



OptaMax NG

Ion Source User Guide

For H-ESI, APCI, and APPI Modes

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Release history:

B51002860 Rev A, October 2023: Fixed incorrect part numbers that were provided for the APPI Interface Kit, APPI drain insert, and APPI source cover (left side).

80111-97029 Rev B, June 2020

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Preface

The *OptaMax NG Ion Source User Guide* describes how to install, remove, and maintain the Thermo Scientific™ OptaMax™ NG ion source.

Note The [Glossary](#) defines some of the terms used in this guide.

- [Accessing Documentation](#)
- [Compatible Mass Spectrometers](#)
- [Special Notices, Symbols, and Cautions](#)
- [Safety Precautions](#)
- [Regulatory Compliance](#)
- [Contacting Us](#)

Accessing Documentation

Thermo Scientific mass spectrometers (MSs) include complete documentation. For system requirements refer to the release notes on the software DVD.

❖ To view the product manuals

- (Windows 7) From the Microsoft™ Windows™ taskbar, choose **Start > All Programs > (Thermo Instruments > model x.x)**, and then open the applicable PDF file.
- (Windows 10) From the Windows taskbar, choose **Start > All Apps> Thermo Instruments > model x.x**, and then open the applicable PDF file.

❖ To view user documentation from the Thermo Fisher Scientific website

- Go to docs.thermofisher.com/ArdiaPlatform to view and download user manuals.

Compatible Mass Spectrometers

Install the OptaMax NG ion source on one of the Thermo Scientific TSQ Series II MSs, or on an Orbitrap™ Tribrid™ Series MS.

If you have instrument compatibility questions, contact Thermo Fisher Scientific Customer Service (see [Contacting Us](#)).



CAUTION The OptaMax NG ion source must connect to a certified Thermo Scientific MS, which supplies high voltage capable of delivering a maximum of 8 kV and 100 μ A.

Do not connect the ion source to another type of MS, as you might impair the protection provided by the equipment.

Special Notices, Symbols, and Cautions

Make sure you understand the special notices, symbols, and caution labels in this guide. Most of the special notices and cautions appear in boxes; those pertaining to safety also have corresponding symbols. Some symbols are also marked on the API source itself and can appear in color or in black and white. For complete definitions, see [Table 1](#).

Table 1. Notices, symbols, labels, and their meanings (Sheet 1 of 2)










Notice, symbol, or label	Meaning
IMPORTANT	Highlights information necessary to prevent damage to software, loss of data, or invalid test results; or might contain information that is critical for optimal performance of the product.
Note	Highlights information of general interest.
Tip	Highlights helpful information that can make a task easier.
	Caution: Read the cautionary information associated with this task.
	Chemical hazard: Observe safe laboratory practices and procedures when handling chemicals. Only work with volatile chemicals under a fume or exhaust hood. Wear gloves and other protective equipment, as appropriate, when handling toxic, carcinogenic, mutagenic, corrosive, or irritant chemicals. Use approved containers and proper procedures to dispose of waste oil and when handling wet parts of the instrument.
	Hot surface: Before touching the API source assembly, allow heated components to cool.

Table 1. Notices, symbols, labels, and their meanings (Sheet 2 of 2)

Notice, symbol, or label	Meaning
	Risk of electric shock: When the mass spectrometer is scanning, do not touch the grounding union, the solvent line or the fittings that connect the grounding union to the probe's sample inlet. Doing so may result in an electrical shock that is strong enough to cause an involuntary "startle" reaction leading to injury.
	Risk of electric shock: This instrument uses voltages that can cause electric shock and personal injury. Before servicing the instrument, shut it down and disconnect it from line power. While operating the instrument, keep covers on.
	Risk of eye injury: Eye injury can occur from splattered chemicals, airborne particles, or sharp objects. Wear safety glasses when handling chemicals or servicing the instrument.
	Sharp object: Avoid handling the tip of the syringe needle.
	Trip obstacle: Be aware of cords, hoses, or other objects located on the floor.
	Ultraviolet light hazard: For the APPI-configured ion source (APPI source), do not look directly at the ultraviolet (UV) light or into the UV source, or risk eye damage. Wear UV eye protection.

Safety Precautions

Observe the following safety precautions when you operate or perform service on the API source.



CAUTION Do not perform any servicing other than that contained in this manual. To avoid personal injury or damage to the instrument, do not perform any servicing other than that contained in this manual or related manuals unless you are qualified to do so.



CAUTION Do not touch heated zones. Allow heated components to cool to room temperature before you service them. The API source housing, its components, and the MS's ion transfer tube can be very hot and can cause severe burns if touched.



CAUTION Risk of eye damage. Do not look in the API source window at the ultraviolet (UV) light during APPI mode operation. If you must do so, wear UV eye protection.



CAUTION Handle the APCI corona discharge needle with care. The corona discharge needle is very sharp and can puncture your skin.

Regulatory Compliance




Thermo Fisher Scientific performs complete testing and evaluation of its products to ensure full compliance with applicable North American and European regulations. The OptaMax NG ion source was tested as part of the Thermo Scientific MS system, which meets the applicable requirements in the electromagnetic compatibility (EMC) and product safety standards. For additional regulatory information, refer to the MS manuals.

Unauthorized changes that you make to your system will void regulatory compliance and may defeat the built-in protections for your instrument. Some examples of unauthorized changes include using replacement parts or adding components, options, or peripherals that Thermo Fisher Scientific has not qualified and authorized. Unauthorized changes can also result in bodily injury and/or damage to your system and laboratory.

Ensure continued compliance with regulatory standards:

- Follow all installation instructions provided in the documentation that comes with your system.
- Order replacement parts (as specified in the instrument manual) and additional components, options, and peripherals directly from Thermo Fisher Scientific or an authorized representative.

Contacting Us

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U.S. Technical Support	us.techsupport.analyze@thermofisher.com	(U.S.) 1 (800) 532-4752	
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<p>Note To provide feedback for this document, go to surveymonkey.com/s/PQM6P62 or send an email message to Technical Publications (techpubs-lcms@thermofisher.com).</p>			

Preface

Introduction

This chapter provides general information about the API techniques (modes) for use with the OptaMax NG ion source. The ionization mode is the specific process used to ionize the sample.

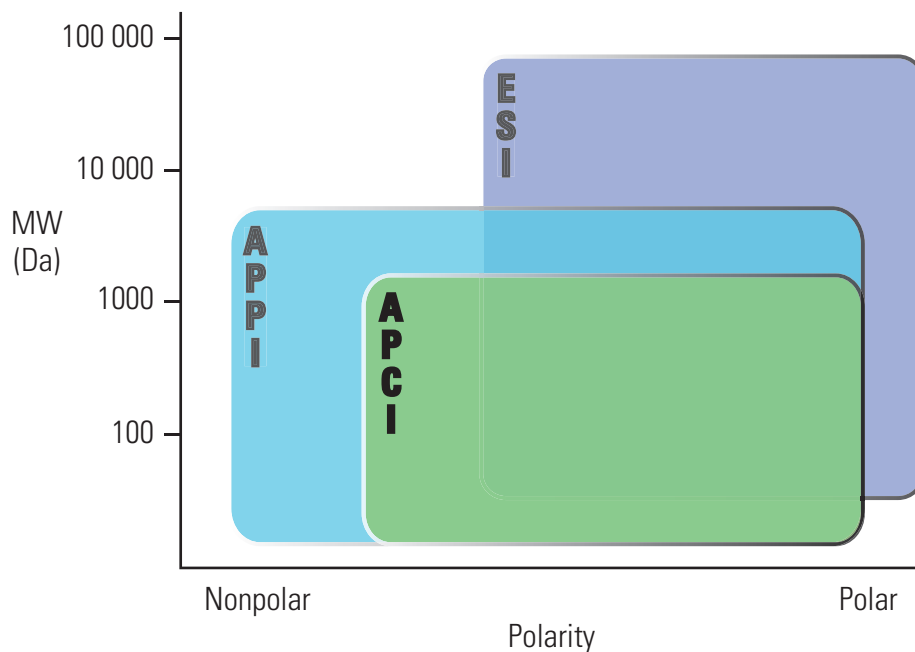
The MS keeps the pressure in the API source housing at atmospheric levels, which reduces the chemical noise that nebulized gases can cause when they are not properly evacuated from the API source. The MS's ion guides transmit the ions produced in the API source into the mass analyzer, where the instrument analyzes them according to their mass-to-charge ratio (m/z). For information about ion analysis, refer to the MS manuals.

- Preferred Ionization Modes
- H-ESI Mode
- APCI Mode
- APPI Mode

Preferred Ionization Modes

The preferred ionization modes are H-ESI for polar compounds (H-ESI is a type of ESI and the ionization properties are the same for both), APCI for medium polarity compounds, and APPI for certain polar and nonpolar compounds.

Figure 1. Polarity ranges for ESI, APCI, and APPI versus molecular weights



H-ESI Mode

H-ESI transforms ions in solution into ions in the gas phase by using electrospray ionization with heated [auxiliary gas](#). An MS with H-ESI can analyze a range of molecular weights greater than 100 000 Da, due to multiple charging. H-ESI is especially useful for the mass analysis of polar compounds that make a preformed ion in solution. These compounds include biological polymers (for example, proteins, peptides, glycoproteins, and nucleotides), pharmaceuticals and their metabolites, and industrial polymers (for example, polyethylene glycols).

Droplet size, surface charge, liquid surface tension, solvent volatility, and ion solvation strength are factors that affect the electrospray process. Large droplets with high surface tension, low volatility, strong ion solvation, low surface charge, and high conductivity prevent good electrospray. The electrospray source produces charged aerosol droplets that contain sample ions. The electrospray source accommodates liquid flow rates of 1 $\mu\text{L}/\text{min}$ to 1 mL/min without splitting.

Organic solvents, such as methanol, acetonitrile, and isopropyl alcohol, are superior to water for H-ESI. Volatile acids and bases are good, but salts above 10 mM concentration and strong acids and bases are extremely detrimental.

Guidelines

These guidelines will help you achieve a strong electrospray.

- Avoid using nonvolatile salts and buffers in the solvent system. For example, avoid the use of phosphates and salts that contain sodium or potassium. If necessary, use ammonium salts instead.
- Use organic-aqueous solvent systems.
- Use volatile acids and bases.
- If possible, optimize the pH of the solvent system for the analyte of interest. For example, if the analyte of interest contains a primary or secondary amine, use an acidic mobile phase (pH 2–5). The acidic pH tends to keep positive ions in solution.

For LC applications that require nonvolatile buffers, use these guidelines:

- Install the [ion sweep cone](#) on the MS.
- Optimize the spray insert position.
- Reduce the concentration of buffers to an absolute minimum.

APCI Mode

Atmospheric pressure chemical ionization (APCI) is a soft ionization technique, but it is not as soft as H-ESI. APCI is used to analyze compounds of medium polarity that have some volatility.

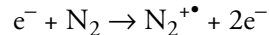
[Figure 2](#) shows the APCI process for positive adduct ion formation. In APCI, the MS produces and analyzes ions as follows:

1. The [nozzle](#) sprays the sample solution into a fine mist of droplets.
2. The [APCI vaporizer](#) (high temperature tube) vaporizes the droplets.
3. The MS applies a high voltage to a needle located near the exit end of the tube. The high voltage creates a [corona discharge](#) that forms reagent ions through a series of chemical reactions with solvent molecules and nitrogen sheath gas.
4. The reagent ions react with sample molecules to form sample ions.
5. The sample ions enter the MS and are analyzed.

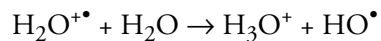
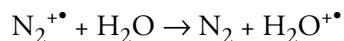
APCI is a gas phase ionization technique. Therefore, the gas phase acidities and basicities of the analyte and solvent vapor play an important role in the APCI process.

In the positive-ion mode, sample ionization occurs in a series of reactions that start with the electron-initiated cation formation. The following are typical examples of primary, secondary, and adduct ion formation:

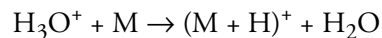
Primary ion formation



Secondary ion formation



Proton transfer



In negative ion mode, $(M - H)^{-}$ is typically formed by the abstraction of a proton by OH^{-} .

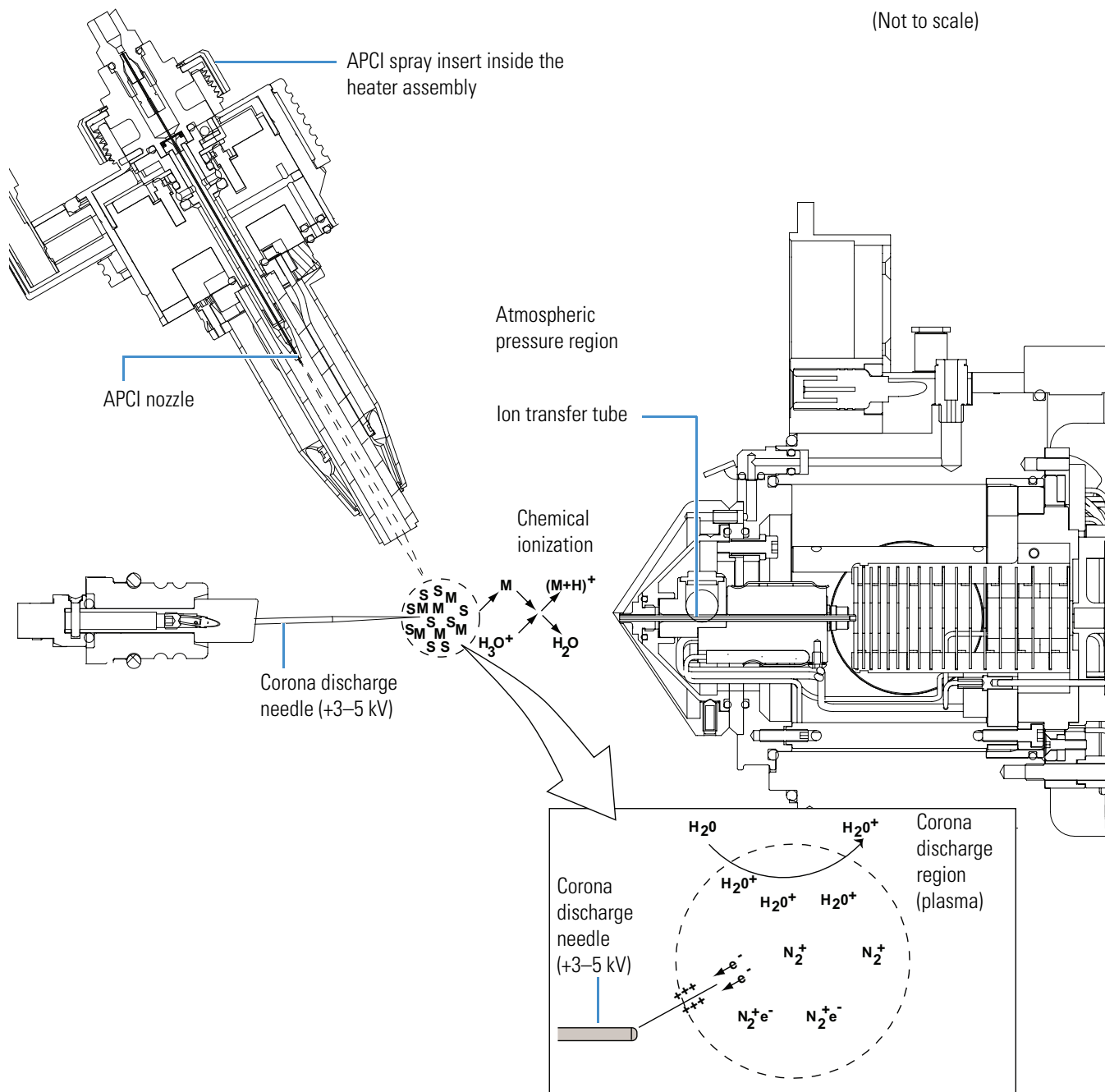
APCI is typically used to analyze small molecules with molecular weights up to about 1500 Da. A very robust ionization technique, APCI is not affected by minor changes in most variables, such as changes in buffers or buffer strength.

