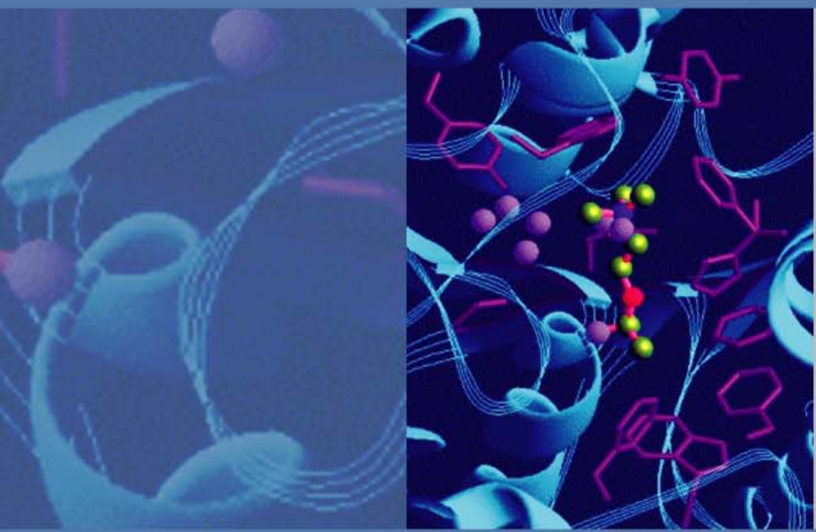


Thermo

# Accela Autosampler

## Field Service Manual

Version 2 November 2011

DOCUMENTATION SURVEY

Part of Thermo Fisher Scientific

Thermo SCIENTIFIC

Release history: Version 1, May 2011; Version 2, November 2011

Software versions: Thermo Xcalibur 2.0.*x* or later data system, ChromQuest 4.2 or later data system, Thermo Foundation 1.0.*x* or later with Xcalibur 2.1.*x* or later

# Regulatory Compliance

Thermo Fisher Scientific performs complete testing and evaluation of its products to ensure full compliance with applicable domestic and international regulations. When the system is delivered to you, it meets all pertinent electromagnetic compatibility (EMC) and safety standards as described in the next section or sections by product name.

Changes that you make to your system might void compliance with one or more of these EMC and safety standards. Changes to your system include replacing a part or adding components, options, or peripherals not specifically authorized and qualified by Thermo Fisher Scientific. To ensure continued compliance with EMC and safety standards, replacement parts and additional components, options, and peripherals must be ordered from Thermo Fisher Scientific or one of its authorized representatives.

# Accela Autosampler

## EMC Directive 89/336/EEC amended by 92/31/EEC and 93/68/EEC

EMC compliance has been evaluated by TUV Rheinland of North America, Inc.

| | | | |
|---|---|---|---|
| EN 61326 | 1997; A1, 1998; A2, 2001; A3, 2003 | EN 61000-4-4 | 1995; A1, 2000; A2, 2001 |
| EN 61000-3-2 | 2000 | EN 61000-4-5 | 2001 |
| EN 61000-3-3 | 1995; A1, 2001 | EN 61000-4-6 | 2003 |
| EN 61000-4-2 | 2001 | EN 61000-4-8 | 2001 |
| EN 61000-4-3 | 2002 | EN 61000-4-11 | 2001 |

FCC Class A, CFR 47 Part 15 Subpart B: 2005

## Low Voltage Safety Compliance

Low Voltage Safety Compliance has been evaluated by TUV Rheinland of North America, Inc.

This device complies with Low Voltage Directive 73/23/EEC and harmonized standard EN 61010-1:2001, IEC 61010-1:2002, UL 61010 A-1:2004, CAN/CSA 22.2 61010-1:2004.

Thermo SCIENTIFIC

# FCC Compliance Statement

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.

**CAUTION** Read and understand the various precautionary notes, signs, and symbols contained inside this manual pertaining to the safe use and operation of this product before using the device.

# Notice on Lifting and Handling of Thermo Scientific Instruments

For your safety, and in compliance with international regulations, the physical handling of this Thermo Fisher Scientific instrument ***requires a team effort*** to lift and/or move the instrument. This instrument is too heavy and/or bulky for one person alone to handle safely.

# Notice on the Proper Use of Thermo Scientific Instruments

In compliance with international regulations: Use of this instrument in a manner not specified by Thermo Fisher Scientific could impair any protection provided by the instrument.

# Notice on the Susceptibility to Electromagnetic Transmissions

Your instrument is designed to work in a controlled electromagnetic environment. Do not use radio frequency transmitters, such as mobile phones, in close proximity to the instrument.

For manufacturing location, see the label on the instrument.

Thermo
SCIENTIFIC

# WEEE Compliance

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the following symbol:

Thermo Fisher Scientific has contracted with one or more recycling or disposal companies in each European Union (EU) Member State, and these companies should dispose of or recycle this product. See www.thermo.com/WEEERoHS for further information on Thermo Fisher Scientific's compliance with these Directives and the recyclers in your country.

# WEEE Konformität

Dieses Produkt muss die EU Waste Electrical & Electronic Equipment (WEEE) Richtlinie 2002/96/EC erfüllen. Das Produkt ist durch folgendes Symbol gekennzeichnet:

Thermo Fisher Scientific hat Vereinbarungen mit Verwertungs-/Entsorgungsfirmen in allen EU-Mitgliedsstaaten getroffen, damit dieses Produkt durch diese Firmen wiederverwertet oder entsorgt werden kann. Mehr Information über die Einhaltung dieser Anweisungen durch Thermo Fisher Scientific, über die Verwerter, und weitere Hinweise, die nützlich sind, um die Produkte zu identifizieren, die unter diese RoHS Anweisung fallen, finden sie unter www.thermo.com/WEEERoHS.

# Conformité DEEE

Ce produit doit être conforme à la directive européenne (2002/96/EC) des  Déchets d'Equipements Electriques et Electroniques (DEEE). Il est marqué par le symbole suivant:

Thermo Fisher Scientific s'est associé avec une ou plusieurs compagnies de recyclage dans chaque état membre de l’union européenne et ce produit devrait être collecté ou recyclé par celles-ci. Davantage d'informations sur la conformité de Thermo Fisher Scientific à ces directives, les recycleurs dans votre pays et les informations sur les produits Thermo Fisher Scientific qui peuvent aider la détection des substances sujettes à la directive RoHS sont disponibles sur www.thermo.com/WEEERoHS.

| CAUTION Symbol | CAUTION | VORSICHT | ATTENTION | PRECAUCION | AVVERTENZA |
|---|---|---|---|---|---|
|  | **Electric Shock:** This instrument uses high voltages that can cause personal injury. Before servicing, shut down the instrument and disconnect the instrument from line power. Keep the top cover on while operating the instrument. Do not remove protective covers from PCBs. | **Elektroschock:** In diesem Gerät werden Hochspannungen verwendet, die Verletzungen verursachen können. Vor Wartungsarbeiten muß das Gerät abgeschaltet und vom Netz getrennt werden. Betreiben Sie das Gerät nicht mit abgenommenem Deckel. Nehmen Sie die Schutzabdeckung von Leiterplatten nicht ab. | **Choc électrique:** L'instrument utilise des tensions capables d'infliger des blessures corporelles. L'instrument doit être arrêté et débranché de la source de courant avant tout intervention. Ne pas utiliser l'instrument sans son couvercle. Ne pas enlever les étuis protecteurs des cartes de circuits imprimés. | **Descarga eléctrica:** Este instrumento utiliza altas tensiones, capaces de producir lesiones personales. Antes de dar servicio de mantenimiento al instrumento, éste debera apagarse y desconectarse de la línea de alimentacion eléctrica. No opere el instrumento sin sus cubiertas exteriores quitadas. No remueva las cubiertas protectoras de las tarjetas de circuito impreso. | **Shock da folgorazione.** L'apparecchio è alimentato da corrente ad alta tensione che puo provocare lesioni fisiche. Prima di effettuare qualsiasi intervento di manutenzione occorre spegnere ed isolare l'apparecchio dalla linea elettrica. Non attivare lo strumento senza lo schermo superiore. Non togliere i coperchi a protezione dalle schede di circuito stampato (PCB). |
|  | **Chemical:** This instrument might contain hazardous chemicals. Wear gloves when handling toxic, carcinogenic, mutagenic, or corrosive or irritant chemicals. Use approved containers and proper procedures to dispose waste oil. | **Chemikalien:** Dieses Gerät kann gefährliche Chemikalien enthalten. Tragen Sie Schutzhandschuhe beim Umgang mit toxischen, karzinogenen, mutagenen oder ätzenden/reizenden Chemikalien. Entsorgen Sie verbrauchtes Öl entsprechend den Vorschriften in den vorgeschriebenen Behältern. | **Chimique:** Des produits chimiques dangereux peuvent se trouver dans l'instrument. Portez des gants pour manipuler tous produits chimiques toxiques, cancérigènes, mutagènes, ou corrosifs/irritants. Utiliser des récipients et des procédures homologuées pour se débarrasser des déchets d'huile. | **Química:** El instrumento puede contener productos quimicos peligrosos. Utilice guantes al manejar productos quimicos tóxicos, carcinogenos, mutagenos o corrosivos/irritantes. Utilice recipientes y procedimientos aprobados para deshacerse del aceite usado. | **Prodotti chimici.** Possibile presenza di sostanze chimiche pericolose nell'apparecchio. Indossare dei guanti per maneggiare prodotti chimici tossici, cancerogeni, mutageni, o corrosivi/irritanti. Utilizzare contenitori aprovo e seguire la procedura indicata per lo smaltimento dei residui di olio. |
|  | **Heat:** Before servicing the instrument, allow any heated components to cool. | **Hitze:** Warten Sie erhitzte Komponenten erst nachdem diese sich abgekühlt haben. | **Haute Temperature:** Permettre aux composants chauffés de refroidir avant tout intervention. | **Altas temperaturas:** Permita que los componentes se enfríen, ante de efectuar servicio de mantenimiento. | **Calore.** Attendere che i componenti riscaldati si raffreddino prima di effetturare l'intervento di manutenzione. |
|  | **Fire:** Use care when operating the system in the presence of flammable gases. | **Feuer:** Beachten Sie die einschlägigen Vorsichtsmaßnahmen, wenn Sie das System in Gegenwart von entzündbaren Gasen betreiben. | **Incendie:** Agir avec précaution lors de l'utilisation du système en présence de gaz inflammables. | **Fuego:** Tenga cuidado al operar el sistema en presencia de gases inflamables. | **Incendio.** Adottare le dovute precauzioni quando si usa il sistema in presenza di gas infiammabili. |
|  | **Eye Hazard:** Eye damage could occur from splattered chemicals or flying particles. Wear safety glasses when handling chemicals or servicing the instrument. | **Verletzungsgefahr der Augen:** Verspritzte Chemikalien oder kleine Partikel können Augenverletzungen verursachen. Tragen Sie beim Umgang mit Chemikalien oder bei der Wartung des Gerätes eine Schutzbrille. | **Danger pour les yeux:** Des projections chimiques, liquides, ou solides peuvent être dangereuses pour les yeux. Porter des lunettes de protection lors de toute manipulation de produit chimique ou pour toute intervention sur l'instrument. | **Peligro par los ojos:** Las salicaduras de productos químicos o particulas que salten bruscamente pueden causar lesiones en los ojos. Utilice anteojos protectores al manipular productos químicos o al darle servicio de mantenimiento al instrumento. | **Pericolo per la vista.** Gli schizzi di prodotti chimici o delle particelle presenti nell'aria potrebbero causare danni alla vista. Indossare occhiali protettivi quando si maneggiano prodotti chimici o si effettuano interventi di manutenzione sull'apparecchio. |
|  | **General Hazard:** A hazard is present that is not included in the above categories. Also, this symbol appears on the instrument to refer the user to instructions in this manual. | **Allgemeine Gefahr:** Es besteht eine weitere Gefahr, die nicht in den vorstehenden Kategorien beschrieben ist. Dieses Symbol wird im Handbuch außerdem dazu verwendet, um den Benutzer auf Anweisungen hinzuweisen. | **Danger général:** Indique la présence d'un risque n'appartenant pas aux catégories citées plus haut. Ce symbole figure également sur l'instrument pour renvoyer l'utilisateur aux instructions du présent manuel. | **Peligro general:** Significa que existe un peligro no incluido en las categorias anteriores. Este simbolo también se utiliza en el instrumento par referir al usuario a las instrucciones contenidas en este manual. | **Pericolo generico.** Pericolo non compreso tra le precedenti categorie. Questo simbolo è utilizzato inoltre sull'apparecchio per segnalare all'utente di consultare le istruzioni descritte nel presente manuale. |
| | When the safety of a procedure is questionable, contact your local Technical Support organization for Thermo Fisher Scientific San Jose Products. | Wenn Sie sich über die Sicherheit eines Verfahrens im unklaren sind, setzen Sie sich, bevor Sie fortfahren, mit Ihrer lokalen technischen Unterstützungsorganisation für Thermo Fisher Scientific San Jose Produkte in Verbindung. | Si la sûreté d'une procédure est incertaine, avant de continuer, contacter le plus proche Service Clientèle pour les produits de Thermo Fisher Scientific San Jose. | Cuando la certidumbre acerca de un procedimiento sea dudosa, antes de proseguir, pongase en contacto con la Oficina de Asistencia Tecnica local para los productos de Thermo Fisher Scientific San Jose. | Quando e in dubbio la misura di sicurezza per una procedura, prima di continuare, si prega di mettersi in contatto con il Servizio di Assistenza Tecnica locale per i prodotti di Thermo Fisher Scientific San Jose. |

| CAUTION Symbol | CAUTION | 危険警告 | 危險警告 |
|---|---|---|---|
|  | **Electric Shock:** This instrument uses high voltages that can cause personal injury. Before servicing, shut down the instrument and disconnect the instrument from line power. Keep the top cover on while operating the instrument. Do not remove protective covers from PCBs. | **電撃**：この計測器は高電圧を使用し、人体に危害を与える可能性があります。保守・修理は、必ず操業を停止し、電源を切ってから実施して下さい。上部カバーを外したままで 計測器を使用しないで下さい。プリント配線板の保護カバーは外さないで下さい。 | 電擊：儀器設備使用會造成人身傷害的高伏電壓。在維修之前，必須先關儀器設備並切除電源。務必要在頂蓋蓋上的情況下操作儀器。請勿拆除PCB保護蓋。 |
|  | **Chemical:** This instrument might contain hazardous chemicals. Wear gloves when handling toxic, carcinogenic, mutagenic, or corrosive or irritant chemicals. Use approved containers and proper procedures to dispose waste oil. | **化学物質**：危険な化学物質が計測器中に存在している可能性があります。毒性、発がん性、突然変異性、腐食・刺激性などのある薬品を取り扱う際は、手袋を着用して下さい。廃油の処分には、規定の容器と手順を使用して下さい。 | 化學品：儀器設備中可能存在有危險性的化學物品。接觸毒性致癌、誘變或腐蝕／刺激性化學品時，請配帶手套。處置廢油時，請使用經過許可 的容器和程序。 |
|  | **Heat:** Before servicing the instrument, allow any heated components to cool. | **熱**：熱くなった部品は冷えるのを待ってから保守・修理を行って下さい。 | 高溫：請先等高溫零件冷卻之後再進行維修。 |
|  | **Fire:** Use care when operating the system in the presence of flammable gases. | **火災**：可燃性のガスが存在する場所でシステムを操作する場合は、充分な注意を払って下さい。 | 火災：在有易燃氣體的場地操作該系統時，請務必小心謹慎。 |
|  | **Eye Hazard:** Eye damage could occur from splattered chemicals or flying particles. Wear safety glasses when handling chemicals or servicing the instrument. | **眼に対する危険**：化学物質や微粒子が飛散して眼を傷つける危険性があります。化学物質の取り扱い、あるいは計測器の保守・修理に際しては防護眼鏡を着用して下さい。 | 眼睛傷害危險：飛濺的化學品或顆粒可能造成眼睛傷害。處理化學品或維修儀器設備時請佩戴安全眼鏡。 |
|  | **General Hazard:** A hazard is present that is not included in the above categories. Also, this symbol appears on the instrument to refer the user to instructions in this manual. | **一般的な危険**：この標識は上記以外のタイプの危険が存在することを示します。また、計測器にこの標識がついている場合は、本マニュアル中の指示を参照して下さい。 | 一般性危險：說明未包括在上述類別中的其他危險。此外，儀器設備上使用這個標誌，以指示用戶本使用手冊中的說明。 |
| | When the safety of a procedure is questionable, contact your local Technical Support organization for Thermo Fisher Scientific San Jose Products. | 安全を確保する手順がよくわからない時は、作業を一時中止し、お近くのサーモエレクトロンサンローゼプロダクトのテクニカールサポートセンターごご連絡ください。 | 如对安全程序有疑问，请在操作之前与当地的菲尼根技术服务中心联系。 |

# Contents

# Preface

This manual describes the features and installation of the Accela™ Autosampler and the maintenance procedures performed by field service engineers.

**Contents**



## Related Documentation

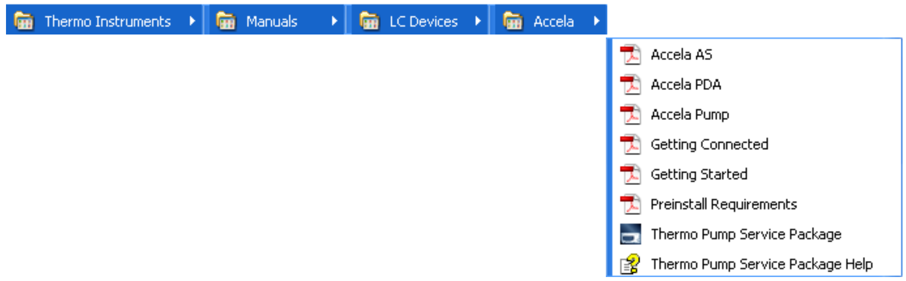
In addition to this guide, Thermo Fisher Scientific provides the following documentation as PDF files for the Accela family of LC instruments:

- *Accela Autosampler Hardware Manual*
- *Accela Preinstallation Requirements Guide*
- *Accela Getting Connected Guide*
- *Accela User Guide for LC Devices* (Xcalibur data system)
- *Accela User Guide for the ChromQuest Data System*
- Help from within the ChromQuest or Xcalibur data system

For the ChromQuest data system, you can find the manuals on the ChromQuest software CD. For the Xcalibur-related instrument control software provided on the LC Devices software CD 2.1.0 or later, you can find the manuals (provided as PDF files) on the data system computer.

- To access the manuals from LC Devices 2.1.0 or 2.2.0, choose **Start > All Programs > Xcalibur > Manuals > LC Devices > Accela**.

- To access the manuals for LC Devices 2.2.1 or later, from the data system computer, choose **Start > All Programs > Thermo Instruments > Manuals > LC Devices > Accela**.




# Safety and Special Notices

Make sure you follow the precautionary statements presented in this guide. The safety and other special notices appear in boxes.

Safety and special notices include the following:

**CAUTION** Highlights hazards to humans, property, or the environment. Each CAUTION notice is accompanied by an appropriate CAUTION symbol.

**CAUTION** Alerts you to the presence of high voltage and to the potential injury that could occur from electrical shock were you to come in contact with a specific instrument area or component. It also tells you how to avoid contact with the high-voltage areas in your instrument.

**CAUTION** Alerts you to the presence of hot surfaces and to the potential injury that could occur were you to come in contact with a specific instrument area.

**CAUTION** Highlights a heavy lifting hazard.

**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 system.

**Note** Highlights information of general interest.

**Tip** Highlights helpful information that can make a task easier.

# Special Precautions

Follow these precautions when handling the autosampler:

- Loading the Autosampler Tray Compartment
- Connecting the Waste Line
- Lifting and Carrying the Autosampler
- Avoiding Contact with Hot Surfaces

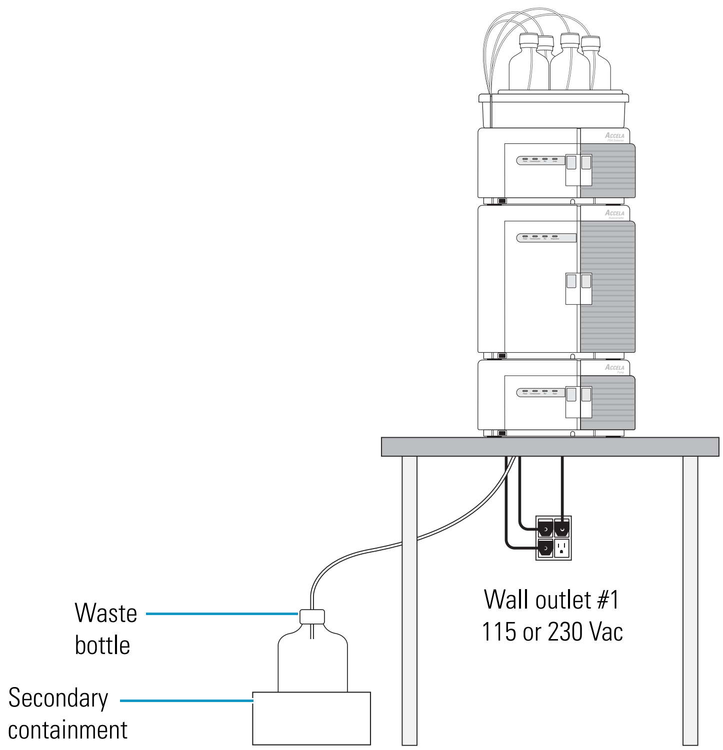
## Loading the Autosampler Tray Compartment

Do not place tall objects taller than 4.6 cm (1.8 in.) in the tray compartment. Placing tall objects in the tray compartment can damage the autosampler arm as it moves within the tray compartment to the sample vial and well locations specified in the injection sequence.

**CAUTION** Placing tall objects in the tray compartment can damage the autosampler's XYZ arm.

## Connecting the Waste Line

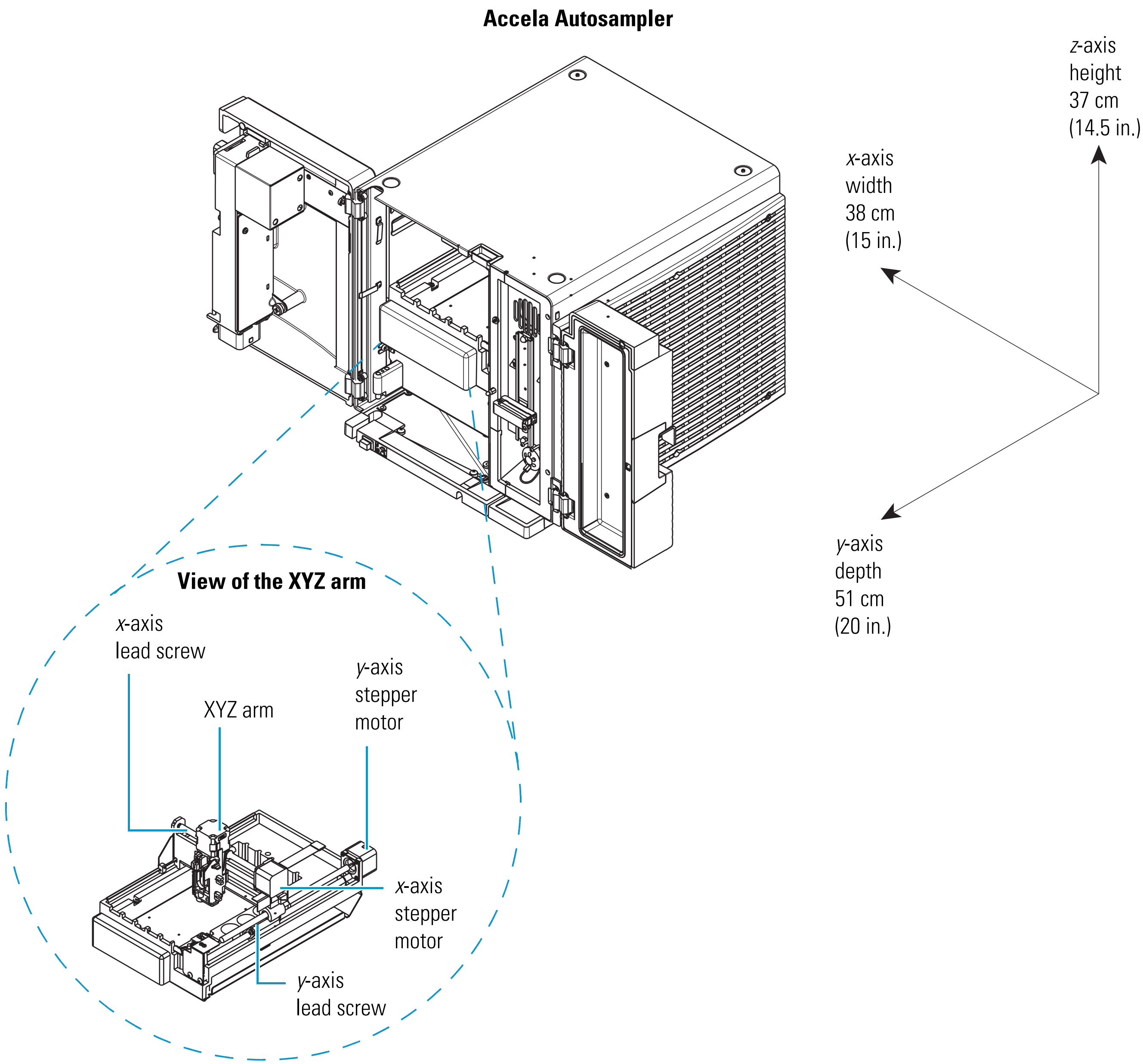
Ensure that the waste line connected to the drainage manifold is routed to a waste bottle as shown below.




## Lifting and Carrying the Autosampler

The autosampler, at 30 kg (66 lb) and with a height, width, and depth of 37× 38× 51 cm (14.5 × 15 × 20 in.), is too heavy and too bulky for one person alone to handle safely. In addition, any jarring or uneven movement can cause misalignment of the autosampler's XYZ arm.

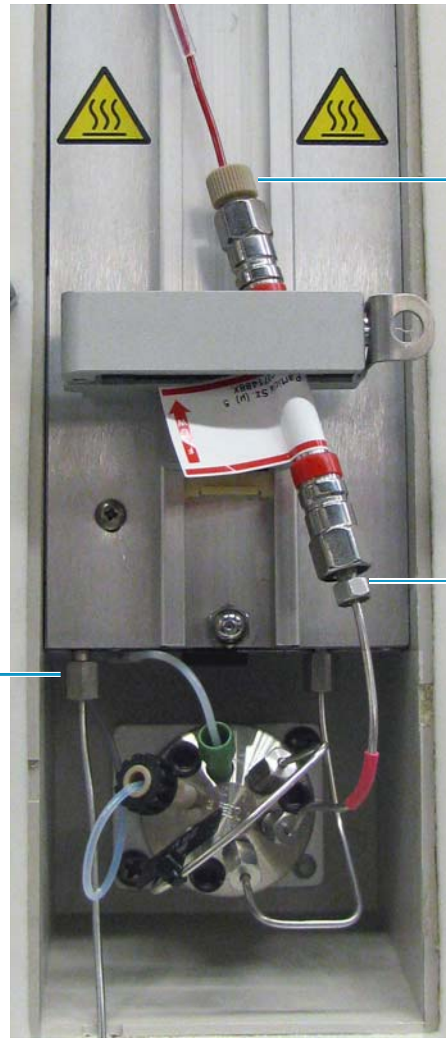
**CAUTION** For your safety and to avoid instrument damage, take care when handling the autosampler. Lifting or moving the autosampler requires a team effort.




## Avoiding Contact with Hot Surfaces

The autosampler has two controlled temperature zones: the tray compartment and the column oven compartment. Because the column oven can reach temperatures as high as 95 °C (203 °F), ensure that the oven is at room temperature before installing or removing the LC column and before connecting the pump outlet to the inlet of the autosampler heat exchanger.

**CAUTION** To prevent personal injury, before installing the LC column or connecting the pump to the autosampler, make sure that the column oven compartment is at room temperature.




## Good Laboratory Practices

To obtain optimal performance from your LC system and to prevent personal injury or injury to the environment, do the following:

- Keep good records.
- Read the manufacturers' Material Safety Data Sheets (MSDSs) for the chemicals being used in your laboratory.

- Remove particulate matter from your samples before you inject them into the liquid chromatograph.
- Use HPLC-grade solvents.
- Connect the drainage tubes from the pump, autosampler, and detector to an appropriate waste receptacle. Dispose of solvents as specified by local regulations.

## Keep Good Records

To help identify and isolate problems with either your equipment or your methodology, for best results, keep good records of all system conditions (for example, % RSDs on retention times and peak areas, and peak shape and resolution). At a minimum, keep a chromatogram of a typical sample and standard mixture, well documented with system conditions, for future reference. Careful comparison of retention times, peak shapes, peak sensitivity, and baseline noise can provide valuable clues to identifying and solving future problems.

## Chemical Toxicity

Although the large volume of toxic and flammable solvents used and stored in laboratories can be quite dangerous, do not ignore the potential hazards posed by your samples. Take special care to read and follow all precautions that ensure proper ventilation, storage, handling, and disposal of both solvents and samples. Become familiar with the toxicity data and potential hazards associated with all chemicals by referring to the manufacturers' Material Safety Data Sheets.

## Sample Preparation

Always consider the solubility of your sample in the solvent/mobile phase. Sample precipitation can plug the column, tubing, or flowcell causing flow restriction. This obstruction can result in irreparable damage to the system. You can remove particulate matter by filtering the samples through 0.45 or 0.2 µ (or less) filters.

## Solvent Requirements

Many chemical manufacturers provide a line of high-purity or HPLC-grade reagents that are free of chemical impurities. Typically, HPLC-grade solvents do not require filtration. You can significantly prolong the life and effectiveness of the inlet filters, check valves and seals, injector, and column by routine filtration of other types of solvents through a 0.45 or 0.2 micron (or less) fluorocarbon filter before placing them in the solvent reservoir bottles.

Choose a mobile phase that is compatible with the sample and column you have selected for your separation. Remember that some solvents are corrosive to stainless steel.

## Solvent Disposal

Make sure you have a solvent waste container or other kind of drain system available at or below the benchtop level. Most solvents have special disposal requirements and should not be disposed of directly down a drain. Follow all governmental regulations when disposing of any chemical.

## High-Pressure Systems and Leaks

LC systems operate at high pressures. Because liquids are not highly compressible, they do not store much energy. Accordingly, the high pressures in an LC system pose little immediate danger. However, correct any leak that occurs as soon as possible. Always wear eye and skin protection when operating or maintaining an LC system. Always shut down the system and return it to atmospheric pressure before attempting any maintenance.

# Contacting Us

There are several ways to contact Thermo Fisher Scientific for the information you need.

### ❖ To contact Technical Support

| | |
|---|---|
| Phone | 800-532-4752 |
| Fax | 561-688-8736 |
| E-mail | us.techsupport.analyze@thermofisher.com |
| Knowledge base | www.thermokb.com |

Find software updates and utilities to download at mssupport.thermo.com.

### ❖ To contact Customer Service for ordering information

| | |
|---|---|
| Phone | 800-532-4752 |
| Fax | 561-688-8731 |
| E-mail | us.customer-support.analyze@thermofisher.com |
| Web site | www.thermo.com/ms |

### ❖ To get local contact information for sales or service

Go to www.thermoscientific.com/wps/portal/ts/contactus.

### ❖ To copy manuals from the Internet

Go to mssupport.thermo.com, agree to the Terms and Conditions, and then click **Customer Manuals** in the left margin of the window.

### ❖ To suggest changes to documentation or to Help

- Fill out a reader survey online at www.surveymonkey.com/s/PQM6P62

  –or–

  Click the link below.

- Send an e-mail message to the Technical Publications Editor at techpubs-lcms@thermofisher.com.

# Introduction

The Accela Autosampler is a member of the Accela family of ultra-high-performance liquid chromatography instruments. The Accela Autosampler (see Figure 1) holds up to 200 standard vials, three 96-well plates, or three 384-well plates; contains a built-in column oven (5 to 95 °C); provides sample temperature control (0 to 60 °C); and can perform automated sample preparation routines.

**Contents**



**Figure 1.** Accela Autosampler

# Autosampler Components

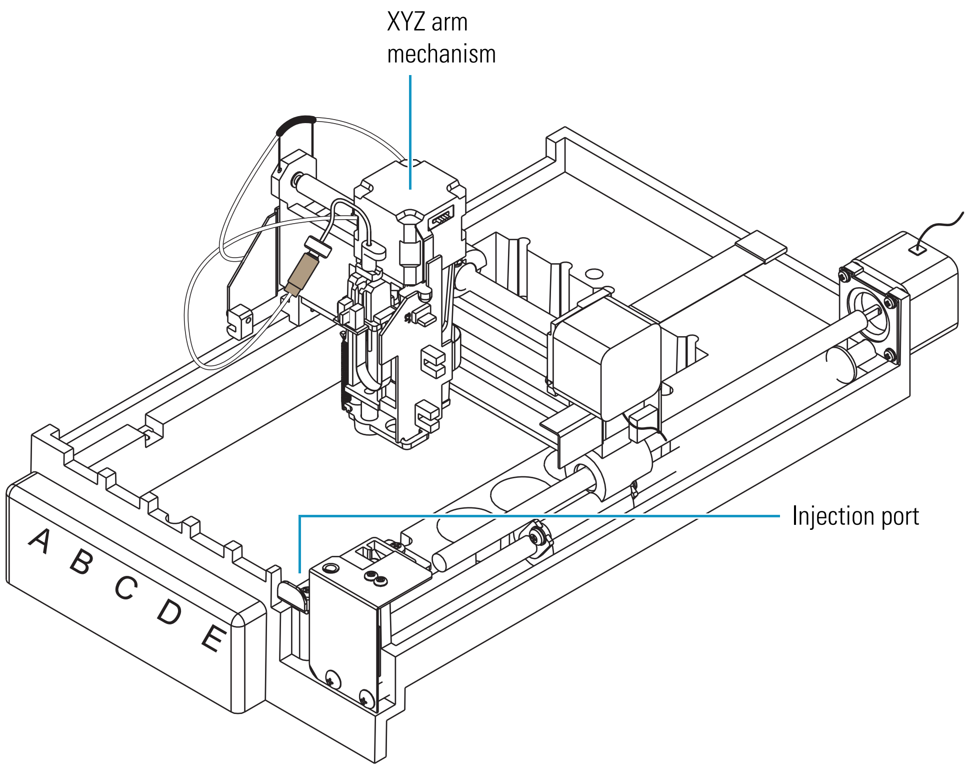
The main components of the Accela Autosampler are as follows:

- Tray Compartment
- Injection System
- Column Oven and Tray Compartment Heater and Cooler

## Tray Compartment

Two types of sample trays are supplied with the Accela Autosampler: a conventional sample tray and a microwell carrier. The tray compartment can hold up to five conventional sample trays or one microwell carrier. The tray compartment also holds up to four 16 mL capacity reservoir vials that can hold solvent, reagent, or diluent. The reservoir vials are located behind the wash station and are designated RV1, RV2, RV3, and RV4. Figure 2 shows an empty tray compartment.

**Figure 2.** Tray compartment




From the left to the right side of the tray compartment, the five conventional sample trays are designated A, B, C, D, and E. Each conventional sample tray holds up to 40 standard 1.8 mL vials for a total capacity of 200 samples. Overlays allow the sample trays to accommodate different vial sizes.

The microwell carrier can hold up to three low-density microplates or up to three high-density microplates. From the front to the back of the tray compartment, the microplates are designated A, B, and C.

The low-density microplate contains 96 wells in an 8 × 12 configuration, designated A1 through H12, for a total capacity of 288 samples. Each well can hold up to 250 µL of sample.

The high-density microplate contains 384 wells in a 16 × 24 configuration, designated A1 through P24, for a total capacity of 1152 samples. Each well can hold up to 50 µL of sample.

The tray compartment door contains a magnetic switch. The magnet is located in the door and the switch is attached to the chassis. When you open the door, the switch signals the autosampler that the door is open. If you turn on the verification option for the door position when you configure the autosampler, the XYZ arm automatically moves to the back of the tray compartment when you open the door so that you can remove trays or replace vials.

Opening the tray compartment door while the autosampler is making an injection does not interrupt the current run. The XYZ arm moves to the back of the compartment after the injection is complete and the sequence pauses. Closing the autosampler door allows the sequence to resume.

## Injection System

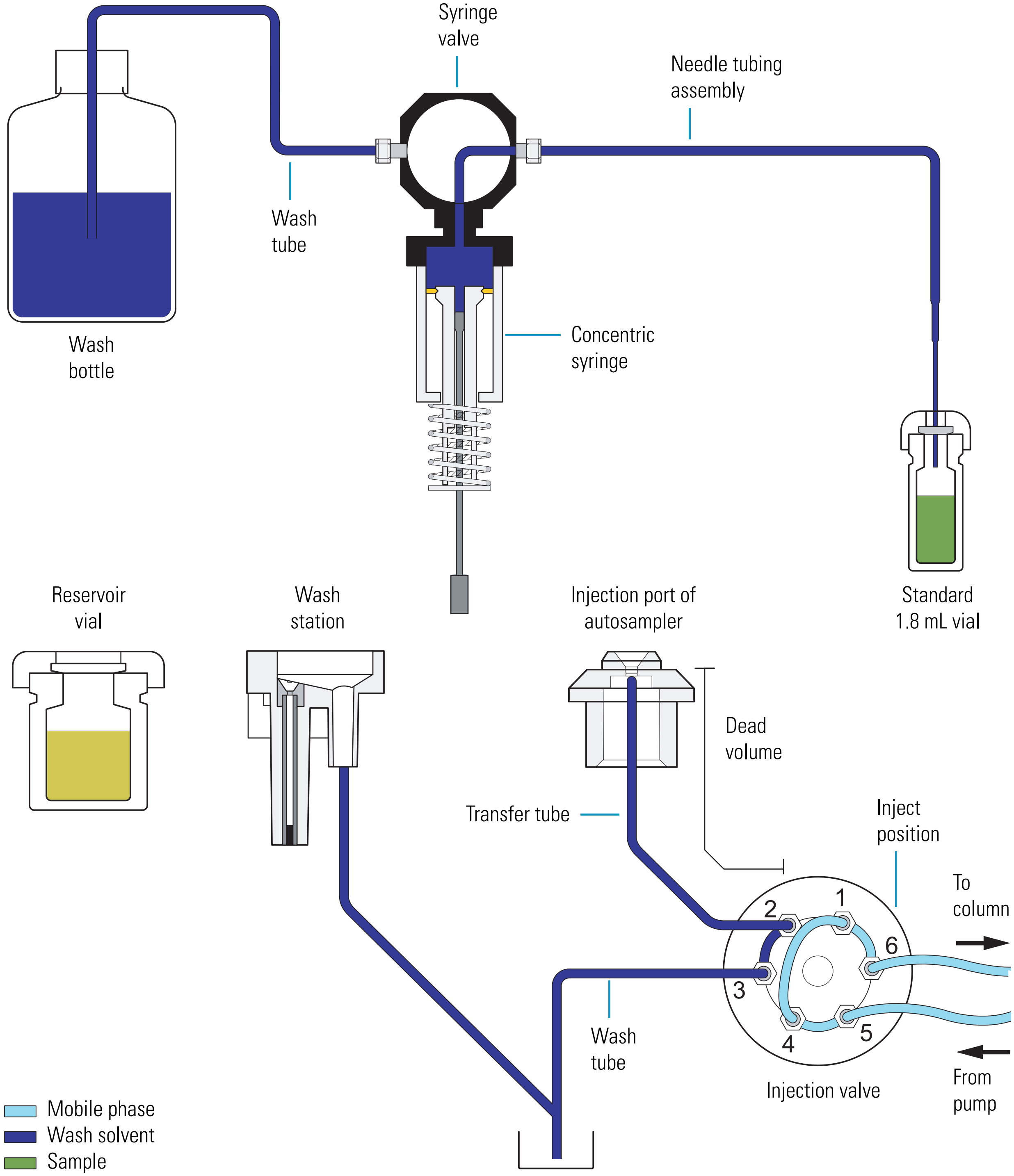
Figure 3 shows the injection system of the Accela Autosampler. The major components of the injection system are as follows:

- Wash Bottle and Wash Bottle Tube
- XYZ Arm Mechanism
- Needle Tubing Assembly and Needle Assembly
- Syringe Valve
- Syringe
- Wash Station
- Injection Port of the Autosampler and Transfer Tube
- Injection Valve
- Sample Loop

You can order the replaceable components of the injection system by Thermo Scientific part number. "Consumables" on page 252 lists the part numbers.

**CAUTION** Because the XYZ arm moves to the sample position, do not place objects taller than 4.5 cm (1.8 in.) in the tray compartment.

**Figure 3.** Accela Autosampler injection components



## Wash Bottle and Wash Bottle Tube

The wash bottle rests in the solvent platform on the top of the Accela stack. The wash bottle tube connects the wash bottle to the syringe valve. Both of the direct commands, Flush (from bottle) and Wash Needle (from bottle), draw solvent from the wash bottle. If you let the wash bottle run dry, the syringe barrel and the wash bottle tube fill with air. When this happens, the autosampler cannot draw sample into the needle tubing during an injection sequence.

**IMPORTANT** Check the volume of solvent in the wash bottle before performing a sequence of injections. Letting the wash bottle run dry compromises the performance of the autosampler.

## XYZ Arm Mechanism

The XYZ arm mechanism moves the needle along the X-Y plane to the requested vial or well location. After it positions the needle above the vial or well, the XYZ arm lowers the needle along the *z* axis to the requested needle height. The syringe plunger descends, drawing sample into the needle tubing. The XYZ arm mechanism moves back to the home position, above the injection port of the autosampler, and then lowers the needle into the injection port. The syringe plunger ascends, expelling the sample from the needle tubing.

Do not move the XYZ arm manually. Instead, use the commands and options listed in Table 1 to control the position of the XYZ arm. For information on using the data system commands, see "Using the Xcalibur Direct Control Commands" on page 267 or "Using the ChromQuest Direct Commands" on page 269.

**Table 1.** Commands and options that control the position of the XYZ arm

| Action | Data system | Command or option |
|---|---|---|
| Make the XYZ arm automatically move to the back of the tray compartment when you open the tray door. | Xcalibur | Select the **Verify Door Is Closed** check box when you specify the instrument configuration options. |
| | ChromQuest | Select the **Verify Door Is Closed** check box when you specify the instrument configuration options. |
| Move the XYZ arm to the back of the tray compartment. | Xcalibur | Use the **Position Arm to Access Tray** direct command. |
| | ChromQuest | Use the **Position Arm to Access Tray** direct control command. |
| Move the XYZ arm to its home position above the injection port and behind the wash station. | Xcalibur | Use the **Set Arm to Home Position** direct command. |
| | ChromQuest | Use the **Go to Home** direct control command. |
| Move the XYZ arm to the center front of the tray compartment, allowing easy access to the needle. | Xcalibur | Use the **Remove Needle** direct command. |
| | ChromQuest | Use the **Needle Removal** direct control command. |

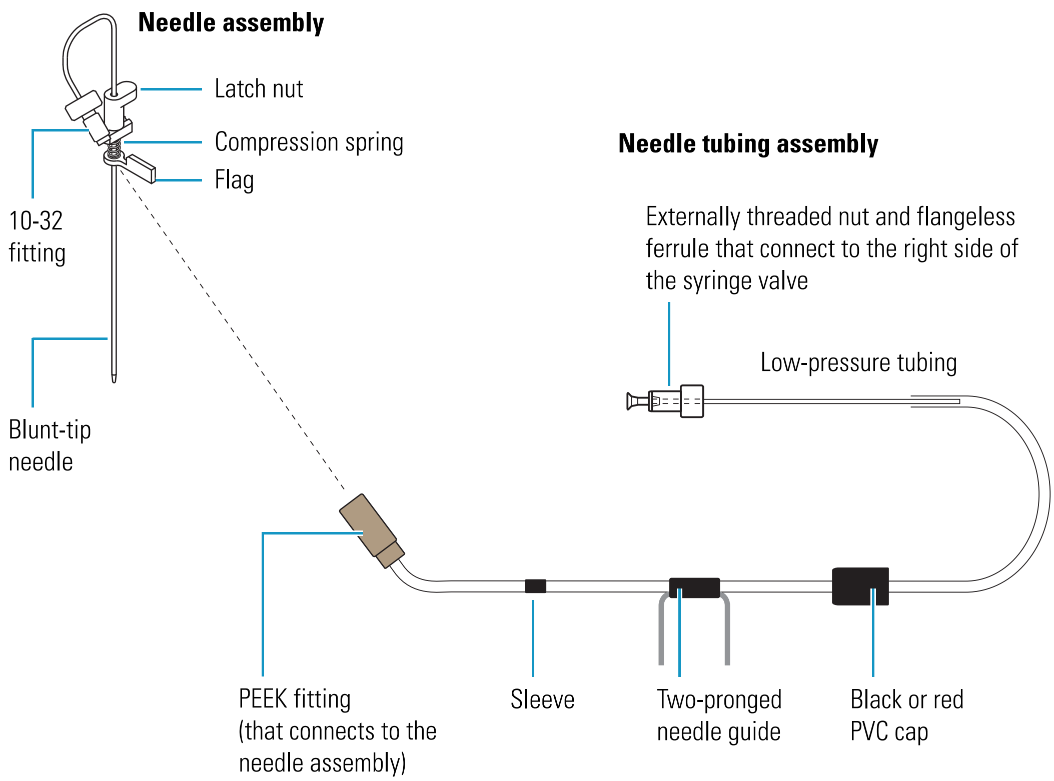
## Needle Tubing Assembly and Needle Assembly

Figure 4 shows the needle assembly and the needle tubing assembly.

The needle assembly consists of a blunt-tip needle, a latch nut, a flag, a compression spring, and an externally threaded fitting that connects to the needle tube assembly.

The needle tube assembly connects the solvent path between the needle and the syringe valve and consists of low-pressure tubing, an internally threaded fitting that connects to the needle assembly fitting, a sleeve, a black or red PVC cap, a needle tube guide that attaches to the *x*-axis positioning frame, and an externally threaded fitting with a flangeless ferrule that connects to the right side of the syringe valve.

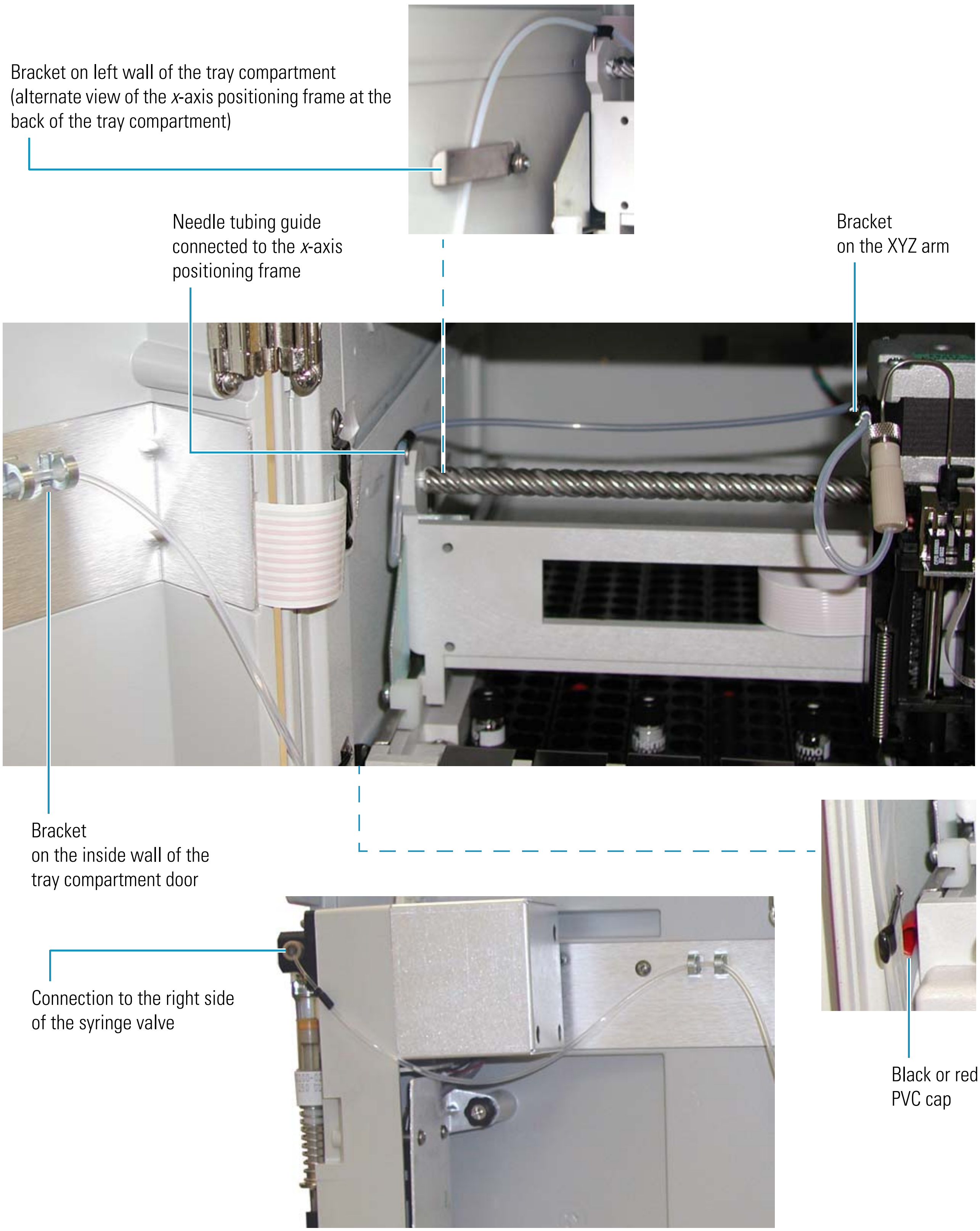
**Figure 4.** Needle assembly and needle tubing assembly




The needle mount on the XYZ arm holds the needle assembly. To prevent the needle tubing from interfering with the movement of the XYZ arm, the following items secure the needle tubing to the autosampler (see Figure 5):

- A bracket on the XYZ arm
- A guide on the *x*-axis positioning frame
- A bracket on the left wall of the tray compartment
- A PVC cap that holds the tubing below the metal runner for the *x*-axis positioning frame
- A bracket on the inner wall of the tray compartment door

**Figure 5.** Needle tubing assembly connections



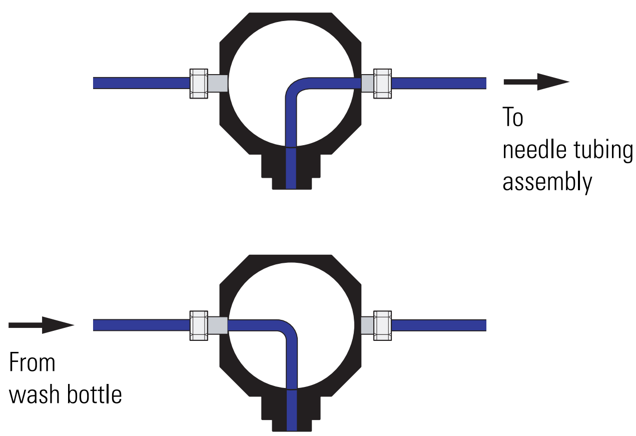
The standard needle tubing assembly holds approximately 560 µL of liquid. During an injection, the syringe draws sample into the needle tubing, not into the syringe barrel. If your autosampler is configured with a 2500 µL standard syringe, and you want to make partial loop injections greater than 500 µL or full loop injections greater than 150 µL, you must add additional needle tubing to your autosampler.

The tubing extension, which the autosampler needs to make large volume injections, holds up to 1 mL of liquid. Adding this additional tubing to your autosampler allows the withdrawal of up to 1500 µL from a sample location or a reservoir vial. To attach this additional tubing to your autosampler, detach the needle tubing assembly from the syringe valve. Use the Teflon™ connector to attach the additional tubing to the needle tubing assembly. Attach the other end of the additional tubing to the syringe valve.

## Syringe Valve

The syringe valve is a 2-position rotary valve (see Figure 6). In the wash bottle position, the downward movement of the syringe plunger draws wash solvent from the wash bottle into the syringe barrel. In the needle position, the downward movement of the syringe plunger draws liquid from a sample vial or a reservoir vial into the needle tubing. As the syringe plunger moves upward, it pushes liquid out of the needle tubing.

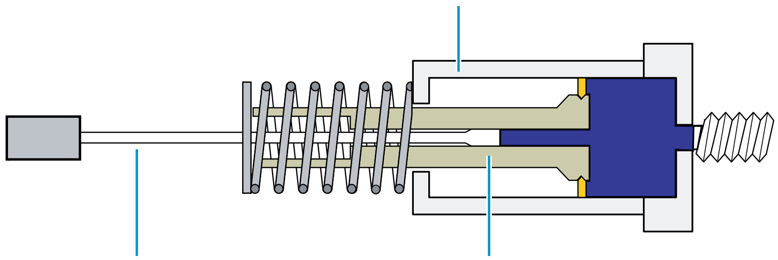
**Figure 6.** Two-position rotary syringe valve



## Syringe

The Accela Autosampler uses a syringe with two concentric barrels to perform liquid transfers (see Figure 7). The autosampler uses the inner barrel plunger to draw and deliver sample amounts equal to or less than the nominal size of the syringe and the outer barrel plunger to draw and expel volumes up to 560 µL.

