outlet.

High Vacuum Pump (Single Turbomolecular Pump)

The High Vacuum Pump creates the low pressure require by the Ion Source, Quadrupole, and Ion Detector Assembly. The *DSQ II* can be equipped with one of two types of single Turbomolecular Pumps: a 70 L/s or a 250 L/s.

In this configuration, the Ion Source, Quadrupole, and Ion Detector Assembly are pumped by a single pump. The 250 L/s pump is recommended for application that use high gas flows into the Vacuum Manifold such as CI.

Turbomolecular Pump operation is purely mechanical and does not require oil to create a high vacuum. These Turbomolecular Pumps have a multi-stage axial-flow turbine in which high speed rotating blades provide compression by increasing the probability of gas molecules moving in the pumping direction. The Turbomolecular Pump requires the use of a Rotary-Vane Pump to exhaust to atmosphere.



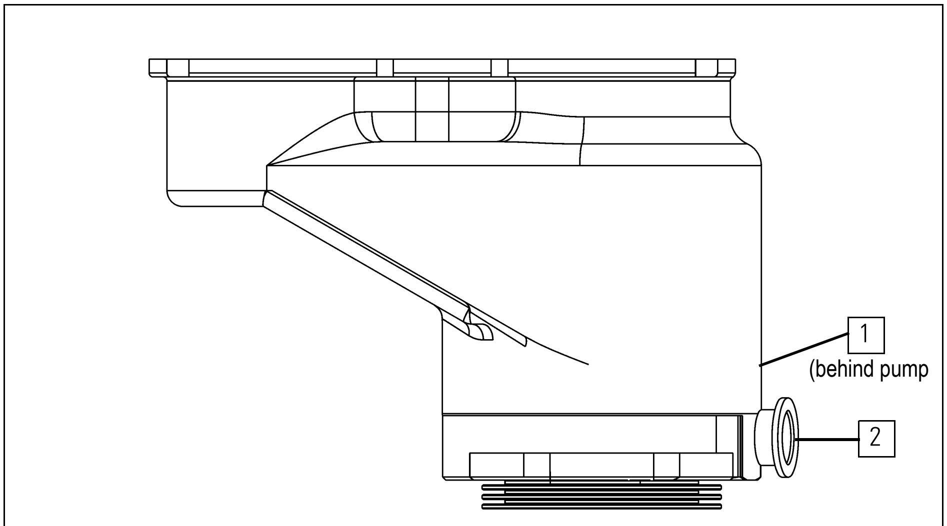
1	Turbomolecular Pump Outlet	2	Electrical Supply Connector

Figure 4-4. 70 L/s Turbomolecular Pump

High Vacuum Pump (Split-Flow Turbomolecular Pump)

As an upgrade option, a differentially pumped configuration of *DSQ II* is available. In a differentially pumped instrument, the Ion Source is pumped separately from the Quadrupole and Ion Detector Assembly. Rather than using two individual Turbomolecular Pumps, a split-flow Turbomolecular Pump is used. Such a pump uses less power, is more reliable, and less expensive than two separate pumps.

With a differentially pumped system, you can use higher flow rates of gas (helium from the GC and CI reagent gas) into the Ion Source without adversely affecting the performance of the Quadrupole. Sensitivity and resolution are optimum when the pressure in the Quadrupole is low.



1	Electric Supply Connector (Not Shown)	2	Turbomolecular Pump Outlet

Figure 4-5. Split-flow Turbomolecular Pump

Ion Gauge (Upgrade Option)

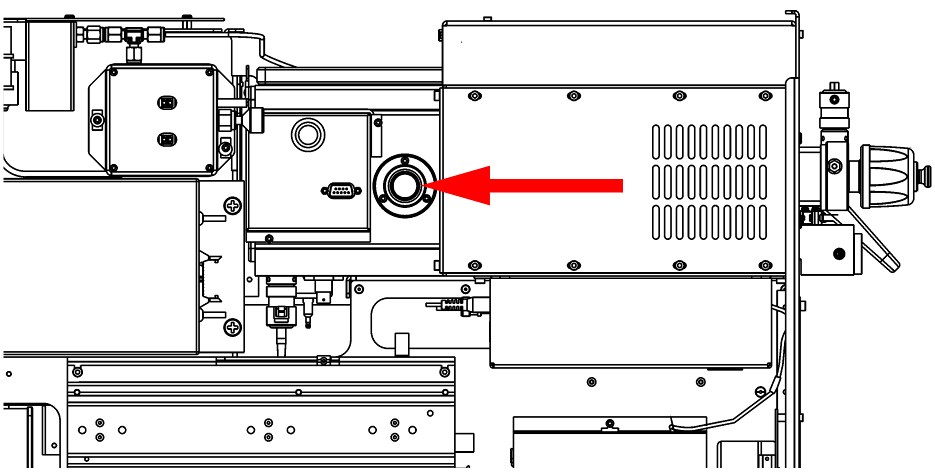
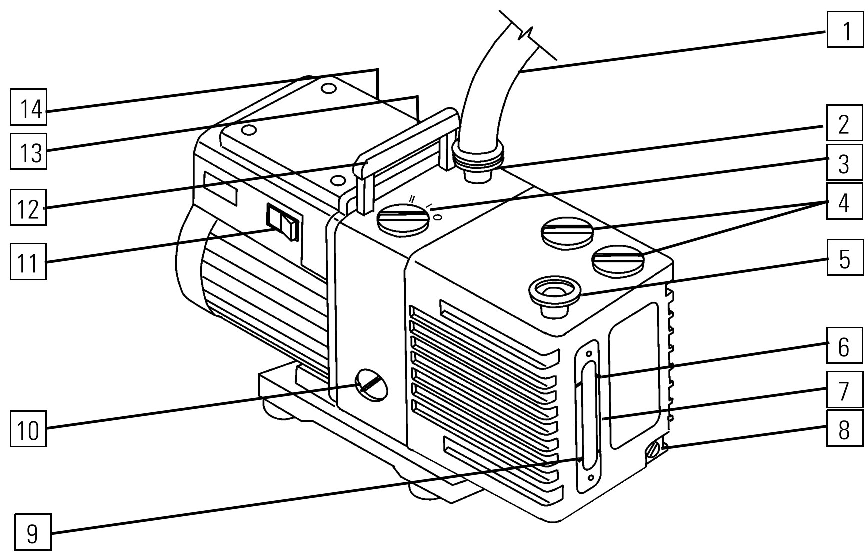


Figure 4-6. Ion Gauge (Left Side)

The Ion Gauge mounts on the left side of the Vacuum Manifold. An Ion Gauge measures the pressure inside the Vacuum Manifold, and produces energetic electrons to ionize molecules. Positive ions formed in the Ion Gauge are attracted to a collector. The collector current is related to the pressure in the Vacuum Manifold.

If you have an Ion Gauge, it must be on and the pressure below $1x10^{-3}$ Torr to turn on the Filament, Electron Multiplier, or Conversion Dynode. This protects these assemblies from damage.

Rotary-Vane Pump



1	Foreline Vacuum Hose	8	Drain Plug
2	Inlet Port	9	MIN (Minimum Level Mark)
3	Gas-Ballast Control	10	Mode Selector
4	Oil Filler Plugs	11	On/Off Switch
5	Outlet Port	12	Handle
6	MAX (Maximum Level Mark)	13	Voltage Indicator
7	Oil-Level Sight-Glass	14	Electrical Inlet Connector

Figure 4-7. Rotary-Vane Pump

The Rotary-Vane Pump is typically located on the floor behind the *DSQ II*. It is a two-stage forepump that connects to the outside of the *DSQ II*. It establishes the vacuum necessary for properly operating the High Vacuum Pump.

The Rotary-Vane Pump connects to the High Vacuum Pump by a piece of 0.75 in. ID tubing. The power cord plugs into the rear of the *DSQ II* in the outlet labeled MECH PUMP. This outlet powers the pump and is controlled by the main circuit breaker and not by the service switch.

CAUTION

Instrument Damage. Always plug the Rotary-Vane Pump power cord into the outlet on the rear of the *DSQ II* and never into a wall outlet. If the pump is not plugged into the *DSQ II* rear it will not shut down when the instrument is powered off. As a result, the pump will continue to run and the *DSQ II* will not be able to vent to atmosphere.

Vacuum Manifold

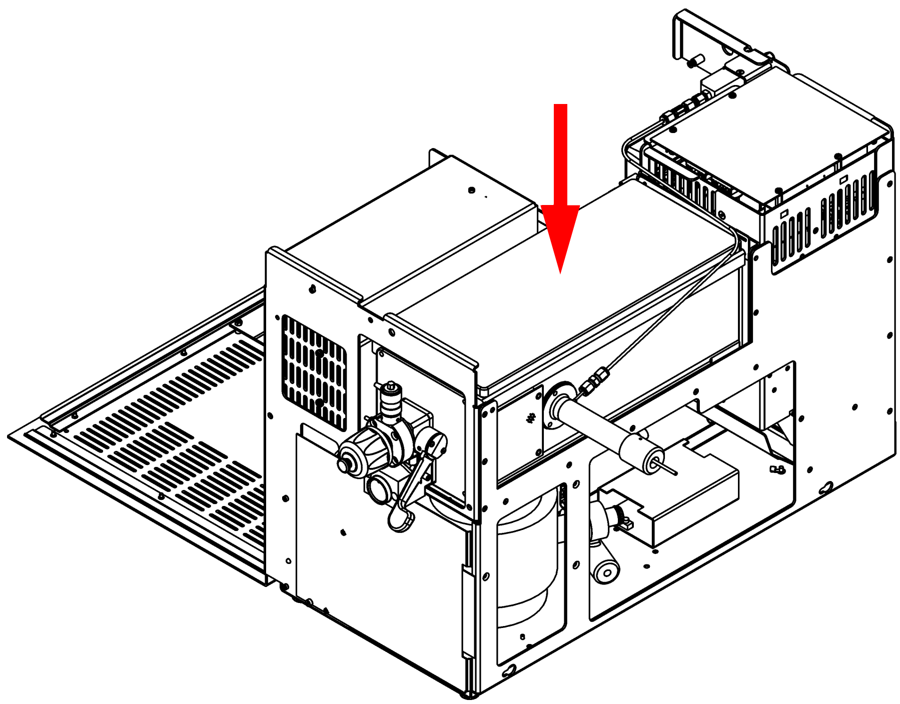


Figure 4-8. Vacuum Manifold (Front, Right Side)

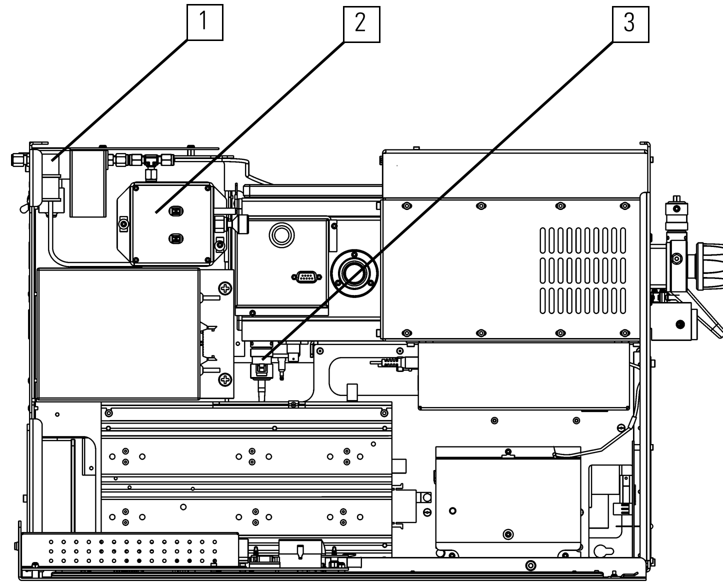
The Vacuum Manifold is located on the top right of the *DSQ II*, directly above the High Vacuum Pump. The Vacuum Manifold is a thick walled, aluminum chamber which encases the heart of the *DSQ II* (the Ion Source, Quadrupole, and Ion Detector Assembly). The Vacuum Manifold has a removable cover, machined flanges on the front and rear, and various electrical feedthroughs and gas inlets.

4.4 Gas Inlets Components

Gas Inlets primary components:

- Calibration Gas Flow Module
- CI Reagent Gas Flow Module (Upgrade Option)
- Vent Valve Solenoid

4.5 Description



1	CI Reagent Gas Flow Module	3	Vent Valve Solenoid
2	Calibration Gas Flow Module		

Figure 4-9. Gas Inlets (Left Side)

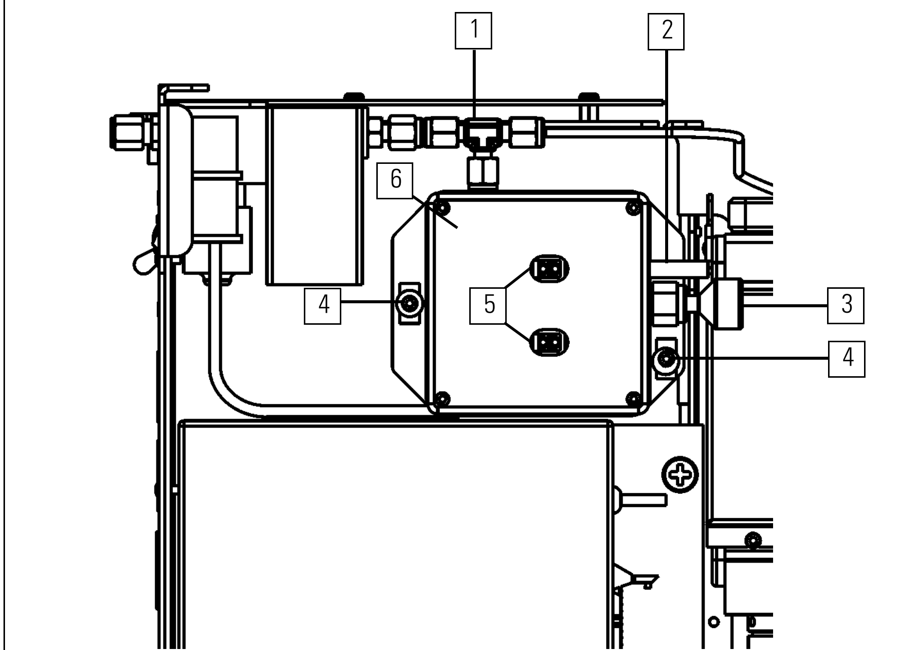
There are three Gas Inlets to the Vacuum Manifold. A Calibration Gas Flow Module for calibration compound control, a CI Reagent Gas Flow Module which regulates the flow of CI reagent gas into the Ion Source, and a Vent Valve Solenoid for venting the Vacuum Manifold to the atmosphere.

4.6 Theory of Operations

Gas Inlets control the input of various gases into the Vacuum Manifold.

Calibration Gas Flow Module

The Calibration Gas Flow Module controls the flow of calibration compound into the Ion Source and is mounted at the back left of the *DSQ II*. The calibration compound provides reference peaks to tune and calibrate the detector.



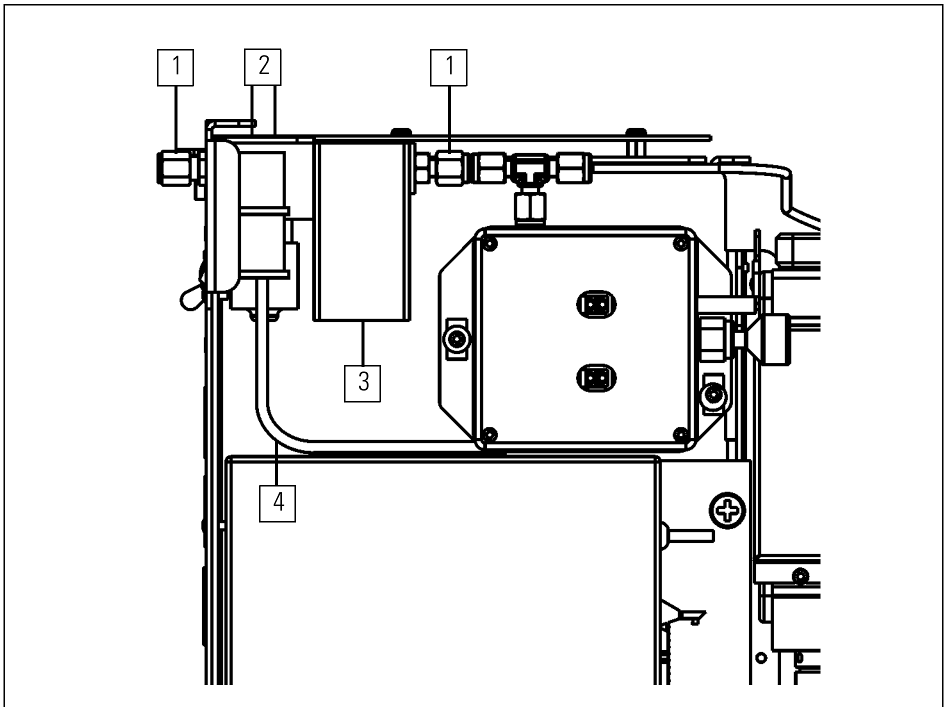
1	Gas Fittings	4	Screws, 2
2	Foreline Adapter Tubing	5	Cables, 4
3	Calibration Compound Vial	6	Calibration Gas Flow Module

Figure 4-10. Calibration Gas Flow Module (Left Side)

The module can deliver two different flows of calibration compound. One is a low flow for EI and NICI. The other is a higher flow used for PICI. The module permits calibration compound to enter the Ion Source through 1/8 in. o.d. tubing.

The module is factory charged with 0.1 mL of perfluorotributylamine, which is adequate for approximately one year of operation.

