Mariner™ API-TOF Workstation

APCI Module

Supplement

Applied Biosystems

For Research Use Only. Not for use in diagnostic procedures.

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Instrument Safety

In this section This section includes:

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- Safety symbols
- Before operating this instrument
- Material Safety Data Sheets (MSDSs)
- General Warnings
- General Cautions

Notes, Hints, Cautions, and Warnings Notes, Hints, Cautions, and Warnings are used in this document as follows.

A Note provides important information to the operator and appears as:

NOTE: *If you are prompted to insert the boot diskette into the drive, insert it, and then press any key.*

A Hint provides helpful suggestions not essential to the use of the system and appears as:

Hint*: To avoid complicated file naming, use Save First to Pass or Save Best Only modes.*

A Caution provides information to avoid damage to the system or loss of data and appears as:

CAUTION

Do not touch the lamp. This may damage the lamp.

A Warning provides specific information essential to the safety of the operator and appears as:

WARNING

CHEMICAL HAZARD. *Familiarize yourself with the MSDSs before using reagents or solvents.*

Remarques, recommandations et avertissements

Une remarque fournit une information importante à l'opérateur er se présente ainsi:

REMARQUE: *Si on vous demande d'insérer la disquette de démarrage dans le lecteur, insérez-la puis appuyez sur n'importe quelle touche.*

Une recommandation fournit une information destinée à éviter des détériorations du système ou la perte de données:

RECOMMANDATION

La lampe peut être endommagée. N'y touchez pas.

Un avertissement fournit une information indispensable à la sécurité de l'operateur et se présente ainsi:

WARNING

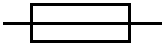
RISQUE CHIMIQUE. *Il convient de se familiariser avec la MSDS (feuille de données concernant la sécurité des matériaux) avant d'utiliser des réactifs ou des solvants.*

Safety symbols

The following symbols may be displayed on the system. These symbols may also appear next to associated warnings in this document.

Electrical Symbols

The following chart is an illustrated glossary of electrical symbols that may be displayed on your instrument. Whenever such symbols appear on instruments, please observe appropriate safety procedures.

	This symbol indicates the **on** position of the main power switch.
	This symbol indicates the **off** position of the main power switch.
	This symbol indicates the **on/off** position of a push-push main power switch.
	This symbol indicates that a terminal may be connected to another instrument's signal ground reference. This is not a protected ground terminal.
	This symbol indicates that this is a protective grounding terminal that must be connected to earth ground before any other electrical connections are made to the instrument.
	A terminal marked with this symbol either receives or delivers alternating current or voltage.
	A terminal marked with this symbol can receive or supply an alternating and a direct current or voltage.
	This symbol appears next to the values of the fuses required by the system.

	**WARNING**: This symbol indicates the presence of high voltage and warns the user to proceed with caution.
	**WARNING**: This symbol alerts you to consult the manual for further information and to proceed with caution.

Non-electrical Symbols

The following is an illustrated glossary of non-electrical safety alert symbols that may be displayed on your instrument.

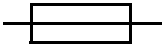
	**WARNING**: This symbol illustrates a heater hazard. Proceed with caution when working around these areas to avoid being burned by hot components.
	This symbol indicates that a laser is present inside the instrument.

Symboles des alertes de sécurité

Les symboles suivants peuvent être affichés sur le système. Dans ce document, ces symboles peuvent aussi apparaître à côté des avertissements auxquels ils s'associent.

Symboles électriques

Le tableau suivant donne la signification de tous les symboles électriques qui figurent sur les appareils. En présence de l'un de ces symboles, il est impératif de se conformer aux consignes de sécurité appropriées.

	Position *MARCHE* de l'interrupteur d'alimentation principal.
	Position *ARRÊT* de l'interrupteur d'alimentation principal.
	Positions MARCHE-ARRÊT de l'interrupteur d'alimentation principal à bouton poussoir.
	Borne pouvant être reliée à la mise à la terre d'un autre appareil. Ce n'est pas une borne de mise à la terre protégée.
	Borne de mise à la terre de protection devant être reliée à la terre avant d'effectuer tout autre raccordement électrique à l'appareil.
	Borne recevant ou fournissant une tension ou un courant de type alternatif.
	Borne pouvant recevoir ou fournir une tension ou un courant de types alternatif et continu.
	Ce symbole apparaît à côté des valeurs des fusibles requis par le système.

	**AVERTISSEMENT**: Indique la présence d'une haute tension et avertit l'utilisateur de procéder avec précaution.
	**AVERTISSEMENT**: Avertit l'utilisateur de la nécessité de consulter le manuel pour obtenir davantage d'informations et de procéder avec précaution.

Symboles non électriques

Le tableau suivant donne la signification des symboles d'alertes de sécurité non électriques qui figurent sur les appareils.

	**AVERTISSEMENT**: Danger associé à la présence d'un appareil de chauffage. Procéder avec précaution pour éviter de se brûler au contact de pièces ou d'éléments chauds.
	Indique que l'appareil renferme un laser.

Before operating the instrument

Ensure that anyone involved with the operation of the instrument is instructed in both general safety practices for laboratories and specific safety practices for the instrument. Make sure you have read and understood all related Material Safety Data Sheets.

Material Safety Data Sheets (MSDSs)

Some of the chemicals that may be used with your system are listed as hazardous by their manufacturer. When hazards exist, they are prominently displayed on the labels of all chemicals. In addition, MSDSs supplied by the chemical manufacturer provide information about:

- Physical characteristics
- Safety precautions
- Health hazards
- First-aid
- Spill clean-up
- Disposal procedures

WARNING

CHEMICAL HAZARD. *Familiarize yourself with the MSDSs before using reagents or solvents.*

WARNING

RISQUE CHIMIQUE. *Il convient de se familiariser avec la MSDS (feuille de données concernant la sécurité des matériaux) avant d'utiliser des réactifs ou des solvants.*

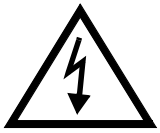
General Warnings

WARNING

FIRE HAZARD. *Using a fuse of the wrong type or rating can cause a fire. Replace fuses with those of the same type and rating.*

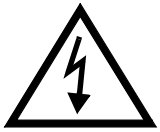
WARNING

DANGER D'INCENDIE. *L'usage d'un fusible de type ou de valeur nominale différents risque de provoquer un incendie. Il convient donc de remplacer les fusibles usagés par des fusibles du même type et de la même valeur nominale.*



WARNING

ELECTRICAL SHOCK HAZARD. *Severe electrical shock can result by operating the instrument without the front or side panels. Do not remove instrument front or side panels. High voltage contacts are exposed with front or side panels removed.*



AVERTISSEMENT

RISQUE DE DÉCHARGE ÉLECTRIQUE. *Des décharges électriques sérieuses peuvent résulter du fonctionnement de l'appareil lorsque le panneau avant et les panneaux latéraux sont retirés. Ne pas retirer le panneau avant ou les panneaux latéraux. Des contacts haute tension sont exposés lorsque les panneaux sont retirés.*

WARNING

CHEMICAL HAZARD. *To prevent eye injury, always wear eye protection when working with solvents.*

WARNING

RISQUE CHIMIQUE. *Pour éviter les blessures aux yeux, porter toujours des protections pour les yeux lorsque vous manipulez des solvants.*

WARNING

PHYSICAL INJURY HAZARD. *Use the system only as specified in this document. Using this system in a manner not specified may result in injury or damage to the system.*

WARNING

DANGER DE BLESSURES CORPORELLES.*Veuillez suivre avec attention les indications figurant dans ce document lorsque vous utilisez le système. Un usage différent de la station pourrait causer un accident ou endommager le système.*

WARNING

CHEMICAL HAZARD. *Before handling any chemicals, refer to the Material Safety Data Sheet provided by the manufacturer, and observe all relevant precautions.*

WARNING

RISQUE CHIMIQUE. *Avant de manipuler des produits chimiques, veuillez consulter la fiche de sécurité du matériel fournie par le fabricant, et observer les mesures de précaution qui s'imposent.*

Safety and EMC (Electromagnetic Compliance) Standards

US Safety and EMC Standards

Safety

This instrument has been tested to and complies with standard ANSI/UL 3101-1, “Electrical Equipment for Laboratory Use; Part 1: General Requirements”, 1st Edition. It is an ETL Testing Laboratories listed product.