**Figure 7.** Dual concentric syringe




The inner plunger wears more rapidly than the rest of the syringe. The lifespan of the inner plunger is approximately 50 000 injections. Replace the inner plunger if you notice liquid leaking from the bottom of the syringe. For ordering information, see page 252.

Dual concentric syringes are available in 100, 250, and 500 µL sizes. In addition, a 2500 µL standard syringe is available. The size of the syringe determines the injection volume range. Table 2 lists the minimum and maximum injection volumes for each syringe size.

**Table 2.** Allowable injection volumes based on the syringe size

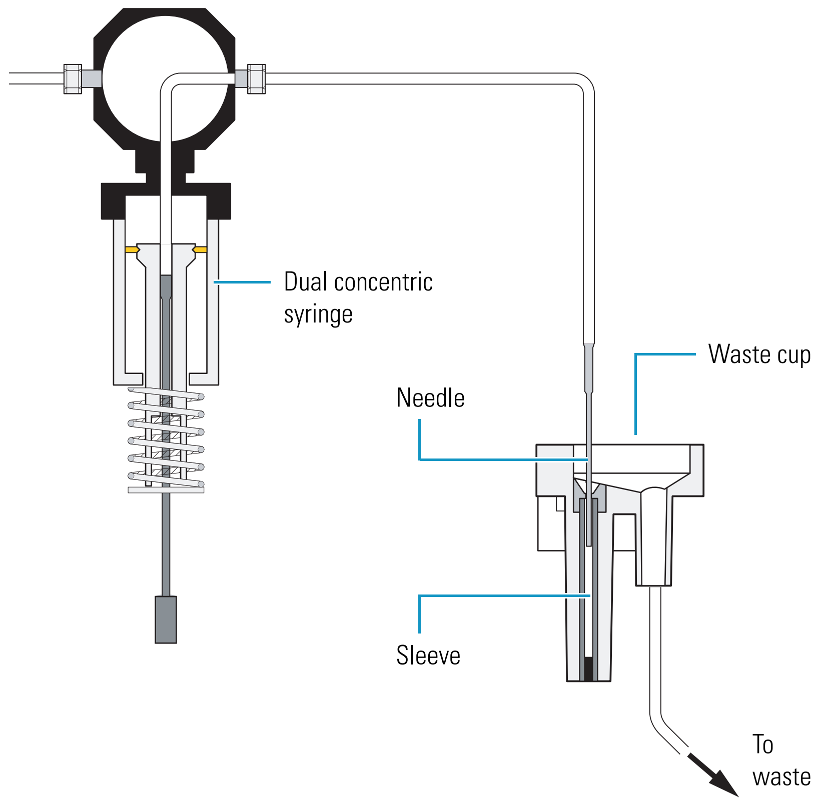
| | Injection volume (µL) | | | |
|---|---|---|---|---|
| Syringe size (µL) | Minimum | Maximum (No waste) | Maximum (Partial loop) | Maximum (Full loop) |
| 100 | 0.1 | 20 | 20 | 20 |
| 250 | 0.1 | 100 | 100 | 100 |
| 500 | 0.1 | 250 | 250 | 250 |
| 2500 | 0.1 | 1000 | 1000 | 1000[a] |

[a] Requires an extension to the standard needle tubing.

## Wash Station

The wash station is a waste cup containing an inner sleeve slightly larger than the needle (see Figure 8). Low-pressure tubing connects the waste cup to the waste bottle. To wash the outside of the needle, the XYZ arm moves the needle to the wash station and lowers the needle into the inner sleeve of the waste cup. The syringe draws solvent from the wash bottle or requested reservoir vial, and then expels the solvent through the needle. As it fills the waste cup, the expelled solvent flows up over the exterior surface of the needle, and then out the waste tubing to the waste bottle.

**Figure 8.** Wash station



## Injection Port of the Autosampler and Transfer Tube

A transfer tube connects the injection port (see Figure 9) to the injection valve (see Figure 10). The transfer tubing has an inner diameter of 0.012 in. One end of the tubing has a flanged stainless steel fitting that connects to the injection port. The other end of the tubing has a PEEK™ fitting that connects to port 2 of the injection valve (see Figure 11).

**IMPORTANT**

1. The label attached to the transfer tube assembly specifies the internal volume of the tubing. Because the autosampler uses this value for its injection algorithm, you must type this value in the Dead Volume box when you configure the Accela Autosampler. If you do not enter the value listed on the label, your data might be compromised.
2. You can constrict the transfer tube by overtightening the fitting to port 2 of the injection valve. Lack of injection precision is a symptom of a constricted transfer tube.

**Figure 9.** Injection port of the Accela Autosampler

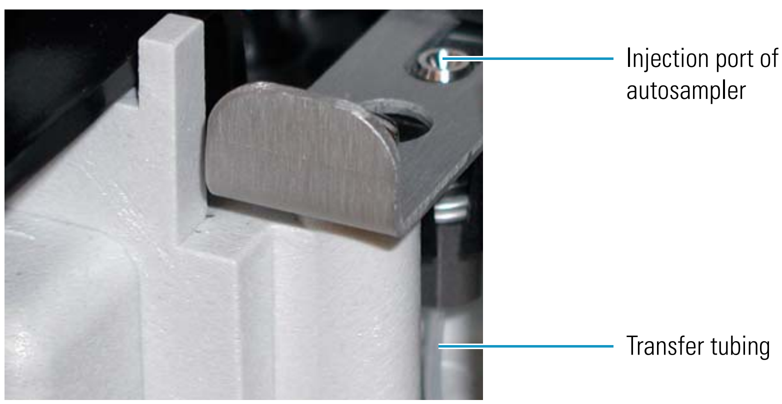
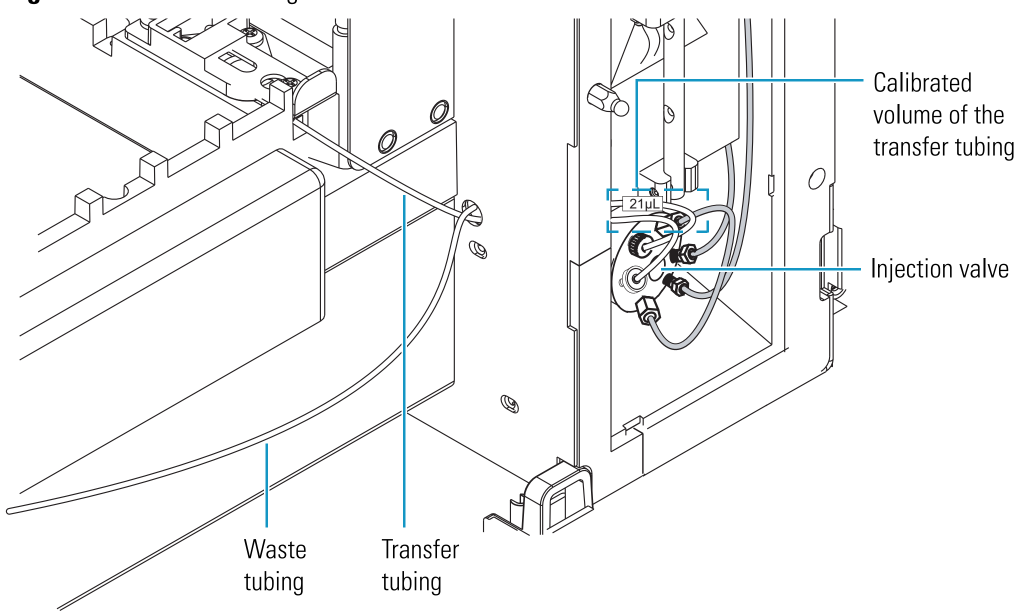



**Figure 10.** Transfer tubing connections

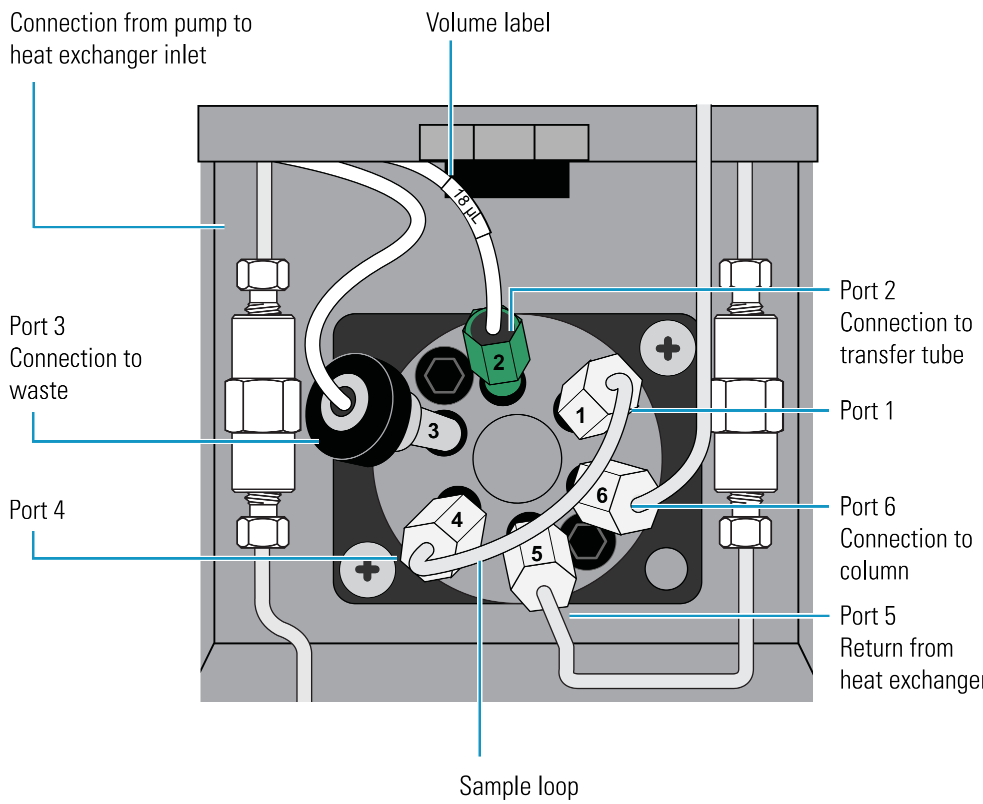


## Injection Valve

The injection valve is a six-port, two-position valve that introduces sample onto the column by way of the sample loop (see Figure 11).

**Note** Figure 11 shows the plumbing connections to the current heat exchanger. For information about the plumbing connections to the original heat exchanger, see "Legacy Versions of the Accela Autosampler" on page 271.

**Figure 11.** Six-port rotary injection valve



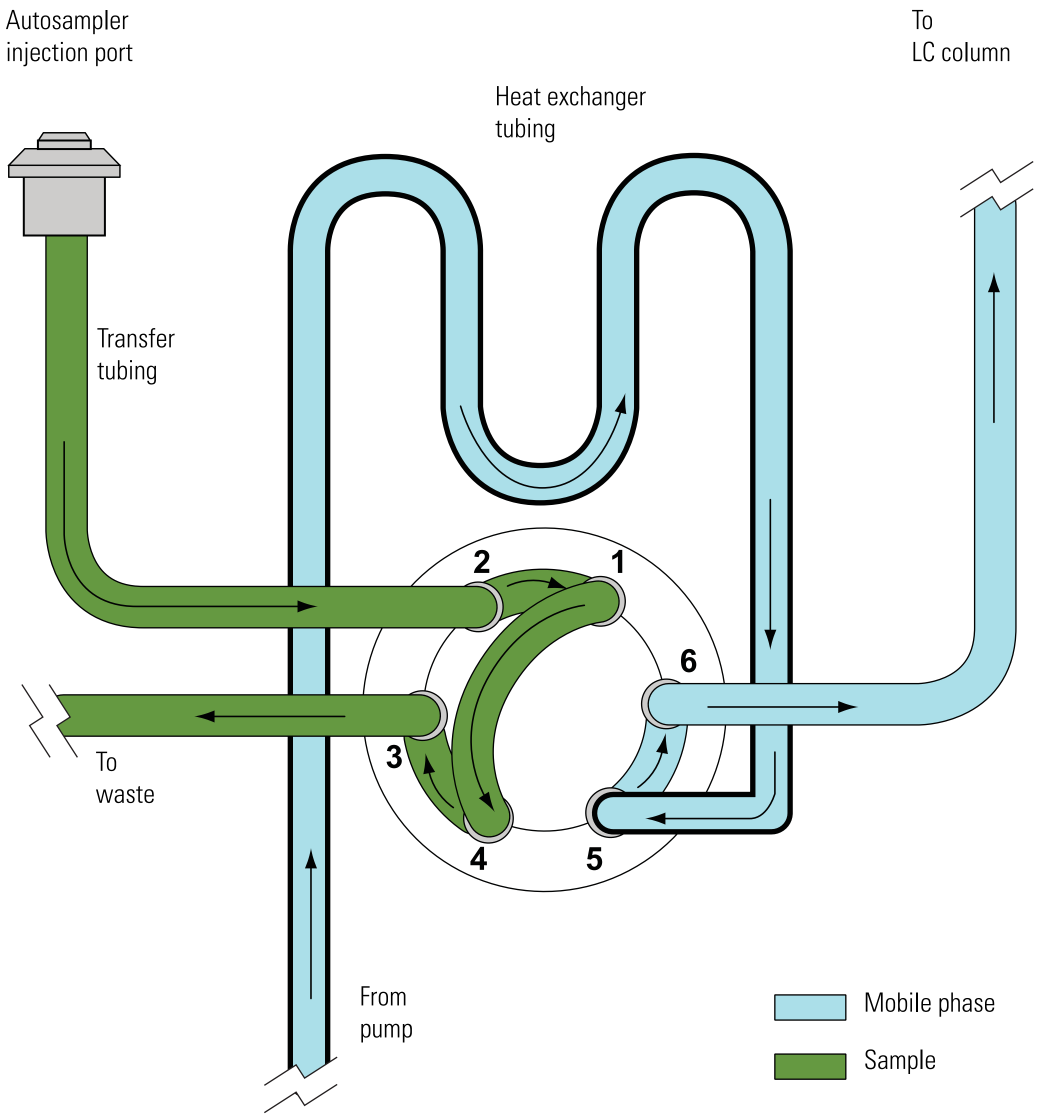

There are two positions for the injection valve: fill (load) and inject. Three passages are open in each position.

In the fill (load) position (see Figure 12), the three passages connect the following ports:

- The injection port of the injection valve (port 2) is connected to the front of the sample loop (port 1).
- The back of the sample loop (port 4) is connected to the waste line (port 3).
- The temperature-equilibrated mobile phase that has passed through the heat exchanger (port 5) is connected to the LC column (port 6).

To isolate the sample loop from the mobile phase stream, the autosampler rotates the valve to the load position (see Figure 12). While the mobile phase stream bypasses the loop, the syringe pushes sample through the transfer tubing and into the front of the sample loop. As the sample loop fills with sample, excess solution passes out of the back of the sample loop to waste.

**Figure 12.** Fill (load) position for the six-port injection valve

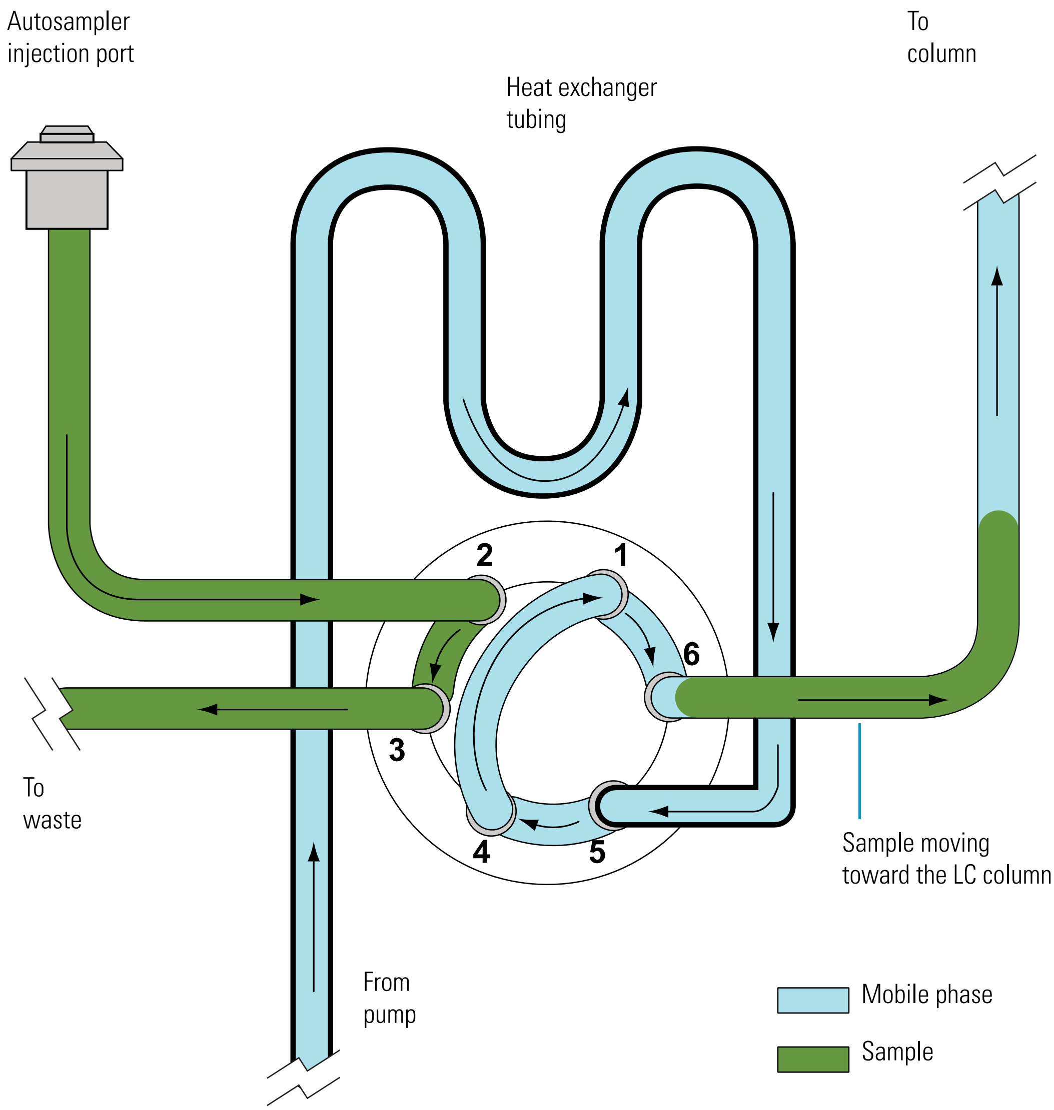


In the inject position (see Figure 13), the three passages connect the following ports:

- The solvent return from the heat exchanger (port 5) is connected to the back of the loop (port 4).
- The front of the sample loop (port 1) is connected to the column inlet (port 6).
- The injection port of the injection valve (port 2) is connected to the waste line (port 3).

To put the sample loop into the path of the mobile phase stream, the autosampler rotates the valve to the inject position (see Figure 13). The mobile phase stream enters the sample loop from the back, backflushing the contents of the sample loop onto the column. Excess sample left in the transfer tube passes directly to waste. To provide ample rinsing of the sample loop with mobile phase, the injection valve remains in the inject position during the entire run.

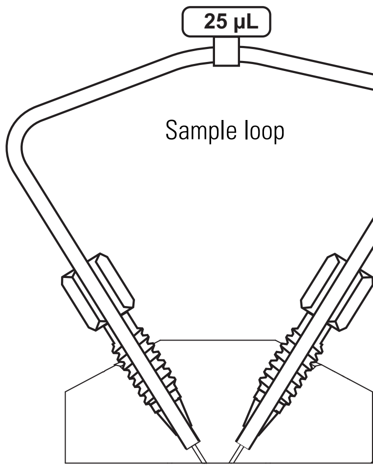
**Figure 13.** Inject position for the six-port injection valve



## Sample Loop

The sample loop is a stainless steel tube with end fittings that holds the sample prior to its introduction onto the column. The sample loop is an interchangeable part swaged onto ports 1 and 4 of the six-port injection valve (see Figure 14).

**Figure 14.** Schematic of the sample loop attached to the injection valve




Thermo Fisher Scientific ships the Accela Autosampler with a 25 µL sample loop. Sample loops are available in nominal sizes ranging from 5 to 1000 µL. The accuracy of the sample loop volume is ± 20%. This means that the actual volume of a 25 µL sample loop is between 20 to 30 µL. For ordering information, see "Consumables" on page 252.

# Column Oven and Tray Compartment Heater and Cooler

The built-in column oven controls the temperature of the air surrounding the chromatographic column. Isothermal temperature control is achieved with a Peltier device. The Peltier device is a solid-state, heat-transferring assembly used to heat or cool the column oven. The temperature control range is 5 to 95 °C.

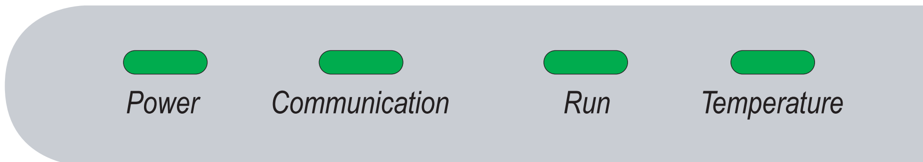
Between the pump outlet and the autosampler injection valve, the mobile phase passes through a heat exchanger that is located behind the column oven plate. As the mobile phase passes through the heat exchanger, it equilibrates to the temperature of the column oven. The heat exchanger consists of a length of 0.004 in. ID tubing that adds only 3 µL of gradient delay volume to the system (see Figure 68 on page 84).

The tray temperature control feature provides temperature control of the samples in the range from 0 to 60 °C. A Peltier device maintains the tray temperature.

# Status LEDs

Four status light-emitting diodes (LEDs) labeled Power, Communication, Run, and Temperature are located on the front of the autosampler's tray compartment door (see Figure 15). Table 3 lists the states of the LEDs.

**Figure 15.** Status LEDs




**Note** To control the temperature of the column oven compartment and the tray compartment, select the Wait for Temperature Ready check box when you add the Accela Autosampler to the data system instrument configuration.

**Table 3.** Status LED states

| LED | State | Meaning |
|---|---|---|
| **Power** | Green | The autosampler power is on. |
| **Comm** | Amber | Communication with the data system has not been established. |
| | Green | Communication with the data system has been established. |
| **Run** | Flashing Amber | An error condition, such as an XYZ arm jam or initialization startup error, has occurred. |
| | Green | The autosampler is in the Ready state. |
| | Flashing Green | An injection or timed event is in progress. |
| **Temp**[a] | Amber | A temperature change within the column oven or tray temperature zones is in progress. |
| | Green | The column oven and tray temperature zones are in equilibrium at the set temperature. |

[a] The Temp LED remains green if you do not select the Wait for Temperature Ready check box when you add the Accela Autosampler to the instrument configuration.

# Injection Modes

The Accela Autosampler can perform the following injection modes:

- No Waste Injection
- Partial Loop Injection
- Full Loop Injection

The optimum injection mode depends on the amount of sample that you have and the degree of precision that your application requires.

## No Waste Injection

In the no waste injection mode, the autosampler withdraws only the exact amount of sample requested from the sample vial. Of the three injection modes, the no waste injection mode uses the least amount of sample, but it is also the least precise. Use this injection mode to conserve sample.

**IMPORTANT** For no waste injections, do the following:

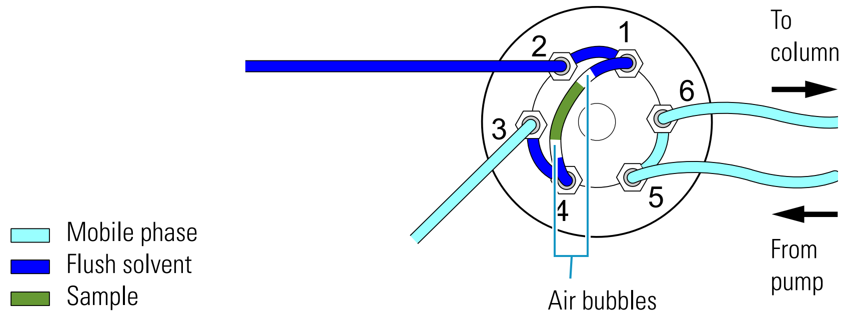
- Use a sample loop that is at least 5 µL larger than the injection volume. Because the accuracy of the nominal size is ± 20%, use an estimate of 80% for the actual size. For example, use 20 µL as an estimate for the actual volume of a 25 µL loop, and inject no more than 15 µL with this loop size.
- Consider matching the chemistry of the sample matrix, the flush solution, and the mobile phase. For no waste injections, the autosampler loads approximately 2 µL of flush solvent and 3 µL of air into the sample loop (see Figure 16), regardless of the requested injection volume.
- Inject at least 1.0 µL of sample.

Approximately 0.25 µL of the sample is lost as it travels from the injection port through the transfer tubing and into the injection valve. Because of this loss, inject at least 1.0 µL of sample with the no waste injection mode.

The quantity of lost sample depends on the syringe rate. Decreasing the syringe rate decreases the sample loss. Thermo Fisher Scientific recommends a syringe rate no greater than 4 µL/s for the no waste injection mode.

In addition to the sample, the no waste injection mode loads approximately 2 µL of flush solvent and 3 µL of air into the sample loop (see Figure 16). Because these values are independent of the injection volume, the chemistry of the flush solution can affect your chromatographic results. For best chromatographic results, consider matching the chemistry of the sample matrix, the flush solution, and the mobile phase.

**Figure 16.** No waste injection mode – load position




**Note** The two 1.5 µL air bubbles isolate the sample from the flush solvent.

## Partial Loop Injection

In the partial loop injection mode, the autosampler withdraws 22 µL of excess sample from the vial in addition to the requested injection volume. The autosampler expels approximately one-half of the excess volume to waste before it meters the center of the sample plug into the front of the sample loop. It expels the second portion of excess sample to waste after the mobile phase stream backflushes the contents of the sample loop onto the column.

Because the autosampler meters sample into the sample loop, the partial loop injection mode is less precise but more accurate than the full loop injection mode. You can inject variable amounts of sample, ranging from a minimum of 0.1 µL to a practical maximum of one-half the volume of your sample loop. The laminar flow of fluid within the stainless steel sample loop causes this maximum volume limitation.

**IMPORTANT** To make precise partial loop injections, limit the maximum injection volume to less than half the nominal sample loop size. Because the accuracy of the nominal volume of the sample loop is ± 20% (which means that the actual volume of the standard 25 µL sample loop is between 20 µL and 30 µL), for best results, limit the maximum injection volume to 10 µL for the standard sample loop.

## Full Loop Injection

In the full loop injection mode, the autosampler withdraws a sample volume sufficient to overfill the loop (according to the equation given on page 19). Because the actual injection volume is determined by the size of the loop, not the metering action of the stepper motor, a full loop injection is very reproducible. However, because the full loop injection mode completely fills the sample loop, you cannot inject variable amounts of sample.

Use the full loop injection mode when you want maximum precision and have unlimited sample. However, if you want to change the injection volume, you must replace the attached sample loop with one of a different size. The available sample loop sizes are listed in "Consumables" on page 252.

**Note** You enter the size of the sample loop when you configure the Accela Autosampler.

In the full loop injection mode, the autosampler withdraws a large excess of solution from the sample vial according to the following equation:

$$\text{Amount withdrawn} = 3 \times IV + DV + 7.5\ \mu\text{L}$$

Where:

$IV$ = requested injection volume

$DV$ = Volume of the transfer tube + volume of the injection port of the autosampler and the rotor slot (1.6 µL)

This equation is valid until the volume exceeds the maximum capacity of the syringe. If you request a 100 µL full loop injection and your autosampler has a 250 µL syringe, the autosampler withdraws 265 µL of sample solution from the vial, which is the maximum capacity of the syringe. A sample volume equal to the actual volume of the sample loop is injected onto the column. Table 4 lists the maximum capacity for each syringe.

**Table 4.** Maximum volume withdrawn for full loop injections

| Nominal syringe size | Maximum volume withdrawn |
|---|---|
| Concentric 100 µL | 101 µL |
| Concentric 250 µL | 265 µL |
| Concentric 500 µL | 535 µL |
| Standard 2500 µL | 1544 µL[a] |

[a] The data system limits the maximum amount withdrawn to 1544 µL.

# Injection Sequence

The primary sequence of events for the full loop injection mode is as follows:

1. Getting ready for an injection
2. Drawing sample from the vial
3. Loading sample into the loop
4. Injecting sample
5. Post-injection events

The full loop injection mode draws enough sample to overfill both the transfer tube and the sample loop. The no waste injection mode, however, draws only the injection volume requested, and the partial loop injection mode draws only the injection amount requested plus an additional 22 µL.

As a result, unlike the full loop mode, both the partial loop and no waste injection modes require additional solvent to push the sample all the way through the transfer tubing to the injection valve before the sample is loaded into the loop. The syringe draws this extra transport solvent from the wash bottle and uses it to compensate for the volume held by the injection port of the autosampler, the transfer tube, and the rotor slot of the injection valve. Before the sample is loaded into the loop, the syringe uses the transport solvent to push the sample to the injection valve.

The primary sequence of events for both the partial loop injection mode and the no waste injection mode is as follows:

1. Getting Ready for an Injection
2. Drawing Transport Solvent (Partial Loop and No Waste Injections)
3. Drawing Sample
4. Pushing Transport Solvent (Partial Loop and No Waste Injections)
5. Loading Sample into the Sample Loop
6. Injecting Sample onto the Column
7. Post-Injection Events

Table 5 outlines the sequential events that occur during an injection.

**Table 5.** Injection sequence

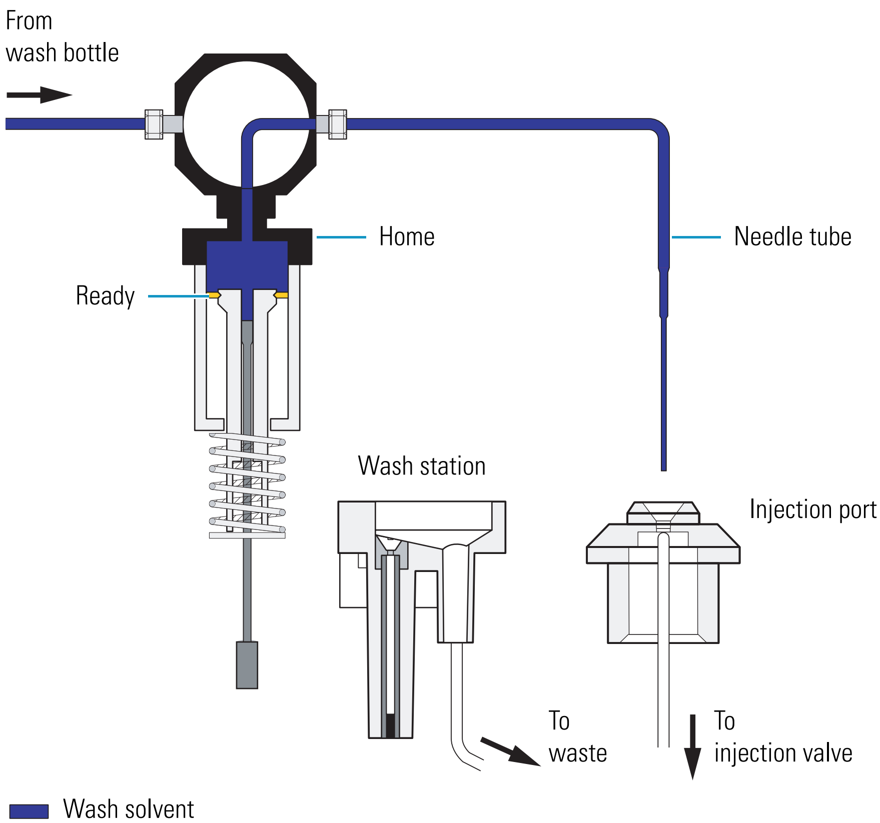
| # | Full loop | # | Partial loop | No waste |
|---|---|---|---|---|
| 1 | **Get ready for injection** | 1 | **Get ready for injection** | **Get ready for injection** |
| | | | Switch injector to inject position | Switch injector to inject position |
| | N/A | 2 | **Draw transport solvent** | **Draw transport solvent** |
| | | | Switch syringe valve to wash solvent position | Switch syringe valve to wash solvent position |
| | Switch injector to fill position | | Draw wash solvent (transport volume = total dead volume + 7.5 µL) | Draw wash solvent (transport volume = total dead volume) |
| 2 | **Draw Sample** | 3 | **Draw Sample** | **Draw Sample** |
| | Move XYZ arm to vial | | Move XYZ arm to vial | Move XYZ arm to vial |
| | Switch syringe valve to needle position | | Switch syringe valve to needle position | Switch syringe valve to needle position |
| | Draw 3 µL air bubble | | Draw 3 µL air bubble | Draw 1.5 µL air bubble |
| | Draw sample [(3 × IV) + DV + 7.5 µL] | | Draw sample equal to Inject Volume (IV) = 22 µL | Draw sample equal to Inject Volume (IV) |
| | Draw 3 µL air bubble | | Draw 3 µL air bubble | Draw 1.5 µL air bubble |
| | **N/A** | 4 | **Push Transport Solvent** | **Push Transport Solvent** |
| | Move XYZ arm to injection port of autosampler | | Move XYZ arm to injection port of autosampler | Move XYZ arm to injection port of autosampler |
| | | | Push the transport volume into the transfer tube | Push the transport volume (minus 1 µL) into the transfer tube |
| 3 | **Load Sample into Loop** | 5 | **Load Sample into Loop** | **Load Sample into Loop** |
| | | | Switch the injector to fill position | Switch the injector to fill position |
| | Overfill the sample loop | | Meter the sample plug into the loop | Meter the sample plug + air bubbles + 2 µL wash solvent into the loop |
| 4 | **Switch the injector to inject position** | 6 | **Switch the injector to inject position** | **Switch the injector to inject position** |
| 5 | **Post-Injection Events** | 7 | **Post-Injection Events** | **Post-Injection Events** |
| | Perform optional flush/wash | | Perform optional flush/wash | Perform optional flush/wash |
| | Home syringe | | Home syringe | Home syringe |
| | Prepare for next injection | | Prepare for next injection | Prepare for next injection |

## Getting Ready for an Injection

Before an injection sequence begins, the autosampler initializes the syringe plunger to the Ready position (see Figure 17).

- If the syringe plunger is in the Home Side of Ready position, the autosampler switches the syringe valve to the solvent bottle position, and then returns the syringe plunger downward to the Ready position at flush speed.
- If the syringe plunger is below the Ready position, the autosampler switches the syringe valve to the needle position, the XYZ arm moves the needle to the wash station, and the syringe plunger moves upward to the Ready position at flush speed.

**Figure 17.** Syringe, syringe valve, and needle position prior to injection (Ready position)



## Drawing Transport Solvent (Partial Loop and No Waste Injections)

To draw transport solvent, the syringe valve switches to the wash bottle position. The amount of solvent that the syringe draws from the wash bottle, referred to as the transport volume, depends on both the injection mode and the configured value for the dead volume.

**IMPORTANT** A transfer tube connects the injection port of the autosampler to port 2 of the injection valve. The transfer tube is labeled with its factory calibrated volume. When you configure the autosampler, you must type the label value in the Dead Volume box of the Accela Configuration dialog box.

In the no waste injection mode, the syringe draws only enough solvent to compensate for the total dead volume of the system according to the following equation:

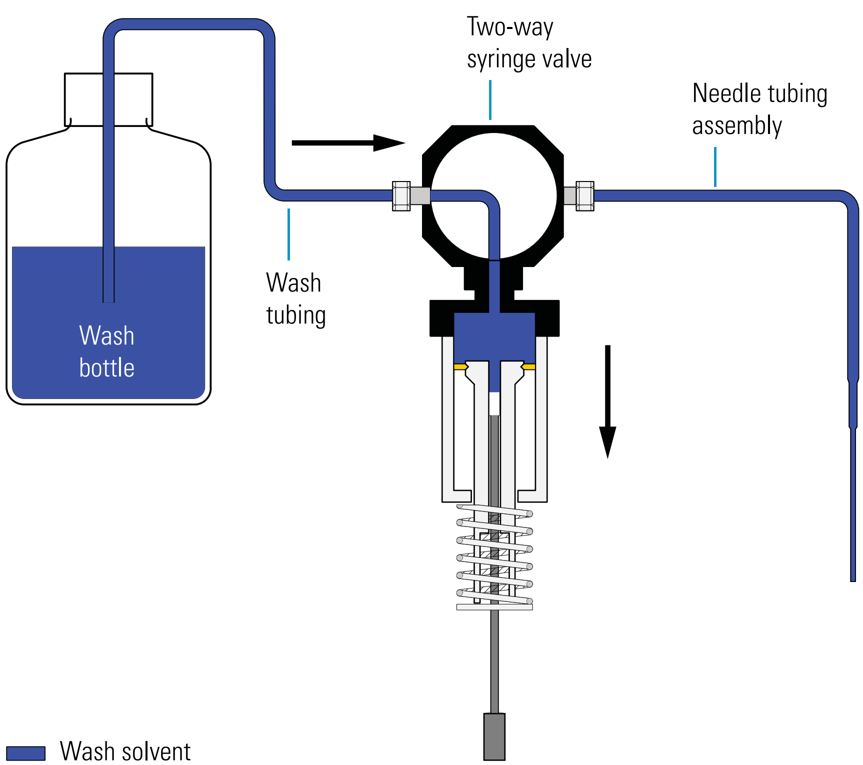
*Transport solvent volume = Total dead volume*

Where:

Total Dead Volume = Transfer tube volume + volume of the injection port of the autosampler and the rotor slot of the injection valve (1.6 µL)

In the partial loop injection mode, the syringe draws enough solvent from the wash bottle to compensate for the total dead volume of the system plus an additional 7.5 µL of solvent (see Figure 18).

**Figure 18.** Drawing wash solvent from the wash bottle



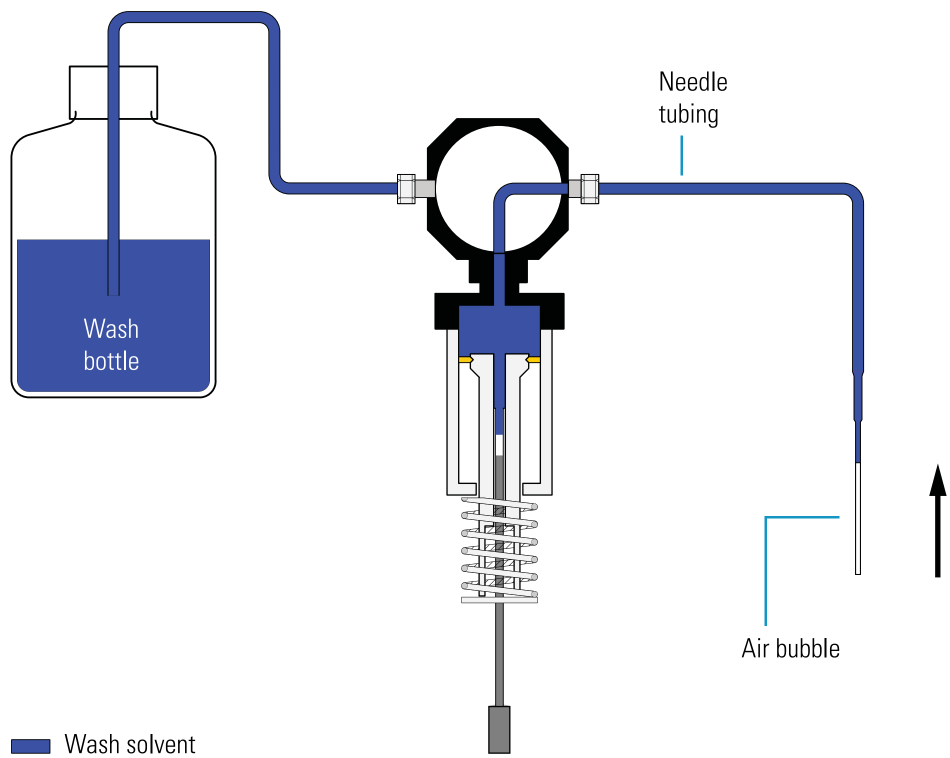
## Drawing Sample

The autosampler draws sample from the sample vial or well as follows:

> **Note** For the full loop injection mode, the injection valve rotates to the load position. For both the no waste injection mode and the partial loop injection mode, the injection valve remains in the inject position.

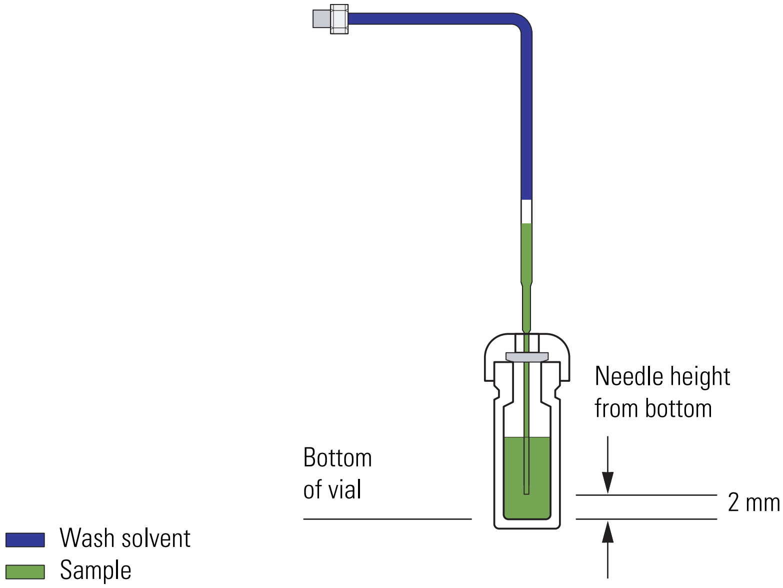
1. The XYZ arm moves to the sample vial.
2. The syringe valve switches to the needle position.
3. The inner syringe plunger descends, drawing an air bubble into the tip of the needle. Depending on the injection mode, the autosampler draws the following volume of air (see Figure 19):
   - For partial loop and full loop injections, the syringe draws 3 µL of air.
   - For no waste injections, the syringe draws 1.5 µL of air.

**Figure 19.** Drawing the first air bubble



4. The XYZ arm lowers the needle tip into the sample vial to the depth requested (see Figure 20).

**Figure 20.** Needle withdrawing sample from a standard vial



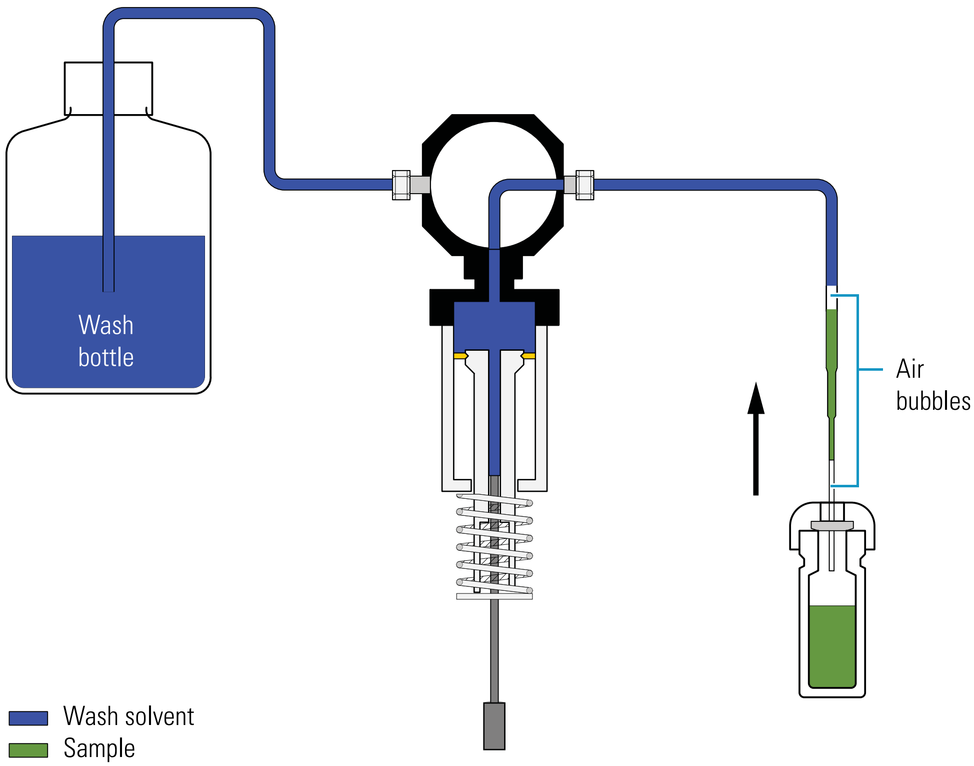

> **Note** The autosampler lowers the needle tip to the position requested in the Needle Height From Bottom box of the Accela Autosampler page of the Instrument Setup dialog box. The allowable range is 0.1 to 18 mm from the bottom of the vial.

5. The inner syringe plunger descends further, drawing sample at syringe sample speed. The volume of sample that the autosampler draws from the vial depends on the requested injection volume and the injection mode as follows:

   - For no waste injections, the autosampler draws only the requested injection volume.
   - For partial loop injections, the autosampler draws the requested injection volume plus an additional 22 µL.

6. The XYZ arm raises the needle out of the sample vial (see Figure 21). The inner syringe plunger descends further, drawing a second air bubble into the needle. The sample plug is now isolated between the two air bubbles.

**Figure 21.** Drawing a second air bubble, which isolates the sample plug




## Pushing Transport Solvent (Partial Loop and No Waste Injections)

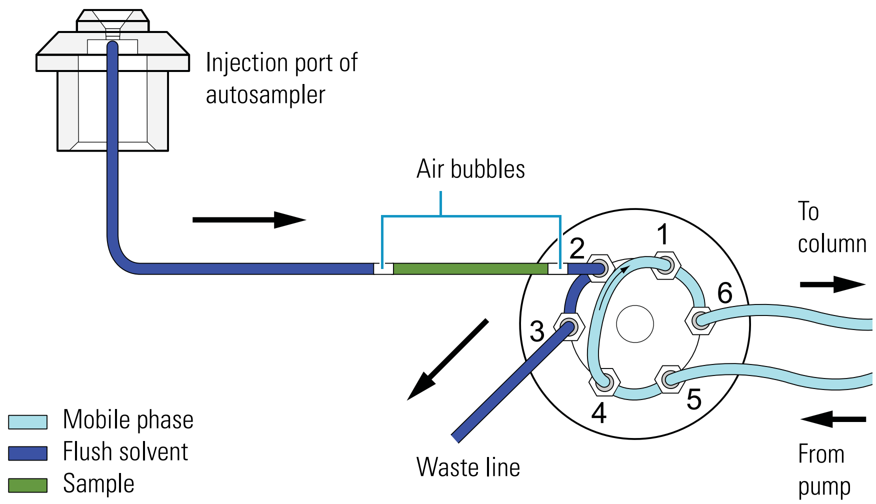
The XYZ arm moves to the home position, and then lowers the needle into the injection port of the autosampler. The inner syringe plunger moves upward, pushing the sample plug followed by the transport solvent into the transfer tube.

The actions that occur during the pushing transport solvent step depend on the injection mode.

## Pushing Transport Solvent Step for No Waste Injections

The needle expels 1 µL less than the transport volume into the transfer tube. The sample plug falls just short of the entry to the injection port (port 2) of the injection valve (see Figure 22).

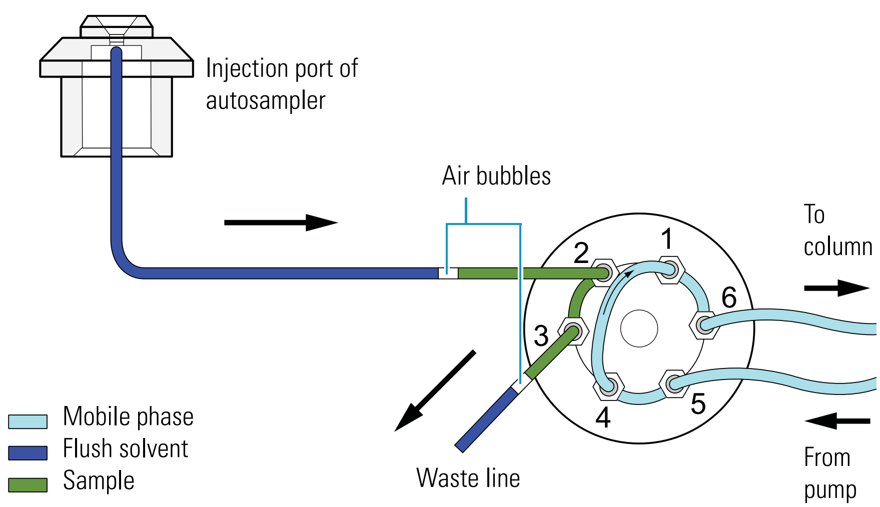
**Figure 22.** No Waste injection—Pushing transport solvent step




## Pushing Transport Solvent Step for Partial Loop Injections

The needle expels the transport volume, which is equal to the dead volume between the injection port of the autosampler and the injection valve plus an excess of 7.5 µL, into the transfer tube. This pushes 4.5 µL of the sample plug plus the first 3 µL bubble through the injection valve and out to waste (see Figure 23).

**Figure 23.** Partial Loop Injection—Pushing transport solvent step



# Loading Sample into the Sample Loop

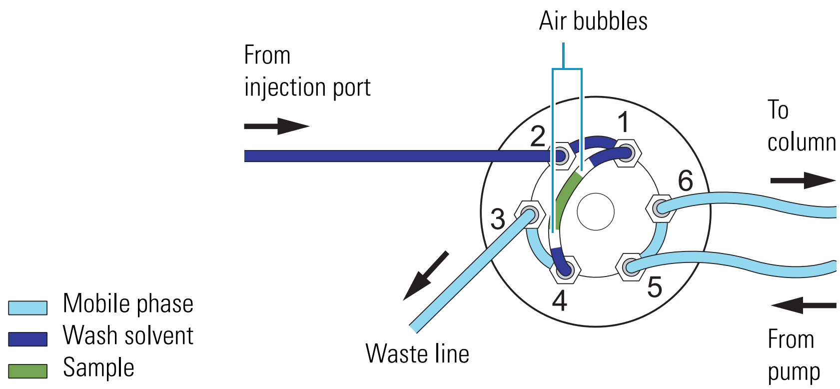
The injection valve switches to the fill position for both the partial loop injection mode and the no waste injection modes. For a full loop injection, the injection valve switches to the fill position at the beginning of the injection sequence. The syringe then pushes the sample into the sample loop. The Accela Autosampler issues a momentary Gradient Start signal.

The actions that occur during the sample loading step depend on the injection mode.

## Sample Loading for No Waste Injections

The syringe meters the requested sample volume plus 5 µL into the sample loop. This pushes the sample plug, the two bracketing air bubbles, and approximately 2 µL of wash solvent into the sample loop (see Figure 24).

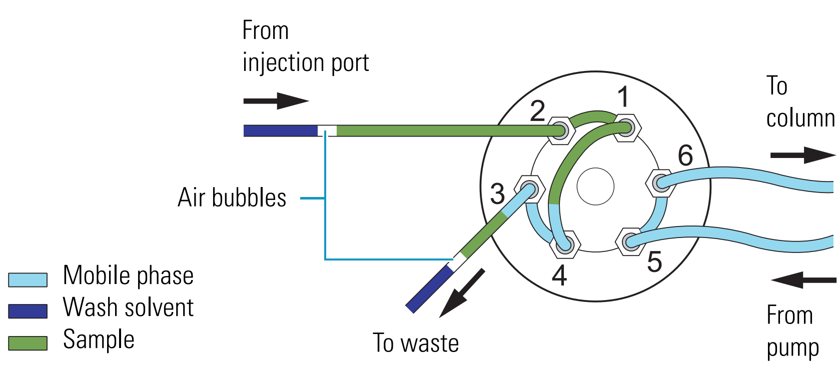
**Figure 24.** No Waste injection—Loading the sample loop




## Sample Loading for Partial Loop Injections

The syringe meters the requested sample volume into the sample loop. This leaves approximately 16 µL of excess sample plus the second 3 µL air bubble in the transfer line (see Figure 25).