CI Reagent Gas Flow Module (Upgrade Option)

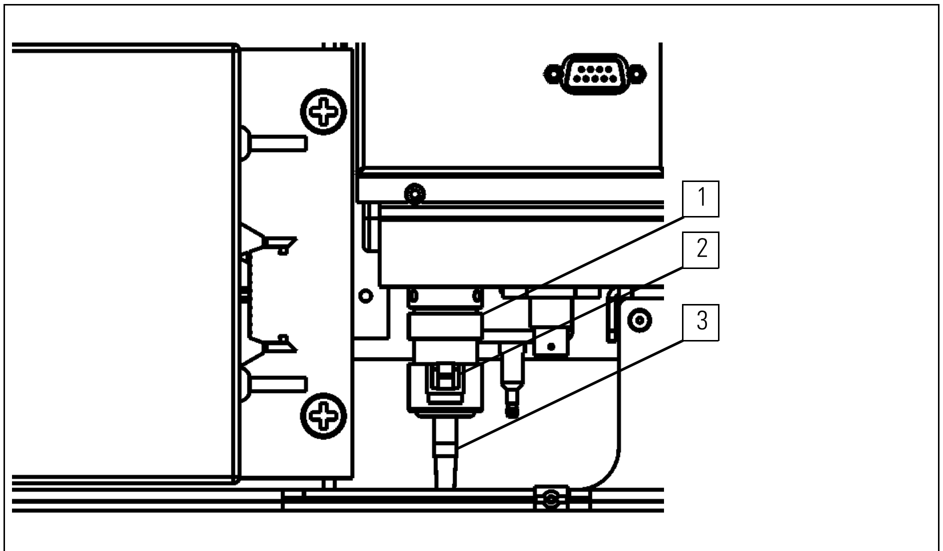


1	Gas Fittings, 2	3	Cable (to Analog PCB)
2	Screws Holding the Module, 2	4	Foreline Adapter Tubing

Figure 4-11. CI Reagent Gas Flow Module (Left Side)

The CI Reagent Gas Flow Module controls the flow of CI reagent gas into the Ion Source and is located at the back left of the *DSQ II*. The module uses electronic pressure control to precisely set the flow of reagent gas. The flow is programmed using *Xcalibur*, which allows you to accurately reproduce flows.

Vent Valve Solenoid



1	Vent Valve Solenoid	3	Vent Valve Filter
2	Cable		

Figure 4-12. Vent Valve Solenoid (Left Side)

The Vent Valve Solenoid allows the Vacuum Manifold to vent to atmospheric pressure and is mounted on the bottom of the Vacuum Manifold. It is controlled by the Vacuum Control PCB. The Vent Valve Filter prevents dust and debris from getting in the Vacuum Manifold.

When the main circuit breaker is on, the Vacuum Control PCB supplies power to the Vent Valve Solenoid to keep it closed. Approximately two to three seconds after power is removed from the system, the Vent Valve Solenoid opens and the Vacuum Manifold is vented to atmospheric pressure. This process takes about four minutes.

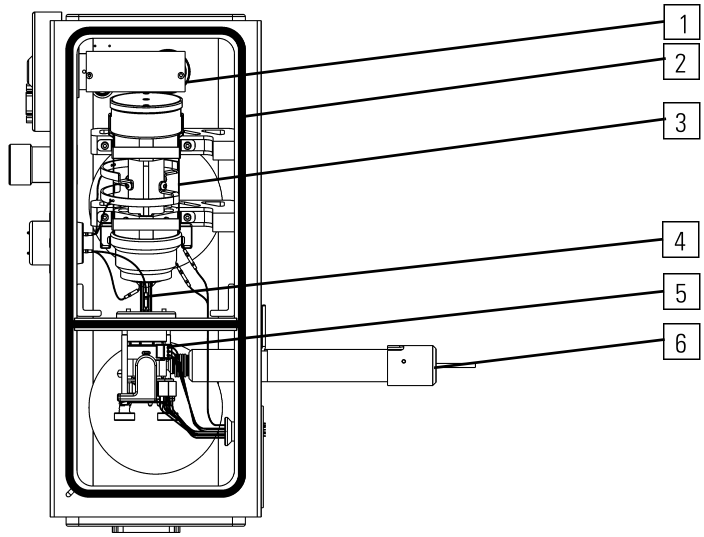
Chapter 5 Ion Source and Inlet Valve

This chapter contains theory of operations for ion source components and the inlet valve.

In This Chapter

- 5.1 Ion Source Components pp. 5-228
- 5.2 Description pp. 5-229
- 5.3 Theory of Operations pp. 5-230
- 5.4 Inlet Valve Components (Upgrade Option) pp. 5-236
- 5.5 Description pp. 5-237
- 5.6 Theory of Operations pp. 5-238

5.1 Ion Source Components



1	Ion Detector Assembly	4	Prefilter
2	O-Ring	5	Ion Source Assembly
3	Quadrupole Assembly	6	Transfer Line

Figure 5-1. Vacuum Manifold Components

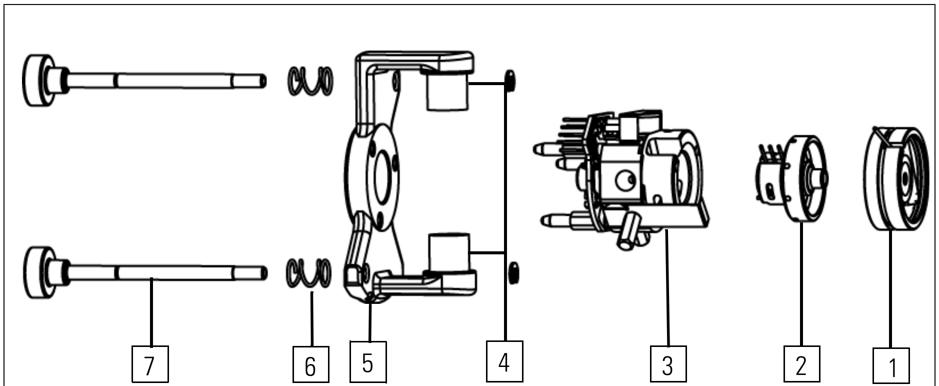
Ion Source (EI or CI) primary components:

- Filament Assembly
- Ion Source Block Assembly
- Ion Volume Assembly
- Lenses
- Magnets and Magnet Support

5.2 Description

The Ion Source is the part of the mass spectrometer where ions are formed. It is located inside and to the front of the Vacuum Manifold.

The Ion Source uses an interchangeable Ion Volumes so that two different ionization modes can be used (EI or CI). The Ion Volume sits inside the Ion Source Block, which is heated by three Cartridge Heaters. Three lenses at the exit of the Ion Volume draw out either positive or negative ions from the Ion Volume and pass them into the Prefilter.



1	Source Spacer, with PreFilter Lens	5	Magnet Support
2	Lens Assembly	6	Spring, 2
3	Ion Source Block Assembly	7	Thumbscrew, 2
4	Magnet, 2		

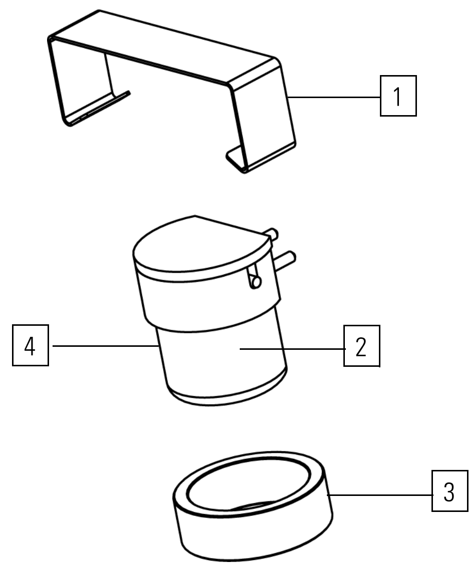
Figure 5-2. Ion Source Assembly

5.3 Theory of Operations

An Ion Source has two main functions: to generate a beam of electrons, and to provide a site for these electrons to interact with sample or reagent gas molecules to form ions. Once formed, these ions are then focused by the Lenses into the Prefilter and then the Quadrupole Mass Filter.

Filament Assembly

A Filament Assembly contains an Electron Lens, Filament, Filament Spacer, and Reflector. It is positioned on top of the Ion Source Block and plugs into the 3-pin Filament Connector on the Ion Source PCB.



1	Filament Retainer Clip	3	Filament Spacer
2	Filament and Reflector (inside Electron Lens)	4	Electron Lens

Figure 5-3. Filament Assembly

An Electron Lens (the metal cylinder enclosing the Filament and Reflector) prevents positive ions from traveling up the electron beam, extending the life of the Filament. It is located between the Filament and the Ion Volume. The voltage applied to the electron lens affects the flux of electrons that enter the ion volume.

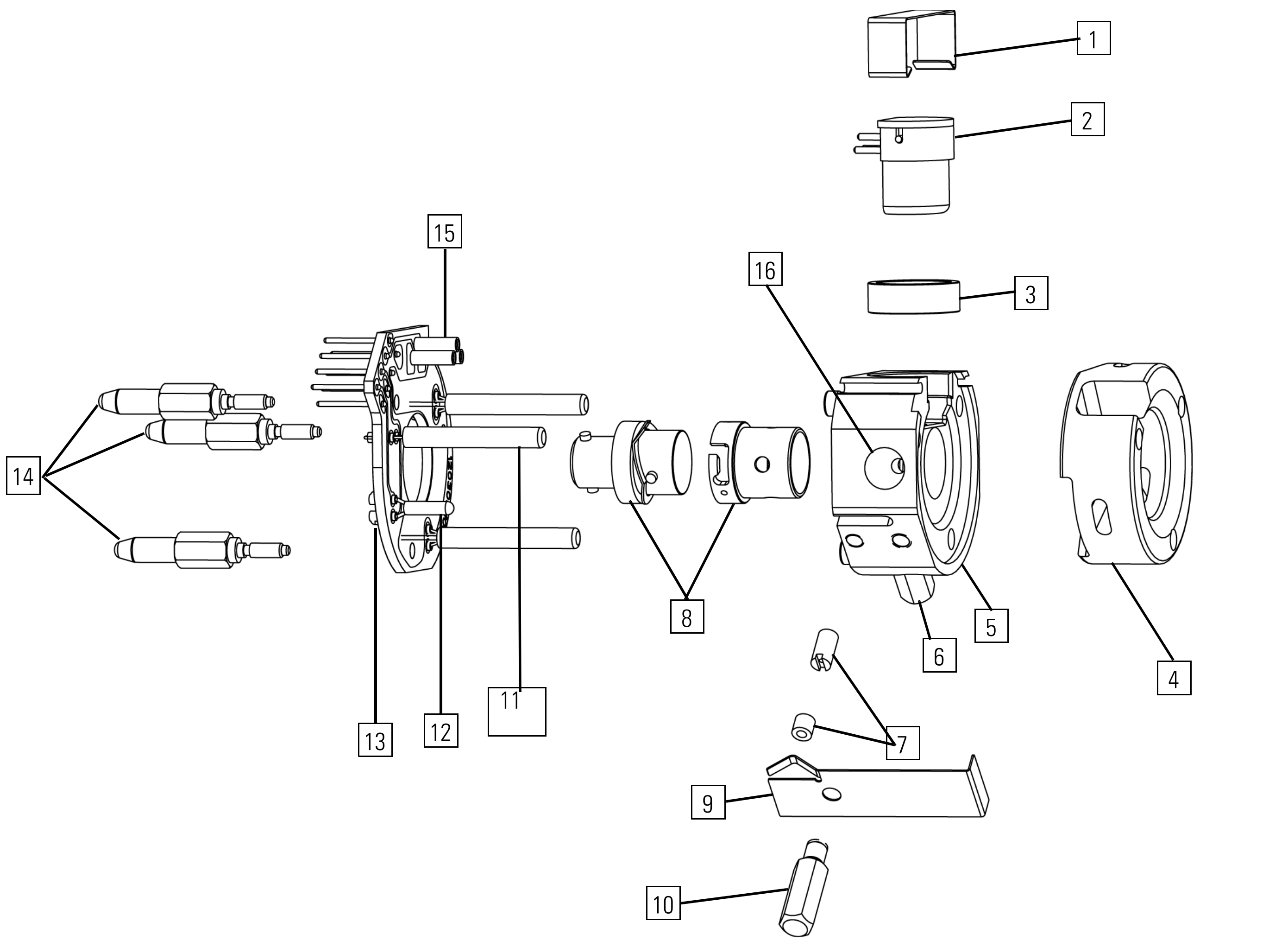
Notice that the Filament is a rhenium wire inside the Electron Lens that is electrically heated to produce electrons by thermionic emission.

A Reflector is located inside the Electron Lens, and repels electrons emitted by the Filament toward the Ion Volume. Filaments and reflectors are maintained at negative potential relative to the Ion Volume, usually -70 V. The electrons emitted by the Filament are accelerated into the Ion Volume.

The Filament Spacer is a ceramic ring that aligns the Filament with the electron entrance hole in the Ion Source Block and Ion Volume.

Likewise, the Filament Retainer Clip is a metal clip that ensures good alignment and fit of the filament to the source block.

Ion Source Block Assembly



1	Filament Retainer Clip	9	Spring
2	Filament	10	Spring Thumbscrew
3	Filament Spacer	11	Cartridge Heaters, 3
4	Heater Ring	12	Temperature Sensor
5	Ion Source Block	13	Ion Source PCB
6	Alignment Pin/Ion Volume Key Thumbscrew	14	Base-Studs, 3
7	Ion Volume Pin/Set Screw & Ball Plunger	15	3-pin Filament Connector
8	Ion Volume and Holder	16	Sample Inlet Aperture

Figure 5-4. Ion Source Block Assembly

During operation, the Ion Source Block holds an Ion Volume in its center. It is aligned by the Ion Volume Key Thumbscrew and secured by the Ball Plunger. Samples are introduced from a GC through the Transfer Line into the sample inlet aperture located on the side of the Ion Source Block. Calibration compound and chemical ionization reagent gas also enter the Ion Volume through the Transfer Line.

The Ion Source PCB supplies voltages to the Filament, Electron Lens, and Cartridge Heaters, as it passes signals from the Temperature Sensor.

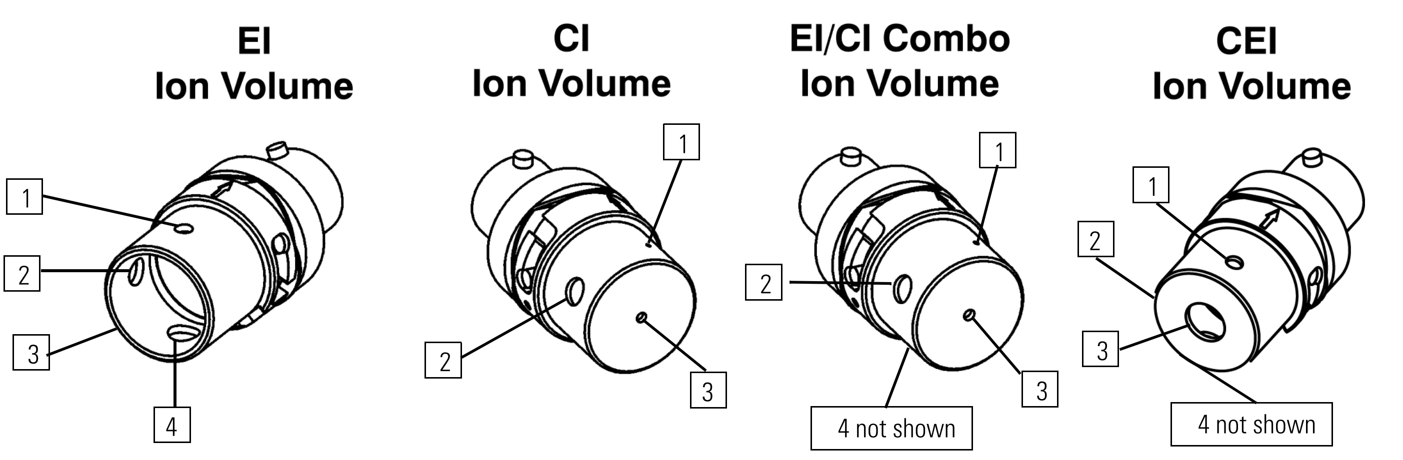
Three Base Studs hold the Ion Source PCB to the Ion Source Block. These studs slip into the Magnet Support and position the Ion Source Block between two permanent Magnets.

Three Cartridge Heaters and a Temperature Sensor are mounted on the Ion Source PCB. Cartridge Heaters pass through and heat the Ion Source Block, as well as heat, align, and support the three ion source Lenses. The Temperature Sensor monitors the temperature of the Ion Source Block.

The Heater Ring slips over the Cartridge Heaters and transfers heat to the Lenses.

Ion Volume Assembly

The Ion Volume Assembly consists of the Ion Volume Holder and the Ion Volume. The Ion Volume Assembly is located in the center of the Ion Source.

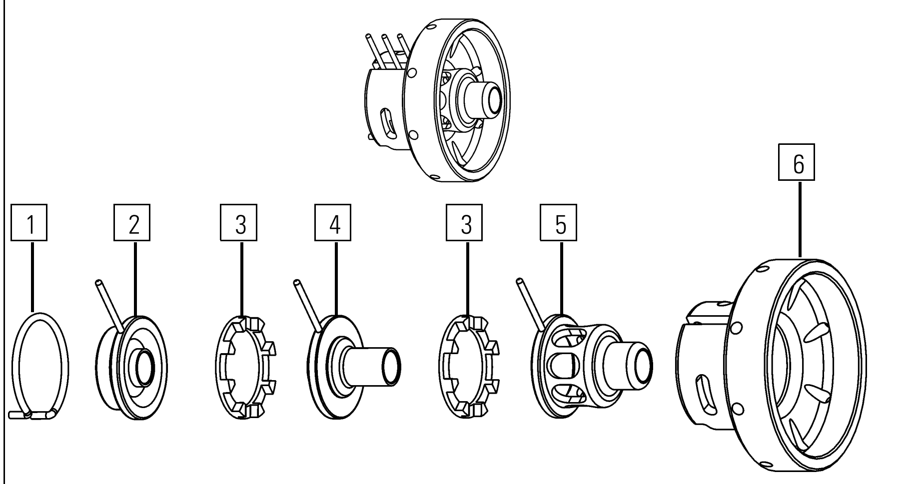


1	Electron Entrance Hole	3	Ion Exit Hole
2	GC Effluent, Calibration Gas, CI Reagent Gas Entrance Hole	4	Electron Exit Hole

Figure 5-5. EI, CI, EI/CI Combo, and CEI Ion Volume Assemblies

The Ion Volume Assembly is the site where the molecules interact with energetic electrons to form ions. Different Ion Volumes are needed for EI and CI operation modes. These optimized geometries maximize sensitivity for each ionization mode. An EI/CI combination Ion Volume is available that offers a compromise in sensitivity for both EI and CI. It allows you to switch ionization modes from one run to the next. This is especially useful for qualitative analysis.