You can use APCI in positive or negative ion polarity mode. For most molecules, the positive ion mode produces a stronger ion current. This is especially true for molecules with one or more basic nitrogen (or other basic) atoms. An exception to the general rule is that molecules with acidic sites, such as carboxylic acids and acid alcohols, produce more negative ions than positive ions.

Although, in general, APCI produces fewer negative ions than positive ions, negative ion polarity is sometimes the mode of choice. Because the negative ion polarity mode sometimes generates less chemical noise than in the positive mode, selectivity might be better in the negative ion mode.

Figure 2. APCI process in the positive ion polarity mode (cross-sectional components)

(Not to scale)

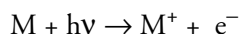


APPI Mode

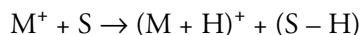
Atmospheric pressure photoionization is also a soft ionization technique. In APPI an ion is generated from a molecule when it interacts with a photon from a light source, such as the Syagen™ PhotoMate™ APPI™ light source. APPI generates molecular ions for molecules that have an ionization potential below the photon energy of the light being emitted by the light source.

In APPI, the MS produces and analyzes ions as follows:

1. The H-ESI or APCI nozzle sprays the sample solution into a fine mist of droplets.
2. The vaporizer (high temperature tube) vaporizes the droplets.
3. The analyte molecule interacts with the light from the PhotoMate light source. The analyte molecule M is ionized to a molecular ion M^+ if the ionization potential of the analyte is less than the photon energy $h\nu$:



4. In the presence of protic solvents, the analyte ion may extract a hydrogen to form an $(M + H)^+$ ion:



5. The analyte ions pass through the [API ion transfer tube](#), enter the MS, and are analyzed.

Molecules including steroids, basic-drug entities, and pesticides have ionization potentials below the threshold, and protonated molecules are generated in the LC/MS experiment. APPI reduces fragmentation because only a small amount of energy is deposited in the molecule. Molecules, such as the nitrogen sheath gas, the auxiliary gas, and the simple solvents used for LC/MS, are not ionized because their ionization potentials are greater than the photon energy. The result is selective ionization of an analyte versus the background. See [Figure 3](#) and [Figure 4](#).

Figure 3. Energetics of photoionization

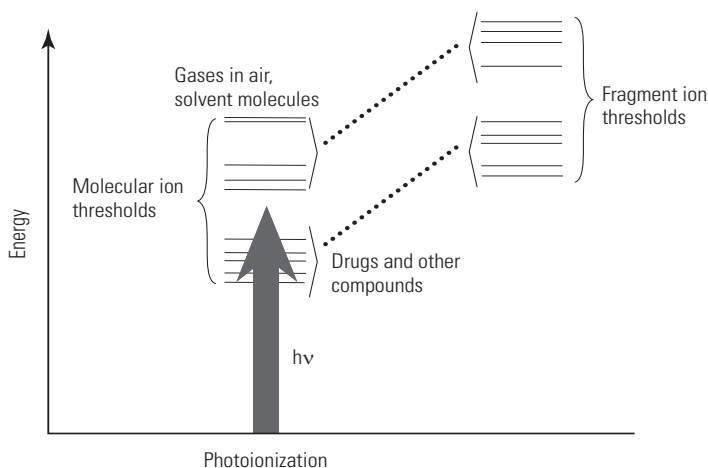
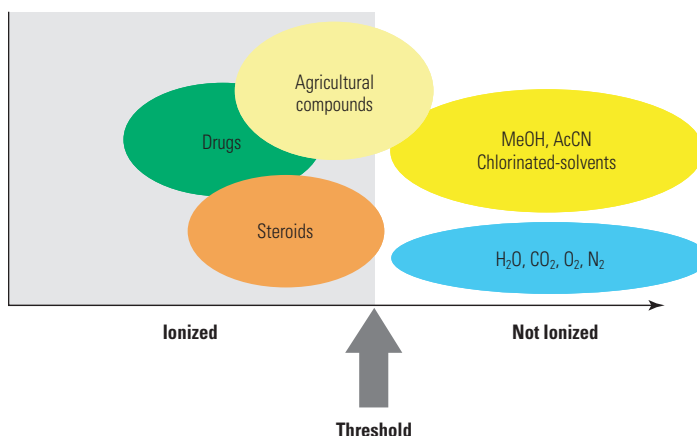


Figure 4. Selective photoionization

APPI Light Source

The PhotoMate APPI light source uses a krypton, vacuum ultraviolet (VUV) lamp that emits photons with energies of 10.0 and 10.6 eV. Molecules with ionization potentials less than 10 eV ionize to form M^+ or $(M + H)^+$, while those with greater ionization potentials do not. [Figure 5](#) shows ionization potentials of typical compounds and solvents.

Figure 5. Ionization potentials of typical compounds and solvents

Krypton 10.0 eV, 10.6 eV			
Ionization Potentials (IP)		Solvent Ionization Potentials (IP)	
Anthracene	7.4 eV	Toluene	8.82 eV
Fluoranthene	7.8 eV	Acetone	9.70 eV
Caffeine	8.0 eV		
4-Nitrotoluene	9.5 eV		
<hr/>			
10.0 eV		Methanol	10.85 eV
		Acetonitrile	12.19 eV
		Water	12.61 eV

API Spray Insert Selection

In APPI mode, you can use either the [APCI Spray Insert](#) or the [H-ESI Spray Insert](#). You can do APCI only, APPI only, or APCI/APPI. When you install the H-ESI spray insert, you can switch between three ionization modes: H-ESI only, APPI only, and H-ESI/APPI.

Select the spray inset that is best suited for your compounds of interest. If the main analysis mode is APPI, use the APCI spray insert. For additional information, contact Thermo Fisher Scientific Technical Support (see [Contacting Us](#)).

1 Introduction

APPI Mode

API Source

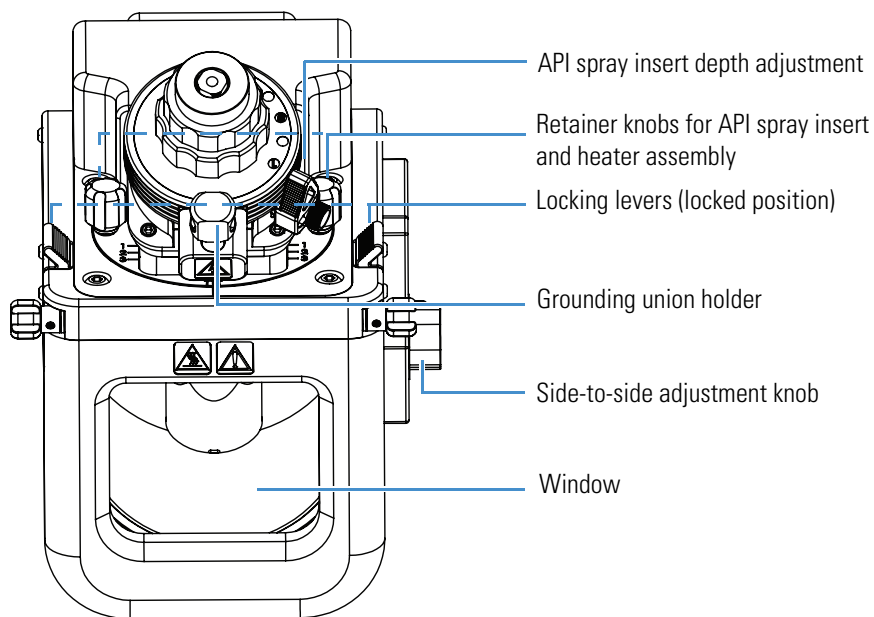
This chapter provides general information about the OptaMax NG ion source (Figure 6) and describes how to remove and install it.

- API Source Features
- Solvent Waste System
- API Spray Inserts
- Removing and Installing the API Spray Insert
- Removing and Installing the API Source



CAUTION To prevent electric shock, verify that the grounding union is made of stainless steel. A grounding union made of a nonconductive material, such as PEEK, creates an electric shock hazard.

Figure 6. OptaMax NG ion source



API Source Features

The API source includes these features:

- Heater assembly—Mounts on top of the API source housing, and used for H-ESI, APCI, and APPI modes. In H-ESI mode, the heater heats the auxiliary gas, which aids in desolvation. In APCI and APPI modes, the heater vaporizes the sample before it reaches the [APCI corona discharge needle](#) (APCI mode) or the PhotoMate light source (APPI mode). For information about the ionization modes, see [Chapter 1, “Introduction.”](#)
- Adjustable API spray insert mount—Moves the API spray insert and heater assembly front-to-back, or rotates them slightly to increase sensitivity or robustness. You can also adjust the spray insert depth. See [“Adjusting the Direction of the Spray Insert.”](#)
- Mounting angle of the API spray insert—Fixed at the optimum angle for signal intensity and API source robustness. You can view the spray insert through the API source window while positioning it.
- Interchangeable ionization modes—You can change the ionization mode by installing a different spray insert and reconfiguring the housing. See [Chapter 3, “Changing the Ionization Mode.”](#)
- Safety interlock system—Prevents contact with high voltages. The API source housing
- has high-voltage, safety interlock switches that turn off the following voltages:
 - Electrospray needle voltage or APCI corona discharge voltage
 - All API source and lens voltages, including the ion transfer tube offset voltage
 - Voltages on the MS ion guides

The following actions turn off these voltages:

- Removing the API spray insert from the API source
- Removing the API source from the MS
- Internal wiring and gas plumbing—You do not have to remove the LC or gas plumbing to remove the API source or change the ionization mode.
- Internal drain inserts —There are two internal drain inserts: a taller one for H-ESI and APCI and a shorter one for APPI. You have no external drain tube to remove when removing the API source.
- Cooling vents—During operation, the external surface of the API source can become hot. The ventilation holes in the housing aid cooling. Before you touch the housing or its components, allow the system to cool for a minimum of 20 minutes.



CAUTION Avoid burns. Avoid touching the API source housing when the mass spectrometer is in operation. The external surface of the housing can become hot enough to burn your skin.

- To prevent corrosion caused by liquid leaks or poor drainage, the API source includes these features:
 - Zero dead volume (ZDV) grounding union—(Required for H-ESI mode only)
Connects the solvent flow from the LC instrument or the syringe pump to the API spray insert's sample inlet. The grounding union's position is offset to prevent liquid leaks from dripping into the API source housing (Figure 7).
 - Drain—Allows eluants to flow directly from the API spray insert into the drain. (Figure 8).

Figure 7. OptaMax NG ion source showing the H-ESI API spray insert, heater assembly, and housing