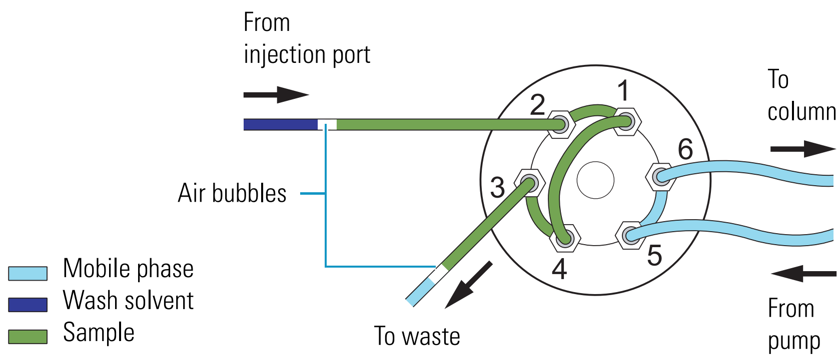
**Figure 25.** Partial Loop injection—Loading the sample loop



### Sample Loading for Full Loop Injections

The needle expels the sample into the sample loop. As the sample loop becomes overfilled, excess sample exits through the waste line (see Figure 26).

**Figure 26.** Full Loop injection—Loading the sample loop

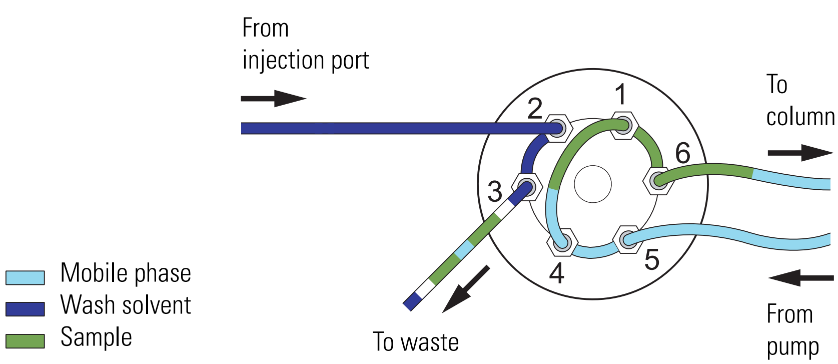



## Injecting Sample onto the Column

The autosampler backflushes the contents of the sample loop onto the column as follows:

1. The injection valve switches to the inject position.
2. Mobile phase enters the sample loop from the back, sweeping the contents of the sample loop onto the column (see Figure 27).
3. The autosampler issues a momentary Inject Out signal.

**Figure 27.** Partial Loop injection—Injecting sample



## Post-Injection Events

At the end of an injection, the autosampler performs the following operations:

1. The autosampler performs an optional flush, wash, or both as specified in the instrument method.
   - **Flush** (optional): During an internal flush, the autosampler lowers the needle into the injection port, and then dispenses a specified volume of solvent through the needle and transfer line out to waste. You can select the solvent wash bottle or a reservoir vial as the flush solvent source. The internal flush removes excess or residual sample from the injection flow path. It does not flush the sample loop.
   - **Wash** (optional): During an external wash, the autosampler lowers the needle into the wash station, and then dispenses a specified volume of solvent through the needle. As the wash station overfills, the wash solvent flows up over the exterior of the needle, and then out to waste. You can select the solvent wash bottle or a reservoir vial as the wash solvent source.
2. The autosampler moves the syringe plunger to the Ready position, and then switches the syringe valve to point to the wash bottle.
3. The autosampler prepares for the next injection by moving the XYZ arm to the Home position, located above the injection port of the autosampler.

# Autosampler Operation

You have full control of the autosampler from the Xcalibur and ChromQuest data systems and limited control of the autosampler from other Thermo Scientific mass spectrometry applications. The power switch is the only manual control. The data system Help, the *Accela User Guide for LC Devices,* and the *Accela User Guide for the ChromQuest Data System* provide information on how to operate the autosampler.

**Note** You can create instrument methods to control the Accela Autosampler from several Thermo Scientific mass spectrometry applications; however, you can calibrate the Accela Autosampler only from the ChromQuest or Xcalibur data system.

The Help and the manuals (provided as PDF files) include information on how to do the following:

- Calibrate the well bottom position for custom vials or wellplates (see “Calibrating the Accela Autosampler” on page 47).
- Perform direct commands to flush the syringe, move the XYZ arm (see “XYZ Arm Mechanism” on page 5), inject sample, and so on.
- Create an instrument method for data acquisition.

# Automated Sample Preparation

With the automated sample preparation feature, you can build a pretreatment routine that the autosampler performs before it performs an injection. The pretreatment routine can consist of multiple tasks including transferring liquid between sample vials, transferring liquid from one of the four reservoir vials to a sample vial, mixing, and more.

The autosampler performs each task by drawing liquid into or expelling liquid from the needle tubing. It uses the inner plunger of the concentric syringe for liquid transfers that require a high degree of precision, such as a transfer of liquid between sample vials. It uses the outer plunger of the concentric syringe for liquid transfers that require less precision, such as sample mixing, which is performed using an aspirate and expunge technique.

For a complete list of sample preparation tasks that the autosampler can perform and a set of rules for creating sample preparation routines, refer to the Help provided with the data system.

# Specifications

These are specifications for the Accela Autosampler.

| | |
|---|---|
| Sample capacity: | • 200 vials in five removable trays<br>• 288 samples in three 96-well microplates<br>• 1152 samples in three 384-well microplates |
| Standard vial: | • 1.8 mL volume |
| Injection precision: | • $\leq$ 1.0% RSD at 5 µL and up |
| Partial loop injection volume: | • 10 µL with standard 25 µL sample loop and 250 µL syringe<br>• Up to 1000 µL injection volume with optional loops and syringes |
| Fixed loop (full loop) injection volume: | • 25 µL with standard loop and 250 µL syringe<br>• Up to 1000 µL injection volume with optional loops and syringes |
| Sample carryover: | • $\leq$ 0.1%<br>• 6 mL flush volumes, user-specified for internal and external needle wash cycles |
| Minimum sample volume: | • 1 µL can be injected from 5 µL |
| Needle height control: | • Programmable in 0.1 mm increments<br>• Active vial bottom search selectable on/off |
| Column oven: | • Programmable in 1 °C increments from 5 to 95 °C |
| Tray temperature control: | • Programmable in 1 °C increments from 0 to 60 °C<br>• Typical vial temperature from 4 to 50 °C |
| Reagent vials: | • Four 16 mL vials can be specified for flush/wash or dilution functions |
| Remote inputs: | • Pump ready, inject hold |
| Remote outputs: | • Pump stop, autosampler ready, inject, gradient start, four timed events |
| Ambient environment: | • 10 to 40 °C, 5 to 95% relative humidity, non-condensing |
| Dimensions: | • 37 × 36 × 50 cm ($h \times w \times d$)<br>• 14.5 × 15 × 20 in. ($h \times w \times d$) |
| Weight: | • 30 kg (66 lb) |
| Power requirements: | • 100/120/220/240 Vac nominal; 50/60 Hz, 550 VA |
| Product certification: | • CSA, TÜV/GS, FCC (EMI), VDE (EMI) |

# Installation

To install the Accela Autosampler as part of an Accela UHPLC system, use the "Installation Checklist" on page 34 and follow the procedures in this chapter. Make a copy of the checklist and fill it out when the installation is complete. Include the completed checklist in your maintenance records.

"Changing the Sample Loop" on page 48 describes how to change the sample loop, a piece of stainless steel tubing with two end fittings connected to the injection valve. For full loop (fixed loop) injections, the sample loop size determines the injection volume.

**Note** Install the Accela Autosampler in the sequence presented in the Installation Checklist.

**Contents**

# Software Compatibility

You have full control of the Accela Autosampler from the ChromQuest chromatography data system and the Xcalibur mass spectrometry application and limited control from several other Thermo Scientific mass spectrometry applications. The following data systems provide compatible firmware and a firmware upgrade utility (see "Downloading Firmware to the Autosampler" on page 259):

- For the ChromQuest 4.2 data system, you can find the Accela device drivers on the Accela Device Driver Add-on CD.
- For the ChromQuest 5.0 data system, you can find the Accela device drivers on the ChromQuest CD.
- For the Xcalibur data system, you can find the Accela device drivers on the LC Devices DVD.

# Installation Checklist

The following installation summarizes the steps that you must complete to properly install the Accela Autosampler.

❒ Unpack and inspect your instrument (page 35).

❒ Read the safety notices (front of manual).

❒ Make the initial instrument preparations (page 35).

❒ Make the initial back panel connections (page 36).

❒ Power on the autosampler for the first time (page 46).

❒ Install the Xcalibur 2.0 (or later) data system or the ChromQuest 4.2 (or later) data system and connect remote communication outputs, as required for external devices that are not controlled by the data system.

❒ Add the Accela Autosampler to the data system instrument configuration. For instructions on specifying the configuration options for the Accela Autosampler, refer to the *Accela User Guide for LC Devices,* the *Accela User Guide for the ChromQuest Data System*, or the Help provided by the data system.

This Accela Autosampler was installed by:

___________________________________________________________

(Name) (Date)

# Unpacking and Inspecting the Instrument

Carefully remove the autosampler from the shipping container and inspect both the autosampler and packing for any signs of damage. If you find any damage, save the shipping materials and immediately contact the shipping company.

The shipping container contains the Accela Autosampler and an accessory kit. Carefully check to make sure you received all the items listed on the packing list. Ensure that the needle tubing assembly is attached to the XYZ arm and the right side of the syringe valve, a 250 µL dual-concentric syringe is attached to the syringe drive mount, a 25 µL sample loop is attached to the injection valve, and the tray compartment contains five sample trays. Each tray holds 40 standard, 1.8 mL vials arranged in two rows of 20.

If any items are missing, contact your Thermo Fisher Scientific representative immediately.

To connect the autosampler to the other instruments in the Accela stack, you must have the Accela System Kit (see “Accela System Kit” on page 255). This kit is provided with orders for instruments sold together with either the Xcalibur or the ChromQuest data system or as a separate option.

# Making Initial Instrument Preparations

Place the autosampler on a benchtop. Allow at least 15 cm (6 in.) of space between the back panel of the autosampler and any wall or obstruction. This provides clearance for the back-panel connectors and cool air flow.

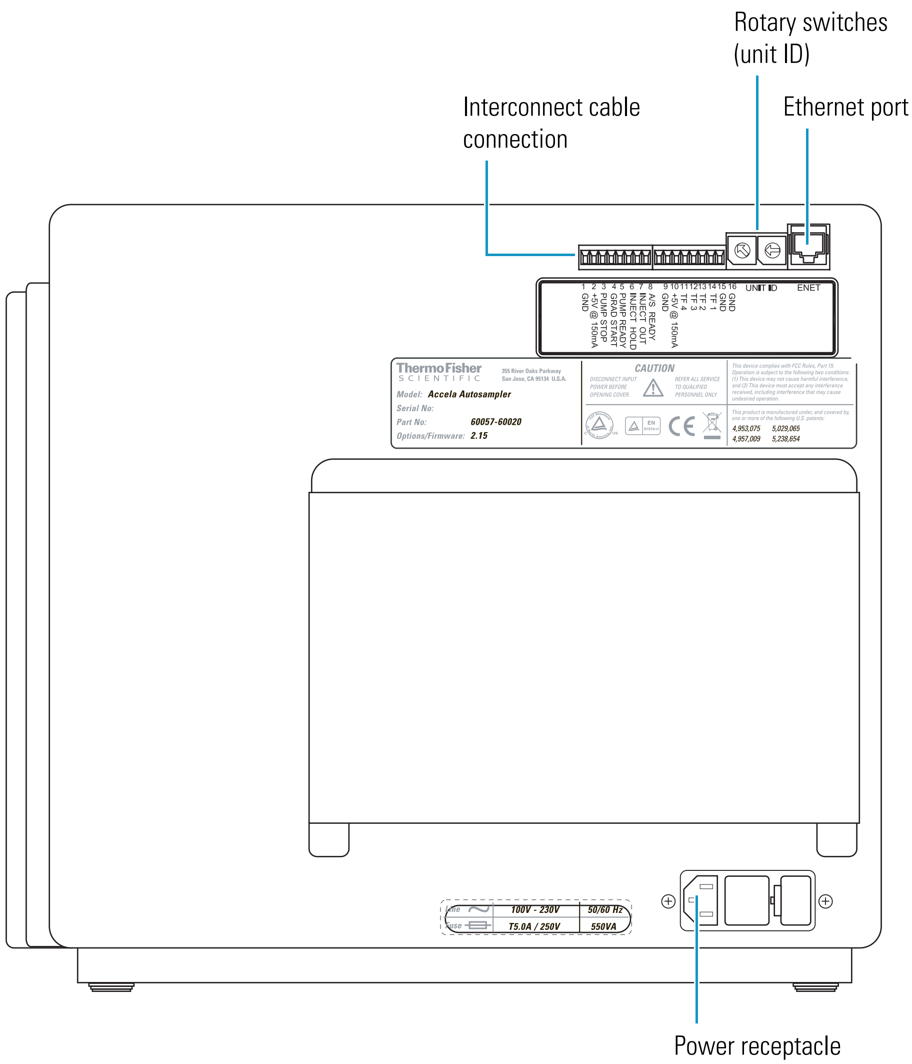
Installing the autosampler requires these tools:

- 5/16 in. open-end wrench
- Narrow flat-head screwdriver

# Making the Back Panel Connections

To operate the Accela Autosampler, connect the power, Ethernet, and system interconnect cable to the back panel (see Figure 28) of the autosampler, and check the unit ID setting.

**Figure 28.** Back panel of the Accela Autosampler



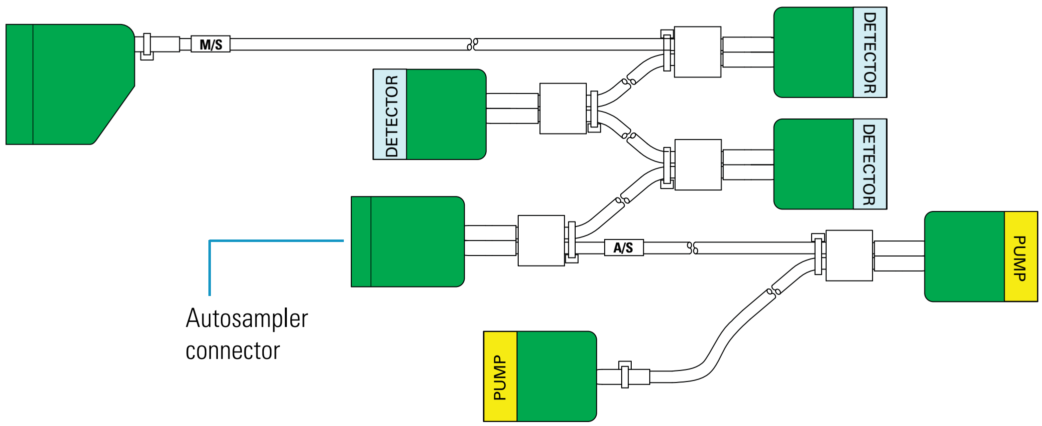

To make the back panel connections, follow these procedures:

- Connecting the System Interconnect Cable
- Connecting the Ethernet Cable
- Checking the Unit ID Settings
- Connecting the Autosampler to Line Power

## Connecting the System Interconnect Cable

The system interconnect cable that synchronizes the timing of the Accela devices is in the Accela System Kit. The interconnect cable has seven combicon connectors: three have a blue DETECTOR label; two have a yellow PUMP label; one has a small A/S tag on its adjacent cable; and one has a small M/S tag on its adjacent cable (see Figure 29).

**Figure 29.** System interconnect cable with seven combicon connectors

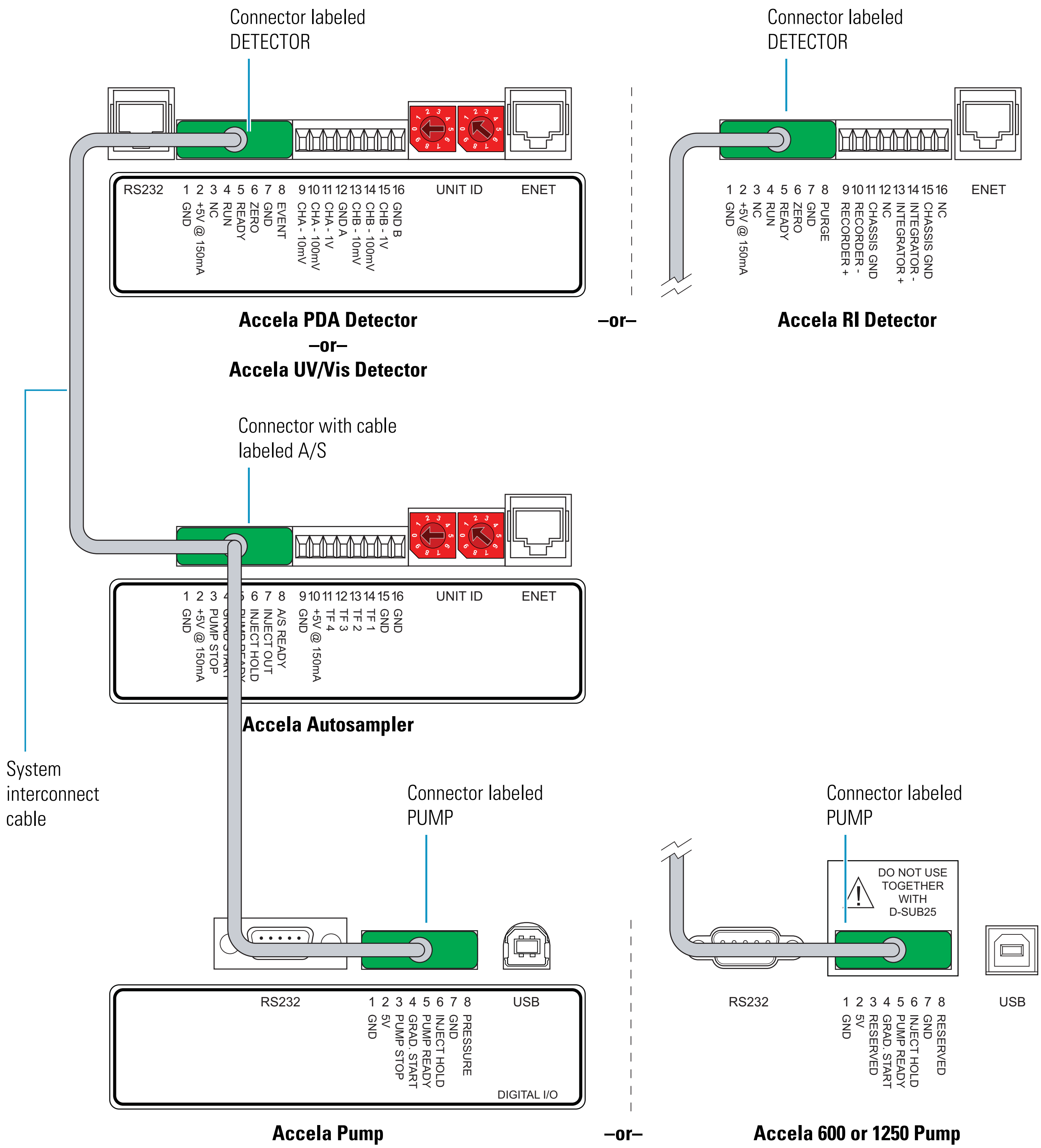



### ❖ To connect the interconnect cable

1. Plug the AS connector into the left 8-pin socket on the back panel of the Accela Autosampler (see Figure 30).
2. Attach one of the pump connectors to the Accela pump (Accela Pump, Accela 600 Pump, or Accela 1250 Pump).
3. If your LC system contains an Accela detector, attach one of the detector connectors to it.

Refer to the *Accela Getting Connected Guide* for instructions on how to connect the system interconnect cable to a Thermo Scientific MS detector.

**Figure 30.** System interconnect cable connections



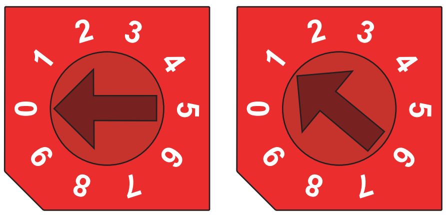
## Connecting the Ethernet Cable

Connect the Ethernet port on the back panel of the Accela Autosampler to the Ethernet switch using the 7 ft length, CAT-5 Ethernet cable with ferrite supplied in the accessory kit.

## Checking the Unit ID Settings

The Accela Autosampler is shipped with the unit ID preset using the two rotary switches located on the back panel (see Figure 31). The unit ID must correspond with the stack number that you specify in configuring the Accela Autosampler.

**Figure 31.** Rotary switches set to 01



The Communication page (see Figure 201 on page 233) of the Accela Autosampler Configuration dialog box in the Thermo Foundation Instrument Configuration application contains one box for the unit ID value. The default is 1, and the range is 1 to 99.
The Accela AS Configuration dialog box (see Figure 202 on page 234) in the ChromQuest data system contains two boxes for the unit ID. The default value is 01 and the range is 01 to 99. The value of 0 or 00, respectively, is reserved for special service functions.

## Connecting the Autosampler to Line Power

The Accela Autosampler is shipped with one of these power cords.

| Destination | Plug type | Voltage rating | Current rating | P/N |
|---|---|---|---|---|
| United Kingdom | BS 1363 | 250 Vac | 5 A | 6003-0810 |
| Switzerland | SEV 1011 | 250 Vac | 10 A | 6003-0620 |
| China and Europe | CEE 7/7 | 250 Vac | 10 A | 6003-0330 |
| United States and Canada | NEMA 5-15P | 125 Vac | 10 A | 6003-0160 |

Local codes in your area might require installing another type of plug and receptacle. The Thermo Fisher Scientific field engineer for your country will provide the appropriate power plugs.

❖ **To connect the autosampler to line power**

1. Ensure that the power switch on the front of the unit is in the Off position (released or out position).
2. Check the fuses (see "Replacing a Fuse" on page 86).
3. Connect the plug to the power receptacle (see Figure 28 on page 36) on the back panel of the autosampler.
4. Connect the other end of the power cord to line power.

When you are ready to power on the autosampler, go to "Turning On the Autosampler" on page 46.

# Connecting the Solvent Lines

Before you can operate the LC system, connect the wash bottle that is contained in the solvent platform to the left side of the syringe valve by using the wash bottle tubing, connect the needle tubing to the right side of the syringe valve, and connect the autosampler to the pump.

To connect the solvent lines, follow these procedures:

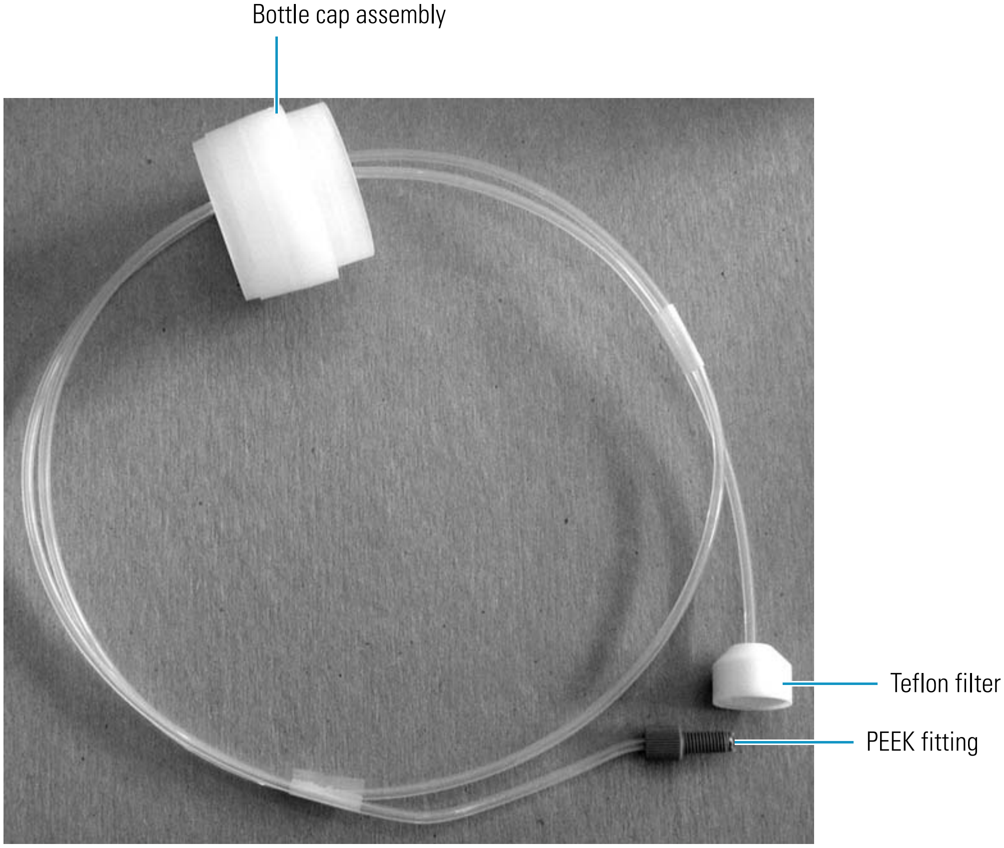
- Connecting the Wash Bottle
- Connecting the Needle Tubing
- Connecting the Autosampler to the Pump

**IMPORTANT** If the wash bottle tubing runs dry during a sequence of injections, the autosampler makes "blank" injections.

## Connecting the Wash Bottle

The Wash Bottle Kit supplied in the Accela System Kit contains a 1 liter bottle and a tubing assembly (see Figure 32).

**Figure 32.** Wash bottle tubing assembly




### ❖ To connect the wash bottle

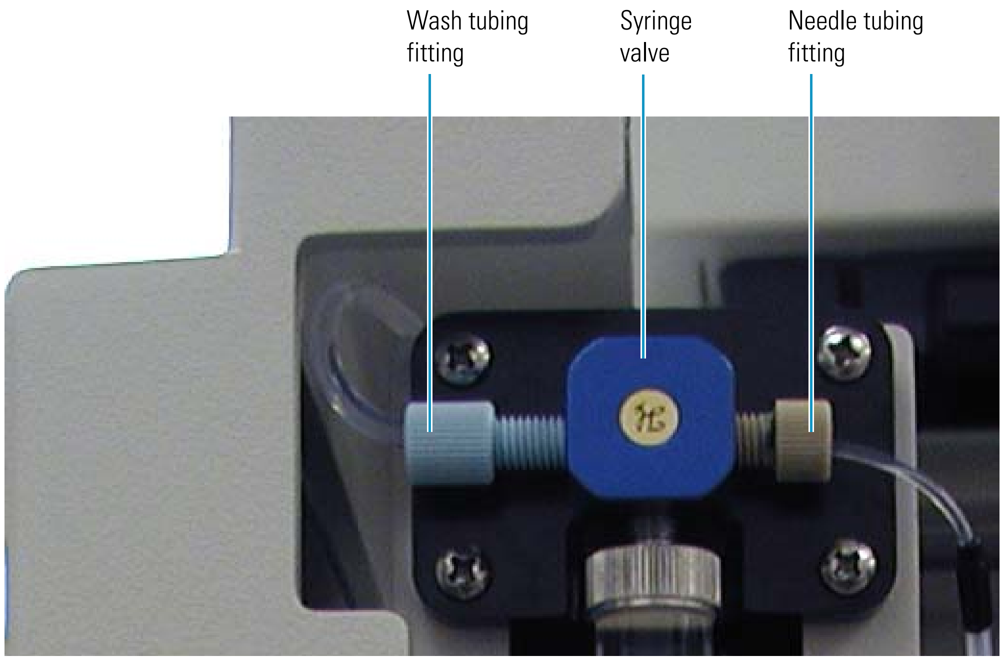
1. Fill the wash bottle with an appropriate solvent, and then place it in the solvent platform on the top of the system stack.

   **Note** The solvent platform holds the 1 L wash bottle and four 1 L solvent reservoir bottles. In case of breakage, the solvent platform can hold up to 7 L and acts as a secondary container for the liquid in the solvent bottles.

2. Insert the Teflon filter into the bottom of the bottle and screw on the cap.

3. Connect the PEEK fitting to the left side of the syringe valve (see Figure 33).

**Figure 33.** Wash tubing and needle tubing connections




## Connecting the Needle Tubing

The Accela Autosampler is shipped with the needle tubing assembly connected and routed through the appropriate brackets. The internally threaded fitting of the needle tubing assembly is connected to the needle assembly and the externally threaded fitting is connected to the syringe valve. The needle tubing is routed through a bracket on the XYZ arm, a bracket on the left wall of the tray compartment, and a bracket on the tray compartment door. In addition, the two-pronged needle tubing guide is connected to the *x*-axis positioning frame, and the PVC cap (red or black) is pushed below the metal runner for the *x*-axis positioning frame.

Before you operate the autosampler, make sure that the needle tubing is routed through the appropriate brackets.

**CAUTION** The needle tubing is easily damaged. Before you operate the autosampler, make sure that the needle tubing is routed through the support brackets, that the needle tubing guide is connected to the *x*-axis positioning frame, and that the PVC cap is pushed below the metal runner for the *x*-axis positioning frame.

## Connecting the Autosampler to the Pump

After you set up the Accela LC stack on the laboratory benchtop, connect the pump outlet to the autosampler inlet (heat exchanger inlet).

**CAUTION** To prevent personal injury, before connecting the pump to the autosampler, make sure that the column oven compartment is at room temperature.

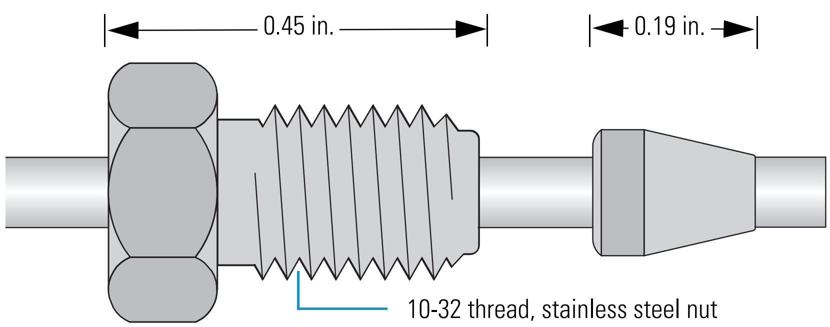
**CAUTION** To prevent personal injury caused by skin contact with hazardous solvents, ensure that the pump is off before you connect it to the autosampler.

### ❖ To connect the Accela pump outlet to the heat exchanger inlet

1. Connect a length of high-pressure tubing to the Accela pump outlet as follows:

   a. Using a stainless steel, two-piece fitting with a 10-32 thread, 0.45 in. length nut and a 0.19 in. length ferrule (see Figure 34), connect a length of stainless steel, 0.005 in. ID × 1/16 in. OD tubing to the pump outlet.

**Figure 34.** Stainless steel two-piece fitting supplied in the current Accela System Kit




**Tip** To prevent leaks, use an appropriate fitting to connect tubing to the pump outlet. Using a fitting that is too short for the port will cause leaks.

You can find these fittings in the Accela System Kit. You can also order replacement ferrules from VIC Valco™ Instruments Company and replacement nuts from IDEX Corporation.

| Item | Third-party part number | Thermo Fisher Scientific part number |
|---|---|---|
| Ferrule, stainless steel, 0.19 in. length, for 1/16 in. OD tubing | VICI Valco ZF-1 | 00101-18122 |
| Nut, 10-32 thread, 0.45 in. length, for 1/16 in. OD tubing | IDEX U-320 | 2522-1880 |

The tubing length depends on the pump model:

- For the Accela Pump, connect a 20 cm (8 in.) length of precut tubing to the outlet of the dynamic mixer.
- For the Accela 600 Pump or the Accela 1250 Pump, connect a 26 cm (10 in.) length of precut tubing to the outlet of the placeholder module or the optional dynamic mixer.

**Tip** To identify the tubing ID, the precut tubing has a color-coded band:

- Red = 0.005 in.
- Black = 0.007 in.
- Blue = 0.010 in.
- Yellow = 0.020 in.

b. Using a 0.25 in. open-end wrench, tighten the nut.

2. Route the tubing through the access slot in the autosampler drip tray.

**Note** The following instructions describe the plumbing connections to the current heat exchanger. For information about the original version of the heat exchanger, see "Legacy Versions of the Accela Autosampler" on page 271.

3. Connect the free end of the tubing to the heat exchanger inlet as follows:

a. Using a stainless steel high-pressure fitting, connect the free end of the tubing to a stainless steel union. Using a 0.25 in. open-end wrench, tighten the nut.

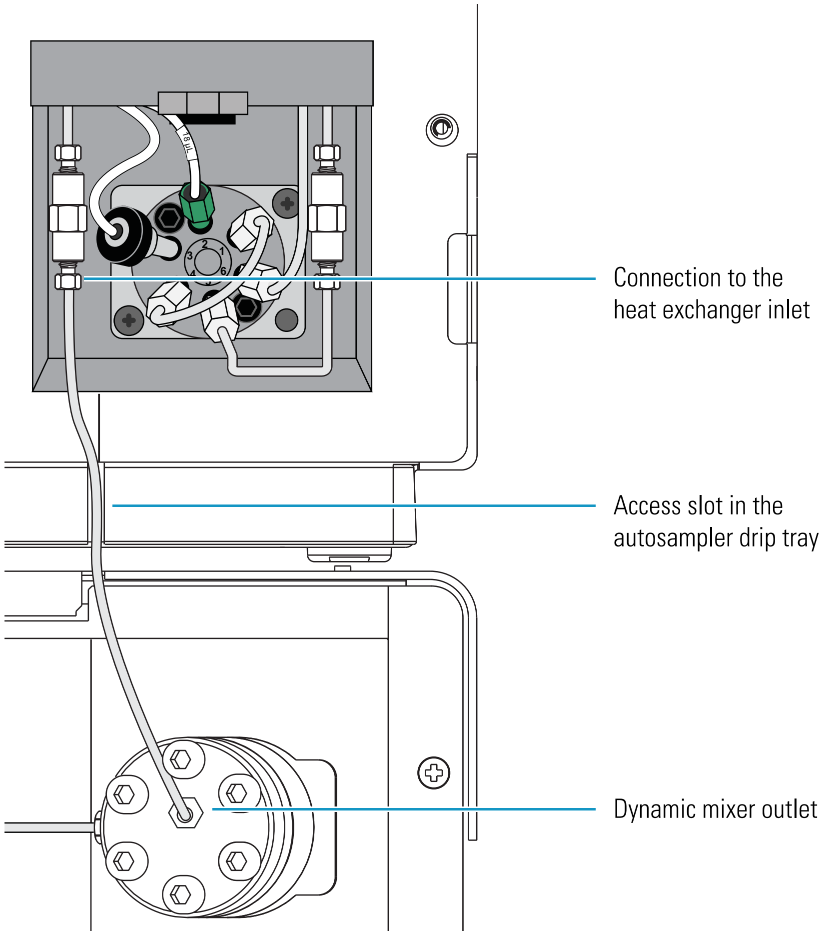
b. Using a stainless steel high-pressure fitting, connect the free end of the union to the heat exchanger inlet. Using a 0.25 in. open-end wrench, tighten the nut.

You can order replacement fittings to connect the heat exchanger inlet and outlet from IDEX Health and Science.

| Item | IDEX part number (subject to change) |
|---|---|
| Nut, stainless steel, 10-32 thread, 0.40 in. length, external threads, for 1/16 in. OD tubing | U-400 |
| Ferrule, 0.16 in. length, for 1/16 in. OD tubing | U-401 |
| Union, 10-32 threads, 0.010 in. thru-hole | U-435 (comes with U-400 and U-401) |

Figure 35 shows the high-pressure connection between the autosampler and an Accela pump with a dynamic mixer.

**Figure 35.** Solvent line connection between the Accela pump and the autosampler



# Turning On the Autosampler

After installing solvent lines and connecting the autosampler to line power, you can turn on the autosampler.

### ❖ To turn on the power to the autosampler

1. Ensure that the power switch at the front of the unit is in the Off position (released or out position).
2. Attach the power cord to the power entry module on the back panel of the autosampler and connect it to the power source.
3. Turn the power on by pushing the power button in to engage it.
4. Make sure that the power indicator briefly lights amber and then turns solid green. If it does not light at all, see Chapter 6, "Routine Troubleshooting." If it stays amber or flashes amber or green, turn the power off for several seconds, and then turn it back on again. Call your Thermo Fisher Scientific service representative if you require assistance.

These events occur during the autosampler startup sequence:

1. The Power LED turns solid green.
2. If the autosampler is communicating with the data system computer, the Com LED turns from amber to green.
3. The Run LED and Temperature LED turn solid green.
4. The autosampler initializes the syringe, injection valve, and XYZ arm positions as follows:
    a. Switches the two-way syringe valve to the flush bottle position.
    b. Switches the injection valve to the inject position.
    c. Moves the syringe to the home (empty) position.
    d. Moves the syringe to the ready position.
    e. Switches the two-way syringe valve to the needle position.
5. If the autosampler is communicating with the data system computer, the Com LED turns from amber to solid green.
6. Every time you close and reopen the data system, the autosampler initializes its hardware components (see step 4).

# Calibrating the Accela Autosampler

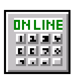
The Accela Autosampler is factory calibrated. The data system provides calibration options for the following:

- Column oven temperature
- Tray compartment temperature
- XYZ arm position
- Depth of custom vials or microplate wells

Only a Thermo Fisher Scientific service representative can perform the first three calibration options.

Before you use any of the three custom tray options, perform the calibration that determines the *z*-axis distance that the needle must travel to reach the bottom of your custom vial or well plate.

### ❖ To access the well bottom distance calibration option from the Xcalibur data system




1. From the Roadmap view, click the **Instrument Setup** icon.

   The Instrument Setup window appears.


2. Click the **Accela AS** icon in the viewbar.

   The Instrument Setup view for the Accela Autosampler appears.

3. From the Accela AS menu, choose **Calibration**.

   The Calibration dialog box appears.

4. Select the **Well Bottom Distance** option.

### ❖ To access the well bottom distance calibration option from the ChromQuest data system

1. From the Instrument window, choose **Control > Instrument Status**.
2. Click the **Accela AS** tab.
3. Click **Diagnostics**.
4. Click the **Calibration** tab.
5. Select the **Bottom Distance Calibration** option.

For instructions on how to perform this calibration, refer to the data system Help.

# Changing the Sample Loop

Several sample loop sizes are available for the Accela Autosampler (see Table 6).

**Table 6.** Sample loops for the Valco injection valve

| Description | Thermo Fisher Scientific part number | VICI Valco part number |
|---|---|---|
| 5 µL | 00109-99-00007 | CSL5 |
| 10 µL | 00109-99-00008 | CSL10 |
| 20 µL | 00109-99-00009 | CSL20 |
| 25 µL | 00109-99-00010 | CSL25 |
| 50 µL | 00109-99-00011 | CSL50 |
| 100 µL | 00109-99-00012 | CSL100 |
| 500 µL | 00109-99-00013 | CSL500 |
| 1000 µL | 00109-99-00014 | CSL1K |

### ❖ To change the sample loop

1. Make sure that the autosampler is in Idle mode.
2. Using an open-end wrench, loosen the fittings at ports 1 and 4, and gently pull out the two ends of the sample loop. If you want to reuse the sample loop, label the end fittings with the port number (1 or 4) that the swaged fitting was connected to.
3. Insert the ends of the new sample loop in the same orientation as the old one.
4. Firmly press one end of the sample loop into port 1 of the injection valve as you hand-tighten the nut.
5. Firmly press the other end of the sample loop into port 4 of the injection valve as you hand-tighten the nut.
6. Using a 1/4 in. open-end wrench, gently tighten the fittings by an additional 3/4 turn.

**Tip** To connect tubing with a two-piece stainless steel fitting to a receiving port, press the tubing against the bottom of the port as you hand-tighten the fitting. Then tighten the fitting by an additional 3/4 turn with a wrench. Once you use the wrench to tighten the fitting, the ferrule portion of the two-piece fitting is permanently connected to the tubing.

To connect tubing with a pre-swaged fitting to a receiving port, press the tubing against the bottom of the port as you hand-tighten the fitting. Then tighten the fitting by an additional 1/4 to 1/2 turn with a wrench.

3

# Routine Maintenance

This chapter contains information on the maintenance record keeping options provided by your Thermo Scientific data system, the routine maintenance procedures necessary to optimize the performance of the autosampler, and the suggested maintenance schedule.

**Contents**



For your own safety and to protect the autosampler from damage, follow the safety precautions in this manual when performing maintenance on the autosampler.

**CAUTION** To avoid electrical shock, do not remove the top cover or remove parts beyond the descriptions in the operation portions or in the maintenance topics of this manual.

**CAUTION** When connecting or disconnecting solvent lines, wear safety gloves that are compatible with the solvents in the lines.

# Maintenance Schedule

The Accela Autosampler requires only a few simple maintenance procedures to keep it in optimum working condition. Table 7 contains the maintenance schedule for the autosampler. A Thermo Fisher Scientific service representative or other qualified person must perform the last procedure, the alignment of the XYZ arm.

To make the maintenance of your autosampler easier, the data system keeps track of how many injections, injection valve cycles, needle cycles, and syringe cycles the autosampler has performed. The data system alerts you to perform maintenance when the number of cycles exceeds a preset value. For information on setting up the tracking system, see "Maintenance Cycles" on page 87.

**Note** You are responsible for maintaining your autosampler. Routine maintenance does not fall under Thermo Fisher Scientific warranty; however, planned maintenance contracts are generally available. Contact your local representative if you are interested in purchasing a planned maintenance contract.

**Table 7.** Maintenance procedures and schedule

| Frequency | Procedure | Performed by |
|---|---|---|
| Monthly | Checking the solvent tubing connections for leaks | User |
| Monthly | Running a standard sample | User |
| Every 15 000 to 20 000 injections | Replacing the rotor seal | User |
| Semiannually | Replacing the flush solvent inlet filter | User |
| As necessary | Replacing the injection port | User |
| As necessary | Clearing a plugged line or needle | User |
| As necessary | Changing the syringe | User |
| As necessary | Changing the sample loop | User |
| As necessary | Replacing a fuse | User |
| Semiannually | Cleaning and lubricating the syringe drive mechanism | User |
| Annually | Cleaning and lubricating the XYZ arm | Field service |
| Annually | Verifying the XYZ arm alignment | Field service |

**Note** Table 7 lists recommended maintenance intervals based on operating the autosampler under typical conditions. Operating the autosampler under certain harsh conditions (corrosive solvents, extreme temperatures, and so on) might require more frequent maintenance than indicated in the table.

# Replacing the Rotor Seal in the Valco Injection Valve

The rotor seal is a disk with three grooves that forms a high-pressure seal with the stator. Replace the rotor seal when you notice a leak between either the stator and rotor or the adjacent ports of the injection valve, or when you notice a decrease in injection precision.

**Tip** The Valco Instruments Co. uses the term *rotor* instead of *rotor seal*. When ordering a replacement rotor seal (see Figure 39 on page 54) from Valco Instruments Co., use the term *rotor*.

This section describes how to replace the rotor seal for the autosampler's Valco injection valve. For information on replacing the rotor seal for the Rheodyne™ injection valve that shipped with earlier versions of the autosampler, see "Replacing the Rotor Seal in the Rheodyne Valve" on page 263.

**CAUTION** Before you remove the injection valve from the autosampler, turn off the power to the autosampler and unplug the autosampler from line power.

Replacing the rotor seal requires these tools.

| Tool | Use |
|---|---|
| 1/4 in. open-end wrench | To remove the tubing from injection valve ports 5 and 6 |
| #2 Phillips screwdriver | To disconnect the injection valve from the autosampler |
| 9/64 in. hex wrench | To disassemble the injection valve |

**IMPORTANT** Because component cleanliness affects the useful life of the injection valve, replace the rotor seal in a clean environment.

To replace the rotor seal, follow these steps:

1. Removing the Injection Valve from the Autosampler
2. Disassembling the Injection Valve
3. Cleaning the Stator
4. Installing a New Rotor Seal
5. Reinstalling the Injection Valve

## Removing the Injection Valve from the Autosampler

Before you remove the injection valve from the autosampler, prepare a clean environment where you can disassemble the valve.

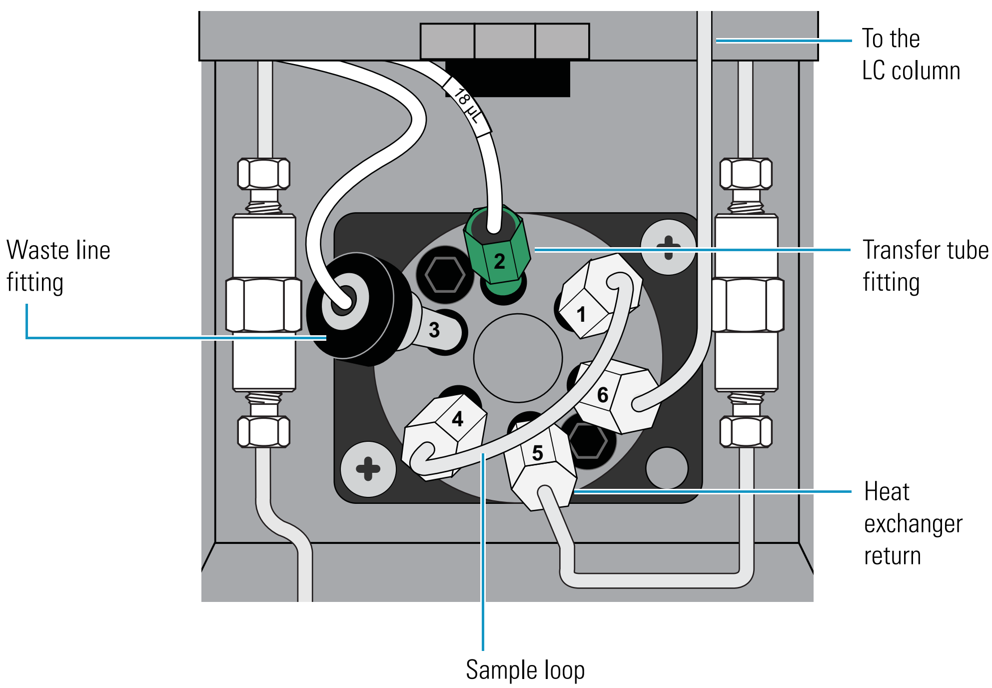
❖ **To remove the injection valve from the autosampler**

1. Disconnect the solvent lines (see Figure 36) connected to the valve as follows:
   - Disconnect the waste tubing from port 3 of the injection valve.
   - Disconnect the transfer tubing from port 2 of the injection valve.
   - Using a 1/4 in. open-end wrench, disconnect the 1/16 in. OD high-pressure tubing from ports 5 and 6.

**IMPORTANT** You do not need to remove the sample loop from the injection valve to disassemble the injection valve. Once the sample loop has been swaged onto the injection valve, the fittings are no longer interchangeable. If you do remove the sample loop from the injection valve, take note of which fitting was connected to port 1 and which fitting was connected to port 4. When you reinstall the sample loop, connect the fittings to their respective ports.

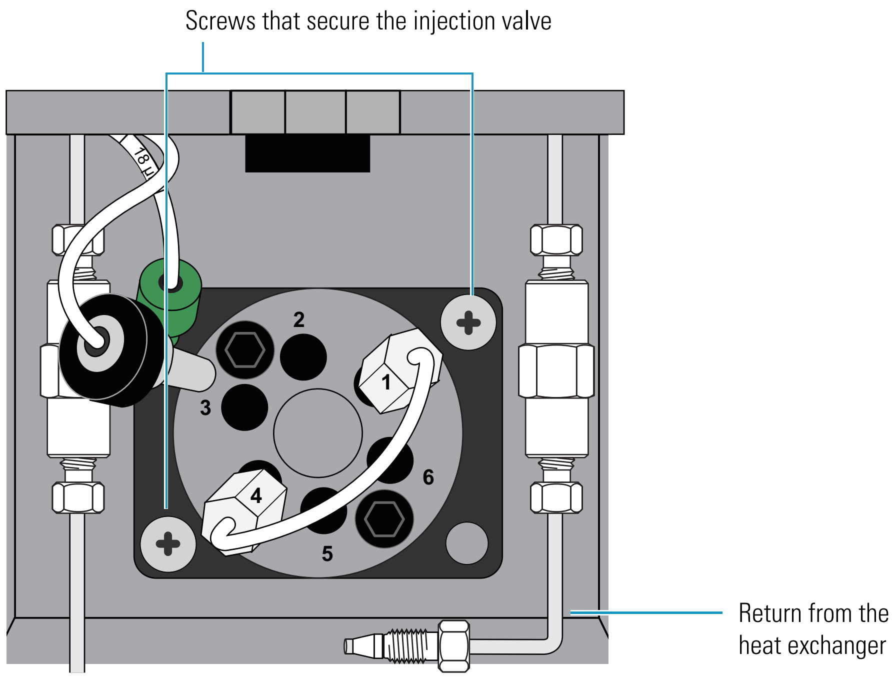
**Note** The drawings in this section show the current version of the autosampler's heat exchanger. For information about the original heat exchanger, see "Legacy Versions of the Accela Autosampler" on page 271.

**Figure 36.** Injection valve solvent line connections



2. Using a #2 Phillips screwdriver, remove the two screws that secure the injection valve to the autosampler (see Figure 37).

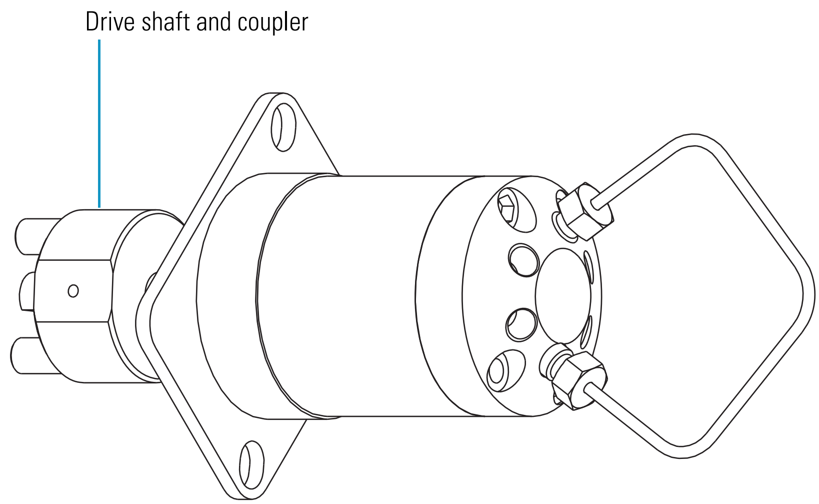
**Figure 37.** Injection valve secured to the autosampler with two screws




3. Slide the injection valve forward out of the autosampler.

Figure 38 shows the drive shaft and coupler on the back side of the injection valve.

**Figure 38.** Injection valve with a view of the drive shaft on the back side of the valve



## Disassembling the Injection Valve

Leave the sample loop connected to the stator as you disassemble the injection valve.

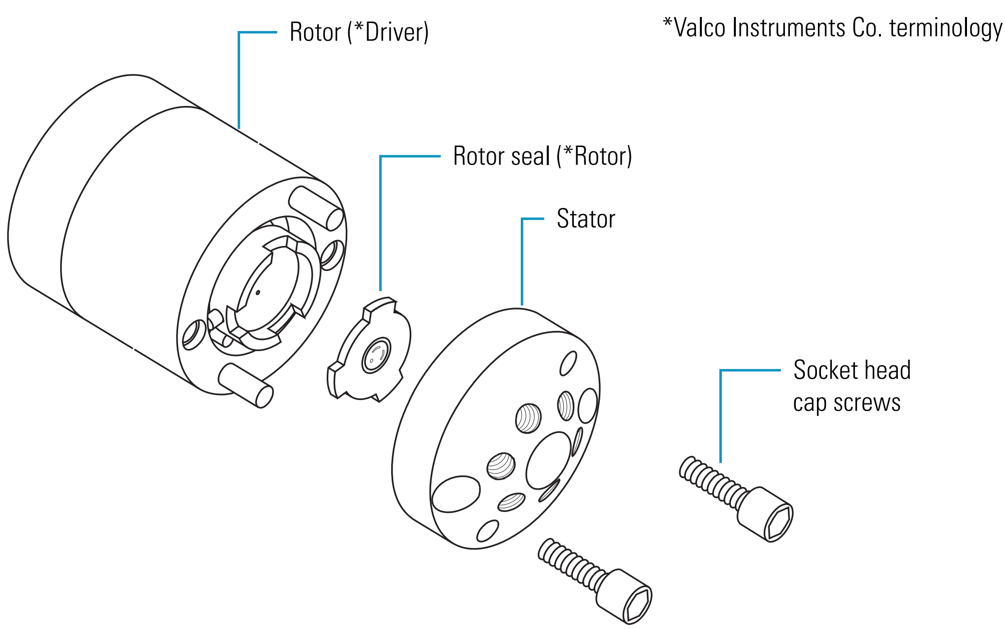
❖ **To disassemble the injection valve**

1. Using a 9/64 in. L-hex wrench, remove the two socket head cap screws that secure the stator to the driver (see Figure 39).

**CAUTION** The polished (sealing) surface of the stator contains six ports that excess handling can easily damage. As you remove the stator from the injection valve, avoid touching this polished surface, and never place the polished surface face down on a hard surface.

**Note** The Valco Instruments Co. uses the term *rotor* instead of *rotor seal* and the term *driver* instead of *rotor* (see Figure 39).

**Figure 39.** Injection valve (exploded view)




2. Gently pry the rotor seal away from the rotor (see Figure 39).
3. Examine the sealing surface of the rotor seal for scratches. If scratches are visible, replace the rotor seal.

