SCIEX 3200 Systems

System User Guide

February 2022

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Contents

Operational Precautions and Limitations

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Note: Before operating the system, carefully read all of the sections of this guide.

This section contains general safety-related information and provides regulatory compliance information. It also describes potential hazards and associated warnings for the system and the precautions that should be taken to minimize the hazards.

In addition to this section, for information about the symbols and conventions used in the laboratory environment, on the system, and in this documentation, refer to the section: Glossary of Symbols. For site requirements, including mains supply, source exhaust, ventilation, compressed air, nitrogen, and roughing pump requirements, refer to the document: *Site Planning Guide*.

General Safety Information

To prevent personal injury or system damage, read, understand, and obey all of the safety precautions and warnings in this document, the manufacturer chemical safety data sheets (SDSs), and product label information. Labels are shown with internationally recognized symbols. Failure to heed these warnings could result in serious injury.

This safety information is intended to supplement federal, state, provincial, and local environmental health and safety (EHS) regulations. The information provided covers system-related safety information applicable to the operation of the system. It does not cover every safety procedure that should be practiced. Ultimately, the user and the organization are responsible for compliance with federal, state, provincial, and local EHS regulations and for maintaining a safe laboratory environment.

Refer to the appropriate laboratory reference material and standard operating procedures.

Documentation Symbols and Conventions

The following symbols and conventions are used throughout the guide.

DANGER! Danger signifies an action that leads to severe injury or death.

WARNING! Warning signifies an action that could cause personal injury if precautions are not followed.

CAUTION: Caution signifies an operation that could cause damage to the system or corruption or loss of data if precautions are not followed.

Note: Note emphasizes significant information in a procedure or description.

Tip! Tip provides useful information that helps apply the techniques and procedures in the text for a specific need and provides shortcuts, but is not essential to the completion of a procedure.

Regulatory Compliance

This system complies with the regulations and standards listed in this section. For dated references, refer to the *Declaration of Conformity* included with the system and the individual system components. Applicable labels have been affixed to the system.

Australia and New Zealand

- **Electromagnetic Compatibility (EMC):** Radio Communications Act 1992 as implemented in these standards:
  - Electromagnetic Interference—AS/NZS CISPR 11/ EN 55011/ CISPR 11 (Class A). Refer to the section: Electromagnetic Interference.
- **Safety:** AS/NZ 61010-1 and IEC 61010-2-061

Canada

- **Electromagnetic Interference (EMI):** CAN/CSA CISPR11. This ISM device complies with Canadian ICES-001. Refer to the section: Electromagnetic Interference.
- **Safety:**
  - CAN/CSA C22.2 No. 61010-1
  - CAN/CSA C22.2 No 61010-2-061

Europe

- **Electromagnetic Compatibility (EMC):** Electromagnetic Compatibility Directive 2014/30/EU as implemented in these standards:

  - EN 61326-1
  - EN 55011 (Class A)

  Refer to the section: Electromagnetic Compatibility.

- **Safety:** Low Voltage Directives 2014/35/EU as implemented in these standards:
  - EN 61010-1
  - EN 61010-2-061
- **Waste Electrical and Electronic Equipment (WEEE):** Waste Electrical and Electronic Equipment Directive 2012/96/EEC, as implemented in EN 40519. Refer to the section: Waste Electrical and Electronic Equipment.
- **Packaging and Packaging Waste (PPW):** Packaging and Packaging Waste Directive 94/62/EC
- **RoHS Restriction of Hazardous Substances:** RoHS Directive 2011/65/EU

United States

- **Radio Emissions Interference Regulations:** 47 CFR 15, as implemented in FCC Part 15 (Class A)
- **Safety:** Occupational Safety and Health Regulations, 29 CFR 1910, as implemented in these standards:
  - UL 61010-1
  - IEC 61010-2-061

International

- **Electromagnetic Compatibility (EMC):**
  - IEC 61326-1
  - IEC CISPR 11 (Class A)
  - IEC 61000-3-2
  - IEC 61000-3-3

  Refer to the section: Electromagnetic Compatibility.

- **Safety:**
  - IEC 61010-1
  - IEC 61010-2-061

Electrical Precautions

⚠ ⚡ **WARNING! Electrical Shock Hazard. Do not remove the covers. Removing the covers might cause injury or malfunctioning of the system. The covers need not be removed for routine maintenance, inspection, or adjustment. Contact a SCIEX Field Service Employee (FSE) for repairs that require the covers to be removed.**

- Follow required electrical safe work practices.
- Use cable management practices to control electrical cables. This will decrease the chance of a tripping hazard.

For information about system electrical specifications, refer to the document: *Site Planning Guide*.

Mains Supply

Connect the system to a compatible mains supply as instructed in this guide.

⚠ ⚡ **WARNING! Electrical Shock Hazard. Use only qualified personnel for the installation of all of the electrical supplies and fixtures, and make sure that all of the installations adhere to local regulations and safety standards.**

⚠ ⚡ **WARNING! Electrical Shock Hazard. Make sure that the system can be disconnected from the mains supply outlet in an emergency. Do not block the mains supply outlet.**

⚠ ⚡ **WARNING! Electrical Shock Hazard. Use only the mains supply cables supplied with the system. Do not use mains supply cables that are not properly rated for the operation of this system.**

An external line transformer is not needed for the mass spectrometer, optional bench, or roughing pump.

Protective Earth Conductor

The mains supply must include a correctly installed protective earth conductor. The protective earth conductor must be installed or examined by a qualified electrician before the system is connected.

WARNING! Electrical Shock Hazard. Do not intentionally interrupt the protective earth conductor. Any interruption of the protective earth conductor creates an electrical shock hazard.

WARNING! Electrical Shock Hazard. Make sure that a protective earth conductor (grounding cable) is connected between the sample loop and an appropriate grounding point at the ion source. This supplementary grounding reinforces the safety configuration specified by SCIEX.

Chemical Precautions

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Determine whether decontamination is required before cleaning or maintenance. If radioactive materials, biological agents, or toxic chemicals have been used with the system, then the customer must decontaminate the system before cleaning or maintenance.

WARNING! Environmental Hazard. Do not dispose of system components in municipal waste. Follow local regulations when disposing of components.

WARNING! Biohazard or Toxic Chemical Hazard. Connect the drain tubing to the mass spectrometer and the source exhaust drain bottle properly, to prevent leaks.

- Determine which chemicals have been used in the system prior to service and regular maintenance. For the health and safety precautions that must be followed for a chemical, refer to the document: *Safety Data Sheet*. For storage information, refer to the document: *Certificate of Analysis*. To find a SCIEX *Safety Data Sheet* or *Certificate of Analysis*, go to sciex.com/tech-regulatory.
- Always wear assigned personal protective equipment, including powder-free gloves, safety glasses, and a laboratory coat.

  Note: Nitrile or neoprene gloves are recommended.

- Work in a well-ventilated area or fume hood.
- Avoid ignition sources when working with flammable materials, such as isopropanol, methanol, and other flammable solvents.
- Take care in the use and disposal of any chemicals. There is a potential risk of personal injury if proper procedures for handling and disposal of chemicals are not followed.
- Avoid skin contact with chemicals during cleaning, and wash hands after use.

- Make sure that all exhaust hoses are connected properly and that all connections are functioning as designed.
- Collect all spent liquids and dispose of them as hazardous waste.
- Comply with all of the local regulations for the storage, handling, and disposal of biohazardous, toxic, and radioactive materials.
- (Recommended) Use secondary containment trays beneath the roughing pump, the solvent bottles, and the waste container to capture potential chemical spills.

System Safe Fluids

The following fluids can safely be used with the system.For information about safe cleaning solutions, refer to the section: Required Materials.

CAUTION: Potential System Damage. Do not use any other fluid until confirmation is received from SCIEX that it does not present a hazard. This is not an exhaustive list.

Note: Use only new, freshly prepared LC-MS-grade or better solvents for the LC mobile phases.

- **Organic Solvents**
  - LC-MS-grade acetonitrile; up to 100%
  - LC-MS-grade methanol; up to 100%
  - LC-MS-grade isopropanol; up to 100%
  - LC-MS-grade or higher water; up to 100%
- **Buffers**
  - Ammonium acetate; less than 100 mM
  - Ammonium formate; less than 100 mM
- **Acids and Bases**
  - Formic acid; less than 1%
  - Acetic acid; less than 1%
  - Trifluoroacetic acid (TFA); less than 1%
  - Heptafluorobutyric acid (HFBA); less than 1%
  - Ammonia/ammonium hydroxide; less than 1%

Ventilation Precautions

The venting of fumes and disposal of waste must comply with all of the federal, state, provincial, and local health and safety regulations. It is the responsibility of the customer to make sure that the air quality is maintained in compliance with local health and safety regulations.

The source exhaust system and roughing pump must be vented to a dedicated laboratory fume hood or an external exhaust system.

WARNING! Fire Hazard. Make sure that the source exhaust system is connected and functioning, to prevent flammable vapor from accumulating in the ion source.

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Take care to vent exhaust gases to a dedicated laboratory fume hood or exhaust system and make sure that the ventilation tubing is secured with clamps. Make sure that the laboratory has appropriate air exchange for the work performed.

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Do not operate the mass spectrometer if the source exhaust drain and roughing pump exhaust hoses are not properly connected to the laboratory ventilation system. Examine the exhaust tubing regularly to make sure that there are no leaks. The use of mass spectrometers without proper system ventilation might constitute a health hazard and might result in serious injury.

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Do not use the ion source without knowledge of and training in the proper use, containment, and evacuation of toxic or injurious materials used with the ion source.

WARNING! Puncture Hazard, Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Discontinue use of the ion source if the ion source window is cracked or broken, and then contact a SCIEX Field Service Employee (FSE). Any toxic or injurious materials introduced in the equipment will be present in the source exhaust output. Exhaust from equipment should be vented from the room. Dispose of sharps following established laboratory safety procedures.

Physical Precautions

WARNING! Lifting Hazard. Use a mechanical lifting device to lift and move the mass spectrometer. If the mass spectrometer must be moved manually, then at least six people are required to move it safely. Follow established safe lifting procedures. We recommend the use of a professional moving service. For the weights of system components, refer to the document: *Site Planning Guide*.

Environmental Precautions

Use qualified personnel for the installation of electrical mains, heating, ventilation, and plumbing supplies and fixtures. Make sure that all of the installations comply with local bylaws and biohazard regulations. For information about the required environmental conditions for the system, refer to the document: *Site Planning Guide*.

Allow access space around the equipment when setting up the system.

DANGER! Explosion Hazard. Do not operate the system in an environment containing explosive gases. The system is not designed for operation in an explosive environment.

WARNING! Biohazard. For biohazardous material use, always comply with local regulations for hazard assessment, control, and handling. This system or any part is not intended to act as a biological containment.

WARNING! Environmental Hazard. Follow established procedures for disposal of biohazardous, toxic, radioactive, and electronic waste. The customer is responsible for disposal of hazardous substances, including chemicals, waste oils, and electrical components, in accordance with local laws and regulations.

CAUTION: Potential Mass Shift. Maintain a stable ambient temperature. If the temperature changes by more than 2 °C per hour, then the resolution and mass calibration might be affected.

Electromagnetic Environment

Electromagnetic Compatibility

Basic Electromagnetic Environment: Environment existing at locations characterized by being supplied directly at low voltage from the public mains network.

Performance Criteria A (Criteria A): Equipment shall operate as intended with no degradation of performance and no loss of function during or after test.

Performance Criteria B (Criteria B): Equipment may experience loss of function (one or more) during test but shall operate as intended with some degradation of performance and functions self-recoverable after test.

Performance Criteria C (Criteria C): Equipment may experience loss of function (one or more) during test but shall operate as intended with some degradation of performance and functions recoverable by operator after test.

The equipment is intended for use in a basic electromagnetic environment.

The expected performance loss under the electromagnetic immunity conditions is less than 20% change in total ion count (TIC).

Make sure that a compatible electromagnetic environment for the equipment can be maintained so that the device will operate as intended. If the power supply line is subject to high electrical noise, then install a surge protector.

Electromagnetic Interference

Group 1 Equipment: This equipment is classified as industrial, scientific, and medical (ISM) equipment that might use RF energy for internal operation.

Class A Equipment: Equipment which is suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes. [Derived from CISPR 11:2009, 5.3] Class A equipment shall meet Class A limits.

CAUTION: Potential Radio Interference. This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

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 (Federal Communications Commission) Compliance 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 and, if not installed and used in accordance with the operator's manual, can cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference in which case you will be required to correct the interference, at your own expense. Changes or modifications not expressly approved by the manufacturer could void your authority to operate the equipment.

Decommissioning and Disposal

WARNING! Environmental Hazard. Follow established procedures for disposal of biohazardous, toxic, radioactive, and electronic waste. The customer is responsible for disposal of hazardous substances, including chemicals, waste oils, and electrical components, in accordance with local laws and regulations.

Before decommissioning, decontaminate the entire system following local regulations.

When removing the system from service, separate and recycle different materials according to national and local environmental regulations. Refer to the section: Storage and Handling.

Note: SCIEX will not accept any system returns without a completed Decontamination Form. Contact an FSE to obtain a copy of the form.

Do not dispose of system components or subassemblies, including computer parts, as unsorted municipal waste.

Waste Electrical and Electronic Equipment

Follow local municipal waste ordinances for proper disposal provisions to reduce the environmental impact of waste, electrical, and electronic equipment (WEEE). To safely dispose of this equipment, contact a local Customer Service office for complimentary equipment pick-up and recycling.

Qualified Personnel

Only qualified SCIEX personnel shall install, inspect, and service the equipment. After installing the system, the Field Service Employee (FSE) uses the *Customer Familiarization Checklist* to orient the customer on system operation, cleaning, and basic maintenance. SCIEX might not cover the damage to a system under warranty if it is serviced by personnel not authorized by SCIEX.

Only personnel qualified by the manufacturer shall maintain the equipment. A laboratory designate can be familiarized with the Qualified Maintenance Person (QMP) procedures during the installation. A QMP is a person who is suitably aware of the electrical and chemical risks associated with servicing laboratory equipment.

Laboratory Conditions

Safe Environmental Conditions

The system is designed to operate safely under these conditions:

- Indoors
- Altitude: Up to 2,000 m (6,560 ft) above sea level
- Ambient temperature: 5 °C (41 °F) to 40 °C (104 °F)
- Relative humidity: 20% to 80%, non-condensing
- Mains supply voltage fluctuations: ± 10% of the nominal voltage
- Transient overvoltages: Up to the levels of Overvoltage Category II
- Temporary overvoltages on the mains supply
- Pollution Degree 2

Performance Specifications

The system is designed to meet specifications under these conditions:

- An ambient temperature of 15 °C to 30 °C (59 °F to 86 °F)

  Over time, the temperature must remain within a range of 4 °C (7.2 °F), with the rate of the change in temperature not exceeding 2 °C (3.6 °F) per hour. Ambient temperature fluctuations exceeding the limits might result in mass shifts in spectra.
- Relative humidity from 20% to 80%, non-condensing

Equipment Use and Modification

WARNING! Personal Injury Hazard. Contact the SCIEX representative if product installation, adjustment, or relocation is required.

WARNING! Electrical Shock Hazard. Do not remove the covers. Removing the covers might cause injury or malfunctioning of the system. The covers need not be removed for routine maintenance, inspection, or adjustment. Contact a SCIEX Field Service Employee (FSE) for repairs that require the covers to be removed.

WARNING! Personal Injury Hazard. Use SCIEX-recommended parts only. Use of parts not recommended by SCIEX or use of parts for any purpose other than their intended purpose can put the user at risk of harm or negatively impact system performance.

WARNING! Lifting Hazard. Use a mechanical lifting device to lift and move the mass spectrometer. If the mass spectrometer must be moved manually, then at least six people are required to move it safely. Follow established safe lifting procedures. We recommend the use of a professional moving service. For the weights of system components, refer to the document: *Site Planning Guide*.

WARNING! Crushing Hazard. Wear protective footwear when moving heavy objects.

Use the system indoors in a laboratory that complies with the environmental conditions recommended in the mass spectrometer document: *Site Planning Guide*.

If the system is used in an environment or in a manner not prescribed by the manufacturer, then the performance and protection provided by the equipment might be impaired.

Unauthorized modification or operation of the system might cause personal injury and equipment damage, and might void the warranty. Erroneous data might be generated if the system is operated outside the recommended environmental conditions or with unauthorized modifications. Contact an FSE for information on servicing the system.

Principles of Operation

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The system is a liquid chromatography-tandem mass spectrometry (LC-MS/MS) system and it includes the following components:

- A mass spectrometer with a Turbo V ion source that uses either the TurboIonSpray probe or the Atmospheric Pressure Chemical Ionization (APCI) probe, a roughing pump, and a source of compressed air and nitrogen.
- SCIEX-supplied computer and monitor with Analyst software for instrument optimization, acquisition method development, and data acquisition and processing.

This section includes information about the mass spectrometer. For an overview of the ion source, refer to the document: *Turbo V Ion Source Operator Guide*.

For information on the computer and software, refer to the document: *Software Installation Guide* for the software.

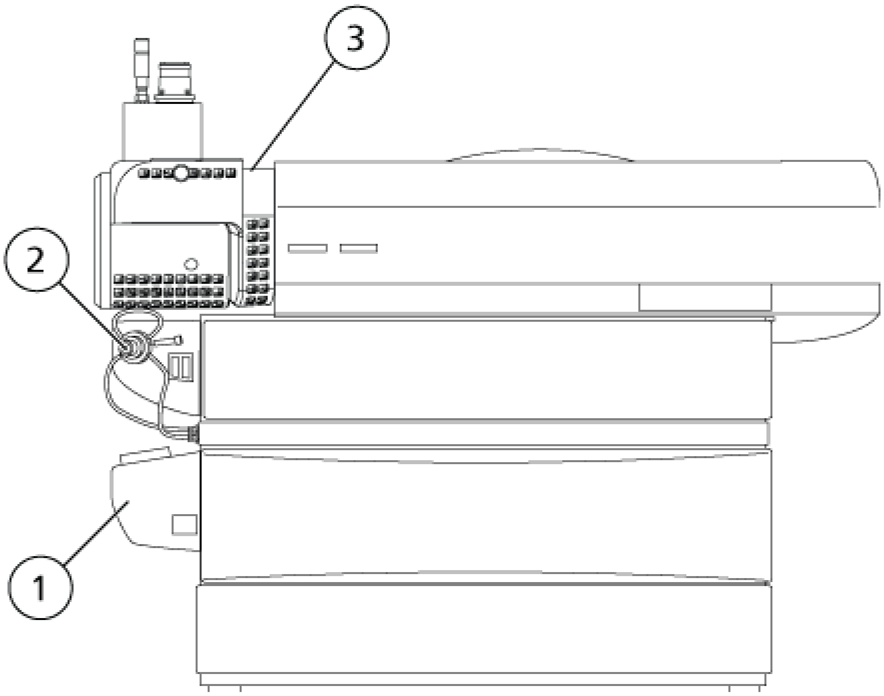
System Overview

The 3200 series of instruments includes the following components:

- A API 3200 or 3200 QTRAP mass spectrometer with a roughing pump and a source of compressed air and nitrogen
- A Turbo V ion source that uses either the TurboIonSpray probe or the atmospheric pressure chemical ionization (APCI) probe. Refer to the document: *Turbo V Ion Source Operator Guide*.
- SCIEX-supplied computer and monitor with the Analyst software for instrument optimization, acquisition method development, data acquisition, and processing. For computer specifications and requirements, refer to the *Software Installation Guide* for the Analyst software.