Lenses



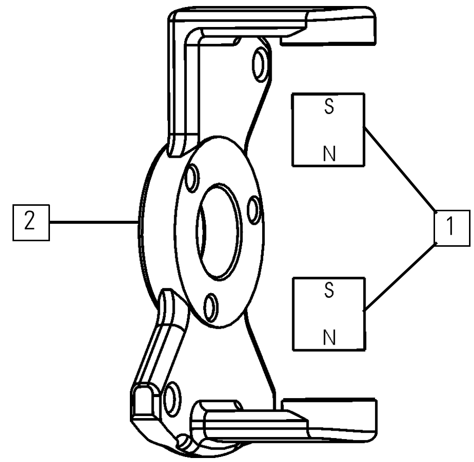
1	Lens Clip	4	Lens 2
2	Lens 1	5	Lens 3
3	Lens Spacer, 2	6	Lens Holder

Figure 5-6. Ion Source Lenses

Lenses transmit the ions formed in the Ion Volume to the Prefilter. The Lenses are stainless steel plates and tubes to which voltages are applied. The three Lenses are designated L1, L2, and L3, with L1 being nearest to the Ion Volume.

A lens' electrical connection is made through a stainless steel pin protruding from the edge of the lens. A small 3-pin Lens Connector attaches to these pins and carries the voltage from the electrical feedthrough to the Lens.

Magnets and Magnet Support



1	Magnets	2	Magnet Support

Figure 5-7. Magnets and Magnet Support

Two Magnets focus emitted electrons into a beam that spirals through the Ion Volume. The spiraling of the beam ensure optimum ionization of the sample. The Magnet Support holds the two Magnets in the proper position above and below the Ion Source Block.

Position both Magnets so the south pole is on top otherwise sensitivity will be poor. Electrons are not focused into the Ion Volume if one Magnet is upside down.

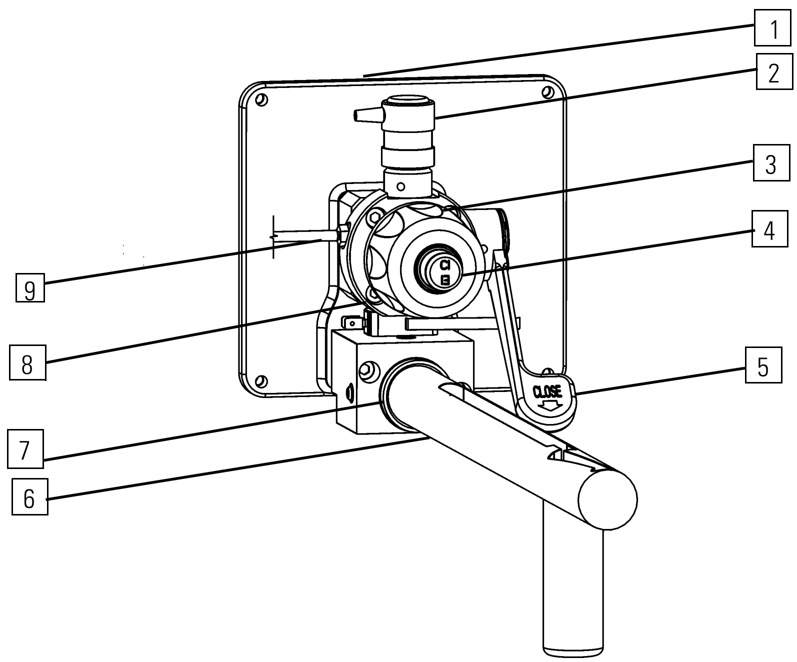
5.4 Inlet Valve Components (Upgrade Option)

Inlet Valve primary components:

- Ball Valve
- Inlet Valve Lever
- Entry Housing
- I/R Tool and Guide Bar
- Inlet Valve Plug
- Inlet Valve Seal

5.5 Description

The Inlet Valve mounts on the front of the Vacuum Manifold and is the vacuum interlock mechanism for the *DSQ II*. The Inlet Valve is a vacuum sealed valve through which you insert and remove the Ion Volume Assembly using an I/R (Insertion/Removal) Tool.



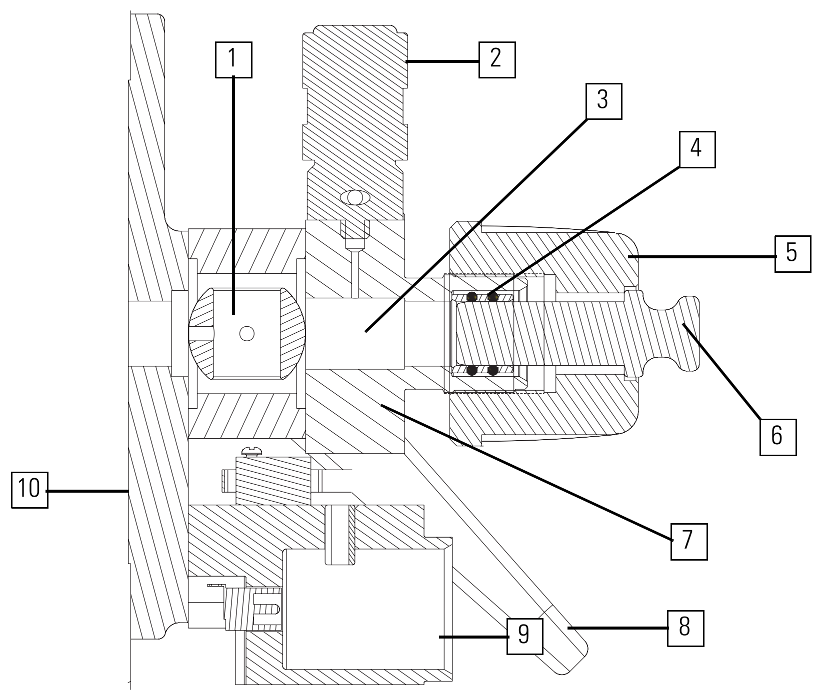
1	Vacuum Manifold	6	Guide Bar
2	Inlet Valve Solenoid	7	Guide Bar Entry
3	Inlet Valve Knob (Ferrule Inside)	8	Hex Socket Screws, 4
4	Inlet Valve Plug	9	Foreline Hose Connection
5	Inlet Valve Lever		

Figure 5-8. Inlet Valve Components (I/R Tool Not Shown)

5.6 Theory of Operations

With the use of the I/R Tool and Guide Bar, the Inlet Valve lets the Ion Volume Assembly be removed or installed in the Ion Source without having to vent the Vacuum Manifold to atmospheric pressure. Once excess pressure is removed by opening the Inlet Valve Solenoid, the Inlet Valve can be opened which allows the I/R Tool to be inserted into the Vacuum Manifold. Excess pressure introduced into the Inlet Valve when inserting the I/R Tool is removed through the Foreline Hose Connection back to either a secondary rotary-vane pump or the primary rotary-vane pump.

Ball Valve



1	Ball Valve	6	Inlet Valve Plug
2	Inlet Valve Solenoid	7	Inlet Valve Block
3	Inlet Valve Chamber	8	Ball Valve Lever
4	Inlet Valve Seal	9	Entry Housing
5	Inlet Valve Knob	10	Vacuum Manifold

Figure 5-9. Inlet Valve Components (Left Side Cross Section)

A Ball Valve is a ball with a hole through it and is located inside the Inlet Valve. The Ball Valve is open when the hole in the ball is aligned with the opening between the Vacuum Manifold and the Inlet Valve Chamber. When the Ball Valve is closed, it prevents the Vacuum Manifold from venting to atmosphere.

Inlet Valve Lever

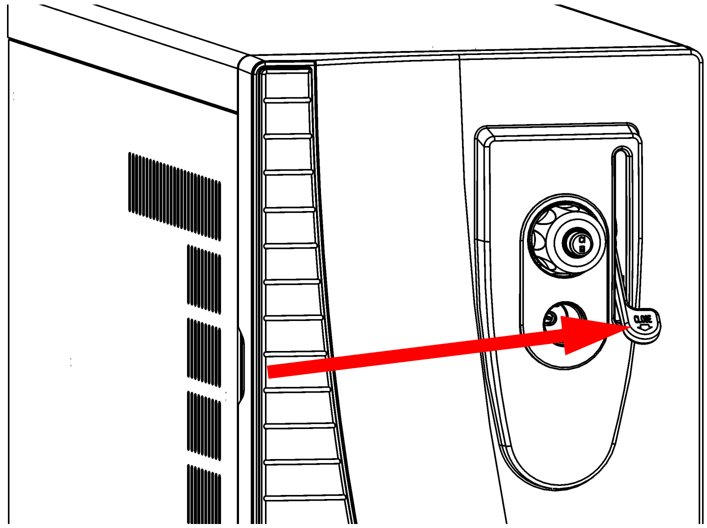


Figure 5-10. Inlet Valve Lever

Open and close the Ball Valve with the Inlet Valve Lever. When the Inlet Valve Lever is up, the Ball Valve is open. The Ball Valve is closed when the Inlet Valve Lever is in the down position. The lever turns the Ball Valve to allow a probe device (sample probe or I/R Tool) to enter the Vacuum Manifold.

Entry Housing

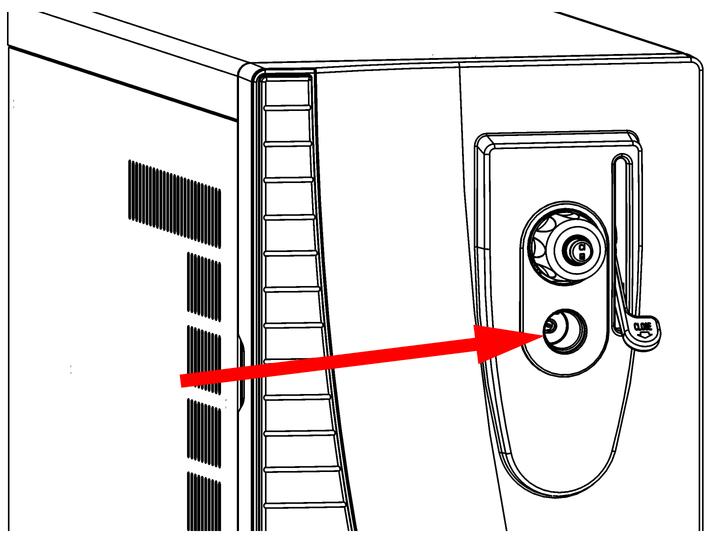
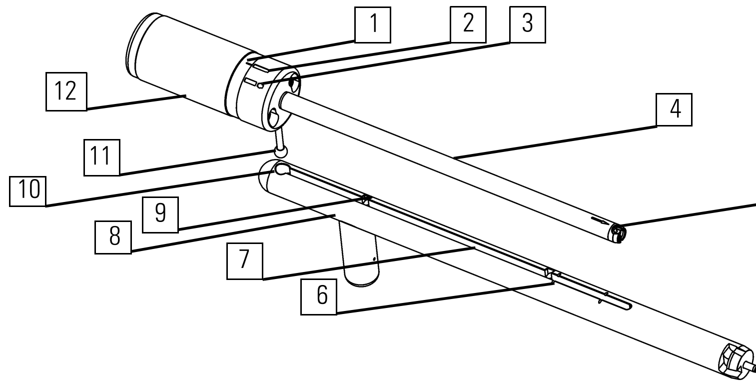


Figure 5-11. Entry Housing

The Entry Housing is an aluminum chamber mounted on the Vacuum Manifold. The Entry Housing has an opening for the Guide Bar.

I/R Tool and Guide Bar



1	Alignment Line	7	Guide Bar Track
2	Hold Position	8	Guide Bar
3	Release Position	9	Guide Bar First Stop
4	I/R Tool	10	Guide Ball Hole
5	Bayonet Lock	11	Guide Ball
6	Guide Bar Second Stop	12	Handle

Figure 5-12. I/R Tool and Guide Bar

The I/R Tool is used to insert and remove Ion Volume Assemblies, and consists of a Shaft, Handle, and Guide Ball. The I/R Tool is designed to be used with the Guide Bar. The Guide Ball located on the I/R Tool fits inside a hole located on the Guide Bar, then slides forward along the Guide Ball Track. The Guide Bar is designed to accurately stop the I/R Tool the correct distance within the Inlet Valve in order to evacuate atmospheric pressure before opening the Ball Valve. Once the Ball Valve is opened, the I/R Tool is slid along the Guide Bar Track all the way into the Vacuum Manifold.

Inlet Valve Plug

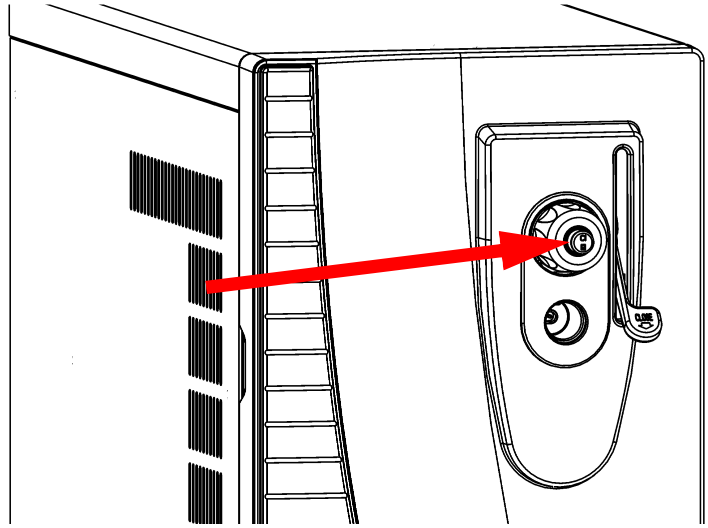


Figure 5-13. Inlet Valve Plug

The Inlet Valve Plug seals the opening of the Inlet Valve when it is not in use. The Inlet Valve Plug is etched with “EI” on one side and “CI” on the other to remind you whether an EI or CI Ion Volume is installed.

Inlet Valve Seal

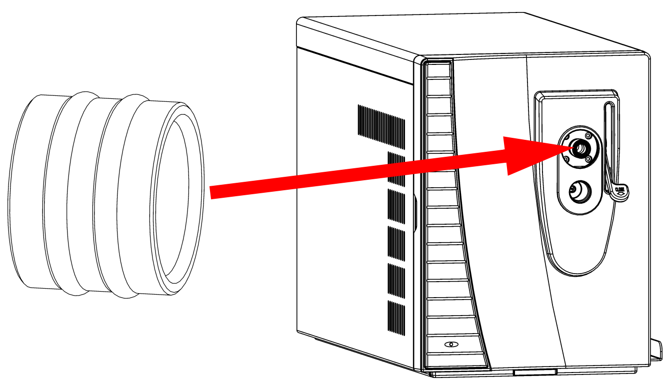


Figure 5-14. Inlet Valve Seal

An Inlet Valve Seal forms a vacuum-tight seal over the shaft of the I/R Tool when it is inserted into the Inlet Valve. The Inlet Valve Knob allows you to tighten the seal against the I/R Tool to form a vacuum-tight seal. Or, you can loosen it to allow the I/R Tool to be inserted and removed. You should replace the Inlet Valve Seal periodically.

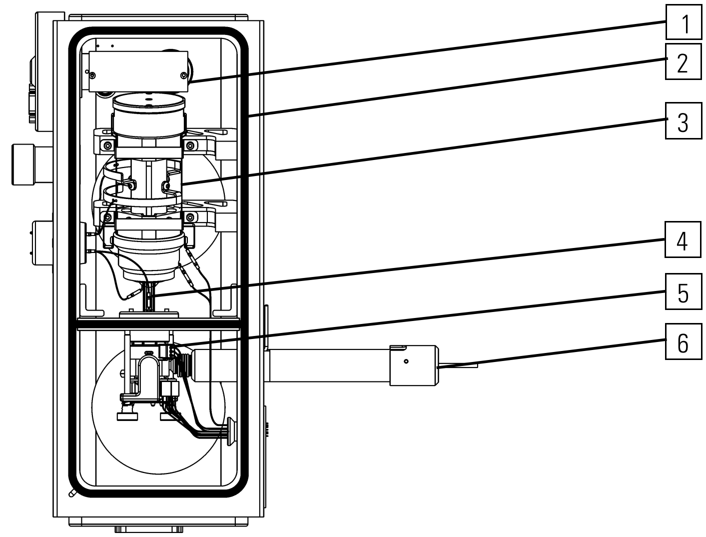
Chapter 6 Prefilter and Quadrupole Assembly

This chapter contains theory of operations for the prefilter and quadrupole mass filter.

In This Chapter

- 6.1 Components pp. 6-244
- 6.2 Description pp. 6-245
- 6.3 Theory of Operations pp. 6-246

6.1 Components



1	Ion Detector Assembly	4	Prefilter
2	O-Ring	5	Ion Source Assembly
3	Quadrupole Assembly	6	Transfer Line

Figure 6-1. Vacuum Manifold Components

Quadrupole primary components:

- Prefilter
- Entrance Lens
- Quadrupole Mass Filter
- Exit Lens

6.2 Description

After ions leave the Ion Source Lenses, they pass through the Prefilter. The Prefilter is mounted to the back side of the Baffle Wall and consists of four metal rods held in a square array. The Prefilter is curved to prevent neutral species (like helium) from reaching the Ion Detector Assembly. Ions next pass through the Entrance Lens and into the Quadrupole Mass Filter. The Quadrupole Mass Filter, like the Prefilter, is composed of four metal rods held in a square array. However, these rods are precisioned aligned so the assembly should be handled with care. Finally, ions pass through the Exit Lens and to the Ion Detector Assembly.