## Cleaning the Stator

Before you replace the rotor seal, clean the stator.

❖ **To clean the stator**

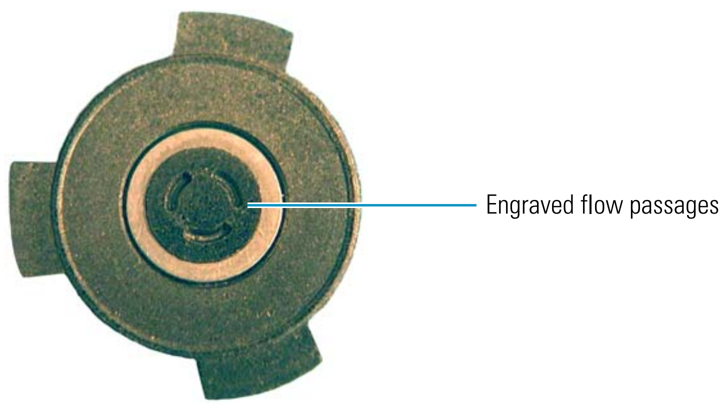
1. Inspect the stator to determine if it requires cleaning.
2. If the stator is dirty, swab it with HPLC-grade methanol. If more stringent cleaning is required, use a sonicator.
3. Inspect the remaining valve components for contamination. Clean them as necessary.

> **IMPORTANT** If the stator is scratched, replace the valve. Scratches can damage the rotor seal and cause cross-port leaks.

## Installing a New Rotor Seal

The rotor seal has two sides. The side containing the engraved flow passages (see Figure 40) faces the stator.

**Figure 40.** Engraved flow passages in the Valco rotor seal




❖ **To install a new rotor seal**

1. Replace the rotor seal in the rotor, making sure that the rotor seal surface with the engraved flow passages is facing out.

   The pattern is asymmetrical to prevent improper placement.

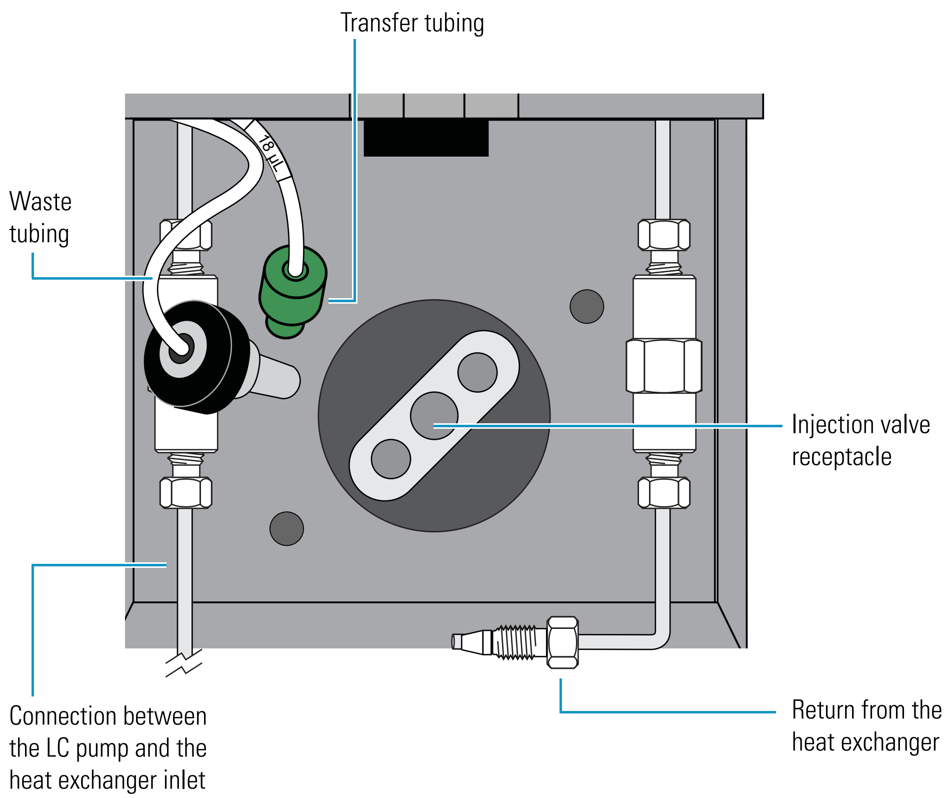
2. Replace the stator.
3. Insert the two socket head screws.
   a. Using a 9/64 in. L-Hex wrench, tighten each screw until you feel resistance (approximately fingertight).
   b. Tighten each screw by 1/8 turn, and then tighten each screw again, until the stator is secured to the driver. Take care not to overtighten the screws.

# Reinstalling the Injection Valve

❖ **To reinstall the injection valve**

1. Align the drive shaft (see Figure 38 on page 53) and the two prongs of the coupling unit with the three holes in the injection valve receptacle located in the lower portion of the column oven compartment. Then insert the injection valve into the receptacle (see Figure 41).

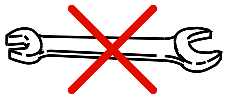
**Figure 41.** Injection valve receptacle in the lower portion of the column oven compartment




2. Align the holes in the mounting plate of the injection valve with the small holes next to the injection valve receptacle.

3. Using the two screws that you removed in step 1 on page 52, secure the injection valve to the autosampler with a #2 Phillips screwdriver.

4. Reconnect the solvent lines to the injection valve as follows (see Figure 41 on page 56):



- Hand-tighten the transfer tube fitting to port 2 and the waste tube fitting to port 3. Never use a wrench to tighten these fittings.

**CAUTION** Never use a wrench to tighten the transfer tube fitting. Over-tightening the fitting can do the following:

- Restrict the end of the tubing, which leads to less sample reaching the sample loop and results in smaller than expected peak areas or blank injections. A restriction in the end of the tubing can also cause the syringe to make a grinding sound during an injection sequence.
- Strip the threads on the fitting, which leads to solvent leaks.

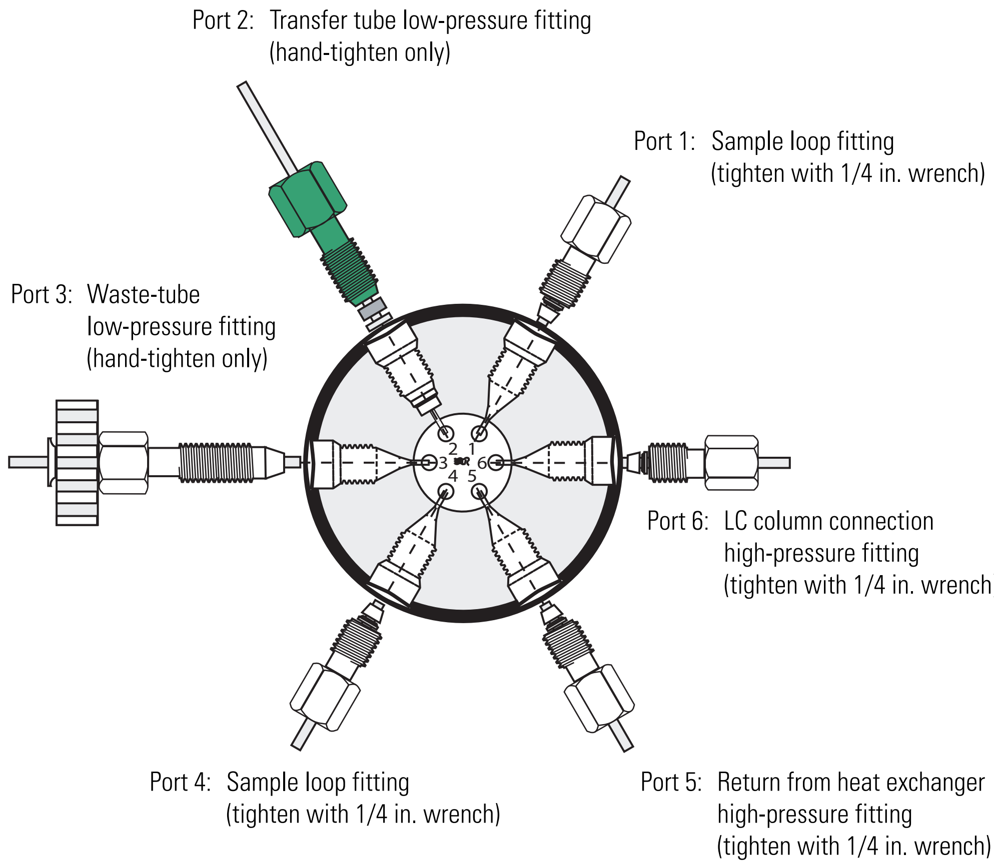
- Press the end of the return tubing from the heat exchanger to the bottom of port 5 as you hand-tighten the high-pressure fitting. Then use a wrench to tighten the fitting by an additional 1/4 turn.
- Using high-pressure tubing and two high-pressure fittings, reconnect the LC column to port 6 of the injection valve.

**Note** To reconnect tubing with a pre-swaged stainless steel fitting to a valve port, hand-tighten the fitting as you press the tubing against the bottom of the port, and then use a wrench to tighten the fitting by an additional 1/4 to 1/2 turn.

To connect tubing with a two-piece stainless steel fitting to a mating port, press the tubing against the bottom of the port as you hand-tighten the fitting. Then tighten the fitting by an additional 3/4 turn with a wrench. Once you use the wrench to tighten the fitting, the ferrule portion of the two-piece fitting is permanently connected to the tubing.

- If you removed the sample loop, connect the appropriate ends of the sample loop to ports 1 and 4.

**Figure 42.** Schematic of the tubing connections to the injection valve




5. Turn on the pump flow and check for leaks.

# Replacing the Inlet Filter for the Wash Bottle Solvent Line

Properly filtering the flush solvent extends the life of the injection valve and the LC column.

❖ **To replace the inlet filter**

1. Be sure the autosampler is in Idle mode.
2. Remove the flush-solvent bottle cap and lift out the inlet tubing.
3. Remove the old inlet filter.

**CAUTION** Be sure to follow all of the safety precautions for each solvent, as prescribed by the MSDS.

4. Install a new filter, and then put the line back into the bottle. Tighten the solvent cap.
5. Flush the inlet filter and lines with an appropriate volume of solvent.

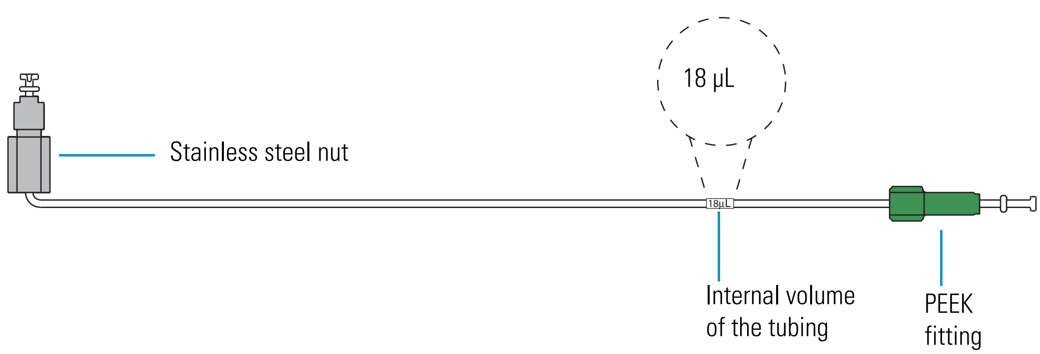
# Replacing the Transfer Tubing

The transfer tubing that connects the injection port of the autosampler to port 2 of the injection valve can become worn, damaged, or plugged with use.

Replace the transfer tubing if it becomes plugged or if your injections become less reproducible (which can indicate of a worn or damaged transfer tube). In addition, replace the transfer tubing when you replace the needle.

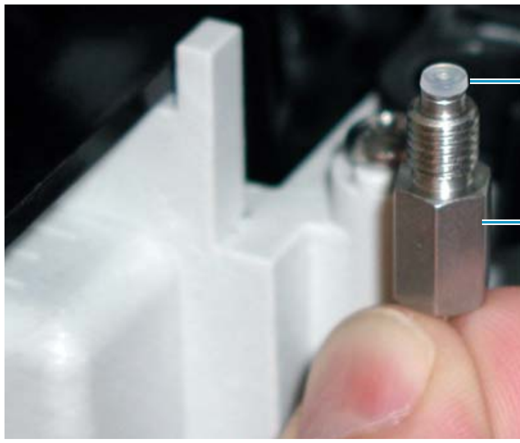
The transfer tubing assembly consists of two fittings and a 9 in. length of 0.012 in. ID tubing (see Figure 43). The stainless steel nut connects to the autosampler injection port and the green PEEK fitting connects to port 2 of the injection valve. The label near the PEEK fitting end of the tubing specifies the internal volume of the tubing.

**Figure 43.** Transfer tubing assembly



**Tip** Because the flanged end of the transfer tubing (see Figure 44) conforms to the shape of the needle, it is good practice to replace the transfer tubing when you replace the needle. The reverse is not true. The tip of the needle does not conform to the shape of the transfer tube fitting, so you do not need to replace the needle when you replace the transfer tubing.

**Figure 44.** Transfer tube nut and flanged end of the transfer tubing



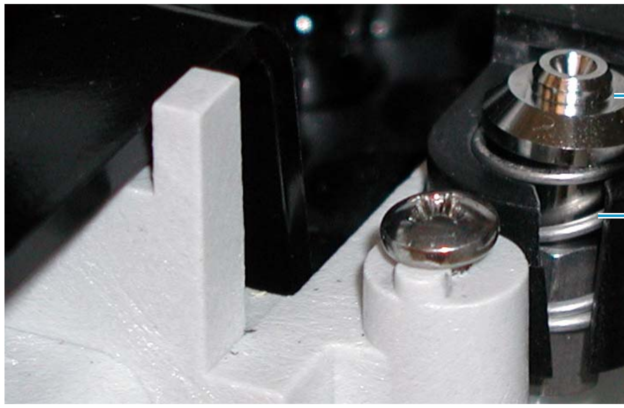

### ❖ To replace the transfer tubing

1. To remove the aluminum retention clip (see Figure 45) from the wash station housing, pull it forward and then upward.

   **Figure 45.** Retention clip for the injection port

2. Pull the injection port out from the wash station (see Figure 46).

**Figure 46.** Injection port seated in the wash station



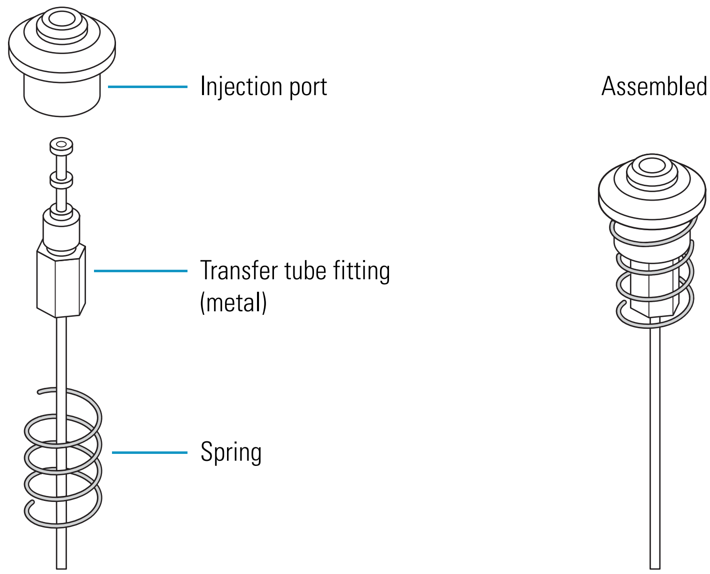

3. Unscrew the transfer tube nut from the injection port fitting (see Figure 47) and from port 2 of the injection valve, and then pull the tubing to the left through the hole in the wall between the tray compartment and the oven compartment (see Figure 10 on page 11). Discard the used transfer tube.

**Figure 47.** Injection port connected to the transfer tube nut


4. Screw the injection port onto the nut of the new transfer tubing.

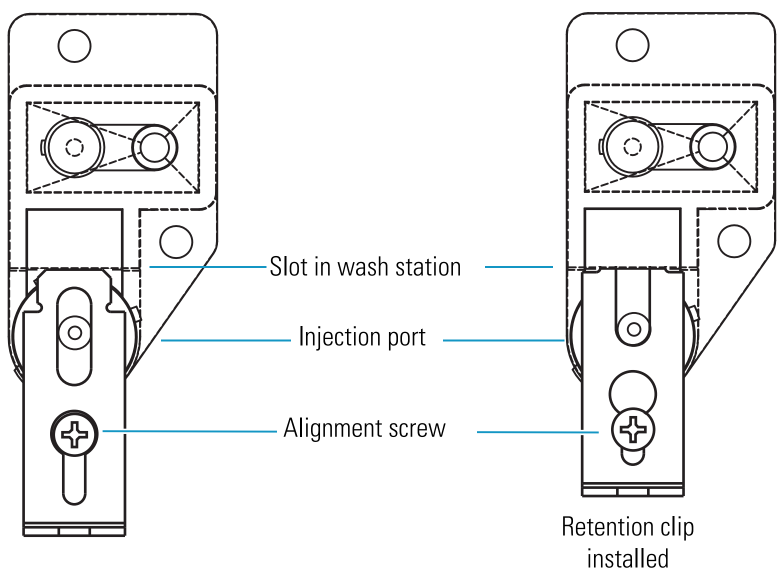
5. Set the injection port into the spring (see Figure 48). Then insert it into the port in front of the wash station.

**Figure 48.** Transfer tubing, spring, and injection port

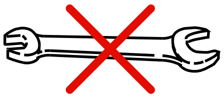



6. Reinstall the retention clip (see Figure 49) as follows:
   a. Align the retention clip with the slot located in front of the wash station.
   b. Using the retention clip to push the injection port down, align the circular cutout in the retention clip over the alignment screw.
   c. Insert the end of the retention clip into the wash station slot as far as it will go.

**Figure 49.** Retention clip installation



7. Route the other end of the transfer tube through the hole in the wall between the tray and column oven compartments (see Figure 10 on page 11).



8. Taking care to avoid overtightening, hand-tighten the fitting to port 2 of the injection valve. Never use a wrench to tighten this fitting.

**CAUTION** Never use a wrench to tighten the transfer tube fitting. Overtightening constricts the transfer tube, causing poor injection precision or blank injections. Eventually, the damaged transfer tube becomes completely plugged.

**IMPORTANT** You must modify the instrument configuration by entering the new value for the internal volume of the transfer tubing. For instructions on updating the instrument configuration for the autosampler, refer to the data system Help.

9. Modify the instrument configuration for the internal volume of the new transfer tube.

   For information on specifying the volume of the transfer tubing, refer to the data system Help.

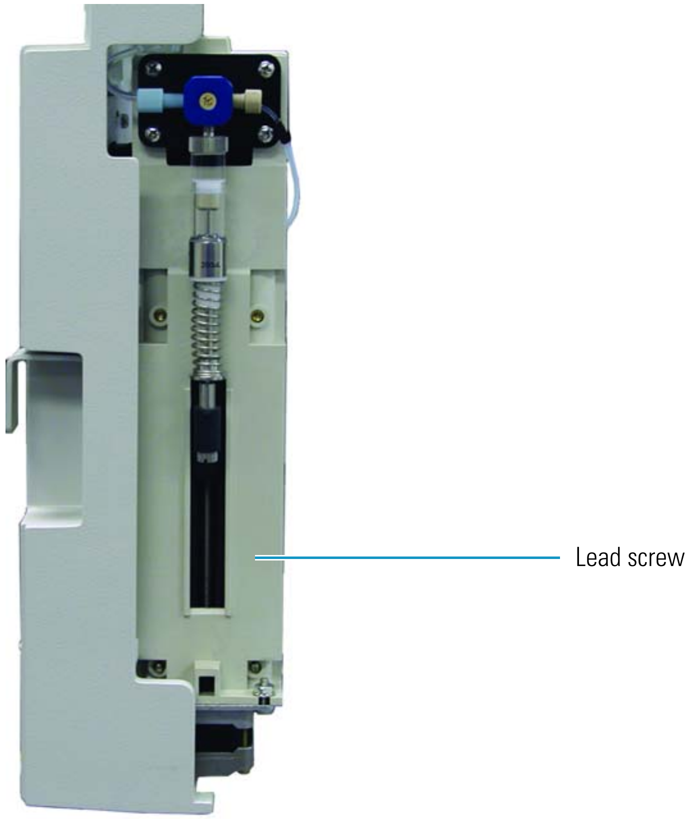
# Maintaining the Syringe Drive Assembly

If you have an older version of the Accela Autosampler with an uncoated, stainless steel lead screw, as a part of routine maintenance, lubricate the lead screw once every six months or as needed. If the syringe drive skips steps and does not return to the home position after you perform a Flush Syringe direct command, lubricate the lead screw before you continue operation.

**Note** The syringe drive assembly in the current version of the Accela Autosampler does not require routine maintenance. The lead screw is coated with black Teflon and the drive nut is made of plastic, so there is minimal friction between these moving parts.

Figure 50 shows the uncoated, stainless steel lead screw in an older version of the Accela Autosampler.

**Figure 50.** Syringe drive assembly with an uncoated, stainless steel lead screw




Lubricating the lead screw requires these tools and materials:

| Tools and materials |
|---|
| Flat-head screwdriver |
| Tri-Flow™ lubricant (For ordering information, see Lubricant in the list of "Consumables" on page 252.) |

### ❖ To clean and lubricate the lead screw of the syringe drive assembly

1. Remove the syringe drive assembly from the autosampler as follows:
   a. To prevent siphoning of the wash solvent, lower the wash bottle below the level of the syringe valve by removing the wash bottle from the solvent platform and placing it on the countertop next to the Accela LC stack.
   b. Disconnect the needle tubing from the right side of the syringe valve.
   c. Disconnect the wash tubing from the left side of the syringe valve.

d. Remove the two thumbscrews that connect the syringe drive assembly to the inner side of the tray compartment door (see Figure 51).

e. To disconnect the cable that is routed through the back of the syringe drive assembly and connected to the P2 receptacle on the inner side of the tray compartment door, press the connector tab (see Figure 52) and pull the connector out of the receptacle.

**Figure 51.** Syringe drive assembly disconnected from the inner side of the door

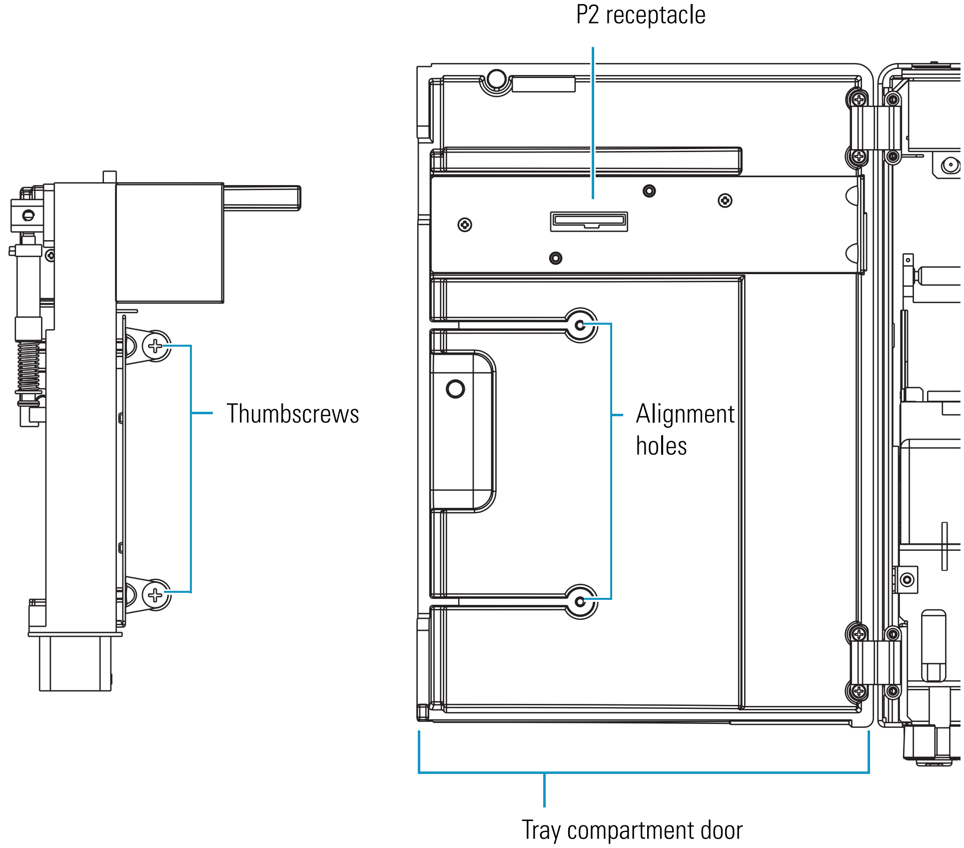
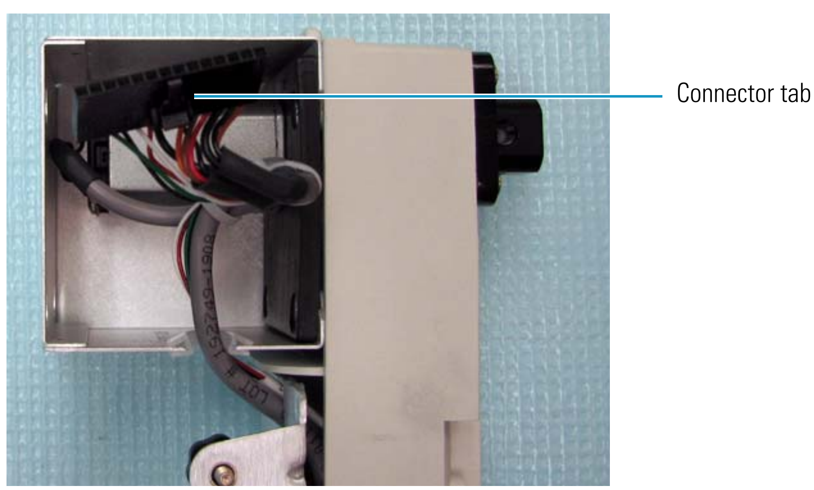



**Figure 52.** Syringe drive assembly cable



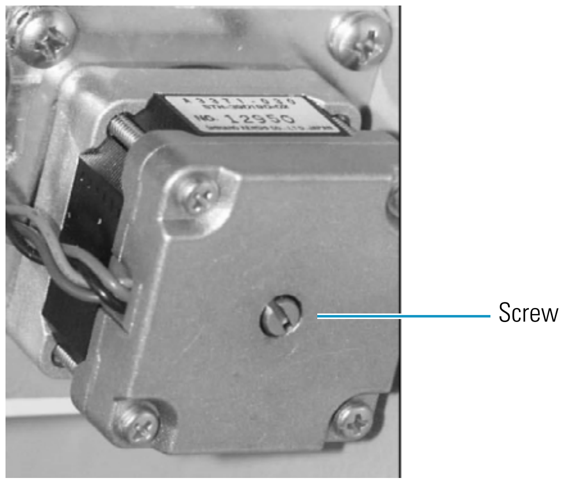
**Note** You can lubricate the lead screw without removing the base plate from the back of the syringe drive assembly.

2. Lubricate the lead screw as follows:

   a. Through the cutout in the front of the syringe drive assembly, apply 2 to 3 drops of Tri-Flow lubricant to the top part of the lead screw.

   b. Using a flat head screwdriver, turn the screw at the bottom of the motor (see Figure 53) counterclockwise until the arm is at the top position.

   **Figure 53.** Screw at the bottom of the syringe drive motor

   c. Apply lubricant to the bottom part of the lead screw.

3. Reconnect the syringe drive assembly to the autosampler as follows:

   a. Plug the syringe drive assembly cable into the P2 receptacle on the inner side of the tray compartment door.

   b. Realign the syringe drive assembly with the alignment holes on the inner side of the tray compartment door (see Figure 51 on page 65).

   c. Using the two thumbscrews that you removed in step 1d on page 65, secure the syringe drive assembly to the door.

   d. Reconnect the needle tubing to the right side of the syringe valve.

   e. Reconnect the wash tubing to the left side of the syringe valve.

4. Set the syringe to its home position (see "Setting the Syringe to the Home Position" on page 83).

5. To ensure that the lead screw has been properly lubricated, set up the autosampler as follows and watch the movement of the syringe as the autosampler flushes the syringe:

   a. Fill the wash bottle with HPLC-grade water.

b. Perform a **Flush Syringe** direct command using these values:

| Parameter | Value |
|---|---|
| Reservoir | Flush Bottle (Xcalibur data system or Tune window)<br>Bottle (ChromQuest data system) |
| Volume (µL) | 6000 |
| Flush Speed (µL/sec) | 100 |

If the lead screw has been properly lubricated, it does not stall as the autosampler flushes water through the system at a speed of 100 µL/sec.

6. Refill the wash bottle with an appropriate solvent mixture for your applications.

# Troubleshooting a Blockage in the Injection System

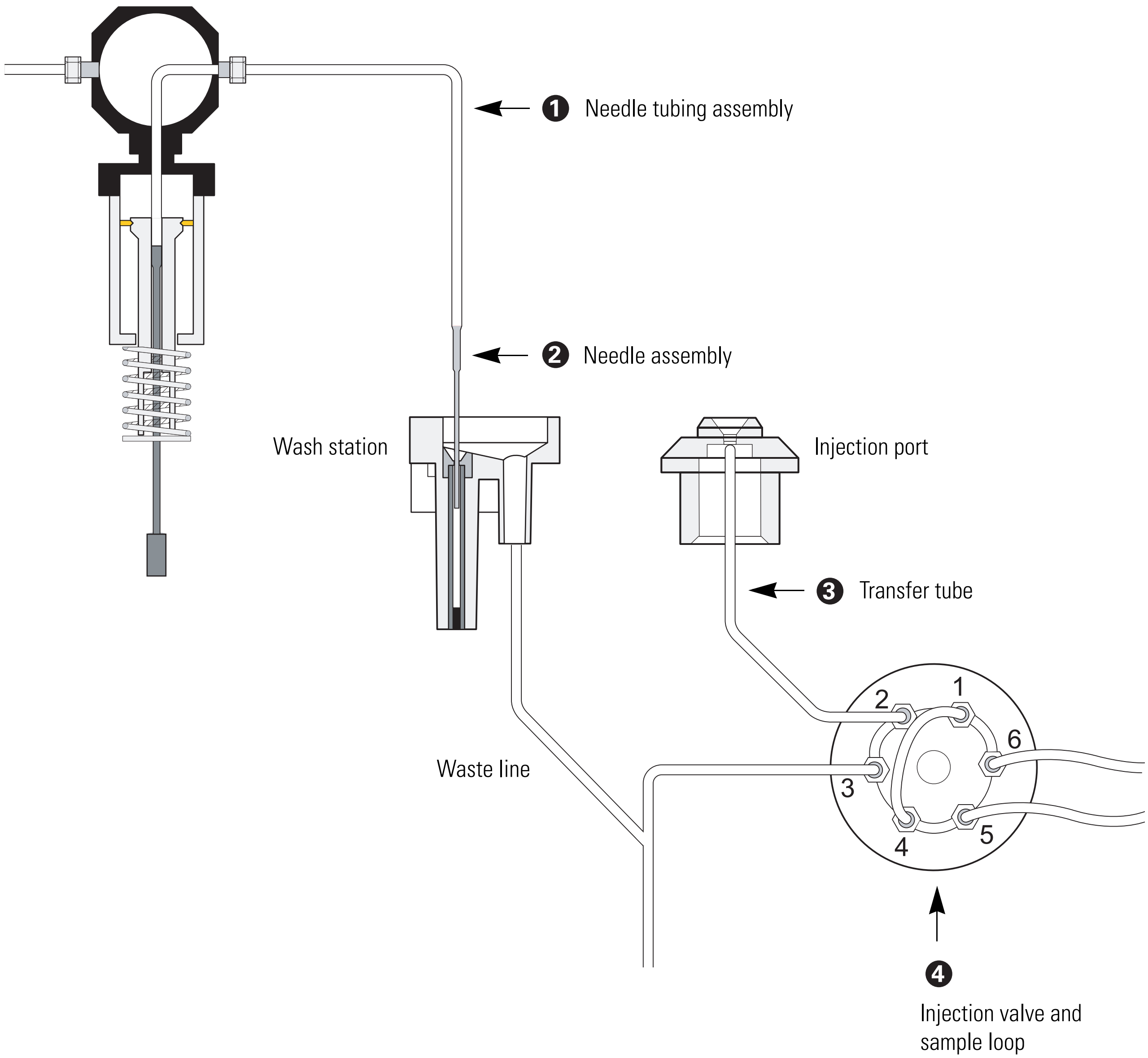
A blocked tubing or a plugged needle can cause the syringe drive to stall. A stalled syringe drive makes a grinding sound because the syringe motor must overcome a greater force to move the plunger.

If the injection system has a plug (as indicated by an abnormally loud grinding sound made by the syringe drive), determine where the plug is located by systematically checking the following sections of the injection system (see Figure 54):

- Section 1: Needle tubing assembly
- Section 2: Needle assembly
- Section 3: Transfer tubing
- Section 4: Injection valve and sample loop

**Tip** The transfer tube, needle, and small ports in the stator of the injection valve are the most commonly plugged components of the injection system. A damaged syringe valve can also reduce the solvent flow and cause a grinding sound.

**Figure 54.** Possible locations of a plug




To find and clear a plug, follow these steps until you find the blockage:

1. Testing the Needle Tubing and the Syringe Valve for Blockage
2. Testing the Needle for Blockage
3. Testing the Transfer Tube for Blockage
4. Cleaning the Injection Valve or the Sample Loop

## Testing the Needle Tubing and the Syringe Valve for Blockage

### ❖ To test the needle tubing for blockage

1. Move the XYZ arm to the front-center of the tray compartment (see "Setting the Needle to the Removal Position" on page 73).
2. Unscrew the needle tubing assembly from the needle assembly (see Figure 4 on page 6) and place the needle tubing fitting into a beaker.
3. As you perform a **Wash Needle** direct command with a 2000 µL volume, observe the solvent flow and listen for a grinding sound from the syringe drive.
4. Depending on whether solvent flows freely out the end of the needle tubing and you hear a grinding sound from the syringe drive, do one of the following:
   - If the wash solvent flows out of the needle tubing at a normal rate and you do not hear a grinding sound, the needle tubing is not the source of blockage. Skip step 5 and step 6 and go to the next procedure to test the needle for blockage.

   –or–

   - If the flow appears to be constricted, go to step 5.
5. Verify that the syringe valve is not the cause of the constricted flow:
   a. Unscrew the needle tubing from the right side of the syringe valve.
   b. Perform a **Wash Needle** direct command using a 2000 µL volume, and observe the solvent flow out of the right side of the syringe valve.
   c. Depending on whether solvent flows freely out of the right side of the syringe valve, do one of the following:
      - If solvent flows out of the right side of the syringe valve, replace the needle tubing, which was the source of the blockage.
      - If solvent does not flow out of the right side of the syringe valve, replace the syringe valve.
6. After you replace the syringe valve or the needle tubing, home the position of the syringe (see "Setting the Syringe to the Home Position" on page 83).

If the needle tubing was not the blockage source, go to the next procedure, "Testing the Needle for Blockage."

## Testing the Needle for Blockage

### ❖ To test the needle for blockage

1. Remove the needle from the needle mount on the XYZ arm by pulling the latch nut of the needle assembly forward, and then pulling the needle up out of the needle mount.
2. Reconnect the needle tubing to the needle.
3. Holding the needle over the beaker, perform a **Wash Needle** direct command using a 2000 µL volume. Watch how freely solvent flows from the end of the needle, and listen for a grinding sound from the syringe drive.
4. Depending on whether solvent flows freely out of the end of the needle and you hear a grinding sound from the syringe drive, do one of the following:
   - If the solvent flow is constricted, the needle is constricted.

   –or–

   - If solvent flows out of the end of the needle at a normal rate and you do not hear a grinding sound from the syringe drive, the needle is not the source of blockage. Go to step 6.
5. To remove the needle blockage, run a clean wire through the needle or replace the needle as described in "Replacing the Needle Tubing Assembly" on page 73. After you replace the needle assembly, set the syringe to its home position.
6. If the needle is not the source of blockage, reconnect the injection system as follows:
   a. Disconnect the needle from the needle tubing.
   b. Move the XYZ arm to the front-center of the tray compartment (see "Setting the Needle to the Removal Position" on page 73).
   c. Insert the needle into the needle mount on the XYZ arm, and then push the latch nut backward.
   d. Reconnect the needle tubing to the needle, and then ensure that the needle tubing is routed through the appropriate brackets (see "Replacing the Needle Tubing Assembly" on page 73).

If the needle was not the blockage source, go to the next procedure, "Testing the Transfer Tube for Blockage."

## Testing the Transfer Tube for Blockage

### ❖ To test the transfer tube for blockage

1. Disconnect the transfer tube from port 2 of the injection valve (see Figure 54 on page 68).
2. Place the free end of the transfer tube into a beaker to collect solvent.
3. As you perform a **Flush Syringe** direct command, listen for an abnormally loud grinding sound.
    - If the syringe drive does not stall, then the plug is in the injection valve or the sample loop. Reconnect the transfer tube to port 2 of the injection valve and go to the next procedure, "Cleaning the Injection Valve or the Sample Loop."
    - If the solvent flow is constricted through the transfer tube, replace the transfer tube (see "Replacing the Transfer Tubing" on page 59).
4. After you replace the transfer tube, home the position of the syringe (see "Setting the Syringe to the Home Position" on page 83).

If the transfer tube was not the blockage source, go to the next procedure, "Cleaning the Injection Valve or the Sample Loop."

## Cleaning the Injection Valve or the Sample Loop

If the blockage was not in the needle tubing assembly or the transfer tube, it must be in either the injection valve or the sample loop. Clear the blockage, and then set the syringe to the home position.

**CAUTION** Do not clean the injection valve with a cleaning wire, which can damage the valve.

### ❖ To clear the blockage from the sample loop

1. Remove the sample loop from the valve.
2. Clear blockage from the sample loop by pushing a wire through it. Or, connect a new sample loop to the valve.
3. After you reconnect the sample loop, home the position of the syringe.

### ❖ To clear the blockage from the injection valve

1. Remove the sample loop from the valve (see "Changing the Sample Loop" on page 48).
2. Remove the valve from the autosampler (see "Removing the Injection Valve from the Autosampler" on page 52).

3. Disassemble the valve (see “Disassembling the Injection Valve” on page 54).

> **CAUTION** The polished (sealing) surface of the stator contains six ports that excess handling can easily damage. As you remove the stator from the injection valve, avoid touching this polished surface, and never place the polished surface face down on a hard surface.

4. Place the stator (with the front face down) and the rotor seal side-by-side in a beaker. Fill the beaker with HPLC-grade methanol or acetonitrile, and then place the beaker in an ultrasonic bath and sonicate for approximately 10 minutes.
5. Reassemble the valve (see “Installing a New Rotor Seal” on page 55).
6. Reinstall the valve (see “Reinstalling the Injection Valve” on page 56).
7. After you clear the source of the blockage, home the position of the syringe (see “Setting the Syringe to the Home Position” on page 83).

# Replacing the Needle Tubing Assembly

The needle tubing assembly connects the solvent path between the needle and the syringe valve.

**CAUTION** The needle tubing is easily damaged. Before you operate the autosampler, take care to route the needle tubing through the support brackets.

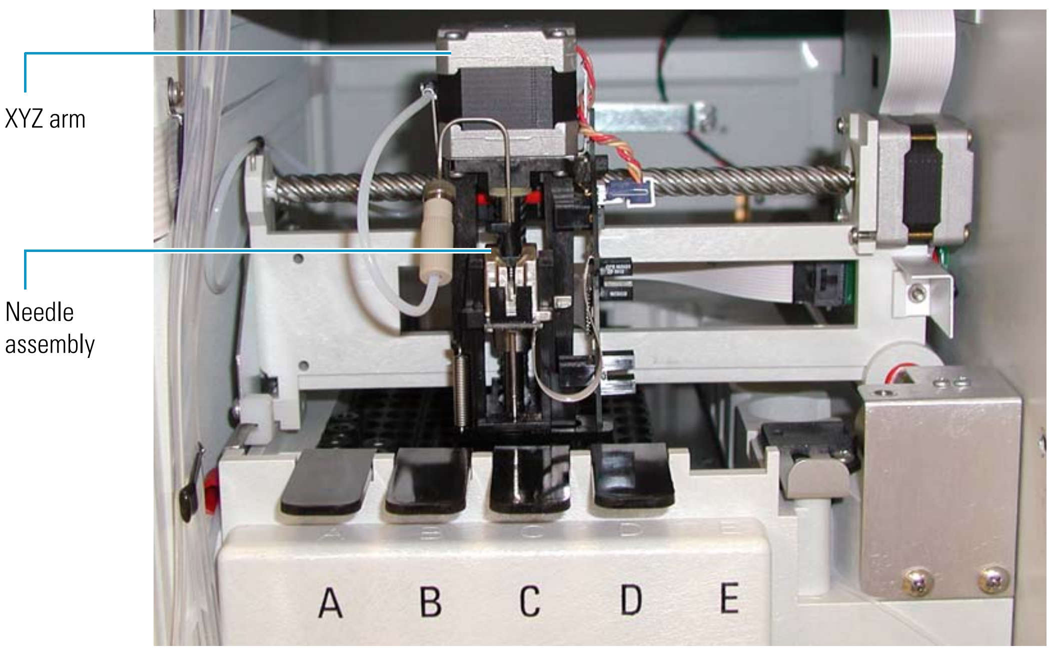
To replace the needle tubing assembly, follow these steps:

1. Setting the Needle to the Removal Position
2. Removing the Needle Tubing Assembly
3. Installing the Needle Tubing Assembly
4. Setting the XYZ Arm to the Home Position

## Setting the Needle to the Removal Position

Setting the needle to the removal position moves the XYZ arm to the front-center of the tray compartment and lowers the needle one inch (see Figure 55).

**Figure 55.** XYZ arm set to the front center of the tray compartment



### ❖ To set the needle to the removal position

Do the following:

- For the Xcalibur data system, open the Direct Control dialog box for the autosampler (see “Using the Xcalibur Direct Control Commands” on page 267). Select **Needle Removal**, and then click **Apply**.
- For the ChromQuest data system, open the Direct Controls page for the autosampler (see “Using the ChromQuest Direct Commands” on page 269). Select **Position Arm to Replace Needle**, and then click **Submit**.

To replace the needle tubing assembly, go to the next procedure, “Removing the Needle Tubing Assembly.”

## Removing the Needle Tubing Assembly

### ❖ To remove the needle tubing assembly

1. Move the XYZ arm to the front center of the tray compartment (see “Setting the Needle to the Removal Position” on page 73).
2. Unscrew the needle tubing from the needle assembly.
3. Remove the needle tubing from the bracket on the XYZ arm (see Figure 57 on page 76).
4. Pull the two-pronged needle tubing guide out of the *x*-axis positioning frame (see Figure 58 on page 76).
5. Move the XYZ arm to the back of the tray compartment (see “Moving the XYZ Arm to the Back of the Tray Compartment” on page 51).
6. Remove the needle tubing from the bracket on the left wall of the tray compartment (see Figure 59 on page 77).
7. Remove the needle tubing from the bracket on the inside of the tray compartment door (see Figure 61 on page 78).
8. Pull the tubing out of the tray compartment. A black or red PVC cap keeps the tubing positioned below the metal runner for the *x*-axis positioning frame.
9. Unscrew the needle tubing from the right side of the two-way syringe valve (see Figure 62 on page 78).

Go to the next procedure, “Installing the Needle Tubing Assembly.”

## Installing the Needle Tubing Assembly

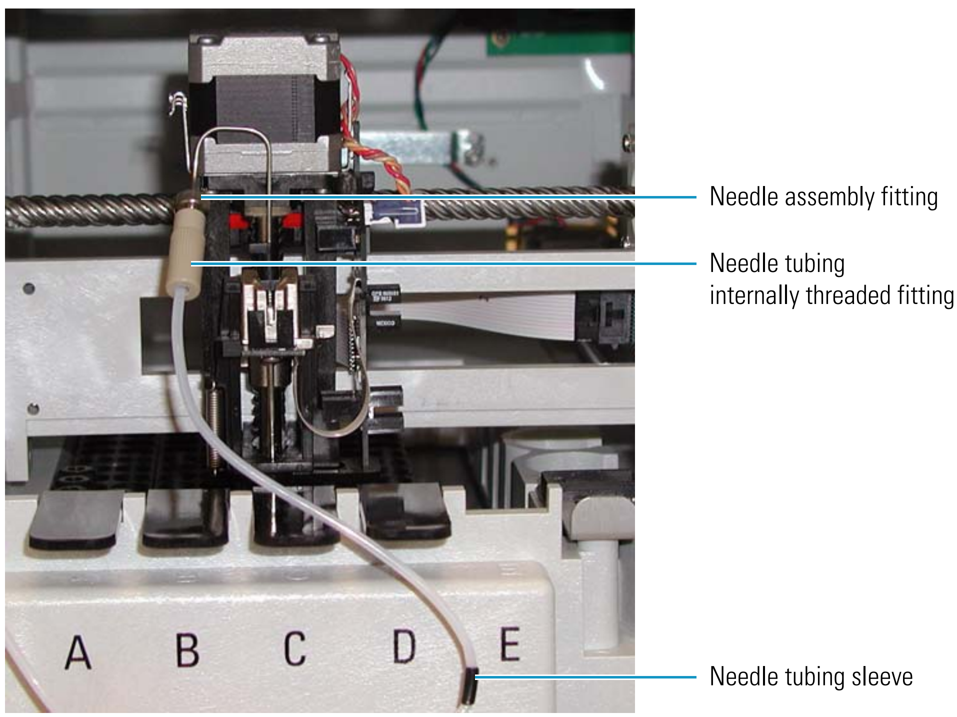
❖ **To install a new needle tubing assembly**

1. Connect the internally-threaded fitting of the needle tubing assembly to the needle assembly fitting (see Figure 56).

2. Verify that the length of tubing between the internally threaded fitting and the black sleeve is approximately 16.5 cm (6.5 in.) in length (see Figure 56).

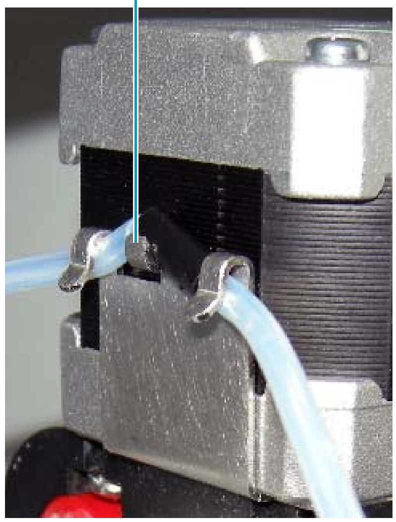
   **Tip** When the needle tubing assembly is connected to the needle assembly, the distance between the needle tubing fitting and the letter E on the tray compartment is approximately 16.5 cm (6.5 in.).

**Figure 56.** Appropriate length of tubing between the needle tubing fitting and the needle tubing sleeve




3. Route the needle tubing through the bracket on the XYZ arm. Seat the black sleeve in the middle of the bracket (see Figure 57).

**Figure 57.** Needle tubing routed through the bracket on the XYZ arm




4. Insert the prongs of the needle tubing guide into the alignment holes in the *x*-axis positioning frame (see Figure 58).

**Figure 58.** Needle tubing guide inserted into the alignment holes in the *x*-axis frame

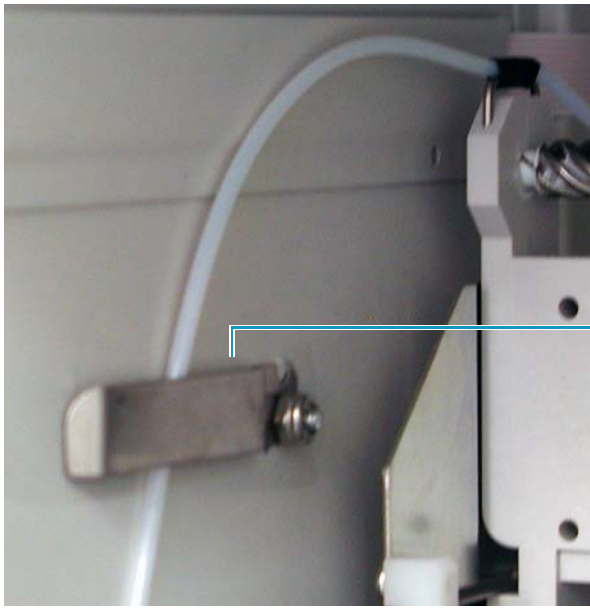

5. Move the XYZ arm to the back of the tray compartment.

For information about using the direct controls for the autosampler, see the quick reference guide for your data system:

- "Using the Xcalibur Direct Control Commands" on page 267
- "Using the ChromQuest Direct Commands" on page 269

6. Route the needle tubing through the bracket on the left wall of the tray compartment (see Figure 59).

**Figure 59.** Bracket on the left wall of the tray compartment

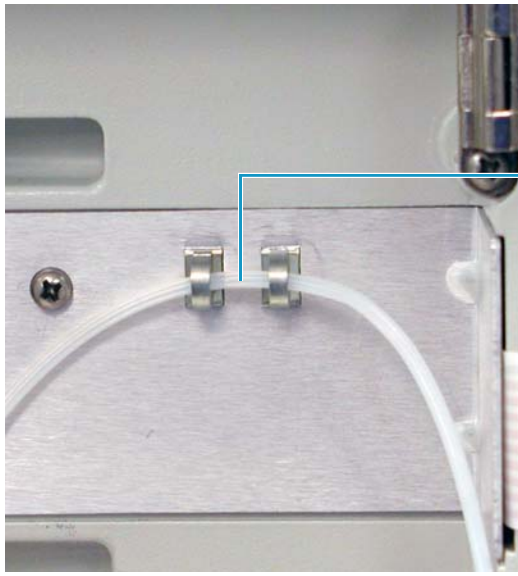



7. Push the black or red PVC cap (that is attached to the needle tubing assembly) below the metal runner for the *x*-axis positioning frame (see Figure 60).

**Figure 60.** Black or red PVC cap that keeps the needle tubing below the metal runner of the *x*-axis positioning frame

8. Route the needle tubing through the bracket on the inside of the tray compartment door (see Figure 61).

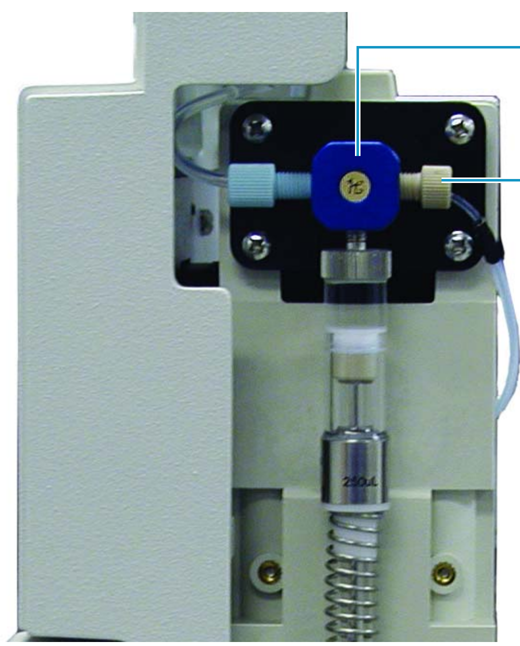
**Figure 61.** Bracket on the inside of the tray compartment door




> **Note** The bracket on the tray compartment door of your autosampler might look different from the bracket shown in Figure 61.

9. Connect the externally threaded fitting of the needle tubing fitting to the right side of the syringe valve (see Figure 62).

**Figure 62.** Needle tubing connected to the right side of the syringe valve




Go to the next procedure, "Setting the XYZ Arm to the Home Position."

## Setting the XYZ Arm to the Home Position

To set the XYZ arm to the home position, use the appropriate command from the data system.