EMC

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two 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.

WARNING

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

NOTE: *This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.*

NOTE: *Shielded cables must be used with this unit to ensure compliance with the Class A FCC limits.*

Canadian Safety and EMC Standards

Safety

This instrument has been tested to and complies with standard CSA 1010, “Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use; Part 1: General Requirements”. It is an ETL Testing Laboratories listed product.

Sécurité

Cet instrument a été vérifié avec la norme CSA 1010, «Spécifications de sécurité du matériel électrique utilisé pour les mesures, les contrôles et dans les laboratoires ; Partie 1 : Spécifications générales», et il est conforme à cette norme. C’est un produit homologué par les ETL Testing Laboratories.

EMC

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le materiel brouilleur du Canada.

European Safety and EMC Standards

CE

Safety

This instrument meets European requirements for safety (EMC Directive 73/23/EEC). This instrument has been tested to and complies with standard EN61010-1 “Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use”.

EMC

This instrument meets European requirements for emission and immunity (EMC Directive 98/336/EEC). This product has been evaluated to the EN55011:1992, Group 1, Class B “Radiated Emissions”, and EN50082-1:1992, “Generic Immunity”.

1 Overview of the APCI Module

Purpose The Mariner™ APCI Module (Figure 1-1) is an optional spray chamber and associated parts that allow high-flow and high-volume operation on the Mariner™ API-TOF Workstation (previously called the Mariner Biospectrometry™ Workstation).

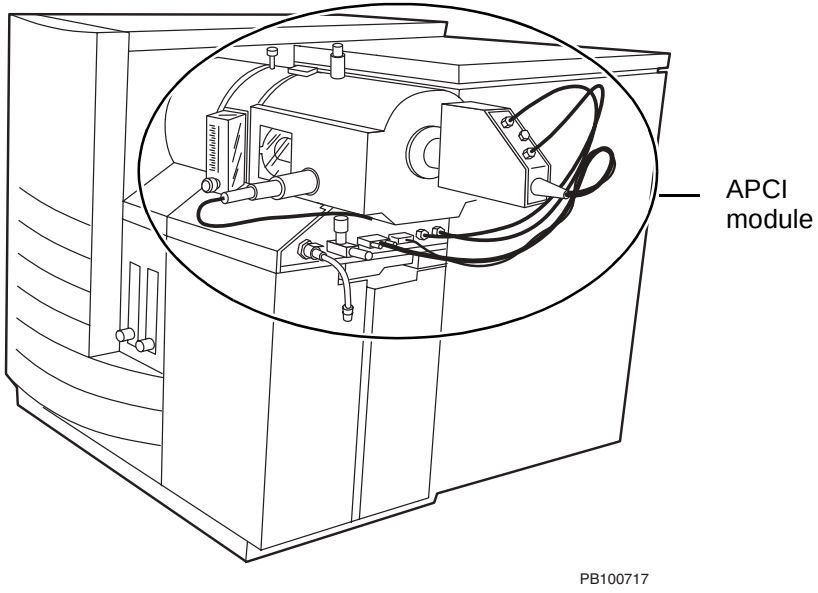


Figure 1-1 Mariner Workstation with APCI Module Installed

The APCI module is a modified version of the Applied Biosystems Heated Nebulizer Ion Source. It has been physically adapted to fit onto the Mariner API-TOF Workstation. For optimum performance with the Mariner Workstation, flow rate range is 200 µl to 1 ml/min. All other basic operation and performance is unchanged.

For APCI theory, refer to the *Mariner Workstation User's Guide* formerly called *Mariner Biospectrometry™ Workstation User's Guide*.

Parts of the APCI module

The APCI module includes:

- APCI spray chamber with heated nebulizer probe
- Exhaust trap line and bottle

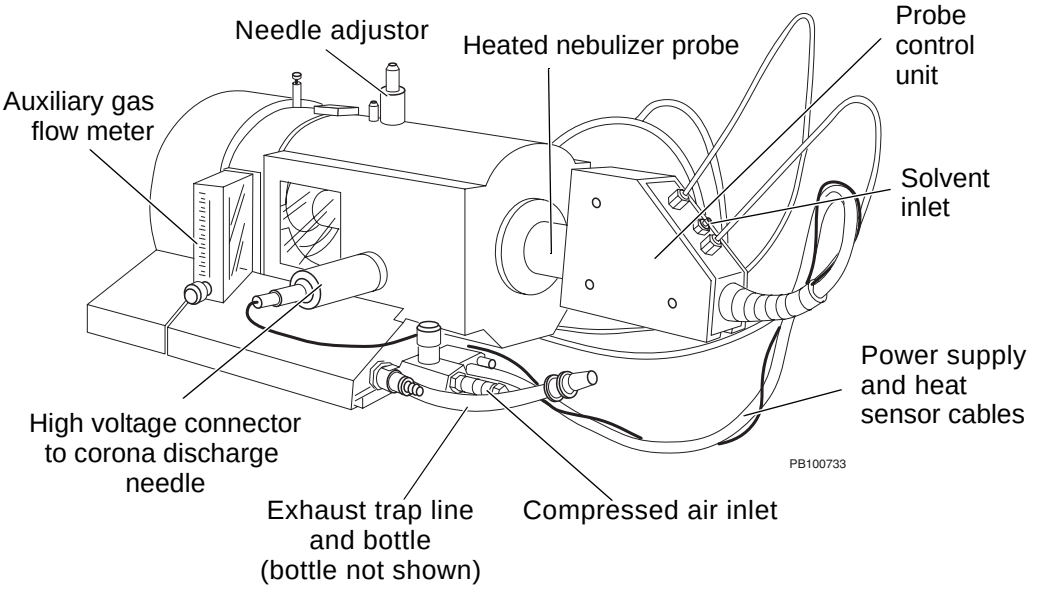


Figure 1-2 Parts of the APCI Module

Features

The APCI spray chamber provides the following features:

- Ionizes a wider range of small molecules than standard electrospray or nanospray modes.
- Useful for analysis of molecules <1,000 Da.
- Accommodates flow rates up to 1.0 ml/min without flow splitting.
- Vaporizes 100 percent aqueous solvents, and can accommodate volatile solvents.
- Vaporizes volatile and labile compounds with minimal decomposition.

2 Installing the APCI Module

In this section

This section includes:

- Overview of the APCI spray chamber
- Installing the APCI spray chamber
- Installing the exhaust trap line and bottle
- Connecting and configuring nebulizer, auxiliary, and curtain gases
- Connecting and adjusting the compressed air supply
- Connecting the solvent inlet
- Positioning the APCI probe and corona discharge needle
- Removing the APCI spray chamber

Materials and supplies needed

In addition to the materials and supplies needed to install and run the Mariner API-TOF Workstation, you need the following to install and run the APCI module:

- **Compressed air**—Powers the exhaust pump in the exhaust system. Compressed air source must be:
  - Oil and water-free
  - Have a pressure range of 80 to 100 psi
  - Be regulated to a minimum flow rate of 15 liters/min
- **External exhaust**—Exhaust bottle must be vented to a fume hood or other external exhaust source, to remove chemical vapors present in the exhaust.

2.1 Overview of the APCI Spray Chamber

Safety interlocks

The Mariner Workstation includes safety interlocks that prevent you from turning on high voltages if:

- Spray chamber is not installed
- Mass spectrometer top cover panel is not in place

If either of the above conditions are true, interlocks are considered “open”, and:

- Interlocks LED on the front panel is yellow and blinking. See the *Mariner Workstation User’s Guide*, Figure 1-10.
- Interlocks indicator on the System Status page in the Instrument Control Panel is yellow. See the appropriate sections for system status in *Mariner Workstation User’s Guide*.

To reset the safety interlocks, install the spray chamber and replace the top cover panel. If the fault does not clear, press the Reset button on the right side panel of the system near the back. See the *Mariner Workstation User’s Guide*, Figure 2-1.