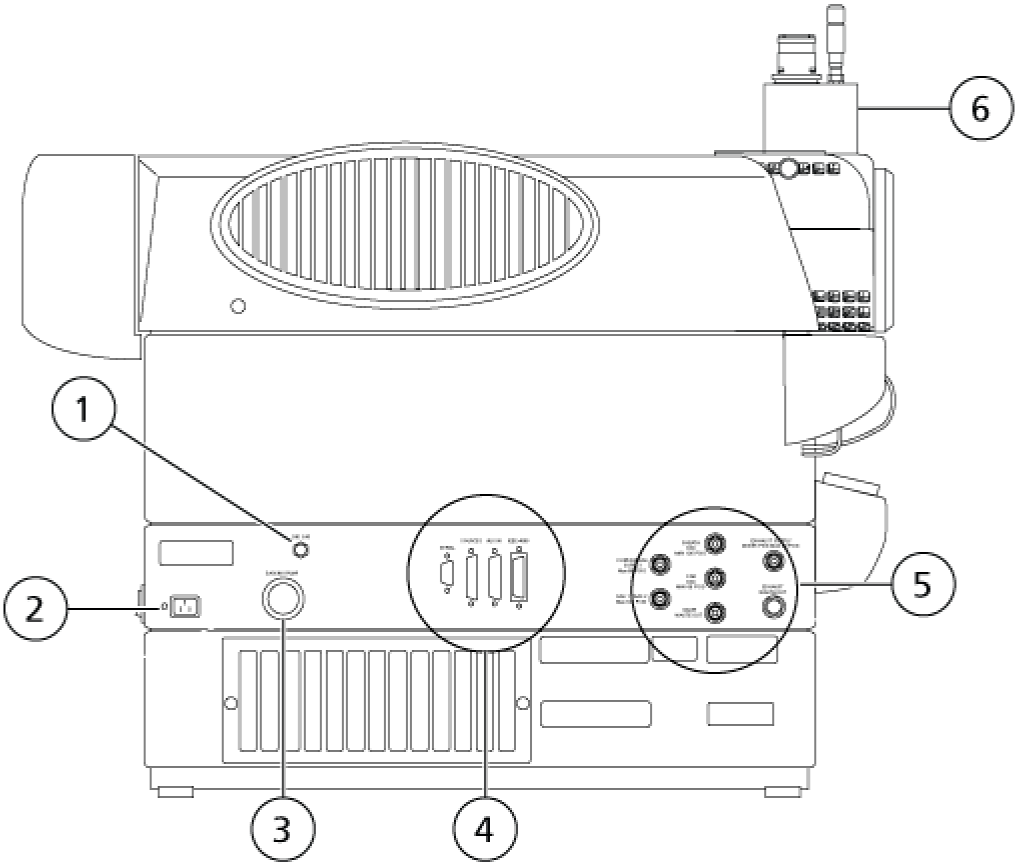
Hardware Overview

Figure 2-1 Front View



Item	Description	Materials Users May Contact
1	Integrated Syringe Pump	Paint over steel (body), stainless steel (rails), bronze (bearings)
2	Integrated Switching Valve	Stainless steel, plastic (tubing, fittings, valve body), PEEK (tubing, fittings)
3	Ion Source	Stainless steel (tubing, fittings, heat shield, micrometer), bronze (lock nut), rubber, FKM (tubes), silica glass (window), polyester (labels)

Figure 2-2 Back View

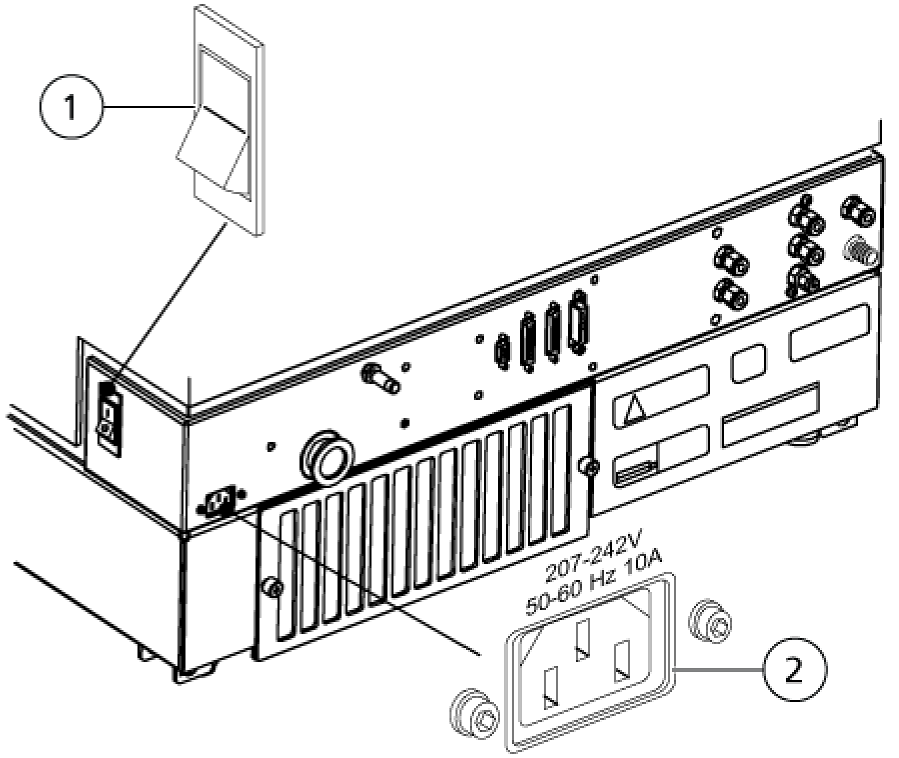


Item	Description	Materials Users May Contact
1	CAD Gas Adjustment Valve	Stainless steel (knob)
2	AC Mains Supply	Plastic (connector), PVC (cable)
3	Roughing Pump Connection	Aluminum (hose fitting), Zn-plated steel (hose clamps)
4	I/O Panel	N/A
5	Gas Panel	Stainless steel (tubing fittings)
6	Ion Source	Stainless steel (tubing fittings, heat shield, micrometer), micrometer, silica glass (window), polyester (labels)

AC Mains Connections

The system mains connection is located near the back left corner of the mass spectrometer, which contains the power distribution module. This area also contains the mass spectrometer convenience switch and the external AC mains supply inlet.

Figure 2-3 Mass Spectrometer Switch and AC Mains Supply Inlet



Item	Description
1	Mass Spectrometer Convenience Switch
2	AC Mains Supply Inlet

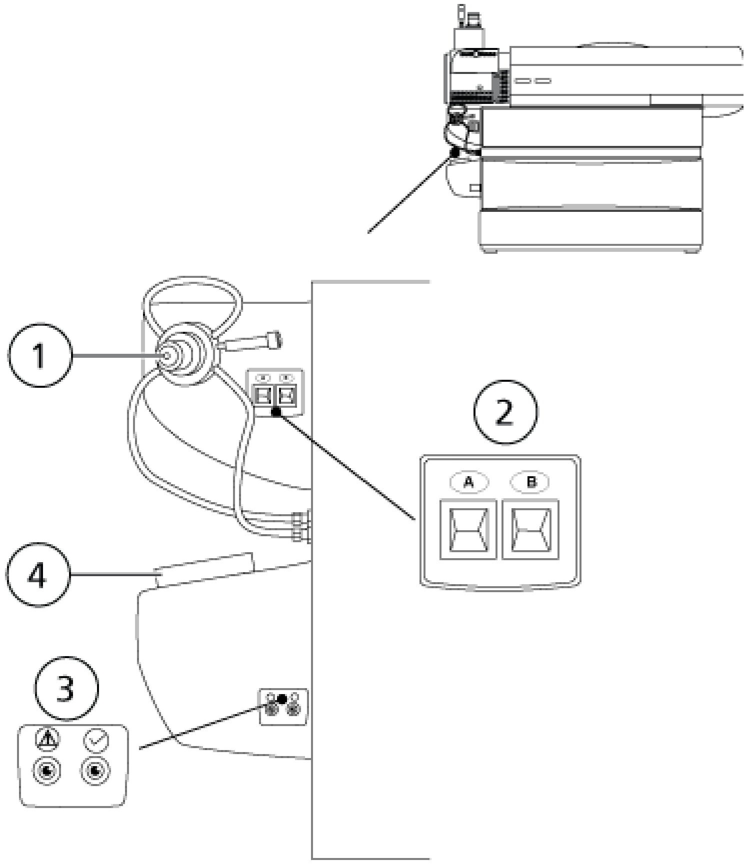
Sample Introduction Features and Status Indicators

This section describes the features and controls on the front left of the mass spectrometer, beside the ion source.

The Instrument Status lights indicate the status of the mass spectrometer vacuum. When the operational vacuum conditions are satisfied and the mass spectrometer is in analysis mode, the Ready light (green) is illuminated and the Fault light (red) is extinguished. The Fault light flashes when a vacuum fault is detected. In pump-down mode, the Ready light flashes for the duration of the sequence.

Directly below the ion source is a set of integrated sample introduction features. An integrated switching valve with associated Load and Inject buttons (marked A and B, respectively) can be used as a manual injector during analyte optimization using FIA, or for diverting LC flow when any precipitate or salts initially come off the LC column. Below that, an integrated syringe pump is available for infusing standards when the system is calibrating the mass spectrometer or optimizing for an analyte.

Figure 2-4 Sample Introduction Features and Status Indicators



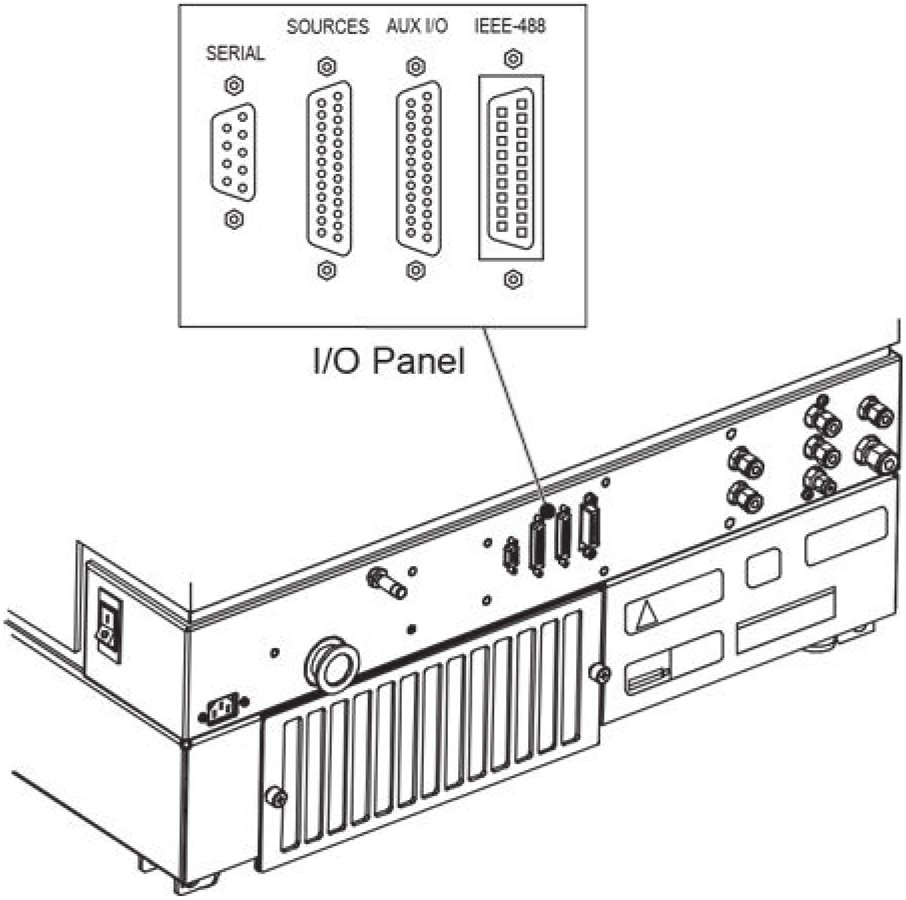
Item	Description
1	Integrated Switching Valve
2	Load / Inject
3	Instrument Status (Fault / Ready)
4	Integrated Syringe Pump

I/O Panel

The input/output (I/O) panel is located at the center back of the chassis. This panel contains several connection ports for the system:

- Serial port
- Ion source port
- AUX I/O outlet
- IEEE-488 (GPIB) port (provides a connection to the acquisition computer)

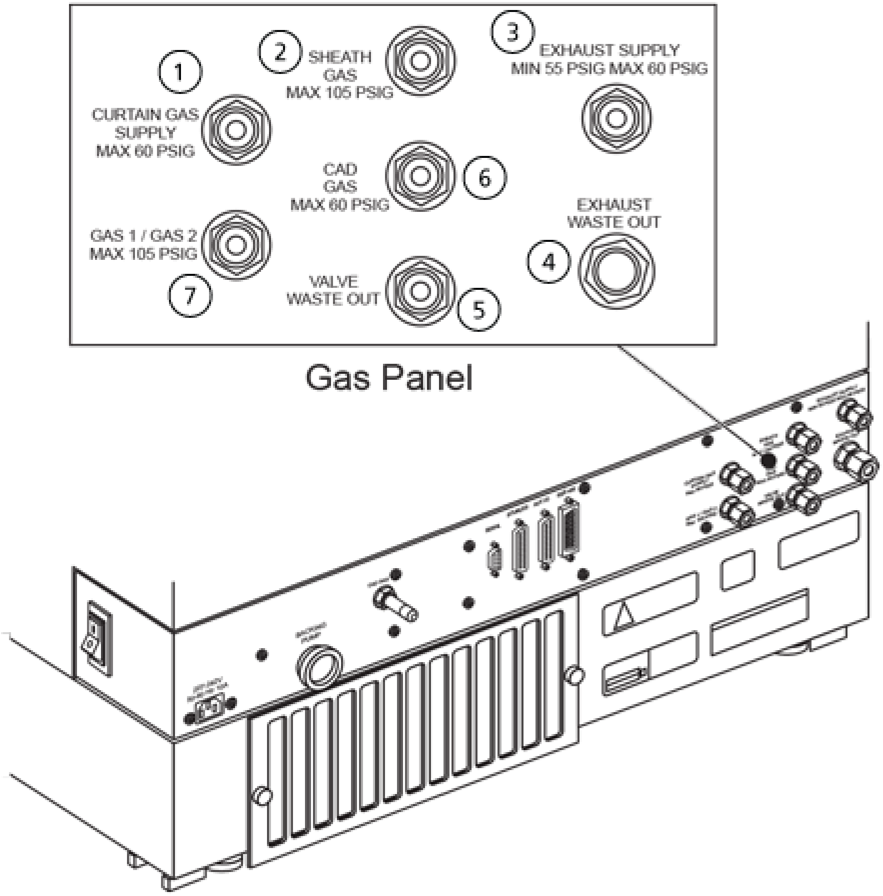
Figure 2-5 I/O Panel



Gas Panel

The gas panel contains the gas supply connections and the external connections for the source exhaust system.

Figure 2-6 Gas and Vacuum Panel



Item	Description
1	Curtain Gas Supply (Max 60 PSIG)
2	Sheath Gas (Max 105 PSIG)
3	Exhaust Supply (55-60 PSIG)
4	Exhaust Waste Out
5	Valve Waste Out
6	CAD Gas (Max 60 PSIG)
7	Gas 1/Gas 2 (Max 105 PSIG)

Ion Source Overview

The Turbo V ion source can be used for either electrospray ionization (ESI) or atmospheric pressure chemical ionization (APCI).

The TurboIonSpray probe is used for ESI mode operation. The APCI probe is used for APCI mode operation.

Applications for the ion source include qualitative method development and qualitative and quantitative analysis.

The installation procedures can be performed on the following systems:

- TripleTOF systems
- QTRAP and SCIEX Triple Quad systems

In this guide, the software that controls the mass spectrometer is referred to as the control software. The control software varies depending on the mass spectrometer used. Refer to the following table.

Ionization Modes

ESI Mode

ESI produces gas phase ions of analytes in a sample by applying a high voltage to the sample effluent flowing through a needle. With the aid of heated gas flow, ESI produces singly and multiply charged ions in a relatively mild condition so that it is suitable for a wide range of compounds including small molecules, such as drugs or pesticides, and larger molecules, such as peptides, proteins, and other biopolymers. The sensitivity depends on the chemical properties of the analyte, the gas flow rate, the temperature, the voltage, and the mobile phase composition.

The ESI technique is mild enough to be used with labile compounds, such as peptides, proteins, and thermally labile pharmaceuticals. It functions with flow rates from 5 µL/min to 3,000 µL/min and it vaporizes 100% aqueous to 100% organic solvents.

Refer to the section: Electrospray Ionization Mode.

APCI Mode

The APCI mode is suitable for:

- Ionization of compounds that do not readily form ions in solution. These are usually non-polar compounds.
- Creation of simple APCI spectra for LC-MS/MS experiments.
- High-throughput analyses of complex and dirty samples. It is less sensitive to ion suppression effects.

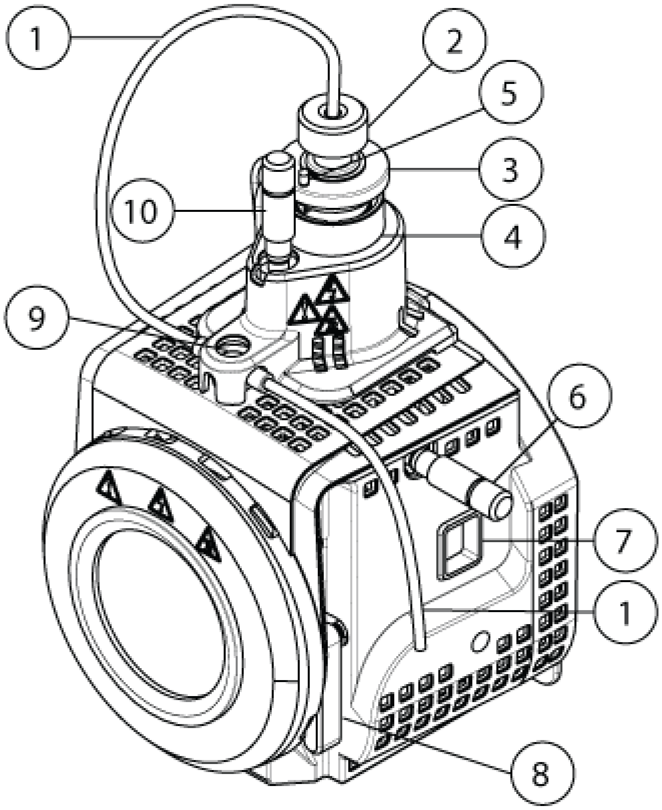
- Rapid sample introduction by flow injection with or without an LC column.

The APCI technique can be used for volatile and thermally labile compounds with minimal thermal decomposition. The rapid desolvation and vaporization of the droplets and entrained analyte minimizes thermal decomposition and preserves molecular identity for ionization by the corona discharge needle. Buffers are readily tolerated by the ion source without significant contamination and the flash vaporization of the sprayed effluent allows up to 100% water to be used. The probe can accept the entire effluent, without splitting, at flow rates from 200 µL/min to 3,000 µL/min, through a wide-bore column.

Refer to the section: APCI Mode.

Ion Source Components

Figure 2-7 Ion Source Components



Item	Description	Primary Materials
1	Sample tubing from a sample supply device	Red PEEK
2	Electrode adjustment nut	Polyoxymethylene
3	Retaining ring	PEEK

Item	Description	Primary Materials
4	Probe tower	Stainless steel
5	Corona discharge needle adjustment screw	PEEK
6	Micrometer used to position the probe on the horizontal axis for ion source sensitivity adjustments	Glass
7	Window port	Stainless steel
8	One of two source latches that secure the ion source to the mass spectrometer	Stainless steel
9	Grounding union, located under the ion source cover.	Stainless steel
10	Micrometer used to position the probe on the vertical axis for ion source sensitivity adjustments	Polyoxymethylene

Probes

The TurboIonSpray and APCI probes provide a range of capability for testing samples. Select the probe and method most suitable for the compounds in the sample.

Table 2-1 Ion Source Specifications

Specification	TurboIonSpray Probe	APCI Probe
Temperature range	From ambient temperature to 750 °C, depending on liquid flow	From ambient temperature to 750 °C, depending on liquid flow
Liquid flow inlet	5 µL/min to 3,000 µL/min	200 µL/min to 3,000 µL/min
Ion source gas 1 / ion source gas 2	Refer to the mass spectrometer document: *Site Planning Guide*	

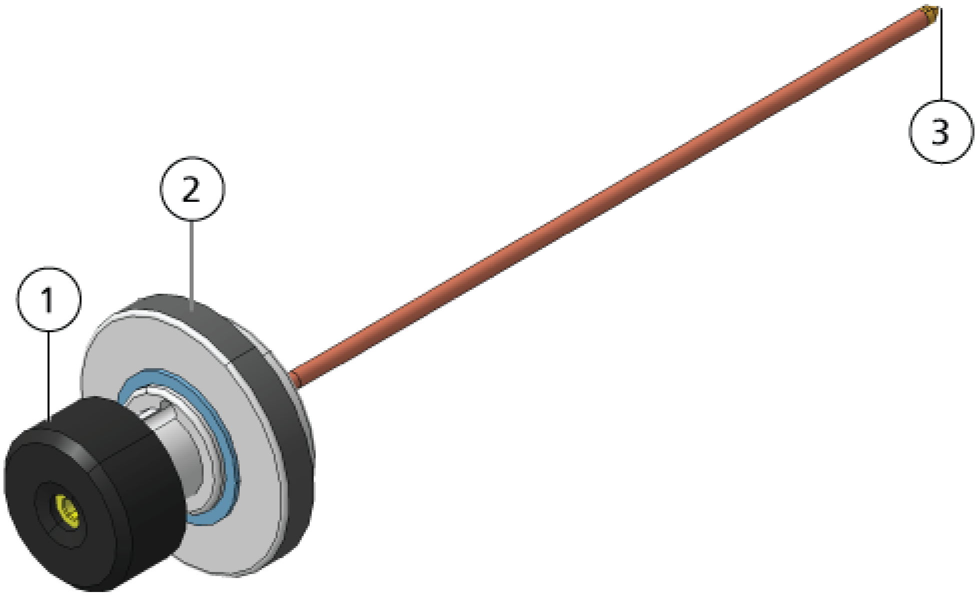
The software for the mass spectrometer identifies the installed probe and enables the corresponding user controls. All of the data acquired using the ion source is identified with an abbreviation representing the probe used to acquire the data (TIS for the TurboIonSpray probe and HN for the APCI probe).

TurboIonSpray Probe

The TurboIonSpray probe consists of 300 µm outer diameter (o.d.) (0.012 inch) stainless steel tubing. It is located centrally with the two turbo heaters placed at a 45 degree angle to each side. Samples introduced through the TurboIonSpray probe are ionized within the tubing, by the application of high voltage (**IonSpray Voltage**). Then they are nebulized by a jet of hot, dry, Zero-grade air from the turbo heaters, creating a mist of small, highly-charged droplets. The combination of the ion source effluent and the heated dry gas from the turbo sprayer is projected at a 90 degree angle to the ion path. Refer to the section: Principles of Operation — Ion Source.