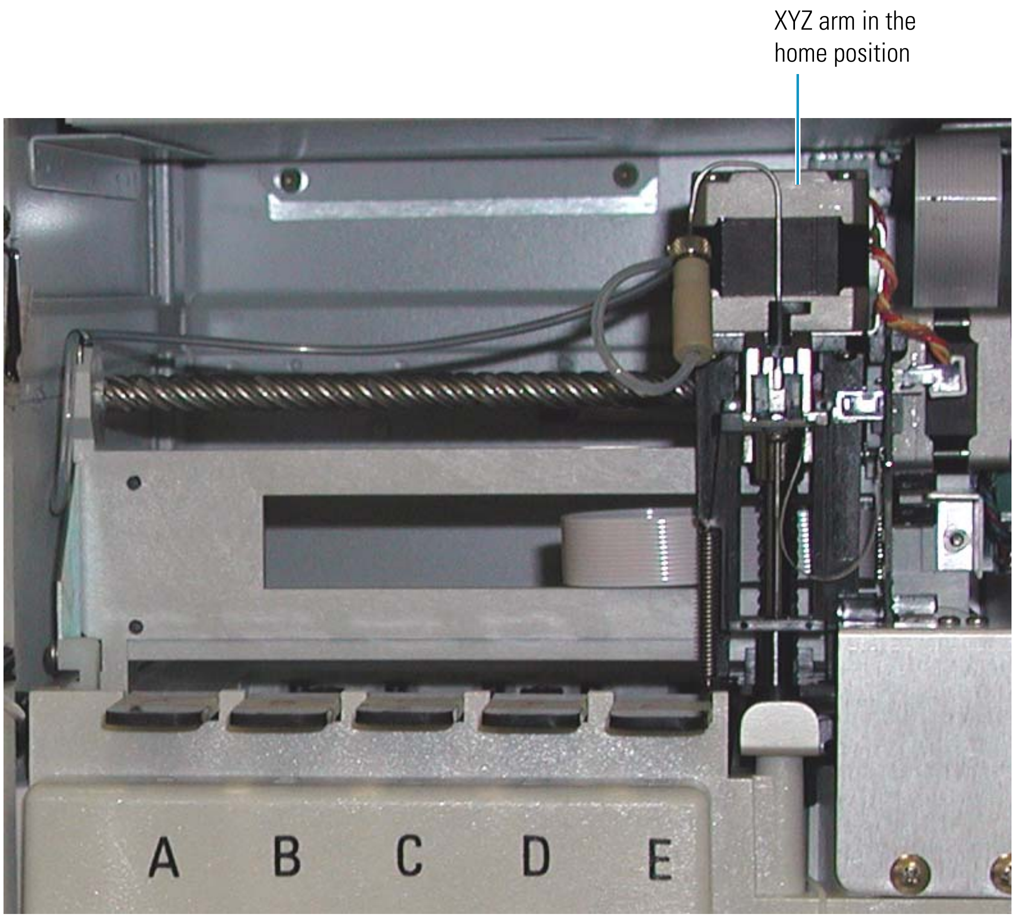
### ❖ To set the XYZ arm to the home position

Do the following:

- For the Xcalibur data system, open the Direct Control dialog box for the autosampler (see "Using the Xcalibur Direct Control Commands" on page 267). Select **Set Arm to Home Position**, and then click **Apply**.
- For the ChromQuest data system, open the Direct Controls page for the autosampler (see "Using the ChromQuest Direct Commands" on page 269). Select **GoTo Home**, and then click **Submit**.

The home position of the XYZ arm is directly behind the wash station (see Figure 63).

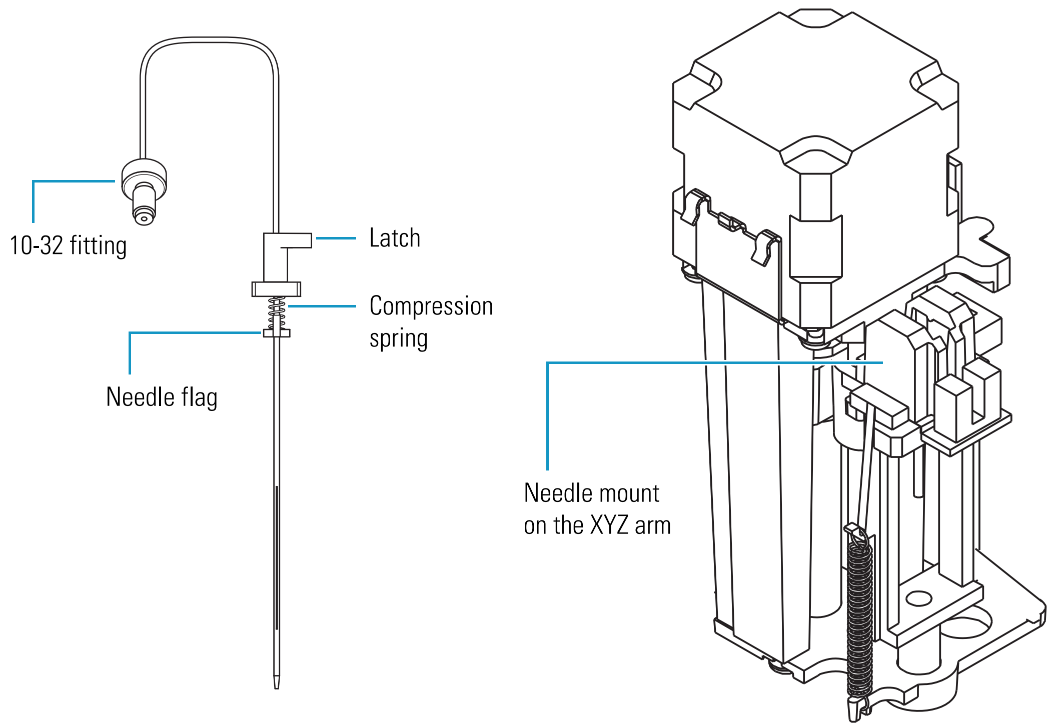
**Figure 63.** XYZ arm in the home position



# Replacing the Needle Assembly

The needle assembly is a welded piece of 0.012 in. ID stainless steel tubing with an externally-threaded fitting, a needle flag, a latch, and a compression spring (see Figure 64). It slides into the needle mount on the XYZ arm and is secured with the latch.

**Figure 64.** Needle assembly




### ❖ To replace the needle assembly

1. Move the XYZ arm to the front-center of the tray compartment (see "Setting the Needle to the Removal Position" on page 73).
2. Remove the needle assembly as follows:
   a. Unscrew the needle tubing assembly from the needle assembly.
   b. Pull the latch nut of the needle assembly forward.
   c. Pull the needle up and out of the needle mount on the XYZ arm.
3. Install a new needle assembly as follows:
   a. Slide the needle into the needle mount on the XYZ arm.
   b. Turn the latch to the right.
   c. Attach the needle tubing assembly to the needle assembly.
4. Home the position of the XYZ arm (see "Setting the XYZ Arm to the Home Position" on page 79).

# Changing the Syringe or Replacing the Inner Plunger

You must change the syringe if a different size is required for your application. For the dual-concentric syringe, the lifespan of the inner plunger is approximately 50000 injections. If the inner plunger of the 250 µL syringe wears out—that is, if fluid leaks out of the bottom of the syringe, you must replace the plunger. For the inner plunger part number, see page 252.

To replace the syringe or the syringe plunger, follow these steps:

1. Setting the Syringe to the Removal Position
2. Removing the Syringe from the Autosampler
3. Replacing the Inner Plunger of the Syringe
4. Installing the Syringe
5. Setting the Syringe to the Home Position

## Setting the Syringe to the Removal Position

### ❖ To set the syringe to the removal position

Do the following:

- For the Xcalibur data system, open the Direct Control dialog box for the autosampler (see "Using the Xcalibur Direct Control Commands" on page 267). Select **Set Syringe to Removal Position**, and then click **Apply**.
- For the ChromQuest data system, open the Direct Controls page for the autosampler (see "Using the ChromQuest Direct Commands" on page 269). Select **Position Syringe for Removal**, and then click **Submit**.

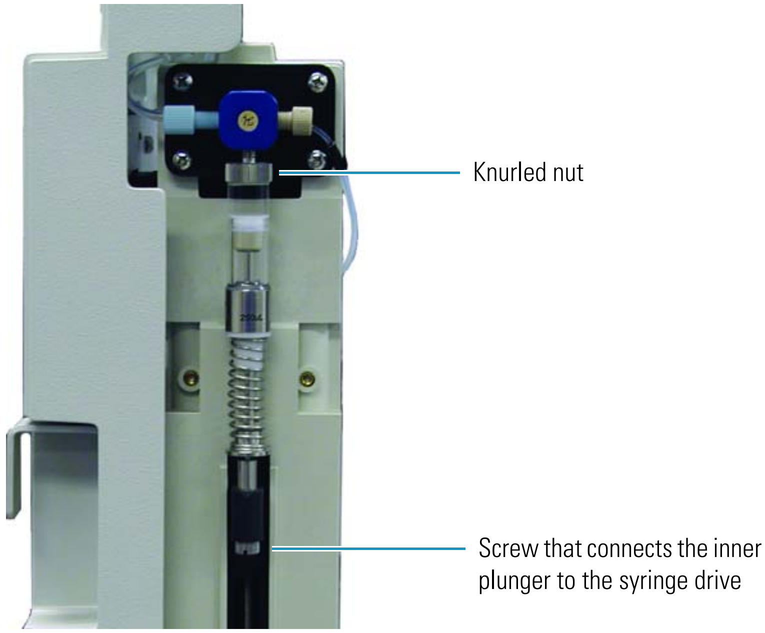
The inner plunger of the dual-concentric syringe and the syringe drive move downward.

## Removing the Syringe from the Autosampler

### ❖ To remove the syringe

1. Set the syringe to the removal position (see the previous procedure, Setting the Syringe to the Removal Position).
2. Undo the screw that connects the syringe plunger to the syringe drive (see Figure 65).
3. Loosen and remove the syringe by turning the knurled top of the syringe counterclockwise (see Figure 65).

**Figure 65.** Syringe mounted to the syringe drive assembly

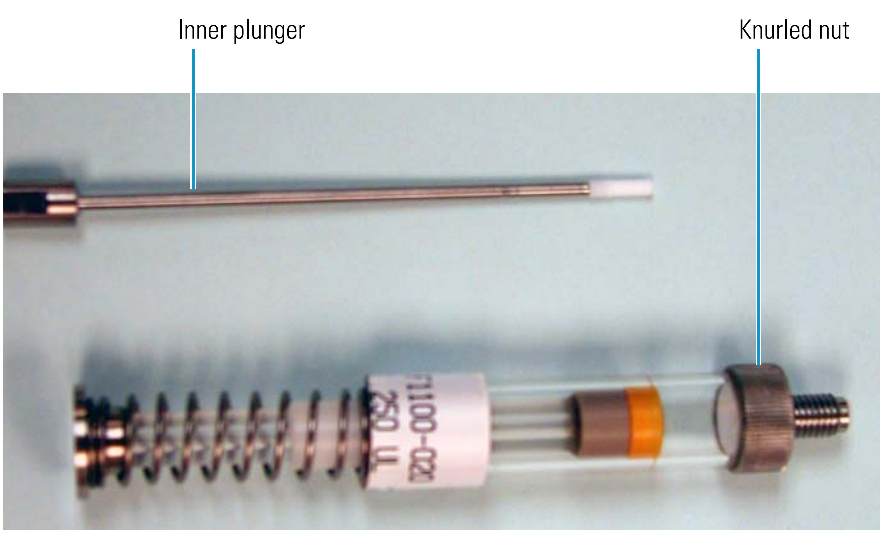



## Replacing the Inner Plunger of the Syringe

❖ **To replace the inner plunger**

1. Remove the syringe from the autosampler (see “To set the syringe to the removal position” on page 81).
2. Pull the worn plunger out of the bottom of the syringe (see Figure 66).
3. Replace the worn plunger with a new replacement inner plunger.

**Figure 66.** Inner plunger removed from the dual-concentric syringe



## Installing the Syringe

### ❖ To reinstall the syringe

1. Screw the top of the syringe into the syringe valve.
2. Reconnect the bottom of the inner plunger to the syringe drive.
3. Home the position of the syringe plungers (see the next procedure, Setting the Syringe to the Home Position).

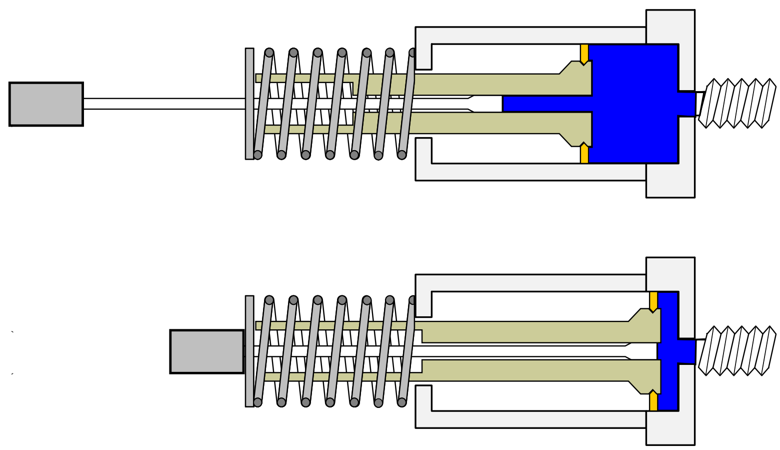
## Setting the Syringe to the Home Position

Figure 67 shows the relative positions of the syringe plungers in the syringe removal position and the home position.

**Figure 67.** Relative positions of the syringe plungers

**Removal position**

**Home position**



### ❖ To set the syringe to the home position

Do the following:

- For the Xcalibur data system, open the Direct Control dialog box for the autosampler (see "Using the Xcalibur Direct Control Commands" on page 267). Select **Set Syringe to Home Position**, and then click **Apply**.
- For the ChromQuest data system, open the Direct Controls page for the autosampler (see "Using the ChromQuest Direct Commands" on page 269). Select **Position Syringe to Home**, and then click **Submit**.

The inner plunger moves upward until the nut on the bottom of the plunger meets the washer on the bottom of the syringe. Then both plungers move upward until they are 1.5 mm (0.06 in.) below the top of the outer syringe barrel.

**IMPORTANT** If you change the size of the syringe, you must change the syringe type parameter for the configuration of the Accela Autosampler.

# Clearing a Plugged Heat Exchanger

The current heat exchanger is a piece of 0.004 in. ID × 1/16 in. OD stainless steel tubing located behind the column oven plate (see Figure 70).

**Note** The original heat exchanger has internal female fittings and does not require unions to connect the solvent lines to the inlet and outlet ports. If your autosampler has the original version of the heat exchanger, see "Legacy Versions of the Accela Autosampler" on page 271.

To clear a plug from the heat exchanger, backflush the tubing by reversing the solvent flow.

### ❖ To backflush the heat exchanger tubing

1. Using a 1/4 in. open-end wrench, disconnect the union connected to the heat exchanger inlet (see Figure 68) and disconnect the union connected to the heat exchanger outlet (see Figure 69).

**Figure 68.** Heat exchanger schematic, showing the unions connected to the inlet and outlet ends of the tubing

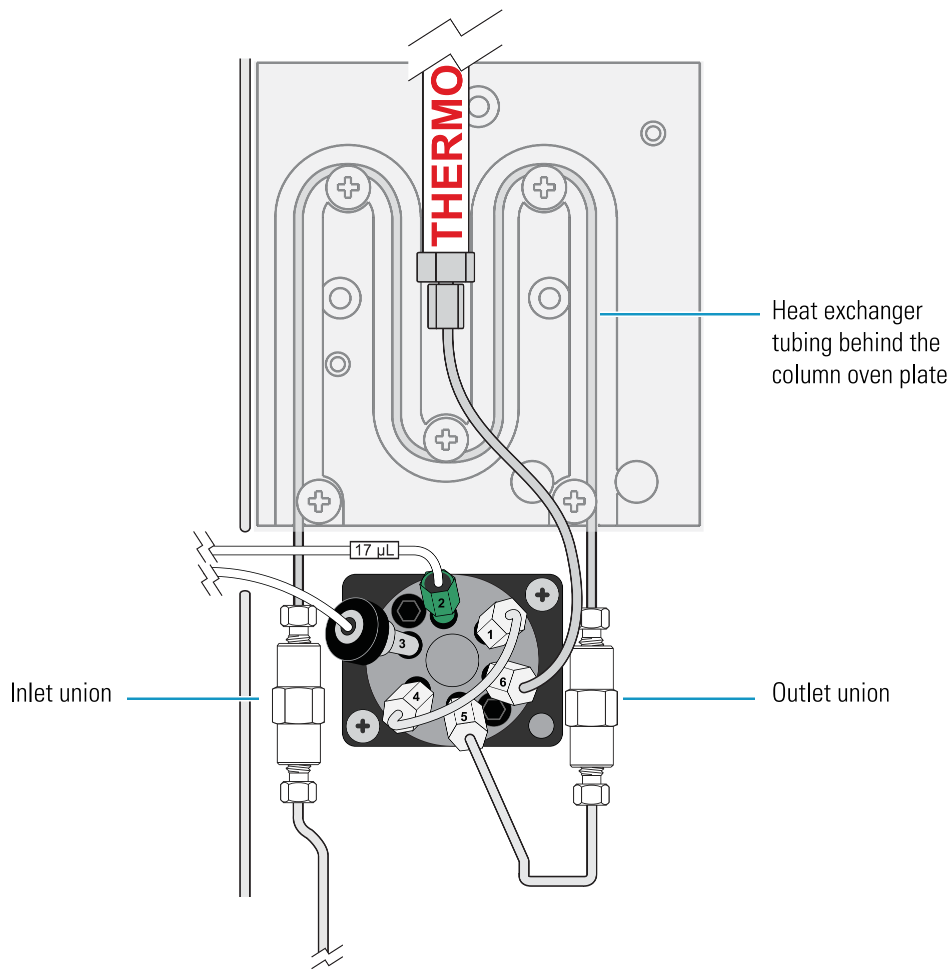
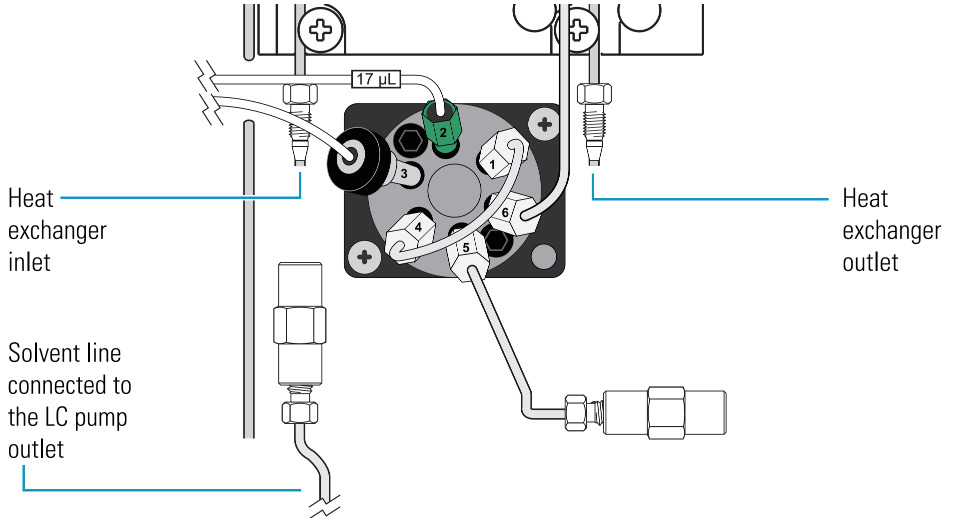
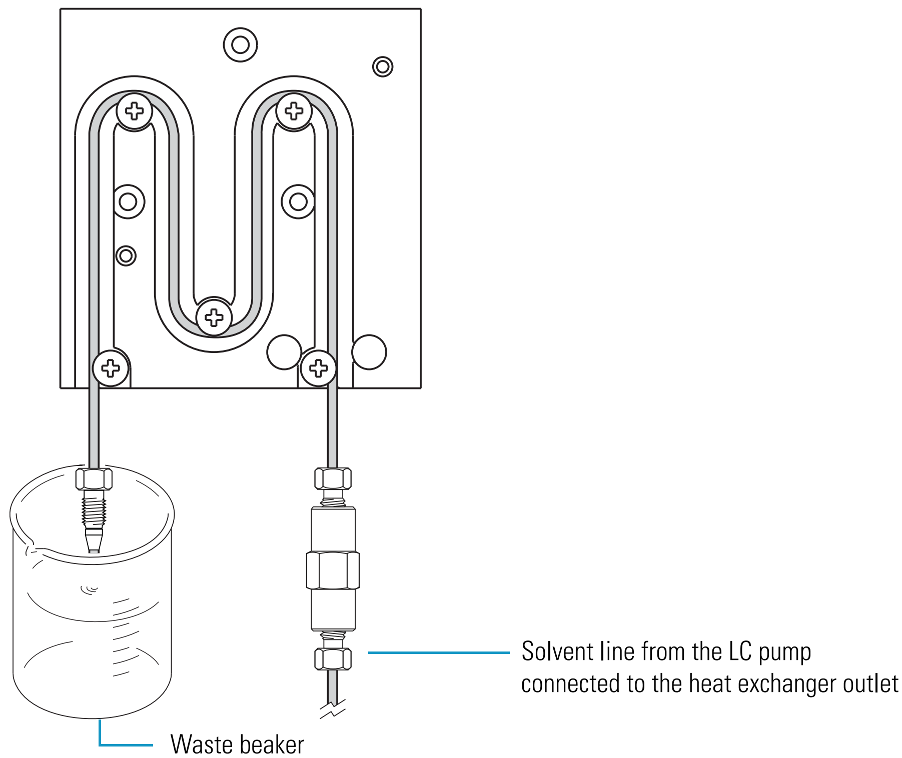


**Figure 69.** Unions disconnected from the inlet and outlet ends of the heat exchanger tubing




2. Connect the solvent flow from the LC pump to the heat exchanger outlet.

**Figure 70.** Heat exchanger schematic, showing the solvent flow reversed

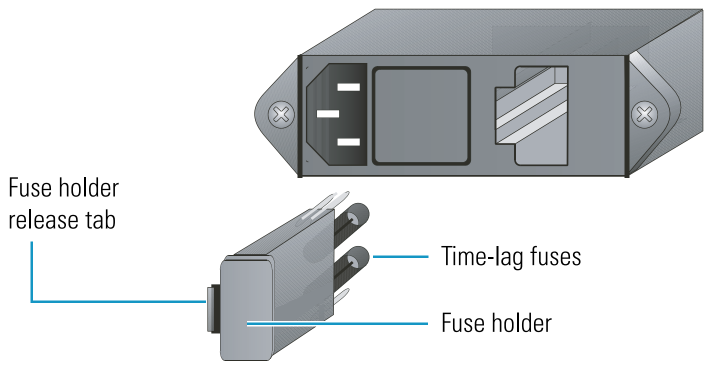



3. Set up a waste beaker to collect the solvent flow from the heat exchanger inlet.
4. Set the flow rate from the LC pump to 1 mL/min.
5. After you clear the plug, reconnect the LC pump to the inlet of the heat exchanger and reconnect the outlet of the heat exchanger to port 5 of the injection valve.

# Replacing a Fuse

Instrument power is supplied by two 5.0 A, 250 V, TL, 5 OD × 20 mm length fuses. The fuses are housed in the fuse compartment on the lower right corner as you are facing the back panel of the autosampler (see Figure 71). If an electrical component in your autosampler stops working, first check for a blown fuse.

**Figure 71.** Power entry module




**CAUTION** Disconnect the power cord before you replace fuses.

### ❖ To replace a fuse

1. Turn off the autosampler and disconnect its power cord.
2. Use a flat blade to press down on the plastic tab at the top edge of the fuse compartment and pull out the fuse holder.
3. Inspect each fuse for a burned or broken wire (which indicates a blown fuse).
4. Pull the blown fuse out of the holder and discard it. Place the new fuse (5.0 A, 250 V, TL, 5 × 20 mm) into the holder with the metal end visible.

**CAUTION** When you are replacing fuses, use only fuses of the type and current rating specified. Do not use repaired fuses and do not short-circuit the fuse holder.

5. Snap the fuse holder back into place.
6. Reconnect the power cord and turn on the autosampler.

If the replacement fuse fails in a short time, you have a serious electrical problem. Leave the blown fuse in place and contact your Thermo Fisher Scientific service representative.

# Maintenance Cycles

The rotor seal, injection needle, and inner syringe plunger wear with use. From the data system, you can set the scheduled maintenance time (SMT) for these autosampler components.

To set the maintenance cycles, follow the procedure for your data system:

- Setting the Maintenance Cycles from the Xcalibur Data System
- Setting the Maintenance Cycles from the ChromQuest Data System

## Setting the Maintenance Cycles from the Xcalibur Data System

Each page of the Maintenance Information dialog box contains a Usage Limit box, a Current Counter readback, a Set New Limit button, and a Zero Counter button. Use each page to set a new usage limit, view the current counter readback, or zero the current counter reading.

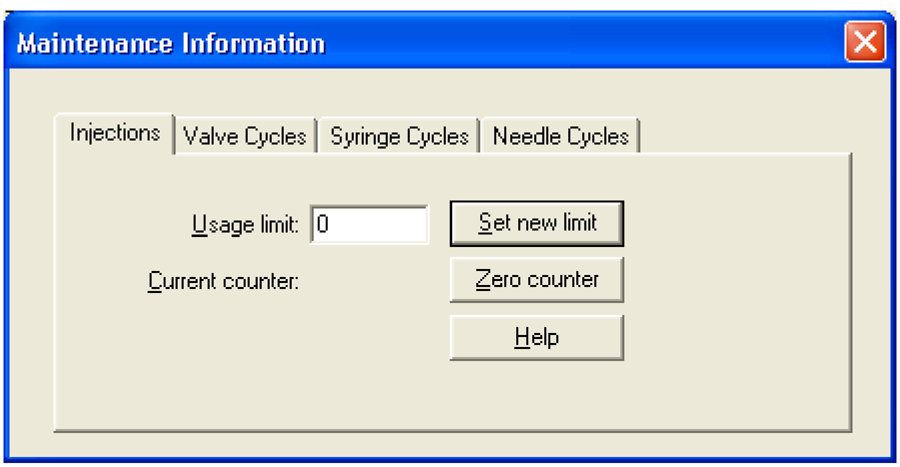
If the counter exceeds the usage limit, the Accela Autosampler cannot start a run until you perform the scheduled maintenance, or you select the Enable Maintenance Log check box of the Accela Autosampler Configuration dialog box.

### ❖ To set the scheduled maintenance limits from the Xcalibur data system

1. In the Instrument Setup window for the Accela AS, choose **Accela AS > Maintenance**.

   The Maintenance Information dialog box appears (see Figure 72).

   **Figure 72.** Maintenance Information dialog box (Xcalibur data system)



2. Depending on the usage limit you want to set, open the appropriate page.

| Page | Usage limit |
|---|---|
| Injections | Maximum number of autosampler injections |
| Valve Cycles | Maximum number of times that the autosampler can switch the valve between the fill and inject positions |
| Needle Cycles | Maximum number of times that the autosampler can insert the needle into a vial septum, the injection port, or the wash station |
| Syringe Cycles | Maximum number of times that the autosampler can return the syringe to the Ready position |

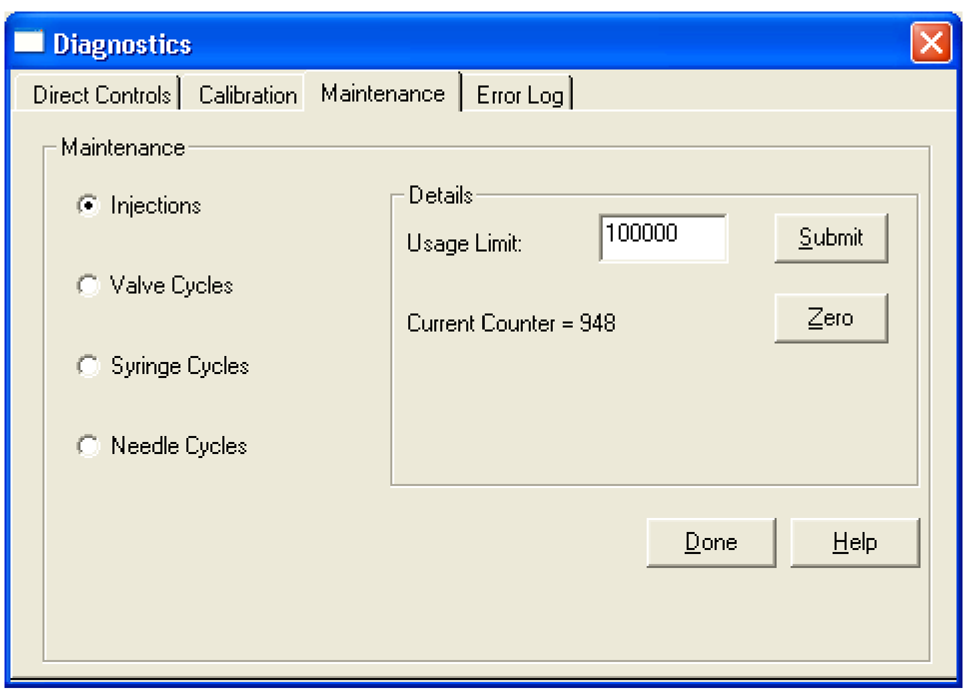
3. To change the usage limit, type the new value in the Usage Limit box, and then click **Set New Limit**.

4. To rezero the counter, click **Zero Counter**.

## Setting the Maintenance Cycles from the ChromQuest Data System

The Maintenance page in the ChromQuest data system contains four options: Injections, Valve Cycles, Syringe Cycles, and Needle Cycles. After you select an option, its corresponding Details box appears on the right side of the Maintenance page. You can use each Details box to set a usage limit, view the current counter readback, or zero the current counter reading (see Figure 73).

**Figure 73.** Maintenance page (ChromQuest data system)



If the counter exceeds the usage limit, the Accela Autosampler cannot start a run until you perform the scheduled maintenance or you clear the Enable Maintenance Log check box of the Accela Autosampler Configuration dialog box.

### ❖ To set up the maintenance cycles from the ChromQuest data system

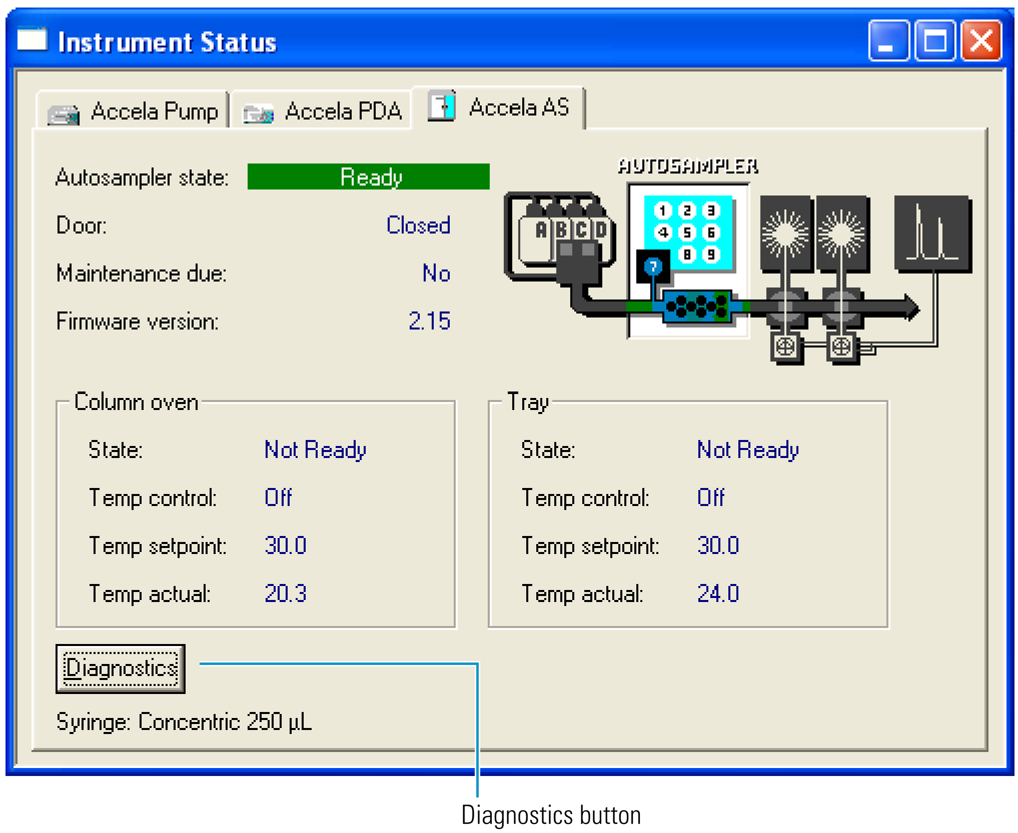
1. In the online Instrument window, choose **Control > Instrument Status**.

   The Instrument Status window appears.

2. Click the **Accela AS** tab.

   The Accela AS status page appears (see Figure 74).

   **Figure 74.** Accela AS status page (ChromQuest data system)

3. Click **Diagnostics**.

   The Diagnostics dialog box appears.

4. Click the **Maintenance** tab.

   The Maintenance page appears (see Figure 73 on page 88).

5. Select the option that you want to set:

   - To set the usage limit for the number of user-defined injections, select the **Injections** option.
   - To set the usage limit for the number of user-defined valve cycles (from Fill to Inject), select the **Valve Cycles** option.
   - To set the usage limit for the number of user-defined syringe cycles where the syringe is put in the Ready position, select the **Syringe Cycles** option.
   - To set the usage limit for the number of user-defined needle cycles where the needle is inserted into a septum, injection port, or wash station, select the **Needle Cycles** option.

6. To change the usage limit, type the new value in the Usage Limit box, and then click **Submit**.

# Advanced Maintenance

This chapter describes maintenance procedures performed by field service engineers.

**CAUTION** Only Thermo Fisher Scientific field service engineers are qualified to perform the following procedures. Follow the safety precautions. Removing the instrument's chassis from its enclosure can expose you to high-voltage hazards.

**Contents**

# Block Diagram of the Accela Autosampler

Figure 75 is a block diagram showing the major functions of the Accela Autosampler. Figure 76 on page 93 through Figure 83 on page 96 show enlarged sections of this block diagram.

**Figure 75.** Block diagram of the Accela Autosampler

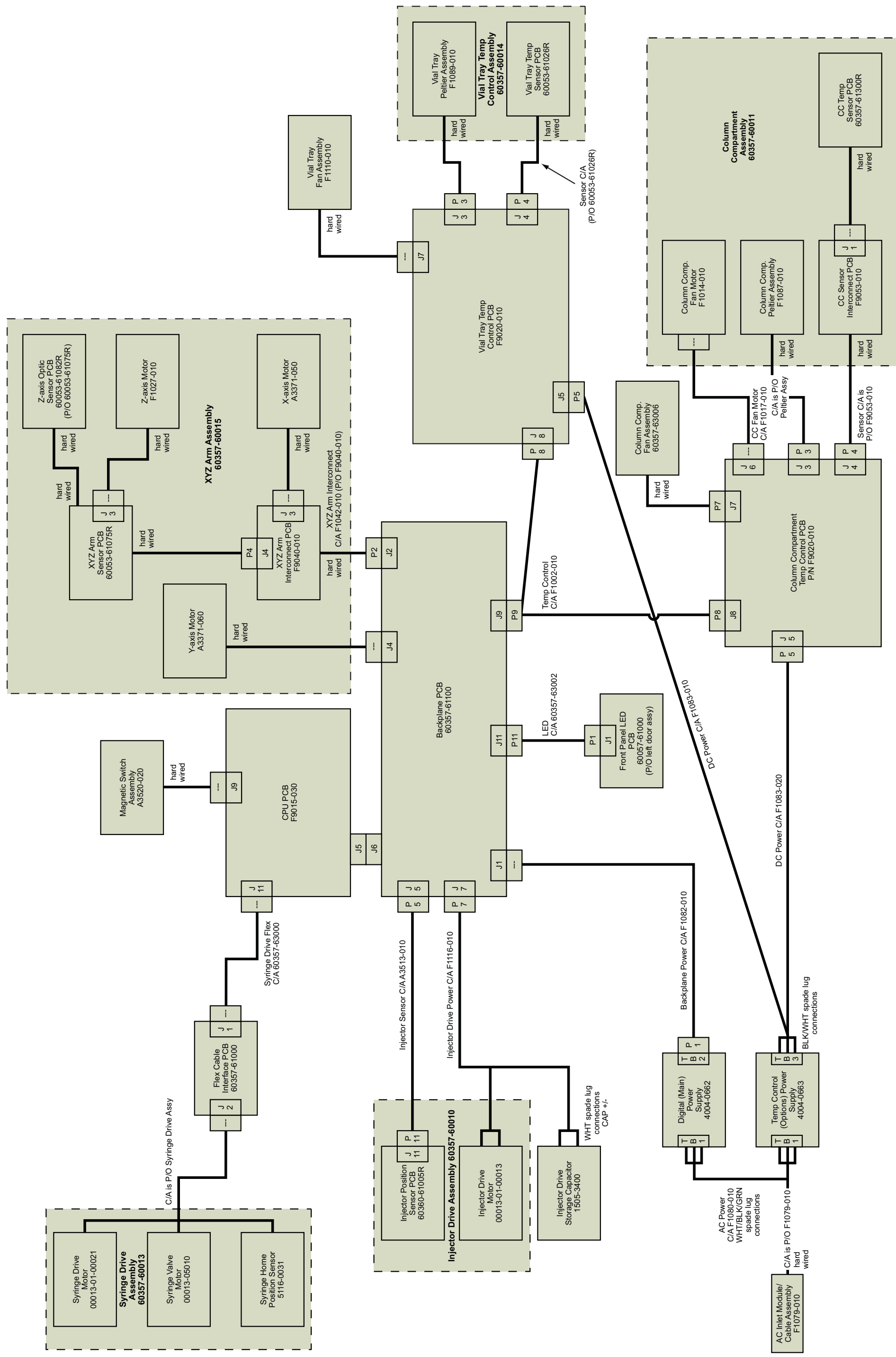


**Figure 76.** Syringe drive assembly

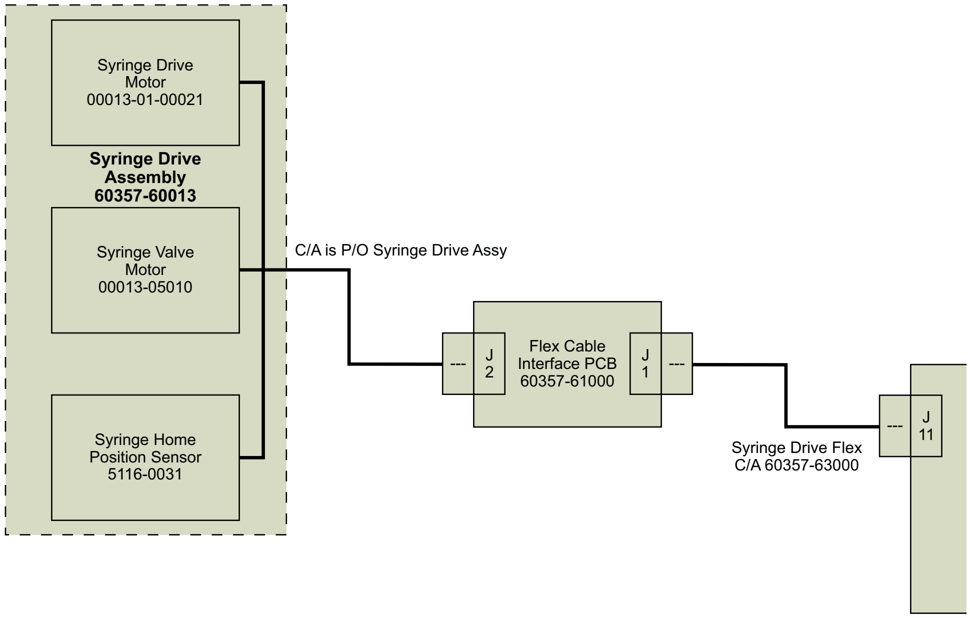



**Figure 77.** CPU PCB and magnetic switch assembly

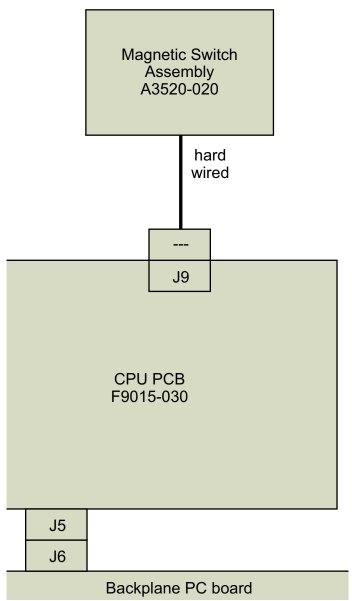


**Figure 78.** XYZ arm assembly

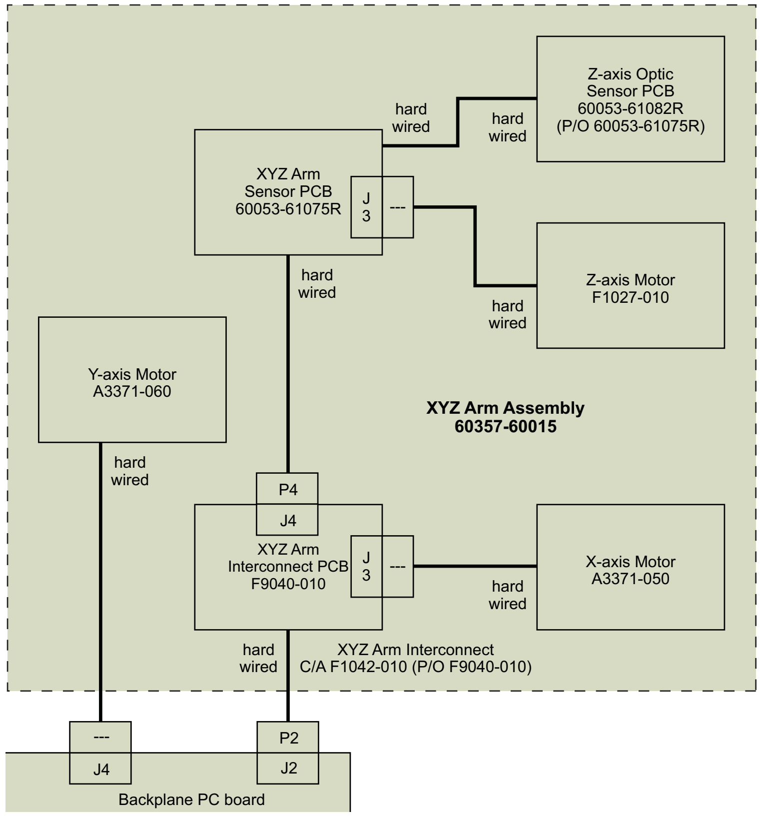



**Figure 79.** Injector drive assembly

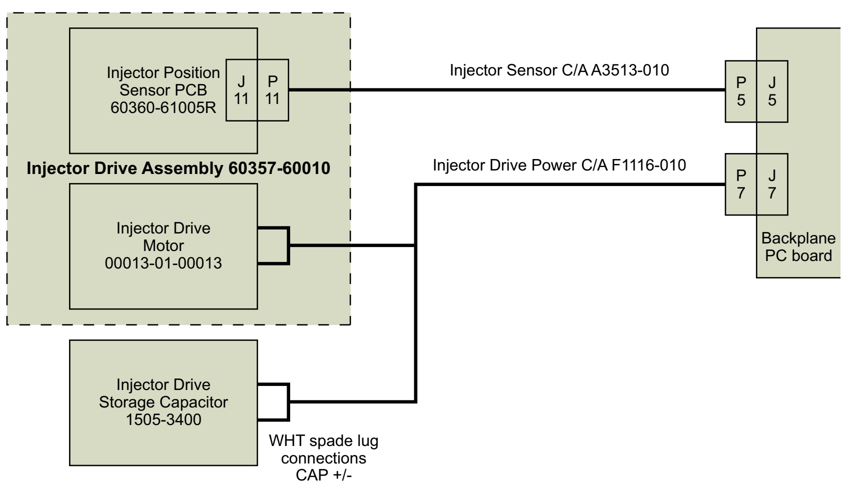


**Figure 80.** Backplane PCB and front panel LED assembly

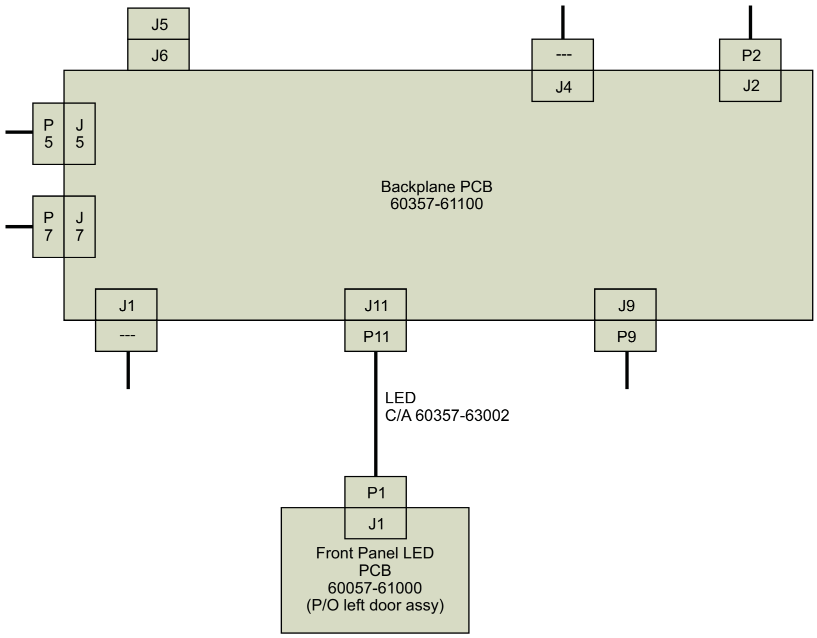



**Figure 81.** Vial tray temperature control assembly

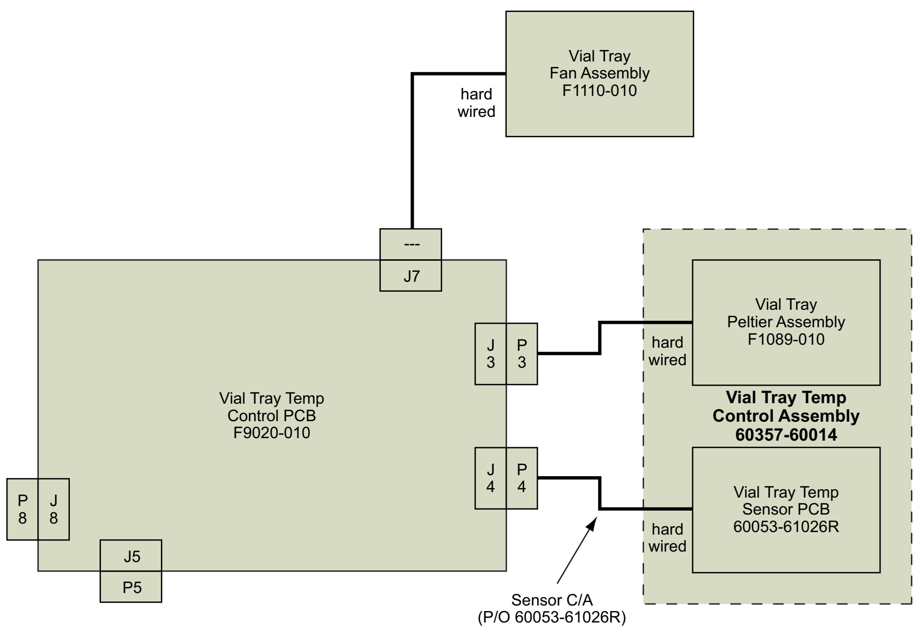


**Figure 82.** Power supply assembly

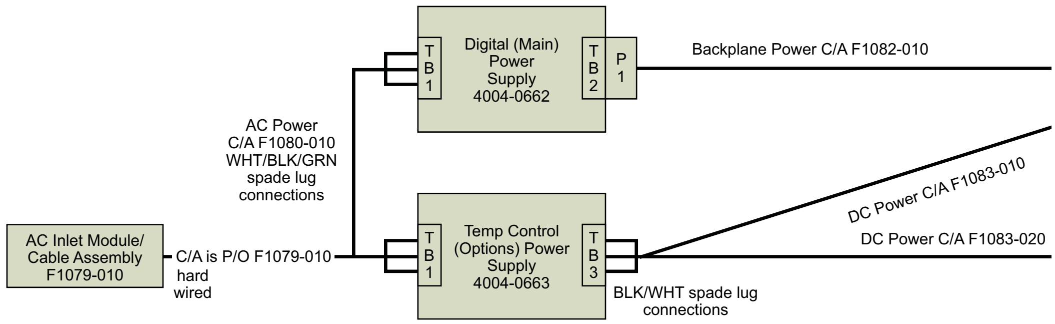
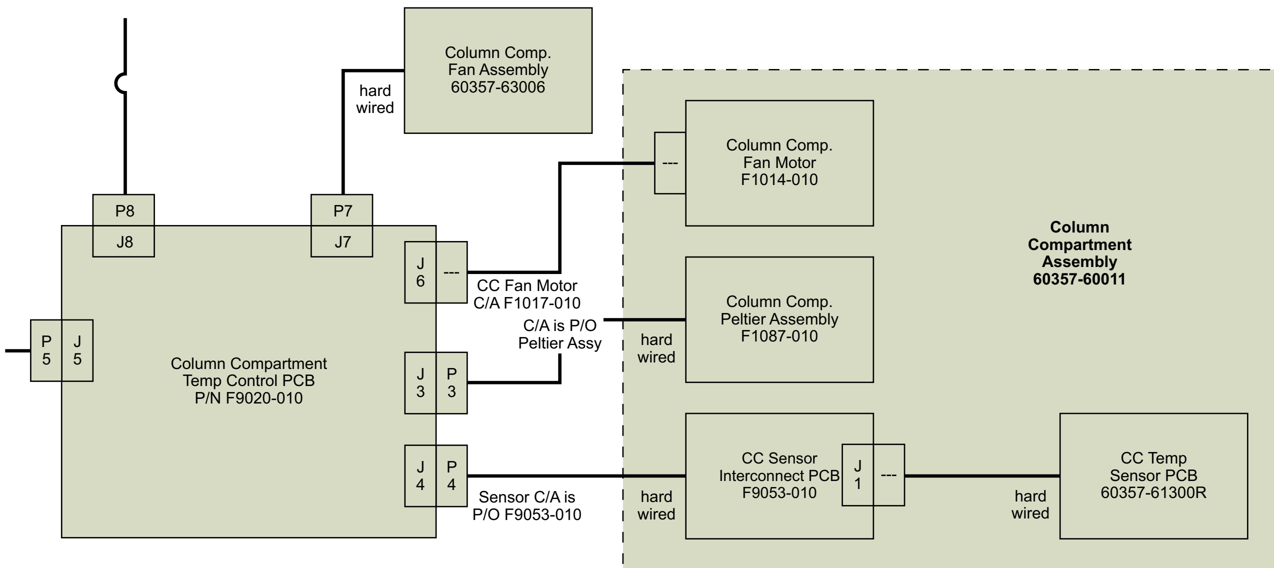



**Figure 83.** Column compartment (oven) assembly




# General Instructions

The following instructions apply to all repair and replacement procedures:

**CAUTION** Always turn the autosampler off and disconnect the AC power cord before you begin the removal or replacement of any part.

- Before you perform repairs, look at the instrument's maintenance history. The maintenance log is kept in the non-volatile random-access memory (NVRAM) of the autosampler's CPU. Access it according to the type of data system that you are using:
  - For Thermo Scientific mass spectrometry data systems such as Xcalibur, see "Setting the Maintenance Cycles from the Xcalibur Data System" on page 87.
  - For the ChromQuest data system, see "Setting the Maintenance Cycles from the ChromQuest Data System" on page 88.

- If you must remove the right panel of the autosampler to repair or change a part, avoid damaging the instrument by following the procedure in "Removing and Replacing the Right Side Panel of the Autosampler."

## Removing and Replacing the Right Side Panel of the Autosampler

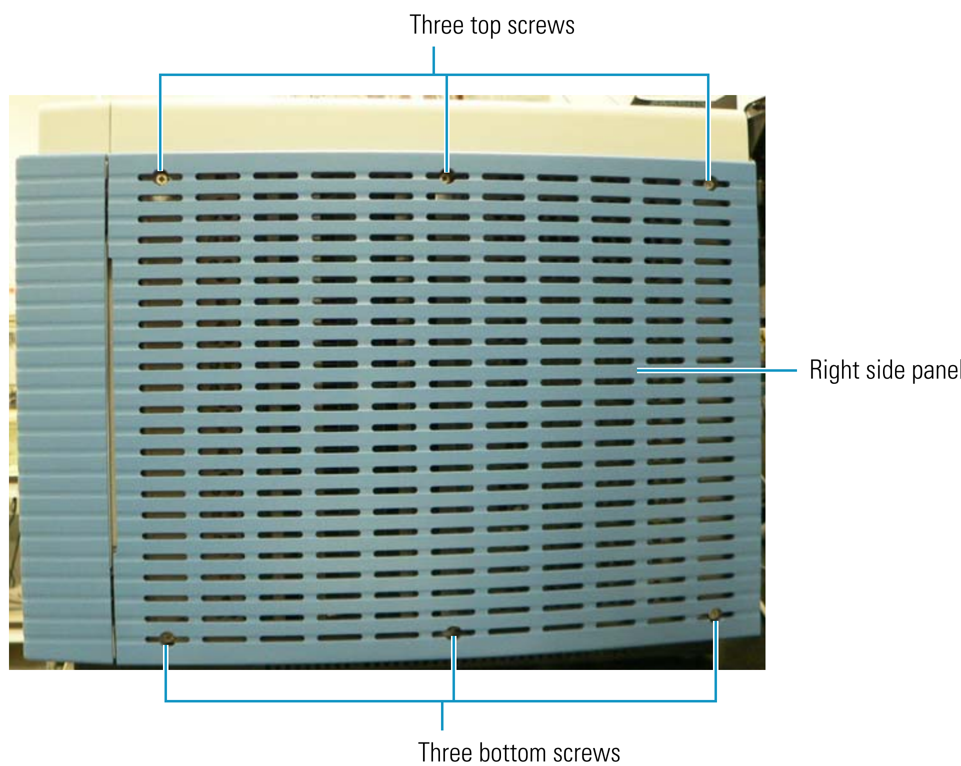
Repairs and maintenance procedures involving the column compartment (oven) or any components residing on the right side of the autosampler require you to take off the right side panel of the Accela Autosampler.