Spray chamber precautions

Read the following warnings before handling the spray chamber.

WARNING

PHYSICAL INJURY HAZARD*. When the spray chamber is removed, the curtain gas plate is exposed and may be hot. Do not touch.*

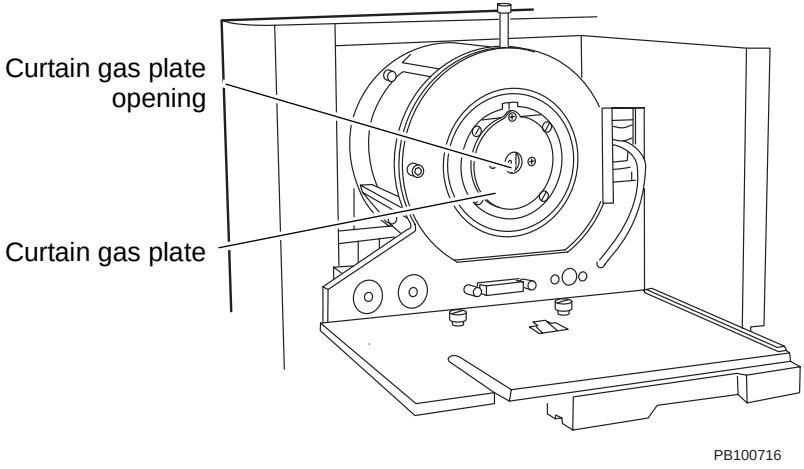


Figure 2-1 Curtain Gas Plate Location with Spray Chamber Removed—Right Side View of System

2.2 Installing the APCI Spray Chamber

Before you begin

Before installing the APCI chamber, make sure that either an integrated syringe pump or the front and side panels are installed on the workstation. Do not install the APCI chamber if there is no support below the spray chamber platform. If unsupported, the spray chamber may not properly seal at the nozzle area, and can cause liquid or gas leaks.

Installing the spray chamber

To install the APCI spray chamber:

1. Read “Spray chamber precautions” on page 5 before proceeding.
2. Make sure the spray chamber lever is pulled out (see Figure 2-14 on page 26).
3. Hold the APCI spray chamber with two hands, one under the base, one on the probe collar (Figure 2-2 and Figure 2-3).

***NOTE**: Do not hold the chamber by the probe. Doing so can change probe position.*

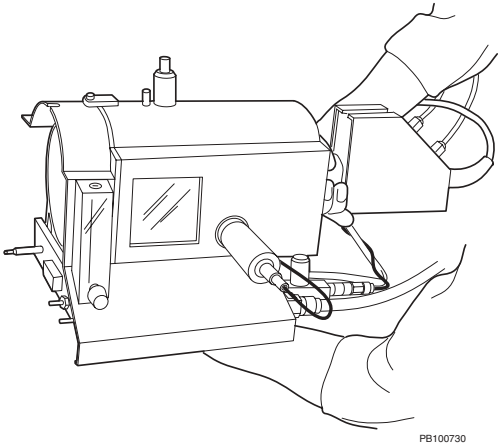


Figure 2-2 Installing the APCI Spray Chamber

4. Position the spray chamber at the top front right corner of the workstation.

5. Push the spray chamber to the back wall of the workstation and slide the spray chamber to the left into place.

   Watch to make sure that the electrical and gas connectors on the spray chamber and the workstation are aligned.

6. Press the spray chamber firmly into place and push in the lever so that it is flush with the side of the mass spectrometer. See Figure 2-14 on page 26 for the location of the lever. When the spray chamber is properly installed, the Interlock LED turns green.

7. Position the heated nebulizer probe control unit with gas connections facing up (Figure 2-3).

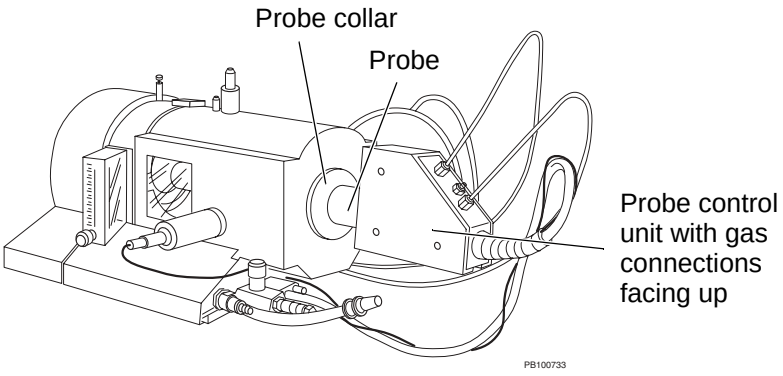


Figure 2-3 Installing the Heated Nebulizer Probe

CAUTION

If the gas connections are facing down with solvent flow on and probe heaters off, fluid can back up into the gas lines and flood the gas seals.

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8. Turn on the spray chamber light using the switch on the rear of the spray chamber.

9. Perform the procedures below as described in the following sections to complete the installation:

   - Section 2.3, Installing the Exhaust Trap Line and Bottle
   - Section 2.4, Connecting, Configuring, and Adjusting Nebulizer, Auxiliary, and Curtain Gases
   - Section 2.5, Connecting and Adjusting the Compressed Air Supply
   - Section 2.6, Connecting the Solvent Inlet Tubing
   - Section 2.7, Positioning the APCI Probe and Corona Discharge Needle

2.3 Installing the Exhaust Trap Line and Bottle

WARNING

EXPLOSION HAZARD*: Make certain there is no restriction in the tubing between the APCI spray chamber exhaust outlet and the exhaust trap bottle. If there is any restriction in the tubing, liquid can back up into the spray chamber and pose an explosion hazard.*

To install the exhaust trap line and bottle:

1. Connect the two lengths of 1/2-inch OD plastic tubing to the connectors on the exhaust trap bottle cap and screw the cap onto the bottle.
2. To one length of 1/2-inch OD tubing, connect the adapter, then connect the exhaust trap inlet tubing (1/4-inch OD plastic tubing with metal connector) to the adapter.
3. Check the length of the combined tubing. It should be just long enough to reach between the spray chamber and the exhaust trap bottle cap, without any extra tubing that might kink and cause a restriction in the line. If it is longer than necessary, shorten the 1/2-inch OD tubing.
4. Remove the end cap from the compressed air fitting on the APCI module (Figure 2-4). Save the end cap. You can replace it on the fitting when the spray chamber is not in use.
5. Connect the exhaust trap inlet tubing (short tubing with metal connector) to the spray chamber by slipping the connector onto the fitting until it locks in place (Figure 2-4).

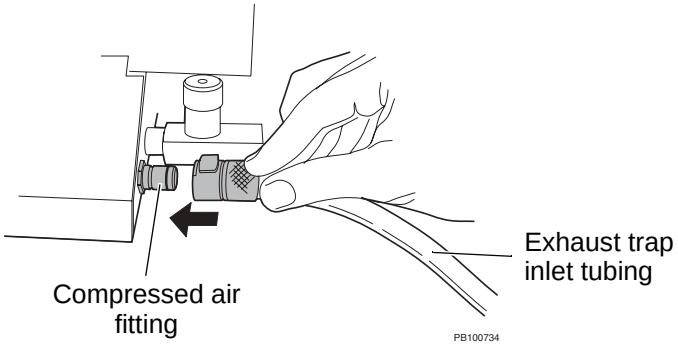

Figure 2-4 Connecting the Exhaust Trap Line to the Spray Chamber

6. Connect the exhaust trap outlet tubing (the other length of tubing connected to the exhaust trap bottle cap) to a fume hood or other ventilation source.

2.4 Connecting, Configuring, and Adjusting Nebulizer, Auxiliary, and Curtain Gases

This section includes:

- Connecting the gases
- Configuring the gases
- Adjusting the gases

Gas functions

Gases perform the following functions:

- **Nebulizer gas**—Breaks solvent into droplets.
- **Auxiliary gas**—Carries vapors and droplets out of the probe to the nozzle.
- **Curtain gas**—Prevents large solvent droplets and uncharged particles from entering into the nozzle. Also aids desolvation.