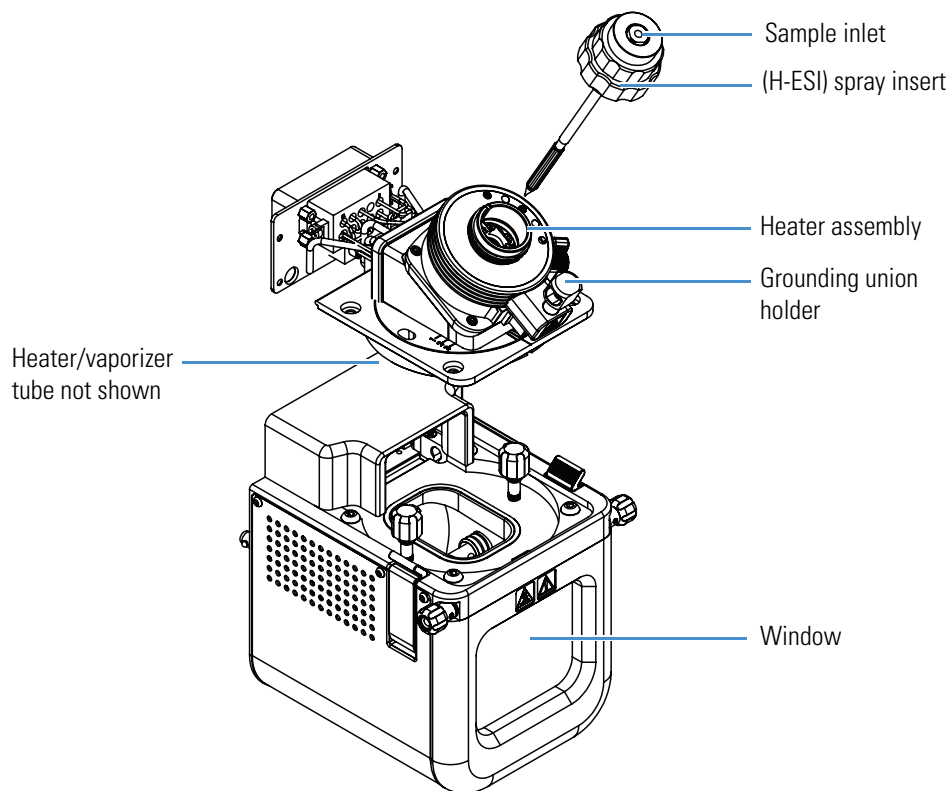
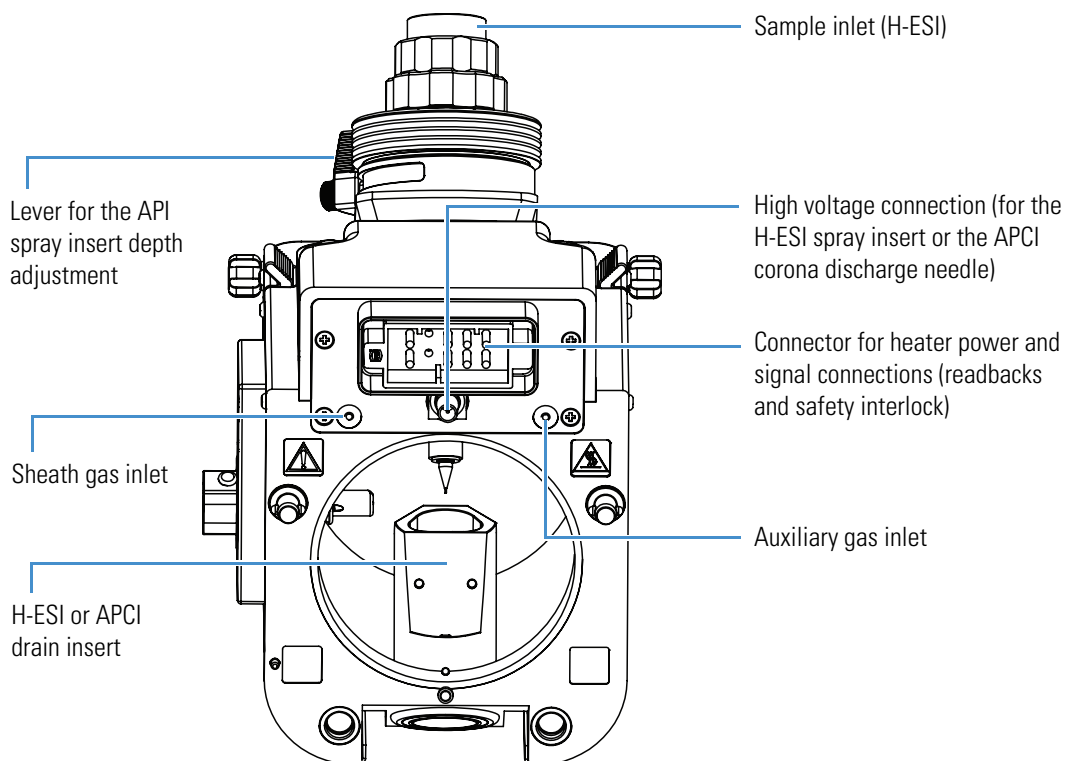


Figure 8. OptaMax NG ion source (back and top view)



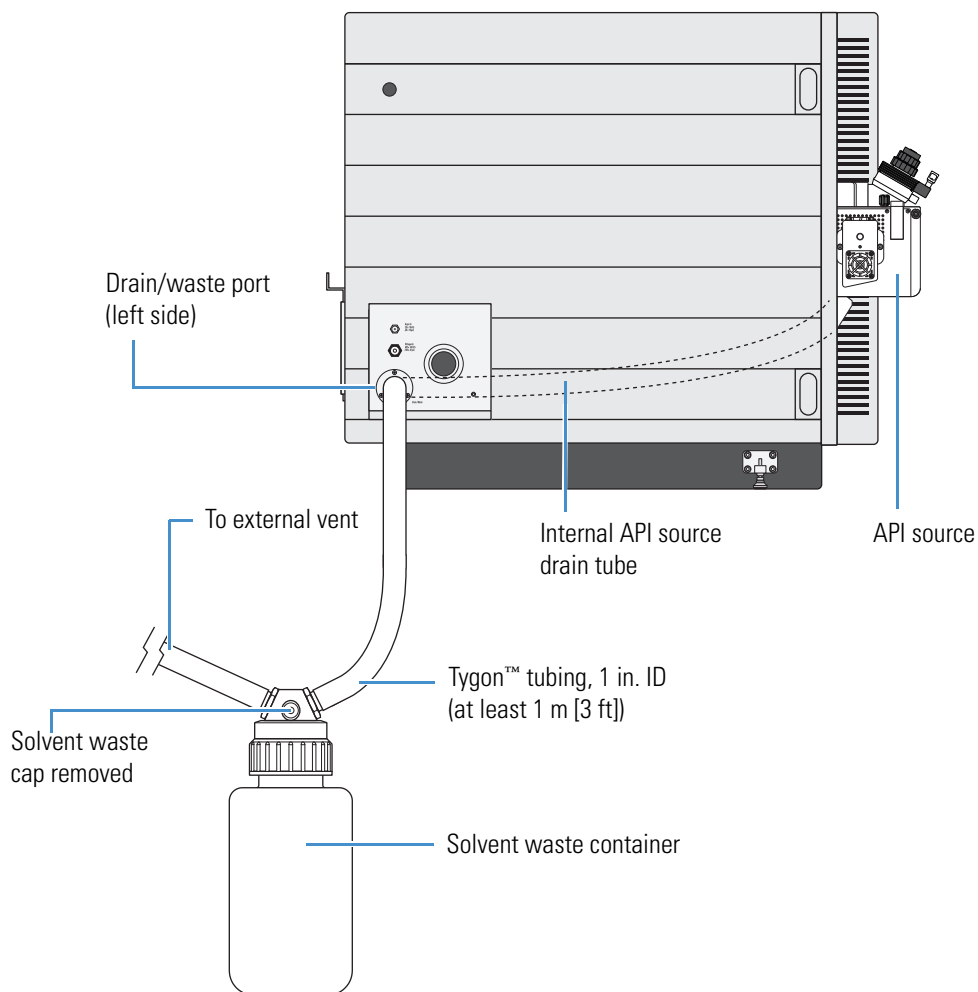
Solvent Waste System

Solvent waste from the drain insert in the API source travels through a fully enclosed drain tube inside the MS and exits the instrument at the left side. [Figure 9](#) shows the solvent waste system.

IMPORTANT Equip your laboratory with at least two fume exhaust systems. The analyzer optics can become contaminated if the API source drain tube and the exhaust tubing from the forepumps connect to the same fume exhaust system. Route the exhaust tubing from the forepumps to a dedicated fume exhaust system.

For additional information, refer to the MS's Preinstallation Requirements Guide.

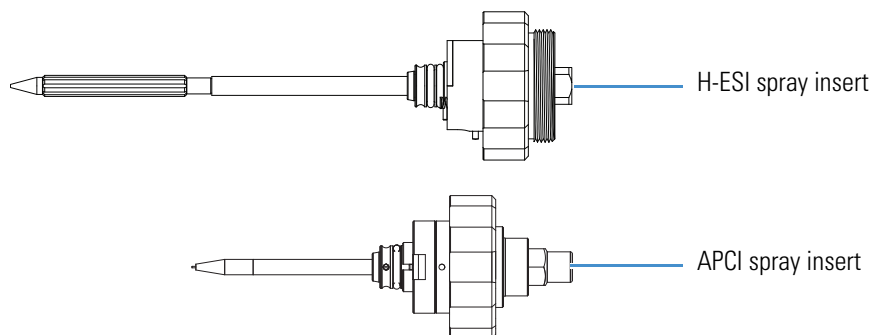
Figure 9. Example solvent waste system



API Spray Inserts

This section describes the API spray inserts ([Figure 10](#)) that you insert into the heater assembly through the top of the API source ([Figure 7](#)).

Figure 10. H-ESI (top) and APCI (bottom) API spray inserts

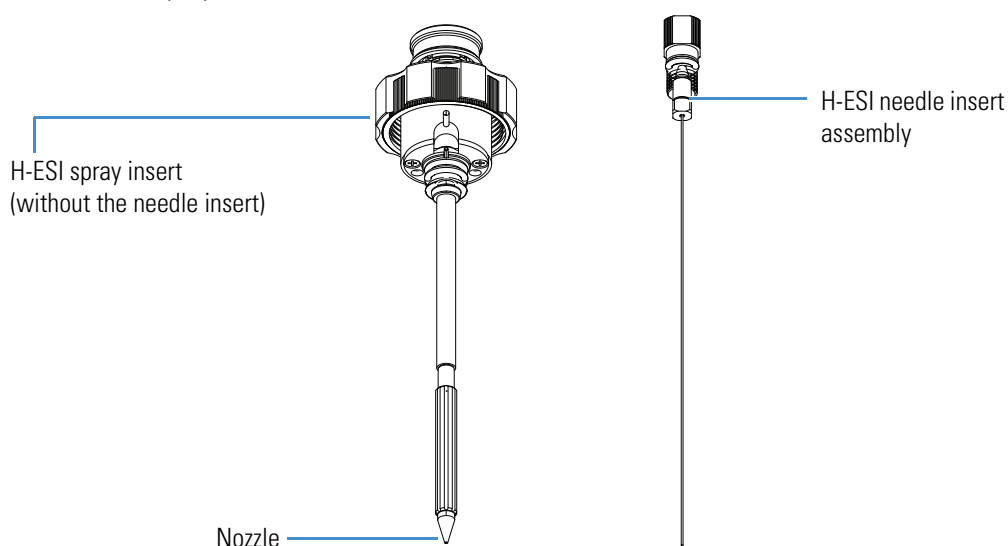


H-ESI Spray Insert

The H-ESI spray insert includes a metal electrospray needle insert, a H-ESI nozzle, and the sheath gas and auxiliary gas plumbing. Sample and solvent enter the nozzle through one of two H-ESI needle inserts: one is for low flow (less than 10 $\mu\text{L}/\text{min}$) and the other, for high flow (greater than 10 $\mu\text{L}/\text{min}$). To change the needle insert, see “Replacing the H-ESI Metal Needle Insert.”

The H-ESI needle insert includes a stainless steel needle that extends from the sample inlet to approximately 1.2 mm (0.05 in.) past the end of the spray insert nozzle. Figure 11 shows the H-ESI needle insert removed from the H-ESI spray insert.

Figure 11. H-ESI spray insert and its metal needle insert



The MS applies a large negative or positive voltage (typically ± 3 to ± 5 kV) to the metal electrospray needle, which sprays the sample solution into a fine mist of charged droplets. The H-ESI spray insert delivers the sheath gas and auxiliary gas to the nozzle. The sheath gas is the inner coaxial nitrogen gas that sprays (nebulizes) the sample solution into a fine mist as it exits the electrospray needle (see the light blue lines in Figure 12). The heated auxiliary gas is the outer coaxial nitrogen gas that assists the sheath gas in the desolvation of sample solutions (see the green lines in Figure 13).

The auxiliary gas heats as it passes through the heater/vaporizer tube. The heater/vaporizer tube (Figure 7) is thermally insulated from the metal electrospray needle to prevent direct heating of the sample solution. You can control the heater/vaporizer temperature from the Thermo Scientific Tune or Method Editor application. The temperature range is from ambient room temperature to 550 °C. For the recommended initial operating settings, see “Setting the Initial Ion Source Parameters.”

Figure 12. Sheath gas flow (blue lines)

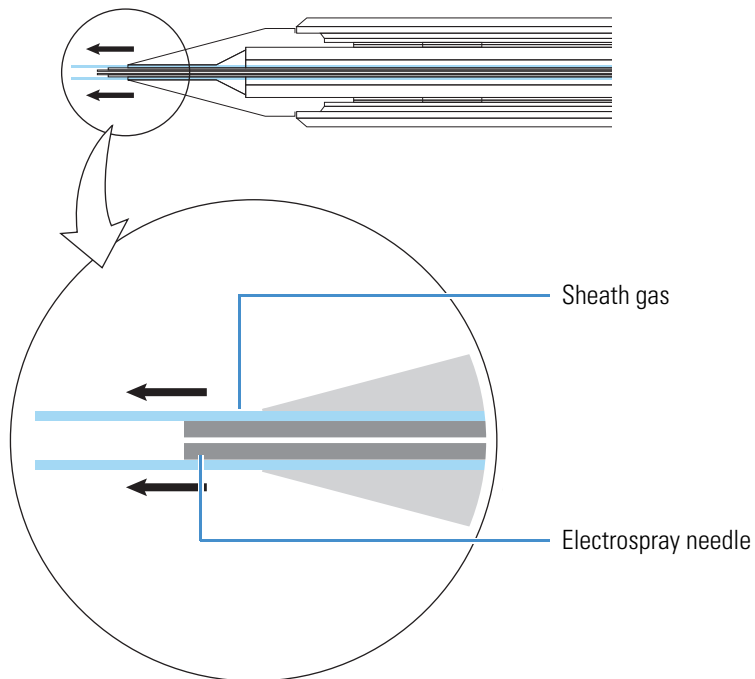
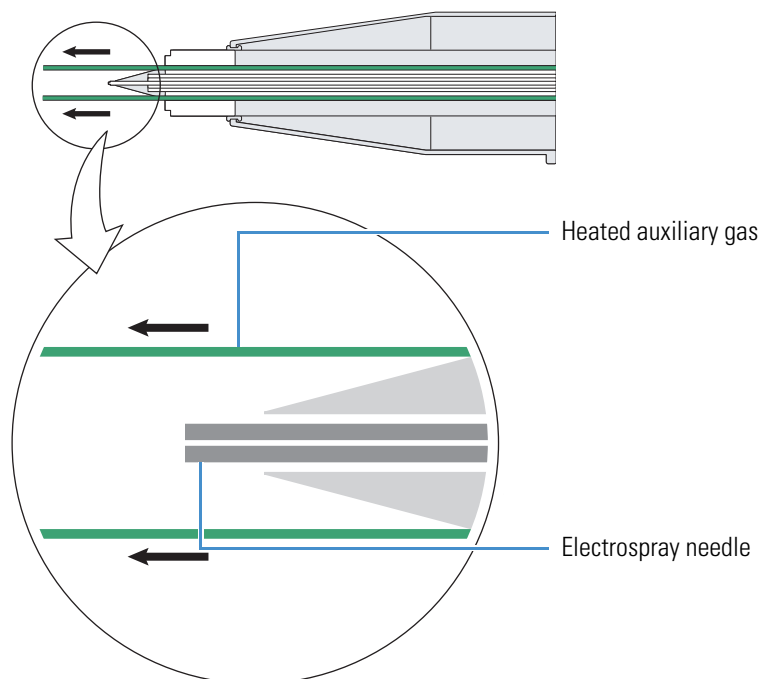


Figure 13. Auxiliary gas flow (green lines)

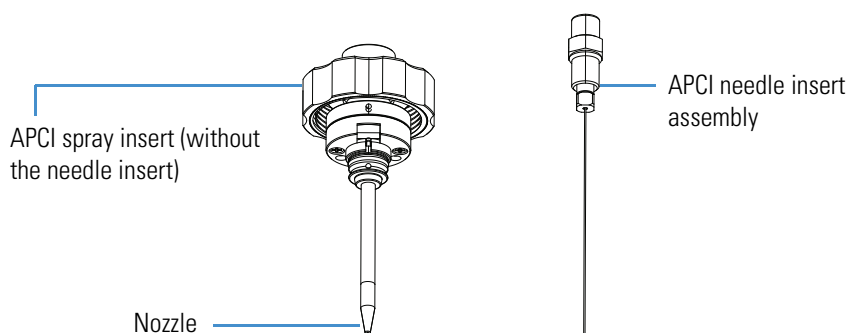


APCI Spray Insert

The APCI spray insert, which is shorter than the H-ESI spray insert, includes a fused-silica capillary (APCI sample tube) insert, an APCI nozzle, and the sheath gas and auxiliary gas plumbing. Sample and solvent enter the nozzle through the fused-silica capillary insert. To change the fused-silica sample tube, see “Replacing the APCI Fused-Silica Sample Tube.”