### ❖ To remove the right side panel of the autosampler

Using a No. 2 Phillips screwdriver, take off the panel on the right side of the autosampler by removing the three screws along the top of the panel and the three screws along the bottom of the panel (see Figure 84).

Loosen the middle screws first. They are captive screws and can be damaged when you pull off the panel.

**Figure 84.** Right side panel of the Accela Autosampler




### ❖ To replace the right side panel of the autosampler

1. Place the panel on the right side of the autosampler and insert the three screws along the top of the panel and the three screws along the bottom of the panel (see Figure 84).

2. Tighten the middle screws last. They are captive screws and can be damaged when you replace the panel.

## Major Components of the Accela Autosampler

Figure 85 shows some of the components that reside near the front of the Accela Autosampler.

**Figure 85.** Front view of the Accela Autosampler

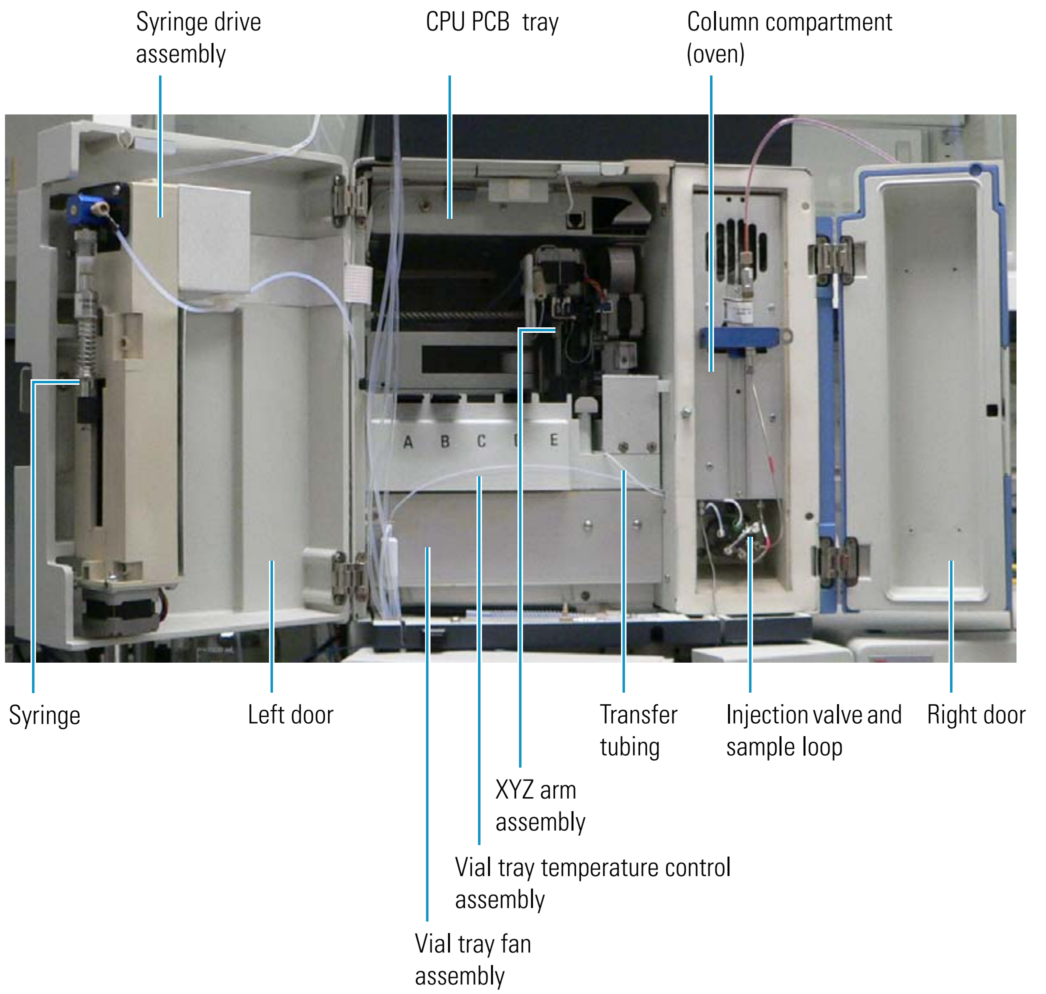
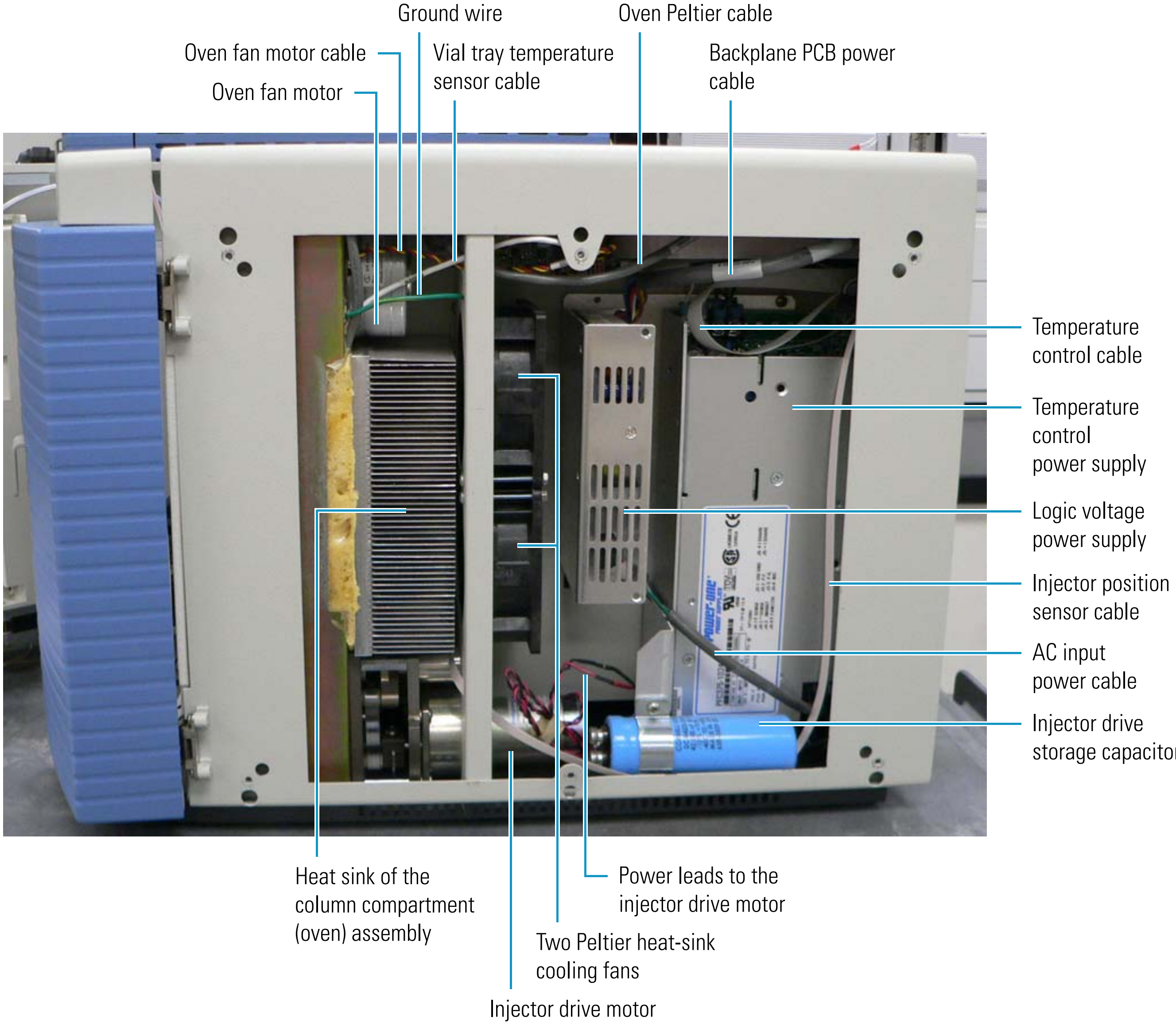


Figure 86 shows where most of the components on the right side of the autosampler reside.

**Figure 86.** Right view of the Accela Autosampler



# Turning On the Accela Autosampler

### ❖ To turn on the Accela Autosampler

Press the On/Off button on the front left side to set the switch to On.

If the autosampler successfully starts, the Communication LED turns amber, and the rest of the LEDs shown in Figure 87 turn green. If the startup is not successful, the LEDs will display the conditions described in Table 3 in "Status LEDs" on page 16. For instructions on diagnosing the problem, see "Power Up Diagnostics" on page 213. If you suspect a problem with the CPU PCB, follow the procedures in "Determining If the CPU PCB Has Failed" on page 104 to diagnose the problem.

**Figure 87.** Status LEDs


Figure 88 and Figure 89 on page 102 show an example of the steps in the HyperTerminal™ emulation program that occur during the Accela Autosampler's initialization procedure and their corresponding physical effects in the autosampler. To start the HyperTerminal application, follow the procedure in "To obtain diagnostic information from HyperTerminal" on page 105.

**Figure 88.** Example of Accela Autosampler startup sequence

Power LED turns green.

```
pSOSystem V2.2.1
Copyright (c) 1991 - 1997, Integrated Systems, Inc.
----------------------------------------------------------------------------------------------------
START-UP MODE:
            Run the ROM/Flash Boot Application
NETWORK INTERFACE PARAMETERS:
            IP address on LAN is 172.16.1.255
            LAN interface's subnet mask is 0xffff0000
HARDWARE PARAMETERS:
            Serial channels will use a baud rate of 9600
            QUICC MicroCode Revision:4
            DRAM Installed: 8 MBytes
            This board's Ethernet hardware address is 00:01:70:02:17:68
            After board is reset, start-up code will wait 1 seconds
----------------------------------------------------------------------------------------------------
To change any of this, press any key within 1 seconds
Updating parameter storage. This may talke a while...IP address cannot be modified, IP address is: 172.16.SW.MM
Done

Standard output device initialized...

Pseudo device initialized...
System clock initialized...

Date & time successfully set
Nework Utilities for  /68K-GHS-DIAB/2.1.0 - Network Utility
Version: ROM 1.08
Found RAM executable at 0x80000
Transferring 2986501 (0x209205) bytes from 0x80010 to 0x4031010,
            testing checksum..........................................
checksum is 59510 (0xE876) stored value is 59510 (0xE876)
Starting RAM code at 0X4031010

Standard output device initialized...

Pseudo device initialized...
System clock initialized...

Date & time successfully set
RAM disk initialized - size is 256 blocks...
Initializg disk volume 3.0, Please wait ...Done

Copyright (c) Integrated Systems, Inc., 1992.
Welcome to pSOSy

pSH+> Network Utilities for  /68k-GHS-DIAB/2.1.0 - Network Utility
```

Communication LED turns amber.
Run LED turns green.
Temperature LED turns green.

**Figure 89.** Example of Accela Autosampler startup sequence, continued

```
initializing motion system
Error: EC PM ITEM NONINIT <Y:\as difMot\srd\difMotion. c 785> Item not initialize
d. : {difmotConfRetrieve: Failed reading Z values from pm
}
Unable to retrieve Z axis config params from PM. Using defaults.
Error: EC_PM_ITEM_NOTINIT <Y:\as\difMot\src\difMotion.c 824> Item not initialize
d. : {difmotConfRetrieve: Failed reading  S values from pm
}
Unable to retrieve S Axis config params from PM. Using defaults.

running startup diagnostics
Timer  1  value 1248
Timer  1  test passed
Timer  2  value 1248
Timer  2  test passed
Timer  3  value 1248
Timer  3  test passed
Timer  4  value 1248
Timer  4  test passed
Dram size setup registers are OK
BR and OR registers OK
X , Y, Z and S motors detected
XZ connector detected
Oven Temperature controller detected
Oven metal sensor ADC value = 1019
Oven air sensor ADC value     =  297
Oven 24V supply ADC value   = 2261
Oven 12V supply ADC value   = 1535
Oven current mirror  (PWM off) ADC value     =  375
Oven current mirror  (100% cool) ADC value  =  1601
Oven current mirror  (100% heat) ADC value  =  1550
Oven current mirror  (50% cool) ADC value    =  1009
Oven current mirror  (50% heat) ADC value    =  982
Oven current mirror  (PWM off) ADC value    =  377
Tray temperature controller detected
Tray metal sensor ADC value = 980
Tray 24V supply ADC value = 2248
Tray 12V supply ADC value = 1535
Tray current mirror   (PWM off) ADC value    =  374
Tray current mirror  (100% cool) ADC value  =  1946
Tray current mirror  (100% heat) ADC value  =  1956
Tray current mirror  (50% cool) ADC value    =  1177
Tray current mirror  (50% heat) ADC value   =  1191
Tray current mirror  (PWM off) ADC value     =  375
Successfully started temperature tasks
Door Opened
Successfully started interrupt handler task.
Successfully initialized Flush Valve system.
Successfully initialized Injector Valve system.
172.16.1.111 is On-Line
#Cnf0bj Inst = 39
#CnfStateModel Inst = 15
#CnfEvent Inst = 0
#CnfTimer Inst = 0
```

Syringe valve moves to solvent (intake) position.

Injection valve moves to inject or fill position.

Syringe drive moves syringe to home (empty) position.
Syringe drive moves syringe to full position.
XYZ arm moves to home position.
Syringe valve moves to needle position.

## Turning Off the Accela Autosampler

❖ **To turn off the Accela Autosampler**

Press the On/Off button on the front left side to set the switch to Off.

# Maintaining the CPU PCB

The Accela Autosampler's central processing unit (CPU) printed circuit board (PCB) (PN F9015-030 or replacement (PN 60053-61070R in 60053-60049), shown in Figure 90, resides in a tray on the ceiling of the autosampler chassis. It performs the following functions:

- Controls the movement and positioning of the motors, including the injection valve and the solvent selection valve.
- Communicates with the personal computer.
- Regulates the temperature in the vial tray and column (oven) compartments through the temperature control PCBs.
- Controls the external input/output signals.
- Stores the firmware—that is, the information that is set during configuration—in memory, both in the NVRAM and the dynamic random-access memory (DRAM).

You can replace the NVRAM and DRAM chips without replacing the CPU PCB.

**Figure 90.** CPU PCB

## CPU PCB LEDs

The autosampler has three green LEDs on the CPU PCB to the right of the connector and just behind the opening for the RS232 port on the front, as shown in Figure 91 on page 105:

- The left LED blinks consistently when the CPU is operating normally. If this light is not blinking 30 seconds after you turn the power on, or if it goes off after a successful initialization, it indicates that the CPU is not running and that power should be cycled on the autosampler. The LED does not blink consistently when you download firmware and program Flash™, but it resumes blinking once the actual download and Flash reprogramming are complete.
- The middle LED connects to the vial bottom sensor. It is normally on when the needle flag is blocking the sensor. It goes off when the needle flag leaves the sensor, indicating that the needle is at the bottom of the vial. The light also goes off when the needle is in the port. You can use this LED as a diagnostic tool to determine if the sensor is working. You can manually trigger this sensor by pulling up on the needle.
- The right LED connects to the vial present sensor, which is the black plastic piece on the *z*-axis mechanism that the needle travels through. This LED is normally on when the slider flag is blocking the sensor and goes off when the needle descends into a vial. You can manually trigger this sensor by pulling up on the slider.

## Determining If the CPU PCB Has Failed

If the autosampler's CPU PCB has failed, only the Power LED comes on when you press the On/Off switch. Once you verify that the CPU PCB has failed, you can remove the old board and replace it.

**Note** An activated Power LED can also indicate that the CPU PC is not in normal operating mode because of other causes, such as a bent pin, a bad connection at the backplane PCB interface, or the firmware operating in the wrong mode.

You can use the HyperTerminal application to obtain diagnostic feedback about the status of the PCBs in the autosampler, including the CPU PCB. Because the HyperTerminal application does not ship with Microsoft™ Windows™ 7 or Vista™, you must download HyperTerminal from the Internet if these operating systems run on your computer. Free downloads are available, but you must keep all of the files together in the same folder. You cannot save the connection settings if you use the free downloads.

This procedure requires the following items:

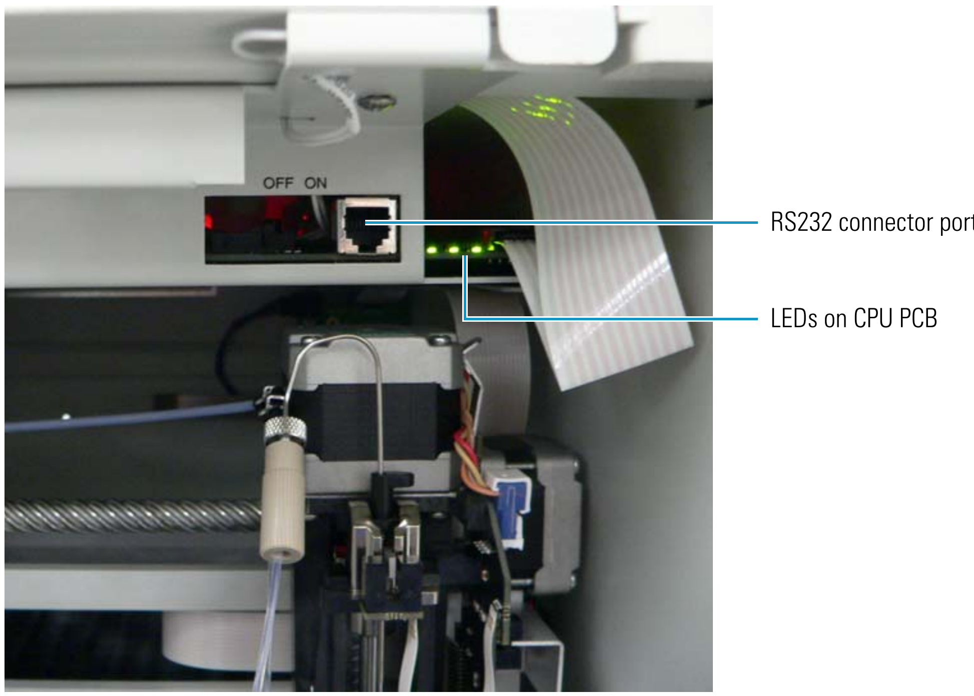
- Adaptor (PN A3538-010)
- Cable (PN A3638-010)

### ❖ To obtain diagnostic information from HyperTerminal

1. Turn off the autosampler.
2. Plug one end of the cable into the adaptor.
3. Plug the adaptor into an available RS232 or com port (com1 or com2) on the computer.

   The RS232 connector on the CPU PCB is a serial port that is used to monitor some internal activities through HyperTerminal. Figure 91 shows this port.

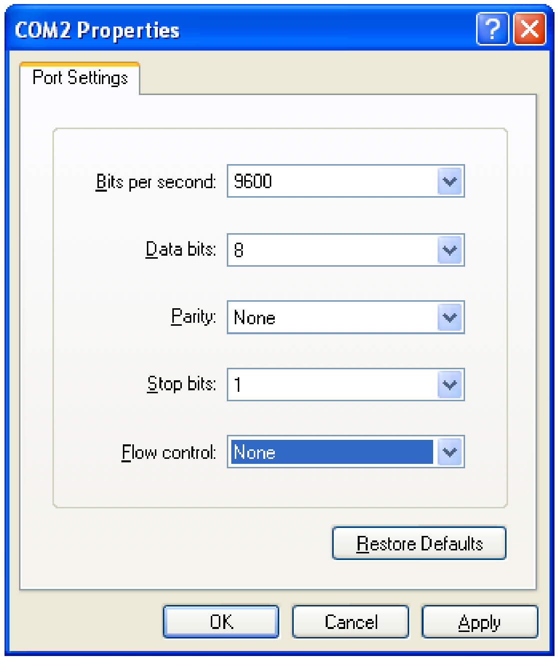
   **Figure 91.** RS232 connector port and CPU PC LEDs

4. Plug the other end of the cable into the RJ-12 port on the autosampler.
5. On the computer, choose **Start** > **All Programs** > **Accessories** > **Communications** > **HyperTerminal** (without the arrow).
6. In the Connections Description dialog box, type the com port number (either com1 or com2), an underscore, and the baud rate, for example, **com2_9600**.
7. Click **OK**.
8. In the Connect To dialog box, click **OK**.
9. In the COM*number* Properties dialog box, set the options as shown in Figure 92:
   - Bits Per Second: **9600**
   - Data Bits: **8**
   - Parity: **None**

- Stop Bits: **1**
- Flow Control: **None**

**Figure 92.** COM*number* Properties dialog box




10. Click **OK**.

11. Turn on the autosampler.

    The diagnostic information begins to appear on the computer monitor. When the HyperTerminal application encounters a serious error, it stops. After you correct the problem, it restarts the diagnostic procedure from the beginning.

### ❖ To save the diagnostic information

1. Choose **Transfer > Capture Text**.

2. In the File box, type the path and name of the file that you want to save the information in.

3. Click **Start**.

   When the HyperTerminal application finishes displaying the diagnostic information, a message box appears on the screen, prompting you to save the configuration information that you entered in step 9 on page 105 (see Figure 92).

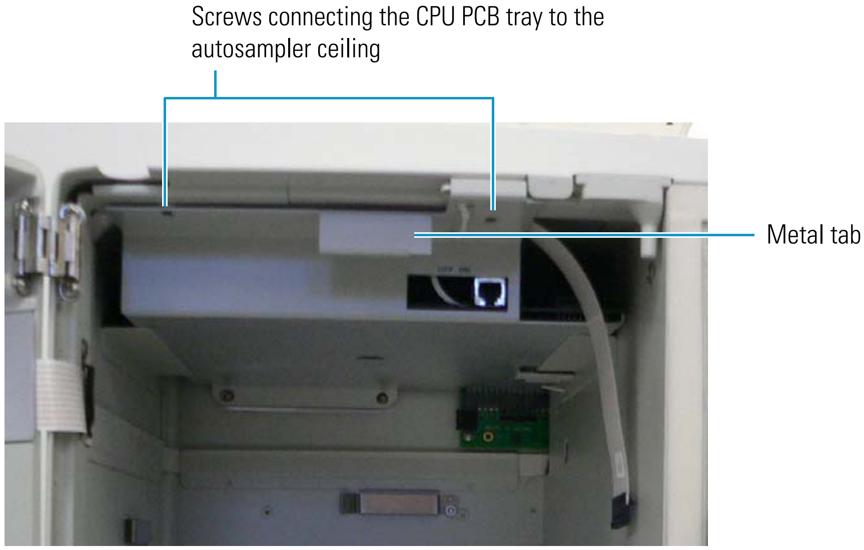
4. Click **OK**.

## Removing and Replacing the CPU PCB

### ❖ To remove the CPU PCB

1. Using a No. 2 Phillips screwdriver, remove the two screws in the ceiling of the autosampler on each side of the large metal tab at the front, as shown in Figure 93.

**Figure 93.** Screws connecting the CPU PCB tray to the autosampler ceiling




2. Release the syringe drive flex cable (PN 60357-63000), shown in Figure 94, from the CPU PCB and move it to the side.

**Figure 94.** Syringe drive flex cable connected to the CPU PCB


3. Pull on the large metal tab at the front of the CPU PCB holder (see Figure 93) to pull out the tray that supports the CPU PCB.

### ❖ To replace the CPU PCB

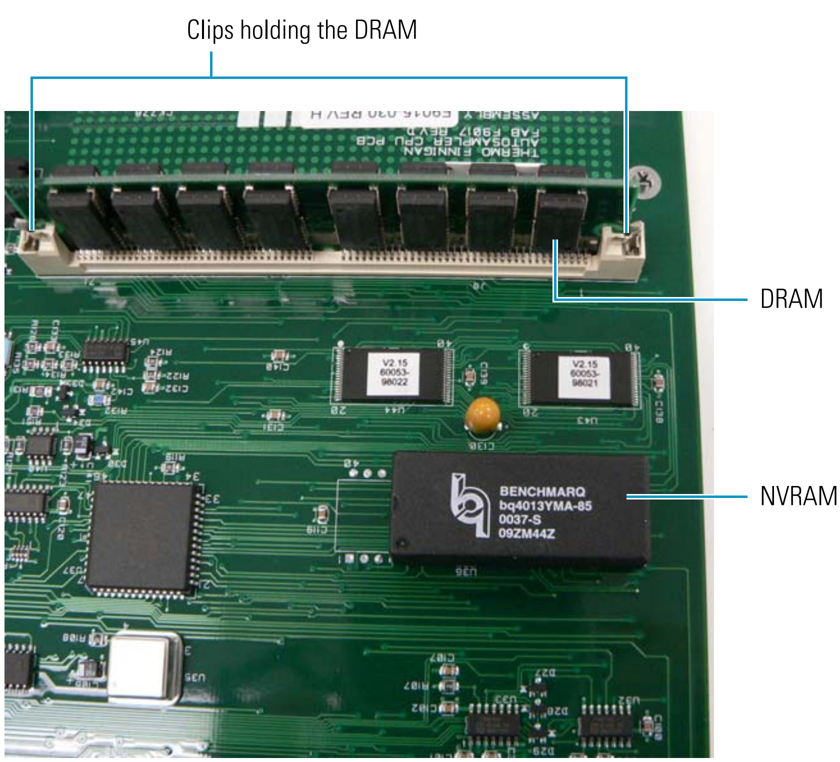
1. Slide in the new CPU PCB on top of the long brackets at the top of the vial tray compartment.
2. Line up the two holes at the back of the CPU PCB with the two cone-shaped pins on the back of the upper chassis wall.
3. Insert the connector on the back edge of the CPU PCB into the backplane PCB (see Figure 181 on page 197 for a picture of this connector).
4. To hold the tray in place, insert the two screws that you removed in step 1 on page 107 into the front ceiling of the autosampler at each side of the large metal tab (as shown in shown in Figure 93 on page 107). Tighten with a No. 2 Phillips-head screwdriver.
5. Reconnect the remaining end of the syringe drive flex cable to the CPU PCB, folding it as shown in Figure 94 on page 107.

> **Note** If the pins are not connected to the edge connector on power-up, the Power LED on the front of the autosampler door is on, and the other three LEDs are off.

## Removing and Replacing the NVRAM

The NVRAM, which resides on the CPU PCB, stores the calibration parameters in RAM without needing any power. It is shown in Figure 95.

**Figure 95.** NVRAM and DRAM on the CPU PCB



**Note** If you replace the CPU (PN F9105-030) with the newer version (PN 600573-61070RS), you might receive a tray mirror error or an oven mirror error at startup. To resolve the tray mirror error, replace the tray temperature controller with the new version, PN 60053-61084RS. To resolve the oven mirror error, replace the oven temperature controller with the new version, PN 60053-61071RS.

❖ **To remove the NVRAM**

1. Remove the CPU PCB from the autosampler by following the instructions in "To remove the CPU PCB" on page 107.

**CAUTION** To prevent instrument damage, use electrostatic discharge (ESD) protection when handling electronic boards and components.

2. Carefully remove the NVRAM from the socket to avoid bending the pins.

❖ **To replace the NVRAM**

1. Line up the dot on the NVRAM board with pin 1 on the CPU PCB.
2. Carefully insert the NVRAM board into the socket to avoid bending the pins.
3. Program the serial number of the board into the NVRAM by following the instructions in "Programming the CPU PC Serial Number into the NVRAM" on page 110.
4. Calibrate the XY home position of the XYZ arm by following the instructions in "Aligning the XYZ Arm" on page 127.

## Removing and Replacing the DRAM

The DRAM, shown in Figure 95 on page 108, stores information that is only available when the power is turned on.

❖ **To remove the DRAM**

1. Remove the CPU PCB from the autosampler by following the instructions in "To remove the CPU PCB" on page 107.
2. Press down on the two clips on the either side of the DRAM to release the DRAM. Figure 95 on page 108 shows these clips.
3. Carefully remove the DRAM from the socket to avoid bending the pins.

❖ **To replace the DRAM**

1. Tilt the DRAM slightly and carefully insert it into the socket between the two clips to avoid bending the pins. Tilt it upright until it snaps into place.

2. Calibrate the XY home position of the XYZ arm by following the instructions in "Aligning the XYZ Arm" on page 127.

## Programming the CPU PC Serial Number into the NVRAM

When you replace the NVRAM, configure the CPU PCB by using the HyperTerminal application. Use the following example as a guide. The bold type shows what you must enter the first time that you configure the NVRAM. Press the ENTER key when you want to move to the next line.

```
DRAM Installed: 8MBytes
--------------------------------------------------------------------
   To change any of this, press any key within 17 seconds
   (M)odify any of this or (C)ontinue? m
For each of the following questions, you can press <RETURN> to select
the value shown in braces, or you can enter a new value.
How should the board boot?
   1. pROBE+ stand-alone mode
   2. pROBE+ waiting for host debugger via serial connection
   3. pROBE+ waiting for host debugger via a network connection
   4. Run the ROM/Flash Boot Application
Which one do you want? [1] 4
NETWORK INTERFACE PARAMETERS:
Do you want a LAN interface? [Y]
This board's LAN IP address(0.0.0.0 = RARP)? [172.16.1.255]
Subnet mask for LAN (0 for none)? [255.255.0.0]
Should there be a default gateway for packet routing? [N]
HARDWARE PARAMETERS:
Baud rate for serial channels [9600]
HARDWARE PARAMETERS:
Do you want to change the board's Ethernet Address? [N] y
   Enter the Ethernet Address from Left to Right
   What should byte 0 be? [8] 0
   What should byte 1 be? [1] 1
   What should byte 2 be? [23] 7d
   What should byte 3 be? [45] 1
   What should byte 4 be? [01] *
   What should byte 5 be? [E1] *
How long (in seconds) should CPU delay before starting up? [17] 1
--------------------------------------------------------------------
```

```
(M)odify any of this or (C)ontinue? [M] C

    *This is clarification and will not display…..Use the last 4
    hexadecimal digits[1]

    (range 0100-FFFF) in the 60053-61070R PCB's serial number for the
    MAC

    Address.

    For example: Serial number 7D01 01E1.

    Byte 4 should be 01.

    Byte 5 should be E1.

Standard output device initialized…

Pseudo device initialized...

System clock initialized...

Date & time successfully set

Network Utilities for /68k-GHS-DIAB/2.1.0 - Network Utility

Version: ROM 1.08

Found RAM executable at 0x80000

Transferring 2986501 (0x2D9205) bytes from 0x80010 to 0x4031010

, testing checksum............................

checksum is 59510 (0xE876) stored value is 59510 (0xE876)

Starting RAM code at 0X4031010

Standard output device initialized...

Pseudo device initialized...

System clock initialized...

Date & time successfully set

RAM disk initialized - size is 256 blocks...

Initializing disk volume 3.0, Please wait...Done

Welcome to pSOSystem...

pSH+> Network Utilities for /68k-GHS-DIAB/2.1.0 - Network Utility

initializing motion system

Error: EC_PM_ITEM_NOTINIT <Y:\as\difMot\src\difMotion.c 705> Item not
initialize

d.: {difMotConfRetrieve: Failed reading X values from pm

}

Unable to retrieve X axis config params from PM. Using defaults.

Error: EC_PM_ITEM_NOTINIT <Y:\as\difMot\src\difMotion.c 745> Item not
initialize
```

[1] The number that you enter here is the serial number of the board; however, do not enter the first four digits.

```
d.: {difMotConfRetrieve: Failed reading Y values from pm
}
Unable to retrieve Y axis config params from PM. Using defaults.
Error: EC_PM_ITEM_NOTINIT <Y:\as\difMot\src\difMotion.c 785> Item not
initialize
d.: {difMotConfRetrieve: Failed reading Z values from pm
}
Unable to retrieve Z axis config params from PM. Using defaults.
Error: EC_PM_ITEM_NOTINIT <Y:\as\difMot\src\difMotion.c 824> Item not
initialize
d.: {difMotConfRetrieve: Failed reading S values from pm
}
Unable to retrieve S axis config params from PM. Using defaults.
Running startup diagnostics
Timer 1 value 1248
Timer 1 test passed
Timer 2 value 1248
Timer 2 test passed
Timer 3 value 1248
Timer 3 test passed
Timer 4 value 1248
Timer 4 test passed
Dram size setup registers are OK
BR and OR registers OK
X, Y, Z and S motors detected
XZ connector detected
Oven Temperature controller detected
Oven metal sensor ADC value = 1151
Oven air sensor ADC value = 1149
Oven 24V supply ADC value = 2242
Oven 12V supply ADC value = 1521
Oven current mirror (PWM off) ADC value = 1136
Oven current mirror (100% cool) ADC value = 1537
Oven current mirror (100% heat) ADC value = 1541
Oven current mirror (50% cool) ADC value = 1343
Oven current mirror (50% heat) ADC value = 1345
Oven current mirror (PWM off) ADC value = 1137
Tray Temperature controller detected
```

```
Tray metal sensor ADC value = 1074
Tray 24V supply ADC value = 2241
Tray 12V supply ADC value = 1523
Tray current mirror (PWM off) ADC value = 1141
Tray current mirror (100% cool) ADC value = 1672
Tray current mirror (100% heat) ADC value = 1675
Tray current mirror (50% cool) ADC value = 1413
Tray current mirror (50% heat) ADC value = 1416
Tray current mirror (PWM off) ADC value = 1141
Successfully started temperature tasks
Successfully started interrupt handler task
Successfully initialized Flush Valve system.
Successfully initialized Injection Valve system.
172.16.1.111 is On-Line
#CnfObj Inst= 39
#CnfStateModel Inst= 15
#CnfEvent Inst= 0
#CnfTimer Inst= 0
pSH+>
```

## Reloading the Firmware File

To reload or update the firmware file, see "Firmware Updates" on page 257.

## Maintaining the XYZ Arm Assembly

The XYZ arm assembly (PN 60357-60015), shown in Figure 96, Figure 97 on page 115, and Figure 98 on page 115, moves the needle to any of the vial positions to extract a fixed amount of sample. It then moves the needle over to the injection port and delivers the sample to the port. From the port, the sample proceeds to the injection valve for induction into the system for analysis.

The XYZ arm assembly resides on top of the vial tray temperature control assembly, shown in Figure 117 on page 132, which rests on the vial tray fan assembly, shown in Figure 118 on page 135. The vial tray temperature control assembly contains fans and a heat sink that remove hot air from the autosampler. The vial tray fan assembly disperses heat generated by the Peltier devices, which are the autosampler's heating and cooling elements.

The XYZ arm assembly includes the following components:

- *X*-axis motor (PN A3371-050)
- *Y*-axis motor (PN A3371-060)
- *Z*-axis motor (PN 1027-010)
- *Z*-axis optic sensor PCB (PN 60053-61082R)
- XYZ arm sensor PCB (PN 60053-61075R)
- XYZ arm interconnect PCB (PN F9040-010)

**Figure 96.** Front view of the XYZ arm assembly

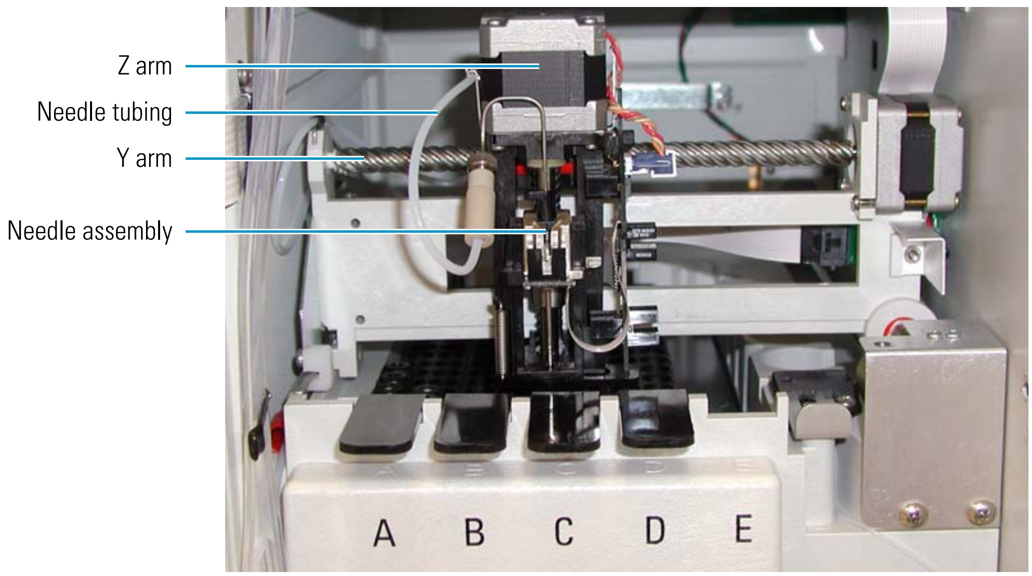


**Figure 97.** Top view of the XYZ arm assembly

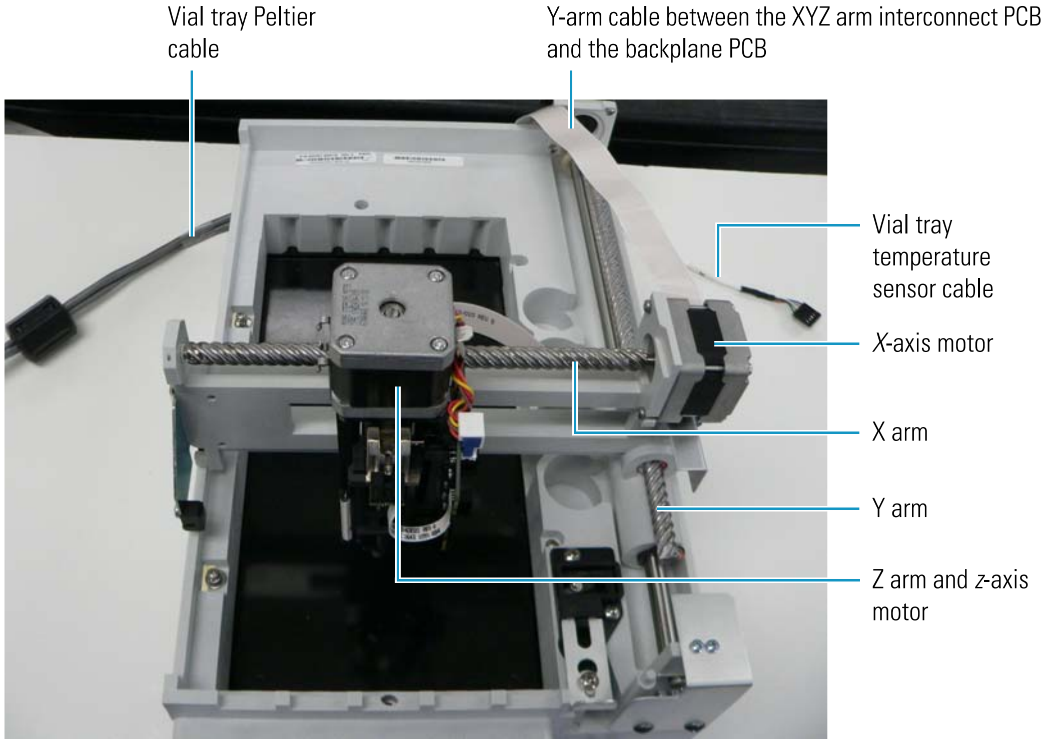
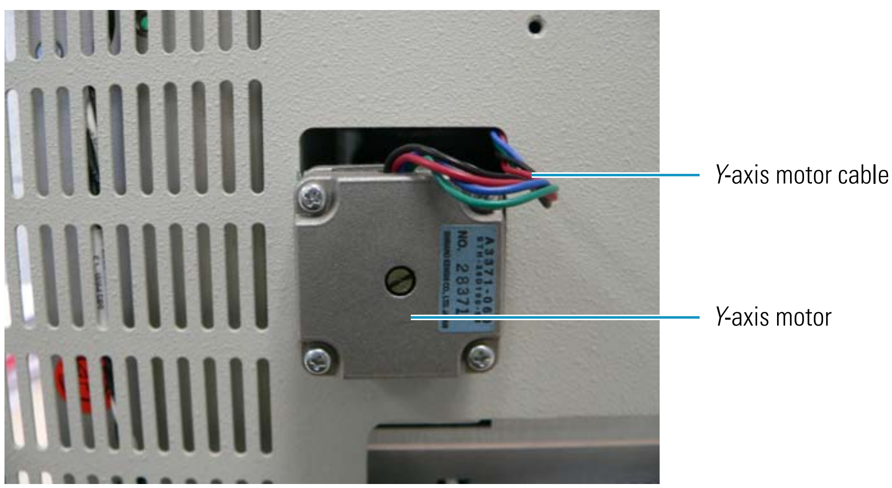



**Figure 98.** *Y*-axis motor and cable at the back of the Accela Autosampler



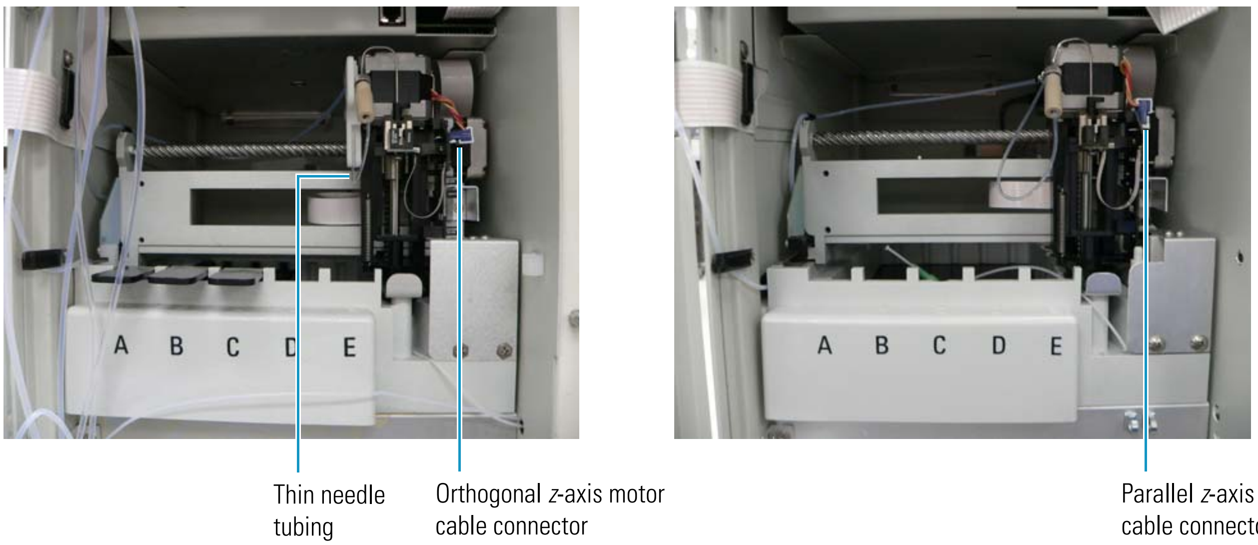
**Note** Some Accela Autosamplers differ from the version shown in Figure 96 on page 114. The autosampler on the left (1) in Figure 99 features needle tubing that routes differently and is thinner in front, more flexible, and more kink-resistant.

Some Accela Autosamplers have a *z*-axis motor cable that connects orthogonally to the XYZ arm sensor PCB, such as that shown in (1). Others have an alternative *z*-axis motor cable connector that plugs in parallel to the XYZ arm sensor PCB, such as that shown on the right (2) in Figure 99.

The illustrations in this manual use Accela Autosamplers with all these variations.

**Figure 99.** Variant features of the Accela Autosampler

(1) (2)




For general information on the XYZ arm, see "XYZ Arm Mechanism" on page 5.

## Cleaning the X and Y Arms

Before you lubricate the X and Y lead screws or the Z rod, use a Kimwipe™ to wipe off the old grease.

## Lubricating the XYZ Arm

It is not necessary to remove the XYZ arm assembly before you lubricate the X and Y lead screws and the Z rod. However, if you want to remove the XYZ arm assembly before you lubricate it, see "Removing and Replacing the XYZ Arm Assembly."

### ❖ To lubricate the XYZ arm

1. Clean the X and Y lead screws and the Z rod by using a Kimwipe to remove the old grease.
2. Squeeze a thin stream of white Teflon grease lubricant (PN 00301-01910) onto the X and Y lead screws.
3. Manually move the arm over the screws a couple of times.
4. Wipe off the excess lubricant.
5. Lubricate the Z rod with a few drops of Triflow™ lubricant, which is non-viscous.
6. Manually move the needle guide up and down over the Z rod a couple of times.

## Removing and Replacing the XYZ Arm Assembly

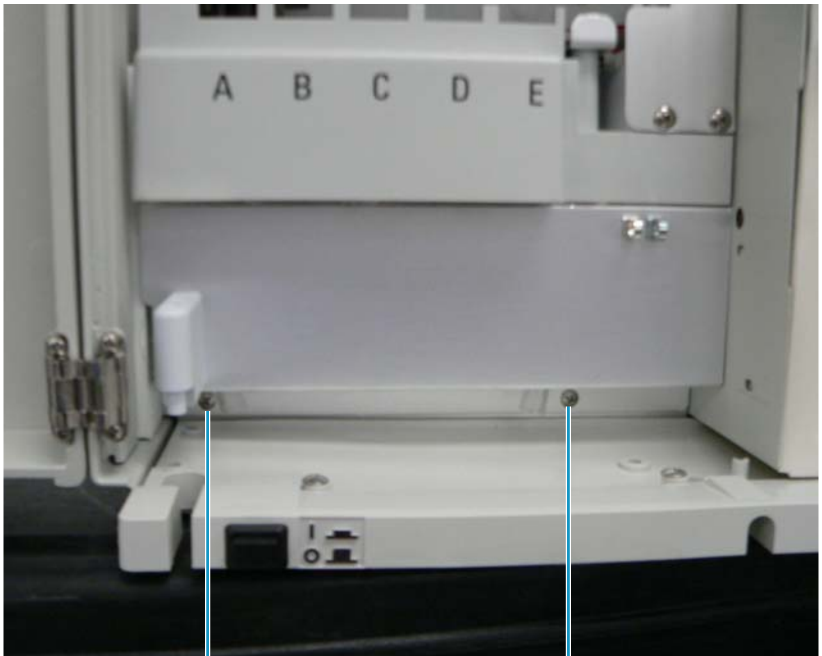
You must remove the XYZ arm assembly and the vial tray temperature control assembly as a unit because they are attached.

Before you begin, you can optionally remove the CPU PCB to give yourself more room to work. Follow the instructions in “To remove the CPU PCB” on page 107.

### ❖ To remove the XYZ arm assembly and vial tray temperature control assembly

1. Set the needle to the removal position. For instructions, see “Setting the Needle to the Removal Position” on page 73.
2. With a No. 2 Phillips screwdriver, remove the two screws shown in Figure 100, which attach the vial tray temperature control assembly to the vial tray fan assembly.

**Figure 100.** Screws holding the vial tray temperature control assembly to the vial tray fan assembly




Screws attaching the vial tray temperature control assembly to the vial tray fan assembly

3. Remove the three screws shown in Figure 101, which hold the column compartment (oven) to the chassis.

**Figure 101.** Screws holding the column compartment (oven) to the chassis


Screws holding the column compartment (oven) to the chassis

4. Push the XYZ arm all the way to the back of the autosampler.

5. Disconnect the ribbon cable (PN F1042-010) that connects the XYZ arm interconnect PCB to the backplane PCB.

   This cable and the XYZ arm interconnect PCB are shown in Figure 116 on page 131.

6. Disconnect the tubing from the needle to get it out of the way. For instructions, see "Removing the Needle Tubing Assembly" on page 74.

   You do not have to remove the injection valve from the autosampler.

7. Disconnect the transfer tubing at the bottom of the injection port. See "Replacing the Transfer Tubing" on page 59.

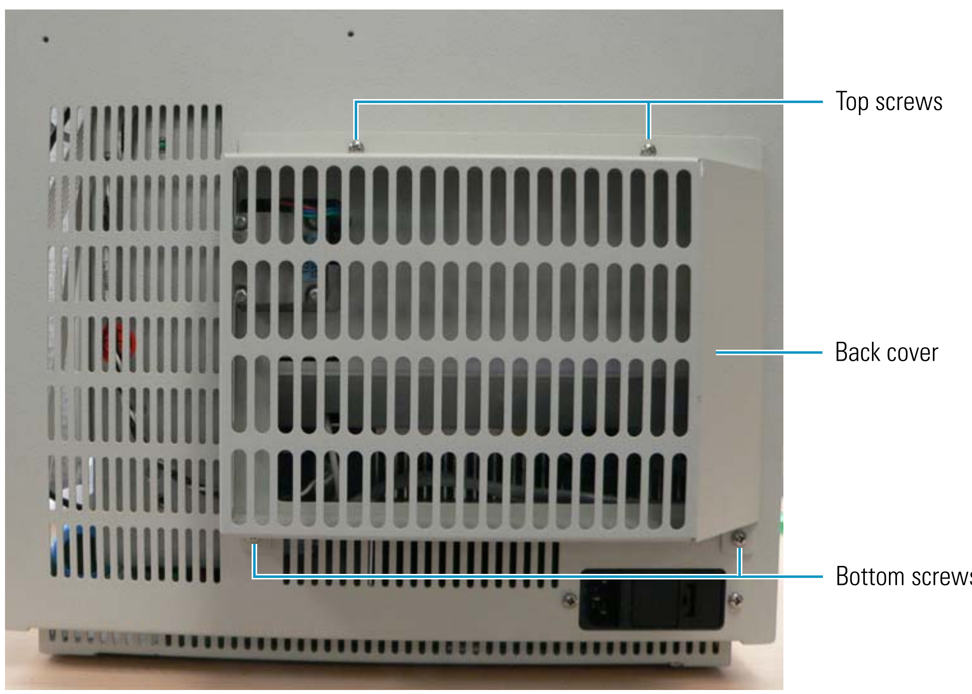
8. Grasp the sample tray and the vial tray and slide them forward, but do not remove them from the autosampler.

9. Disconnect the *y*-axis motor cable (PN A3371-060) (see Figure 98 on page 115) from the backplane PCB.

   This cable goes through a metal clip on the back of the autosampler.

10. Remove the back cover of the autosampler by removing the four screws, shown in Figure 102, with a No. 2 Phillips screwdriver.

**Figure 102.** Back cover of the autosampler




11. Reach through the large opening at the back of the autosampler and disconnect the vial tray Peltier cable (PN F1089-010) (Figure 97 on page 115) from the vial tray temperature control PCB (PN 60053-61084R).

12. Reach through the large opening at the back of the autosampler and disconnect the vial tray temperature sensor cable (PN 60053-61026R) (Figure 97 on page 115) from the vial tray temperature control PCB.

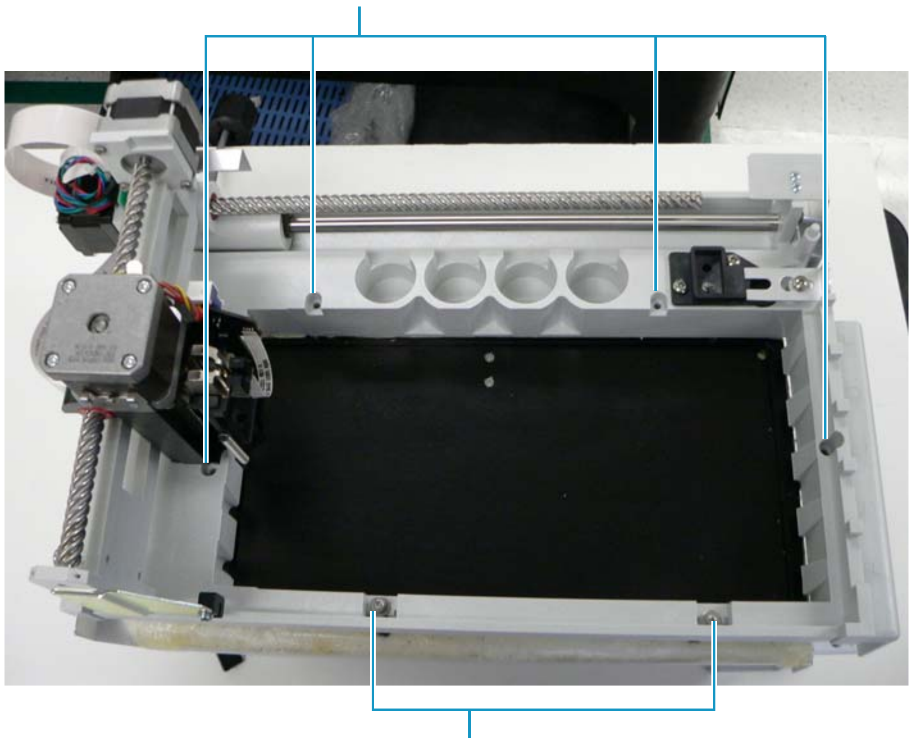
> **Note** The vial tray temperature sensor cable is also identified as PN F1114-010, although you cannot replace it independently of the vial tray temperature sensor PCB.