Gas requirements

Use one of the following for nebulizer, curtain, and auxiliary gases:

- Compressed dry nitrogen, grade 4.8 or better
- Liquid nitrogen in a dewar (requires drying if you see water clusters or water adducts on proteins)

Using one gas supply

If you want to use one gas supply for all gases, you can connect one line from the regulated nitrogen supply and install a quick-connect tee (provided in the Mariner Workstation startup kit) just before the Gas 1 and Gas 2 connections on the right side panel of the workstation.

2.4.1 Connecting the Gases

Compressed gas connections

To connect the compressed gas supply lines:

1. Using Teflon® tubing (1/16-inch ID, 1/8-inch OD), connect the gas sources to the right side of the mass spectrometer (see the *Mariner Workstation User's Guide*):

Gas	Connector
Nebulizer	Gas 1
Auxiliary	Gas 2
Curtain	Gas 2

   Push the tubing on to the push-on fittings on the mass spectrometer.

2. Regulate the gases at the source between **80** and **100** psi.

CAUTION

Do not regulate gas above 100 psi. Doing so can damage the gas seals in the Mariner Workstation. Regulating the gas below 80 psi may not generate high enough gas pressure at the flow meters and may not engage the gas seals.

Internal gas connections on the spray chamber

Internal gas tubing between the spray chamber base and the probes may be disconnected when the spray chamber is provided to you.

If this tubing is disconnected, connect the internal gas tubing to the probes (Figure 2-5):

- **Nebulizer**—Connect from the left fitting on the base to the Nebulizer gas fitting on the probe control unit
- **Auxiliary**—Connect from the right fitting on the base to the Auxiliary gas fitting on the probe control unit

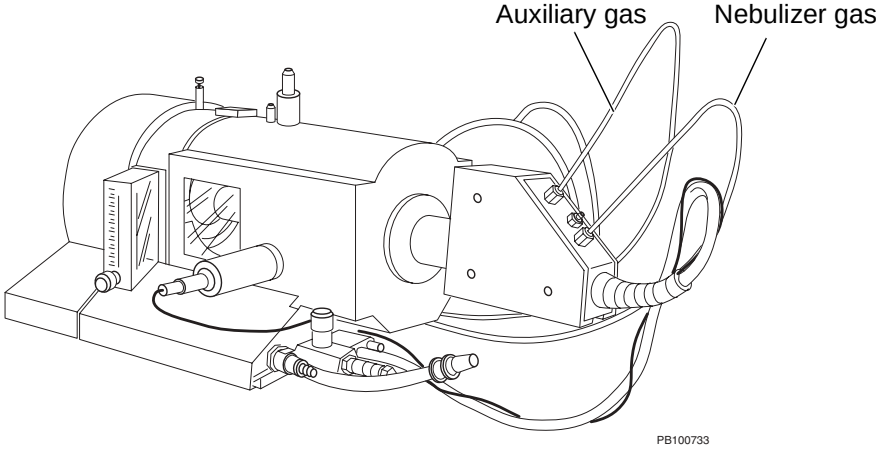

Figure 2-5 Connecting the Gas Tubing

2.4.2 Configuring the Gases

To configure the gases:

1. In the Instrument Control Panel, select **System Settings** from the Instrument menu, then click the **Gas Flow** tab to display the Gas Flow page (Figure 2-6).

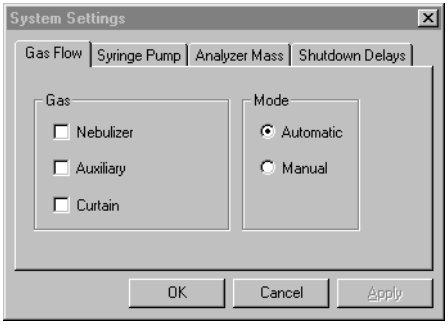

Figure 2-6 Gas Flow Page

2. Select **Nebulizer**, **Curtain**, and **Auxiliary**.
3. Select the gas mode:
   - **Automatic**—Gas flow starts automatically when you set the instrument state to On.

     ***NOTE**: You can override automatic control mode by clicking*  *in the toolbar during operation.*

   - **Manual**—Gas flow does not start automatically when you set the instrument state to On. Click  in the toolbar to start gas flow during operation.

2.4.3 Adjusting the Gases

To adjust the gases:

1. Regulate the gases at the supply between **80** and **100** psi.

CAUTION

Do not regulate gas above 100 psi. Doing so can damage the gas seals in the Mariner Workstation. Regulating the gas below 80 psi may not generate high enough gas pressure at the flow meters and may not engage the gas seals.

2. Turn gas on using toolbar buttons in the Instrument Control Panel:
   - If the gas flow is in automatic mode, click  in the toolbar to turn on.
   - If the gas flow is in manual mode, click  in the toolbar to turn on.
3. Turn gas off using toolbar buttons in the Instrument Control Panel:
   - If the gas flow is in automatic mode, click  in the toolbar to turn off.
   - If the gas flow is in manual mode, click  in the toolbar to turn off.

CAUTION

Do not turn gas off using the flow meters on the front panel of the mass spectrometer. Doing so will damage the valve in the flow meters. Turn off gas using toolbar buttons or at the gas supply.

2.5 Connecting and Adjusting the Compressed Air Supply

Requirements

Compressed air drives the exhaust pump in the exhaust system. The compressed air source must:

- Be oil and water-free
- Have a pressure range of 80 to 100 psi
- Be regulated to a minimum flow rate of 15 liters/min

Connecting

To connect:

1. Connect the air inlet source tubing.
2. Connect the air inlet tubing to the spray chamber by pulling back on the quick-disconnect fitting, inserting the fitting into the compressed air port on the bottom right corner of the spray chamber, and releasing the connector (Figure 2-7).

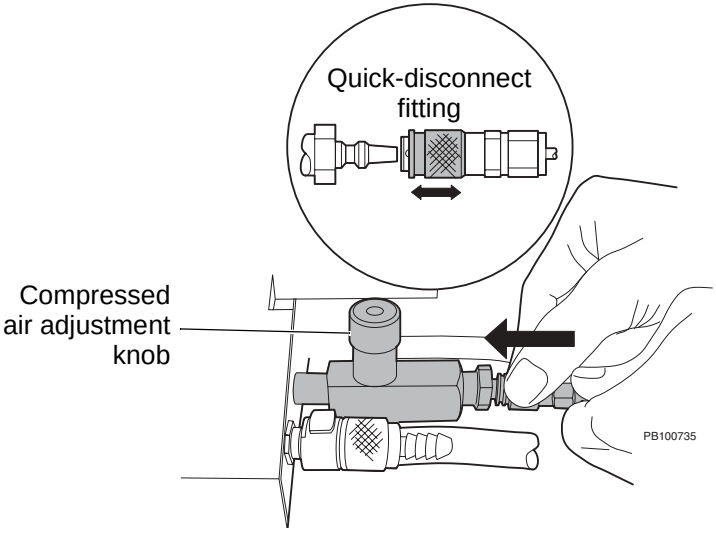

Figure 2-7 Connecting the Compressed Air to the Spray Chamber

Adjusting

After you start solvent flow, turn the compressed air adjustment knob (Figure 2-7) one to one and a half turns until you hear the flow. This generates 15 liters/min of flow.

Adjust the flow to optimize signal intensity. If the compressed air flow is:

- **Too high**—Gas removes the reagent gas needed to produce ions and signal intensity decreases.
- **Too low**—Exhaust pump does not work effectively and moisture condenses in the spray chamber.

***NOTE**: If you do not hear flow when you turn the compressed air knob, the fitting may not be connected properly. Push the fitting on to the connector and pull away from the connector to seat.*

2.6 Connecting the Solvent Inlet Tubing

Fitting requirements

Use plastic or stainless steel fittings to connect the solvent inlet tubing to the APCI spray chamber.

Connecting

To connect tubing:

1. Slip a compression fitting over the end of the tubing (Figure 2-8).
2. Slip a ferrule over the end of the tubing, with the tapered end of the ferrule pointing away from the compression fitting (Figure 2-8).