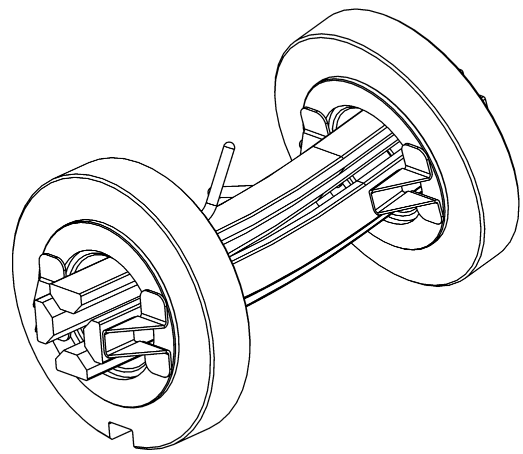


Figure 6-2. Prefilter

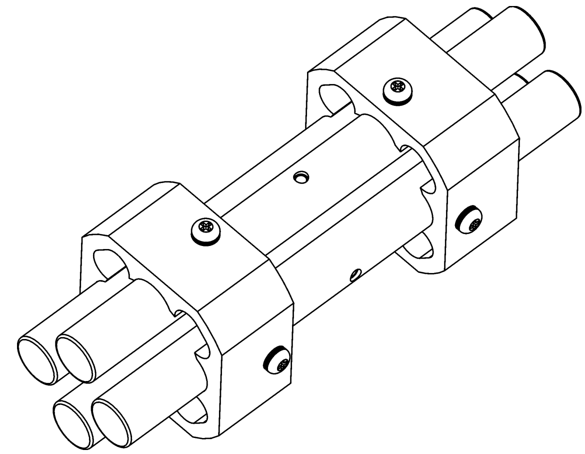


Figure 6-3. Quadrupole Mass Filter

6.3 Theory of Operations

The four Quadrupole Mass Filter rods are charged with a combination of radio frequency (RF) and direct current (DC) voltages. The magnitudes of these voltages give stable oscillations to ions with a specific *m/z* ratio and unstable oscillations to all others. The unstable ions strike one of the rods, become neutralized, and are pumped away. The Quadrupole Mass Filter behaves as a filter allowing only ions with a certain *m/z* ratio to reach the Ion Detector Assembly. As the RF and DC voltages are ramped, ions of different *m/z* ratios are transmitted through the Exit Lens to the Ion Detector Assembly. This produces the mass spectrum.

The ratio of the RF and DC voltage determines the range of *m/z* ions that pass through the Quadrupole Mass Filter at one time. This determines the width of mass peaks and is called resolution. Resolution can be adjusted. Higher resolution produces narrower mass peaks but lower sensitivity.

Ion offset controls the how fast ions fly through the Quadrupole Mass Filter. Lower ion offsets produce better resolution since ions spend a longer time in the Quadrupole Mass Filter. Higher ion offsets often produce higher sensitivity because ions are focused better.

Rod DC (A or B) sets the polarity of the DC that is applied to each pair of Quadrupole Mass Filter rods. The Rod DC that works best for your instrument has been selected at the factory. To ensure the best performance, do not change the Rod DC. Also, be sure to reinstall the Quadrupole Mass Filter in the same orientation as when it was removed.

To improve the performance of the Quadrupole Mass Filter a Prefilter is used before the Quadrupole Mass Filter. The Prefilter also has a combination of RF and DC voltages applied to it. The Prefilter serves two main purposes. First, the efficiency of the Quadrupole Mass Filter is impaired after a build up of ions impacting on them. The Prefilter removes many of the low *m/z* ions that would have otherwise struck the Quadrupole Mass Filter rods. Since the Prefilter does not have precision electric fields like the Quadrupole Mass Filter, it is not strongly affected by ions striking the surface. This increases the time needed between routine cleaning of the instrument.

Second, helium atoms (not ions) coming from the ion source cause noise if they reach the Exit Lens or Ion Detector Assembly. This is known as neutral noise. Helium atoms cannot negotiate the bend in the Prefilter. Therefore, the noise is virtually eliminated. This leads to better signal-to-noise ratio and lower limits of detection. In addition, higher GC helium flows can be used without causing excessive amounts of noise that would blind an instrument without a curved Prefilter to low-level signals.

Chapter 7 Ion Detector Assembly

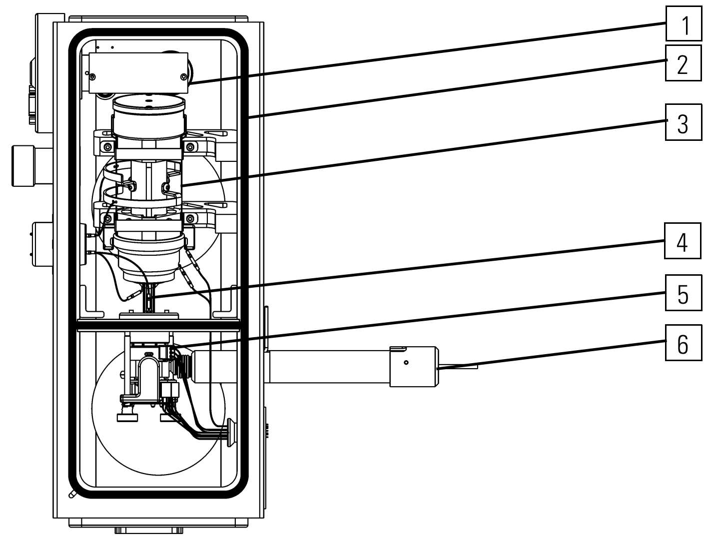
This chapter contains theory of operations for ion detector assembly components.

In This Chapter

- 7.1 Conversion Dynode Components, pp. 7-248
- 7.2 Description pp. 7-250
- 7.3 Theory of Operations pp. 7-251
- 7.4 Electron Multiplier Components, pp. 7-252
- 7.5 Description pp. 7-253
- 7.6 Theory of Operations pp. 7-254

7.1 Conversion Dynode Components

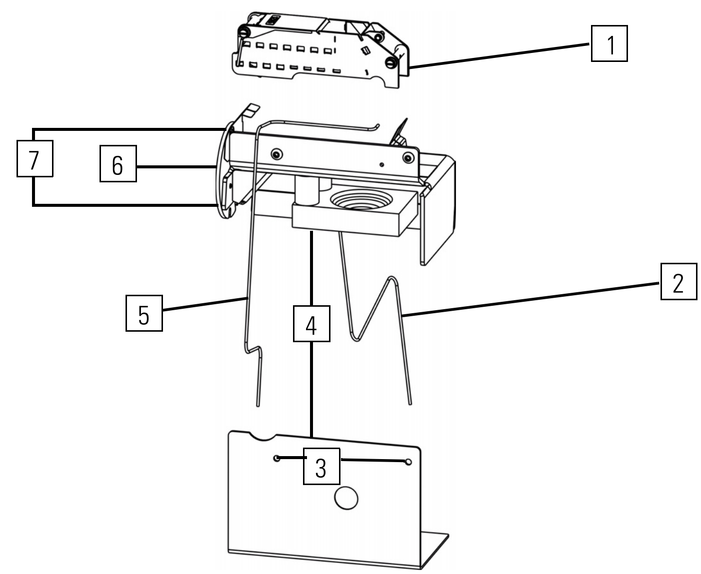
The Conversion Dynode is part of the Ion Detector Assembly. The Ion Detector Assembly is mounted inside the Vacuum Manifold, directly behind the Quadrupole Assembly.



1	Ion Detector Assembly	4	Prefilter
2	O-Ring	5	Ion Source Assembly
3	Quadrupole Assembly	6	Transfer Line

Figure 7-1. Vacuum Manifold

Ion Detector Assembly



1	Electron Multiplier Cathode, A0022-14633	5	Electron Multiplier Connection
2	Conversion Dynode Connection	6	Base
3	Screws that hold the Shield, 2	7	Screw that Holds the Base, 2
4	Shield & Conversion Dynode		

Figure 7-2. ETP Ion Detector Assembly, Replacement Detector Assembly 76022-14635 (without items 2 & 5)

7.2 Description

The Conversion Dynode is a concave metal surface located at a right angle to the ion beam. A potential of +10 kV for negative ion detection or -10 kV for positive ion detection is applied to the Conversion Dynode.

The Conversion Dynode increases signal and decreases noise. High voltage applied to the Conversion Dynode results in a high conversion efficiency and increased signal. That is, for each ion striking the Conversion Dynode, many secondary particles are produced. The increase in conversion efficiency is more pronounced for more massive ions than for less massive ions.

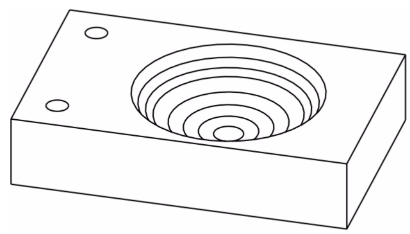


Figure 7-3. ETP Conversion Dynode

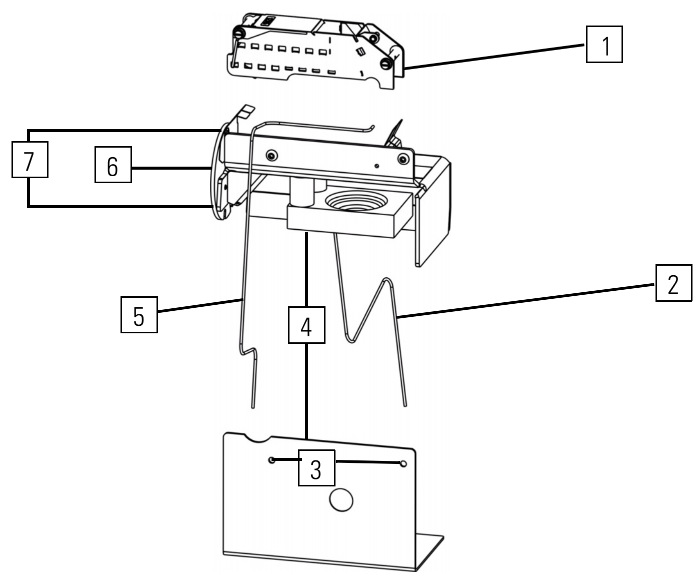
7.3 Theory of Operations

When an ion strikes the surface of the Conversion Dynode, one or more secondary particles are produced. These secondary particles can include positive ions, negative ions, protons, electrons, and neutrals. When positive ions strike a negatively charged Conversion Dynode, the secondary particles are negative ions and electrons. When negative ions strike a positively charged Conversion Dynode, the secondary particles are positive ions and protons. These secondary particles are focused by the curved surface of the Conversion Dynode and accelerated toward the Electron Multiplier.

Because of the off-axis orientation of the Ion Detector Assembly relative to the Quadrupole Assembly, neutral molecules from the mass analyzer tend not to strike the Conversion Dynode or Electron Multiplier. Thus, neutral noise reduces.

7.4 Electron Multiplier Components

The Electron Multiplier is another part of the Ion Detector Assembly. The Ion Detector Assembly is mounted inside the Vacuum Manifold, directly behind the Quadrupole Assembly.



1	Electron Multiplier Cathode, A0022-14633	5	Electron Multiplier Connection
2	Conversion Dynode Connection	6	Base
3	Screws that hold the Shield, 2	7	Screw that Holds the Base, 2
4	Shield & Conversion Dynode		

Figure 7-4. Ion Detector Assembly, Replacement Detector Assembly 76022-14635 (without items 2 & 5)

7.5 Description

An Electron Multiplier is a device that amplifies a current by generating an electron cascade from an oxide-coated surface of an electrode. The two primary components of an Electron Multiplier are the Cathode and Anode.

Cathodes serve as the electrode the electron multiplier uses to generate the electron cascade. It is a lead oxide funnel-like resistor, which receives a potential of up to -2.5 kV from the high voltage ring. The exit end of the Cathode is near ground potential.

The Anode collects electrons produced by the Cathode. It is a cup located at the exit end of the Cathode and is part of the Anode Feedthrough on the left side of the Vacuum Manifold.

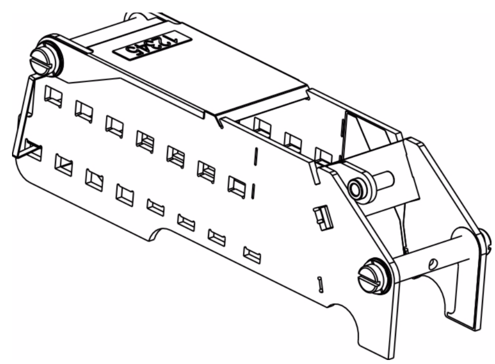


Figure 7-5. ETP Electron Multiplier, A0002-14633

7.6 Theory of Operations

Secondary particles from the Conversion Dynode strike near the inner walls of the Electron Multiplier Cathode with sufficient energy to eject electrons. The ejected electrons are accelerated farther into the Cathode, drawn by the increasingly positive potential gradient. Due to the funnel shape of the Cathode, the ejected electrons do not travel far before they again strike its inner surface, causing the emission of more electrons. Thus, a cascade of electrons is created that finally results in a measurable current at the end of the Cathode where the electrons are collected by the Anode. The current collected by the Anode is proportional to the number of secondary particles striking the Cathode.

Typically, the electron multiplier has a gain of about 10^5. If the current of ions and electrons entering the Electron Multiplier from the Conversion Dynode is 10^{-12} A, and the gain of the Electron Multiplier is 10^5, then a current of 10^{-7} A leaves the Electron Multiplier through the Anode. This current is converted to a voltage by the electrometer circuit and recorded by the data system.

Glossary

µ micro (10^{-6})

A ampere

ac alternating current

amu atomic mass unit

ADC analog-to-digital converter

ASCII American Standard Code for Information Interchange

baud rate data transmission speed in events per second

°C degrees Celsius

CD-ROM compact disc read-only memory

CE (F. Conformité Européenne) European conformity. Mandatory European marking for certain product groups to indicate conformity with essential health and safety requirements set out in European Directives.

cfm cubic feet per minute

CI chemical ionization

CIP Carriage and Insurance Paid To

cm centimeter

cc or cm^3 cubic centimeter

CPU central processing unit (in a computer)

Da Dalton

DAC digital-to-analog converter

dc direct current

DDS direct digital synthesizer

DEP™ direct exposure probe

DIP direct insertion probe

DS data system

DSP digital signal processor

EI electron ionization

ESD electrostatic discharge

eV electron volt

EN european conformity

f femto (10^{-15})

°F degrees Fahrenheit

FCC Federal Communication Commission

FOB Free on Board

ft. foot

FSE Field Service Engineer

FTP file transfer protocol

g gram

G giga (10^9)

GB gigabytes 1024 MB (billion)

GC gas chromatograph

GC/MS gas chromatograph / mass spectrometer

GND electrical ground

GPIB general-purpose interface bus

GUI graphical user interface

HV high voltage

Hz hertz (cycles per second)

ICIS™ Interactive Chemical Information System

IEC International Electrotechnical Commission

IEEE Institute of Electrical and Electronics Engineers

in. inch

I/O input/output

k kilo (10^3, 1000);

K kilo (2^{10}, 1024); Kelvin

kb kilobyte 1024 bytes (thousand)

kg kilogram

kPa kilopascal

L liter

LAN local area network

lb pound

LED light-emitting diode

m meter; milli (10^{-3})

M mega (10^6)

MB megabyte 1, 048, 576 kb (million)

M$^+$ molecular ion

min minute

mL milliliter

mm millimeter

MS scan power: MS^1, Mass Spectrometer

m/z mass-to-charge ratio

n nano (10^{-9})

p pico (10^{-12})

Pa Pascal

PCB printed circuit board

PID proportional / integral / differential

PN part number

P/P peak-to-peak voltage

ppm parts per million

psig pounds per square inch, gauge

RAM random access memory

RF radio frequency

RMS root mean square

ROM read-only memory

RS-232 industry standard for serial communications

s second

SCSI small computer system interface

SIM selected ion monitoring

SI International System of Units

S/N signal to noise ratio

TIC total ion current

TCP/IP transmission control protocol / Internet protocol

Torr torr

URL uniform resource locator

USB universal serial bus

V volt

V ac volts alternating current

V dc volts direct current

Ω ohm

Appendix A Replaceable Parts

This appendix contains *DSQ II* drawings and part numbers for replaceable parts and consumables.

To ensure proper results in servicing the *DSQ II* system, order only the parts listed or their equivalent. Contact technical support and have your *DSQ II* serial number ready when calling.