The APCI fused-silica insert is a short section of 0.15 mm (0.59 in.) ID fused-silica tubing that extends from the sample inlet to 1 mm (0.04 in.) past the end of the spray insert nozzle. Figure 14 shows the APCI needle insert removed from the APCI spray insert.

Figure 14. APCI spray insert and its fused-silica needle insert



The APCI spray insert sprays the sample solution into a fine mist that enters the APCI vaporizer tube, which is ceramic and heated by the heater assembly. The vaporizer tube vaporizes the mist droplets at temperatures up to 550 °C (typically 350–450 °C for flow rates of 0.1–2 mL/min). The APCI spray insert delivers the sheath gas and auxiliary gas to the nozzle. The flow of the nitrogen sheath and auxiliary gases pushes the sample vapor toward the corona discharge needle.


During APCI operation, the tip of the corona discharge needle, which is mounted inside the API source housing, is positioned near the vaporizer. The mass spectrometer applies a high APCI corona discharge voltage (typically ± 3 to ± 5 kV) to the corona discharge needle to produce a steady APCI corona discharge current of up to 100 μA (typically 5 μA). The corona discharge from the needle produces chemical ionization (CI) plasma primarily from the solvent vapor. Ion molecule reactions with the reagent ions in the plasma ionize the sample vapor.

The APCI source can accommodate liquid flows of 100 $\mu\text{L}/\text{min}$ to 2 mL/min without splitting the flow from the LC.

Removing and Installing the API Spray Insert

Use the following procedures when you want to change the ionization configuration (mode) of the API source or perform the maintenance tasks in [Chapter 4, “Maintenance.”](#)

❖ To remove the API spray insert

1. Complete all data acquisition, if any.
2. Place the MS in Off mode as follows:
 - a. From the Windows taskbar, open the Tune application:
 - (Windows 7) From the Microsoft™ Windows™ taskbar, choose **Start > All Programs > Thermo Instruments > model x.x > model Tune**, where *model* is your specific MS.
 - (Windows 10) From the Windows taskbar, choose **Start > All Apps > Thermo Instruments > model x.x, model Tune**, where *model* is your specific MS.
 - b. Click the **Off** icon, 

The center of the selected icon changes from white to green. You can leave the power on for the MS, the LC components, and the data system.



CAUTION Hot surface. Accidental contact with the part of the API spray insert located inside the housing can severely burn you, as this area of the insert can reach 350 °C (662 °F). In addition, although the housing’s exterior surface and the exposed part of the spray insert fall below the limit of 70 °C (158 °F) for accessible metal surfaces, they too pose a burn hazard. Before removing the API spray insert or housing, allow the part to cool to room temperature (approximately 20 minutes) before you touch it.

If the MS connects to an LC system, leave the solvent flow from the LC pump on while the API spray insert cools to room temperature. Then turn off the solvent flow to the API source.

3. Disconnect the sample line from the spray insert’s sample inlet ([Figure 7](#)).
4. After the spray insert cools to room temperature, loosen the spray insert nut ([Figure 15](#)).
5. Lift up and remove the spray insert from the heater assembly.

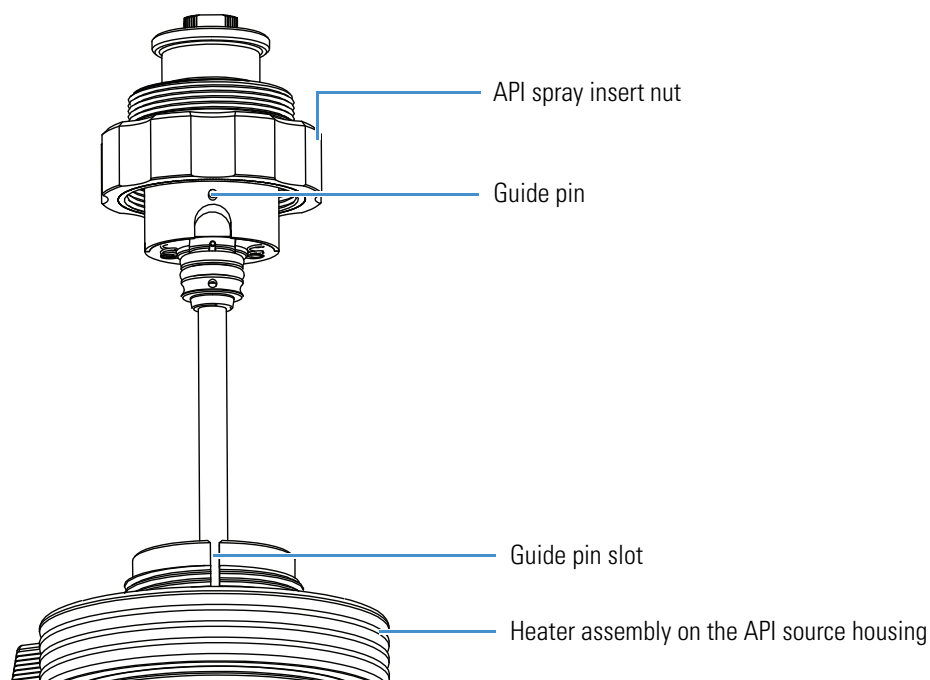
2 API Source

Removing and Installing the API Source

❖ To install the API spray insert

1. Align the guide pin on the API spray insert with the guide pin slot in the heater assembly (Figure 15).

Figure 15. Guide pin and guide pin slot locations



2. Slowly place the spray insert into the heater assembly on the source.
3. With your hand, tighten the spray insert nut.

Removing and Installing the API Source

This section describes how to remove and install the OptaMax NG ion source. If any other source is installed, refer to its documentation for how to remove it from the MS after it has cooled to room temperature.

- [Removing the API Source from the Mass Spectrometer](#)
- [Installing the API Source onto the Mass Spectrometer](#)

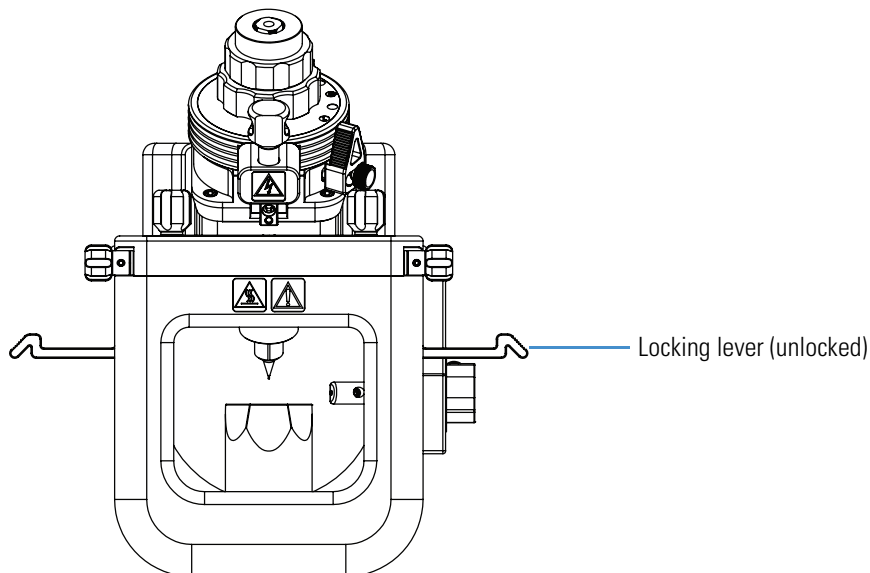
Removing the API Source from the Mass Spectrometer

You must remove the API source to access the mass spectrometer's ion sweep cone, ion transfer tube, and ion source interface, and to access the APCI corona discharge needle and the optional APPI lamp inside the API source housing. Always place the MS in off mode before you remove any components. When the instrument is in standby mode, the API gases, the high voltage, and the syringe pump are off.

❖ **To remove the API source**

1. Place the MS in Off mode (see [page 17](#)).
2. Disconnect the sample line from the grounding union (H-ESI mode) or the spray insert's sample inlet (APCI or APPI mode). See [Figure 25](#).
3. Rotate the locking levers to the unlocked position ([Figure 16](#)).

Figure 16. OptaMax NG ion source with unlocked levers (front view)



4. Grasp the source housing with both hands and slowly pull it away from the MS.

Note If you plan to store the API source, rotate the locking levers to the locked position.

Installing the API Source onto the Mass Spectrometer

Before installing the API source, you must prepare the MS.

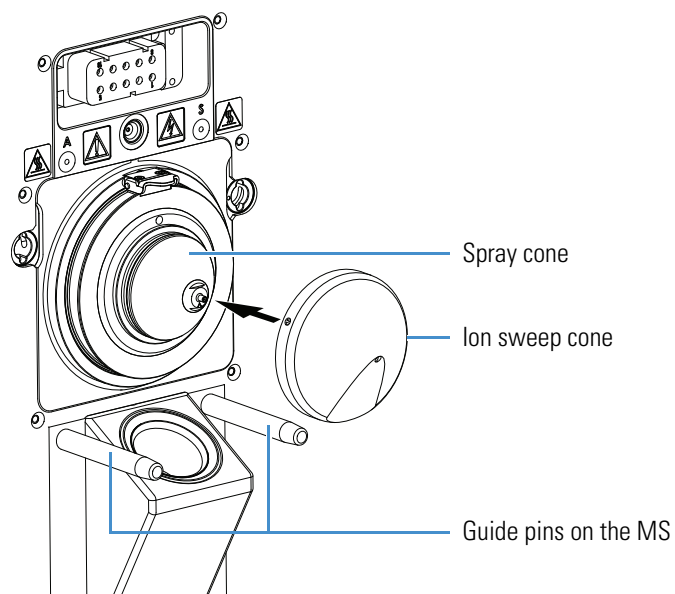
❖ **To prepare the mass spectrometer**

1. If a different API source is installed, remove it from the MS after it has cooled to room temperature.
2. While wearing a new pair of lint- and powder-free gloves, make sure that the ion sweep cone is installed over the spray cone ([Figure 17](#)).

2 API Source

Removing and Installing the API Source

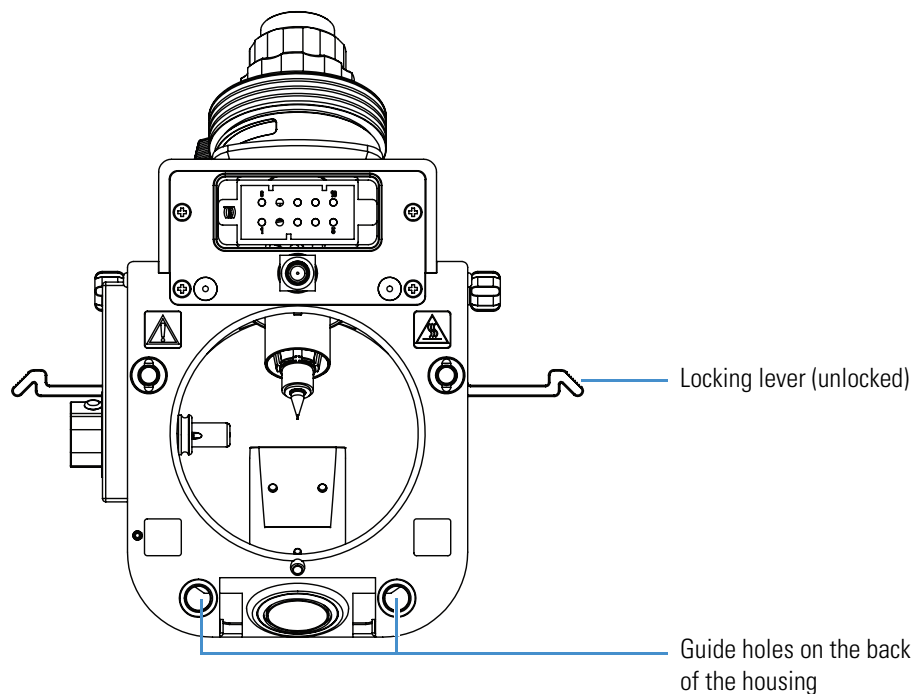
Figure 17. Mass spectrometer mount assembly with ion sweep cone



❖ To install the API source

1. Follow the procedure “[To prepare the mass spectrometer.](#)”
2. Make sure that the locking levers are in the unlocked position ([Figure 16](#)).
3. Align the two guide pin holes on the back of the source ([Figure 18](#)) with the guide pins on the front of the MS ([Figure 17](#)).

Figure 18. OptaMax NG ion source with unlocked levers (back view)



4. Carefully press the source onto the MS.
5. Lock the locking levers.
6. Reconnect the sample line to the grounding union (H-ESI mode) or the spray insert's sample inlet (APCI and APPI modes).