13. Slide out the whole XYZ arm assembly and vial tray temperature control assembly.

14. Remove the drain manifold (see Figure 106 on page 122) by removing the screw behind the top hole in the drain manifold.

15. To detach the XYZ arm assembly from the vial tray temperature control assembly, remove the six screws shown in Figure 103.

**Figure 103.** Six screws attaching the XYZ arm assembly to the vial tray temperature control assembly

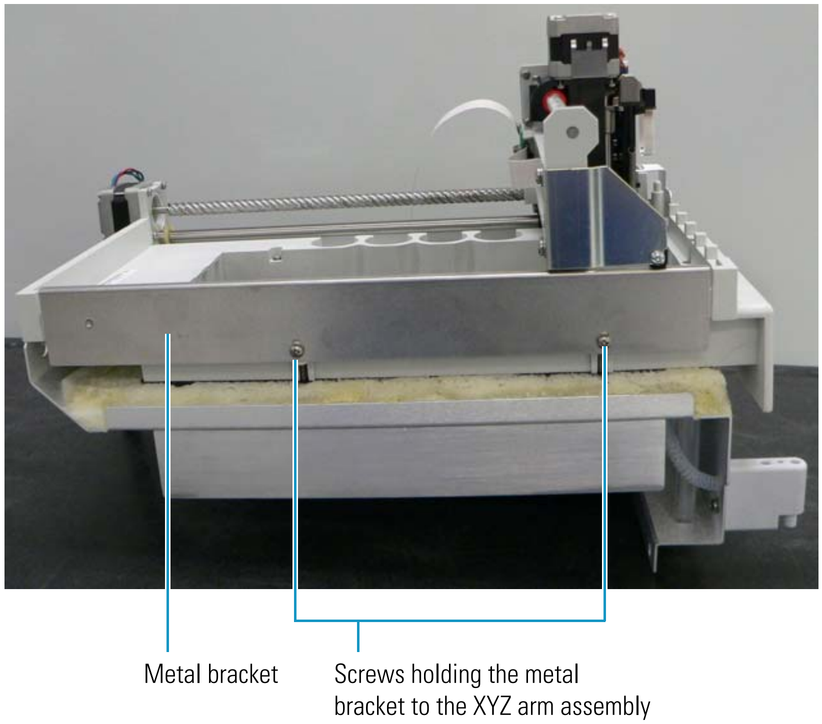



16. To detach the long metal bracket (PN 60053-10009) from the XYZ arm assembly, remove the two screws.

    Because the new XYZ arm assembly does not include this bracket, you must save it to install on the new XYZ arm assembly.

    Figure 104 shows both the bracket and the screws.

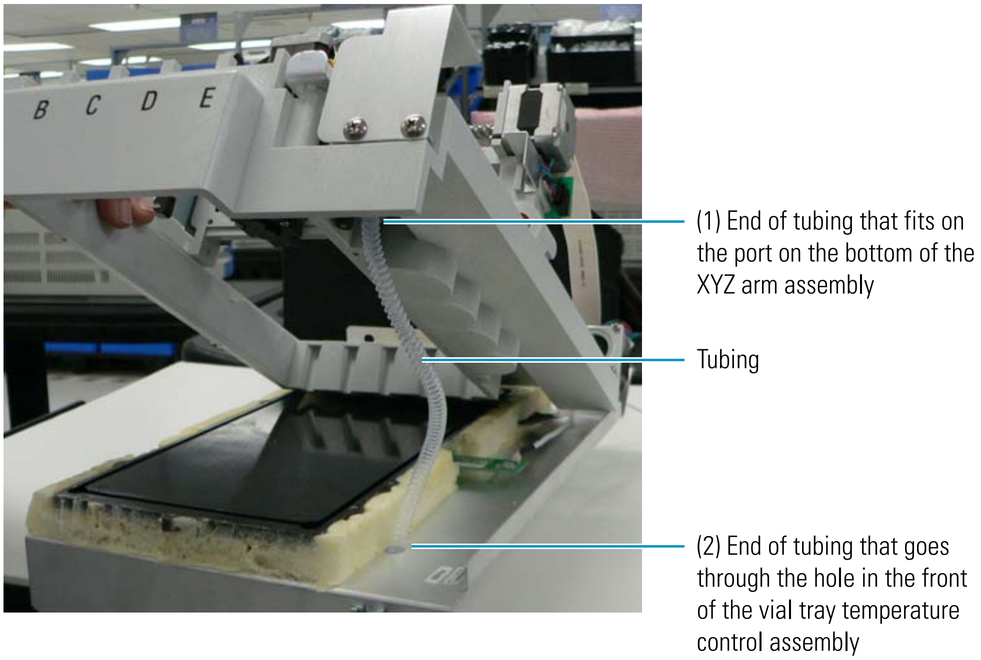
**Figure 104.** Metal bracket on the XYZ arm assembly




### ❖ To replace the XYZ arm assembly

1. If there is excess foam at the front of the XYZ arm assembly, use a box cutter to trim it so that it is flat with the vial tray temperature control assembly.
2. Place the XYZ arm assembly on top of the vial tray temperature control assembly.
3. Gently stretch the piece of tubing (PN F5034-030) included with the XYZ arm assembly.
4. Insert one end of the tubing through the port on the bottom of the XYZ arm assembly, as shown in (1) in Figure 105.
5. Route the other end of the tubing through the hole in the front of the vial tray temperature control assembly, as shown in (2) in Figure 105.

**Figure 105.** Tubing installed in the XYZ arm assembly




The drain manifold (PN F1013-010), shown in Figure 106, collects injection waste, wash solvents, and waste liquids.

**Figure 106.** Drain manifold

6. Attach the end of the tubing shown in (2) in Figure 105 to the drain manifold:

   a. Run the end of the tubing under and in back of the front of the vial tray temperature control assembly.

      Figure 107 shows the assembly on its side for clarity.

**Figure 107.** Underside of the vial tray temperature control assembly showing tubing installed


b. Place the drain manifold over the two holes in the left front of the vial tray temperature control assembly, as shown in Figure 108.

**Figure 108.** Ends of tubing at the front of the vial tray temperature control assembly


c. Insert the end of the tubing through the top hole of the left front area of the vial tray temperature control assembly and into the top hole in the drain manifold.

d. Insert the screw that you removed in step 14 on page page 120 on through the hole in the vial temperature control assembly and into the back of the drain manifold. Tighten the screw with a No. 2 Phillips screwdriver.

7. Attach the XYZ arm assembly to the vial tray temperature control assembly:

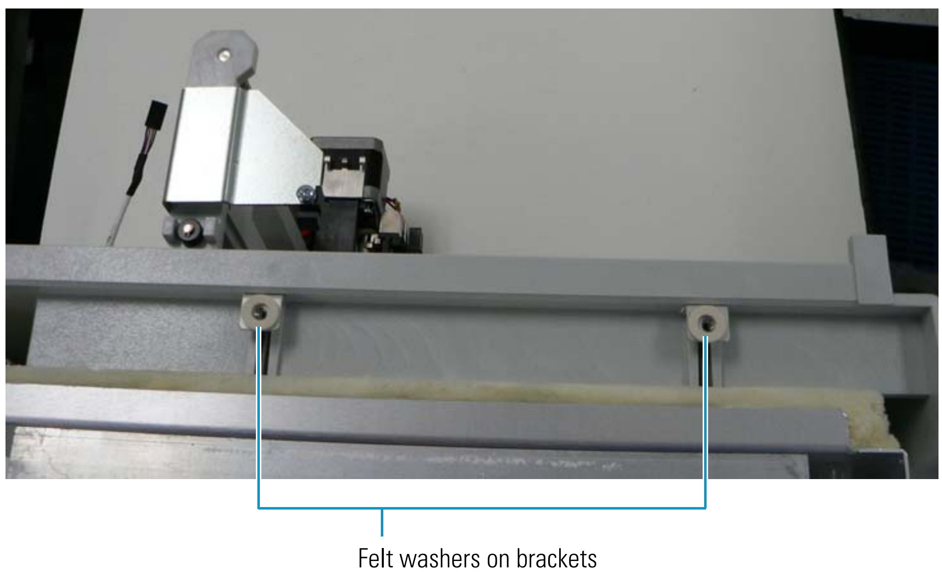
   a. Place two flat washers over the location of the two screws shown in (1) in Figure 103 on page 120. Insert the screws that you removed in step 15 on page page 120 into these locations, but do not tighten. Make sure that the tubing remains in place.

   b. Insert the four screws without washers that you removed in step 15 on page page 120 into the locations shown in (b) in Figure 103 on page 120, and tighten with a No. 2 Phillips screwdriver.

   c. Place two mounting brackets (PN 60053-10010) under the flat washers on the two screws shown in (1) in Figure 103 on page 120, and tighten the screws with a No. 2 Phillips screwdriver.

   d. Place two felt washers over the brackets, as shown in Figure 109.

   **Figure 109.** Felt washers on brackets



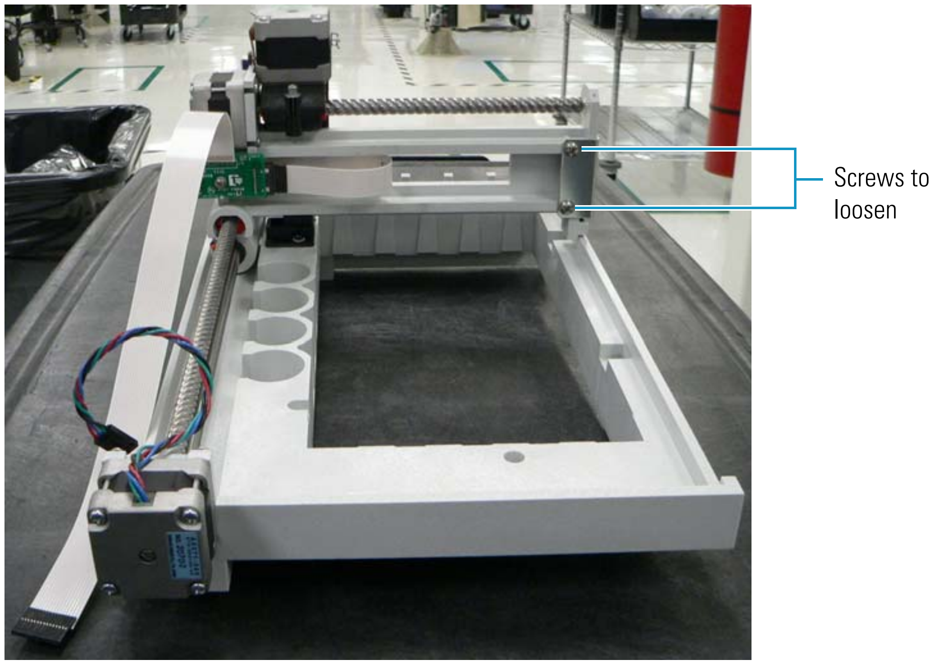

8. Place the long metal bracket shown in Figure 104 on page 121, which you removed in step 16 on page 120, on top of the felt washers, aligning the holes in the bracket to the screws and washers. Fasten with two screws but leave them loose.

9. Use the HPLC Special Tool (PN 60053-41009) to smoothly align the bracket to the XYZ arm assembly. Hold the bracket and the tool together. Tighten the two screws that you left loose in step 8. Be sure that the top of the bracket is even with the corners of the XYZ chassis. Remove the tool.

> **Note** You can purchase the HPLC Special Tool as part of the Arm Lifting Stop Bracket kit (PN 60053-62028). If the HPLC Special Tool is not available, slide the arm back and forth while holding the long metal bracket in place and then tighten the two screws that you left loose.

10. Be sure that the *x*-axis arm slides easily back and forth. If it is too tight, loosen the two screws shown in Figure 110 that are beneath and to the right of the *x*-axis arm. Also, lubricate the Y arm with TriFlow. After the arm moves easily, tighten these two screws.

**Figure 110.** Screws to loosen to slide *x*-axis arm



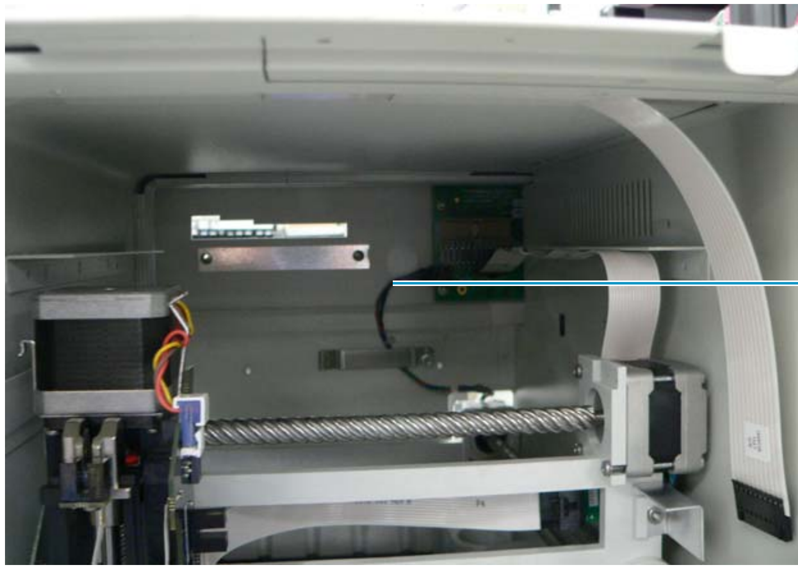

11. Slide the whole XYZ arm assembly and temperature control assembly forward into the front of the autosampler, but do not slide them in all the way.

12. Connect location P4 on the vial tray temperature sensor cable on the vial tray temperature control assembly to location J4 on the vial tray temperature control PCB. For two different views of the vial tray, see Figure 97 on page 115 or Figure 117 on page 132. Drop the cable into the area to the right of the vial tray fan assembly.

13. Connect location P3 on the vial tray Peltier cable to location J3 on the vial tray temperature control PCB. For two different views of the vial tray, see Figure 97 on page 115 or Figure 117 on page 132.

14. Thread the *y*-axis motor cable (see Figure 98 on page 115) under the metal bracket at the back of the autosampler chassis and connect it to location J4 on the backplane PCB, as shown in Figure 111.

**Figure 111.** *Y*-axis motor cable to the backplane PCB




15. Connect location P2 on the XYZ arm interconnect PCB cable (see Figure 116 on page 131) to location J2 on the backplane PCB. Thread the cable through the bracket on the right side of the column compartment.

16. Finish sliding the XYZ arm assembly and the vial tray temperature control assembly all the way into the autosampler.

17. Connect the tubing to the injection valve. For instructions, see "Reinstalling the Injection Valve" on page 56.

18. Push the XYZ arm all the way forward to the front of the autosampler.

19. Insert the three screws that you removed in step 3 on page page 118 into the locations shown in Figure 101 on page 118 to hold the column compartment (oven) to the chassis.

20. At the bottom of the vial tray temperature control assembly near the drip tray, insert the two screws that you removed in step 2 on page page 117, shown in Figure 100 on page 118, and tighten with a No. 2 Phillips screwdriver.

    The vial tray temperature control assembly is now attached to the vial tray fan assembly.

21. If you removed the CPU PCB, reinstall and reconnect it. Follow the instructions in "To replace the CPU PCB" on page 108.

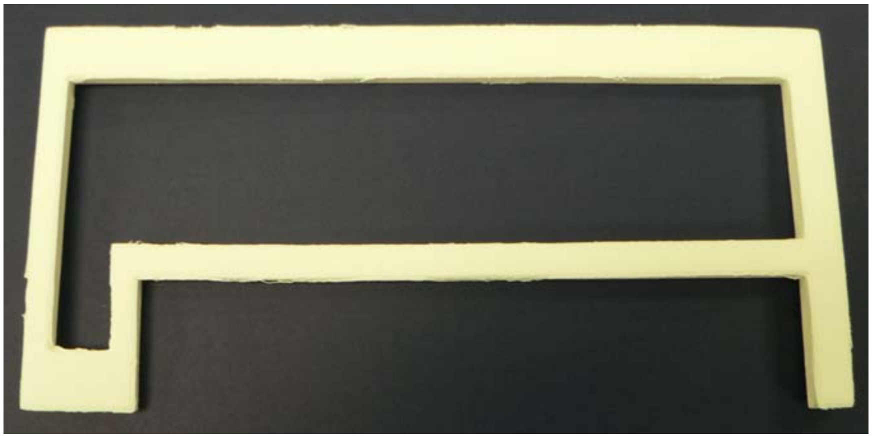
22. To replace the needle assembly, see "Replacing the Needle Assembly" on page 80. To replace the needle tubing, see "Replacing the Needle Tubing Assembly" on page 73.

23. If you have removed the left or right door of the autosampler or both, follow the instructions in "Removing and Replacing the Autosampler Doors" on page 204 to rehang the doors.

## Removing and Replacing the Side Foam Gasket

Once you remove the XYZ arm assembly and the vial tray temperature control assembly, you can remove and replace the side foam gasket (PN F1099-010) if it is worn or damaged. The side foam gasket, shown in Figure 112, adheres to the inner left side of the Accela Autosampler and helps to seal off the area above the fan and the heat sink on the floor of the autosampler, controlling the temperature of this area.

**Figure 112.** Left side foam gasket



### ❖ To remove the side foam gasket

Pull the gasket off by the adhesive, using a scraper, if necessary to remove all of it.

### ❖ To replace the side foam gasket

Peel off the paper on the underside of the new gasket and place the adhesive side of the gasket on the left side of the autosampler chassis, as shown in Figure 196 on page 210.

## Aligning the XYZ Arm

To align the XYZ arm, refer to the following manuals:

- Xcalibur data system: *Accela User Guide for LC Devices*
- ChromQuest data system: *Accela User Guide for the ChromQuest Data System* or the Accela Help

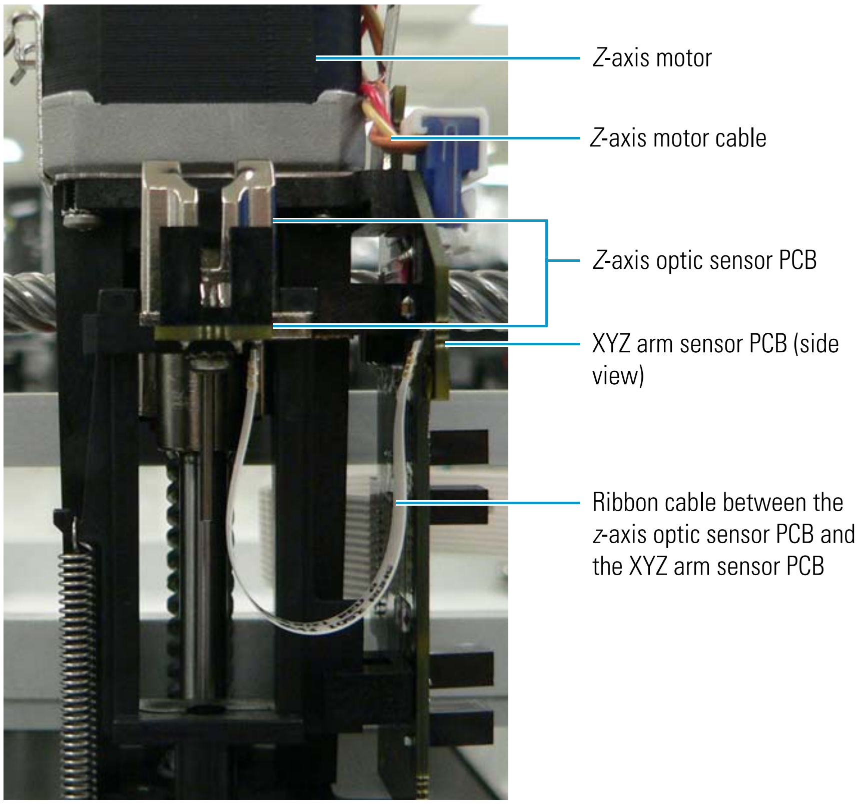
## Removing and Replacing the *X*-Axis, *Y*-Axis, and *Z*-Axis Motors

You cannot replace the *x*-axis, *y*-axis, and *z*-axis motors individually. You must replace the entire XYZ arm assembly if the functioning of one of these motors becomes impaired. For instructions, see "Removing and Replacing the XYZ Arm Assembly" on page 117.

# Removing and Replacing the *Z*-Axis Optic Sensor PCB and the XYZ Arm Sensor PCB

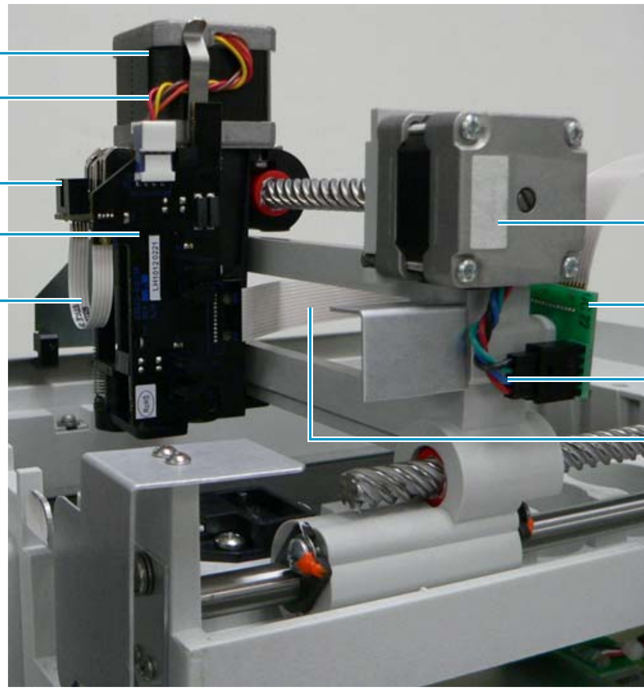
The *z*-axis optic sensor PCB (PN 60053-61082R) enables the *z*-axis arm to detect the home position of the needle. It resides on the front of the *z*-axis arm, as shown in Figure 113.

**Figure 113.** *z*-axis optic sensor PCB




The XYZ arm sensor PCB (PN 60053-60175R), shown in Figure 114, enables the *x*-axis and *y*-axis arms to detect their relative home positions. It is attached to the right side of the *z*-axis arm, with the left side of the board jutting out from the *z*-axis arm. The sensors on the board are orthogonal to the board.

**Figure 114.** XYZ arm sensor PCB




A ribbon cable (PN 60053-63021), shown in Figure 114, connects the *z*-axis optic sensor PCB to the XYZ arm sensor PCB. It provides needle home position input. It is permanently attached to the *z*-axis optic sensor PCB and the XYZ arm sensor PCB, so you must remove and replace the two boards and the cable as a unit.

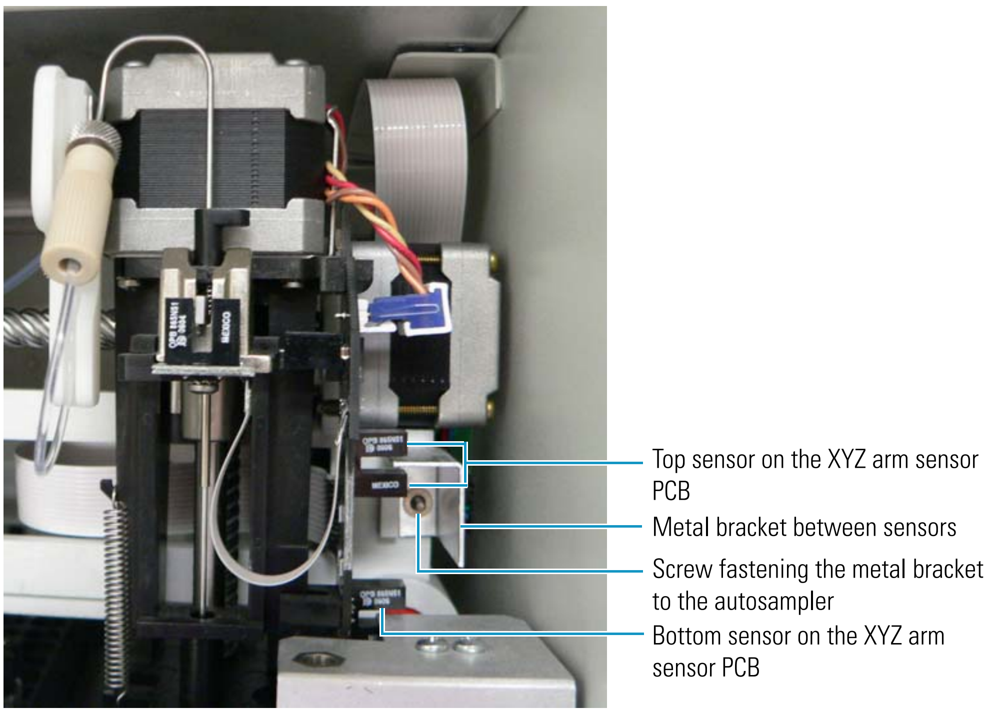
### ❖ To remove the *z*-axis optic sensor PCB and the XYZ arm sensor PCB

1. On the right side of the *z*-axis arm, remove the ribbon cable (PN F1043-010) that connects the XYZ arm sensor PCB to the XYZ arm interconnect PCB (see Figure 114).
2. Disconnect the *z*-axis motor cable that plugs into the XYZ arm sensor PCB (see Figure 114).
3. With a No. 1 Phillips screwdriver, remove the screw beneath the *z*-axis optic sensor PCB.
4. Press down on the top of the *z*-axis optic sensor PCB and at the same time gently pull the left side of the board toward you.
5. Carefully lift the XYZ arm sensor PCB from the slit at the bottom of the chassis of the *z*-axis pod.
6. Detach the two sensor boards (shown in Figure 114) as a unit from the *z*-axis arm.

### ❖ To replace the *z*-axis optic sensor PCB and the XYZ arm sensor PCB

1. Fit the tab at the bottom of the XYZ arm sensor PCB into the slit at the bottom of the chassis of the *z*-axis arm.
2. Grasping the left side of the sensor board, push the *z*-axis optic sensor PCB into the z-axis arm until it clicks into place.
3. Push the *z*-axis arm toward the metal bracket, making sure that the bracket goes in straight between the sensors on the XYZ arm sensor PCB, as shown in Figure 115. If the bracket goes in at an angle, adjust it by loosening the screw, adjusting the bracket, and tightening the screw.

**Figure 115.** Metal bracket between sensors



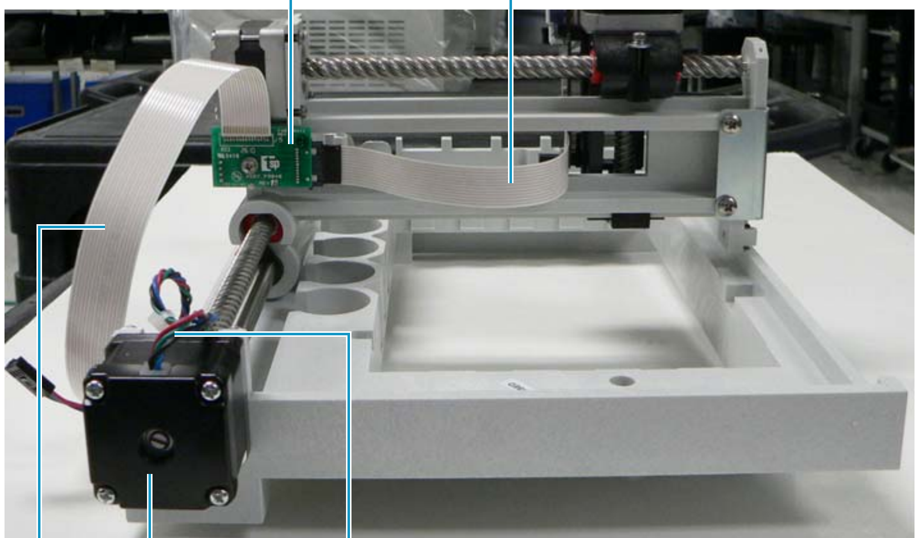

4. Place the *z*-axis optic sensor PCB on the *z*-axis pod, insert the screw beneath it, and tighten it with a No. 1 Phillips screwdriver.
5. Reconnect the *z*-axis motor cable to the XYZ arm sensor PCB (see Figure 114 on page 129).
6. Reconnect the ribbon cable that connects the XYZ arm sensor PCB to the XYZ arm interconnect PCB (see Figure 114 on page 129).

## Removing and Replacing the XYZ Arm Interconnect PCB

The XYZ arm interconnect PCB (PN F9040-010) passes various signals from one section of the arm assembly to another. A ribbon cable (PN F1043-010) connects to the XYZ arm sensor PCB, providing input and output to the *x*-axis and *z*-axis motors.

A second ribbon cable (PN F1042-010) connects location P2 on the XYZ arm interconnect PCB to location J2 on the backplane PCB. Figure 116 shows the two ribbon cable connections.

**Figure 116.** XYZ arm interconnect PCB connections




## ❖ To remove the XYZ arm interconnect PCB

1. Disconnect the wide ribbon cable (PN F1042-010) from the backplane PCB (see Figure 116).
2. Disconnect the *x*-axis motor cable (see Figure 114 on page 129) from the XYZ arm interconnect PCB.
3. Disconnect the ribbon cable (PN F1043-010) from the XYZ arm sensor PCB (see Figure 116).
4. Using a No. 1 Phillips screwdriver, remove the screw from the middle of the XYZ arm interconnect PCB (see Figure 116).

## ❖ To replace the XYZ arm interconnect PCB

1. Put the XYZ arm interconnect PCB in place on the *z*-axis arm, insert the screw that you removed in step 4 into the middle of the board (see Figure 116), and tighten with a No. 1 Phillips screwdriver.

2. Reconnect the ribbon cable to the XYZ arm sensor PCB (see Figure 116).

3. Reconnect the *x*-axis motor cable (see Figure 114 on page 129) to the XYZ arm interconnect PCB.

4. Reconnect location P2 on the ribbon cable (see Figure 116) to location J2 on the backplane PCB.

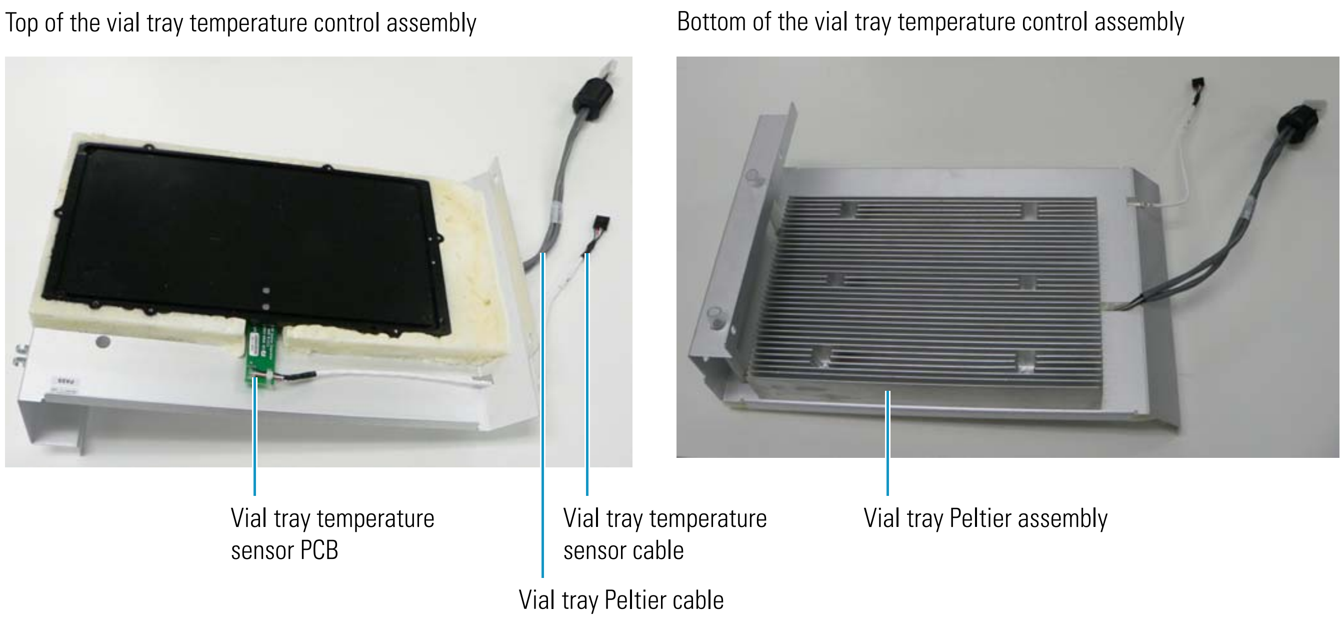
# Maintaining the Vial Tray Temperature Control Assembly

The vial tray temperature control assembly (PN 60357-60014) controls the temperature of the vial tray compartment. It both heats and cools the compartment, depending on the application. It consists of the following components:

- Vial tray Peltier assembly (PN F1089-010) and its associated vial tray Peltier cable (PN F1089-010)
- Vial tray temperature sensor PCB (PN 60053-61026R) and its associated vial tray temperature sensor cable (PN 60053-61026R)

Figure 117 shows these components.

**Figure 117.** Vial tray temperature control assembly




The vial tray temperature control PCB (PN 60053-61084R) and the vial tray fan assembly (PN F1110-010) are not part of the vial tray temperature control assembly but are described in this section.

The vial tray temperature control assembly includes a vial tray Peltier cable, shown in Figure 117 on page 132, that connects to the vial tray temperature control PCB. You cannot replace this cable individually; you must replace the entire vial tray temperature control assembly if it malfunctions. The vial tray temperature control assembly also includes a vial tray temperature sensor cable, also shown in Figure 117, that connects to the vial tray temperature control PCB. You can replace this cable by replacing the vial tray temperature sensor PCB.

## Removing and Replacing the Vial Tray Temperature Control Assembly

As noted earlier, you must remove and replace the XYZ arm assembly and the vial tray temperature control assembly as a unit.

### ❖ To remove the vial tray temperature control assembly

Follow the instructions in “To remove the XYZ arm assembly and vial tray temperature control assembly” on page 117.

### ❖ To replace the vial tray temperature control assembly

Follow the instructions in “To replace the XYZ arm assembly” on page 121.

## Removing and Replacing the Vial Tray Peltier Assembly

The vial tray Peltier assembly (PN F1089-010), shown in Figure 117 on page 132, provides the heating and cooling function for the vial tray compartment.

You cannot replace this assembly by itself; you must replace the vial tray temperature control assembly. For instructions, see “Removing and Replacing the XYZ Arm Assembly” on page 117.

## Removing and Replacing the Vial Tray Temperature Sensor PCB

The vial tray temperature sensor PCB (PN 60053-61026R), shown in Figure 117 on page 132, is a small board that fits orthogonally into the side of the vial tray temperature control assembly. It measures the temperature of the vial tray compartment.

Before you remove the vial tray temperature sensor PCB, you might want to manually check the black plate on the top of the vial tray temperature control assembly to be sure all areas are equally cool. A warm area on the plate might indicate a failure of the Peltier device.

The vial tray Peltier cable (PN F1089-010) is included in the vial tray temperature control assembly, and there is no need to disconnect this cable.

### ❖ To remove the vial tray temperature sensor PCB

1. Follow the instructions in "Removing and Replacing the XYZ Arm Assembly" on page 117 to remove the XYZ arm assembly and the vial tray temperature control assembly.
2. Separate the XYZ arm assembly and vial tray temperature control assembly by removing the six screws shown in Figure 103 on page 120.
3. Scrape away the RTV sealant from the top of the two screws on the top of the black plate of the vial tray temperature control assembly.
4. Using a No. 2 Phillips screwdriver, remove these two screws from the vial tray temperature control assembly plate.
5. Slide out the vial tray temperature sensor PCB from the vial tray temperature control assembly.

### ❖ To replace the vial tray temperature sensor PCB

1. Using a cotton-tipped applicator, apply thermal compound to the temperature sensor on the board.

   The compound ensures better contact between the temperature sensor and the underside of the vial tray temperature control assembly plate.
2. Insert the vial tray temperature sensor PCB into the side of the vial tray temperature control assembly.
3. Insert the two screws that you removed in step 4 into the top of the vial tray temperature control assembly plate and tighten with a No. 2 Phillips screwdriver.
4. Reapply silicone RTV compound to the top of the screws and wipe off the excess.
5. Allow the sealant on the screws to dry at least two hours before reattaching the vial tray temperature control assembly to the XYZ arm assembly.
6. Reattach the vial tray temperature control assembly to the XYZ arm assembly and replace the vial tray temperature control assembly and the XYZ arm assembly in the autosampler by following the instructions in "To replace the XYZ arm assembly" on page 121.

# Removing and Replacing the Vial Tray Fan Assembly

The vial tray fan assembly (PN F1110-010) disperses heat generated by the Peltier devices (the autosampler's heating and cooling elements) from the heat sinks beneath the sample vial tray when they are in cooling mode. Figure 118 shows the vial tray fan assembly and its associated cable.

**Figure 118.** Vial tray fan assembly

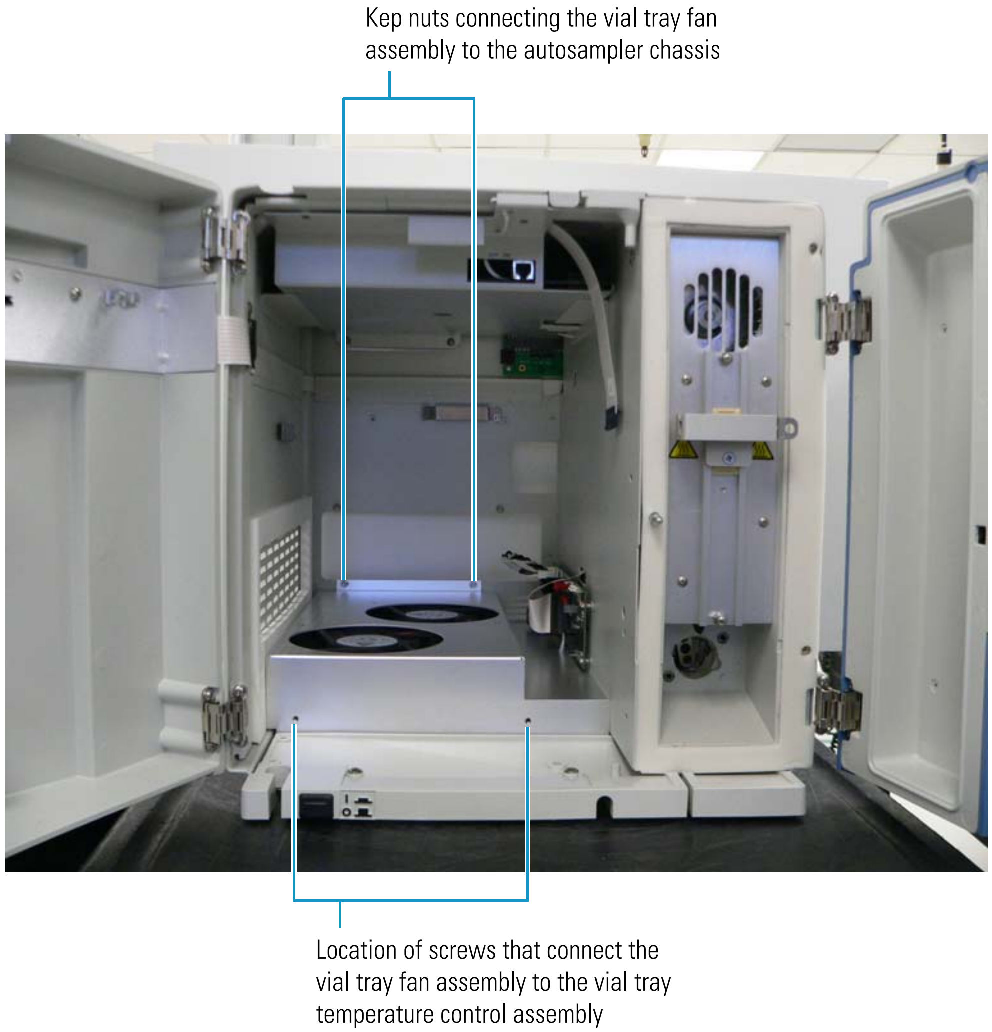

### ❖ To remove the vial tray fan assembly

1. Remove the XYZ arm assembly and the vial tray temperature control assembly by following the instructions in "To remove the XYZ arm assembly and vial tray temperature control assembly" on page 117.

2. Detach the vial tray fan assembly cable shown in Figure 118 from the vial tray temperature control PCB.

3. Using a 1/4 inch nut driver, remove the two kep nuts shown in Figure 119 that attach the vial tray fan assembly to the back of the autosampler chassis.

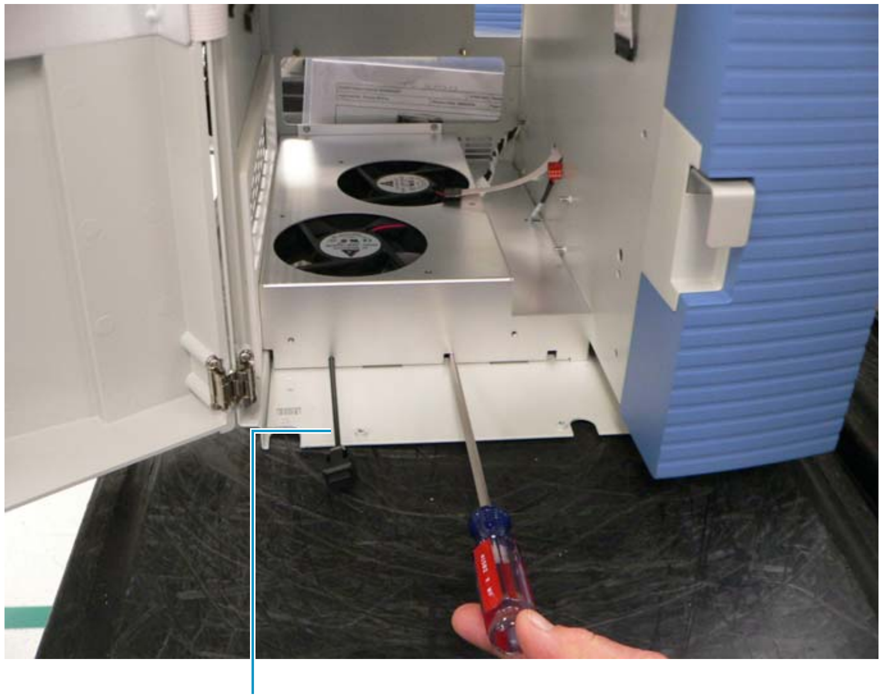
**Figure 119.** Installed vial tray fan assembly




4. Remove the drip tray by following the instructions in "To remove the drip tray" on page 210.

5. Using a flat-sided screwdriver, carefully pry up the fan assembly through the holes on the bottom of the assembly, as shown in Figure 120.

**Figure 120.** Prying up the vial tray fan assembly




6. Slide out the vial tray fan assembly.

### ❖ To replace the vial tray fan assembly

1. If the side foam gasket (PN F1099-010) is worn or damaged, replace it before you install or replace the vial tray fan assembly. For information on this procedure, see "Removing and Replacing the Side Foam Gasket" on page 127.

2. Slide the vial tray fan assembly into the floor of the autosampler, tilting it slightly to the right to avoid touching the side foam gasket. As you push in the fan assembly, gently pull the Bowden cable toward you. Align the two holes shown in Figure 118 on page 135 with the two threaded studs at the back of the autosampler chassis.

3. Insert two kep nuts onto the two threaded studs and tighten with a 1/4 inch nut driver.

   Figure 119 on page 136 shows the installed vial tray fan assembly.

4. Insert the end of the vial tray fan assembly cable into location J7 on the vial tray temperature control PCB.

5. Slide in the XYZ arm assembly and vial tray temperature control assembly. For instructions, see "To replace the XYZ arm assembly" on page 121.

6. Position the drip tray in front of the vial tray fan assembly. For instructions, see "To replace the drip tray" on page 211.

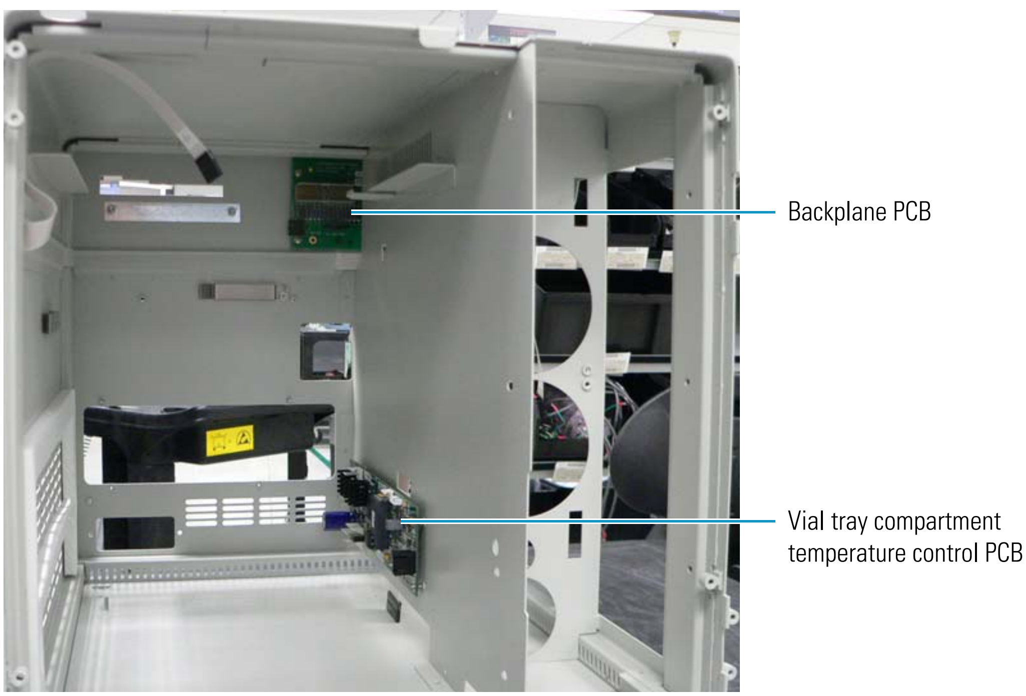
## Removing and Replacing the Vial Tray Temperature Control PCB

The vial tray compartment of the Accela Autosampler contains a temperature control PCB (PN 60053-61084R), shown in Figure 121, which regulates the temperature of the vial tray compartment. The board uses the temperature readings from the vial tray temperature sensor PCB to regulate the power delivered to certain components in the autosampler and to adjust the temperature of the vial tray compartment according to the settings that you select through a user interface, usually the graphical user interface of a data system. It is similar to the temperature control PCB located in the column compartment (oven) (see "Removing and Replacing the Column Compartment (Oven) Temperature Control PCB" on page 155).

**Figure 121.** Temperature control PCB

The vial tray compartment temperature control PCB resides on the lower part of the middle wall in the vial tray compartment, as shown in Figure 122.

**Figure 122.** Vial tray compartment temperature control PCB



### ❖ To remove the vial tray temperature control PCB

1. Remove the XYZ arm assembly and the vial tray temperature control assembly by following the instructions in "To remove the XYZ arm assembly and vial tray temperature control assembly" on page 117.
2. Remove the vial tray fan assembly (PN F1110-010) by following the instructions in "To remove the vial tray fan assembly" on page 135.
3. Disconnect the following cables from the vial tray temperature control PCB:
   - Vial tray Peltier cable (PN F1089-010) from the vial tray temperature control assembly (see Figure 117 on page 132)
   - Vial tray temperature sensor cable (PN 60053-61026R) from the vial tray sensor PCB (see Figure 117 on page 132)
   - Long DC power cable (PN F1083-010) from the power supply module (see Figure 167 on page 185)
   - Vial tray fan assembly cable (PN F1110-010) from the vial tray fan assembly (see Figure 118 on page 135)
   - Temperature control cable (PN F1002-010) from the backplane PCB (see Figure 126 on page 143 or Figure 180 on page 196)
4. Using a No. 2 Phillips screwdriver, remove the screw in the middle of the vial tray temperature control PCB.

   The board rests on four small pins set in the wall.
5. Gently pry out the board out from the pins with a flat-edged screwdriver.

### ❖ To replace the vial tray temperature control PCB

1. Place the four holes at each corner of the board over the pins set in the wall or the floor, and push the board onto the pins.
2. Insert the screw that you removed in step 4 in the middle of the board, and tighten it with a No. 2 Phillips screwdriver.
3. Install the vial tray fan assembly by following the instructions in "To replace the vial tray fan assembly" on page 137.
4. Replace the XYZ arm assembly and the vial tray temperature control assembly by following the instructions in "To replace the XYZ arm assembly" on page 121.
5. Reconnect the following cables to the temperature control PCB:
   - Location P3 on the vial tray Peltier cable to location J3 on the vial tray temperature control PCB (see Figure 117 on page 132)
   - Location P4 on the vial tray temperature sensor cable to location J4 on the vial tray temperature control PCB (see Figure 117 on page 132)

- Location P5 on the long DC power cable to location J5 on the vial tray temperature control PCB (see Figure 167 on page 185)
- Vial tray fan assembly cable to location J7 on the vial tray temperature control PCB (see Figure 118 on page 135)
- Location P8 on the temperature control cable to location J8 on the vial tray temperature control PCB (see Figure 126 on page 143 or Figure 180 on page 196)

## Calibrating the Temperature of the Vial Tray Compartment

You must recalibrate the temperature of the vial tray compartment when you replace the temperature control PCB. For instructions, refer to the following manuals:

- Xcalibur data system: *Accela User Guide for LC Devices*
- ChromQuest data system: *Accela User Guide for the ChromQuest Data System* or the Accela Help

# Maintaining the Column Compartment (Oven) Assembly

The Accela Autosampler column compartment (oven) assembly (PN 60357-60011) occupies the right side of the autosampler. The column compartment sets the temperature of the column and maintains it at a constant temperature during the course of the sample analysis. It also brings the mobile phase up to this temperature before it enters the column. This temperature is usually elevated. Finally, the column compartment (oven) assembly holds the column. For general information on this assembly, see "Column Oven and Tray Compartment Heater and Cooler" on page 15.

The column compartment (oven) assembly consists of the following components:

- Column compartment (oven) Peltier assembly (PN F1087-010)
- Circulating oven fan (PN F1015-010)
- Column compartment (oven) fan motor (PN F1014-010)
- Heat exchanger (PN 60057-20087)
- Column compartment (oven) temperature sensor PCB (PN 60357-61300R)
- Column compartment (oven) sensor interconnect PCB (PN F9053-010) and cable
- The cables associated with these components

The column compartment (oven) temperature control PCB (PN 60053-61071R) and the column compartment (oven) fan assembly (PN 60357-63006) are not part of the column compartment (oven) assembly but are discussed in this section.

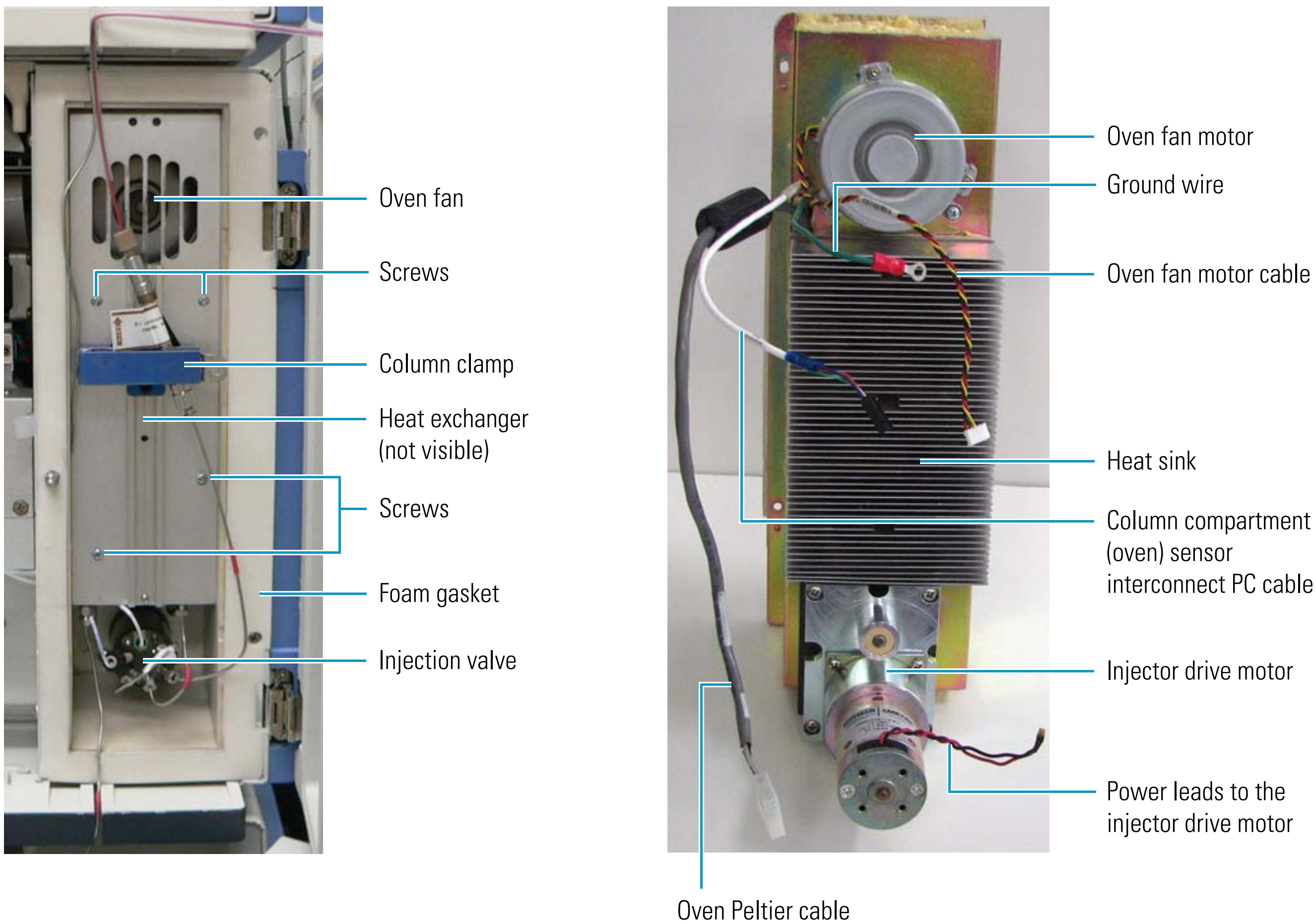
You cannot replace the column clamp on the front of the oven assembly by itself.