In This Chapter

- A.1 Vacuum Manifold pp. A-260
- A.3 Ion Source Assembly pp. A-263
- A.4 Ion Source Block Assembly pp. A-264
- A.5 Lens Assembly pp. A-266
- A.6 Quadrupole Assembly pp. A-267
- A.7 Gas Inlets and Gauges pp. A-268
- A.8 PCBs and Cables pp. A-270
- A.9 Turbomolecular Pump pp. A-276
- A.10 Split-Flow Turbomolecular Pump (Upgrade Option) pp. A-278
- A.11 Inlet Valve (Upgrade Option) pp. A-280
- A.12 Power Module pp. A-282
- A.13 Installation Kit pp. A-283
- A.14 Document Set pp. A-284
- A.15 Miscellaneous Items pp. A-285s

A.1 Vacuum Manifold

Table A.1. Vacuum Manifold

Description	Part Number
12-Pin Feedthrough	119610-0005
Analyzer Wiring Harness	119610-0015
Anode Feedthrough	120252-0001
Baffle Wall, Differential Pump	119805-0026
Baffle Wall, Single Pump	119805-0025
Cathode Feedthrough	96000-20073
Dynode Feedthrough	119875-0500
Electron Multiplier, Replacement, ETP	A0022-14633
ETP, Ion Detector Assembly, with leads	76022-0001
Glass Cover	119805-0060
O-Ring, Top Cover	119805-0038
Prefilter	119800-0500
Prefilter Mount	119800-0525
Prefilter Wires	120159-0003
Quadrupole Mount	119800-0540
Quadrupole Strap	120155-0010
RF Feedthrough Assembly	119865-0500
Transfer Line Assembly	119640-1050
Vent Valve Solenoid	76461-1003

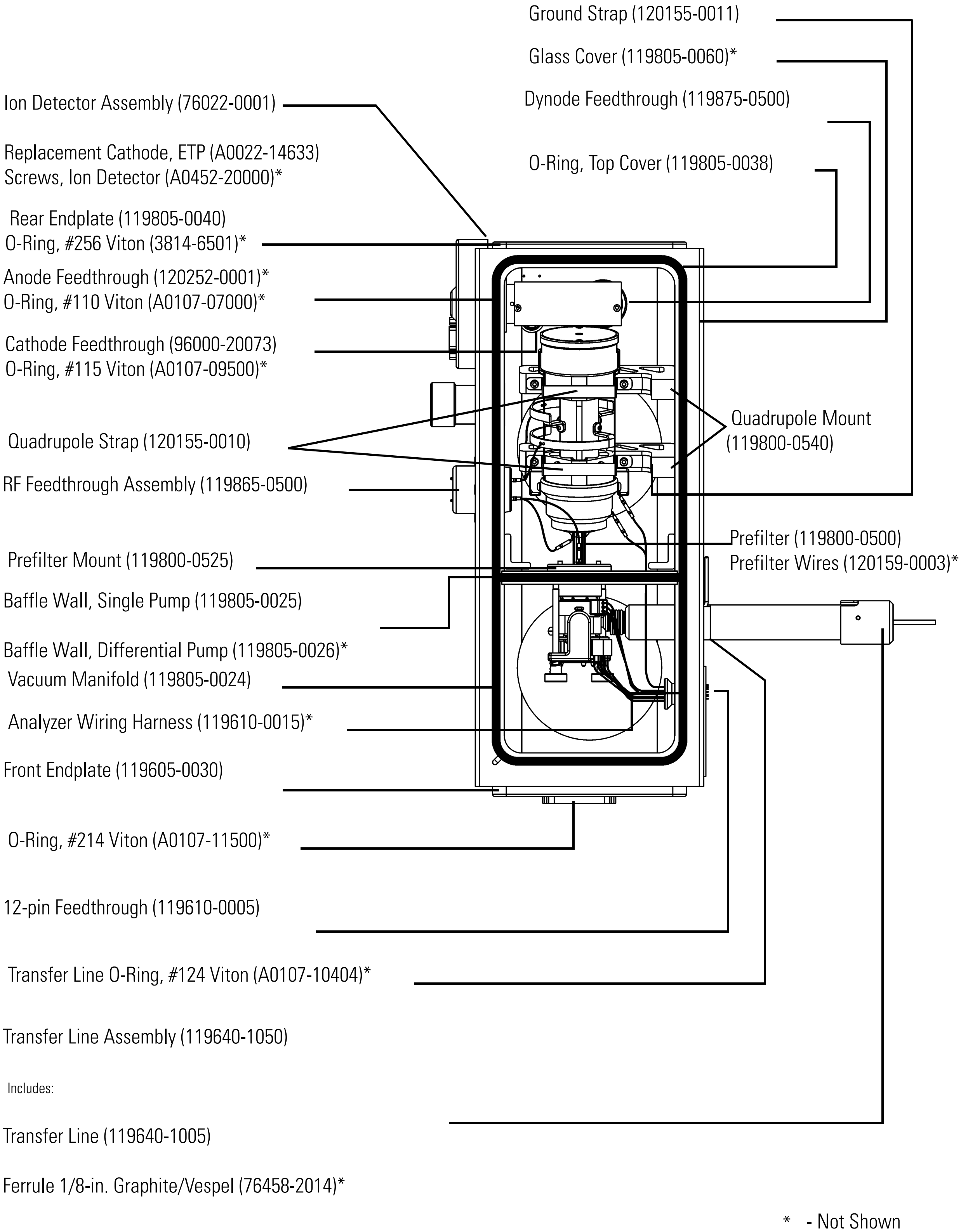


Figure A-1. Vacuum Manifold Components

A.2 Replacement Baffle Wall Kit

Replace a Single Turbo Manifold with Baffle Wall PN 119805-0025 and a Differentially Pumped Manifold with Baffle Wall PN 119805-0026.

The pre-filter mounts to the baffle wall using a yoke and screws. Since the pre-filter fits securely into a recess in the baffle wall, it is not necessary that it be secured with a yoke and screws.

The baffle walls for both the single turbo and the dual turbo manifold have been changed to allow easier removal and remounting of the pre-filter. The pre-filter is now held in place with a sliding clip. All DSQs shipped after November 1, 2004 will contain this new baffle wall with pre-filter clip.

Baffle wall replacement kits have been created for the single turbo manifold and split turbo manifold. The baffle wall part number did not change. If a replacement baffle wall is required for a system that uses the prefilter yoke mount, the Baffle Wall Kit must be ordered. If a customer chooses to upgrade an existing system the kit will contain all the necessary parts and diagram for easy installation. Figure A-2 offers a compressed view of the two baffle plates and pre-filter mounting. Contact your local parts distributor for current kit pricing.

Two kits exist:

- PN 119805-1025, Kit Baffle Wall W/clip for a single turbo manifold.
- PN 119805-1026, Kit Baffle Wall W/Clip for a split turbo manifold.

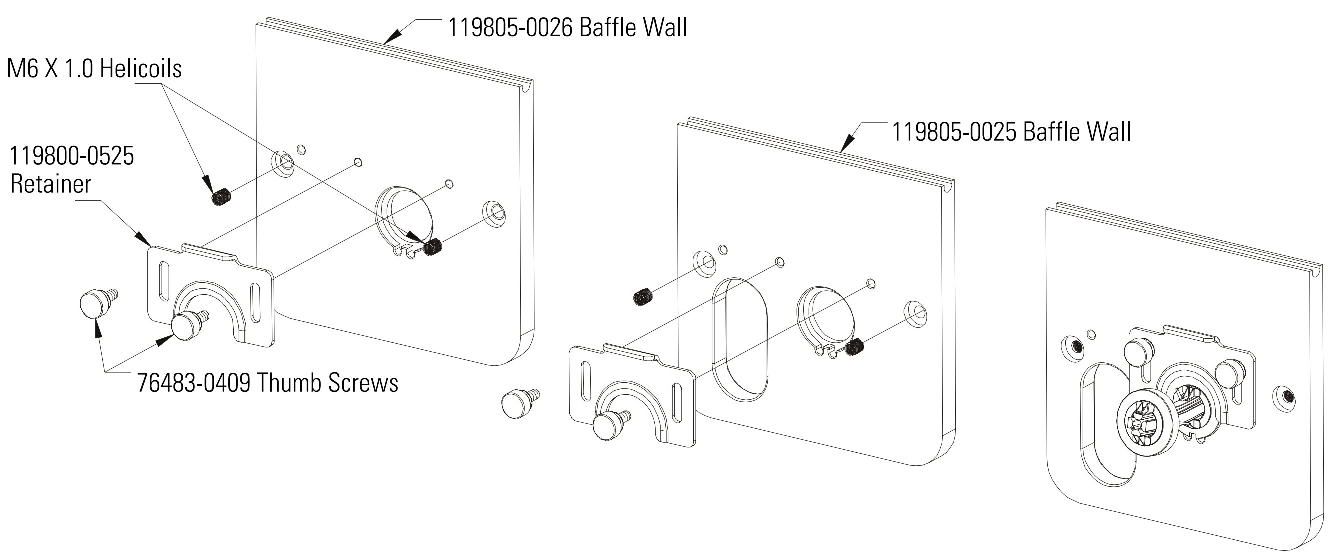


Figure A-2. Baffle Wall Assembly PN 119805-View (Before Shipment)

A.3 Ion Source Assembly

Table A.2. Ion Source Assembly

Description	Part Number
Ion Source Assembly (Complete) includes:	120320-0001
Ion Source Block Assembly	120320-0101
Lens Alignment Tool	120271-0001
Lens Assembly	119650-0151
Magnet	70001-98195
Magnet Support	119850-0710
Source Spacer Assembly	119800-0475
Spring	76485-0032
Thumbscrew	119825-0100

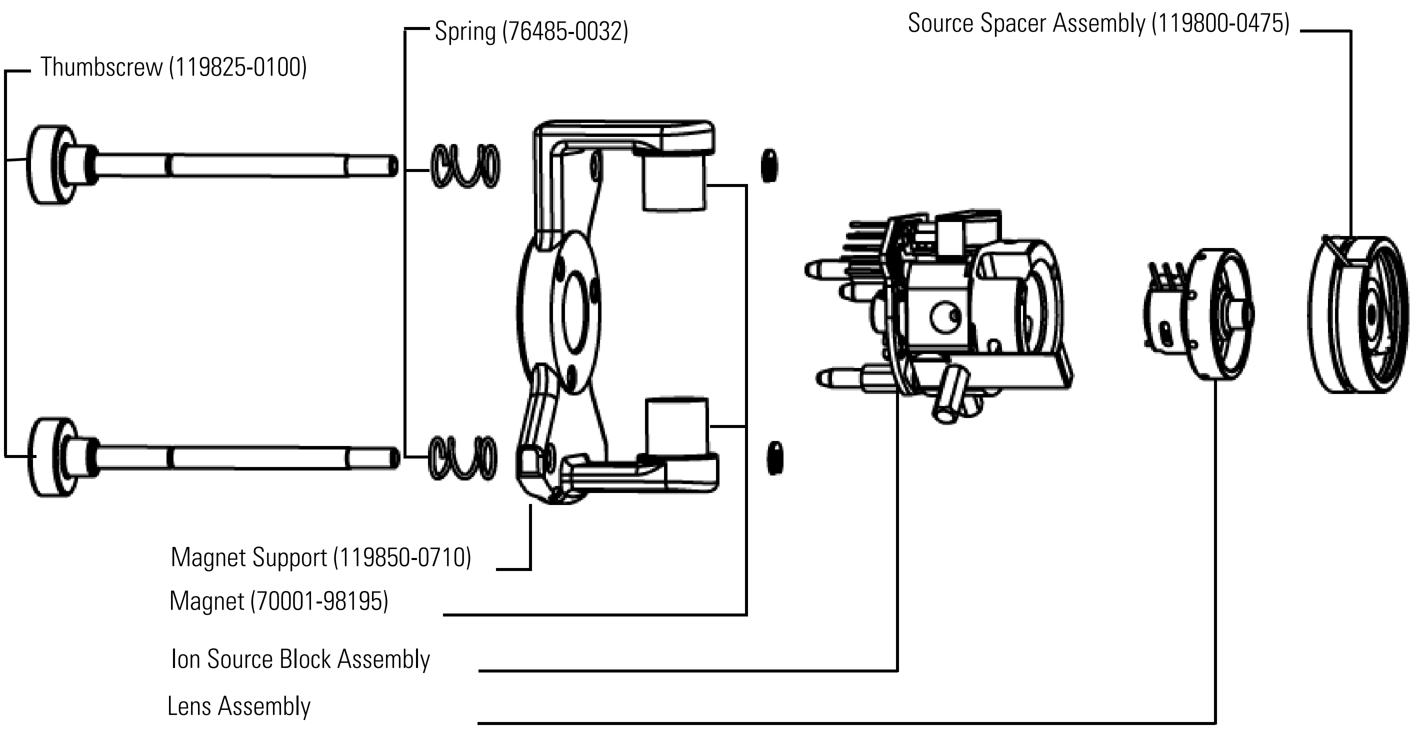


Figure A-3. Ion Source Assembly, Complete (120320-0001)

A.4 Ion Source Block Assembly

Table A.3. Ion Source Block

Description	Part Number
Base Stud	119650-0215
Ball Plunger	119572-0001
Filament	120320-0030
Filament Retainer Clip	120320-0050
Filament Spacer	119650-0235
Heater Ring	120320-0020
Ion Source Block Assembly	120320-0101
Ion Source PCB	120309-0001
Ion Volume, CI	119650-0230
Ion Volume, EI	119650-0220
Ion Volume, EI/CI Combo	119650-0240
Ion Volume, CEI	119650-0221-T
Ion Volume Holder, CEI	70001-20532-T
Ion Volume Key Thumbscrew	120320-0042
Ion Volume Holder	70001-20532
Ion Volume Holder for Probes	119324-0001
Setscrew	119573-0002
Spring	120320-0040B
Spring Thumbscrew	120320-0041
Wave Washer, Ion Volume Holder (5)	A0474-51001

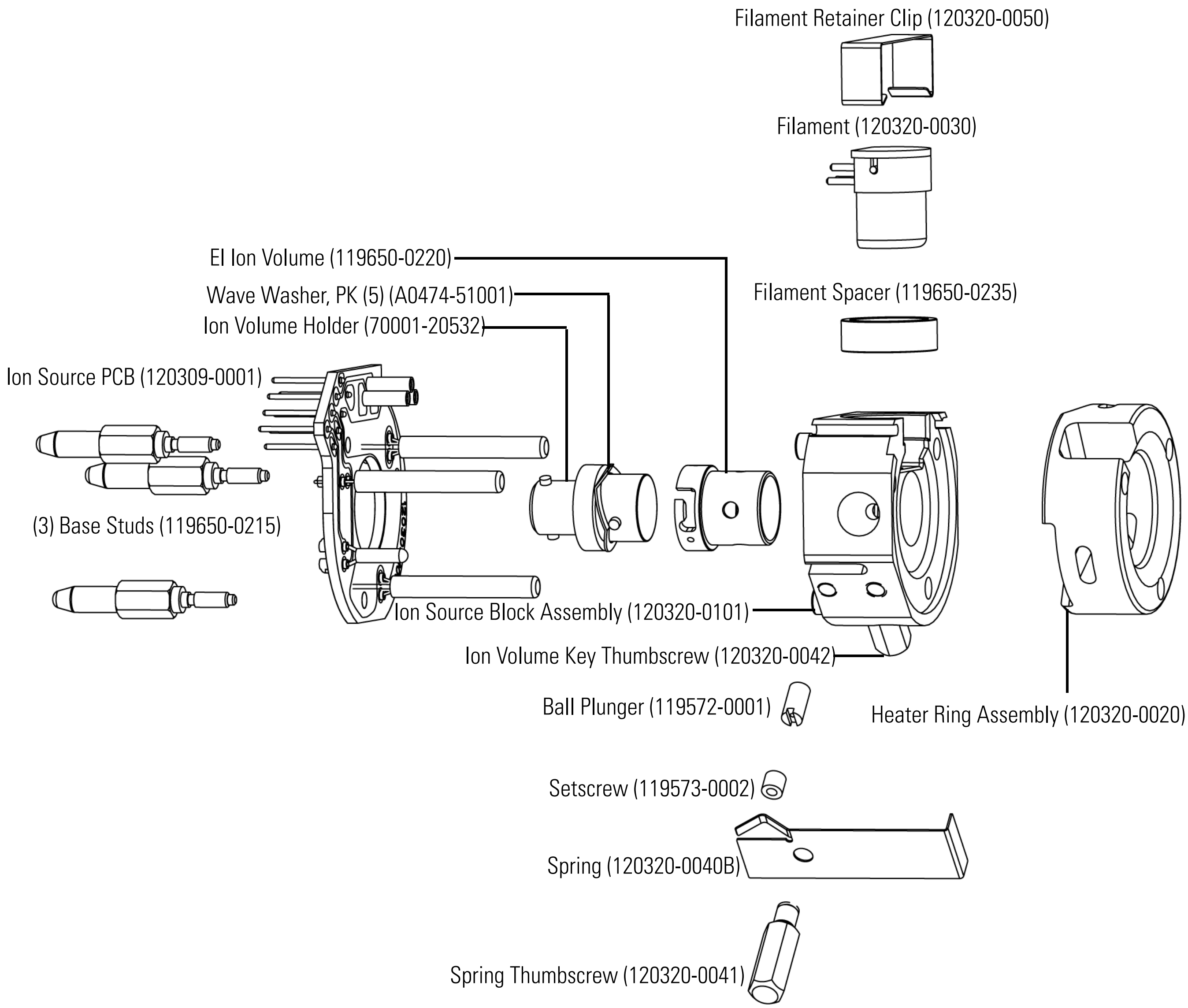


Figure A-4. Ion Source Block Assembly

A.5 Lens Assembly

Table A.4. Lens Assembly

Description	Part Number
Lens 1	119650-0414
Lens 2	119650-0416
Lens 3	119650-0423
Lens Clip	119650-0428
Lens Holder	119650-0420
Lens Spacer	119650-0426

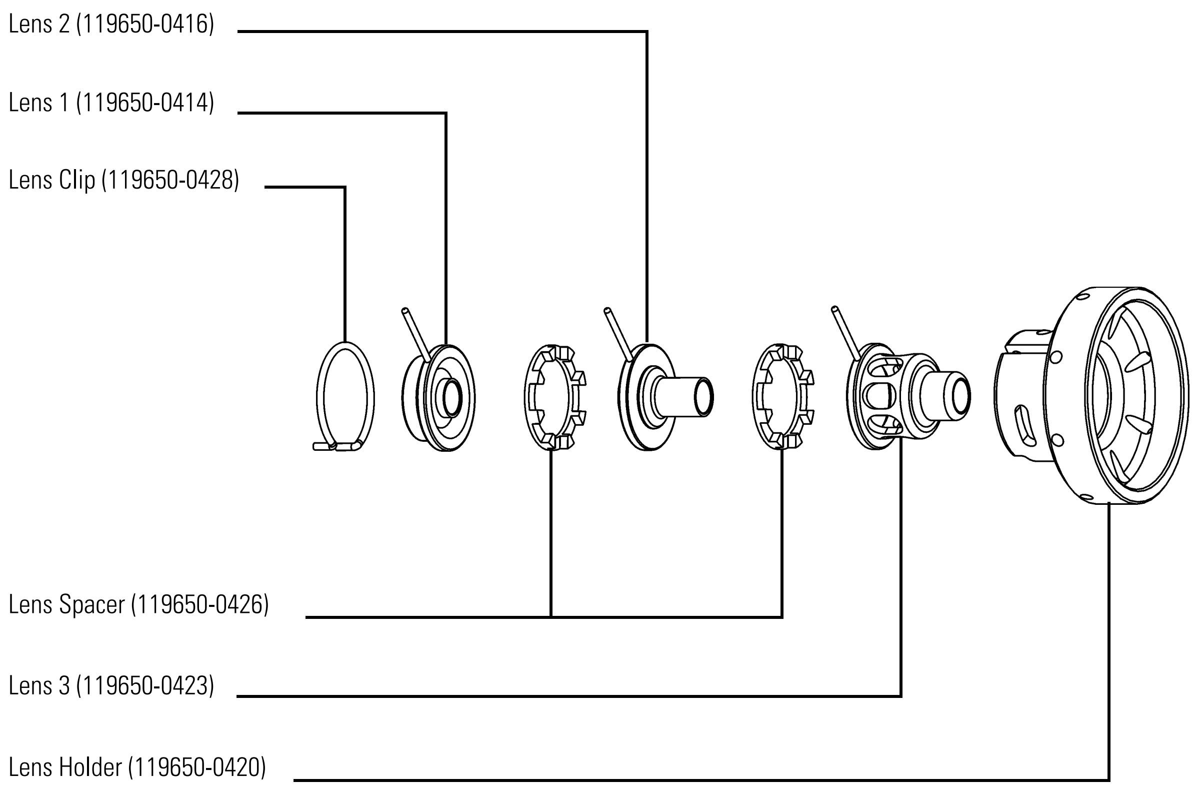


Figure A-5. Lens Assembly

A.6 Quadrupole Assembly

Table A.5. Quadrupole Assembly

Description	Part Number
Quadrupole Assembly (Complete) includes:	120151-0100
Exchange Quadrupole Assembly (complete) include:	EX120151-0100
• Entrance Lens Assembly	120286-0001
• Exit Lens Assembly	120170-0001
• Quad Wiring, Long	120153-0101
• Quad Wiring, Short	120153-0100
• Quadrupole Mass Filter	120151-0001
• Strap, Quadrupole Assembly	120155-0012