2 API Source

Removing and Installing the API Source

Changing the Ionization Mode

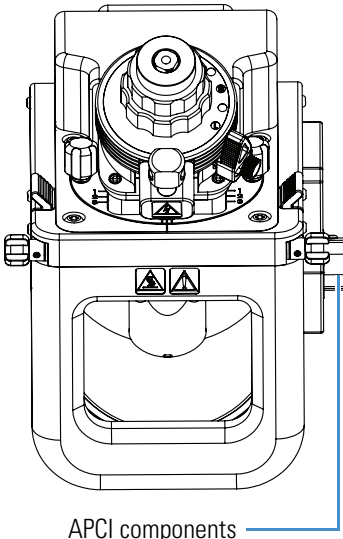
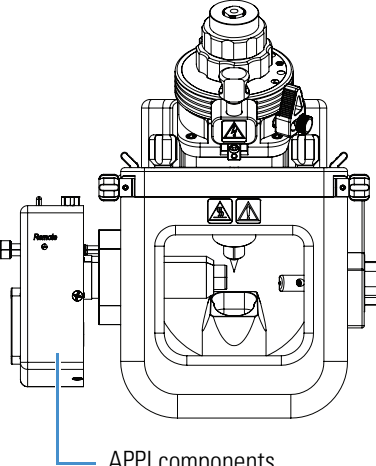
This chapter describes how to identify the current ionization configuration (mode) for the API source and how to reconfigure it between H-ESI, APCI, and APPI combination modes.

- [Identifying the Ionization Configuration](#)
- [Changing the Ionization Configuration](#)
- [Setting the Initial Ion Source Parameters](#)
- [Adjusting the Direction of the Spray Insert](#)

Identifying the Ionization Configuration

To identify the current ionization configuration, compare your API source housing to the images shown in [Table 2](#). These images show the API source housing configured for H-ESI and APCI modes; and H-ESI, APCI, and APPI combination modes.

Table 2. Images showing the possible API source housing configurations

API source housing image	Possible ionization modes
 <p>APCI components</p>	<p>H-ESI or APCI modes</p> <p>Shows the APCI corona needle assembly on the right side of the API source housing with the APCI spray insert.</p> <p>You can replace the APCI spray insert with the H-ESI spray insert.</p>
 <p>APPI components</p>	<p>APPI/H-ESI combination mode</p> <p>—or—</p> <p>APPI/APCI combination mode</p> <p>Shows the API source housing configured for APPI (left side).</p> <p>Depending on the intended combination mode, install either spray insert (H-ESI or APCI) into the housing.</p>

Changing the Ionization Configuration

The procedures in [Table 3](#) show you how to configure the API source housing between H-ESI, APCI, and APPI combination modes. Before you continue, make sure you know the current ionization configuration (mode) for the API source housing (see [Table 2](#)).



CAUTION Handle the APCI corona discharge needle with care. The corona discharge needle is very sharp and can puncture your skin.



CAUTION Hot surface. Avoid touching the API source housing or the API spray insert when the MS is in operation. These components can become hot enough to burn your skin. Allow the components to cool (minimum 20 minutes) before you touch them.

Table 3. Summary procedures for configuring the API source housing (Sheet 1 of 3)

Current mode	New mode	Procedure
H-ESI	APCI	<ol style="list-style-type: none"> 1. Remove the H-ESI spray insert (see page 17), and place it in a safe place. 2. Install the APCI spray insert (see page 18) and the LC plumbing. 3. Follow the procedure “Setting the Initial Ion Source Parameters.”
	APPI	<ol style="list-style-type: none"> 1. Remove the H-ESI spray insert (see page 17), and place it in a safe place. 2. If the API source is not already configured for APPI, do the following: <ol style="list-style-type: none"> a. Remove the API source from the MS (see page 19). b. Configure the API source for APPI mode (see page 29). c. Install the API source onto the MS (see page 20). 3. Install the H-ESI spray insert (see page 18) and the LC plumbing. For guidelines, see “API Spray Insert Selection.” 4. Turn on the left-side power switch for the APPI (VUV) lamp. 5. Follow the procedure “Setting the Initial Ion Source Parameters.”

Table 3. Summary procedures for configuring the API source housing (Sheet 2 of 3)

Current mode	New mode	Procedure
APCI	H-ESI	<ol style="list-style-type: none"> 1. Remove the APCI spray insert (see page 17), and place it in a safe place. 2. Do one of the following: <ul style="list-style-type: none"> • Place the corona discharge needle in the (0) position away from the spray insert (see page 28). • Remove the corona discharge needle (see page 28), and then install the API source onto the MS (see page 20). 3. If it is not already installed, install the grounding union and its holder onto the API source (Figure 25). 4. Install the H-ESI spray insert (see page 18) and the LC plumbing. 5. Follow the procedure “Setting the Initial Ion Source Parameters.”
	APPI	<ol style="list-style-type: none"> 1. Remove the APCI spray insert (see page 17), and place it in a safe place. 2. If the API source is not already configured for APPI, do the following: <ol style="list-style-type: none"> a. Remove the API source from the MS (see page 19). b. Configure the API source for APPI mode (see page 29). 3. Do one of the following: <ul style="list-style-type: none"> • Place the corona discharge needle in the (0) position away from the spray insert (see page 28). • Remove the corona discharge needle (see page 28). 4. If you removed the API source, install it onto the MS (see page 20). 5. Install the APCI spray insert (see page 18) and the LC plumbing. For guidelines, see “API Spray Insert Selection.” 6. Turn on the left-side power switch for the APPI (VUV) lamp. 7. Follow the procedure “Setting the Initial Ion Source Parameters.”

Note The APCI needle can remain in the housing when the system operates in H-ESI or APPI mode.

Table 3. Summary procedures for configuring the API source housing (Sheet 3 of 3)

Current mode	New mode	Procedure
APPI	H-ESI	<ol style="list-style-type: none"> 1. If the APCI spray insert is installed, remove it (see page 17) and place it in a safe place. 2. If it is not already done, install the grounding union and its holder onto the ion source (Figure 25). 3. (Optional) Reinstall the APPI lamp cover. 4. Install the H-ESI spray insert (see page 18) and the LC plumbing. 5. Follow the procedure “Setting the Initial Ion Source Parameters.”
	APCI	<ol style="list-style-type: none"> 1. If the H-ESI spray insert is installed, remove it (see page 17) and place it in a safe place. 2. (Optional) Reinstall the APPI lamp cover. 3. Install the APCI spray insert (see page 18) and the LC plumbing. 4. Follow the procedure “Setting the Initial Ion Source Parameters.”

Note The APPI components can remain in the housing when the system operates in H-ESI or APCI mode.

If you configure the API source housing for all three ionization modes (see the second image in [Table 2](#)), set the APCI corona discharge needle and the PhotoMate APPI light source as listed in [Table 4](#).

Table 4. Light source and corona discharge needle settings for the ionization modes

Ionization mode	Corona discharge needle	PhotoMate light source
H-ESI		
APCI	On	
APPI		On
Combined H-ESI/APPI		On
Combined APCI/APPI	On	On

Changing the Position of the APCI Corona Discharge Needle

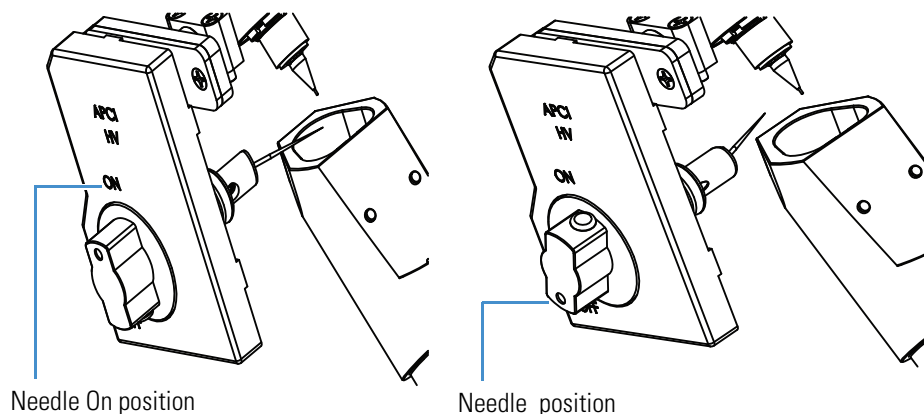
Use the following procedure when you want to use the corona discharge needle (On position) or move it out of the way of the API spray insert (Off position).

❖ **To change the position of the corona discharge needle**

Do the following to adjust the corona discharge needle position (Figure 19):

- To use the needle (APCI mode), turn the right-side knob to the On position.
- To not use the needle and move it away from the API spray insert (H-ESI and APPI modes), turn the right-side knob to the position.

Figure 19. Corona discharge needle adapter showing the On and knob positions



Removing the APCI Corona Discharge Needle

If you do not plan to use APCI mode for a while, you can remove the corona discharge needle.

❖ **To remove the corona discharge needle**

1. Remove the API source from the MS (see page 19).
2. Put on a new pair of lint- and powder-free gloves.
3. Using the pliers, grasp the base of the corona discharge needle and slowly pull it straight out of the socket (Figure 20).

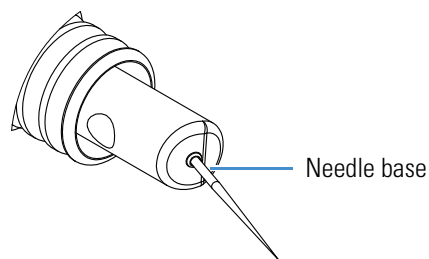


CAUTION To prevent damage to the corona needle tip, avoid touching it with the pliers.



CAUTION Sharp object. The corona discharge needle can puncture your skin. Handle it with care.

Figure 20. Corona discharge needle (close-up view)



4. Rinse the needle with solvents compatible with your compounds, and then store the needle in a safe place.

Configuring the API Source Housing for APPI Mode

Use the following procedures to install the left-side APPI components (see [APPI Parts](#)).

1. [To remove the left-side H-ESI components from the API source](#)
2. [To install the APPI installation kit](#)

Note If you already installed the left-side APPI components, you only need to install the APPI drain insert and one of the spray inserts. For guidelines, see [“API Spray Insert Selection.”](#)

❖ To remove the left-side H-ESI components from the API source

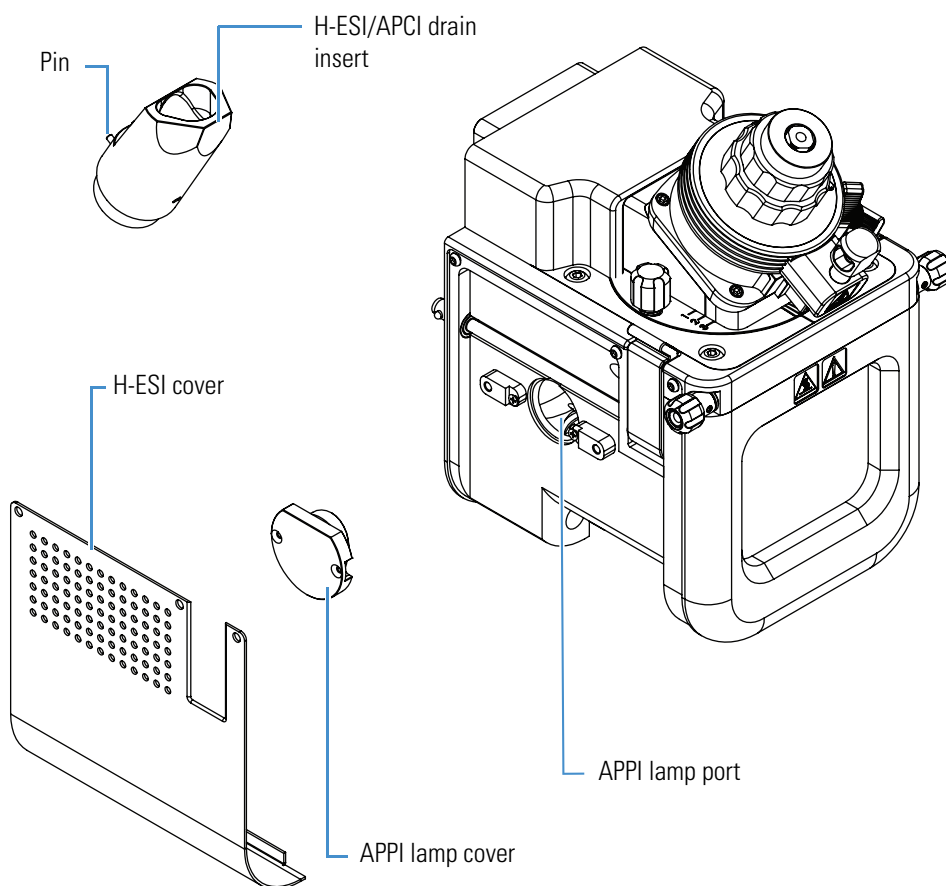
1. Put on a new pair of lint- and powder-free gloves.
2. After the API source cools to room temperature, remove it from the MS (see [page 19](#)).
3. Remove the H-ESI spray insert (see [page 17](#)). If you installed the APCI components, place the corona discharge needle in the (0) position.
4. Using the 2 mm hex key and the Phillips #2 screwdriver, remove from the source the left-side H-ESI cover and the APPI lamp cover ([Figure 21](#)).

You might need to use one of your gloved hands to push the APPI lamp cover out of the housing.



CAUTION Sharp object. An installed APCI corona discharge needle can puncture your skin. Be careful when you place your fingers inside the API source housing.