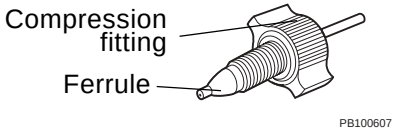

Figure 2-8 Connecting Plastic Fittings to Tubing

3. Bottom the tubing in the LC connector/solvent inlet on the face of the probe control unit (Figure 2-9). Finger-tighten the compression fitting.

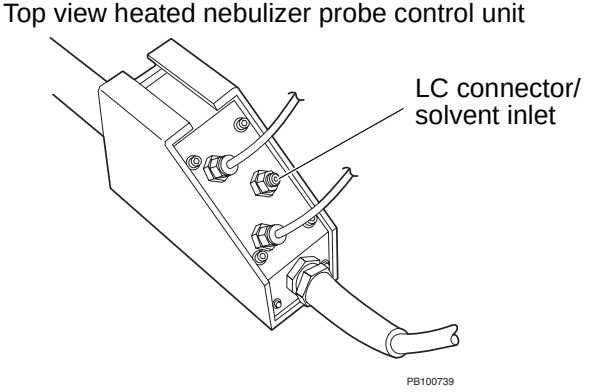

Figure 2-9 Connecting the Solvent Inlet Tubing

2.7 Positioning the APCI Probe and Corona Discharge Needle

This section includes:

- Overview
- Adjusting probe distance from nozzle
- Adjusting lateral probe position
- Adjusting the corona discharge needle position

Overview

Before operation, position the probe so that it is:

- 5 to 7 cm away from the nozzle opening for 0.5 to 1 ml/min applications
- < 5 cm away from the nozzle opening for applications running below 0.5 ml/min

During operation, you can optimize signal by adjusting:

- Lateral probe position so that it is slightly off-center to the left of the nozzle opening as described on page 21, then fine-tuning the position.
- Corona discharge needle so that it is slightly off-center from the probe and directly in line between the probe and the nozzle opening, as described on page 22, then fine-tuning the position.

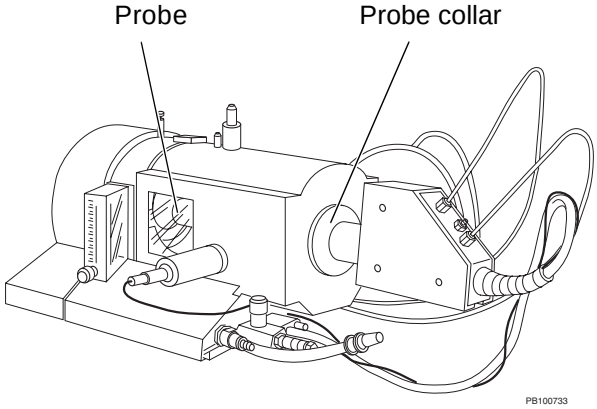

Figure 2-10 Positioning the APCI Probe

Adjusting probe distance from nozzle

To adjust the probe distance from the nozzle opening:

1. In the Instrument Control Panel, set Spray Chamber Temperature 2 to **0°C**.
2. In the Instrument Control Panel, select **Instrument-Standby** from the Instrument menu.

***NOTE**: Do not leave the instrument state set to Standby for any longer than necessary. Setting the state to Standby turns off internal voltages. Internal voltages can require time to stabilize once they are turned on again.*

High voltages are turned off.

If the integrated syringe pump and gases are in automatic mode, they are turned off.

If the integrated syringe pump and gases are in manual mode, click 

and 

in the toolbar to turn them off.

3. Loosen the probe collar on the right side of the spray chamber (Figure 2-10).
4. Push or pull the probe while twisting to move the probe until it is:
   - 5 to 7 cm away from the nozzle opening for 0.5 to 1 ml/min applications
   - < 5 cm away from the nozzle opening for applications running below 0.5 ml/min

---

CAUTION

Positioning the probe too close to the corona discharge needle can generate an Interlock fault which is caused by arcing between the probe and the needle.

---

5. Position the heated nebulizer probe control unit with gas connections facing up (see Figure 2-3 on page 8).
6. Hand-tighten the probe collar.

Adjusting lateral probe position

To adjust the probe position over the nozzle opening:

1. Locate the adjustment wheel behind the black collar (Figure 2-11). Note the position markings on the spray chamber housing.

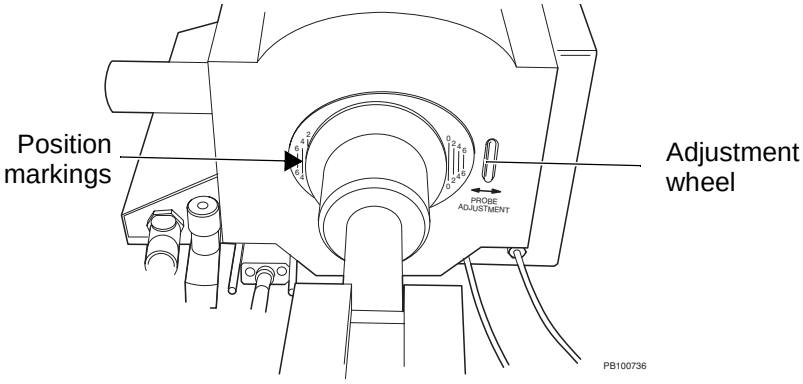

Figure 2-11 Lateral Probe Gauge Markings on Right Side of Spray Chamber

2. Turn the adjustment wheel until the probe is positioned appropriately for your flow rate:

Flow Rate	Position Setting
<200 µl/min	1–2
200–500 µl/min	3
>500 µl/min	4–6

***NOTE**: A setting of 3 positions the probe to the left of center of nozzle opening. A lower setting positions the probe closer to the nozzle opening. Note that lower settings may yield improved sensitivity for lower flow rates, but can also contaminate the nozzle and ion optics more quickly.*

Adjusting the corona discharge needle position

To adjust corona discharge needle position, turn the corona discharge needle adjustment knobs on the top of the spray chamber (Figure 2-12).

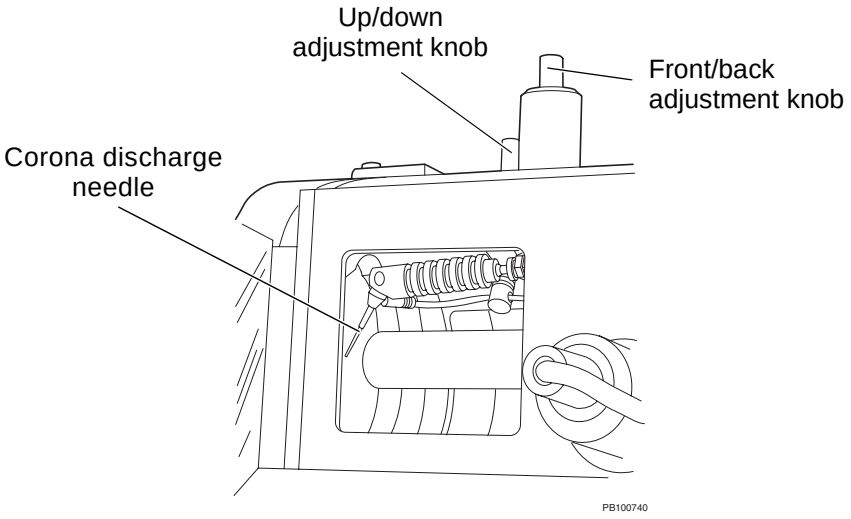

Figure 2-12 Corona Discharge Needle Location

***NOTE**: Figure 2-12 illustrates the position of the corona discharge needle as seen when the APCI spray chamber is removed from the system.*

Position the corona discharge needle so that it is vertically at the same level as the nozzle opening, but horizontally off-center (Figure 2-13).