WARNING! Puncture Hazard. Be careful when handling the electrode. The tips of the electrodes are extremely sharp.

Figure 2-8 Parts of the TurboIonSpray Probe



Item	Description
1	Electrode adjustment nut (black collar) that adjusts the extension of the electrode tip
2	Retaining ring that fastens the probe to the probe tower on the ion source housing
3	Electrode tip through which samples are sprayed in the sample inlet area of the ion source

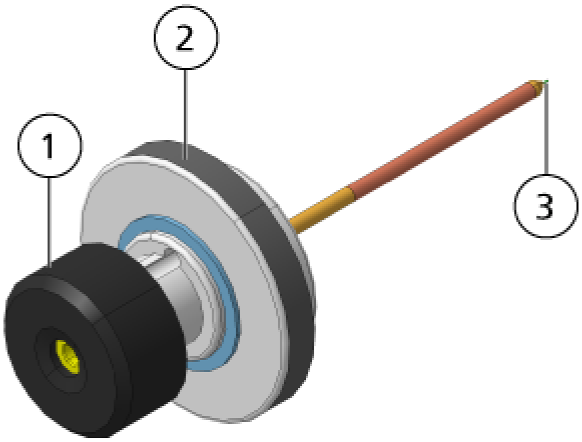
APCI Probe

The APCI probe consists of 100 µm inner diameter (i.d.) (0.004 inch) stainless steel tubing surrounded by a flow of nebulizer gas (Gas 1). The liquid sample stream is pumped through the sprayer, where it is nebulized in a ceramic tube containing a heater. The inner wall of the ceramic tube can be maintained at a temperature range of 100 °C to 750 °C and is monitored by the sensor embedded in the heater.

A high-velocity jet of nebulizer gas flows around the electrode tip to disperse the sample as a mist of fine particles. It moves through the ceramic vaporization heater to the reaction region of the ion source and then past the corona discharge needle where the sample molecules are ionized as they pass through the ion source housing. Refer to the section: Principles of Operation — Ion Source.

WARNING! Puncture Hazard. Be careful when handling the electrode. The tips of the electrodes are extremely sharp.

Figure 2-9 Parts of the APCI Probe



Item	Description
1	Electrode adjustment nut (black collar) that adjusts the extension of the electrode tip
2	Retaining ring that secures the probe in the probe tower
3	Electrode tip through which samples are sprayed in the sample inlet area of the ion source

Gas and Electrical Connections

Gas and low- and high-voltage electrical connections are provided on the front plate of the vacuum interface and they connect internally through the ion source housing. When the ion source is installed on the mass spectrometer, all of the electrical and gas connections are complete.

Ion Source Sense Circuit

An ion source sense circuit disables the high-voltage power supply for the mass spectrometer and the source exhaust system under these conditions:

- The ion source is not installed or is improperly installed.
- A probe is not installed.

- The mass spectrometer senses a gas fault.
- A turbo heater has failed.
- The ion source has overheated.

Source Exhaust System

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Make sure that the source exhaust system is connected and functioning, to safely remove sample vapor exhaust from the laboratory environment. Emissions from the equipment must be exhausted in the general building exhaust and not allowed to exhaust in the workspace of the laboratory. For requirements for the source exhaust system, refer to the document: *Site Planning Guide*.

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Vent the source exhaust system to either a dedicated laboratory fume hood or an external ventilation system to prevent hazardous vapors from being released in the laboratory environment.

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. If an LC system is used with the mass spectrometer, and if the source exhaust system is not functioning properly, then shut down the LC system until functionality of the source exhaust system has been restored.

WARNING! Fire Hazard. Do not direct more than 3 mL/min of flammable solvent in the ion source. Exceeding the maximum flow rate can cause solvent to accumulate in the ion source. Do not use the ion source if the source exhaust system is not enabled and functioning when the ion source and the probe are properly installed.

Note: Make sure that all of the exhaust tubing is securely connected to reduce the chance of equipment exhaust entering the room.

An ion source produces both sample and solvent vapors. These vapors are a potential hazard to the laboratory environment. The source exhaust system is designed to safely remove and allow for the appropriate handling of the sample and solvent vapors. When the ion source is installed, the mass spectrometer does not operate unless the source exhaust system is operating.

A vacuum switch installed in the source exhaust sense circuit measures the vacuum in the source. If the vacuum in the source rises above the set point while the probe is installed, then the system enters an exhaust fault, that is, Not Ready, state.

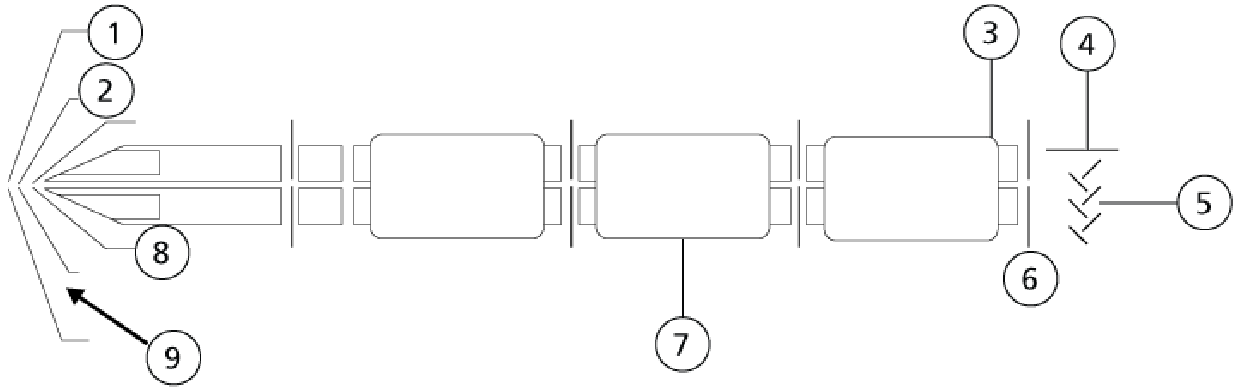
An active exhaust system removes ion source exhaust, including gases, solvent, and sample vapor, through a drain port, without introducing chemical noise. The drain port connects through a drain chamber and a source exhaust pump to a drain bottle, and from there to a customer-supplied exhaust ventilation system. For information about the ventilation requirements for the source exhaust system, refer to the document: *Site Planning Guide*.

Note: Examine the source exhaust system periodically to make sure that the exhaust tubing is intact and that exhaust is not leaking in the room.

Theory of Operation

Mass spectrometry measures the mass-to-charge ratio of ions to identify unknown compounds, to quantify known compounds, and to provide information about the structural and chemical properties of molecules.

Figure 2-10 Ion Optics Path for the 3200 System



Item	Description
1	Curtain plate
2	DP (orifice)
3	C2B (collar lens) (QTRAP only)
4	DF (deflector)
5	Detector
6	EXB (exit lens) (QTRAP only)
7	LINAC® collision cell

Item	Description
8	Skimmer
9	CUR (Curtain Gas™ flow)

The system uses the Turbo V ion source which can use either the TurboIonSpray probe or the atmospheric pressure chemical ionization (APCI) probe to produce ions from liquid samples. The mass spectrometer is configured to perform complex MS/MS analysis, but for less rigorous analytical requirements it can perform single MS scans.

The linear ion trap (LIT) functionality provides a number of Enhanced modes of operation. A common factor of the Enhanced modes is that ions are trapped in the Q3 quadrupole region and then scanned out to produce full spectrum data. Many spectra are rapidly collected in a short period of time and are significantly more intense than spectra collected in a comparable standard quadrupole mode of operation.

During the collection phase, ions pass through the Q2 collision cell where the CAD gas focuses the ions into the Q3 region. The Q3 quadrupole is operated with only the main RF voltage applied. Ions are prevented from passing through the Q3 quadrupole and are reflected back by an exit lens to which a DC barrier voltage is applied. After the fill time elapses, a time defined by the user, or determined by the Dynamic Fill Time feature, a DC barrier voltage is applied to the Q3 entrance lens (IQ3). This voltage confines the collected ions in the Q3 region and stops additional ions from entering. The entrance and exit lens DC voltage barriers and the RF voltage applied to the quadrupole rods confine the ions within the Q3 region.

During the scan out phase, the voltage on the exit lens and the auxiliary RF voltage are ramped simultaneously with the main RF voltage for increased resolution and sensitivity as compared to quadrupole scan types. An auxiliary AC frequency is applied to the Q3 quadrupole. The main RF voltage amplitude is ramped from low to high values, which sequentially brings masses into resonance with the auxiliary AC frequency. When ions are brought into resonance with the AC frequency, they acquire enough axial velocity to overcome the exit lens barrier and are axially ejected towards the mass spectrometer ion detector. Full spectra data can be acquired from the ions collected in the Q3 region by rapidly scanning the main RF voltage.

Ion Source Installation 3

WARNING! Electrical Shock Hazard. Install the ion source on the mass spectrometer as the last step in this procedure. High voltage is present when the ion source is installed.

CAUTION: Potential System Damage. Do not lift or carry the ion source with one hand. The ion source is designed to be lifted or carried using two hands, one on each side of the ion source.

The ion source is connected to the vacuum interface and is held in position by two source latches. The interior of the ion source is visible through the windows on the side and front of the ion source.

When the ion source is installed, the software recognizes the ion source and shows the ion source identification.

Required Materials
• Ion source • TurboIonSpray probe • (Optional) APCI probe • Red PEEK tubing (0.005 inch bore)

Prepare for Installation

WARNING! Puncture Hazard. Be careful when handling the electrode. The tip of the electrode is extremely sharp.

Tip! Do not discard the empty package. Use it to store the ion source when it is not in use.

Adjust the electrode adjustment nut on the probe to move the electrode tip inside the electrode tube. Refer to the figures: TurboIonSpray Probe and APCI Probe.

For optimum stability and performance, the electrode tip should extend between 0.5 mm and 1.0 mm from the end of the probe. Refer to the section: Optimize the TurboIonSpray Probe Position or APCI Probe Optimization.

Install the Probe

WARNING! Electrical Shock Hazard. Make sure that the ion source is completely disconnected from the mass spectrometer before proceeding.

WARNING! Puncture Hazard. Be careful when handling the electrode. The tip of the electrode is extremely sharp.

CAUTION: Potential System Damage. Do not let the protruding electrode tip or the corona discharge needle touch any part of the ion source housing, to avoid damaging the probe.

CAUTION: Potential System Damage. Make sure that the corona discharge needle tip is turned away from the aperture if the TurboIonSpray probe is in use.

Prerequisite Procedures
• Remove the Ion Source.

The probe is not pre-installed in the ion source. Always remove the ion source from the mass spectrometer before exchanging probes.

Note: If the probe is not properly installed in the ion source, then the high-voltage power for the mass spectrometer and source exhaust system is turned off.

1. Make sure that the corona discharge needle tip is pointed away from the curtain plate aperture. Refer to the section: Adjust the Position of the Corona Discharge Needle.
2. Insert the probe in the tower. Align the hole on the probe with the corona discharge needle adjustment screw at the top of the ion source. Refer to the section: Ion Source Components.
3. Gently push the probe down until the contacts engage with those in the tower.
4. Turn the retaining ring over the probe, push it down to engage the threads on the probe with the threads on the tower, and then tighten it until it is finger-tight.
5. For the APCI probe only, make sure that the corona discharge needle tip is pointed toward the curtain plate aperture. Refer to the section: Adjust the Position of the Corona Discharge Needle.

Connect the Ion Source Tubing

WARNING! Electrical Shock Hazard. Do not bypass the grounding union connection. The grounding union provides grounding between the mass spectrometer and the sample introduction device.

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Make sure that the sample tubing nut is tightened properly before operating this equipment, to prevent leakage.

Refer to the section: Ion Source Components.

1. Insert a 30 cm piece of red PEEK tubing in the sample tubing nut.
2. Install the sample tubing nut in the port at the top of the probe, and then tighten the sample tubing nut until it is finger-tight.
3. Connect the other end of the tubing to the grounding union on the ion source.

Install the Ion Source on the Mass Spectrometer

WARNING! Electrical Shock Hazard. Install the probe in the ion source before installing the ion source on the mass spectrometer.

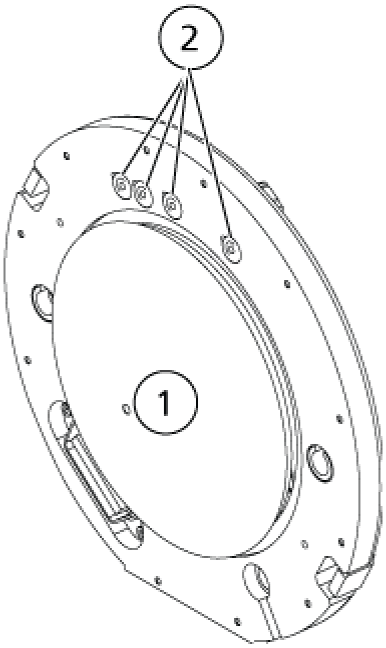
WARNING! Pinching Hazard. When installing the ion source, be careful not to pinch fingers between the ion source and the vacuum interface.

CAUTION: Potential System Damage. Do not let the protruding electrode tip or the corona discharge needle touch any part of the ion source housing, to avoid damaging the probe.

Note: If the probe is not properly installed in the ion source, then the high-voltage power for the mass spectrometer and source exhaust system is turned off.

Prerequisites
• Make sure that all of the O-rings are present on the vacuum interface.

Figure 3-1 O-rings on the Vacuum Interface



Item	Description
1	Curtain plate
2	O-rings

1. Make sure that the ion source latches on either side of the ion source are pointing up in the 12 o’clock position. Refer to the section: Ion Source Components.
2. Align the ion source with the vacuum interface, making sure that the guide pins on the ion source are aligned with the sockets in the vacuum interface.
3. Push the ion source gently against the vacuum interface and then rotate the ion source latches down to lock the ion source in place.
   The mass spectrometer recognizes the ion source and then shows the ion source identification in the control software.
4. Connect the red PEEK tubing from the sample supply device to the other side of the grounding union on the ion source.

Inspect for Leaks

WARNING! Toxic Chemical Hazard. Wear personal protective equipment, including a laboratory coat, gloves, and safety glasses, to avoid skin or eye exposure.

Inspect fittings and tubing to make sure that there are no leaks.

Ion Source Optimization

4

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Do not use the ion source without knowledge of and training in the proper use, containment, and evacuation of toxic or injurious materials used with the ion source.

WARNING! Fire Hazard. Do not direct more than 3 mL/min of flammable solvent in the ion source. Exceeding the maximum flow rate can cause solvent to accumulate in the ion source. Do not use the ion source if the source exhaust system is not enabled and functioning when the ion source and the probe are properly installed.

WARNING! Puncture Hazard, Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Discontinue use of the ion source if the ion source window is cracked or broken, and then contact a SCIEX Field Service Employee (FSE). Any toxic or injurious materials introduced in the equipment will be present in the source exhaust output. Exhaust from equipment should be vented from the room. Dispose of sharps following established laboratory safety procedures.

Optimize the ion source whenever the analyte, flow rate, or mobile phase composition changes.

When optimizing ion source-dependent parameters, introduce the sample at a flow rate that will be used during sample analysis, using either flow injection analysis (FIA) or tee infusion as the method of sample introduction. Optimize the position of the ion source before optimizing the ion source-dependent parameters.

Several parameters affect the performance of the source. Optimize the performance while injecting a known compound and monitoring the signal of the known ion. Adjust the micrometer and gas and voltage parameters to maximize the signal-to-noise ratio and signal stability.

Refer to the section: TurboIonSpray Probe Optimization or APCI Probe Optimization.

Sample Introduction

Method

The liquid sample stream is delivered to the ion source by an LC pump or by a syringe pump. If it is delivered by an LC pump, then the sample can be injected directly in the mobile phase using flow injection analysis (FIA) or tee infusion, through a syringe pump, or through a separation column using a loop injector or autosampler. If it is introduced by a syringe pump, then the sample is injected directly in the ion source. Infusion optimization can only be used for ion path optimization and MS/MS fragment selection.

Flow Rate

Sample flow rates are determined by the LC system or syringe pump. The TurboIonSpray probe supports flow rates from 5 µL/min to 3,000 µL/min. The APCI probe supports flow rates from 200 µL/min to 3,000 µL/min.

TurboIonSpray Probe Optimization

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Make sure that the source exhaust system is connected and functioning, and that good general laboratory ventilation is provided. Adequate laboratory ventilation is required to control solvent and sample emissions, and to provide for the safe operation of the system.

WARNING! Fire Hazard. Do not direct more than 3 mL/min of flammable solvent in the ion source. Exceeding the maximum flow rate can cause solvent to accumulate in the ion source. Do not use the ion source if the source exhaust system is not enabled and functioning when the ion source and the probe are properly installed.

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Make sure that the electrode protrudes beyond the tip of the probe, to prevent hazardous vapors from escaping from the source. The electrode must not be recessed within the probe.

CAUTION: Potential System Damage. If the LC system connected to the mass spectrometer is not controlled by the software, then do not leave the mass spectrometer unattended while in operation. The liquid stream from the LC system can flood the ion source when the mass spectrometer goes in Standby state.

Note: To keep the system clean and at optimum performance, adjust the probe position when changing the flow rate.

Tip! It is easier to optimize signal and signal-to-noise with flow injection analysis than with on-column injections.

Note: If the **IonSpray Voltage** is too high, then a corona discharge can occur. A corona discharge is visible as a blue glow at the tip of the probe. It results in decreased sensitivity and stability of the signal.

Flow Rate and Ion Source Temperature

The sample introduction flow rate and the sample solvent composition affect the optimal TurboIonSpray probe temperature. A higher flow rate or a higher aqueous content requires a higher optimal temperature.

The TurboIonSpray probe is often used with sample flow rates of 5 µL/min to 1,000 µL/min. The heat is used to increase the rate of evaporation which improves ionization efficiency, resulting in increased sensitivity. Extremely low flow rates of high organic solvent usually do not require increased temperatures. Refer to the section: Source Parameters and Voltages.

Set Up the System

1. Configure the LC pump to deliver the mobile phase at the required flow rate. Refer to the section: Source Parameters and Voltages.
2. Connect the grounding union on the ion source to an LC pump, through an injector equipped with a 5 µL loop, or to an autosampler.
3. If an autosampler is being used, then configure the autosampler to perform multiple injections.

Prepare the System

1. Open the control software.
2. On the Navigation bar, under **Tune and Calibrate** mode, double-click **Manual Tuning**.
3. Open a previously optimized method or create a method based on the compounds.
4. If the ion source has been allowed to cool, then do the following.
    a. Set the ion source temperature to `450`.
    b. Let the ion source warm up for 30 minutes.

    The 30-minute warm-up stage prevents solvent vapors from condensing in the cold probe.
5. Start the solvent flow and sample injection.

Set the Starting Conditions

1. In the Tune Method Editor, make sure that the correct **Scan Type** and appropriate compound parameters are selected.
2. Type a starting value for **Ion Source Gas 1**.

   For LC pumps, use a value between 40 and 60 for Gas 1.
3. Type a starting value for **Ion Source Gas 2 (GS2)**.

   For LC pumps, use a value between 30 and 50 for Gas 2.

   Note: Gas 2 is used with higher flow rates typical with an LC system and in conjunction with increased temperature.
4. Type `4500` in the **IonSpray Voltage (IS)** field.
5. Type `20` in the **Curtain Gas (CUR)** field.
6. Start acquisition.

Optimize the TurboIonSpray Probe Position

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Make sure that the electrode protrudes beyond the tip of the probe, to prevent hazardous vapors from escaping from the source. The electrode must not be recessed within the probe.

WARNING! Puncture Hazard. Be careful when handling the electrode. The tip of the electrode is extremely sharp.

After the probe is optimized, it needs only minor adjustment. If the probe is removed, or if the analyte, flow rate, or solvent composition change, then repeat the optimizing procedure.

Refer to the section: Ion Source Components.

1. Look through the window of the ion source to view the position of the probe.
2. Use the previous horizontal and vertical micrometer settings or set them to **5** as a starting position.
3. Monitor the signal or signal-to-noise of the analytes in the control software.
4. Use the horizontal micrometer to adjust the probe position in small increments to achieve the best signal or signal-to-noise ratio.

   The probe can optimize slightly to either side of the aperture.

Tip! Adjust the horizontal micrometer setting to direct the liquid spray from the TurboIonSpray probe away from the aperture to prevent contamination of the aperture; to prevent piercing of the flow of the gas for the Curtain Gas interface, which can create an unstable signal; and to prevent electrical shorting due to the presence of the liquid.

5. Use the vertical micrometer to adjust the probe position in small increments to achieve the best signal or signal-to-noise ratio.

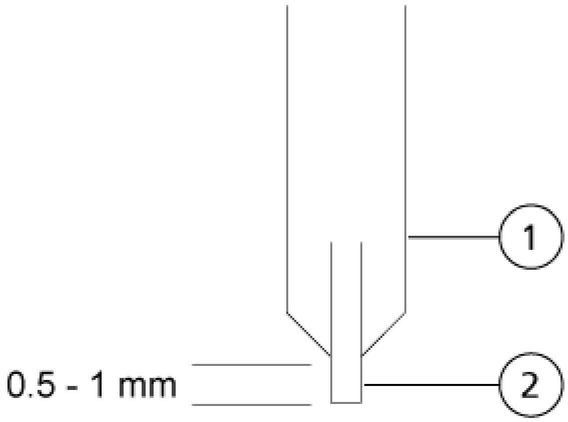
Note: The vertical position of the probe depends on the flow rate. At lower flow rates, the probe should be closer to the aperture. At higher flow rates, the probe should be farther from the aperture.