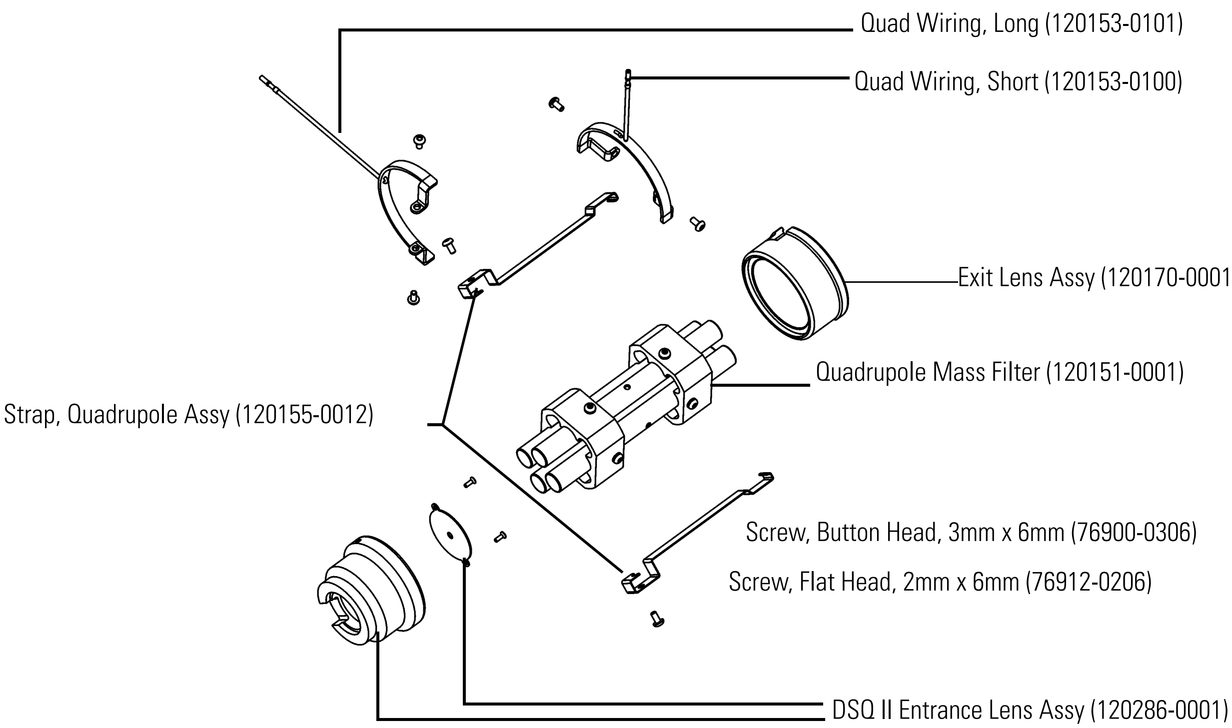


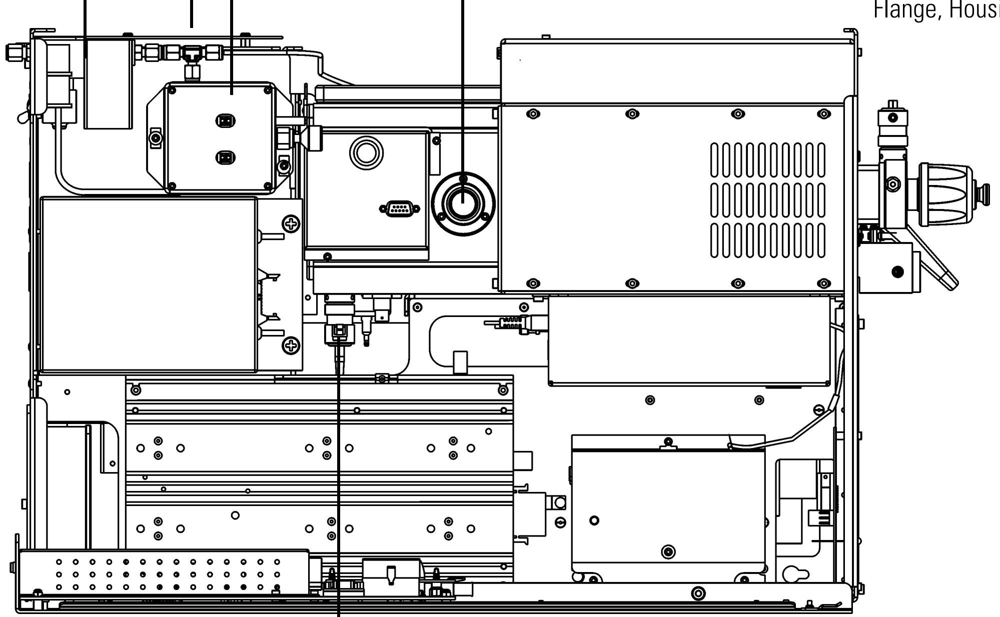
Figure A-6. Quadrupole Assembly

A.7 Gas Inlets and Gauges

Table A.6. Gas Inlets and Gauges

Description	Part Number
Cable, CI Flow Module to Analog PCB	119378-0014
Cable, Vacuum Control PCB to Calibration Gas and Vent Valves	119378-0019
Calibration Gas Flow Module	119246-0001
Calibration Gas Tubing, Cleaned	119248-0001
Calibration Gas Vial	96000-40013
CI Reagent Gas Flow Module	23331-0091
Ferrule, Glass Filled Teflon	95001-20310
Ion Gauge Flange	119605-0005
Ion Gauge Tube, Replacement	A0105-06003
Muffler/Filter 40 Micron	76475-0040
O-Ring, # 116 Viton	A0107-10056
Port Connector, CI Gas Module	4033-4200
Tee, Hose Barb - CI Vent to Foreline	76256-0042
Union, Elbow, 1/8-in., SS (Without CI)	4030-0602
Union, Tee, 1/8-in., SS (With CI)	4032-0182
Vent Valve Solenoid	76461-1003

CI Reagent Gas Flow Module (23331-0091)
Cable CI Flow Module to Analog PCB (119378-0014)*
Tee, Hose Barb CI to Cal Gas Foreline Vent (76256-0042))
with CI: Union, Tee, 1/8-in., SS (4032-0182)
without CI: Union, Elbow, 1/8-in., SS (4030-0602)*
Port Connector (4033-4200)
Calibration Gas Flow Module (119246-0001)
Cable, Vacuum Control PCB to Cal Gas and Vent Valves (119378-0019)*
Ferrule, Glass Filled Teflon (95001-20310)*
Calibration Gas Vial (96000-40013)
Cal Gas Transfer Tubing 1/8 SS Cleaned (119248-0001)
Ion Gauge (A0105-06003)
O-Ring, #116 Viton (A0107-10056)*
Flange, Housing (119605-0005)



Vent Valve Solenoid (76461-1003)
Cable, Vacuum Control PCB to Cal Gas and Vent Valves (119378-0019)*
Muffler, Filter. 40 Micron (76475-0040)

* - Not Shown

Figure A-7. Gas Inlets and Gauges

A.8 PCBs and Cables

Table A.7. PCBs and Cables (Left Side)

Description	Part Number
Analog PCB	119590-0022
Cable, Analog PCB to Low Pass Filter PCB	119378-0039
Cable, Ground Strap	119378-0030
Cable, Main System Power	119378-0001
Cable, Ribbon, Analog PCB to Multiplier/Dynode Power Supply	119378-0009
Digital PCB	119590-0010
Dynode/Multiplier Power Supply	119377-0001
PPINICI Dynode/Multiplier Power Supply	119377-0002
RF Generator PCB	119590-0060
Spacer, Analog PCB	76350-0056
Spacer, Digital to Analog PCB	119567-0001

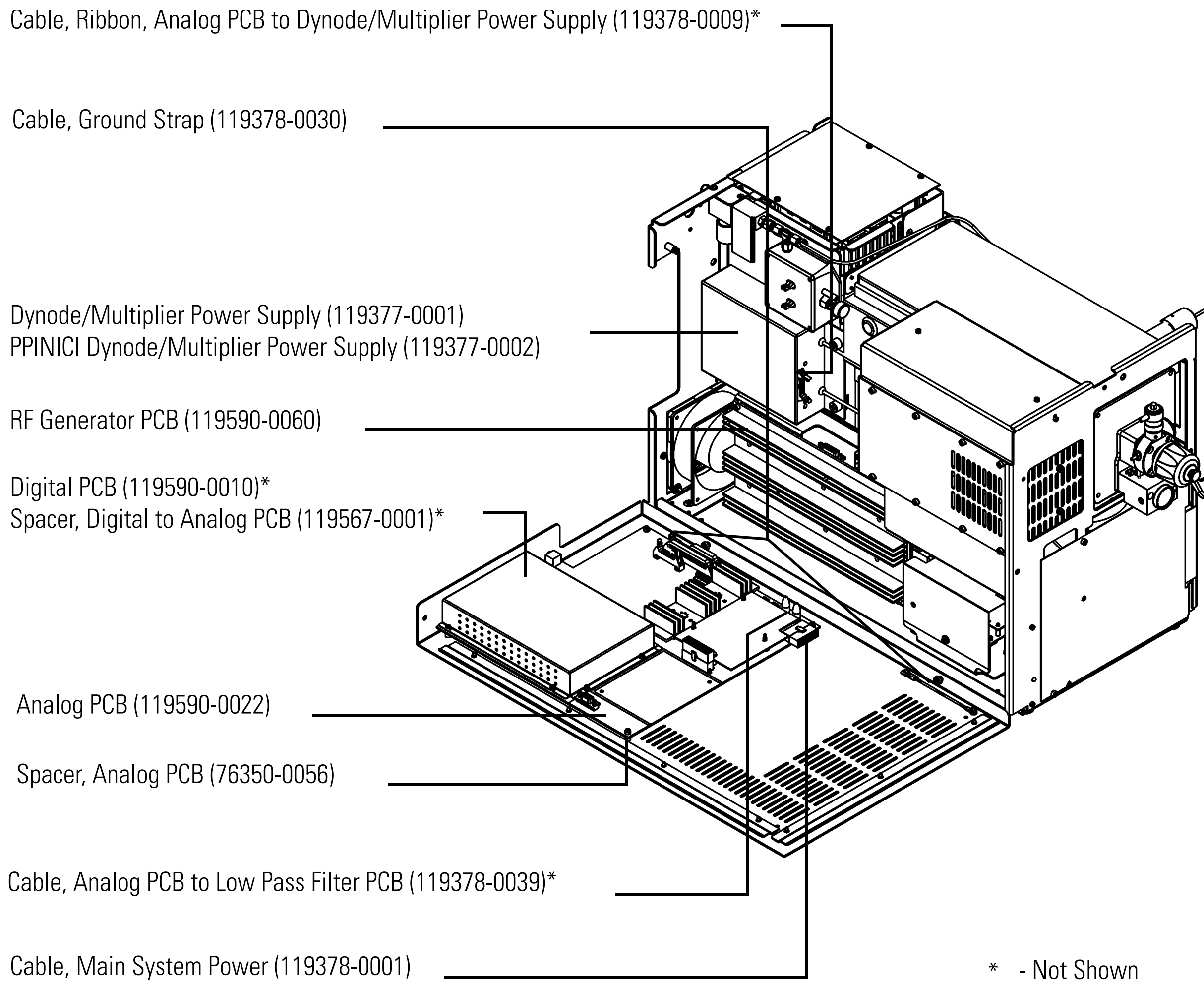
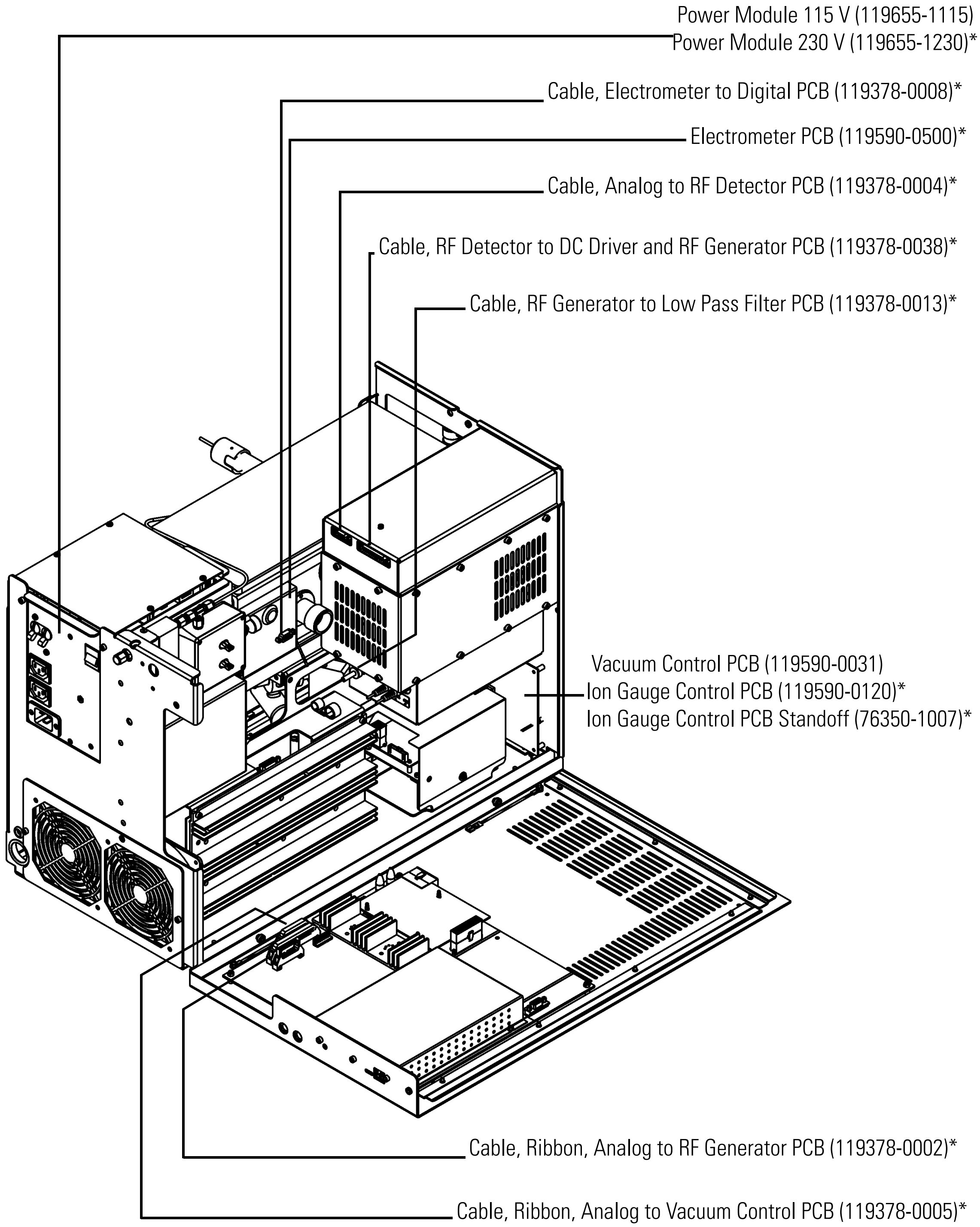


Figure A-8. PCBs and Assemblies

Table A.8. PCBs and Cables (Left Side)

Description	Part Number
Cable, Analog to RF Detector PCB	119378-0004
Cable, Coax, RF Generator to Low Pass Filter PCB	119378-0013
Cable, Electrometer to Digital PCB	119378-0008
Cable, RF Detector to DC Driver and RF Generator PCB	119378-0038
Cable, Ribbon, Analog to RF Generator PCB	119378-0002
Cable, Ribbon, Analog to Vacuum Control PCB	119378-0005
Electrometer PCB	119590-0500
Ion Gauge Control PCB	119590-0120
Ion Gauge Control PCB Standoff	76350-1007
Power Module 115 V	119655-1115
Power Module 230 V	119655-1230
Vacuum Control PCB	119590-0031



* - Not Shown

Figure A-9. PCBs and Assemblies (Left Side)

Table A.9. PCBs and Cables (Right Side)

Description	Part Number
Cable, Vacuum Control PCB to Forepressure Gauge	119378-0015
Fan	119253-0001
Lens Interface PCB	119590-0110