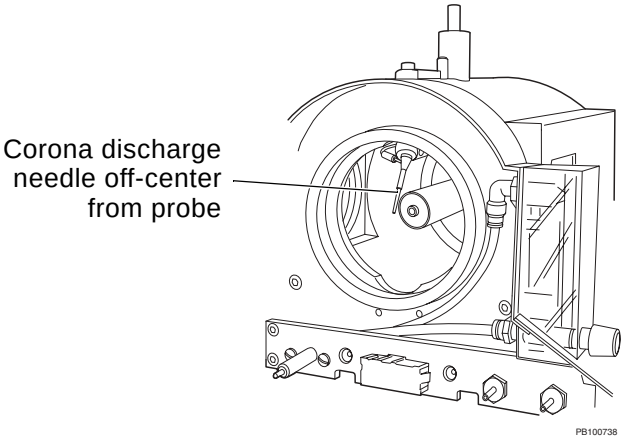

Figure 2-13 Positioning the Corona Discharge Needle

2.8 Removing the APCI Spray Chamber

Removing

To remove the APCI spray chamber:

1. Read “Spray chamber precautions” on page 5 before proceeding.
2. Stop solvent flow and close the shutter.

CAUTION

Always turn off solvent flow before turning off high voltages to prevent liquid from accumulating in the spray chamber. Accumulated liquid can cause degradation of gas seals.

3. In the Instrument Control Panel, set Spray Chamber Temperature 2 to **0°C**.
4. If Nozzle Temp is set above 100°C, set it to **100°C** to facilitate cooling.
5. Wait until Spray Chamber Temperature 2 decreases below 50°C.

***NOTE**: To facilitate cooling, leave the gases and compressed air flowing until temperature decreases below 50°C.*

6. In the Instrument Control Panel, select **Instrument-Off** from the Instrument menu.

CAUTION

Removing the spray chamber when the instrument is in Standby or On state (and gas and internal heaters are on) can damage the gas seals and cause fuses to blow.

***NOTE**: Do not leave the instrument state set to Off for any longer than necessary. Setting the state to Off turns off instrument heaters. Internal elements of the system can take up to an hour and a half to equilibrate.*

High voltages, integrated syringe pump, and gases are turned off. The gas seals release when the gases are turned off.

7. Disconnect the compressed air by pulling back on the fitting and removing the tubing. See Figure 2-7 on page 16.

***NOTE**: It is not necessary to turn off the compressed air before disconnecting.*

8. In the Instrument Control Panel, check the status bar to make sure the High Voltage status is Off.
9. Disconnect the following from the spray chamber:
   - Exhaust trap inlet tubing (Figure 2-14)
   - Solvent tubing (Figure 2-14)
10. Pull the spray chamber lever to the right (Figure 2-14).
11. Remove the spray chamber by grasping the probe collar and pulling the spray chamber to the right, away from the workstation (Figure 2-14).
12. Hold the APCI spray chamber with two hands, one under the base, one on the probe collar (see Figure 2-2 on page 7) and lift it out of the way.

***NOTE**: Do not hold the chamber by the probe. Doing so can change probe position.*

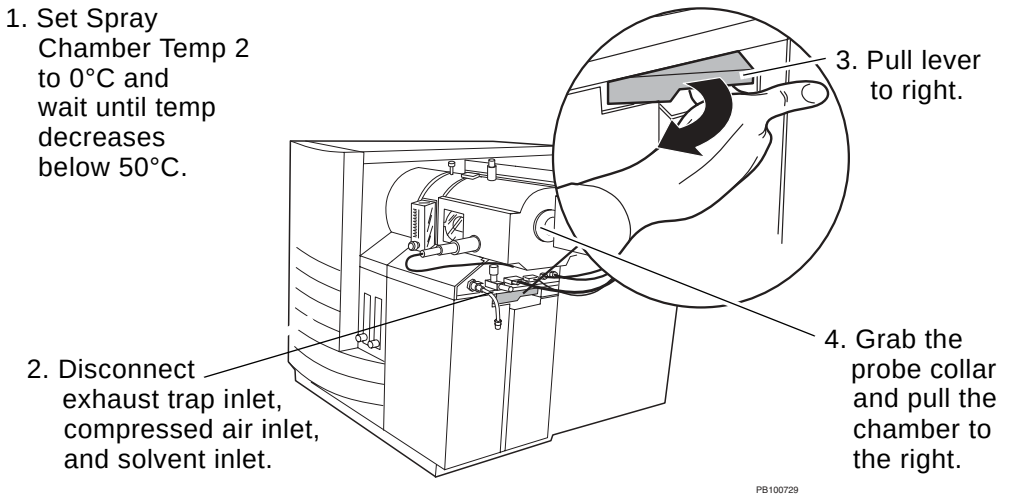

Figure 2-14 Removing the APCI Spray Chamber

Reconfiguring gas for use with standard spray chamber

If you are removing the spray chamber and replacing it with the standard spray chamber, disable the auxiliary gas. See Section 2.4.2, Configuring the Gases.

The standard spray chamber does not use auxiliary gas. If auxiliary gas is enabled and turned on when a standard spray chamber is installed, you may hear a hissing sound as gas leaks from the auxiliary gas line.

3 APCI Operation

This section includes:

- Overview of APCI operation
- Sample, solvent, and LC column guidelines
- Optimizing signal
- Shutting down the APCI spray chamber when not in use

3.1 Overview of APCI Operation

Basic operation

After optimizing signal as described in this section, operation is identical to standard electrospray operation. Refer to the sections of the *Mariner Workstation User's Guide* listed below to perform the following tasks:

- Chapter 5, Tuning and Calibrating the Mass Analyzer
- Chapter 6, Acquiring Data

Refer to the *Data Explorer User's Guide,* formerly called *Biospectrometry™ Data Explorer User's Guide,* to learn how to use the Data Explorer software to process and analyze data.

For additional information, refer to the following sections in this document:

- Section 3.4, Shutting Down the APCI Spray Chamber When Not in Use
- Section 4, Maintenance
- Section 5, APCI Troubleshooting

3.2 Sample, Solvent, and LC Column Guidelines

For information on sample, solvent and LC column guidelines, and sample cleanup, refer to appropriate sections of the *Mariner Workstation User's Guide*.

3.3 Optimizing Signal

Preparing the workstation

To prepare the workstation before optimizing signal:

1. Read "Spray chamber precautions" on page 5 before proceeding.
2. Check the exhaust trap bottle daily and empty as needed.
3. Load an instrument settings file. See the appropriate sections on using instrument settings in the *Mariner Workstation User's Guide*.
4. In the Instrument Control Panel, select **Instrument-Standby** from the Instrument menu.
5. If gases are in manual mode, click 

in the toolbar to turn on.
6. Adjust the gas flow rates as indicated in Table 3-1 using the flow meters on the front panel of the mass spectrometer and spray chamber.

Table 3-1 Gas Flow Rates

Gas	Flow Rate (liter/min)	Comment
Nebulizer (right flow meter on the front panel)	0.2 to 1.0	Use lower nebulizer gas flow for lower solvent flow rates. If nebulizer gas flow is too high, liquid can be blown off the tip and a stable spray does not form.
Curtain (left flow meter on the front panel)	0.5 to 2.0	Use higher curtain gas flow for samples with high water content.
Auxiliary (flow meter on APCI spray chamber)	3 to 5	Use lower auxiliary gas flow for lower solvent flow rates. If auxiliary gas flow is too high, liquid can be blown off the tip and a stable spray does not form.

7. Turn the compressed air adjustment knob (see Figure 2-7 on page 16) one to one and a half turns until you hear the flow. This generates 15 liters/min of flow.

***NOTE**: If you do not hear flow when you turn the compressed air knob, the fitting may not be connected properly. Push the fitting on to the connector and pull away from the connector to seat.*

---

8. In the Instrument Control Panel, set:

   - Spray Chamber Temperature 2 to **300°C**.

   CAUTION
   Do not set Spray Chamber Temperature 2 above 300°C unless solvent is running.

   - In the Instrument Control Panel, set Nozzle Temperature to **180°C** to **200°C** and wait for the temperature to stabilize.

   ***NOTE**: Temperatures closer to 200°C may provide increased sensitivity.*

9. When the Spray Chamber Temperature 2 reaches 300°C, allow the probe to warm up for 5 minutes to minimize condensation in the probe.