6. Adjust the black electrode adjustment nut on the probe to move the electrode tube in or out of the probe (to adjust the protrusion).

Note: The electrode tip should protrude between 0.5 mm and 1.0 mm from the end of the probe.

The optimal setting for the electrode tip is compound-dependent. The distance that the electrode tip protrudes affects the shape of the spray cone, and the shape of the spray cone affects mass spectrometer sensitivity.

Figure 4-1 Electrode Tip Extension Adjustment



Item	Description
1	Probe
2	Electrode

Optimize Source and Gas Parameters and Voltage

Optimize ion source gas 1 (nebulizer gas) for the best signal stability and sensitivity. Ion source gas 2 (heater gas) aids in the evaporation of solvent, which helps to increase the ionization of the sample.

Too high a temperature can cause premature vaporization of the solvent at the tip of the TurboIonSpray probe, especially if the probe protrudes too far, which results in signal instability and a high chemical background noise. Similarly, a high heater gas flow can produce a noisy or unstable signal.

Use the lowest ion source voltage possible without losing signal. In the Analyst software, this is the **IonSpray Voltage** field. Focus on signal-to-noise and not just signal.

Note: If the **IonSpray Voltage** is too high, then a corona discharge can occur. A corona discharge is visible as a blue glow at the tip of the probe. It results in decreased sensitivity and stability of the signal.

1. Adjust ion source gas 1 and ion source gas 2 in increments of 5 to achieve the best signal or signal-to-noise ratio.

2. Increase the flow rate of the gas for the Curtain Gas interface until the signal begins to decrease.

   Note: To prevent contamination, use the highest possible value for the flow rate of the gas for the Curtain Gas interface that does not sacrifice sensitivity. Do not set the flow rate lower than the values in the table: Table 4-1. This helps to prevent penetration of the flow of the gas for the Curtain Gas interface, which can produce a noisy signal; prevent contamination of the aperture; and increase the overall signal-to-noise ratio.

   Table 4-1 CUR Parameter Values

Mass Spectrometer	Starting Value
SCIEX 3200 systems	20

3. Adjust the ion source voltage in increments of 500 V to maximize signal-to-noise.

Optimize the Turbo Heater Temperature

The optimal heater temperature is dependent on the compound, flow rate, and mobile phase composition. The higher the flow rate and the higher the aqueous composition, the higher the optimized temperature.

When optimizing the source temperature, make sure that the ion source equilibrates to the new temperature setting.

Adjust the ion source temperature in increments of 50 °C to 100 °C to achieve the best signal or signal-to-noise ratio.

APCI Probe Optimization

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Make sure that the source exhaust system is connected and functioning, and that good general laboratory ventilation is provided. Adequate laboratory ventilation is required to control solvent and sample emissions, and to provide for the safe operation of the system.

WARNING! Fire Hazard. Do not direct more than 3 mL/min of flammable solvent in the ion source. Exceeding the maximum flow rate can cause solvent to accumulate in the ion source. Do not use the ion source if the source exhaust system is not enabled and functioning when the ion source and the probe are properly installed.

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Make sure that the electrode protrudes beyond the tip of the probe, to prevent hazardous vapors from escaping from the source. The electrode must not be recessed within the probe.

CAUTION: Potential System Damage. If the LC system connected to the mass spectrometer is not controlled by the software, then do not leave the mass spectrometer unattended while in operation. The liquid stream from the LC system can flood the ion source when the mass spectrometer goes in Standby state.

Note: The minimum flow rate supported by the APCI probe is 200 µL/min. For a complete list of APCI probe parameters, refer to the section: APCI Probe Parameters.

Tip! It is easier to optimize signal and signal-to-noise with flow injection analysis than with on-column injections.

Note: When using the APCI probe, make sure that the corona discharge needle is pointing toward the aperture.

Optimization Tips

Optimization of the ion source minimizes the need for cleaning of the ion source and vacuum interface components.

- Use the highest temperature possible when optimizing compounds. A temperature of 700 °C is common for many compounds. High temperatures help keep the ion source clean and reduce background noise.
- Use the highest possible value for the flow rate of the gas for the Curtain Gas interface that does not sacrifice sensitivity. This helps to:
  - Prevent penetration of the flow of gas for the Curtain Gas interface, which can produce a noisy signal.
  - Prevent contamination of the aperture.
  - Increase the overall signal-to-noise ratio.
- Adjust the horizontal micrometer setting to direct the liquid spray from the probe away from the aperture to:
  - Prevent contamination of the aperture.
  - Prevent piercing of the flow of gas for the Curtain Gas interface, which can create an unstable signal.
  - Prevent electrical shorting due to the presence of the liquid.

  To do so, use the vertical micrometer to move the probe up.
- Use the lowest ion source voltage possible without losing signal. Focus on signal-to-noise and not just signal.
- For flow rates greater than 2 mL/min in APCI mode, equilibrate the mass spectrometer before starting the liquid flow, to make sure that the nebulization temperature is reached.

Operating Instructions

5

WARNING! Personal Injury Hazard. Follow the instructions in the documentation when using the system. The protection provided by the equipment might be impaired if the equipment is used in a manner not specified by SCIEX.

Start Up the System

WARNING! Electrical Shock Hazard. Make sure that the system can be disconnected from the mains supply outlet in an emergency. Do not block the mains supply outlet.

Note: Before operating the instrument, read the safety information in the section: Operational Precautions and Limitations.

Prerequisites
• The site requirements specified in the *Site Planning Guide* are met. The *Site Planning Guide* includes information on the mains supply and connections, compressed air, nitrogen, roughing pump, ventilation, exhaust, and site clearance requirements. Contact SCIEX for a copy of the *Site Planning Guide*, if required. For contact information, go to sciex.com/contact-us. • The source exhaust gas, compressed air, and nitrogen gases are connected to the mass spectrometer. • The 4 L source exhaust drain bottle is connected to the exhaust waste connection on the back of the mass spectrometer and to the laboratory ventilation system. • The source exhaust hoses are securely clamped at the mass spectrometer, source exhaust drain bottle, and ventilation connections. • The mass spectrometer convenience switch is turned off and the mains supply cable is connected to the mass spectrometer. • The mass spectrometer and roughing pump mains supply cables are connected to the 200 VAC to 240 VAC mains supply. • The Ethernet cable is connected to both the mass spectrometer and the computer.

1. Turn on the roughing pump.

   The On/Off switch is beside the mains supply input connection on the roughing pump.

2. Wait five minutes, and then turn on the mass spectrometer convenience switch.
3. Turn on the computer.
4. Open the control software.

Syringe Pump

Adjust the Integrated Syringe Pump Position

WARNING! Puncture Hazard. Take care when handling the syringe. The tip of the syringe is extremely sharp.

WARNING! Puncture Hazard. Make sure that the syringe is seated properly in the syringe pump and that the automatic syringe pump stop is adjusted properly to avoid damaging or breaking the glass syringe. If the syringe breaks, follow established safety procedures for sharps disposal.

For the location of the syringe pump on the mass spectrometer, refer to the figure: Figure 2-1.

1. Press the Release button on the right side of the syringe pump to lower the base and then insert the syringe.
2. Make sure that the end of the syringe is flush with the base and that the shaft of the syringe rests in the cutout.
3. Adjust the post so that it triggers the automatic syringe stop before the syringe plunger hits the bottom of the glass syringe.
4. Make sure that the mass spectrometer and integrated syringe pump are activated in the software.
5. In the Analyst software, on the Navigation bar, double-click **Manual Tuning**.
6. Click **Start Syringe**.
7. To stop the syringe pump, click **Stop Syringe**.

Diverter Valve

To configure the valve, access the **Configuration** tab and then make sure that the **Use integrated injector/diverter valve** check box is selected.

CAUTION: Potential Wrong Result. Do not press the diverter valve button during a run. Doing so might result in incorrect data.

Plumb the Diverter Valve in Injector Mode

When the valve is in Position A, the sample flows through the external loop. When the valve switches to Position B, the sample is injected.

Plumb the valve for Injector mode.

Figure 5-1 Diverter Valve—Injector Mode Position A

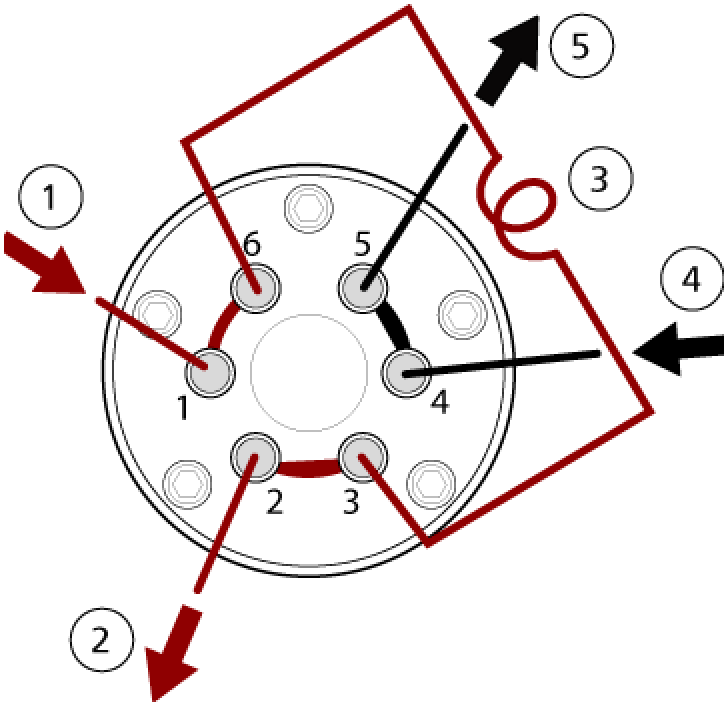
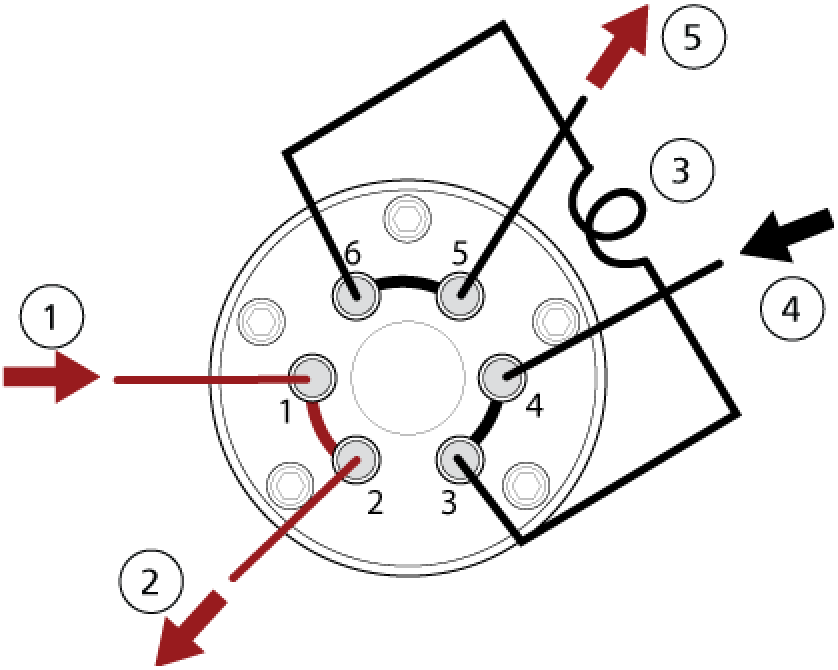


Figure 5-2 Diverter Valve—Injector Mode Position B



Item	Description
1	Sample in
2	Waste out
3	Sample loop (ports 3 and 6)
4	Mobile phase in
5	To column, or to the mass spectrometer, if a column is not installed

Plumb the Diverter Valve in Diverter Mode

When the valve is in Position A, the sample flow goes to the mass spectrometer. When the valve switches to Position B, the flow goes to waste.

Plumb the valve for Diverter mode.

Figure 5-3 Diverter Valve—Diverter Mode Position A

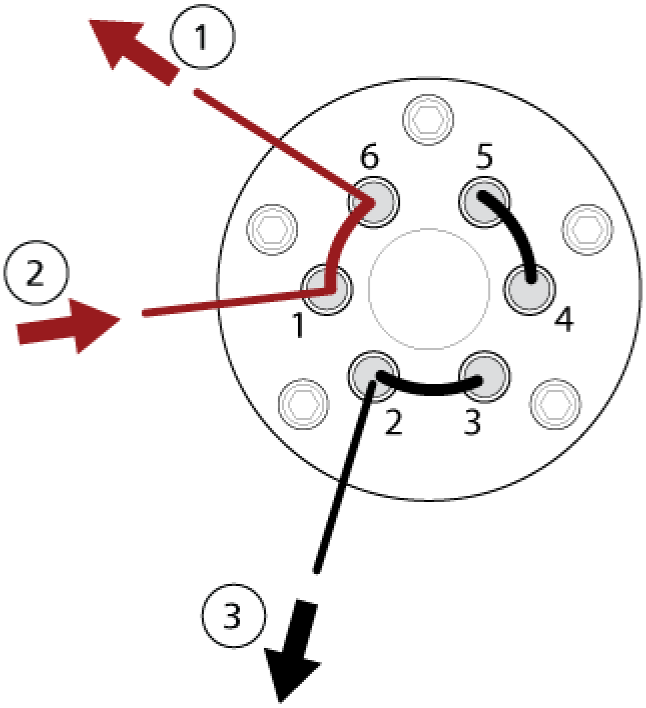
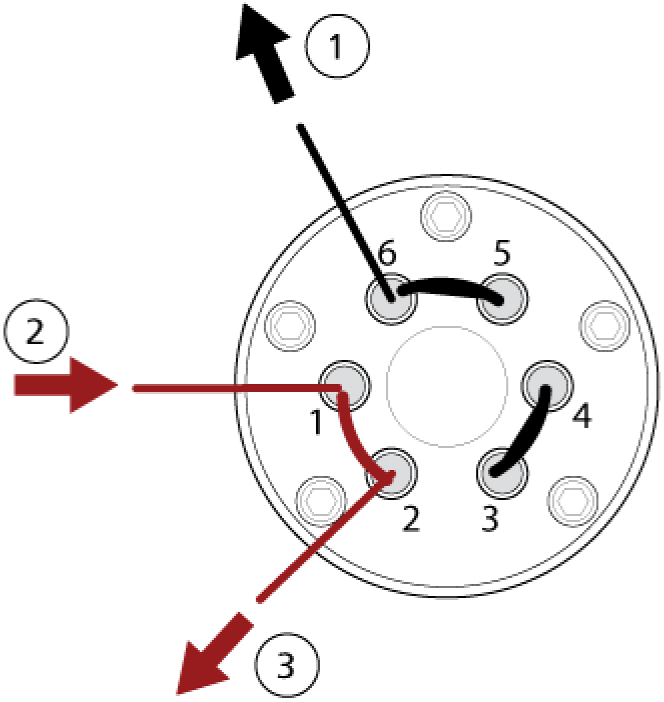


Figure 5-4 Diverter Valve—Diverter Mode Position B



Item	Description
1	To mass spectrometer
2	From column
3	Waste out

Shut Down and Vent the System

Note: If the input gas supply must be disconnected, then relieve the pressure in the gas lines before disconnecting it.

Tip! If the mass spectrometer must be shut down, then follow these instructions.

1. Complete or stop any ongoing scans.

   CAUTION: Potential System Damage. Turn off the sample flow before shutting down the system.

2. Turn off the sample flow to the system.
3. Close the software.
4. Follow these steps to vent the system:
   a. Press and hold the **Vent** button for three seconds.
      The Vacuum LED begins flashing more quickly than during pump down. The turbo pump spins down gradually.
5. Turn off the mass spectrometer convenience switch.
6. Disconnect the mass spectrometer mains supply cable from the mains supply outlet.
7. Disconnect the roughing pump mains supply cable from the mains supply outlet.

Operating Instructions — User Workflows

6

After the system is installed and configured, it is ready for use. The following table shows the workflows available. For each task, it lists a reference that contains more information.

Task	Reference
Analyst	
Monitor the system status	*Software User Guide* or Help System.
Create and submit batches	*Software User Guide* or Help System.
View and manage samples in the queue	*Software User Guide* or Help System.
Explore data	*Software User Guide* or Help System.
Method Developer	
Configure the system	• Configure the mass spectrometer: *Software User Guide* or Help System. • Create projects and data folders: *Software User Guide* or Help System • Configure the LC devices: *Software User Guide* or Help System
Tune the mass spectrometer	*Software User Guide* or Help System.
Create MS methods	*Software User Guide* or Help System.
Create LC methods	*Software User Guide* or Help System.
Develop processing methods	*Software User Guide* or Help System.
Administrator	
Set the Windows file permissions	*Laboratory Director Guide*.
Configure the LIMS	*Software User Guide* or Help System.
Add users to the software and assign roles	*Laboratory Director Guide* or Help System.
Archive logs	*Software User Guide* or Help System.
Reviewer	

Task	Reference
Review processed results	*Software User Guide* or Help System.
Explore data	*Software User Guide* or Help System.
Review logs	*Software User Guide* or Help System.

Service and Maintenance Information — Mass Spectrometer 7

Regularly clean and maintain the system for optimal performance.

WARNING! Electrical Shock Hazard. Do not remove the covers. Removing the covers might cause injury or malfunctioning of the system. The covers need not be removed for routine maintenance, inspection, or adjustment. Contact a SCIEX Field Service Employee (FSE) for repairs that require the covers to be removed.

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Determine whether decontamination is required before cleaning or maintenance. If radioactive materials, biological agents, or toxic chemicals have been used with the system, then the customer must decontaminate the system before cleaning or maintenance.

Recommended Maintenance Schedule

The following tables provide a recommended schedule for cleaning and maintaining the system.

Tip! Perform maintenance tasks regularly to make sure that the system is performing optimally.

- Perform periodic gas leakage tests and general maintenance inspections to be sure of safe operation of the system.
- Clean the system regularly to keep it in good working condition.
- During system maintenance, carefully examine parts of the external gas supply system, including tubing connected to the equipment, to confirm that the condition is satisfactory. Replace any cracked, pinched, or collapsed tubing.

To determine how often to clean or perform maintenance on the mass spectrometer and ion source, consider the following factors. These factors can cause changes in mass spectrometer performance, indicating that maintenance is required.

- Compounds tested
- Cleanliness of the samples and the sample preparation methods
- Amount of time that the probe is exposed to the sample

- Overall system run time

For information about tuning frequency, refer to the section: Calibration Ions and Solutions.

To order consumable parts and for basic service and maintenance requirements, contact a QMP or refer to the document: *Parts and Equipment Guide*. Contact a SCIEX FSE for all other service and maintenance requirements.

Table 7-1 Mass Spectrometer Maintenance Tasks

Component	Frequency	Task	For More Information
System	Daily	Inspect for leaks	Refer to the section: Chemical Precautions.
Curtain plate	Daily	Clean	Refer to the section: Clean the Curtain Plate.
Roughing pump oil	Weekly	Inspect the level	Refer to the section: Inspect the Roughing Pump Oil Level. Contact the local QMP or FSE to add oil, if required.
Card cage air filter	Every 6 months	Replace	Contact the local QMP or FSE.
Roughing pump oil	Every 6 months, or as needed	Replace	Contact the local QMP or FSE.
Roughing pump oil	As needed	Refill	Contact the local QMP or FSE.
Orifice plate (front)	As needed	Clean	Refer to the section: Clean the Front of the Orifice Plate.
Orifice plate (front and back)	As needed	Clean	Contact the local QMP or FSE.
Skimmer	As needed	Clean	Contact the local QMP or FSE.
Instrument surfaces	As needed	Clean	Refer to the section: Clean the Surfaces.
Source exhaust drain bottle	As needed	Empty	Refer to the section: Empty the Source Exhaust Drain Bottle.
Interface heater	As needed	Replace	Contact the local QMP or FSE.

Table 7-2 Ion Source Maintenance Tasks

Component	Frequency	Task	For More Information
TurboIonSpray and APCI probes	As needed	Examine and replace	Refer to the section: Remove the Probe and Install the Probe.
Electrodes for the TurboIonSpray and APCI probes	As needed	Examine and replace	Refer to the section: Replace the Electrode.
Corona discharge needle	As needed	Replace	Refer to the section: Replace the Corona Discharge Needle.
Turbo heater	As needed	Replace	Contact the local QMP or FSE.
Sample tubing	As needed	Replace	Refer to the section: Connect the Ion Source Tubing.

For “As needed” tasks, follow these guidelines:

- Clean the mass spectrometer surfaces after a spill or when they become dirty.
- Empty the source exhaust drain bottle before it becomes full.
- Clean the curtain plate, orifice plate, skimmer, and Q0 region if system sensitivity degrades.

Tip! Clean the Q0 region regularly to minimize the impact of charging (a significant loss of sensitivity of the ions of interest over a short period of time) on the quadrupoles and lenses. Contact a QMP or FSE.