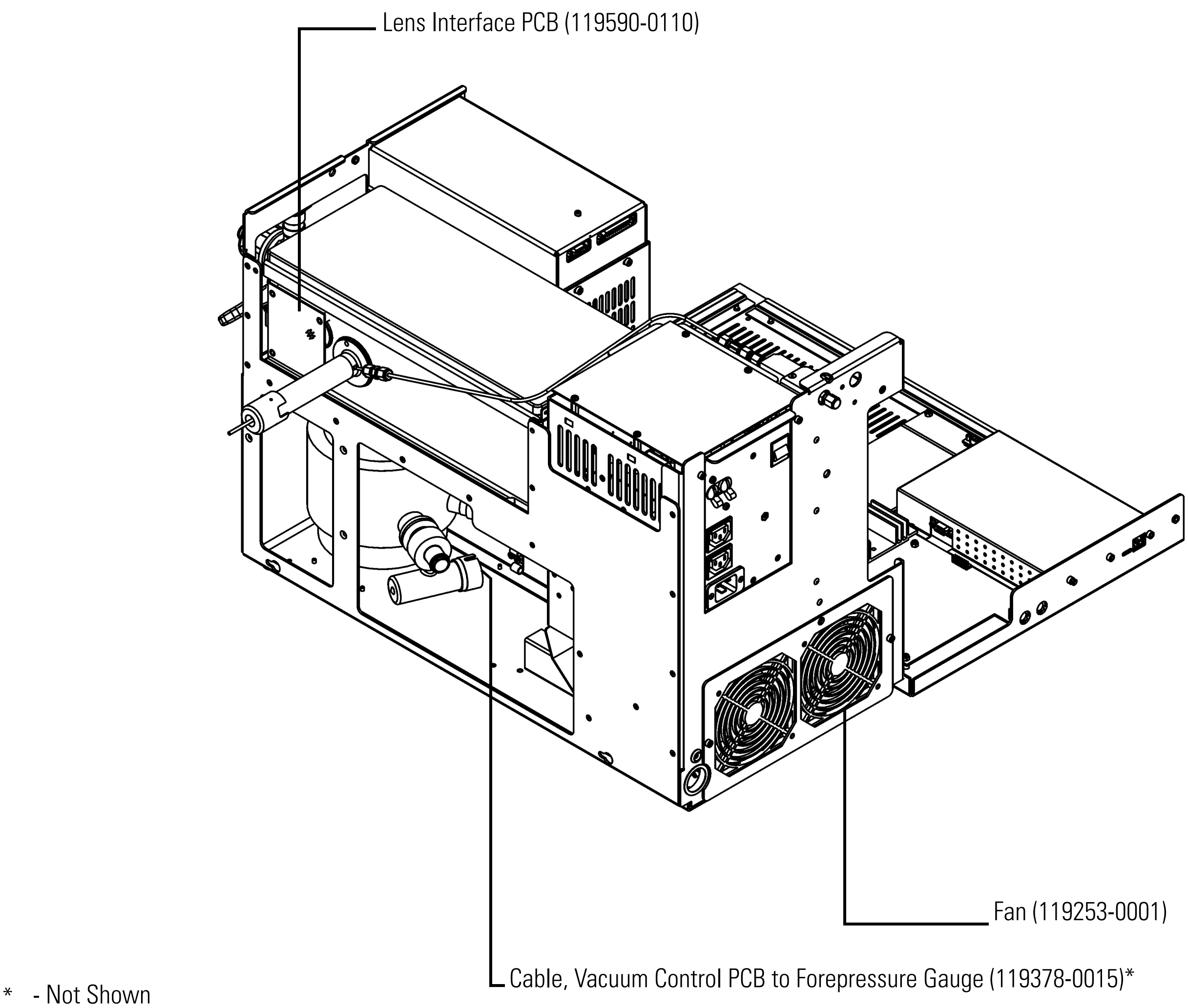


Figure A-10. PCBs and Assemblies (Right Side)

Table A.10. PCBs and Cables (Under the RF Detector Cover)

Description	Part Number
Cable, Analog PCB to DC Driver	119378-0037
Cable, DC Driver to Low Pass Filter PCB	119378-0036
Cable, RF Coil to Low Pass Filter PCB	119378-0040
DC Driver Assembly	120152-1000
Low Pass Filter PCB	119590-0480
RF Detector PCB	119590-0270
RF Capacitor Assembly	119669-0250
RF Coil Assembly	119668-1000

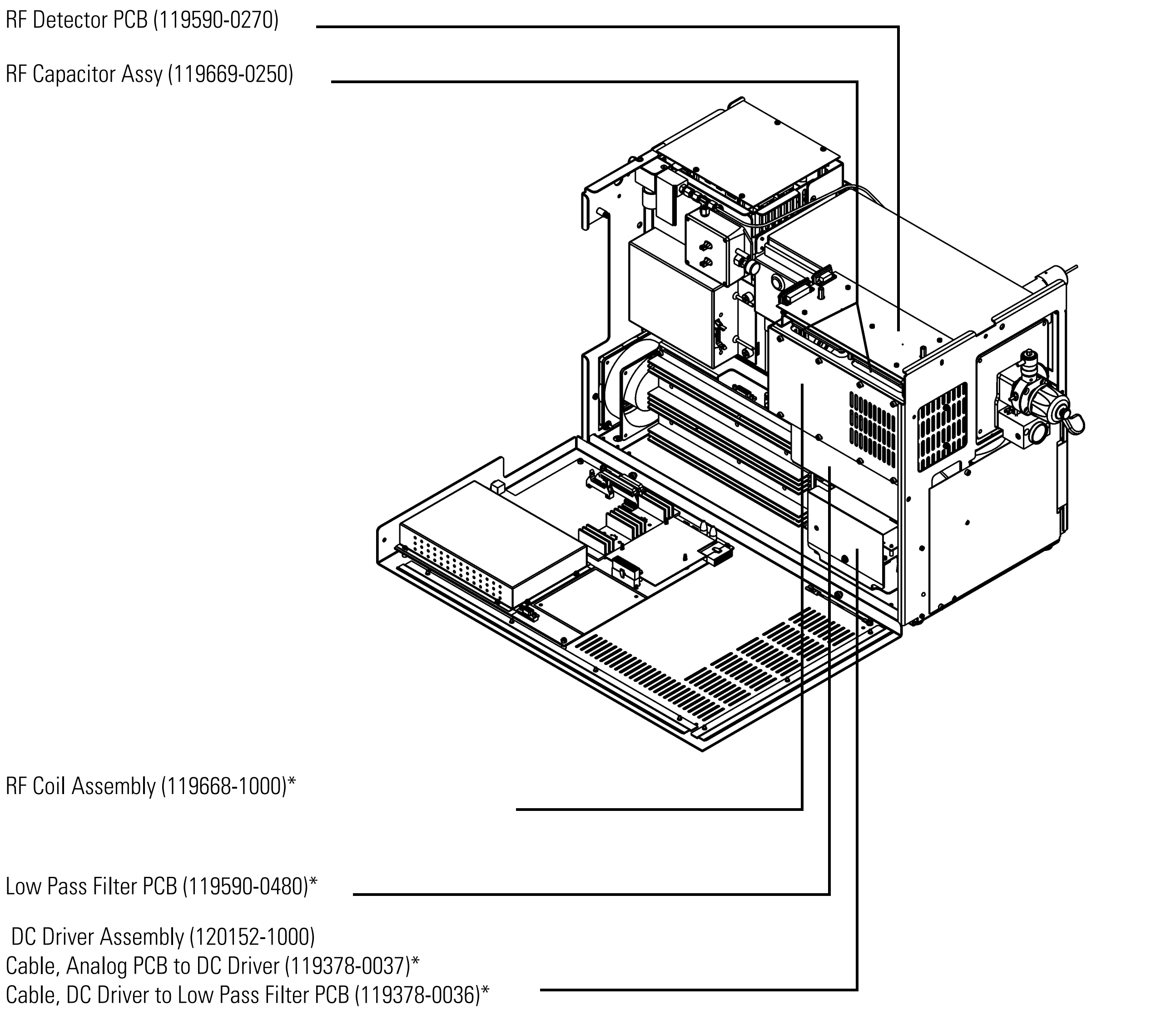


Figure A-11. PCBs and Assemblies

A.9 Turbomolecular Pump

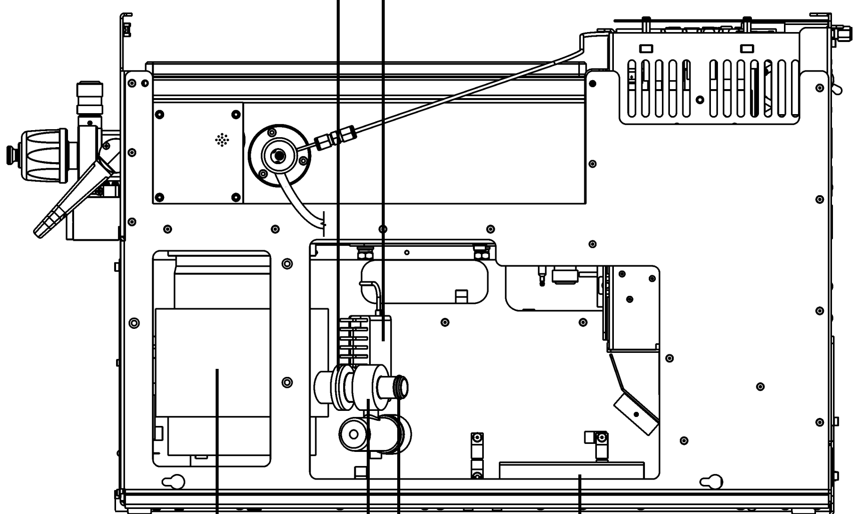
Table A.11. Turbomolecular Pump

Description	Part Number
Cable, Turbomolecular Pump Power Supply to Main Power	119378-0042
Cable, Turbomolecular Pump Power Supply to Vacuum Control PCB	119378-0041
Clamp Nut, NW16	76505-1013
Clamp Nut, NW25	76505-2002
Foreline Adapter Assembly (70 L/s Turbo Pump) includes:	119259-0003
• Forepressure Gauge	A0105-00501
Foreline Adapter Assembly (250 L/s Turbo Pump) includes:	119259-0002
• Forepressure Gauge	A0105-00501
Foreline Hose	76505-0003
Oil, Rotary-Vane Pump, 1 L	A0301-15101
O-Ring, w/centering ring, NW16	76505-0005
O-Ring, w/centering ring, NW25	76505-2001
Rotary-Vane Pump	76505-3007
Turbomolecular Pump, 70 L/s	76505-3006
Turbomolecular Pump, 250 L/s	119268-0001
Turbomolecular Pump Controller	76505-3005
Turbomolecular Pump Power Supply	76330-0230
Turbomolecular Pump Power Supply Assembly **Includes:** Cable, Turbo Power Supply to Main Power 119378-0042 Cable, Turbo Power Supply to Vacuum Control PCB 119378-0041	119254-1000

Turbomolecular Pump Controller (76505-3005)

250 L/s Turbomolecular Pump
Clamp, NW25 (76505-2002)*
O-Ring, w/Centering Ring, NW25 (76505-2001)*
70 L/s Turbomolecular Pump
Clamp, NW16 (76505-1013)*
O-Ring, w/Centering Ring, NW16 (76505-0005)*

Rotary-vane Pump (76505-3007)*



Turbomolecular Pump, 250 L/s (119268-0001)
Turbomolecular Pump, 70 L/s (76505-3006)*

250 L/s Turbomolecular Pump
Foreline Adapter Assembly (119259-0002)*
includes:
Forepressure Gauge (A0105-00501)
70 L/s Turbomolecular Pump
Foreline Adapter Assembly (119259-0003)*
includes:
Forepressure Gauge (A0105-00501)

Foreline Hose (76505-0003)*

Turbomolecular Pump Power Supply (76330-0230)
Cable, Turbomolecular Pump Power Supply to Main Power (119378-0042)
Cable, Turbomolecular Pump Power Supply to Vacuum Control (119378-0041)

*- Not Shown

Figure A-12. Turbomolecular Pump

A.10 Split-Flow Turbomolecular Pump (Upgrade Option)

Table A.12. Split-Flow Turbomolecular Pump

Description	Part Number
Foreline Adapter Assembly includes: Forepressure Gauge	119259-0002 A0105-00501
Cable, Turbomolecular Pump Power Supply to Main Power	119378-0042
Cable, Turbomolecular Pump Power Supply to Vacuum Control PCB	119378-0041
Clamp, 250 L/s Turbo Pump, NW25	76505-2002
Foreline Hose	76505-0003
O-Ring, w/centering ring, NW25	76505-2001
Oil, Rotary-Vane Pump, 1 L	A0301-15101
Rotary-Vane Pump	76505-3007
Split-Flow Turbomolecular Pump	119268-0002
Turbomolecular Pump Controller	76505-3005
Turbomolecular Pump Power Supply	76330-0230
Turbomolecular Pump Power Supply Assembly Includes: Cable, Turbo Power Supply to Main Power 119378-0042 Cable, Turbo Power Supply to Vacuum Control PCB 119378-0041	119254-1000

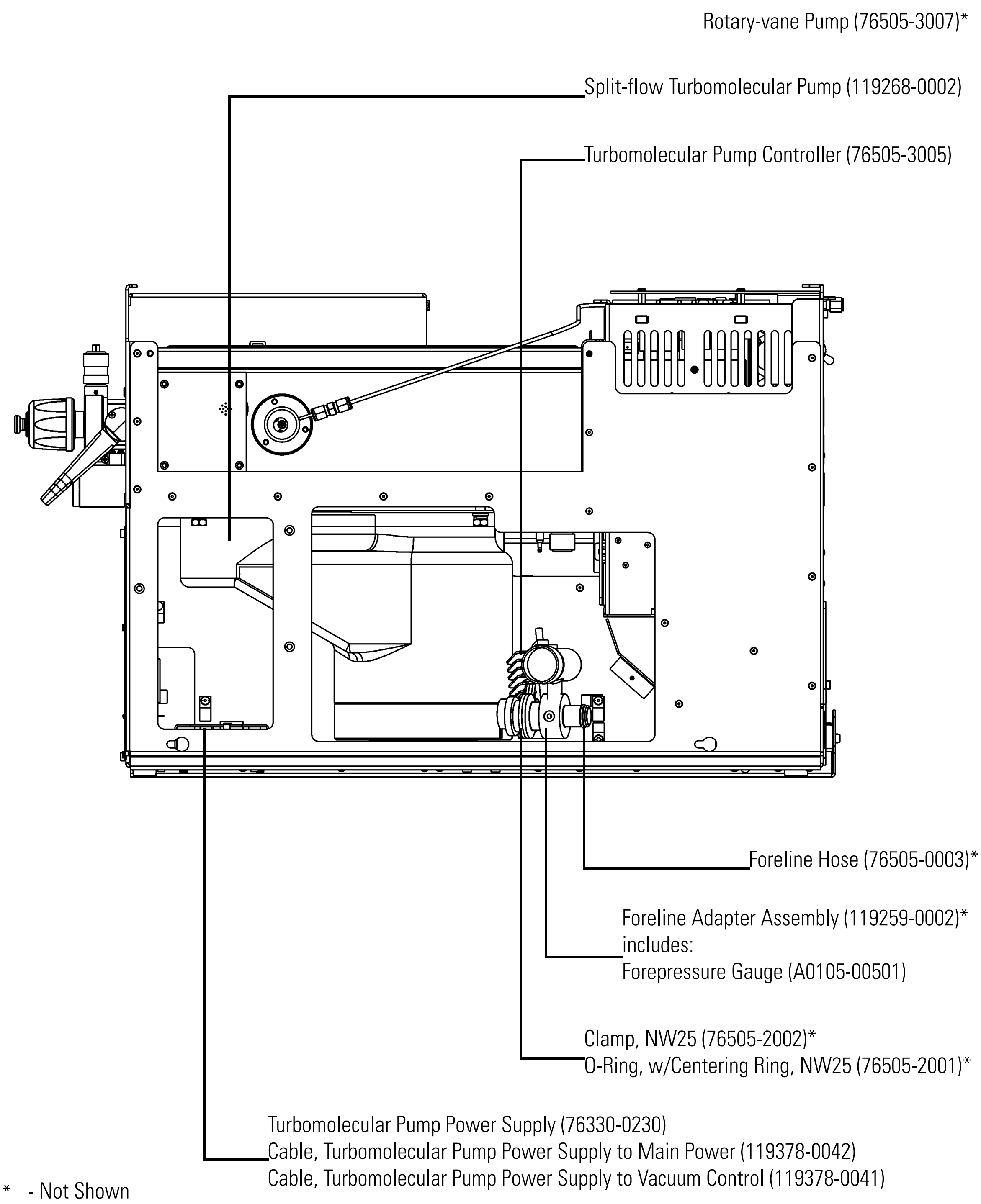


Figure A-13. Split-Flow Turbomolecular Pump

A.11 Inlet Valve (Upgrade Option)

Table A.13. Inlet Valve

Description	Part Number
Ball Valve	A0101-02530
Ball Valve Seal Replacement Kit	76461-2002
Ball Valve Stem Bearing Kit	76461-2003
Ferrule, Inlet Valve	119684-0001
Guide Bar	119687-0010
I/R Tool	96000-60057
Inlet Valve Housing	119682-0100
Inlet Valve Seal Replacement Kit	119265-0003
Inlet Valve Solenoid	119262-0001
Knob	119685-0010
Lever	119554-0001
Plug	119273-0001
Tubing	76433-0107