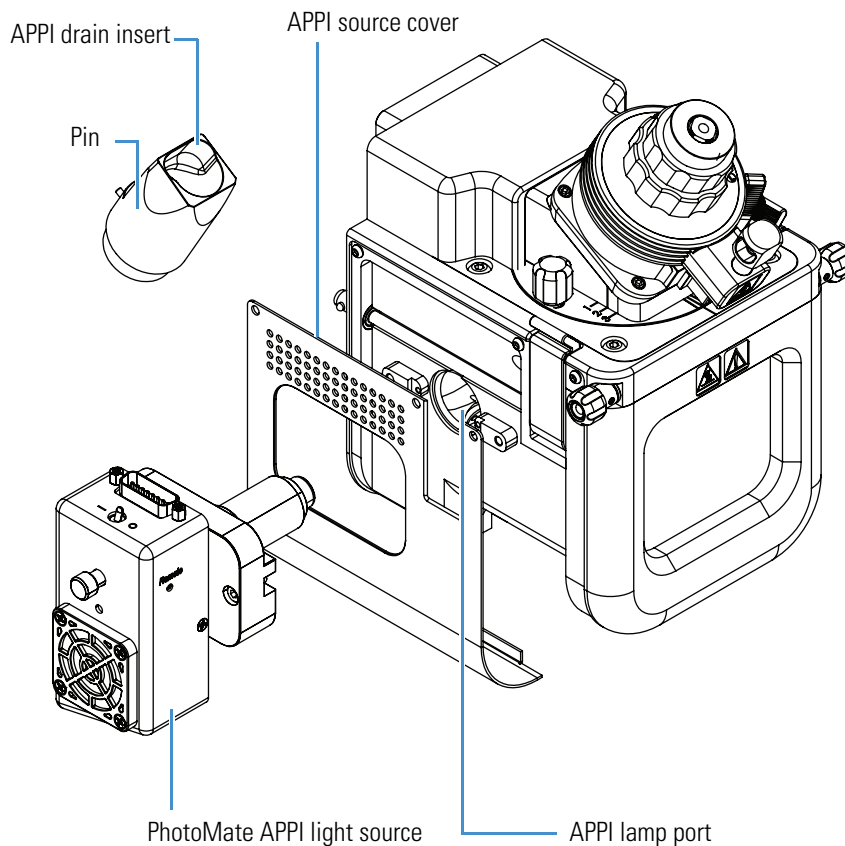
Figure 21. API source showing the left-side H-ESI components (exploded view)



❖ **To install the APPI installation kit**

1. Follow the procedure “[To remove the left-side H-ESI components from the API source.](#)”
2. Remove the H-ESI/APCI drain insert, rinse it with methanol, and store it in a safe place.
3. Align the APPI drain insert alignment pin with the slot for the alignment pin on the housing, and then carefully insert the drain insert into the housing.
4. Using the screwdriver, secure the APPI source cover onto the left side ([Figure 22](#)).

Figure 22. API source showing the left-side APPI components (exploded view)



5. Using the 2 mm hex key, secure the APPI light source into the left-side APPI lamp port.

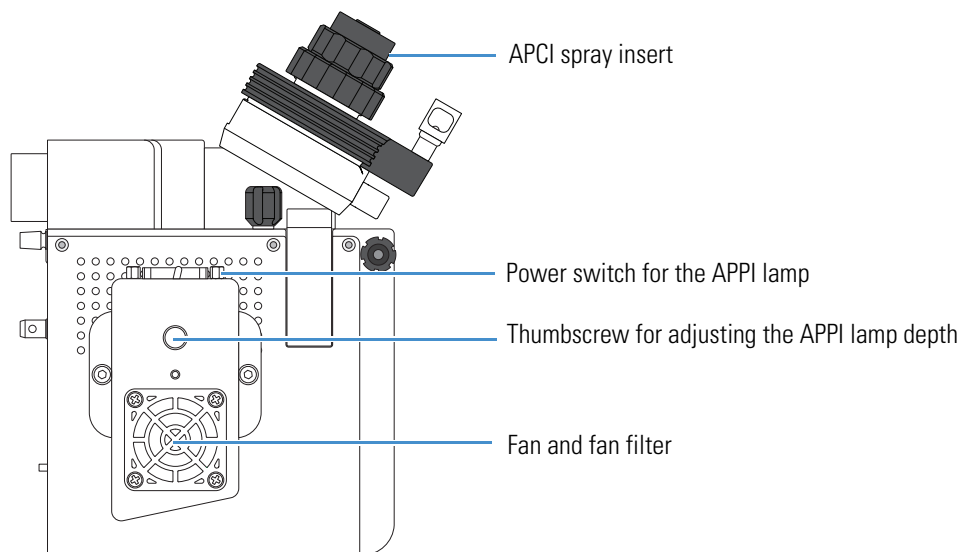


CAUTION To prevent damage to the APPI lamp, make sure that it does not touch the APCI corona discharge needle (if installed).

6. Install either the H-ESI or APCI spray insert (see [page 18](#)).

For guidelines, see “[API Spray Insert Selection.](#)” [Figure 23](#) shows the completed API source housing for APPI mode.

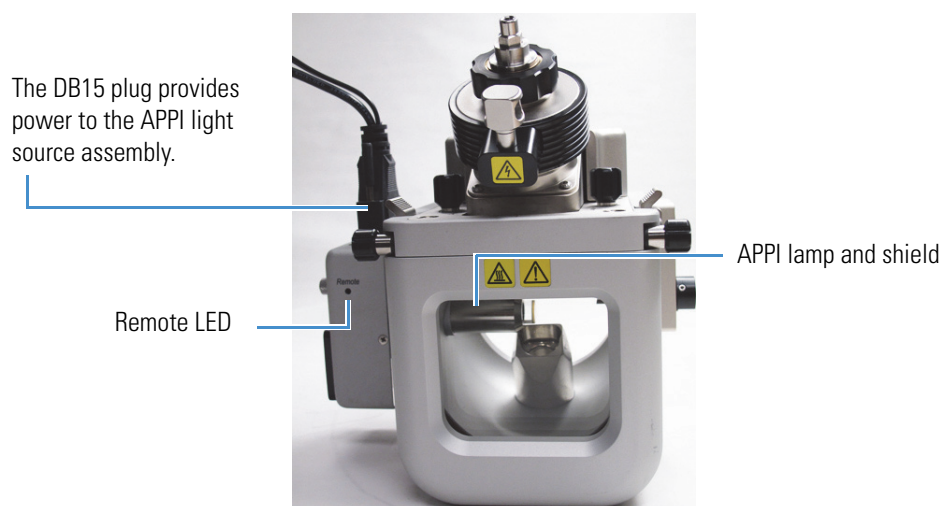
Figure 23. Left side of the assembled APPI source with the APCI spray insert



7. Connect the APPI power supply unit as follows:
 - a. If it is not already connected, connect the detachable power supply cord to the power supply unit, and then plug the power cord into a wall outlet.
 - b. Connect the DB15 plug to the top of the APPI light source. [Figure 24](#) shows the correct power connection on an older model ion source.

The DB15 plug is connected to a Y-cable. One side of the Y-cable connects to the power supply unit and the other side connects to a USB port on the MS.

Figure 24. Power connection to the APPI light source



- c. Connect the USB cable to an open USB port on the mass spectrometer, not to the data acquisition computer. If both ports are occupied, install the provided USB splitter into either USB port.

The USB ports are on the right side of the mass spectrometer. The Remote LED on the APPI light source indicates that the USB connection is on.

Note For troubleshooting purposes, you might want to record which devices connect to which USB ports on the mass spectrometer.



CAUTION After completing the power supply connections, route the cords so that they are not a trip hazard.

8. Using your fingers, turn the thumbscrew ([Figure 23](#)) on the APPI light source clockwise until it is fingertight (the default lamp depth position).

The thumbscrew controls the APPI lamp's depth position inside the API source housing.

9. Place the power switch for the APPI lamp in the On (I) position.

You can now install the API source onto the mass spectrometer and connect the LC plumbing.

Configuring the API Source Housing for H-ESI Mode

Use the following procedure to configure the API source for H-ESI mode.

Note If you did not install the APPI installation kit (see [Identifying the Ionization Configuration](#)), you do not need to make any changes to the API source housing. If you installed the APPI installation kit, you do not need to remove the housing components from the API source.

❖ To configure the API source for H-ESI mode

- If you did not install the APPI installation kit, do the following:
 - Make sure that the H-ESI spray insert is installed ([Figure 10](#)).
 - Place the APCI corona needle in the (0) position (see [page 27](#)).
- If you installed the APPI installation kit, do the following:
 - a. Place the power switch for the APPI light source in the (0) position.
 - b. Disconnect the APPI power supply unit's input and output cords.
 - c. Make sure that the H-ESI spray insert is installed ([Figure 10](#)).
 - d. After the API source cools to room temperature (allow 20 minutes), remove it from the mass spectrometer (see [page 19](#)).
 - e. Remove the APPI drain insert, and then install the H-ESI/APCI drain insert ([Figure 22](#)).
 - f. Install the APPI lamp cover.

3 Changing the Ionization Mode

Changing the Ionization Configuration

- g. Store the APPI power supply unit and APPI drain insert in a safe place.
- h. If it is not already installed, install the H-ESI grounding union (Figure 25).

You can now install the API source onto the mass spectrometer and connect the LC plumbing.

Installing the H-ESI Grounding Union onto the API Source



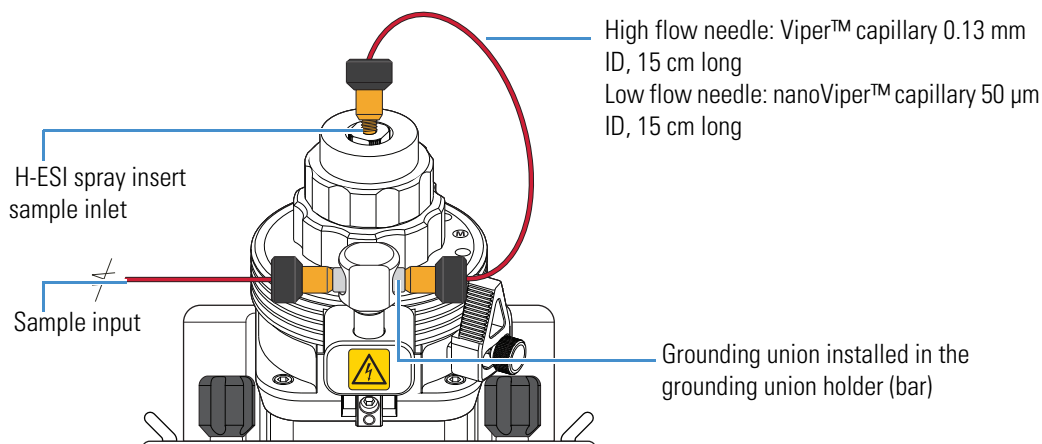
CAUTION Avoid operating the API source in H-ESI mode at elevated temperatures without solvent flow. Running the source dry at elevated temperatures can cause blockage of the replaceable metal needle.

Install the stainless steel grounding union (P/N 00101-1812) in the LC liquid flow path when you want to use the API source for H-ESI mode. You can optionally leave this plumbing installed when you use APCI mode; the plumbing path is not used for APCI mode. Refer to the mass spectrometer manual for how to install the grounding union, its holder, and the sample line (Figure 25).



CAUTION To prevent electric shock, verify that the grounding union is made of stainless steel. A grounding union made of a nonconductive material, such as PEEK, creates an electric shock hazard.

Figure 25. Installed H-ESI grounding union and sample line (example)



Setting the Initial Ion Source Parameters

After you install the configured source, use the Tune application to set the initial ion source parameters for the experiment's LC flow rate. For example, the ion source parameters for H-ESI mode include the spray voltage, the three API gas pressures, the ion transfer tube temperature, and the vaporizer temperature. For the auxiliary gas flow with vaporizer temperatures up to 100 °C, the allowable range is 0–25 units. For vaporizer temperatures above 100 °C, the minimum is 5 units (recommended).

The initial settings provide a starting point for optimizing system performance. The optimal settings for your experiment depend on the compound of interest, the solvent matrix, and the chromatographic conditions. For information on how to optimize the ion source settings, refer to the Hardware Manual.



CAUTION For best results in H-ESI mode, avoid operating the API source at elevated temperatures without solvent flow from the LC system or the syringe pump. Allowing the API spray insert to run dry at elevated temperatures can cause blockage of the replaceable metal needle, which you would then need to replace.

❖ To set the initial ion source parameters

1. Open the Tune application, and then open the Ion Source pane.
2. In the Current LC Flow (µL/min) box, enter a value for the experiment.
3. Click **Get Defaults**, and then click **Apply**.

The Tune application sets the default parameters for the H-ESI, APCI, or APPI source.

❖ To optimize the API source parameters

For instructions on how to optimize the spray voltage, the API gas pressures, and the discharge current (APCI only), refer to the Hardware Manual.

Adjusting the Direction of the Spray Insert

To maximize sensitivity or robustness, you can adjust the direction of the spray inlet by a few millimeters. Typically, you adjust the direction of the spray insert while optimizing the API source parameters for the analytes.

Note The angle of the API spray insert and heater assembly is not adjustable.

3 Changing the Ionization Mode

Adjusting the Direction of the Spray Insert

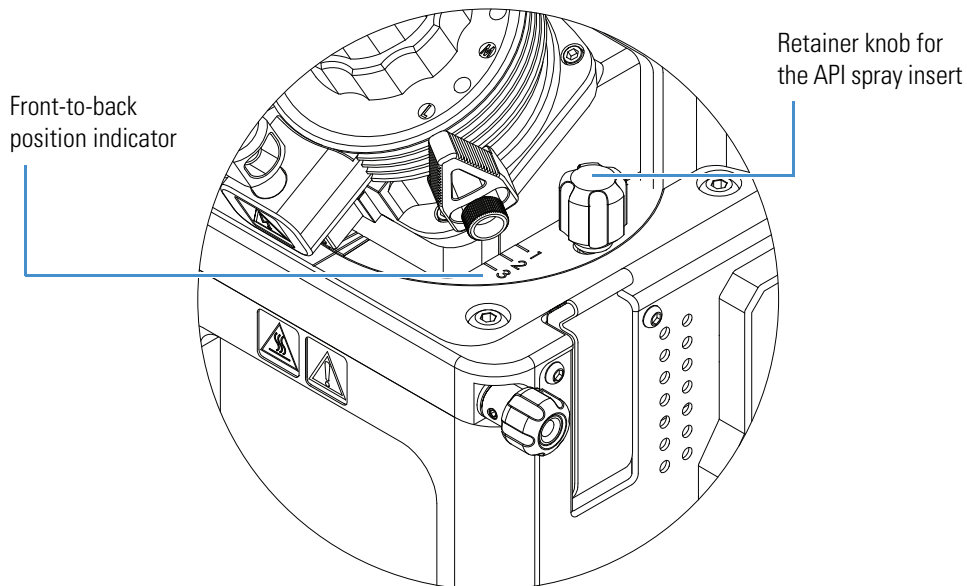
❖ To adjust the front-to-back position of the spray insert



CAUTION Hot surface. Avoid touching the API source housing when the mass spectrometer is in operation. The external surface of the housing can become hot enough to burn your skin. Allow the housing to cool for 20 minutes before you touch it.

1. Loosen the top two retainer knobs that secure the spray insert. [Figure 26](#) shows one of the knobs.
2. Slide the spray insert forward or backward to the appropriate position: 1, 2, or 3.