- Refill the roughing pump oil when it falls below the minimum oil level.
- Periodically inspect all exhaust connections to make sure that the integrity is maintained, and that any exhaust is removed from the customer lab.
- Replace the oil exhaust filter if it is leaking.
- Replace the oil return line if it is damaged.
- Clean the roughing pump filter trap when pump performance deteriorates.

Clean the Surfaces

Clean the external surfaces of the mass spectrometer after a spill or when they become dirty.

CAUTION: Potential System Damage. Use only the recommended cleaning methods and materials to avoid damaging the equipment.

1. Wipe the external surfaces with a soft cloth dampened with warm, soapy water.
2. Wipe the external surfaces with a soft cloth dampened with water to remove any soap residue.

Clean the Front-End

The following warning applies to all of the procedures in this section:

WARNING! Hot Surface Hazard. Let the Turbo V ion source cool for at least 30 minutes before starting any maintenance procedures. Some surfaces of the ion source and vacuum interface become hot during operation.

Clean the mass spectrometer front-end using the routine cleaning method, to:

- Minimize unscheduled system downtime.
- Maintain optimum sensitivity.
- Avoid more extensive cleaning that requires a service visit.

When contamination occurs, perform an initial routine cleaning. Clean up to and including the front of the orifice plate. If routine cleaning does not resolve issues with sensitivity, then a full cleaning might be necessary.

This section provides instructions for performing routine cleaning without breaking vacuum.

Note: Follow all of the applicable local regulations. For health and safety guidelines, refer to the section: Chemical Precautions.

Symptoms of Contamination

The system might be contaminated if any one of the following is observed:

- Significant loss in sensitivity
- Increased background noise
- Additional peaks that are not part of the sample in full scan or survey scan methods

If any of these issues are observed, then clean the mass spectrometer front-end.

Required Materials

Note: U.S. customers can call 877-740-2129 for ordering information and inquiries. International customers can visit sciex.com/contact-us.

- Powder-free gloves, nitrile or neoprene recommended
- Safety glasses
- Laboratory coat
- Fresh LC-MS-grade water. Old water can contain contaminants that can further contaminate the mass spectrometer.
- LC-MS-grade methanol, isopropanol (2-propanol), or acetonitrile
- Cleaning solution. Use one of:
    - 100% methanol
    - 100% isopropanol
    - 1:1 acetonitrile:water solution, freshly prepared
    - 1:1 acetonitrile:water with 0.1% acetic acid solution, freshly prepared
- Clean 1 L or 500 mL glass beaker to prepare cleaning solutions
- 1 L beaker to catch used solvent
- Organic waste container
- Lint-free wipes. Refer to the section: Tools and Supplies Available from the Manufacturer.
- (Optional) Polyester (poly) swabs

Tools and Supplies Available from the Manufacturer

Table 7-3

Description	Part Number
Small poly swab, thermally bonded. Also available in the Cleaning kit.	1017396
Lint-free wipe (11 cm x 21 cm, 4.3 inches x 8.3 inches). Also available in the Cleaning kit.	018027

Cleaning Best Practices

WARNING! Hot Surface Hazard. Let the Turbo V ion source cool for at least 30 minutes before starting any maintenance procedures. Some surfaces of the ion source and vacuum interface become hot during operation.

WARNING! Toxic Chemical Hazard. Refer to the chemical product safety data sheets and follow all of the recommended safety procedures when handling, storing, and disposing of chemicals.

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Determine whether decontamination is required before cleaning or maintenance. If radioactive materials, biological agents, or toxic chemicals have been used with the system, then the customer must decontaminate the system before cleaning or maintenance.

WARNING! Environmental Hazard. Do not dispose of system components in municipal waste. Follow local regulations when disposing of components.

- Allow the ion source to cool before removing it.
- Always wear clean, powder-free gloves, nitrile or neoprene recommended, for the cleaning procedures.
- After cleaning the mass spectrometer components, and before reassembling them, put on a new, clean pair of gloves.
- Do not use cleaning supplies other than those specified in this procedure.
- If possible, prepare cleaning solutions just before cleaning.
- Prepare and store all of the organic solutions and organic-containing solutions in very clean glassware only. Never use plastic bottles. Contaminants can leach from these bottles and further contaminate the mass spectrometer.
- To avoid contaminating the cleaning solution, pour the solution on the wipe or swab.
- Allow only the center area of the wipe to contact the mass spectrometer surface. Cut edges can leave fibers behind.

Tip! Wrap the wipe around a thermally-bonded poly swab.

Figure 7-1 Example: Folding the Wipe

- To avoid cross-contamination, discard the wipe or swab after it has touched the surface once.
- If required, perform multiple cleanings, using multiple wipes for larger parts of the vacuum interface, such as the curtain plate.
- Only dampen the wipe or swab slightly when applying water or cleaning solution. Water, more often than organic solvents, might cause the wipe to deteriorate, leaving residue on the mass spectrometer.

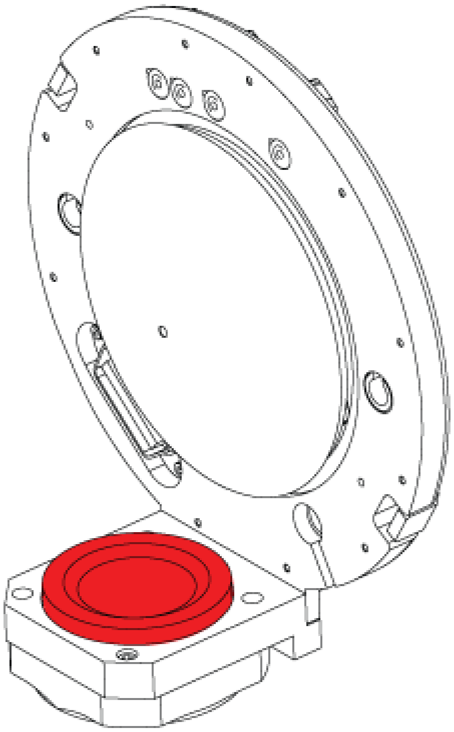
- Do not rub the wipe across the aperture. Wipe around the aperture to prevent fibers from the wipes from entering the mass spectrometer.

Prepare the Mass Spectrometer

WARNING! Hot Surface Hazard. Let the Turbo V ion source cool for at least 30 minutes before starting any maintenance procedures. Some surfaces of the ion source and vacuum interface become hot during operation.

CAUTION: Potential System Damage. Do not drop anything in the source drain when the ion source is removed.

Figure 7-2 Source Drain on the Vacuum Interface



1. Deactivate the hardware profile. Refer to the document: *Software User Guide*.
2. Remove the ion source. Refer to the section: Remove the Ion Source.

   When the ion source is not in use, store it to protect it from damage and to maintain operating integrity.

Clean the Curtain Plate

CAUTION: Potential System Damage. Do not rest the curtain plate or orifice plate on the aperture tip. Make sure that the conical side of the curtain plate faces up.

CAUTION: Potential System Damage. To avoid damaging the aperture, do not insert a wire or metal brush in the aperture on the curtain plate, orifice plate, or interface heater.

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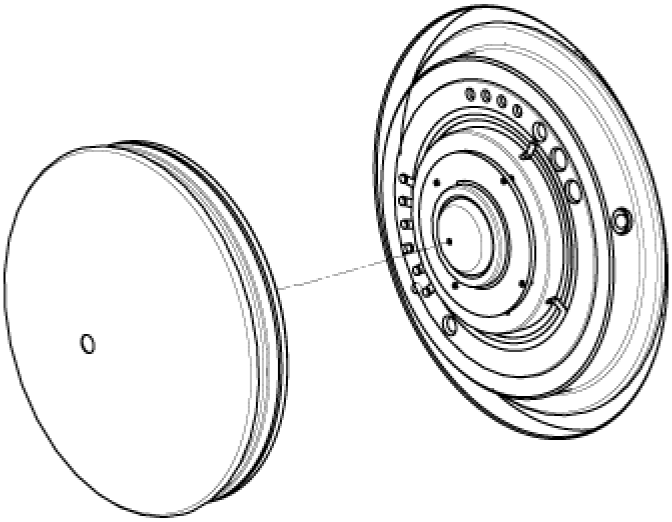
1. Pull the curtain plate off of the vacuum interface and then put it, conical side up, on a clean, stable surface.

   Figure 7-3 Curtain Plate Removal

   The curtain plate is held in place by three retaining ball catches mounted on the orifice plate.

   Tip! If the curtain plate does not immediately separate from the orifice plate, then turn the curtain plate slightly, less than 90 degrees, to release the ball spring latches.

2. Dampen a lint-free wipe with LC-MS-grade water and then clean both sides of the curtain plate.

   Note: Use multiple wipes, as required.

3. Repeat step 2 using the cleaning solution.
4. Using a dampened wipe or small poly swab, clean the aperture.
5. Wait until the curtain plate is dry.
6. Inspect the curtain plate for solvent stains or lint, removing any residue with a clean, slightly damp, lint-free wipe.

Note: Persistent spotting or filming is an indicator of contaminated solvent.

Clean the Front of the Orifice Plate

CAUTION: Potential System Damage. When cleaning the surface of the orifice plate, do not remove the interface heater. Frequent removal of the interface heater can result in damage to the interface heater. Surface cleaning of the interface heater is adequate for routine cleaning.

CAUTION: Potential System Damage. To avoid damaging the aperture, do not insert a wire or metal brush in the aperture on the curtain plate, orifice plate, or interface heater.

1. Dampen a lint-free wipe with LC-MS-grade water and then wipe the front of the orifice plate, including the interface heater.
2. Repeat step 1 using the cleaning solution.
3. Wait until the orifice plate is dry.
4. Inspect the orifice plate for solvent stains or lint, removing any residue with a clean, slightly damp, lint-free wipe.

   Note: Persistent spotting or filming is an indicator of contaminated solvent.

Put the Mass Spectrometer Back in Service

1. Install the curtain plate.
2. Install the ion source on the mass spectrometer. Refer to the section: Install the Ion Source on the Mass Spectrometer.

   Tighten the ion source by turning the source latches down in the locking position.
3. Activate the hardware profile. Refer to the document: *Software User Guide*.

Empty the Source Exhaust Drain Bottle

WARNING! Hot Surface Hazard. Let the Turbo V ion source cool for at least 30 minutes before starting any maintenance procedures. Some surfaces of the ion source and vacuum interface become hot during operation.

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Deposit hazardous materials in appropriately labeled waste containers and dispose of them according to local regulations.

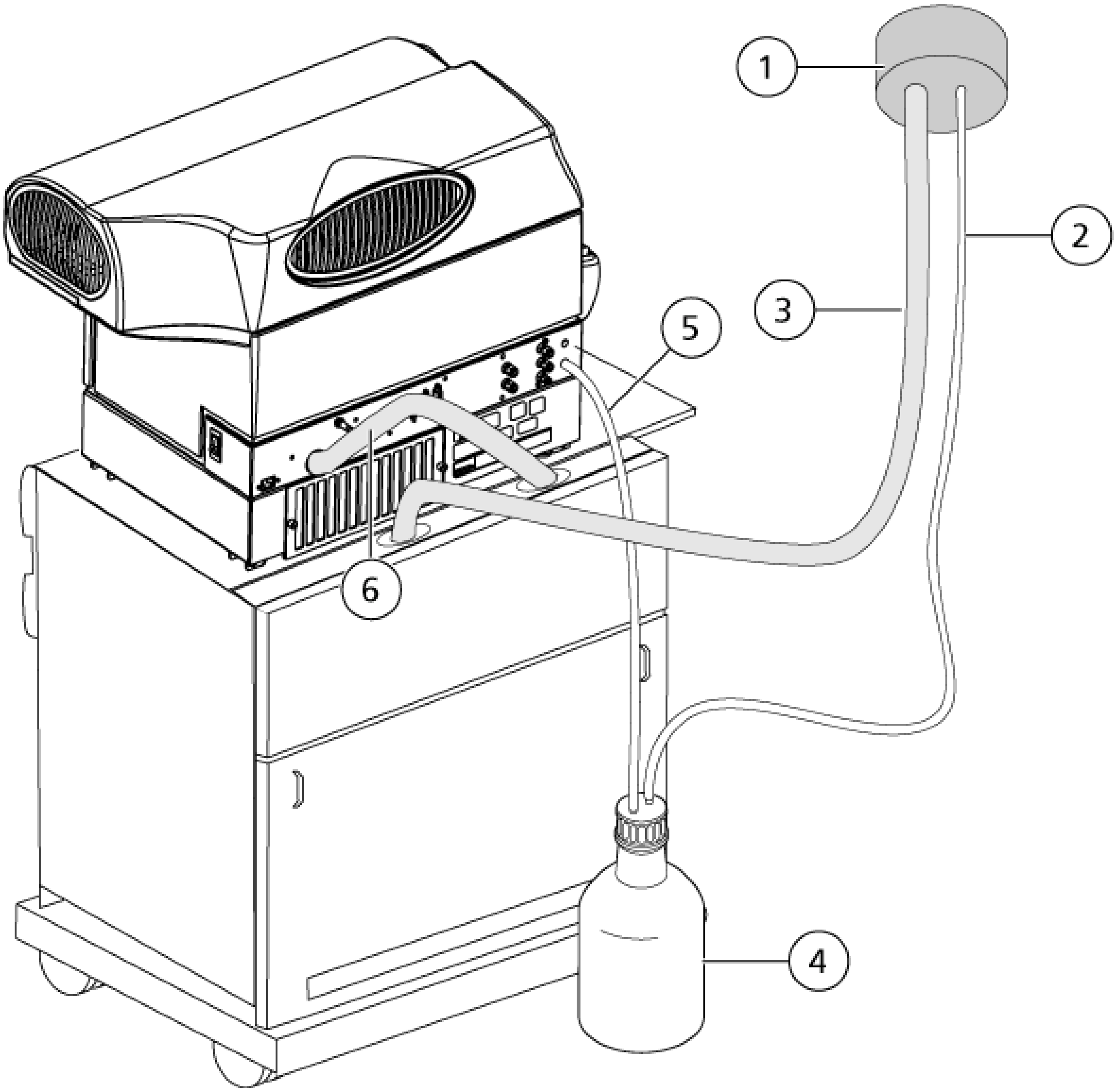
WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Take care to vent exhaust gases to a dedicated laboratory fume hood or exhaust system and make sure that the ventilation tubing is secured with clamps. Make sure that the laboratory has appropriate air exchange for the work performed.

Note: Make sure that there are no kinks, sags, or twists in the source waste line.

Inspect the source exhaust drain bottle regularly, and empty it before it becomes full. Also inspect the bottle and the fitting for leaks, and tighten connections or replace components, if required. Follow the steps in this procedure to empty the bottle.

1. Remove the ion source.
2. Loosen the clamps connecting the hoses to the cap of the source exhaust drain bottle.

Figure 7-4 Source Exhaust Drain Bottle



Item	Description
1	Connection to vent
2	Source exhaust drain tubing: 2.5 cm (1.0 inch) inner diameter (i.d.)
3	Roughing pump exhaust hose: 3.2 cm (1.25 inch) i.d.

Item	Description
4	Source exhaust drain bottle The drain bottle might be located at the side of the mass spectrometer in the drain bottle holder. Make sure that the bottle is secured to prevent spillage.
5	Source exhaust connection to the mass spectrometer: 1.6 cm (0.625 inch) i.d.

Note: Source exhaust hose connections at the drain bottle, mass spectrometer, and the lab vent are secured with hose clamps.

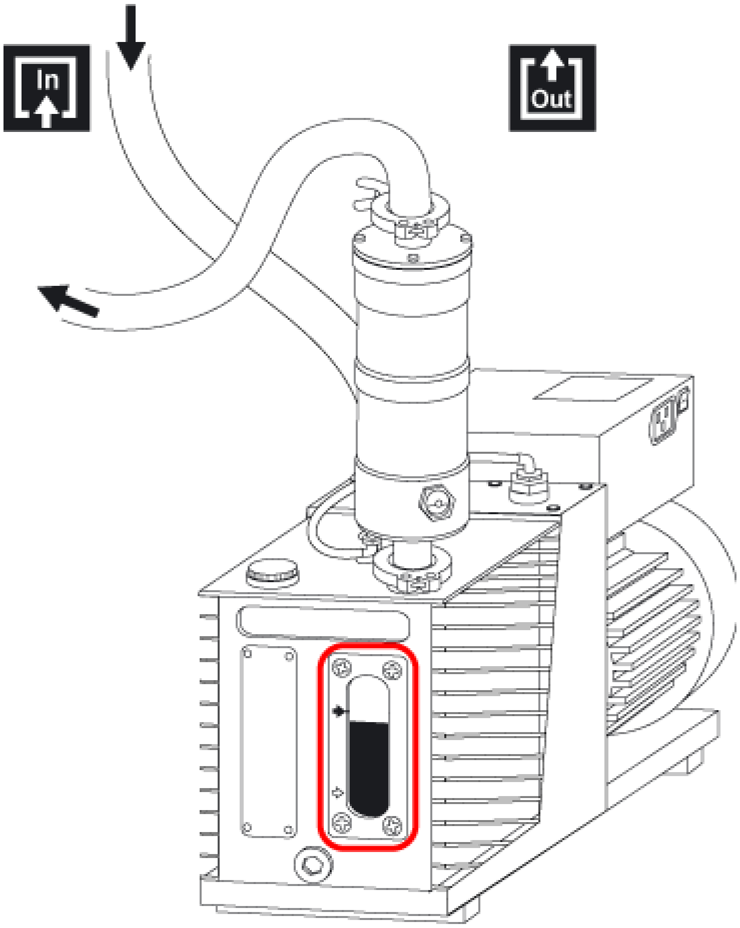
3. If applicable, lift the drain bottle out of the holder.
4. Disconnect the hoses from the cap.
5. Remove the cap from the drain bottle.
6. Empty the drain bottle and then dispose of the waste according to laboratory procedures and local waste regulations.
7. Install the cap on the bottle and then put the bottle in the holder.
8. Attach the hoses to the cap and then secure them tightly with clamps.

Inspect the Roughing Pump Oil Level

Inspect the sight glass on the roughing pump to verify that the oil is above the minimum level.

If the oil is below the minimum level, then contact the Qualified Maintenance Person (QMP) or SCIEX Field Service Employee (FSE).

Figure 7-5 Sight Glass



Storage and Handling

WARNING! Environmental Hazard. Do not dispose of system components in municipal waste. Follow local regulations when disposing of components.

If the mass spectrometer must be stored for a long time or prepared for shipping, then contact a SCIEX FSE for decommissioning information. To disconnect power from the mass spectrometer, remove the mains supply connector from the AC mains supply.

Note: The ion source and mass spectrometer must be transported and stored at a temperature between –30 °C to +45 °C (–22 °F to 113 °F) and relative humidity not exceeding 99%, non-condensing. Store the system at an altitude not exceeding 2,000 m (6,562 feet) above sea level.

Service and Maintenance — Ion Source

8

The following warnings apply to all of the maintenance procedures in this section.

WARNING! Hot Surface Hazard. Let the Turbo V ion source cool for at least 30 minutes before starting any maintenance procedures. Some surfaces of the ion source and vacuum interface become hot during operation.

WARNING! Fire and Toxic Chemical Hazard. Keep flammable liquids away from flame and sparks and use them only in vented chemical fume hoods or safety cabinets.

WARNING! Toxic Chemical Hazard. Wear personal protective equipment, including a laboratory coat, gloves, and safety glasses, to avoid skin or eye exposure.

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. In the event of a chemical spill, review product safety data sheets for specific instructions. Make sure that the system is in Standby state before cleaning a spill near the ion source. Use appropriate personal protective equipment and absorbent wipes to contain the spill and dispose of it following local regulations.

WARNING! Electrical Shock Hazard. Avoid contact with the high voltages applied to the ion source during operation. Put the system in Standby state before adjusting the sample tubing or other equipment near the ion source.

WARNING! Puncture Hazard, Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Discontinue use of the ion source if the ion source window is cracked or broken, and then contact a SCIEX Field Service Employee (FSE). Any toxic or injurious materials introduced in the equipment will be present in the source exhaust output. Exhaust from equipment should be vented from the room. Dispose of sharps following established laboratory safety procedures.

CAUTION: Potential System Damage. Do not lift or carry the ion source with one hand. The ion source is designed to be lifted or carried using two hands, one on each side of the ion source.

This section contains general maintenance procedures for the ion source. To determine how often to clean or perform maintenance on the ion source, consider the following:

- Compounds tested
- Cleanliness of the samples and sample preparation techniques
- Amount of time an idle probe contains a sample
- Overall system run time

These factors can cause changes in ion source performance, indicating that maintenance is required.

Make sure that the installed ion source is fully sealed to the mass spectrometer with no evidence of gas leaks. Regularly inspect the ion source and its fittings for leaks. Clean the ion source components regularly to keep the ion source in good working condition.