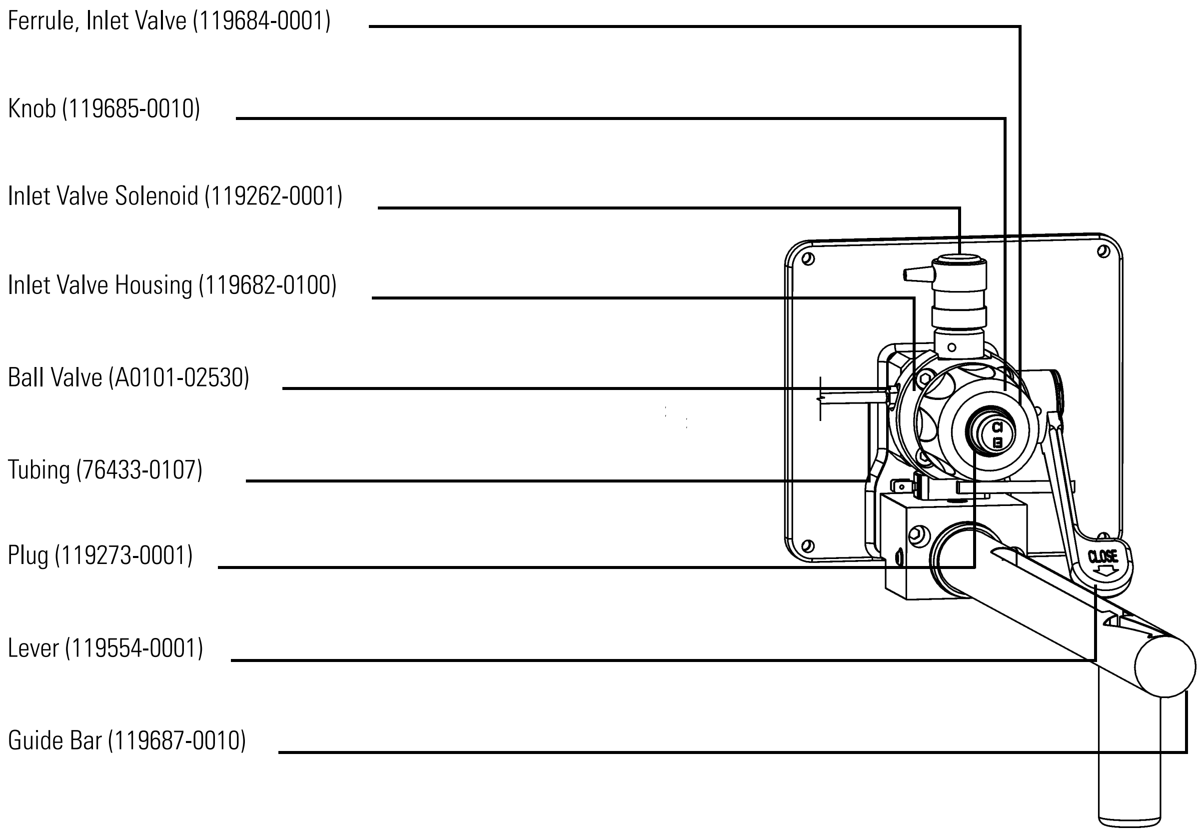


Figure A-14. Inlet Valve

A.12 Power Module

Table A.14. Power Module

Description	Part Number
Power Module	
• 115 V	119655-1115
• 230 V	119655-1230
Circuit Breaker, 15 A, 115 V	A0019-00520
Circuit Breaker, 10 A, 230 V	A0019-00505
Fuse, 3.15 A SB, 5x20 mm, 250 V (F1, F2)	A0006-10510
HV Regulator PCB	119590-0050
Line Filter	A0007-18349
Power Cord, 115 V (NEMA 5-20P plug)	96000-98034
Power Cord, 230 V (no plug)	96000-98036
Power Supply 1 (+5, ±15, +24 V)	76330-0225
Power Supply 2 (+36, -28 V)	76330-0226
Power Supply 3 (+5, ±12 V)	76330-0080
Transformer	119376-0002

A.13 Installation Kit

Table A.15. Installation Kit (119255-0003)

Description	**Part Number**
Kit, Installation includes:	119255-0003
• Allen Wrench Kit, Metric	3812-0100
• Aluminum Oxide	32000-60340
• Back Ferrule, 1/8-in., Brass	A0101-02500
• Cable, PC to Instrument (15 ft Ethernet crossover)	76396-0052
• Cable Tie, 7-in	A0007-90500
• Calibration Compound	50010-30059
• CD ROM GCMS Manuals & Methods	120315-CDMans
• Column Measuring Tool	119640-0550
• Copper Tubing, Precleaned, 25 ft	76381-0041
• Cotton Tipped Applicators (1 pack)	A0301-02000
• Filament	120320-0030
• Forceps	76360-0400
• Front Ferrule, 1/8-in., Brass	A0101-08500
• Fuse, 0.315 A SB	A0006-04550
• Fuse, 0.5 A	A0006-07608
• Fuse, 0.8 A SB	A0006-06075
• Fuse, 1.0 A	A0006-07610
• Fuse, 2A Microfuse	76339-0008
• Fuse, 3.15A SB	A0006-10510
• Gloves, Nitrile, Large	23827-0009
• Gloves, Nitrile, Medium	23827-0008
• Ion Volume Tool	119270-0001
• Lens Alignment Tool	120271-0001
• Nut, 1/8-in., Brass	A0101-15500
• Oxygen, Hydrocarbon, Moisture Trap (replacement for use with a quick change base)	A0950-R1600
• Oxygen, Hydrocarbon, Moisture Trap (with quick change base)	A0950-01600
• DSQ II User's Guide	120299-0003
• Syringe, 10 μL with 70 mm Needle	36500103
• Test Mix, octafluoronaphthalene, benzophenone	120150-TEST
• Transfer Line Ferrule, 1/16-in. to 0.4 mm, Graphite/Vespel	A0101-18100
• Union, Tee, 1/8-in., Brass	4032-0082

A.14 Document Set

Table A.16. Document Set

Description	**Part Number**
DSQ II Preinstallation Guide	120299-0001
DSQ II Hardware Manual	120299-0002
DSQ II User's Guide	120299-0003
Xcalibur Getting Productive: Merlin the Custom Report Writer	Xcali-97065
Xcalibur Getting Productive: Processing Setup	Xcali-97064
Xcalibur Getting Productive: Qual Analysis	Xcali-97061
Xcalibur Getting Productive: Quan Analysis	Xcali-97063
Xcalibur Getting Productive: Libraries	Xcali-97062

A.15 Miscellaneous Items

Table A.17. Miscellaneous Items

Description	Part Number
Cable, TRACE GC to PC	230 980 00
Cable, TRACE GC to DSQ II Remote Start	76396-0050
Capillary Column, 5MS, 0.25 mm ID, 15 m, 0.25 µm	76317-3015
Injector Ferrule, for 0.25 mm ID Column	290 134 88
Syringe, 10 µL with 70 mm Needle	365 001 03
Transfer Line Ferrule, 1/16-in. to 0.4 mm, Graphite/Vespel	A0101-18100

Appendix B Functional Block Diagrams

This appendix contains functional block diagrams for the *DSQ II* system and its subsystems.

In This Chapter

- B.1 Vacuum System and Gas Inlets pp. B-288
- B.2 Electronic Assemblies pp. B-289
- B.3 Power Distribution pp. B-290
- B.4 Remote Start Cable Connections pp. B-291

B.1 Vacuum System and Gas Inlets

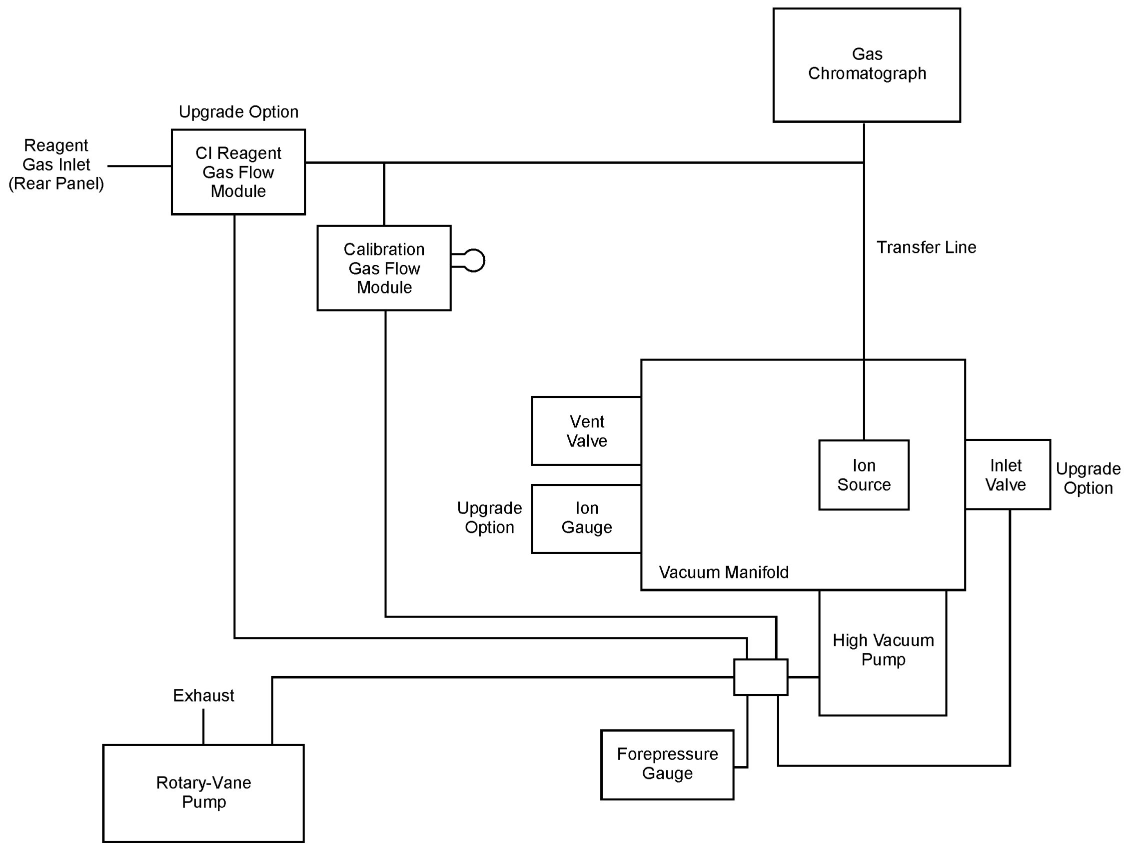


Figure B-1. Vacuum System and Gas Inlets

B.2 Electronic Assemblies

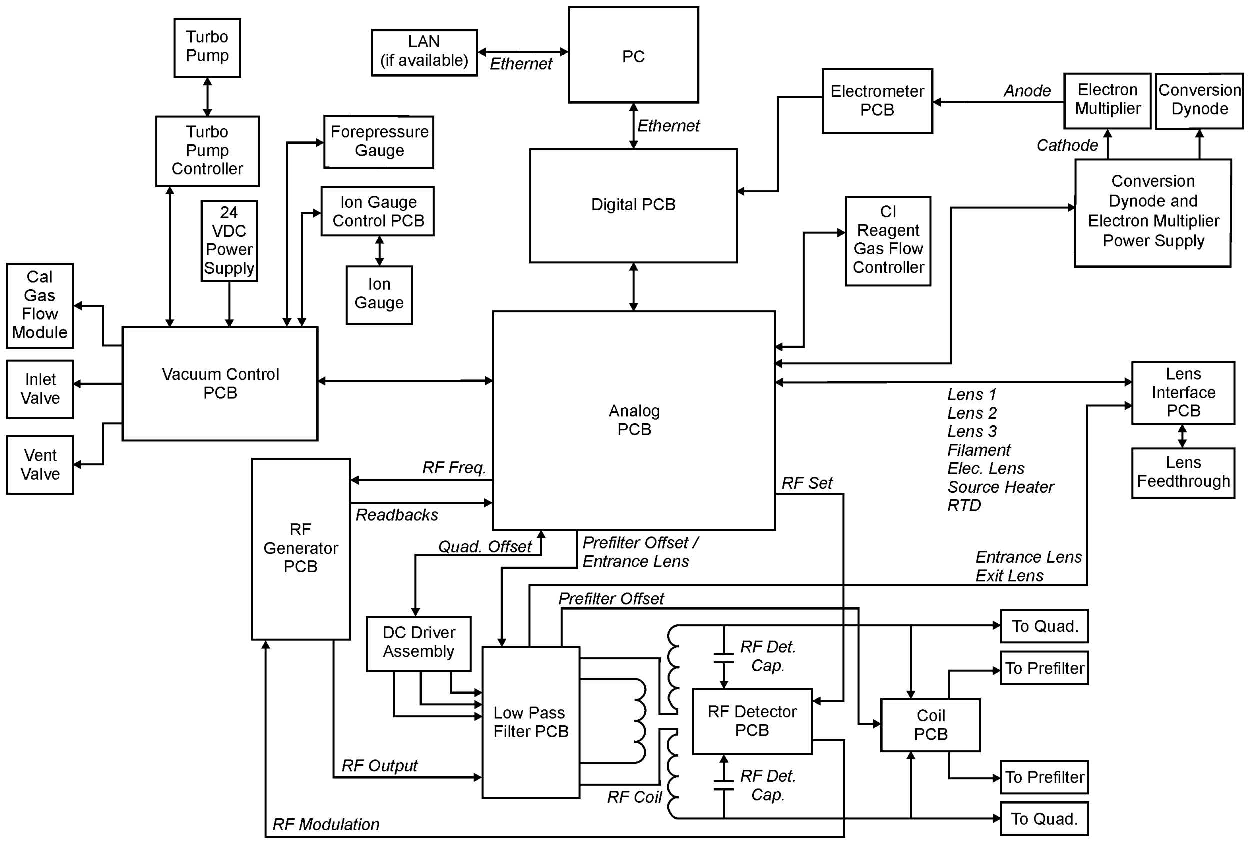


Figure B-2. Electronic Assemblies

B.3 Power Distribution

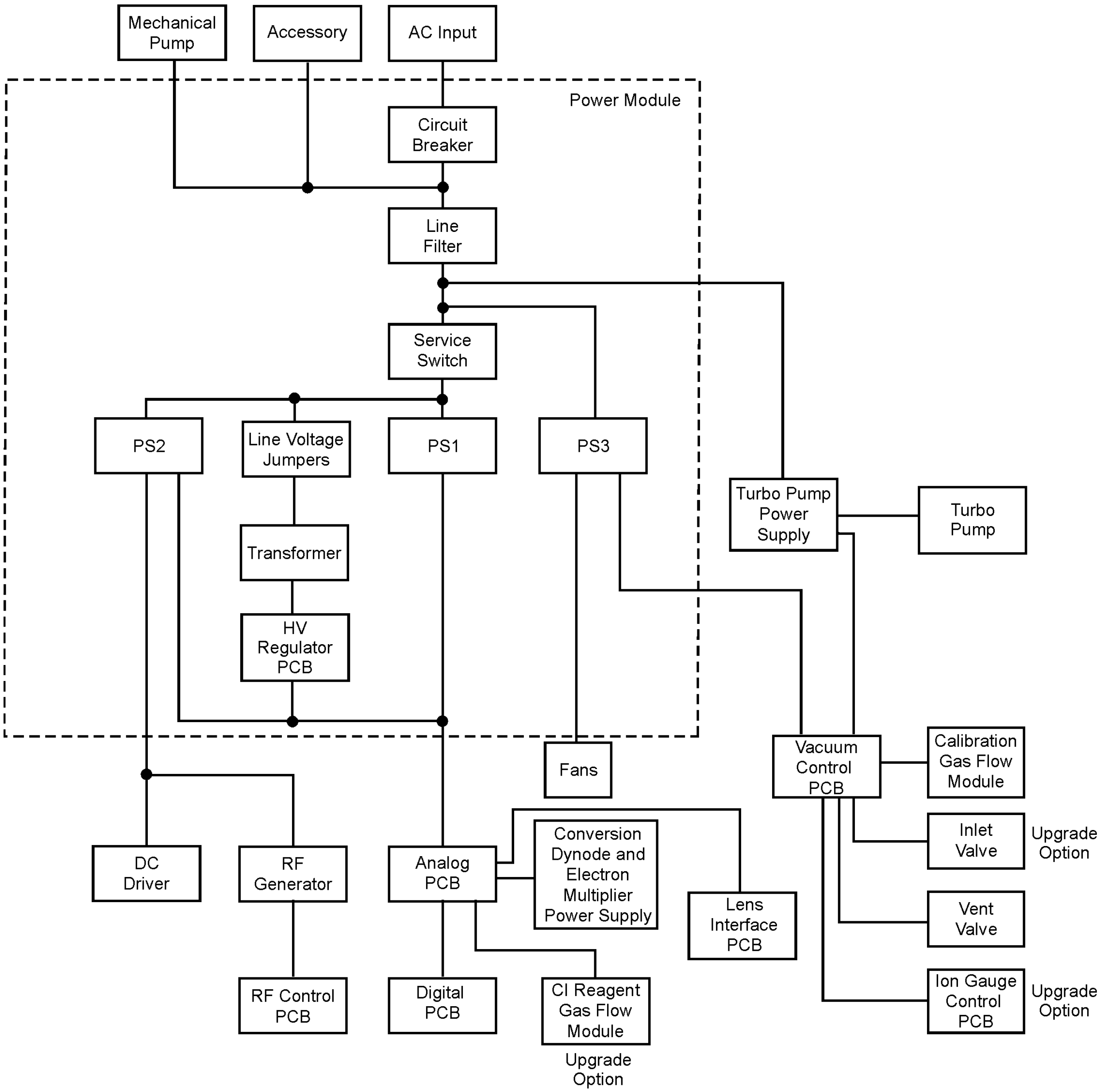
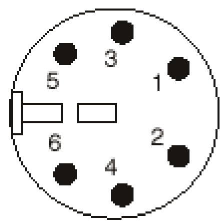


Figure B-3. Power Distribution

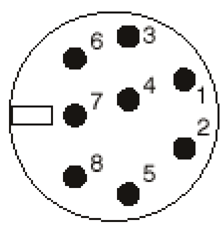
B.4 Remote Start Cable Connections

Accessory Start



Trigger Bit 0 *	1
Trigger Bit 1 *	2
Trigger Bit 2 *	3
Trigger Bit GND **	4
Remote Start In ***	5
GND	6

GC Start



N/C (Not Connected)	1
Inhibit Ready Out with High Signal	2
GND	3
Remote Start In ***	4
N/C	5
N/C	6
N/C	7
Inihibit Ready Out with Low Signal	8

* For electromagnetic compatibility (EMC), use a shielded cable. Tie the shield to the metal can of the connector.
** Use only with trigger bits (pins 1-3)
*** Polarity set in instrument configuration. Default is start when signal is low.

Figure B-4. Remote Start Cable Connections (Back)

The *DSQ II* offers two connections to start remote injections; Accessory Start and GC Start.

Use these connections to determine which connection to plug the remote start cable into. Plug one end of the remote start cable into the back of the *DSQ II* and the other end into the device you intend to use to start injections.

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