Optimizing signal

To optimize signal:

1. In the Instrument Control Panel, select **Instrument-On** from the Instrument menu.
2. Set the Spray Tip Potential between **5,000** and **5,500 V**. This is the potential applied to the corona discharge needle.
3. Open the shutter.
4. Start solvent flow at a flow rate appropriate for your application.
5. Set Spray Chamber Temperature 2 to:

Flow rate/solvent	Temperature (°C)
0.5 ml/min in 100% water	350
1 ml/min in 100% water	425

6. Make a loop injection of a standard.
7. Observe signal intensity in the Instrument Control Panel.
8. Increase the compressed air flow by turning the compressed air adjustment knob (see Figure 2-7 on page 16) until the signal drops off, then decrease the flow rate slightly until the signal returns to maximum intensity.
9. To further optimize signal, adjust the following conditions in the order listed below:

Condition to Adjust	Comments
Corona discharge needle position as described on page 22	This condition has the greatest impact on signal.
Spray Tip Potential	Adjust in 100 V increments.
Auxiliary, nebulizer, and curtain gas flow rates as described in Table 3-1, “Gas Flow Rates,” on page 29	Increase the flow rate until the signal drops off, then decrease the flow rate slightly.
Lateral probe position as described on page 21	At higher flow rates, moving the probe slightly more to the left (3.5 to 4 on the lateral probe gauge shown in Figure 2-11 on page 21) can improve signal.
Spray Chamber Temperature 2	Increase in 25°C increments until you no longer see an increase in signal response. Note the effects of setting too high or low: • **Too high**—Causes thermal decomposition of sample. • **Too low**—Evaporation of droplets does not occur quickly enough to allow desorption of organic molecules.

Example TIC data Figure 3-1 represents typical TIC data for APCI applications.

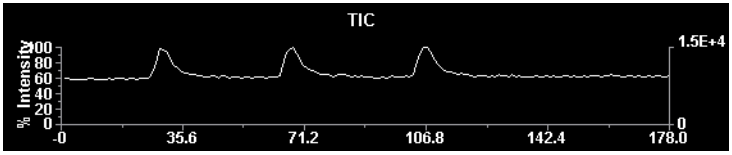

Figure 3-1 Example APCI TIC Data

NOTE*: Due to some dead volume in the spray chamber tubing, you may see some peak tailing.*

3.4 Shutting Down the APCI Spray Chamber When Not in Use

When not acquiring data:

1. Close the shutter.
2. Stop solvent flow.
3. In the Instrument Control Panel, set Spray Chamber Temperature 2 to **0°C**.
4. Leave the compressed air flowing for at least 15 minutes after stopping solvent flow to vent all solvent vapors, particularly if you have used highly combustible solvent mixtures.

4 Maintenance

This section includes:

- Cleaning the probe
- Replacing the corona discharge needle
- Replacing the lamp bulb

4.1 Cleaning the Probe

When to clean Clean the probe if you see increased background, particularly after running high-protein biological media such as plasma or urine.

Cleaning To clean the probe:

1. Prepare a 50/50 solution of methanol/water.

WARNING

CHEMICAL HAZARD*: Before handling methanol, consult the MSDS provided by the manufacturer.*

2. In the Instrument Control Panel, select **Instrument-Standby** from the Instrument menu.
3. Close the shutter.

NOTE*: Do not leave the instrument state set to Standby for any longer than necessary. Setting the state to Standby turns off internal voltages. Internal voltages can require time to stabilize once they are turned on again.*

High voltages are turned off.

4. Set the Spray Chamber Temperature 2 to **300°C**.
5. Start flow of the 50/50 solution of methanol/water at **1 ml/min**.
6. Set the Spray Chamber Temperature 2 to **475°C**.
7. Run for **20 minutes**.
8. Stop flow.
9. Set the Spray Chamber Temperature 2 to **300°C** and allow the temperature to stabilize for 10 minutes.
10. Open the shutter, turn on high voltages, and start flow.
11. Observe the signal. If background is still high, repeat step 2 through step 10.

4.2 Replacing the Corona Discharge Needle

When to replace

Replace the corona discharge needle if performance decreases, approximately every 2 to 3 months.

***NOTE**: No cleaning or replacement is required if the corona discharge needle appears dirty. Replace only if performance decreases.*

Replacing

To replace the corona discharge needle:

1. Remove the spray chamber as described in Section 2.8, Removing the APCI Spray Chamber.

WARNING

***PHYSICAL INJURY HAZARD**: The corona discharge needle is extremely sharp. Handle with care.*

2. With a forceps, grasp the corona discharge needle and pull it out of the holder (Figure 4-1).

***NOTE**: Do not handle the corona discharge needle with bare fingers.*

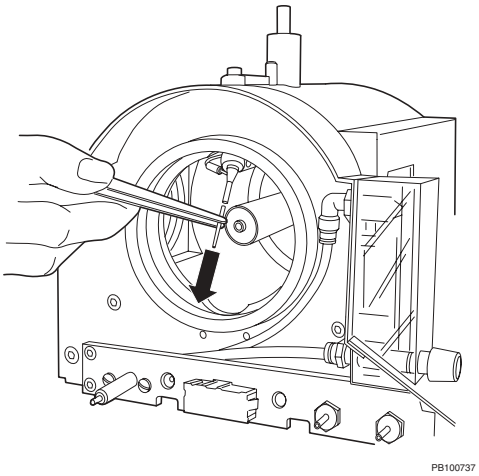

Figure 4-1 Replacing the Corona Discharge Needle

3. Discard the old corona discharge needle in a container appropriate for needles and other sharp objects.
4. With a forceps, grasp a new corona discharge needle and insert it into the holder until it is seated in the holder.
5. Replace the spray chamber as described in Section 2.2, Installing the APCI Spray Chamber.
6. Adjust the needle as described in “Adjusting the corona discharge needle position” on page 22.

4.3 Replacing the Lamp Bulb

Removing the spray chamber from the base

To remove the spray chamber from the base:

1. Remove the spray chamber as described in Section 2.8, Removing the APCI Spray Chamber.
2. Disconnect the high voltage connector from the front of the spray chamber. See Figure 1-2 on page 2.
3. Remove the 9/64-inch hex screw holding the spray chamber to the base (Figure 4-2).

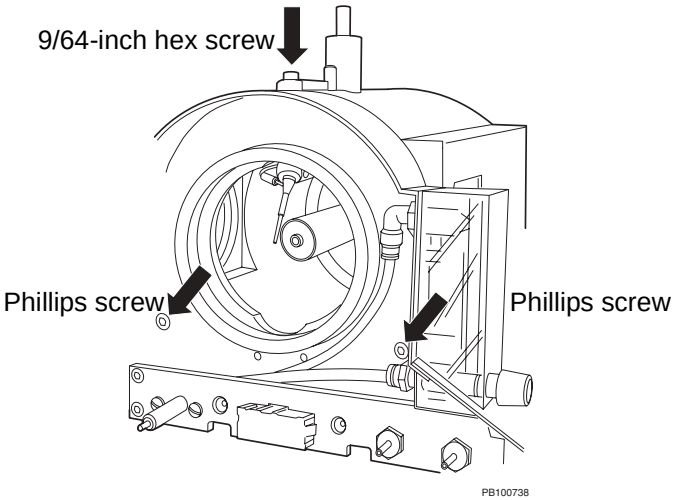

Figure 4-2 Removing the Spray Chamber from the Base

4. Remove the two Phillips screws from the left side of the spray chamber that hold the spray chamber to the base. Slide the chamber out of the base and set the base aside.

Replacing the bulb

Snap the bulb out of the holder and replace with a new bulb.

Reassemble the base and the spray chamber.

Replace the spray chamber as described in Section 2.2, Installing the APCI Spray Chamber.

5 APCI Troubleshooting

This section includes troubleshooting information for the APCI module. For additional troubleshooting information, refer to the Technical Support section of the *Mariner Workstation User's Guide*.

Troubleshooting information is organized according to likelihood of possible cause, from most likely to least likely possible cause. If you are unable to solve your problem using the information in the following tables, call Applied Biosystems Technical Support. To reach Applied Biosystems Technical Support, refer to the Technical Support section of the *Mariner Workstation User's Guide*.