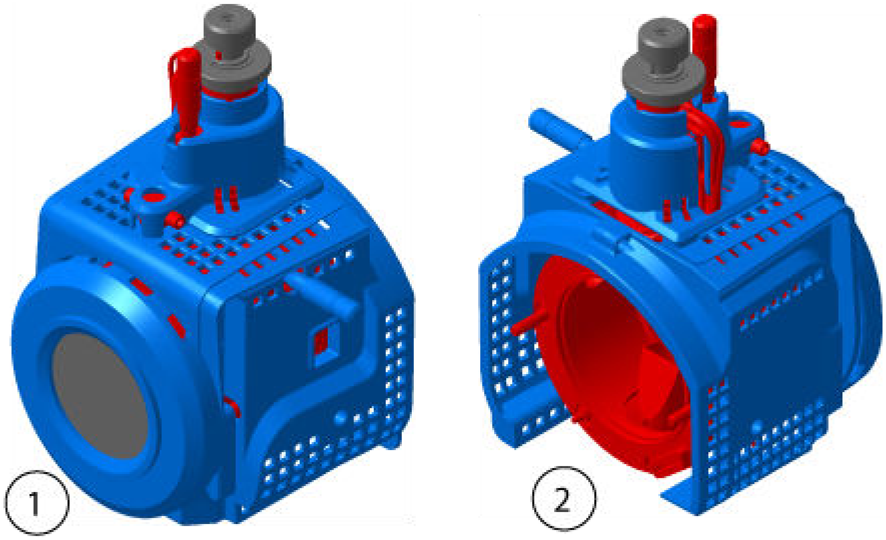
CAUTION: Potential System Damage. Use only the recommended cleaning methods and materials to avoid damaging the equipment.

Required Materials
• 1/4 inch open-ended wrench • Flat-bladed screwdriver • LC-MS-grade methanol • LC-MS-grade deionized water • Safety glasses • Breathing mask and filter • Powder-free gloves, nitrile or neoprene recommended • Lab coat

Ion Source Handling

Surfaces of the ion source become hot during operation. The following figure shows surfaces that are cooler (blue and gray) and surfaces that remain hot for an extended period of time (red). Do not touch the surfaces shown in red while using or removing the ion source.

Figure 8-1 Ion Source Hot Surfaces (Red=Hot, Gray=Warm, Blue=Handle with Care)



Item	Description
1	Front
2	Back

Remove the Ion Source

Note: Nitrogen continues to flow at a rate of 5.3 L/min when the mass spectrometer is off or when the ion source is removed from the system. To minimize nitrogen gas consumption and to keep the mass spectrometer clean when it is not in use, leave the ion source installed on the mass spectrometer and leave the system on.

The ion source can be removed quickly and easily, without tools. Always remove the ion source from the mass spectrometer before performing any maintenance on the ion source or exchanging the probes.

1. Stop any ongoing scans.
2. Turn off the sample stream.
3. Set the ion source **Temperature** to 0, if the heaters are in use.
4. Wait at least 30 minutes for the ion source to cool.
5. Disconnect the sample tubing from the grounding union.
6. Turn the two source latches up to the 12 o'clock position to release the ion source.

7. Pull the ion source gently away from the vacuum interface.

   Note: Be careful not to lose the O-rings that are installed on the vacuum interface.

8. Put the ion source on a clean, secure surface.

Clean the Ion Source Surfaces

WARNING! Electrical Shock Hazard. Remove the ion source from the mass spectrometer before starting this procedure. Follow all electrical safe work practices.

Prerequisite Procedures
• Remove the Ion Source.

Clean the surfaces of the ion source after a spill or when they become dirty.

Wipe the surfaces of the ion source with a soft, damp, cloth.

Clean the Probe

Flush the ion source periodically, regardless of the type of compounds sampled. Do this by setting up a method in the control software specifically for performing a flushing operation.

1. Change to a mobile phase that is 1:1 water:acetonitrile or 1:1 water:methanol.
2. Adjust the position of the probe so that it is as far from the orifice as possible.
3. In the control software, do the following:
    a. Create an MS method.
    b. Set the ion source temperature between `500` ° C and `600` °C.
    c. Set ion source gas 1 and ion source gas 2 to at least `40`.
    d. Set the flow rate of the gas for the Curtain Gas interface to the highest setting possible.
4. Wait until the temperature setpoint is reached.
5. Make sure that the probe and sample tubing are flushed thoroughly.

Remove the Probe

WARNING! Electrical Shock Hazard. Remove the ion source from the mass spectrometer before starting this procedure. Follow all electrical safe work practices.

CAUTION: Potential System Damage. Do not let the protruding electrode tip or the corona discharge needle touch any part of the ion source housing, to avoid damaging the probe.

Prerequisite Procedures
• Remove the Ion Source.

The probe can be removed quickly and easily, without tools. Always remove the ion source from the mass spectrometer before changing probes or performing maintenance on the probe.

1. Loosen the sample tubing nut and then disconnect the sample tubing from the probe.
2. Loosen the retaining ring that secures the probe on the ion source housing.
3. Gently pull the probe straight up out of the tower.
4. Put the probe on a secure, clean surface.

Replace the Electrode

WARNING! Electrical Shock Hazard. Remove the ion source from the mass spectrometer before starting this procedure. Follow all electrical safe work practices.

WARNING! Puncture Hazard. Be careful when handling the electrode. The tip of the electrode is extremely sharp.

Prerequisite Procedures
• Remove the Ion Source. • Remove the Probe.

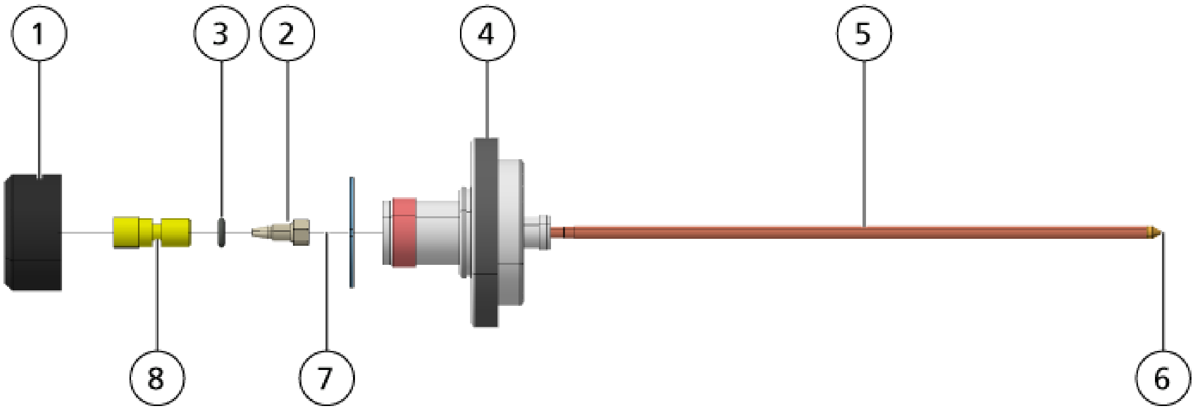
The probe contains an electrode. Replace the electrode when there is a decrease in performance.

Note: After replacing the electrode, evaluate the effect of the change on system performance.

This procedure applies to both probes.

1. Remove the electrode adjustment nut and then remove the electrode.
2. Holding the probe with the tip pointing down, so that the spring remains inside the probe, install a sample fitting in the PEEK union, tightening until it is finger-tight.

Figure 8-2 Probe, Expanded View



Item	Description
1	Electrode adjustment nut
2	1/4 inch retaining nut
3	Spring
4	Retaining ring
5	Sprayer tube
6	Electrode tip
7	Electrode tube
8	PEEK union

3. Pull the PEEK union and the attached electrode tube from the probe.
4. Remove the sample fitting from the PEEK union.
5. Use the 1/4 inch open-ended wrench to remove the retaining nut that holds the electrode tube in the PEEK union.
6. Remove the electrode tube from the retaining nut.
7. Insert the new electrode tube in the retaining nut and then in the PEEK union.

Make sure that the electrode tube is inserted as far as possible in the PEEK union. If there is a gap between the electrode tube and its seat inside the union, a dead volume may occur.

8. Tighten the retaining nut.

   Do not cross-thread or over-tighten the retaining nut or the tubing might leak.
9. Make sure that the spring is still inside the probe and then tighten the electrode adjustment nut.
10. Align the electrode tube with the narrow opening in the sprayer tube and then insert the PEEK union and attached electrode tube in the probe. Be careful not to bend the electrode tube.
11. Install and then tighten the electrode adjustment nut.
12. Install the probe. Refer to the section: Install the Probe.
13. Install the ion source on the mass spectrometer. Refer to the section: Ion Source Installation.
14. Connect the sample tubing. Refer to the section: Connect the Ion Source Tubing.
15. Adjust the electrode tip extension. Refer to the section: Optimize the TurboIonSpray Probe Position or Optimize the APCI Probe Position.

Replace the Corona Discharge Needle

WARNING! Electrical Shock Hazard. Remove the ion source from the mass spectrometer before starting this procedure. Follow all electrical safe work practices.

WARNING! Puncture Hazard. Handle the needle with care. The tip of the needle is extremely sharp.

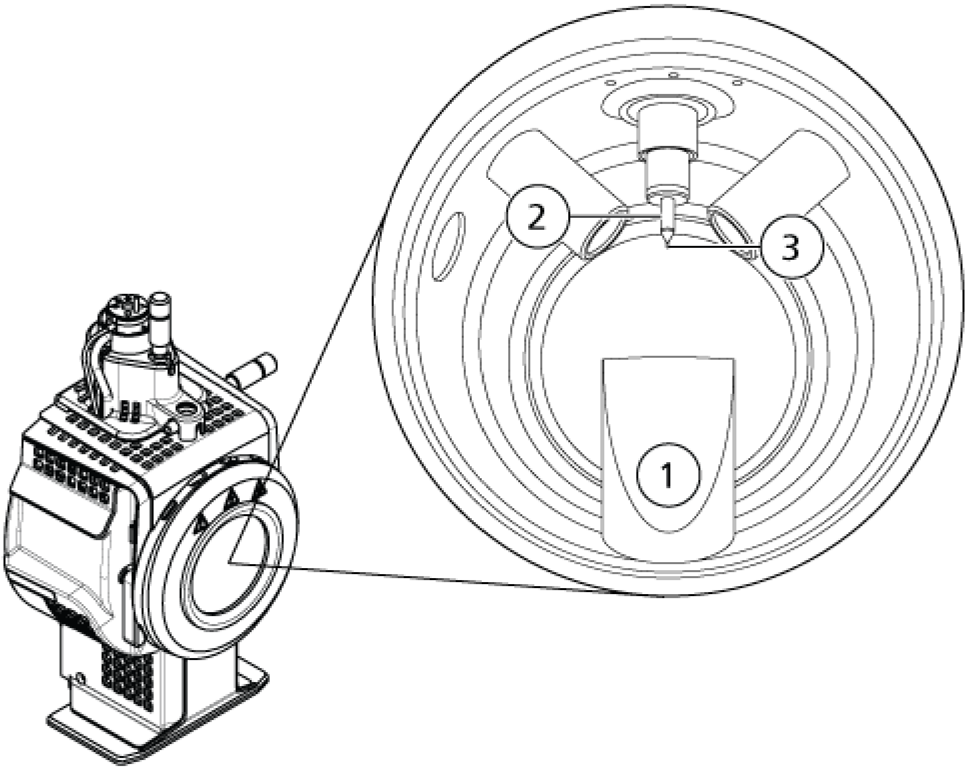
Prerequisite Procedures

- Remove the Ion Source.
- Remove the Probe.

If the corona discharge needle tip becomes corroded, then it might not be removable by hand. If it cannot be removed, then cut off the needle tip to remove it and replace the entire corona discharge needle.

1. Rotate the ion source so that the open side is accessible.

Figure 8-3 Corona Discharge Needle



Item	Description
1	Exhaust chimney
2	Ceramic sleeve
3	Corona discharge needle tip

2. While holding the corona discharge needle adjustment screw between the thumb and forefinger of one hand and the corona discharge needle with the other hand, rotate the corona discharge needle tip counter-clockwise to loosen and then gently remove the tip. Refer to the section: Ion Source Components.
3. Gently pull the corona discharge needle down through the exhaust chimney to remove it.
4. Insert the new needle through the exhaust chimney in the ceramic sleeve as far as possible.
5. Holding a new tip between the thumb and forefinger of one hand and the corona discharge needle adjustment screw with the other hand, rotate the corona discharge needle tip clockwise to install the tip.
6. Insert the probe and then install the ion source on the mass spectrometer. Refer to the section: Ion Source Installation.

Replace the Sample Tubing

WARNING! Electrical Shock Hazard. Remove the ion source from the mass spectrometer before starting this procedure. Follow all electrical safe work practices.

Prerequisite Procedures

- Stop the sample flow and make sure that any remaining gas has been removed through the source exhaust system.
- Remove the ion source. Refer to the section: Remove the Ion Source.

Use the following procedure to replace the sample tubing if it has a blockage.

1. Disconnect the sample tubing from the probe and the grounding union.
2. Replace the sample tubing with an appropriate length of tubing, cut with a proper tubing cutter. Refer to the section: Connect the Ion Source Tubing.
3. Install the ion source. Refer to the section: Ion Source Installation.
4. Start the sample flow.

Storage and Handling

WARNING! Environmental Hazard. Do not dispose of system components in municipal waste. Follow local regulations when disposing of components.

The environmental requirements for the storage and transport of the ion source:

- Ambient temperature between –30 °C and +60 °C (–22 °F and 140 °F)
- Atmospheric pressure between 75 kPa to 101 kPa
- Relative humidity not exceeding 99%, non-condensing

Mass Spectrometer Troubleshooting 9

This section contains information for troubleshooting basic system issues. Certain activities can only be carried out by a SCIEX-trained Qualified Maintenance Person (QMP) in the laboratory. For advanced troubleshooting, contact a SCIEX Field Service Employee (FSE).

Table 9-1 System Issues

Symptom	Possible Cause	Corrective Action
The skimmer is extremely dirty or frequently becomes dirty.	The flow rate of the gas for the Curtain Gas interface is too low.	Examine the setting for the gas for the Curtain Gas interface and increase it, if applicable.
A system fault has occurred because the vacuum pressure is too high.	1. The oil level is too low. 2. There is a leak. 3. The wrong orifice plate is installed.	1. Inspect the oil level in the roughing pump, and then contact the local QMP or an FSE to add oil. Refer to the section: Inspect the Roughing Pump Oil Level. 2. Inspect and repair leaks. 3. Install the correct orifice plate.
A system fault has occurred because the QPS exciter module temperature is too high.	1. The card cage air filter is blocked. 2. Ambient temperature is too high.	1. Contact the local QMP or FSE. 2. For the ambient temperature specifications, refer to the document: *Site Planning Guide* for the system.

Table 9-1 System Issues (continued)

Symptom	Possible Cause	Corrective Action
The control software reports that the mass spectrometer is in Fault status because of the ion source.	1. The probe is not installed. 2. The probe is not connected securely.	Confirm the fault in the Status panel of the device details page. 1. Install the probe. Refer to the section: Install the Probe. 2. Remove and then install the probe. Tighten the retaining ring securely. Refer to the section: Remove the Probe and Install the Probe.
The roughing pump is too hot to touch.	The roughing pump filter trap is blocked.	Contact the local QMP or FSE.
The control software indicates that the APCI probe is in use, but the TurboIonSpray probe is installed.	The F3 fuse is blown.	Contact an FSE.
The spray is not uniform.	The electrode is blocked.	Clean or replace the electrode. Refer to the document: *Turbo V Ion Source Operator Guide*. Clean or replace the electrode. Refer to the section: Replace the Electrode.
The interface heater is not ready.	The interface heater is faulty.	Contact the local QMP or FSE.
The mass spectrometer resolution is poor.	The mass spectrometer is not tuned.	Use the Instrument Optimization wizard to optimize the mass spectrometer. Refer to the documents: *Software User Guide* or *Help*.

Table 9-1 System Issues (continued)

Symptom	Possible Cause	Corrective Action
The mass spectrometer performance has degraded.	1. The ion source conditions are not optimized. 2. The sample was not prepared correctly or the sample has degraded. 3. The sample inlet fittings are leaking.	1. Optimize the ion source conditions. Refer to the section: Optimize the TurboIonSpray Probe Position or APCI Probe Optimization. 2. Confirm that the sample was prepared correctly. 3. Verify that the fittings are the right size and type and make sure that they are tight. Do not overtighten the fittings. Replace the fittings if leaks continue. 4. Install and optimize an alternate ion source. 5. Contact an FSE if the issue persists.
Arcing or sparks occur.	The position of the corona discharge needle is incorrect.	If the TurboIonSpray probe is being used, then turn the corona discharge needle toward the curtain plate and away from the stream of heater gas. Refer to the section: Replace the Corona Discharge Needle.

Table 9-2 Sensitivity Issues

Possible Cause	Corrective Action
Sensitivity is Decreased	
The ion source parameters are not optimized.	Optimize the ion source parameters.
The mass spectrometer is not optimized.	Use the Instrument Optimization wizard to optimize the mass spectrometer.

Table 9-2 Sensitivity Issues (continued)

Possible Cause	Corrective Action
The curtain plate is dirty.	Clean the curtain plate. Refer to the section: Clean the Curtain Plate.
The orifice plate is dirty.	Refer to the section: Clean the Front of the Orifice Plate or contact the local QMP or FSE.
The skimmer is dirty.	Clean the skimmer. Contact the QMP or FSE.
The syringe or sample line is leaking.	Inspect the syringe or sample line for leaks and repair any leaks found. Make sure that all fittings are the correct type and size.
The sample has degraded or has a low concentration.	Verify the sample concentration. Use a fresh sample.
The probe is not installed properly.	Remove and install the probe.
The ion source is not installed properly or it is faulty.	Remove and install the ion source, making sure that the latches are properly secured. If this does not resolve the issue, then install and optimize an alternate ion source.
There is an issue with the LC system or connections.	Troubleshoot the LC system.
The electrode is dirty or blocked.	Replace the electrode. Refer to the section: Replace the Electrode.
There is No Signal or the Signal is Unstable	
The tubing is blocked.	Replace the sample tubing. Refer to the section: Connect the Ion Source Tubing.

Table 9-3 Background Noise Issues

Possible Cause	Corrective Action
The **Temperature (TEM)**, **IonSpray Voltage (IS)** or heater gas flow rate (GS2) is too high.	Optimize the ion source parameters. Refer to the section: TurboIonSpray Probe Optimization or APCI Probe Optimization.
The syringe or sample line is dirty.	Clean or replace the syringe or sample line.
The curtain plate is dirty.	Clean the curtain plate. Refer to the section: Clean the Curtain Plate.
The orifice plate is dirty.	Clean the front of the orifice plate. Refer to the section: Clean the Front of the Orifice Plate.

Table 9-3 Background Noise Issues (continued)

Possible Cause	Corrective Action
The skimmer is dirty.	Do a full cleaning of the front end components of the mass spectrometer. Contact the local QMP or FSE.
The Q0 region is dirty.	Clean the Q0 region. Contact the QMP or FSE.
Mobile phase is contaminated.	Replace the mobile phase.
The ion source is contaminated.	Clean or replace the ion source components and then condition the ion source and front end: 1. (Analyst software) Make sure that the interface heater is on. 2. Infuse or inject 50:50 methanol:water with a pump flow rate of 1 mL/min. 3. In the control software, set the temperature to `650`, ion source gas 1 to `60`, and ion source gas 2 to `60`. 4. Set the flow rate for the gas for the Curtain Gas interface to `45` or `50`. 5. Run for a minimum of 2 hours or preferably overnight for best results.

For sales, technical assistance, or service, contact an FSE or visit the SCIEX website at sciex.com for contact information.

Calibration Ions and Solutions

A

CAUTION: Potential Wrong Result. Do not use expired solutions or solutions that have not been stored at the indicated storage temperature.

Note: Immediately after use, put a cap on the bottle and then store it at 2 °C to 8 °C. Refer to the information on the label.

Table A-1 Tuning Frequency

Calibration		Resolution Optimization
Scan Type	**Frequency**	**Frequency**
Q1 and Q3	3 months to 6 months	3 months to 6 months
LIT	3 months to 6 months	3 months to 6 months

Table A-2 Suggested Tuning Solutions for the 3200 Series of Instruments

System	Q1 and Q3		LIT
	Positive	**Negative**	**Positive and Negative**
API 3200 LC-MS/MS system	POS PPG, 1e–5 M	NEG PPG, 3e–4 M	N/A
3200 QTRAP LC-MS/MS system	POS PPG, 1e–5 M	NEG PPG, 3e–4 M	NEG PPG, 3e–4 M

Table A-3 Masses for Q1 and Q3 PPG Scans

System	Masses					
Positive Mode						
API 3200 LC-MS/MS system	59.05	175.13	616.46	906.67	1,254.93	1,545.13
3200 QTRAP LC-MS/MS system	59.05	175.13	616.46	906.67	1,254.93	1,545.13
Negative Mode						
API 3200 LC-MS/MS system	45.00	585.39	933.64	1,223.85	1,572.10	1,863.31
3200 QTRAP LC-MS/MS system	45.00	585.39	933.64	1,223.85	1,572.10	N/A

Table A-4 Masses and Polarity for LIT Scans (PPG 3000)

Instrument/ Polarity	Masses			
Positive	115.1	500.4	1080.8	1661.2
Negative	121.1	585.4	991.8	1630.1

Principles of Operation — Ion Source

B

Electrospray Ionization Mode

The probe is located centrally between the two turbo heaters, which are located at a 45-degree angle on either side of the probe. The combination of the spray and the heated dry gas from the turbo heaters is projected at a 90-degree angle to the aperture in the curtain plate.