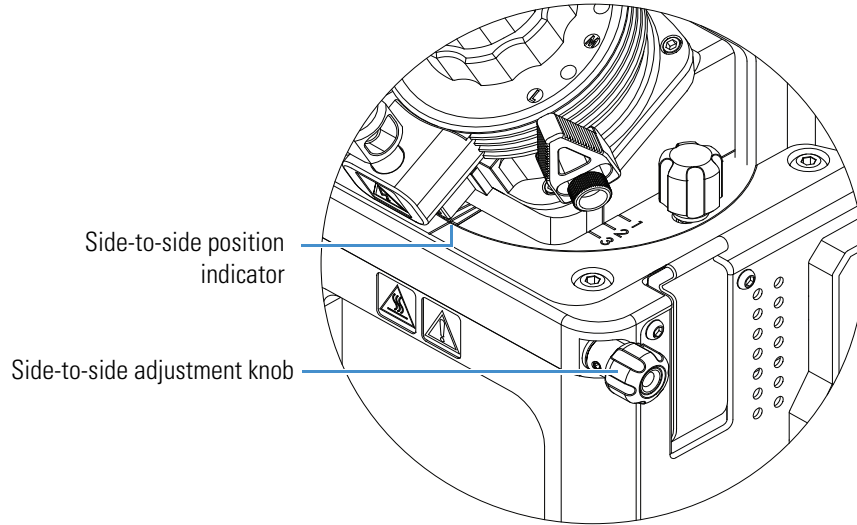
Figure 26. Front-to-back adjustment of the spray insert



❖ **To adjust the side-to-side position of the spray insert**

Turn the side-to-side adjustment knob to the appropriate position indicator [Figure 27](#).

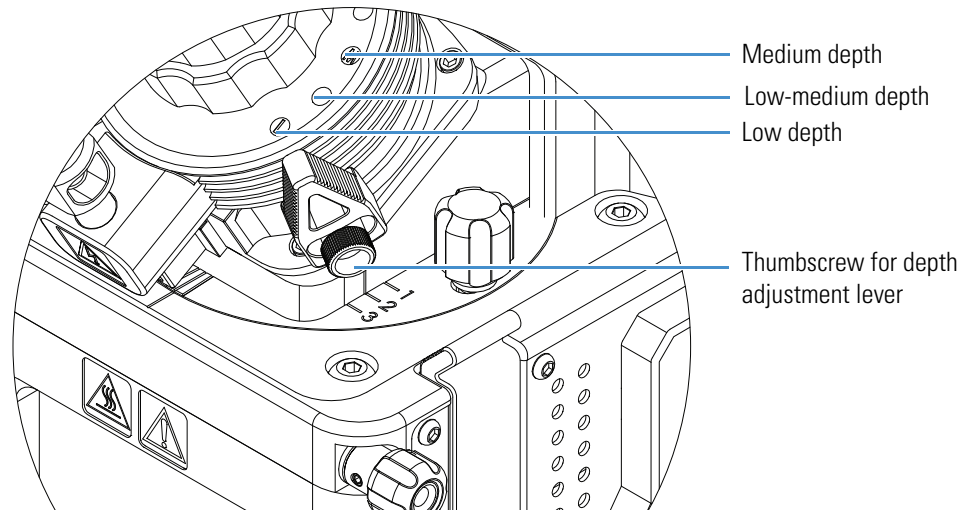
Figure 27. Side-to-side adjustment



❖ **To adjust the depth position of the spray insert**

1. Loosen the thumb screw on the depth adjustment lever ([Figure 28](#)).
2. Move the lever to the appropriate depth position: low, low-medium, or medium.
3. Tighten the thumbscrew.

Figure 28. Depth adjustment



4. Tighten the top two retainer knobs by hand ([Figure 6](#)).

3 Changing the Ionization Mode

Adjusting the Direction of the Spray Insert

Maintenance

This chapter provides routine maintenance procedures that you must perform to ensure optimum performance of the OptaMax NG ion source. For a list of replaceable parts, see Chapter 5, “Replaceable Parts.”

- [Maintenance Schedule](#)
- [Tools and Supplies](#)
- [Preparation](#)
- [Flushing the Inlet Components](#)
- [Maintaining the API Spray Insert](#)
- [Maintaining the PhotoMate APPI Light Source](#)
- [Maintaining the API Source Housing](#)

Maintenance Schedule

Table 5 list the recommended frequency for maintenance procedures.

Table 5. API source maintenance procedures and frequency

Recommended frequency	Procedure	Location
Daily (end of the work day)	Flush (clean) the sample transfer line, sample tube, and API spray insert.	page 41
	Clean the APPI lamp window.	page 48
As needed	Replace the H-ESI metal needle insert.	page 43
	Replace the APCI fused-silica sample tube.	page 44
	Replace the APPI lamp.	page 50
	Clean the APPI fan filter.	page 50
	Clean the API source housing.	page 51

Tools and Supplies

The API source requires few tools to perform routine maintenance procedures. [Table 6](#) lists the tools and supplies for maintaining the ion source.



CAUTION Avoid exposure to potentially harmful materials.

By law, producers and suppliers of chemical compounds are required to provide their customers with the most current health and safety information in the form of Material Safety Data Sheets (MSDSs) or Safety Data Sheets (SDSs). The MSDSs and SDSs must be freely available to lab personnel to examine at any time. These data sheets describe the chemicals and summarize information on the hazard and toxicity of specific chemical compounds. They also provide information on the proper handling of compounds, first aid for accidental exposure, and procedures to remedy spills or leaks.

Read the MSDS or SDS for each chemical you use. Store and handle all chemicals in accordance with standard safety procedures. Always wear protective gloves and safety glasses when you use solvents or corrosives. Also, contain waste streams, use proper ventilation, and dispose of all laboratory reagents according to the directions in the MSDS or SDS.

Table 6. Chemicals, equipment, and tools (Sheet 1 of 2)

Item	Part number
Chemicals	
Detergent (for example, Liquinox™)	(Liquinox) Fisher Scientific: <ul style="list-style-type: none"> • 16-000-125 (1 quart) • 16-000-128 (1 gallon)
Isopropyl alcohol	Fisher Scientific A459-1
Methanol, LC/MS-grade	Fisher Scientific A456-1
Nitrogen gas, clean and dry	–
Water, LC/MS-grade	Fisher Scientific W6-1
Equipment and tools	
Cotton-tipped swabs, lint-free	Fisher Scientific NC9954124
Kimwipes	S47299
Fused-silica cutting tool ^a	Fisher Scientific NC9003245
Gloves, lint-free and powder-free	–
Needle Adjustment Tool ^b	Thermo Fisher Scientific: 80000-20957
Magnification device	–

Table 6. Chemicals, equipment, and tools (Sheet 2 of 2)

Item	Part number
Screwdriver, Phillips #2	–
Wrench, 3/8 and 3/16 in.	–

^a Provided in the installation kit

^b Provided in the installation kit

Preparation

Before you perform the procedures in this chapter, do the following:

- Place the necessary tools, supplies, and replacement parts (when applicable) nearby.
- Place the components on a clean, lint-free work surface.
- Wear a new pair of lint- and powder-free gloves when handling internal components. Never reuse gloves after you remove them because the surface contaminants on them recontaminate clean parts.

Flushing the Inlet Components


At the end of each work day (or more often if you suspect contamination) flush the inlet components (sample transfer line, sample tube, and API spray insert) with a 50:50 methanol/water solution from the LC system through the API source to remove contamination.

Tip You do not need to flush the inlet components daily. However, if a mass spectrum shows unwanted contamination peaks, flush the inlet components.



CAUTION When the ion transfer tube is installed, do not flush it with cleaning solution, which flushes the residue into the MS.

❖ To flush the inlet components

1. Complete all data acquisition, if any.
2. Open the Tune application, and then place the mass spectrometer in the On mode.
The center of the selected icon changes from white to green, .
3. Open the Ion Source page in the Ion Source pane, and set the parameters listed in [Table 7](#) based on the API source housing's configured mode (see the images in [Table 2](#) on [page 24](#)).

4 Maintenance


Maintaining the API Spray Insert

- Set up and start a flow of 50:50 methanol/water solution at 200 $\mu\text{L}/\text{min}$ from the LC to the API source.

Note For the flushing solution, use a solvent bottle without buffers.

Table 7. Ion source parameters for flushing the inlet components

Parameter	H-ESI mode	APCI or APPI mode
Spray Voltage (V)	0	0
Sheath Gas (Arbitrary)	30	30
Auxiliary Gas (Arbitrary)	5	5
Capillary Heater ($^{\circ}\text{C}$)	350	350
Vaporizer Temperature ($^{\circ}\text{C}$)	400	450

- Click **Apply**.
- Flush the solution through the inlet components for 15 minutes. Then, turn the liquid flow from the LC.
- Place the mass spectrometer in Standby mode, . The API source turns.

Maintaining the API Spray Insert

The H-ESI and APCI spray inserts require minimum maintenance.

- [Replacing the H-ESI Metal Needle Insert](#)
- [Replacing the APCI Fused-Silica Sample Tube](#)



CAUTION Hot surface. Accidental contact with the part of the API spray insert located inside the housing can severely burn you, as this area of the insert can reach 350 $^{\circ}\text{C}$ (662 $^{\circ}\text{F}$). In addition, although the housing's exterior surface and the exposed part of the spray insert fall below the limit of 70 $^{\circ}\text{C}$ (158 $^{\circ}\text{F}$) for accessible metal surfaces, they too pose a burn hazard. Therefore, handle ALL heated components with extreme caution.

Replacing the H-ESI Metal Needle Insert

If the H-ESI metal needle (sample tube) in the H-ESI spray insert becomes plugged, you must replace it. Replacing the metal needle requires that you partially disassemble the spray insert.

IMPORTANT For best results, wear clean gloves when you handle API spray insert components.

❖ **To review the animation “H-ESI Needle Replacement” for your MS**

1. Go to thermofisher.com.
2. In the search field enter either TSQ Altis, TSQ Quantis, or TSQ Fortis.
3. In the **Catalog** tab click on the instrument name.
4. Scroll down until you see the Product overview, Videos, and Documents tab.
5. Click **Videos** and select “H-ESI Needle Replacement.”

Follow these procedures:

1. [To remove the needle insert from the H-ESI spray insert](#)
2. [To install the new needle insert into the H-ESI spray insert](#)

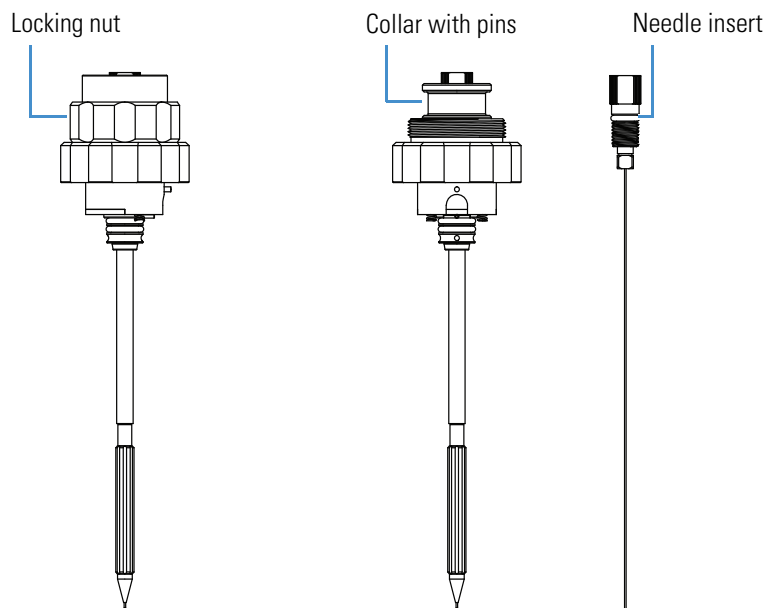
❖ **To remove the needle insert from the H-ESI spray insert**



CAUTION Before you begin, place the mass spectrometer in Standby mode (see [page 17](#)).

1. If your LC/MS system includes an LC pump, turn the liquid flow to the API source.
2. After the API source cools to room temperature, remove the spray insert (see [page 17](#)).
3. Remove the needle insert from the spray insert as follows:
 - a. With one hand, twist the locking nut ([Figure 29](#)).
 - b. Pull the collar with the pins straight out of the spray insert.

Figure 29. Needle insert removed from the H-ESI spray insert

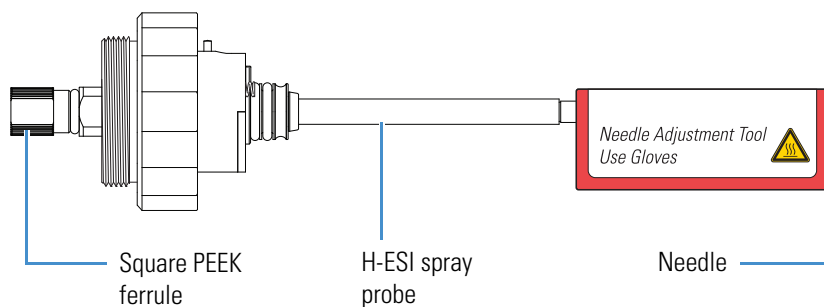


- c. Using the 3/8 in. wrench or your other hand, loosen the square nut of the needle insert.
- d. Slowly pull the needle insert out of the spray insert.

❖ **To install the new needle insert into the H-ESI spray insert**

1. Place the needle into the H-ESI spray probe.
2. Rotate the square PEEK ferrule about four turns to secure the needle insert in the spray insert.
3. Insert the spray insert into the needle adjustment tool (Figure 30) and make sure the spray insert is seated firmly.

Figure 30. Installing the needle insert into the H-ESI spray insert



4. Rotate the square ferrule clockwise until you can see the needle extend from the tool.

5. Slowly rotate the square ferrule counterclockwise until the spray needle is flush with the tool.
6. Continue to rotate the square ferrule counterclockwise until the square nut is aligned with the square housing. The needle protrudes within the 1.2 to 1.5 mm specification.
7. Place the collar with pins over the spray insert.
8. Screw the locking nut over the spray insert.
9. Place the spray insert into the source housing and connect it.

Replacing the APCI Fused-Silica Sample Tube

If the fused-silica sample tube (capillary) in the APCI spray insert becomes plugged, you must replace it. Replacing the sample tube requires that you partially disassemble the spray insert and then the fused-silica insert.

IMPORTANT For best results, wear clean gloves when you handle the API spray insert components.