Table 5-1 APCI Troubleshooting

Symptom	Possible Cause	Action
Sample tailing, band broadening, poor chromatographic resolution with LC/MS	Auxiliary gas flow rate not optimized between 1.5 to 3 liter/min	Adjust Auxiliary gas. See Table 3-1, "Gas Flow Rates," on page 29.
	Dead volume in spray chamber	No action. Normal occurrence.
Background ions	Exhaust backed up	Empty exhaust trap bottle, uncrimp exhaust trap tubing.
	Probe contaminated	Clean. See Section 4.1, Cleaning the Probe.

Continued

Table 5-1 APCI Troubleshooting (Continued)

Symptom	Possible Cause	Action
Low sensitivity	Corona discharge needle degraded	Replace. See Section 4.2, Replacing the Corona Discharge Needle.
	Compressed air flow too high. Gas is removing the reagent gas needed to produce ions.	Decrease compressed air flow by turning the compressed air knob (see Figure 2-7 on page 16).
Corona discharge needle appears dirty	Normal occurrence caused by oxidation and sample deposits	No action. Replace the corona discharge needle only if you see decreased sensitivity.
Unstable background signal	Gases not optimized	Optimize nebulizer and auxiliary gas flow rates. See “Preparing the workstation” on page 28.
Unstable baseline observed at high flow rates or with high aqueous solvent composition	Heated nebulizer probe temperature too low	Increase Spray Chamber Temperature 2 setting.
No peaks observed above 300 m/z. Corona discharge observed at spray tip.	Spray Tip Potential too high	Decrease Spray Tip Potential.
No peaks observed above 300 m/z. No corona discharge observed at spray tip.	Solvent, sample, or tubing contaminated	Use fresh solvent, clean up sample, change tubing.

Continued

Table 5-1 APCI Troubleshooting (Continued)

Symptom	Possible Cause	Action
Phthalate peaks at many masses	Leaching from LC tubing	No action. Normal occurrence.
Condensation on spray chamber window	Exhaust pump not working effectively	Increase compressed air flow by turning the compressed air knob (see Figure 2-7 on page 16).
You do not hear flow when you turn the compressed air knob	Quick-disconnect fitting not connected properly	Push the quick-disconnect fitting on to the connector and pull away from the connector to seat.
Large liquid droplets spray from the probe and bounce off curtain plate	Auxiliary or nebulizer gas flow rate too low	Adjust. See Table 3-1, “Gas Flow Rates,” on page 29.

A Spare Parts

Table A-1 Mariner APCI Spare Parts

Item	Where used	Quantity	Part Number
Exhaust bottle kit, includes 1/2-inch OD and 1/4-inch OD plastic tubing, adapter, exhaust bottle and cap	Exhaust outlet	1 kit	V700710
Corona discharge needle	APCI spray chamber	1	WC015656
Bulbs, lamp	APCI spray chamber	10/pkg	V700672

B Warranty/Service Information

Applied Biosystems supplies or recommends certain configurations of computer hardware, software, and peripherals for use with its instrumentation. Applied Biosystems reserves the right to decline support for or impose charges for supporting nonstandard computer configurations or components that have not been supplied or recommended by Applied Biosystems. Applied Biosystems also reserves the right to require that computer hardware and software be restored to the standard configuration prior to providing service or technical support. For systems that have built-in computers, installing unauthorized hardware or software may void the Warranty or Service Plan.

B.1 Limited Product Warranty

Limited warranty

Applied Biosystems warrants that all standard components of the Mariner™ API-TOF Workstation APCI Module will be free of defects in materials and workmanship for a period of ninety (90) days. Applied Biosystems will repair or replace, at its discretion, all defective components during this warranty period. After this warranty period, repairs and replacement components may be purchased from Applied Biosystems at its published rates. Applied Biosystems also provides service agreements for post-warranty coverage. Applied Biosystems reserves the right to use new, repaired, or refurbished instruments or components for warranty and post-warranty service agreement replacements. Repair or replacement of products or components under warranty does not extend the original warranty period.

Applied Biosystems warrants that all optional accessories supplied with its Mariner API-TOF Workstation APCI Module**,** such as peripherals, printers, and special monitors, will be free of defects in materials and workmanship for a period of ninety (90) days. Applied Biosystems will repair or replace, at its discretion, defective accessories during this warranty period. After this warranty period, Applied Biosystems will pass on to the buyer, to the extent that it is permitted to do so, the warranty of the original manufacturer for such accessories.

With the exception of consumable and maintenance items, replaceable products or components used on the instrument are themselves warranted to be free of defects in materials and workmanship for ninety (90) days.

Applied Biosystems warrants that chemicals and other consumable products will be free of defects in materials and workmanship when received by the buyer, but not thereafter, unless otherwise specified in documentation accompanying the product.

Applied Biosystems warrants that for a period of ninety (90) days from the date of installation, the software designated for use with the product will perform substantially in accordance with the function and features described in its accompanying documentation when properly installed on the product. Applied Biosystems does not warrant that the operation of the instrument or software will be uninterrupted or error free. Applied Biosystems will provide any software corrections or “bug-fixes” if and when they become available, for a period of ninety (90) days after installation.

Warranty period effective date

Any applicable warranty period under these sections will begin on the date of installation for hardware and software installed by Applied Biosystems personnel, unless that date has been delayed at the buyer's request. In that case, and for all hardware and software installed by the buyer, and for all other products, the applicable warranty period begins the date the component is received by the buyer.

Warranty exceptions

The above warranties shall not apply to defects resulting from misuse, neglect, or accident, including without limitation: operation with incompatible solvents or samples in the system; operation outside of the environmental or use specification instructions for the product or accessories; performance of improper or inadequate maintenance by the user; installation of software or interfacing not supplied by Applied Biosystems; and modification or repair of the product or the software not authorized by Applied Biosystems.

The foregoing provisions set forth Applied Biosystems' sole and exclusive representations, warranties, and obligations with respect to its products, and Applied Biosystems makes no other warranty of any kind whatsoever, expressed or implied, including without limitation, warranties of merchantability and fitness for a particular purpose, whether arising from a statute or otherwise in law or from a course of dealing or usage of trade, all of which are expressly disclaimed. Such limited warranty is given only to buyer or any third party in the event of use of products furnished hereunder by any third party.

Warranty limitations

The remedies provided herein are the buyer's sole and exclusive remedies. Without limiting the generality of the foregoing, in no event shall Applied Biosystems be liable, whether in contract, in tort, warranty, or under any statute (including without limitation, any trade practice, unfair competition, or other statute of similar import) or on any other basis, for direct, indirect, punitive, incidental, multiple, consequential, or special damages sustained by the buyer or any other person, whether or not foreseeable and whether or not Applied Biosystems is advised of the possibility of such damage, including without limitation, damage arising from or related to loss of use, loss of data, failure or interruption in the operation of any equipment or software, delay in repair or replacement, or for loss of revenue or profits, loss of good will, loss of business or other financial loss or personal injury or property damage.

No agent, employee, or representative of Applied Biosystems has any authority to bind Applied Biosystems to any affirmation, representation, or warranty concerning the product that is not contained in this Limited Warranty Statement. Any such affirmation, representation, or warranty made by any agent, employee, or representative of Applied Biosystems will not be binding on Applied Biosystems.

This warranty is limited to the buyer of the product from Applied Biosystems and is not transferable.

B.2 Damages, Claims, Returns

Damages If shipping damage to the instrument is discovered, contact the shipping carrier and request inspection by a local agent. Secure a written report of the findings to support any claim. Do not return damaged goods to Applied Biosystems without first securing an inspection report and contacting Applied Biosystems Technical Support for a Return Authorization (RA) number.

Claims After a damage inspection report is secured, Applied Biosystems will supply the replacements and process claims that are initiated by either party.

Returns Do not return any material without prior notification and authorization.

If for any reason it becomes necessary to return material to Applied Biosystems, contact Applied Biosystems Technical Support or your nearest Applied Biosystems subsidiary or distributor for a return authorization (RA) number and forwarding address. Place the RA number in a prominent location on the outside of the shipping container, and return the material to the appropriate address.

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