Only compounds that ionize in the liquid solvent can be generated as gas phase ions in the source. The efficiency and rate of ion generation depends on the solvation energies of the specific ions. Ions with lower solvation energies are more likely to evaporate than ions with higher solvation energies.

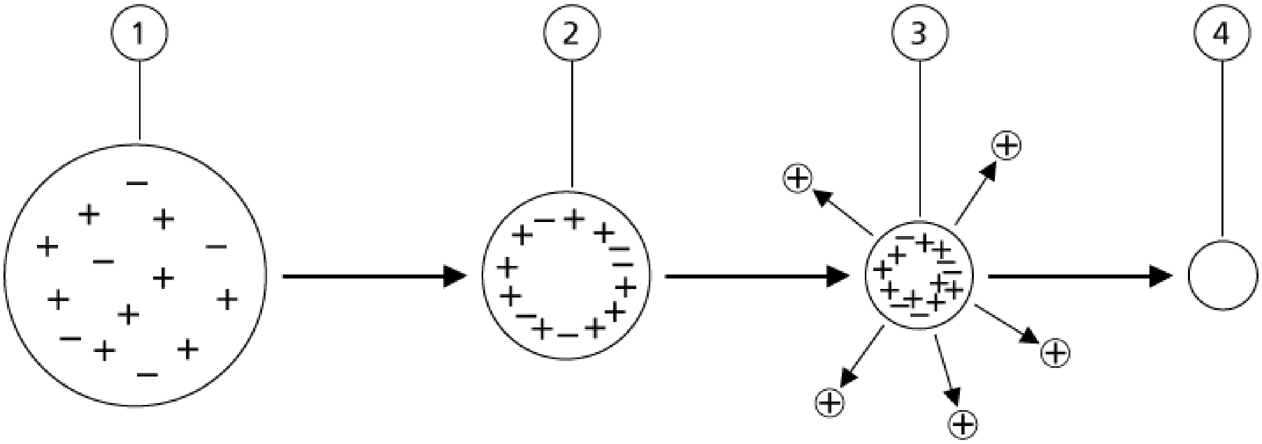
The interaction of the **IonSpray Voltage** and the turbo heaters helps focus the stream and increases the rate of droplet evaporation, resulting in an increased ion signal. The heated gas increases the efficiency of ion evaporation, resulting in increased sensitivity and the ability to handle higher liquid sample flow rates.

A high-velocity flow of nebulizer gas shears droplets from the liquid sample stream in the **IonSpray Voltage** inlet. Using the variable high voltage applied to the sprayer, the ion source applies a net charge to each droplet. This charge aids in the droplet dispersion. Ions of a single polarity are preferentially drawn in the droplets by the high voltage as they are separated from the liquid stream. However, this separation is incomplete and each droplet contains many ions of both polarities. Ions of one polarity are predominant in each droplet, and the difference between the number of positively or negatively charged ions results in the net charge. Only the excess ions of the predominant polarity are available for ion evaporation, and only a fraction of these actually evaporate.

The probe can generate multiply-charged ions from compounds that have multiple charge sites, such as peptides and oligonucleotides. This is useful during analysis of high-molecular-weight species where the multiple charges produce ions of a mass-to-charge ratio (*m/z*) within the mass range of the mass spectrometer. This allows routine molecular-weight determinations of compounds in the kiloDalton (kDa) range.

Each charged droplet contains solvent and both positive and negative ions, but with ions of one predominant polarity. Refer to the figure: Figure B-1. As a conducting medium, excess charges reside at the surface of the droplet. As the solvent evaporates, the electrical field at the surface of the droplet increases due to the decreasing radius of the droplet.

Figure B-1 Ion Evaporation



Item	Description
1	Droplet contains ions of both polarities with one polarity being predominant.
2	As the solvent evaporates, the electrical field increases and the ions move to the surface.
3	At some critical field value, ions are emitted from the droplets.
4	Nonvolatile residue remains as a dry particle.

If the droplet contains excess ions and enough solvent evaporates from the droplet, a critical field is reached at which ions are emitted from the surface. Eventually, all of the solvent will evaporate from the droplet, leaving a dry particle consisting of the nonvolatile components of the sample solution.

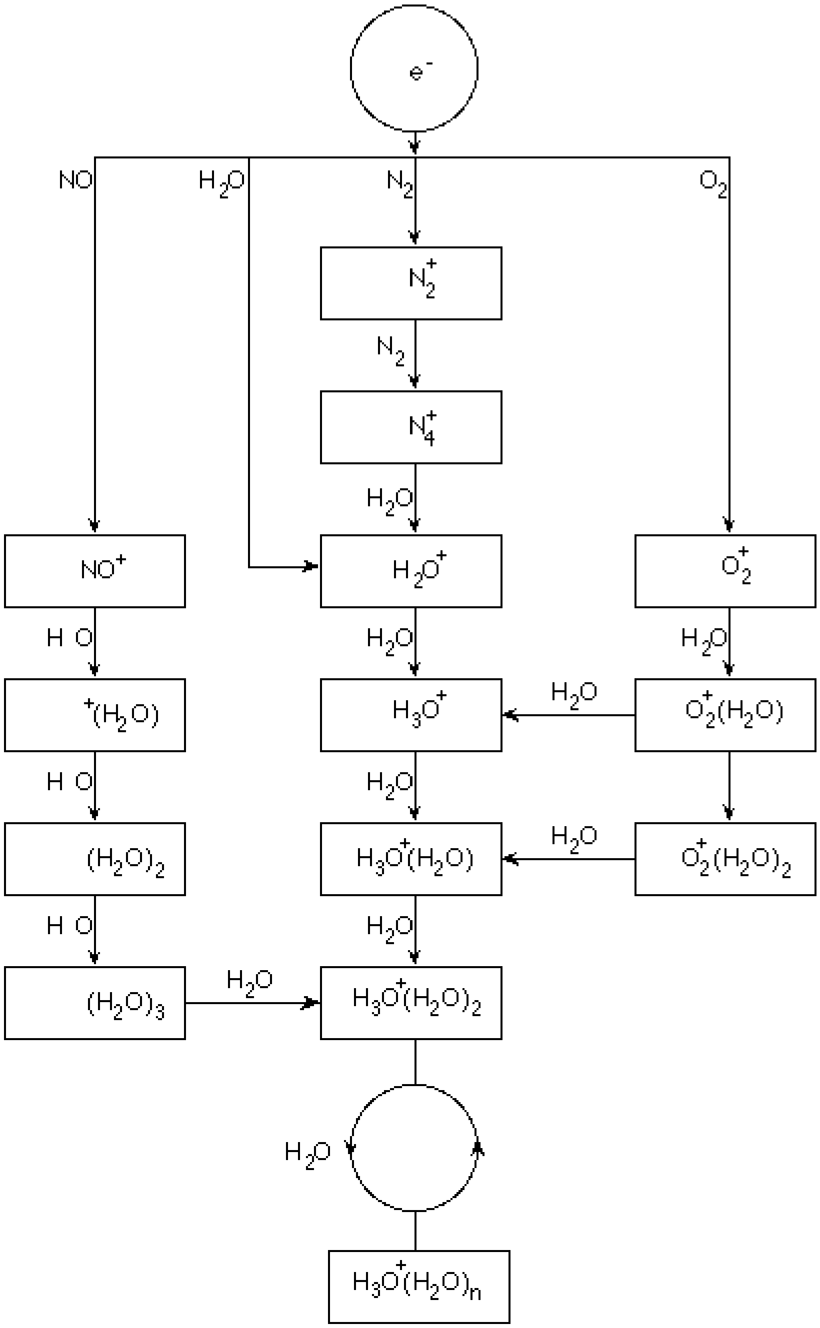
Because the solvation energies for most organic molecules are unknown, the sensitivities of any given organic ion to ion evaporation are difficult to predict. The importance of solvation energy is evident because surfactants that concentrate at the surface of a liquid can be detected very sensitively.

APCI Mode

The basis for past incompatibilities in linking liquid chromatography with mass spectrometry arose from difficulties converting relatively nonvolatile molecules in solution in a liquid into a molecular gas without inducing excessive decomposition. The APCI probe process of gently nebulizing the sample to finely dispersed small droplets in a heated ceramic tube results in the rapid vaporization of the sample so that the sample molecules are not decomposed.

The following figure shows the reaction flow of the APCI process for reactant positive ions, the proton hydrates, $H_3O^+[H_2O]_n$.

Figure B-2 APCI Reaction Flow Diagram



The major primary ions N_2^+, O_2^+, H_2O^+, and NO^+ are formed by the electron impact of corona-created electrons on the major neutral components of air. Although NO^+ is normally not a major constituent of clean air, the concentration of this species in the ion source is enhanced due to neutral reactions initiated by the corona discharge.

Samples that are introduced through the APCI probe are sprayed, with the aid of a nebulizer gas, in the heated ceramic tube. Within the tube, the finely dispersed droplets of sample and solvent undergo a rapid vaporization with minimal thermal decomposition. The gentle vaporization preserves the molecular identity of the sample.

The gaseous sample and solvent molecules pass to the ion source housing where the ionization by APCI is induced by a corona discharge needle connected to the end of the ceramic tube. The sample molecules are ionized by colliding with the reagent ions that are created by the ionization of mobile phase solvent molecules. The vaporized solvent molecules ionize to produce the reagent ions $[X+H]^+$ in Positive polarity and $[X-H]^-$ in Negative polarity. Refer to the figure: Figure B-3. It is these reagent ions that produce stable sample ions when they collide with the sample molecules.

Figure B-3 Atmospheric Pressure Chemical Ionization

Item	Description
1	Sample
2	Primary ions are created in the vicinity of the corona discharge needle
3	Ionization produces predominantly solvent ions
4	Reagent ions react with sample molecules, forming clusters
5	Curtain plate
6	Interface
x = solvent molecules; M=sample molecules	

The sample molecules are ionized through a process of proton transfer in Positive polarity and by either electron transfer or proton transfer in Negative polarity. The energy for the APCI ionization process is collision-dominated because of the relatively high atmospheric pressure of the ion source.

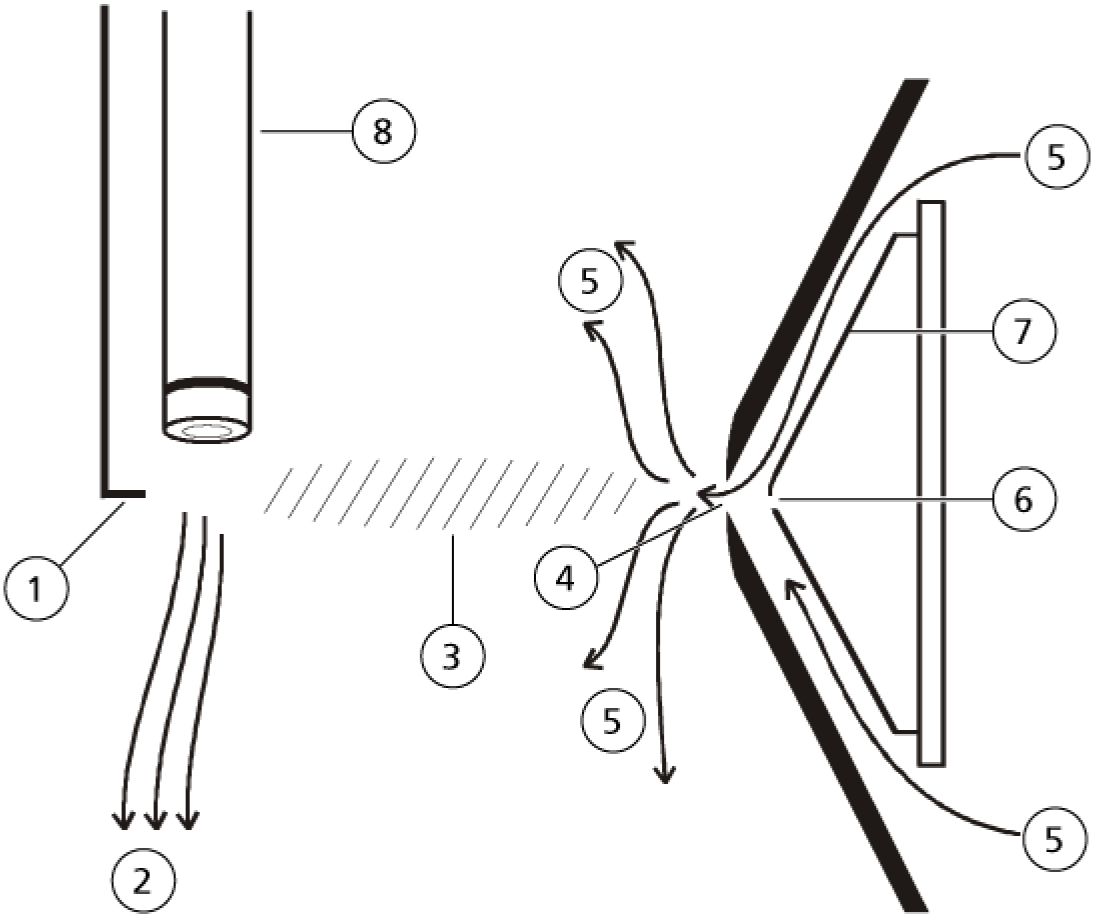
For reverse phase applications, the reagent ions consist of protonated solvent molecules in Positive polarity and solvated oxygen ions in Negative polarity. With favorable thermodynamics, the addition of modifiers changes the reagent ion composition. For example, the addition of acetate buffers or modifiers can make the acetate ion $[CH_3COO]^-$ the primary reagent in Negative polarity. Ammonium modifiers might make protonated ammonia $[NH_4]^+$ the primary reagent in Positive polarity.

Through collisions, an equilibrium distribution of certain ions, such as protonated water cluster ions, is maintained. The likelihood of premature fragmentation of the sample ions in the ion source is reduced because of the moderating influence of solvent clusters on the reagent ions and the relatively high gas pressure in the ion source. As a result, the ionization process yields primarily molecular product ions for mass analysis in the mass spectrometer.

APCI Ionization Region

The following figure shows the general location of the ion-molecule reactor of the APCI probe. The slanted lines indicate a wall-less reactor. A self-starting corona discharge ion current in the microampere range is created as a result of the electric field between the discharge needle and the curtain plate. Primary ions, for example, N_2^+ and O_2^+, are created by the loss of electrons that originate in the plasma in the immediate vicinity of the discharge needle tip. The energy of these electrons is moderated by a number of collisions with gas molecules before attaining an energy where their effective ionization cross-section allows them to ionize neutral molecules efficiently.

Figure B-4 APCI Ionization Region



Item	Description
1	Discharge needle tip

Item	Description
2	Sample flow
3	Wall-less reactor
4	Curtain plate aperture
5	Gas for the Curtain Gas interface
6	Orifice
7	Orifice plate
8	Ceramic tube

The primary ions, in turn, generate intermediate ions that lead to the formation of sample ions. Ions of the chosen polarity drift under the influence of the electric field in the direction of the curtain plate and through the gas curtain to the mass analyzer. The whole ion formation process is collision-dominated because of the relatively high atmospheric pressure of the APCI probe. Except in the immediate vicinity of the discharge needle tip, where the strength of the electric field is greatest, the energy imparted to an ion by the electric field is small in comparison with the thermal energy of the ion.

Through collisions, an equal distribution of certain ions (for example, protonated water cluster ions) is maintained. Any excess energy that an ion might acquire in the ion-molecule reaction process is thermalized. Through collisional stabilization, many of the product ions are fixed, even though many subsequent collisions occur. The formation of both product ions and reactant ions is governed by equilibrium conditions at 760 torr (atmospheric) operating pressure.

The APCI probe functions as a wall-less reactor because the ions that pass from the ion source to the vacuum chamber and eventually to the detector never experience collisions with a wall—only collisions with other molecules. Ions are also formed outside the designated ion source, but are not detected and are eventually neutralized by interacting with a wall surface.

The temperature of the probe is an important factor for APCI probe operation. To preserve the molecular identity, the temperature must be set high enough to ensure a rapid evaporation. At a sufficiently high operating temperature, the droplets are vaporized quickly so that organic molecules are desorbed from the droplets with minimal thermal degradation. If, however, the temperature is set too low, the evaporation process is slower and pyrolysis, or decomposition, might occur before vaporization is complete. Operating the APCI probe at temperatures above the optimal temperature might cause thermal decomposition of the sample.

Ion Source Optimization C

TurboIonSpray Probe Optimization

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Make sure that the source exhaust system is connected and functioning, and that good general laboratory ventilation is provided. Adequate laboratory ventilation is required to control solvent and sample emissions, and to provide for the safe operation of the system.

WARNING! Fire Hazard. Do not direct more than 3 mL/min of flammable solvent in the ion source. Exceeding the maximum flow rate can cause solvent to accumulate in the ion source. Do not use the ion source if the source exhaust system is not enabled and functioning when the ion source and the probe are properly installed.

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Make sure that the electrode protrudes beyond the tip of the probe, to prevent hazardous vapors from escaping from the source. The electrode must not be recessed within the probe.

CAUTION: Potential System Damage. If the LC system connected to the mass spectrometer is not controlled by the software, then do not leave the mass spectrometer unattended while in operation. The liquid stream from the LC system can flood the ion source when the mass spectrometer goes in Standby state.

Note: To keep the system clean and at optimum performance, adjust the probe position when changing the flow rate.

Tip! It is easier to optimize signal and signal-to-noise with flow injection analysis than with on-column injections.

Note: If the **IonSpray Voltage** is too high, then a corona discharge can occur. A corona discharge is visible as a blue glow at the tip of the probe. It results in decreased sensitivity and stability of the signal.

Set Up the System

1. Configure the LC pump to deliver the mobile phase at the required flow rate. Refer to the section: Source Parameters and Voltages.
2. Connect the grounding union on the ion source to an LC pump, through an injector equipped with a 5 µL loop, or to an autosampler.
3. If an autosampler is being used, then configure the autosampler to perform multiple injections.

Prepare the System

1. Open the control software.
2. On the Navigation bar, under **Tune and Calibrate** mode, double-click **Manual Tuning**.
3. Open a previously optimized method or create a method based on the compounds.
4. If the ion source has been allowed to cool, then do the following.
    a. Set the ion source temperature to `450`.
    b. Let the ion source warm up for 30 minutes.

    The 30-minute warm-up stage prevents solvent vapors from condensing in the cold probe.
5. Start the solvent flow and sample injection.

APCI Probe Optimization

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Make sure that the source exhaust system is connected and functioning, and that good general laboratory ventilation is provided. Adequate laboratory ventilation is required to control solvent and sample emissions, and to provide for the safe operation of the system.

WARNING! Fire Hazard. Do not direct more than 3 mL/min of flammable solvent in the ion source. Exceeding the maximum flow rate can cause solvent to accumulate in the ion source. Do not use the ion source if the source exhaust system is not enabled and functioning when the ion source and the probe are properly installed.

WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Make sure that the electrode protrudes beyond the tip of the probe, to prevent hazardous vapors from escaping from the source. The electrode must not be recessed within the probe.

CAUTION: Potential System Damage. If the LC system connected to the mass spectrometer is not controlled by the software, then do not leave the mass spectrometer unattended while in operation. The liquid stream from the LC system can flood the ion source when the mass spectrometer goes in Standby state.

Note: The minimum flow rate supported by the APCI probe is 200 µL/min. For a complete list of APCI probe parameters, refer to the section: APCI Probe Parameters.

Tip! It is easier to optimize signal and signal-to-noise with flow injection analysis than with on-column injections.

Note: When using the APCI probe, make sure that the corona discharge needle is pointing toward the aperture.

Set Up the System

1. Configure the LC pump to deliver the mobile phase at the required flow rate. Refer to the section: Source Parameters and Voltages.
2. Connect the grounding union on the ion source to an LC pump, through an injector equipped with a 5 µL loop, or to an autosampler.
3. If an autosampler is being used, then configure the autosampler to perform multiple injections.

Prepare the System

1. Open the control software.
2. On the Navigation bar, under **Tune and Calibrate** mode, double-click **Manual Tuning**.
3. Open a previously optimized method or create a method based on the compounds.
4. If the ion source has been allowed to cool, then do the following.
    a. Set the ion source temperature to `450`.
    b. Let the ion source warm up for 30 minutes.

    The 30-minute warm-up stage prevents solvent vapors from condensing in the cold probe.

5. Start the solvent flow and sample injection.

Set the Starting Conditions

1. In the Tune Method Editor, make sure that the correct **Scan Type** and appropriate compound parameters are selected.
2. Type `30` in the **Ion Source Gas 1 (GS1)** field.
3. In the Curtain Gas (CUR) field, type the value appropriate to the mass spectrometer.

Table C-1 CUR Parameter Values

Mass Spectrometer	Starting Value
SCIEX 3200	20

4. Type `1` in the **Nebulizer Current (NC)** field.
5. On the Compound tab, in the **Declustering potential (DP)** field, type `100`.
6. Start acquisition.

Optimize Source and Gas Parameters

1. Adjust ion source gas 1 in increments of five to achieve the best signal or signal-to-noise ratio.
2. Increase the flow rate of the gas for the Curtain Gas interface until the signal starts to decrease.

Note: To prevent contamination, use the highest possible value for the flow rate of the gas for the Curtain Gas interface that does not sacrifice sensitivity. Do not set the flow rate lower than the values in the table: Table C-2. This helps to prevent penetration of the flow of the gas for the Curtain Gas interface, which can produce a noisy signal; prevent contamination of the aperture; and increase the overall signal-to-noise ratio.