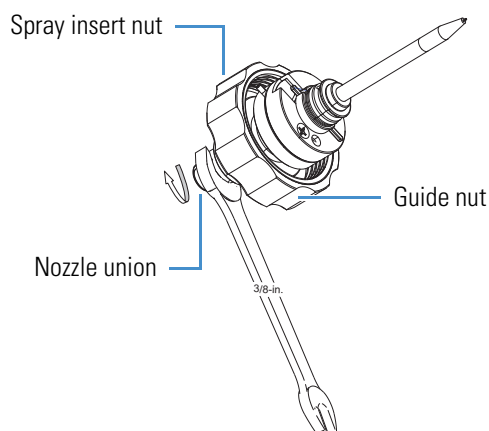
Follow these procedures:

1. To remove the fused-silica insert from the APCI spray insert
2. To remove the fused-silica tubing from the fused-silica insert assembly
3. To install the new fused-silica tubing into the insert assembly
4. To install the fused-silica insert into the APCI spray insert

❖ **To remove the fused-silica insert from the APCI spray insert**

1. Place the mass spectrometer in Off mode (see [page 17](#)).
2. If your LC/MS system includes an LC pump, turn the liquid flow to the API source.
3. After the API source cools to room temperature, remove the spray insert (see [page 17](#)).
4. Remove the fused-silica insert from the spray insert as follows:
 - a. With one hand, grasp the spray insert nut ([Figure 31](#)).

Figure 31. Removing the fused-silica insert from the APCI spray insert

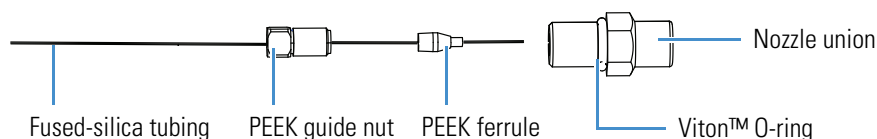


- b. Using the 3/8 in. wrench or your other hand, loosen the nozzle union.
- c. Slowly pull the fused-silica insert out of the spray insert.

❖ **To remove the fused-silica tubing from the fused-silica insert assembly**

1. Using the 3/8 in. and 3/16 in. wrenches, loosen and remove the nozzle union from the PEEK guide nut (Figure 32).

Figure 32. APCI fused-silica insert assembly (exploded view)



2. Remove the PEEK ferrule from inside the nozzle union.
3. Slide the ferrule and guide nut of the fused-silica tubing, and then discard the tubing.

❖ **To install the new fused-silica tubing into the insert assembly**

1. If necessary, replace the nozzle union's Viton O-ring (Figure 32).
2. Using the fused-silica cutting tool, cut an approximate 13 cm (5 in.) length of fused-silica tubing, and then under magnification check that the end is squarely cut.
3. Connect the fused-silica tubing to the nozzle union as follows:
 - a. Slide the guide nut and the ferrule onto the tubing (Figure 32).
 - b. While you press the tubing into the externally threaded end of the APCI nozzle union, tighten the guide nut until the tubing is secure.

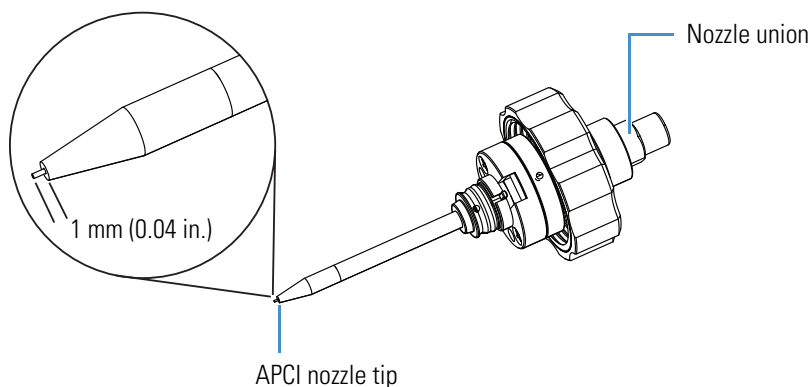
❖ **To install the fused-silica insert into the APCI spray insert**

1. Carefully insert the free end of the fused-silica tubing into the top of the spray insert and out of the nozzle tip. Then, fingertighten the APCI nozzle union.
2. Using the 3/8 in. wrench, tighten the nozzle union an additional quarter turn.
3. Using the fused-silica cutting tool, cut the tubing so that approximately 1 mm (0.04 in.) protrudes past the nozzle tip (Figure 33).
4. Reinstall the APCI spray insert into the API source.

4 Maintenance

Maintaining the PhotoMate APPI Light Source

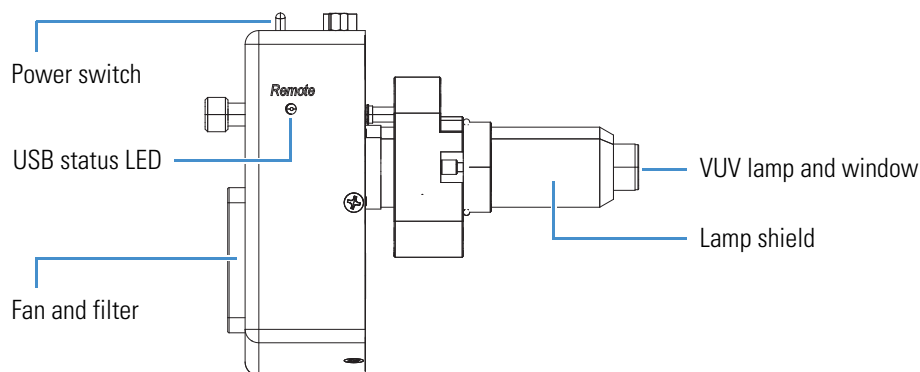
Figure 33. Exit end of the fused-silica tubing protrudes 1 mm (0.04 in.)



Maintaining the PhotoMate APPI Light Source

When you flush the mass spectrometer's inlet components at the end of the day, you also clean the APPI lamp window. Any time you notice a weak ion signal in APPI mode, you might want to clean or polish the APPI lamp window (Figure 34).

Figure 34. PhotoMate APPI light source



Maintenance for the APPI Lamp

This section describes how to clean and polish the APPI lamp window (the glass piece secured to the end of the lamp), and how to replace a damaged lamp.

- To prepare the API source
- To clean the APPI lamp window
- To remove the APPI lamp and polish the window
- To replace the APPI lamp



CAUTION Minimize the chance of breaking the APPI lamp by doing the following:

- Always wear clean gloves when you handle the lamp. Fingerprints on the lamp can cause it to fail when in use.
- Do not spray solvent on the lamp while it is hot, as the lamp can crack.
- Never turn the power to the PhotoMate light source while the vaporizer is hot. Without power, the fan stops running and the vaporizer heat can damage the light source's internal printed circuit board (PCB).
- Do not leave the LC or other liquid delivery device on while the mass spectrometer is in standby mode or off. The absence of sheath and auxiliary gas can cause the hot lamp to break upon contact with liquids.

❖ **To prepare the API source**

1. If your LC/MS system includes an LC pump, turn the liquid flow to the source.
2. Place the mass spectrometer in Off mode (see [page 17](#)).
3. Make sure that the APPI lamp and shield are at room temperature.



CAUTION Hot surface. The vaporizer heater can reach temperatures of 500 °C (923 °F). Allow the vaporizer and APPI lamp/shield to cool to room temperature (approximately 30 minutes) before you touch them.

4. Configure the API source as follows:
 - a. Place the APPI power switch ([Figure 34](#)) in the position, and then disconnect the DB15 plug ([Figure 24](#)) from the APPI light source.
 - b. If you installed the APCI components, place the corona discharge needle in the (0) position.
5. Remove the API source from the mass spectrometer (see [page 19](#)).

❖ **To clean the APPI lamp window**

1. Follow the procedure “[To prepare the API source.](#)”
2. Put on a clean pair of lint- and powder-free gloves.
3. Soak a lint-free swab in the LC solvent, and then carefully wash the lamp window.

If you were unable to remove all material from the lamp window, follow the procedure “[To remove the APPI lamp and polish the window.](#)”

4 Maintenance

Maintaining the PhotoMate APPI Light Source

❖ To remove the APPI lamp and polish the window

1. While wearing clean gloves, carefully pull the lamp out of the lamp shield.
2. Soak a lint-free swab in isopropyl alcohol, and then dip the swab in aluminum oxide polishing compound (5 micron powder).
3. Carefully polish the lamp window with the swab until you remove the remaining material.
4. Soak another lint-free swab in isopropyl alcohol and remove the polishing compound from the window.
5. While wearing a new pair of clean gloves, carefully push the lamp into the lamp shield.

❖ To replace the APPI lamp

1. Follow the procedure [“To prepare the API source.”](#)
2. While wearing clean gloves, carefully pull the lamp out.
3. Push the new lamp into the light source.

You can now install the API source onto the mass spectrometer, reconnect the DB15 plug to the APPI light source, and turn on the APPI power switch.

Maintenance for the APPI Fan Filter

This procedure describes how to clean the air filter for the APPI light source's fan.

❖ To clean the APPI fan filter

1. Follow steps 1–3 in the procedure [“To prepare the API source.”](#)
2. Place the APPI power switch in the position.
3. Using the screwdriver, remove the fan guard.
4. Remove the air filter.
5. Wash the filter in a solution of soap and tap water.
6. Rinse the filter with tap water, and then allow it to air dry.
7. Reinstall the filter and then the fan guard.

Maintaining the API Source Housing

Only Thermo Fisher Scientific field service engineers can service the API source housing, while user maintenance is limited to cleaning the housing as necessary. For any additional service, contact your local Thermo Fisher Scientific service engineer.

❖ To clean the API source housing

1. After the API source cools to room temperature, remove it from the mass spectrometer (see [page 19](#)).
2. Put on appropriate eyewear and gloves.
3. Under an appropriate fume hood, use a spray bottle to put UHPLC/MS-grade methanol on Kimwipes
4. Wipe the interior of the housing with the moistened Kimwipes.
5. Use MS grade Nitrogen gas to blow dry the API source housing.

4 Maintenance

Maintaining the API Source Housing

Replaceable Parts

This chapter provides the part numbers for the OptaMax NG ion source's replaceable parts.

- [API Source Housing](#)
- [APCI Parts](#)
- [APPI Parts](#)

API Source Housing

OptaMax NG Source Housing	OPTON-32100
H-ESI/APCI combination nozzle (spray insert) and source housing	80111-60470
H-ESI spray insert (high flow).	OPTON-32103
Viper capillary, high flow, 0.13 mm ID, 15 cm long	OPTON-30137
Viper Capillary Kit, 0.13 mm ID 15 cm long (5 each)	00109-99-00068
Needle insert, electrospray, low flow	OPTON-30139
nanoViper™ capillary, low flow, 50 µm ID, 15 cm long	OPTON-30695

APCI Parts

APCI kit w/APCI Sprayer, OptaMax.	OPTON-32101
APCI nozzle assembly, complete	80111-60060
APCI corona needle, stainless steel	80111-20683
APCI fused-silica capillary insert	80000-60164
APCI fused-silica insert assembly	
Fused-silica sample tube (capillary), 150 µm ID, 390 µm OD,	
8.8 cm long	00106-10498
O-ring, Viton, 0.219 in. ID, 1/16 in. thick	00107-04000

APPI Parts

APPI VUV lamp	00950-10002
APPI Interface Kit (see page 31)	OPTON-30350
APPI drain insert	80111-20396
Cover, APPI source (left side)	80111-10725
PhotoMate APPI light source and accessories	00950-01-00235

5 Replaceable Parts

APPI Parts

Glossary

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A

APCI corona discharge current The ion current carried by the charged particles in the APCI source. The voltage on the APCI corona discharge needle supplies the potential required to ionize the particles. The APCI corona discharge current is set; the [APCI corona discharge voltage](#) varies, as required, to maintain the set discharge current.

APCI corona discharge voltage The high voltage that is applied to the corona discharge needle in the APCI source to produce the APCI corona discharge. The corona discharge voltage varies, as required, to maintain the set APCI spray current.

APCI corona discharge needle A needle to which a sufficiently high voltage (typically ± 3 to ± 5 kV) is applied to produce a [chemical ionization \(CI\) plasma](#) by the [corona discharge](#) mechanism.

APCI sample tube A fused silica tube that delivers sample solution to the APCI [nozzle](#). The APCI sample tube extends from the sample inlet to the APCI nozzle.

APCI vaporizer A heated tube that vaporizes the sample solution as the solution exits the [APCI sample tube](#) and enters the atmospheric pressure region of the APCI-configured source.

API ion transfer tube A tube assembly that assists in desolvating ions that are produced by the ESI, APCI, or APPI nozzle.

API source The sample interface between the liquid chromatograph (LC) and the mass spectrometer (MS).

APPI nozzle The nozzle in the APPI spray insert that sprays the sample solution into a fine mist.

atmospheric pressure chemical ionization (APCI) A soft ionization technique done in an ion source operating at atmospheric pressure. Electrons from a [corona discharge](#) initiate the process by ionizing the mobile phase vapor molecules, forming a reagent gas.

atmospheric pressure ionization (API) Ionization performed at atmospheric pressure by using [electrospray ionization \(ESI\)](#), [heated-electrospray ionization \(H-ESI\)](#), [atmospheric pressure chemical ionization \(APCI\)](#), or [atmospheric pressure photoionization \(APPI\)](#).

atmospheric pressure photoionization (APPI) A soft ionization technique that shows an ion generated from a molecule when it interacts with a photon from a light source.

auxiliary gas The outer-coaxial gas (nitrogen) that assists the sheath (inner-coaxial) gas in dispersing and/or evaporating sample solution as the sample solution exits the ESI, APCI (optional), or APPI (optional) spray insert.

C

chemical ionization (CI) plasma The collection of ions, electrons, and neutral species formed in the ion source during chemical ionization (CI).

corona discharge In the APCI source, an electrical discharge in the region around the corona discharge needle that ionizes gas molecules to form a [chemical ionization \(CI\) plasma](#), which contains CI reagent ions.

E

electrospray ionization (ESI) A type of atmospheric pressure ionization that is currently the softest ionization technique available to transform ions in solution into ions in the gas phase.

H

heated-electrospray ionization (H-ESI) A type of atmospheric pressure ionization that converts ions in solution into ions in the gas phase by using electrospray (ESI) in combination with heated auxiliary gas.

I

ion source *See* [API source](#).

ion sweep cone A removable cone shaped metal cover that fits on top of the API ion transfer tube and acts as a physical barrier to protect the entrance of the tube.

N

nozzle The nozzle in the spray insert that sprays the sample solution into a fine mist.

S

sheath gas The inner coaxial gas (nitrogen), which is used in the [API ion transfer tube](#) to help nebulize the sample solution into a fine mist as the sample solution exits the H-ESI or APCI nozzle.



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