Table C-2 CUR Parameter Values

Mass Spectrometer	Starting Value
SCIEX 3200 systems	20

Adjust the Position of the Corona Discharge Needle

WARNING! Electrical Shock Hazard. Follow this procedure to avoid contact with the high voltages applied to the corona discharge needle, curtain plate, and turbo heaters.

Required Materials
• Insulated flat-bladed screwdriver

When using the APCI probe, make sure that the corona discharge needle is pointing toward the aperture. When using the TurboIonSpray probe, make sure that the corona discharge needle is pointed away from the aperture.

1. Use an insulated flat-bladed screwdriver to rotate the corona discharge needle adjustment screw on the top of the needle.
2. Look through the glass window to make sure that the needle is aligned with the tip facing the aperture.

Optimize the APCI Probe Position

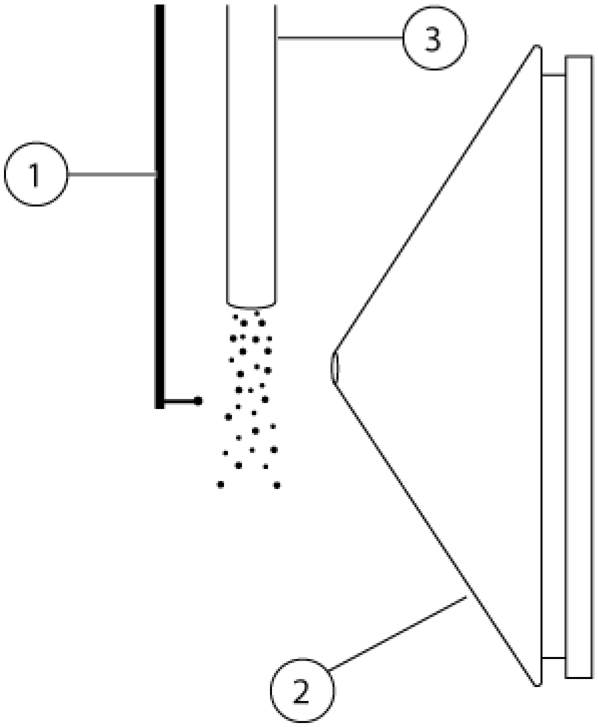
WARNING! Ionizing Radiation Hazard, Biohazard, or Toxic Chemical Hazard. Make sure that the electrode protrudes beyond the tip of the probe, to prevent hazardous vapors from escaping from the source. The electrode must not be recessed within the probe.

WARNING! Puncture Hazard. Be careful when handling the electrode. The tip of the electrode is extremely sharp.

Make sure that the curtain plate aperture remains clear of solvent or solvent droplets at all times.

The position of the sprayer nozzle affects sensitivity and signal stability. Adjust the probe position in small increments only. At lower flow rates, move the probe closer to the aperture. For higher flow rates, move the probe farther away from the aperture. After the probe is optimized, it needs only minor adjustment. If the probe is removed, or if the analyte, flow rate, or solvent composition changes, then repeat the optimization procedure.

Figure C-1 Sprayer Nozzle Position



Item	Description
1	Corona discharge needle
2	Curtain plate
3	APCI probe

1. Use the previous horizontal and vertical micrometer settings or set them to 5 as a starting position.

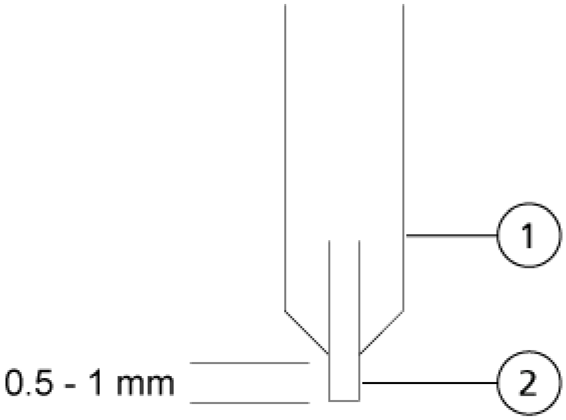
   Note: To avoid reducing the performance of the mass spectrometer, do not spray directly in the aperture.

2. In the control software, monitor the signal or signal-to-noise of the analytes.
3. Use the horizontal micrometer to adjust the probe in small increments to achieve the best signal or signal-to-noise ratio.
4. Use the vertical micrometer to adjust the probe in small increments to achieve the best signal or signal-to-noise ratio.
5. Adjust the black electrode adjustment nut on the probe to move the electrode tube in or out of the probe (to adjust the protrusion).

Note: The electrode tip should protrude between 0.5 mm and 1.0 mm from the end of the probe.

The optimal setting for the electrode tip is compound-dependent. The distance that the electrode tip protrudes affects the shape of the spray cone, and the shape of the spray cone affects mass spectrometer sensitivity.

Figure C-2 Electrode Tip Extension Adjustment



Item	Description
1	Probe
2	Electrode

Optimize the Nebulizer Current

The ion source is controlled by current and not by voltage. Select the appropriate current for the acquisition method, regardless of the ion source selection position.

Start with a nebulizer current value of 3 and then increase or decrease it to achieve the best signal or signal-to-noise ratio.

The nebulizer current applied to the corona discharge needle usually optimizes between 1 μA and 5 μA in either polarity. If no changes in signal are observed when the current is increased, then leave the current at the lowest value that provides the best signal or signal-to-noise ratio.

Optimize the APCI Probe Temperature

The quantity and type of solvent affects the optimal APCI probe temperature. At higher flow rates, the optimal temperature increases.

Adjust the ion source temperature in increments of 50 °C to 100 °C to achieve the best signal or signal-to-noise ratio.

Source Parameters and Voltages D

TurboIonSpray Probe Parameters

The following table shows the recommended operating conditions for the TurboIonSpray probe at three different flow rates. For each flow rate, the flow rate of the gas for the Curtain Gas interface should be as high as possible. The solvent composition used for optimization was 1:1 water:acetonitrile. These conditions represent a starting point from which to optimize the probe. Using an iterative process, optimize the parameters using flow injection analysis to achieve the best signal or signal-to-noise for the compound of interest.

Table D-1 Parameter Optimization for the TurboIonSpray Probe

Parameters	**Typical Values**			**Operational Range**
	Low	**Medium**	**High**	
LC flow rate	5 µL/min to 50 µL/min	200 µL/min	1,000 µL/min	5 µL/min to 3,000 µL/min
Ion source gas 1 (nebulizer gas)	20 psi to 40 psi	40 psi to 60 psi	40 psi to 60 psi	0 psi to 90 psi
Ion source gas 2 (heater gas)	0 psi	50 psi	50 psi	0 psi to 90 psi
IonSpray Voltage	5500 V	5500 V	5500 V	5500 V
Gas for the Curtain Gas interface	20 psi	20 psi	20 psi	20 psi to 50 psi
Ion source temperature[1]	Ambient to 200 ºC	200 ºC to 650 ºC	400 ºC to 750 ºC	Up to 750 ºC
Declustering potential (DP)[2]	Positive: 70 V Negative: –70 V	Positive: 70 V Negative: –70 V	Positive: 100 V Negative: –100 V	Positive: 0 V to 400 V Negative: –400 V to 0 V

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[1] Optimum temperature values depend on the compound and mobile phase composition. Higher aqueous content requires a higher temperature. Zero (0) means no temperature is applied.

[2] DP values depend on the compound.

Table D-1 Parameter Optimization for the TurboIonSpray Probe (continued)

Parameters	Typical Values			Operational Range
	Low	Medium	High	
Probe vertical micrometer setting	7 to 10	2 to 5	0 to 2	0 to 13
Probe horizontal micrometer setting	4 to 6	4 to 6	4 to 6	0 to 10

APCI Probe Parameters

Table D-2 Parameter Optimization for the APCI Probe

Parameter	Typical Value	Operational Range
LC flow rate	1,000 µL/min	200 µL/min to 3,000 µL/min
Ion source gas 1 (nebulizer gas)	30 psi	0 psi to 90 psi
Gas for the Curtain Gas interface	20 psi	20 psi to 50 psi
Ion source temperature[3]	400 ºC	100 ºC to 750 ºC
Nebulizer current	Positive: 3 µA Negative: –3 µA	Positive: 0 mA to 5 µA Negative: –5 mA to 0 µA
Nebulizer Current (NC)	Positive: 2 µA Negative: –2 µA	Positive: 1 mA to 5 µA Negative: –1 mA to 0 µA
Declustering potential (DP)	Positive: 60 V Negative: –60 V	Positive: 0 V to 300 V Negative: –300 V to 0 V
Probe vertical micrometer setting	4	Scale 0 to 13

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[3] Temperature values depend on the compound.

Parameter Descriptions

Table D-3 Source-Dependent Parameters

Parameter	Description
Ion source gas 1	Controls the nebulizer gas for the TurboIonSpray and APCI probes. Refer to the section: Principles of Operation — Ion Source.
Ion source gas 2	Controls the heater gas for the TurboIonSpray probe. The best sensitivity is achieved when the combination of temperature and heater gas flow rate causes the LC solvent to reach a point at which it is nearly all vaporized. To optimize the ion source gas 2, increase the flow to obtain the best signal or signal-to-noise ratio if there is a significant increase in background noise. Too high a gas flow can produce a noisy or unstable signal. Refer to the section: Principles of Operation — Ion Source.
Curtain gas	Controls the flow rate of the gas for the Curtain Gas interface. The Curtain Gas interface is located between the curtain plate and the orifice. It prevents ambient air and solvent droplets from entering and contaminating the ion optics, while permitting direction of sample ions in the vacuum chamber by the electrical fields generated between the vacuum interface and the spray needle. Contamination of the ion entrance optics reduces Q0 transmission, stability, and sensitivity, and increases background noise. Maintain the flow rate of the gas for the Curtain Gas interface as high as possible without losing sensitivity.
Ion source temperature	Controls the heat applied to the sample to vaporize it. The optimal ion source temperature is the lowest temperature at which the sample is vaporized completely. Optimize in increments of 50 °C.

Table D-3 Source-Dependent Parameters (continued)

Parameter	Description
Ion source temperature (TurboIonSpray probe)	Controls the temperature of the heater gas in the TurboIonSpray probe. The best sensitivity is achieved when the combination of temperature and ion source gas 2 flow rate causes the LC solvent to reach a point at which it is nearly all vaporized. As the organic content of the solvent increases, the optimal probe temperature decreases. With solvents consisting of 100% methanol or acetonitrile, the probe performance might optimize as low as 300 °C. Aqueous solvents consisting of 100% water at flows of approximately 1,000 µL/min require a maximum probe temperature of 750 °C. If the ion source temperature is set too low, then vaporization is incomplete, and large, and visible droplets are expelled into the ion source housing. If the ion source temperature is set too high, then solvent might vaporize prematurely at the probe tip, especially if the probe is set too low (5 to 13).
Ion source temperature (APCI probe)	Controls the temperature of the APCI probe. As the organic content of the solvent increases, the optimal probe temperature should decrease. With solvents consisting of 100% methanol or acetonitrile the probe performance might optimize at temperatures as low as 400 °C at flow rates of 1,000 µL/min. Aqueous solvents consisting of 100% water set at flows of approximately 2,000 µL/min require a minimum probe temperature of 700 °C. If the ion source temperature is set too low, then vaporization is incomplete, and large, and visible droplets are expelled into the ion source housing. If the ion source temperature is set too high, then thermal degradation of the sample occurs.

Table D-3 Source-Dependent Parameters (continued)

Parameter	Description
Nebulizer current	Controls the current applied to the corona discharge needle in the APCI probe. The discharge ionizes solvent molecules, which in turn ionize the sample molecules. For the APCI probe, the current applied to the corona discharge needle usually optimizes over a broad range of about 1 µA to 5 µA, in Positive polarity. To optimize, start at a value of 1 and then increase to achieve the best signal or signal-to-noise ratio. If, when the current is increased, no changes in signal are observed, then leave the current at the lowest setting that provides the best sensitivity, for example, 2 µA.
Ion source voltage	Controls the voltage applied to the sprayer in the TurboIonSpray probe, which ionizes the sample in the ion source. The parameter value depends on the polarity, and affects the stability of the spray and the sensitivity. In the Analyst software, this is the **IonSpray Voltage** field.
Interface heater	This parameter is always on for 3200 series systems. Turns the interface heater on and off. Heating the interface helps maximize the ion signal and prevents contamination of the ion optics. Unless the compound the user is analyzing is extremely fragile, we recommend that the user heat the interface.

Probe Position

The position of the probe can affect the sensitivity of the analysis. For more information on how to optimize the position of the probe, refer to the section: Ion Source Optimization.

Solvent Composition

The standard concentration of ammonium formate or ammonium acetate is from 2 mmol/L to 10 mmol/L for positive ions and 2 mmol/L to 50 mmol/L for negative ions. The concentration of organic acids is 0.1% to 0.5% by volume for the TurboIonSpray probe and 0.1% to 1.0% by volume for the APCI probe.

Commonly used solvents are:

- Acetonitrile
- Methanol

- Propanol
- Water

Commonly used modifiers are:

- Acetic acid
- Formic acid
- Ammonium formate
- Ammonium acetate

The following modifiers are not commonly used because they complicate the spectrum with their ion mixtures and cluster combinations. They might also suppress the strength of the target compound ion signal.

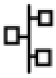
- Triethyl amine (TEA)
- Sodium phosphate
- Trifluoroacetic acid (TFA)
- Sodium dodecyl sulfate

Glossary of Symbols

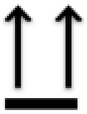
E

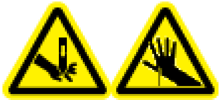
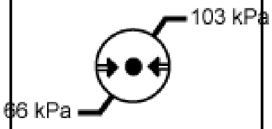
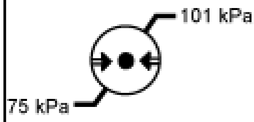
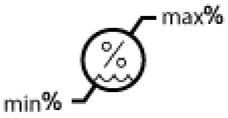
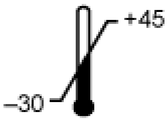
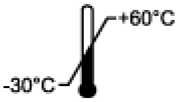
Note: Not all of the symbols in the following table are applicable to every instrument.

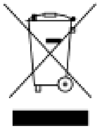
Symbol	Description
	Australian Regulatory Compliance Mark. Indicates that the product complies with Australian Communications Media Authority (ACMA) EMC Requirements.
∼	Alternating current
A	Amperes (current)
	Asphyxiation Hazard
EC REP	Authorized representative in the European community
	Biohazard
CE	CE Marking of Conformity
	cCSAus mark. Indicates electrical safety certification for Canada and USA.
REF	Catalog number

Symbol	Description
	Caution. Consult the instructions for information about a possible hazard. **Note:** In SCIEX documentation, this symbol identifies a personal injury hazard.
	China RoHS Caution Label. The electronic information product contains certain toxic or hazardous substances. The center number is the Environmentally Friendly Use Period (EFUP) date, and indicates the number of calendar years the product can be in operation. Upon the expiration of the EFUP, the product must be immediately recycled. The circling arrows indicate the product is recyclable. The date code on the label or product indicates the date of manufacture.
	China RoHS logo. The device does not contain toxic and hazardous substances or elements above the maximum concentration values and it is an environmentally-friendly product that can be recycled and reused.
	Consult instructions for use.
	Crushing Hazard
	cTUVus mark for TUV Rheinland of North America
	Data Matrix symbol that can be scanned by a barcode reader to obtain a unique device identifier (UDI)
	Environmental Hazard
	Ethernet connection

Symbol	Description
	Explosion Hazard
	Eye Injury Hazard
	Fire Hazard
	Flammable Chemical Hazard
	Fragile
	Fuse
Hz	Hertz
	International safety symbol "Caution, risk of electric shock" (ISO 3864), also known as High Voltage symbol If the main cover must be removed, then contact a SCIEX representative to prevent electric shock.
	Hot Surface Hazard
IVD	In Vitro Diagnostic Device
	Ionizing Radiation Hazard

Symbol	Description
	Keep dry. Do not expose to rain. Relative humidity must not exceed 99%.
	Keep upright.
	Lacerate/Sever Hazard
	Laser Radiation Hazard
	Lifting Hazard
	Magnetic Hazard
	Manufacturer
	Moving Parts Hazard
	Pacemaker Hazard. No access to people with pacemakers.
	Pinching Hazard

Symbol	Description
	Pressurized Gas Hazard
	Protective Earth (ground)
	Puncture Hazard
	Reactive Chemical Hazard
SN	Serial number
	Toxic Chemical Hazard
	Transport and store the system within 66 kPa to 103 kPa.
	Transport and store the system within 75 kPa to 101 kPa.
	Transport and store the system within the specified minimum (**min**) and maximum (**max**) levels of relative humidity, noncondensing.
	Transport and store the system within –30 °C to +45 °C.
	Transport and store the system within –30 °C to +60 °C.

Symbol	Description
	USB 2.0 connection
	USB 3.0 connection
	Ultraviolet Radiation Hazard
UK CA	United Kingdom Conformity Assessment Mark
VA	Volt Ampere (power)
V	Volts (voltage)
	WEEE. Do not dispose of equipment as unsorted municipal waste. Environmental Hazard
W	Watts
	*yyyy-mm-dd* Date of manufacture

Glossary of Warnings

F

Note: If any of the labels used to identify a component become detached, contact a Field Service Employee (FSE).

Label	Translation (if applicable)
EN61326—1, EN61326—2-6, CLASS A, GROUP 1, ISM EQUIPMENT	EN61326—1, EN61326—2-6, CLASS A, GROUP 1, ISM EQUIPMENT
FCC Compliance. This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.	FCC Compliance. This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
FOR RESEARCH USE ONLY. NOT FOR USE IN DIAGNOSTIC PROCEDURES.	FOR RESEARCH USE ONLY. NOT FOR USE IN DIAGNOSTIC PROCEDURES.
IMPACT INDICATOR SENSITIVE PRODUCT WARNING	IMPACT INDICATOR SENSITIVE PRODUCT WARNING **Note:** If the indicator is tripped, then this container has been dropped or otherwise mishandled. Make a note on the Bill of Lading and then check for damage. Any claims for shock damage require a notation.

Label	Translation (if applicable)
IMPORTANT! RECORD ANY VISIBLE CRATE DAMAGE INCLUDING TRIPPED “IMPACT INDICATOR” OR “TILT INDICATOR” ON THE WAYBILL BEFORE ACCEPTING SHIPMENT AND NOTIFY YOUR LOCAL AB SCIEX CUSTOMER SUPPORT ENGINEER IMMEDIATELY. DO NOT UNCRATE. CONTACT YOUR LOCAL CUSTOMER SUPPORT ENGINEER FOR UNCRATING AND INSTALLATION.	IMPORTANT! RECORD ANY VISIBLE CRATE DAMAGE INCLUDING TRIPPED “IMPACT INDICATOR” OR “TILT INDICATOR” ON THE WAYBILL BEFORE ACCEPTING SHIPMENT AND NOTIFY YOUR LOCAL AB SCIEX CUSTOMER SUPPORT ENGINEER IMMEDIATELY. DO NOT UNCRATE. CONTACT YOUR LOCAL CUSTOMER SUPPORT ENGINEER FOR UNCRATING AND INSTALLATION.
MINIMUM OF SIX PERSONS REQUIRED TO SAFELY LIFT THIS EQUIPMENT	MINIMUM OF SIX PERSONS REQUIRED TO SAFELY LIFT THIS EQUIPMENT
TIP & TELL	Tilt Indicator **Note:** Indicates whether the container was tipped or mishandled. Write on the Bill of Lading and inspect for damage. Any claims for tipping require a notation.
This ISM device complies with Canadian ICES-001.	This ISM device complies with Canadian ICES-001.
TiltWatch PLUS ShockWatch	Tilt Indicator **Note:** Indicates whether the container was tipped or mishandled. Write on the Bill of Lading and inspect for damage. Any claims for tipping require a notation.
WARNING: DO NOT OPERATE WITHOUT FIRST ENSURING BOTTLE CAP IS SECURED.	WARNING: DO NOT OPERATE WITHOUT FIRST ENSURING BOTTLE CAP IS SECURED. **Note:** This warning is attached to the source exhaust waste bottle.

Label	Translation (if applicable)
WARNING: NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED PERSONNEL.	WARNING: NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED PERSONNEL. **Note:** Consult instructions for use.

Contact Us

Customer Training

- In North America: NA.CustomerTraining@sciex.com
- In Europe: Europe.CustomerTraining@sciex.com
- Outside the EU and North America, visit sciex.com/education for contact information.

Online Learning Center

- SCIEX Now Learning Hub

SCIEX Support

SCIEX and its representatives maintain a staff of fully-trained service and technical specialists located throughout the world. They can answer questions about the system or any technical issues that might arise. For more information, visit the SCIEX website at sciex.com or contact us in one of the following ways:

- sciex.com/contact-us
- sciex.com/request-support

CyberSecurity

For the latest guidance on cybersecurity for SCIEX products, visit sciex.com/productsecurity.

Documentation

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To find software product documentation, refer to the release notes or software installation guide that comes with the software.

To find hardware product documentation, refer to the *Customer Reference* DVD that comes with the system or component.

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