Figure 123 shows the front and back of this assembly.

**Figure 123.** Front and back of the column compartment (oven) assembly

Front of the column compartment (oven) assembly

Back of the column compartment (oven) assembly

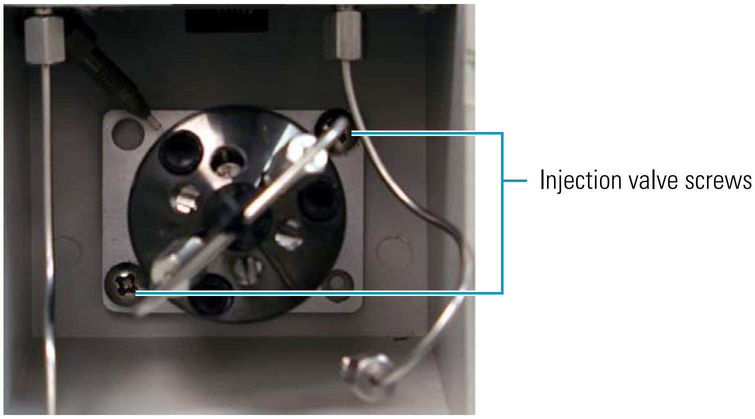



## Removing and Replacing the Column Compartment (Oven) Assembly

❖ **To remove the column compartment (oven) assembly**

1. Take off the panel on the right side of the autosampler by following the instructions in "Removing and Replacing the Right Side Panel of the Autosampler" on page 97.
2. Using a No. 2 Phillips screwdriver, remove the two screws near the upper right and lower left of the injection valve, as shown in Figure 124.

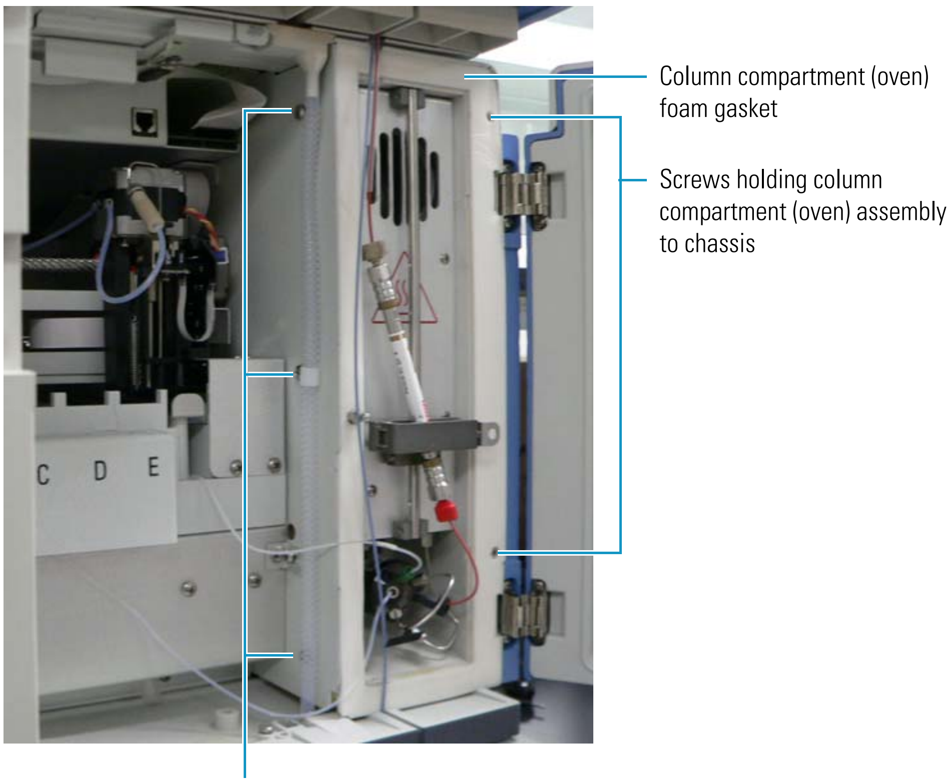
**Figure 124.** Injection valve screws




3. Pull the injection valve toward you to remove it.

4. Using a No. 2 Phillips screwdriver, remove the five screws holding the column compartment (oven) assembly to the autosampler. Figure 125 shows the locations of these screws.

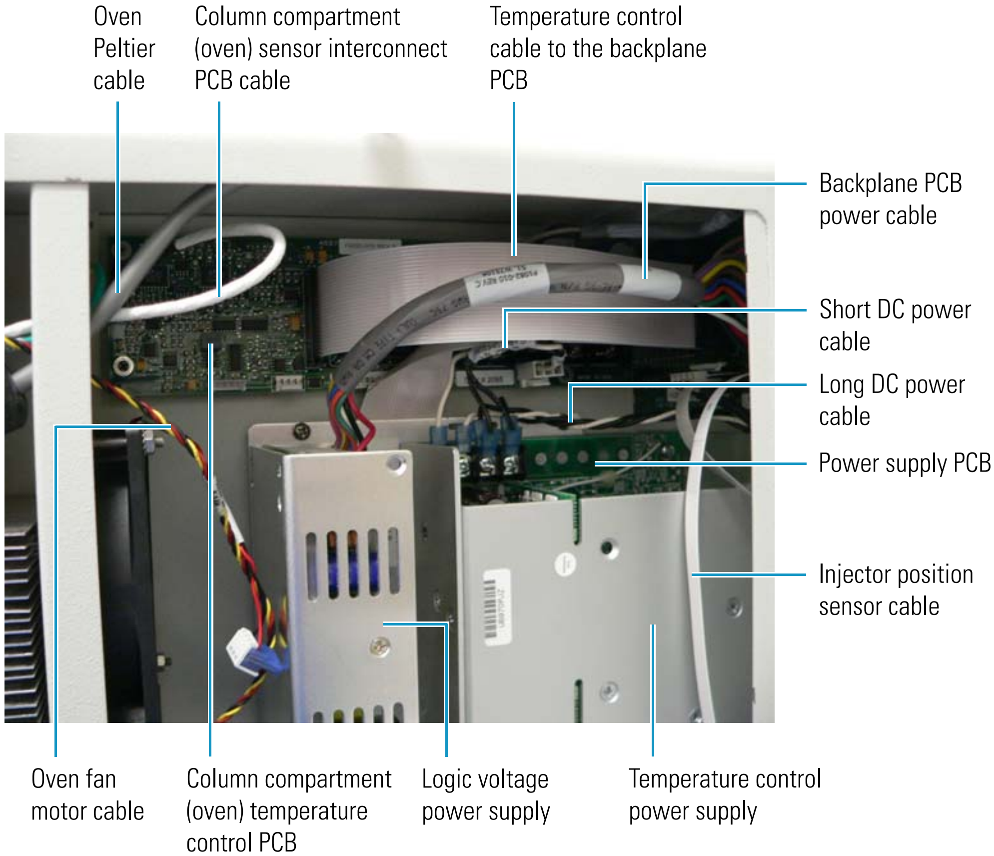
**Figure 125.** Screws holding the column compartment (oven) assembly to the chassis




5. Disconnect the power leads to the injector drive motor (shown in Figure 123 on page 141), which connect the injector drive valve motor to the power source.

6. Reach into the upper right area of the oven assembly to disconnect the injector position sensor cable (PN A3513-010) from the backplane PCB . Figure 126 shows this cable.

**Figure 126.** Cables connected to the oven assembly




7. Disconnect the oven Peltier cable (PN F1087-010), shown in Figure 126, from the column compartment (oven) temperature control PCB.

8. Disconnect the column compartment (oven) sensor interconnect PCB cable, shown in Figure 126, from the column compartment (oven) temperature control PCB.

9. Disconnect the oven fan motor cable (PN F1017-010), shown in Figure 126, from the column compartment (oven) temperature control PCB.

10. Disconnect the ground wire bolted to the chassis (see Figure 123 on page 141).

11. Grasping the column clamp positioning bar, slide the oven assembly out from the front of the autosampler. Use a flat-edged screwdriver to pry out the oven assembly, if necessary.

### ❖ To replace the column compartment (oven) assembly

1. Before you place the oven assembly in the autosampler, connect location P11 on the injector position sensor cable to location J11 on the injector position sensor board (PN 60360-61005R).

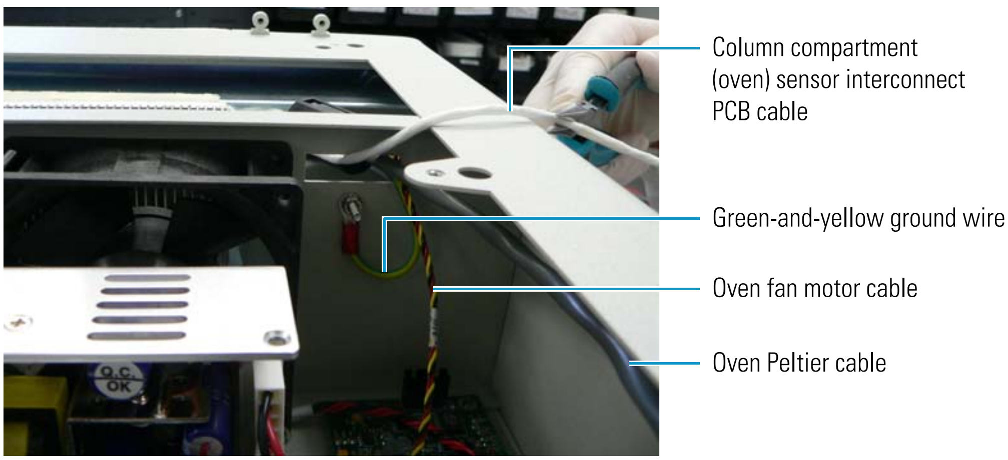
2. If the column compartment (oven) foam gasket on the front of the column compartment (oven) needs replacing, follow the instructions in "Removing and Replacing the Front Foam Gasket" on page 147.

3. Slide the oven assembly into the front of the autosampler.

4. Feed the following cables through the slot shown in Figure 127 (the autosampler is shown on its side for clarity):

   - Oven Peltier cable
   - Column compartment (oven) sensor interconnect PCB cable (PN F9053-010)
   - Oven fan motor cable
   - Green-and-yellow ground wire (no part number)

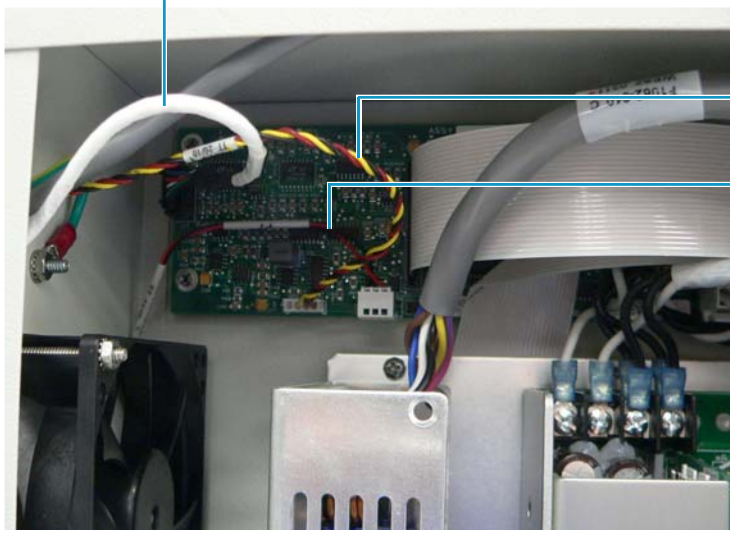
**Figure 127.** Ground wire, oven Peltier cable, column compartment (oven) sensor interconnect PCB cable, and oven fan motor cable shown through the slot in the autosampler




5. Fasten the green-and-yellow ground wire to the pin on the chassis with a kep nut, as shown in Figure 127.

6. Connect the oven fan motor cable to location J6 on the column compartment (oven) temperature control PCB, as shown in Figure 128.

**Figure 128.** Connection of the oven fan motor cable




7. Connect location P4 on the column compartment (oven) sensor interconnect PCB cable to location J4 on the column compartment (oven) temperature control PCB.

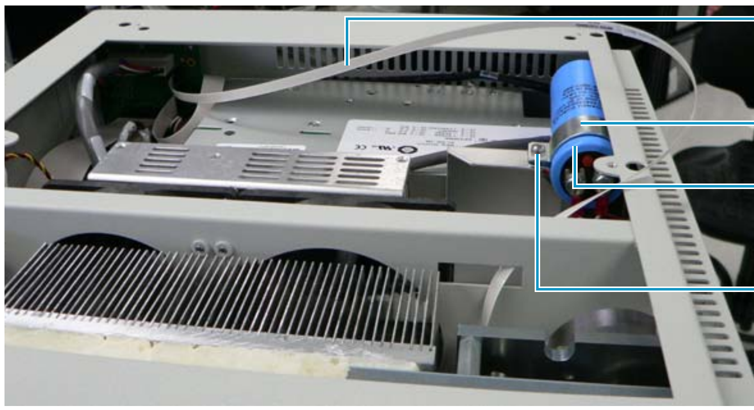
8. Connect location P3 on the oven Peltier cable to location J3 on the column compartment (oven) temperature control PCB, as shown in Figure 129 (the board is shown detached from position for clarity).

**Figure 129.** Connecting the oven Peltier cable to the temperature control PCB

9. Reach into the upper right area of the oven assembly to connect location P5 on the injector position sensor cable, shown in Figure 126 on page 143, to location J5 on the backplane PCB.

   Figure 130 shows this cable connected at both ends. Tuck this ribbon cable behind the injector drive storage capacitor. The autosampler is shown on its side for clarity.

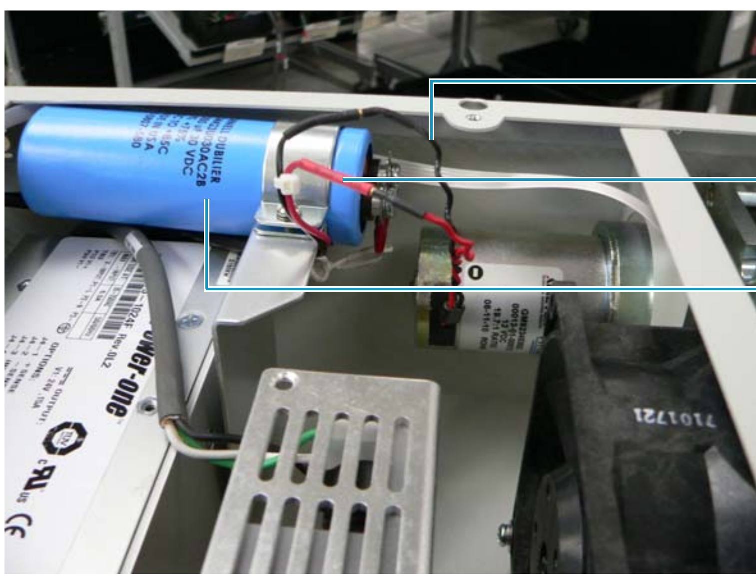
   **Figure 130.** Injection valve position sensor cable




10. Reconnect the power leads on the injector drive storage capacitor (PN F1116-010) to the leads on the injector drive motor (see Figure 123 on page 141).

    Figure 131 shows the connections of these leads, with the autosampler on its side for clarity. Connect the two black wires to each other, and connect the two red wires to each other.

    **Figure 131.** Connection of the injector drive storage capacitor power leads to the injector drive motor power leads



11. Insert the five screws that you removed in step 4 on page page 142 into the locations shown in Figure 125 on page 142, and tighten with a No. 2 Phillips screwdriver.
12. Replace the injection valve by following the instructions in "Reinstalling the Injection Valve" on page 56.
13. Insert the two screws near the upper right and lower left of the injection valve (see Figure 124 on page 142), and tighten with a No. 2 Phillips screwdriver.
14. Replace the panel on the right side of the autosampler by following the instructions in "To replace the right side panel of the autosampler" on page 97.

## Removing and Replacing the Front Foam Gasket

If required, remove and replace the front foam gasket, shown in Figure 132, after you remove the column compartment (oven) assembly and before you replace the assembly.

**Figure 132.** Column compartment (oven) foam gasket

### ❖ To remove the front foam gasket

Pull the gasket off by the adhesive, using a scraper, if necessary to remove all of it.

### ❖ To replace the front foam gasket

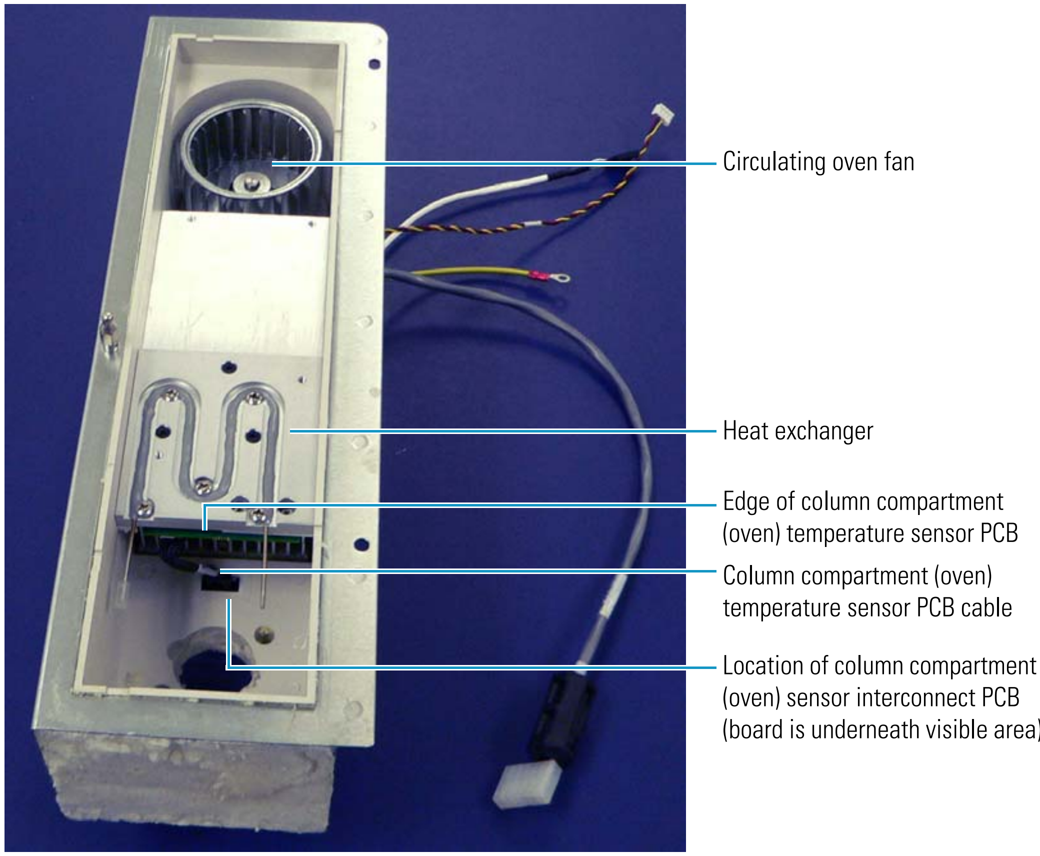
Peel off the paper on the underside of the new gasket and press the adhesive side of the gasket onto the front rim of the column compartment (oven) assembly.

Figure 196 on page 210 shows the front foam gasket installed.

## Removing and Replacing the Column Compartment (Oven) Peltier Assembly

Figure 133 shows the column compartment (oven) Peltier assembly (PN F1087-010), which provides heating and cooling for the column compartment.

**Figure 133.** Column compartment (oven) Peltier assembly




In this assembly, you can replace the following components:

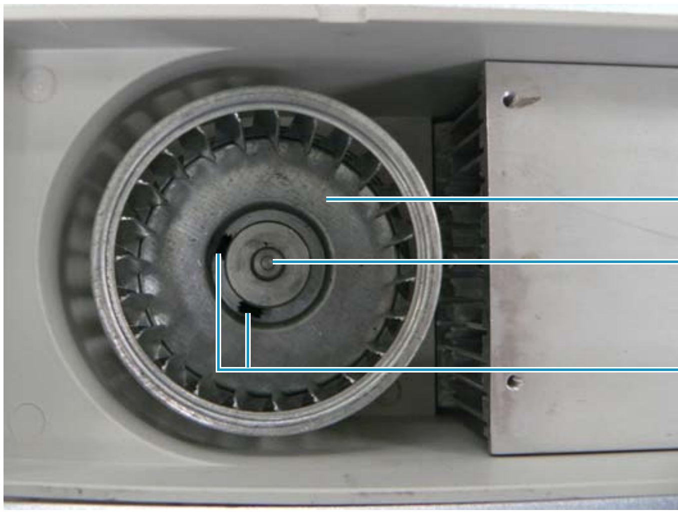
- Heat exchanger (see "Removing and Replacing the Heat Exchanger" on page 151)
- Column compartment temperature sensor PCB (see "Removing and Replacing the Column Compartment (Oven) Temperature Sensor PCB" on page 153)
- Circulating oven fan (see "Removing and Replacing the Circulating Oven Fan" on page 149)

For all other parts, you must replace the entire column compartment (oven) assembly. For instructions, see "Removing and Replacing the Column Compartment (Oven) Assembly" on page 141.

## Removing and Replacing the Circulating Oven Fan

The circulating oven fan (PN F1015-010) evenly distributes the hot or cooled air throughout the column compartment (oven) to prevent the occurrence of a thermal gradient from the top to the bottom of the compartment. Both Figure 134 and Figure 137 on page 152 show the circulating oven fan.

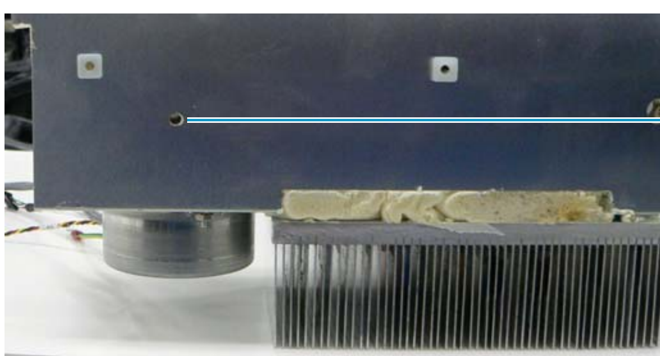
**Figure 134.** Circulating oven fan




### ❖ To remove the circulating oven fan

1. Using a No. 1 long-handled Phillips screwdriver, remove the four screws shown in Figure 123 on page 141 from the front metal plate of the oven assembly.
2. Lift off the front plate.
3. Insert a 7/64 inch ball driver through the access hole on the outer side of the oven assembly (see Figure 135), and loosen the two screws shown in Figure 134 on the side of the shaft coupler in the circulating oven fan, positioning each screw in succession near the access hole.

   **Figure 135.** Access hole in the column compartment (oven) Peltier assembly

4. Lift the fan off over the shaft.

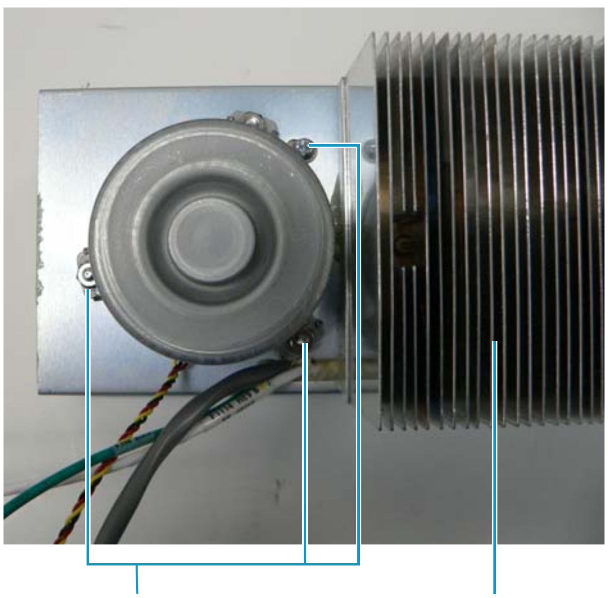
### ❖ To replace the circulating oven fan

1. Fit the hole in the middle of the circulating oven fan over the shaft.
2. Insert a 7/64 inch ball driver through the access hole on the outer side of the oven assembly, and tighten the two screws shown in Figure 134 on page 149 on the side of the shaft coupler in the oven fan, positioning each screw in succession near the access hole.
3. Replace the oven assembly plate. Insert the four screws that you removed in step 1 on page 149 into the metal plate of the oven assembly and tighten with a No. 1 long-handled Phillips screwdriver.

## Removing and Replacing the Column Compartment (Oven) Fan Motor

The column compartment (oven) fan motor (PN F1014-010) supplies power to the circulating oven fan. Figure 136 shows the fan motor.

**Figure 136.** Column compartment (oven) fan motor




### ❖ To remove the column compartment (oven) fan motor

1. Remove the column compartment (oven) assembly by following the instructions in "To remove the column compartment (oven) assembly" on page 141.
2. Remove the circulating oven fan by following the instructions in "To remove the circulating oven fan" on page 149.
3. Using a 5/16 inch nut driver, remove the three kep nuts shown in Figure 136 on the fan motor cover, and remove the cover.
4. Remove the bushing from the inside of the motor and then remove the motor.

### ❖ To replace the column compartment (oven) fan motor

1. Place the motor in the column compartment (oven) housing over the three threaded studs.
2. Replace the bushing on the inside of the motor.

   The plastic side goes toward the back.
3. Replace the three kep nuts that you removed in step 3 on page 150 on the motor cover and tighten with a 5/16 inch nut driver.
4. Replace the circulating oven fan by following the instructions in "To replace the circulating oven fan" on page 150.
5. Replace the oven assembly by following the instructions in "To replace the column compartment (oven) assembly" on page 144.

## Removing and Replacing the Heat Exchanger

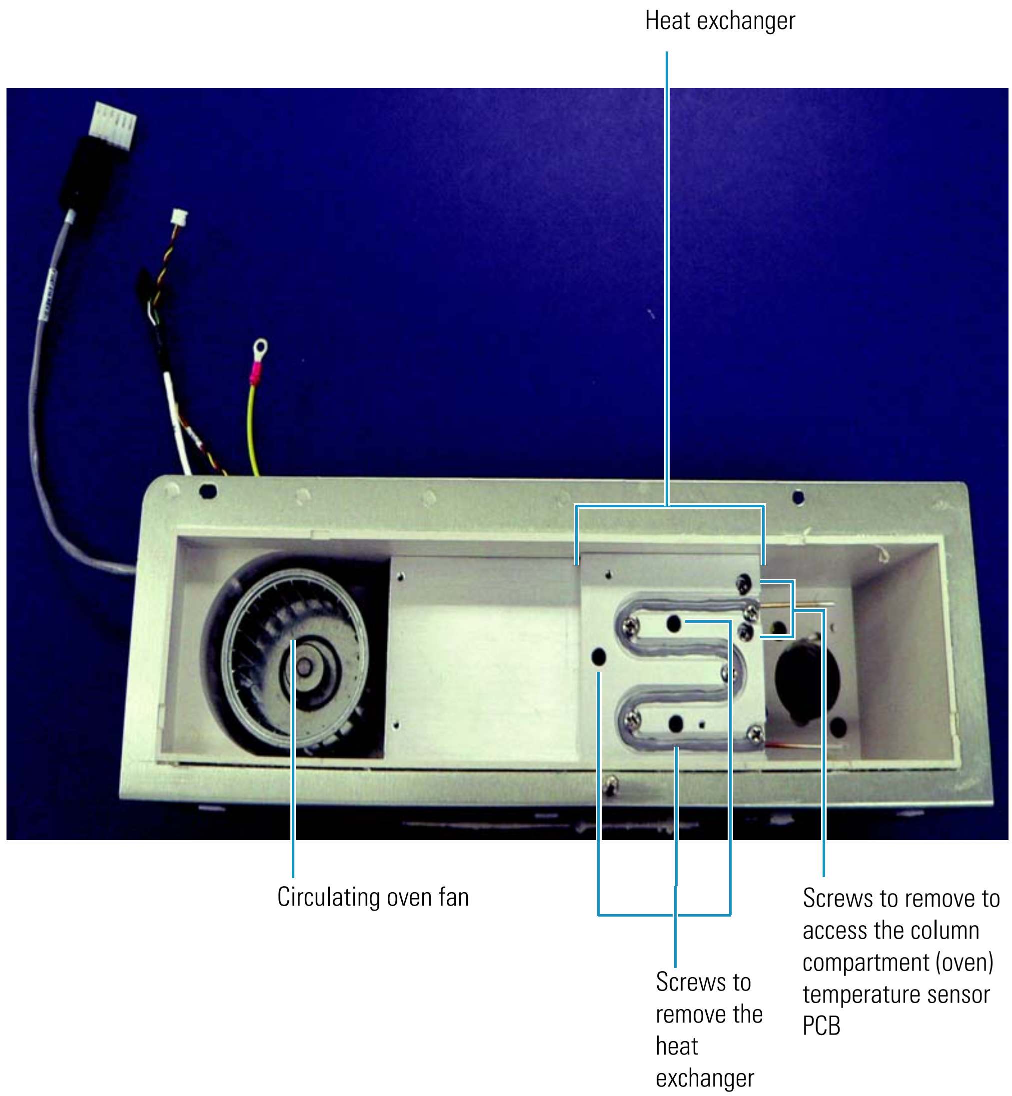
The heat exchanger (PN 60057-20087 rev. B) in the Peltier assembly heats the mobile phase to the temperature of the column, which also resides in the column compartment (oven). Figure 68 on page 84 shows the heat exchanger schematic.

If the Peltier assembly in your autosampler contains an older version of the heat exchanger (PN 60057-20087 rev. A), see "Legacy Versions of the Accela Autosampler" on page 271 for information.

### ❖ To remove the heat exchanger

1. Disconnect the union connected to the heat exchanger inlet and the union connected to the heat exchanger outlet. For instructions, see "Clearing a Plugged Heat Exchanger" on page 84.
2. Using a No. 1 long-handled Phillips screwdriver, remove the four screws shown in Figure 123 on page 141 (left side) from the front metal plate of the oven assembly.
3. Lift off the front plate.
4. Using a No. 1 long-handled Phillips screwdriver, remove the three black screws underneath the plate on the heat exchanger, shown in Figure 137.

**Figure 137.** Heat exchanger screws




The five silver screws that are not identified in Figure 137 align the tubing to the heat exchanger.

5. Remove the heat exchanger from the Peltier assembly.

### ❖ To replace the heat exchanger

1. Place the new heat exchanger into the Peltier assembly.
2. Insert the three black screws that you removed in step 4 on page 151 into the heat exchanger, and tighten with a No. 1 long-handled Phillips screwdriver.
3. Replace the oven assembly plate.
4. Insert the four screws that you removed in step 2 on page 151 into the metal plate of the oven assembly and tighten with a No. 1 long-handled Phillips screwdriver.

## Clearing the Heat Exchanger

Unfiltered mobile phase, dirty samples, and particulate matter can clog the heat exchanger. For information on clearing blockages, see "Clearing a Plugged Heat Exchanger" on page 84. For information on clearing blockages in the original heat exchanger, see "Legacy Versions of the Accela Autosampler" on page 271.

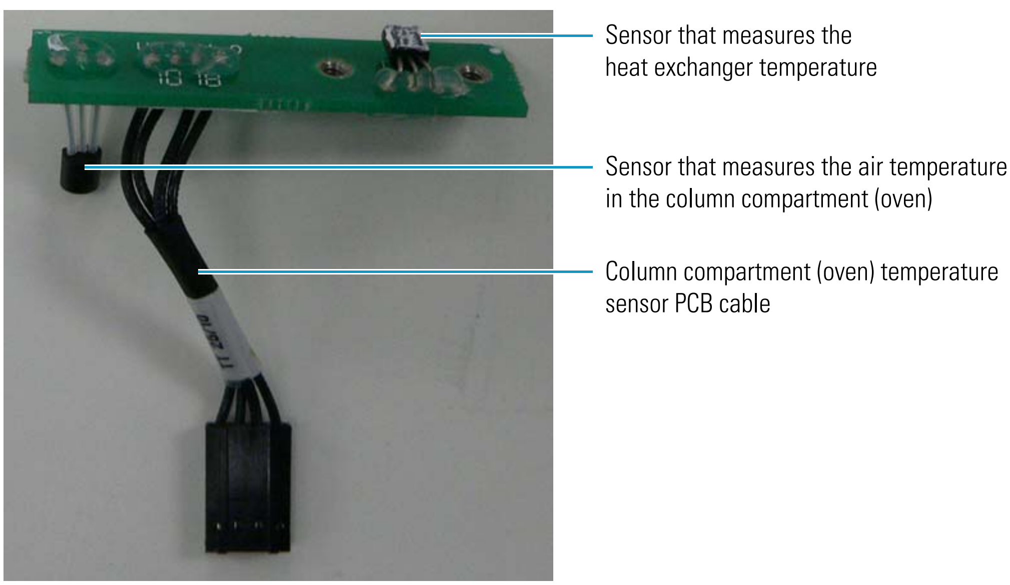
## Connecting the Accela Pump to the Heat Exchanger Inlet

To connect the Accela pump to the heat exchanger inlet, see "Connecting the Autosampler to the Pump" on page 43. For information on connecting the Accela pump to the original heat exchanger, see "Legacy Versions of the Accela Autosampler" on page 271.

## Removing and Replacing the Column Compartment (Oven) Temperature Sensor PCB

The column compartment (oven) temperature sensor PCB (PN 60357-61300R), shown in Figure 138, measures the air temperature in the column compartment (oven) and in the heat exchanger. The board includes two sensors: one monitors the air temperature and the other monitors the plate temperature. The board reports the air temperature back to the firmware. It resides beneath the heat exchanger, shown in Figure 133 on page 148. The column compartment (oven) temperature sensor PCB cable connects to the column compartment (oven) sensor interconnect PCB.

**Figure 138.** Column compartment (oven) temperature sensor PCB




### ❖ To remove the column compartment (oven) temperature sensor PCB

1. If necessary, remove the injection valve to make more room to work. Remove the two screws near the upper right and lower left of the valve, as shown in Figure 124 on page 142.

2. Pull the injection valve toward you to remove it.
3. Using a No. 1 long-handled Phillips screwdriver, remove the four screws shown in Figure 123 on page 141 from the front metal plate of the oven assembly.
4. Lift off the front plate.
5. Using a No. 1 long-handled Phillips screwdriver, remove the two screws at the bottom of the heat exchanger, shown in Figure 137 on page 152.
6. Disconnect the column compartment (oven) temperature sensor PCB cable (PN 60357-61300R) from the column compartment (oven) sensor interconnect PCB.

   Figure 133 on page 148 or Figure 138 on page 153 shows both the column compartment (oven) temperature sensor PCB cable and the sensor interconnect PCB.

   Remove the column compartment temperature sensor PCB.

❖ **To replace the column compartment (oven) temperature sensor PCB**

1. Plug the column compartment (oven) temperature sensor PCB cable, shown in Figure 138 on page 153, into the column compartment (oven) sensor interconnect PCB. Figure 133 on page 148 shows both the column compartment (oven) temperature sensor PCB cable and sensor interconnect PCB.
2. Replace the column compartment (oven) temperature sensor PCB in the column compartment (oven) assembly under the heat exchanger.
3. Insert the two screws that you removed in step 5 on page 154 at the bottom of the heat exchanger and tighten with a No. 1 long-handled Phillips screwdriver.
4. Replace the oven assembly plate.
5. Insert the four screws from the metal plate of the column compartment (oven) assembly that you removed in step 3 on page 154 and tighten with a No. 1 long-handled Phillips screwdriver.
6. Push the injection valve back into place. Insert the two screws that you removed in step 1 on page 153 near the upper right and lower left of the valve, and tighten with a No. 2 Phillips screwdriver.

## Removing and Replacing the Column Compartment (Oven) Sensor Interconnect PCB

The column compartment (oven) sensor interconnect PCB (PN F9053-010) resides next to the heat exchanger in the column compartment Peltier assembly. For its location, see Figure 133 on page 148. The column compartment sensor interconnect PCB is connected to the temperature control PCB by a cable that is hardwired onto it. You can see this cable in Figure 123 on page 141 and Figure 126 on page 143.

You cannot replace this board by itself; you must replace the column compartment (oven) Peltier assembly. For instructions, see "Removing and Replacing the Column Compartment (Oven) Peltier Assembly" on page 148.

## Removing and Replacing the Column Compartment (Oven) Temperature Control PCB

The column compartment (oven) of the Accela Autosampler contains a temperature control PCB (PN 60053-61071R), shown in Figure 139, which regulates the temperature of the column compartment (oven). The board uses the temperature readings from the column compartment (oven) temperature sensor PCB to regulate the power delivered to certain components in the autosampler and to adjust the temperature of the column compartment according to the settings that you select through a user interface, usually the graphical user interface of a data system. It is similar to the temperature control PCB located in the vial tray compartment (see "Removing and Replacing the Vial Tray Temperature Control PCB" on page 138).

**Figure 139.** Temperature control PCB


The column compartment (oven) temperature control PCB resides on the upper part of the middle wall in the column compartment near the backplane PCB, as shown in Figure 140.

**Figure 140.** Column compartment (oven) temperature control PCB

You do not need to take out the temperature control power supply when you replace the temperature control PCB. (Figure 140 shows the power supply removed for clarity.)

### ❖ To remove the column compartment (oven) temperature control PCB

1. Take off the panel on the right side of the autosampler by following the instructions in "Removing and Replacing the Right Side Panel of the Autosampler" on page 97.
2. Disconnect the following cables from the column compartment (oven) temperature control PCB (see Figure 126 on page 143):
   - Temperature control cable (PN F1002-010) from the backplane PCB
   - Oven Peltier cable (PN F1087-010) from the column compartment Peltier assembly
   - Oven fan motor cable (PN F1017-010) from the oven fan motor
   - Black and red column compartment (oven) fan assembly cable (PN 60357-63006) from the two Peltier fans
   - White column compartment (oven) sensor interconnect PCB cable (PN F9053-010) from the column compartment (oven) sensor interconnect PCB
   - The short DC power cable (PN F1083-010), which provides power to the temperature control PCB for the column compartment (oven)
3. Using a No. 2 Phillips screwdriver, remove the screw in the middle of the board.

   The board rests on four small pins set in the wall.
4. Gently pry the board away from the pins with a flat-edged screwdriver.

### ❖ To replace the column compartment (oven) temperature control PCB

1. Place the four holes at each corner of the board over the pins set in the wall, and push the board onto the pins.
2. Insert the screw that you removed in step 3 into the middle of the board, and tighten it with a No. 2 Phillips screwdriver.
3. Reconnect the following cables in any order (see Figure 126 on page 143):
   - Location P3 on the oven Peltier cable to location J3 on the column compartment (oven) temperature control PCB
   - Location P4 on the white column compartment (oven) sensor interconnect PCB cable to location J4 on the column compartment (oven) temperature control PCB
   - Location P5 on the short DC power cable to location J5 on the column compartment temperature (oven) control PCB
   - Oven fan motor cable to location J6 on the column compartment (oven) temperature control PCB

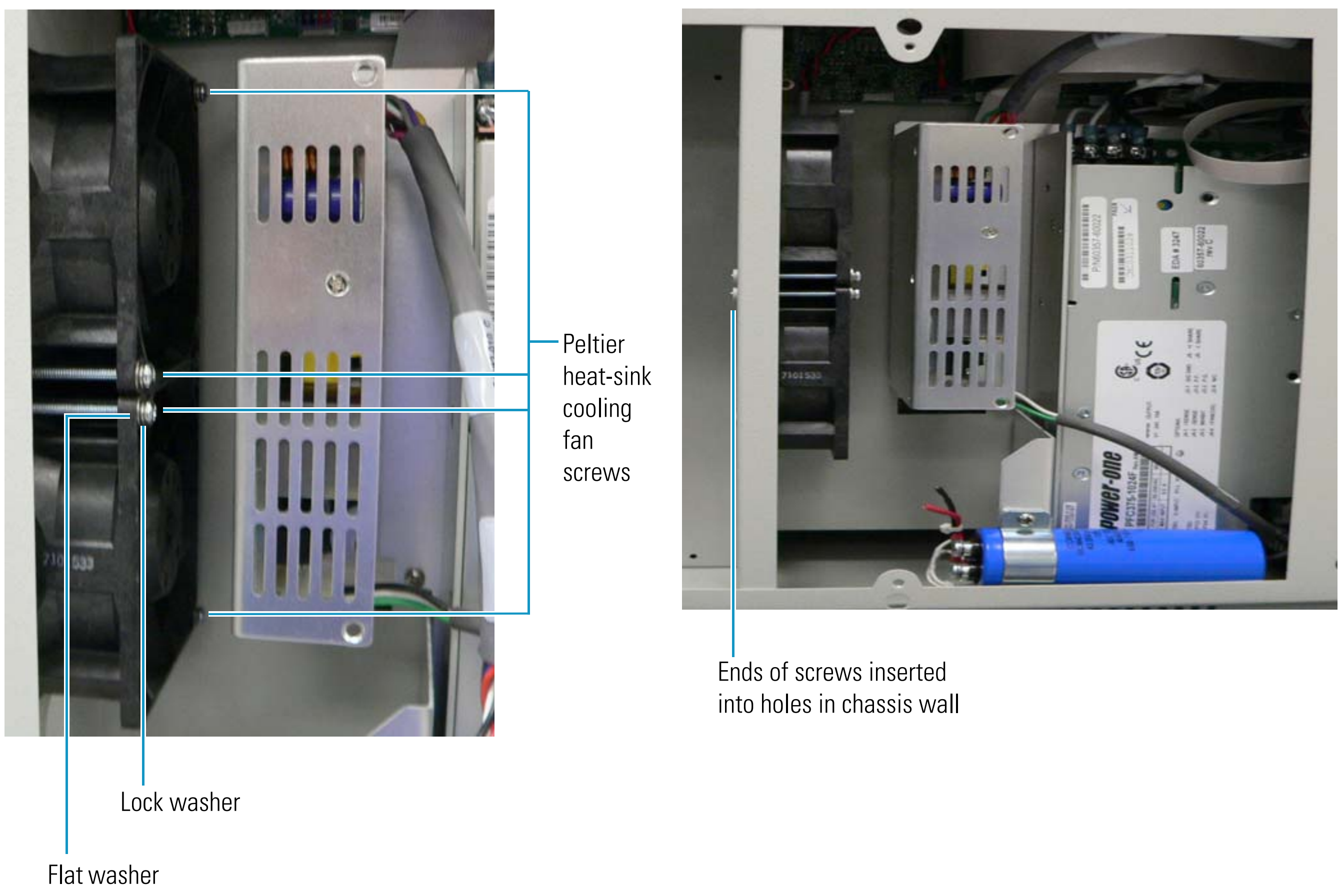
- Location P7 on the black and red column compartment (oven) fan assembly cable to location J7 on the column compartment (oven) temperature control PCB
- Location P8 on the temperature control cable to location J8 on the column compartment (oven) temperature control PCB

4. Replace the panel on the right side of the autosampler by following the instructions in "To replace the right side panel of the autosampler" on page 97.

## Removing and Replacing the Column Compartment (Oven) Fan Assembly

The column compartment (oven) fan assembly (PN 60357-63006) consists of two Peltier fans, or column compartment (oven) heat sink cooling fans. They reside on the right side of the autosampler, as shown in Figure 141. They extract hot air from the column compartment heat sinks. However, they are not part of the column compartment (oven) assembly.

**Figure 141.** Column compartment (oven) Peltier heat-sink cooling fans




❖ **To remove the column compartment (oven) fan assembly**

1. Take off the panel on the right side of the autosampler by following the instructions in "To remove the right side panel of the autosampler" on page 97.

2. Disconnect the black and red column compartment (oven) fan assembly cable (PN 60357-63006) (see Figure 128 on page 145) from the column compartment (oven) temperature control PCB.

3. Remove the logic voltage power supply by following the instructions in "To remove the logic voltage power supply" on page 192.

4. Using a No. 2 Phillips screwdriver, remove the four screws shown in Figure 141 on page 157.

5. Remove the fans from the autosampler.

❖ **To replace the column compartment (oven) fan assembly**

1. Insert the fans into the autosampler.

2. Place a lock washer and then a flat washer over the end of each of the four screws that you removed in step 4, and insert each screw in the locations shown in Figure 141 on page 157. Push the screws through the small holes in the chassis wall.

3. Using a No. 2 Phillips screwdriver, manually tighten the screws in the two fan units.

**CAUTION** Do not use a power screwdriver to tighten the screws, because it can crack the fan assembly.

4. Attach location P7 on the black and red column compartment (oven) fan assembly cable (see Figure 128 on page 145) to location J7 on the column compartment (oven) temperature control PCB.

5. Replace the logic voltage power supply. For instructions, see "To replace the logic voltage power supply" on page 193.

6. Replace the panel on the right side of the autosampler by following the instructions in "To replace the right side panel of the autosampler" on page 97.

## Calibrating the Temperature of the Column Compartment (Oven)

You must recalibrate the temperature of the column compartment (oven) when you replace the temperature control PCB. For instructions, refer to the following manuals or Help:

- Xcalibur data system: *Accela User Guide for LC Devices*
- ChromQuest data system: *Accela User Guide for the ChromQuest Data System* or the Accela Help

# Maintaining the Syringe Drive Assembly

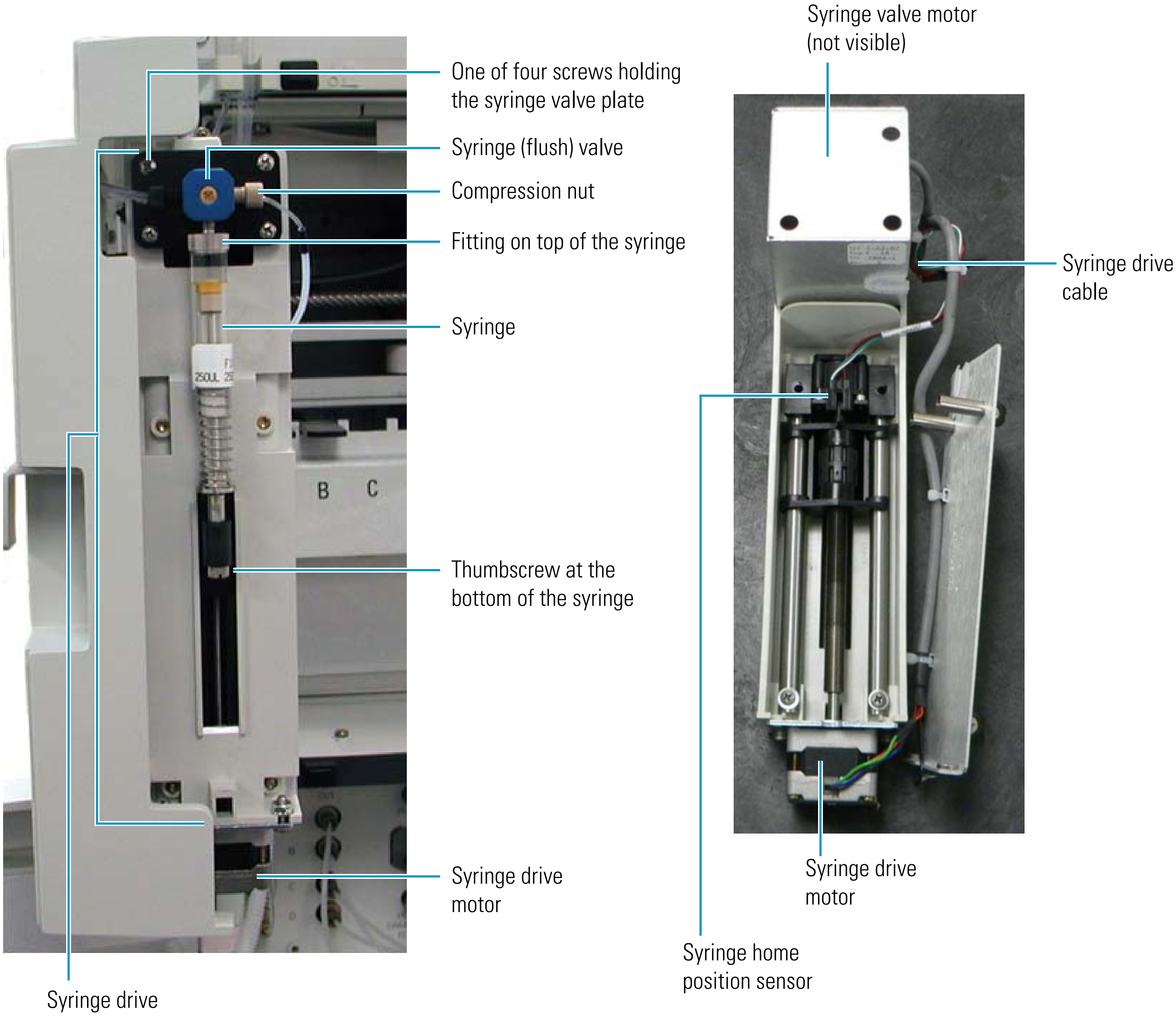
The syringe drive assembly (PN 60357-60013) extracts the sample from the vials in the vial tray and dispenses it into the injection system. It also supplies and dispenses the needle wash solvent. The syringe drive assembly includes the following components:

- Syringe (PN F1100-010 for 100 µL volume, optional; PN F1100-020 for 250 µL volume, standard; and PN F1100-030 for 500 µL volume, optional)
- Syringe drive (PN 60357-60013, identical to the part number for the entire syringe drive assembly)
- Syringe drive motor (PN 00013-01-00021)
- Syringe valve (PN A3630-010)
- Syringe valve motor (PN 00013-05010)
- Syringe home position sensor (PN 5116-0031)

The flex cable interface PCB (PN 60357-61000) and the syringe drive flex cable (PN 60357-63000) are not part of the syringe drive assembly but are discussed in this section.

Figure 142 shows some of the features of the syringe drive assembly. The syringe home position sensor and the syringe valve motor reside on the back of the syringe drive assembly.

**Figure 142.** Front and back views of the syringe drive assembly

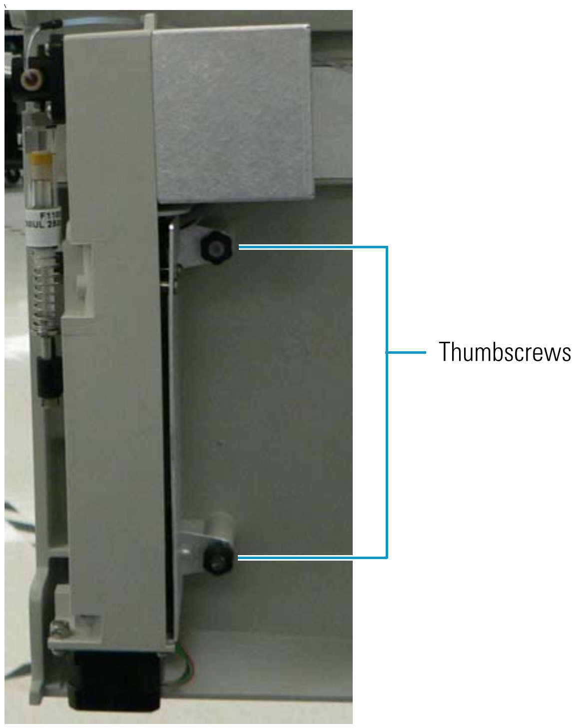


## Removing and Replacing the Syringe Drive Assembly

### ❖ To remove the syringe drive assembly

1. Loosen the two thumbscrews shown in Figure 143.

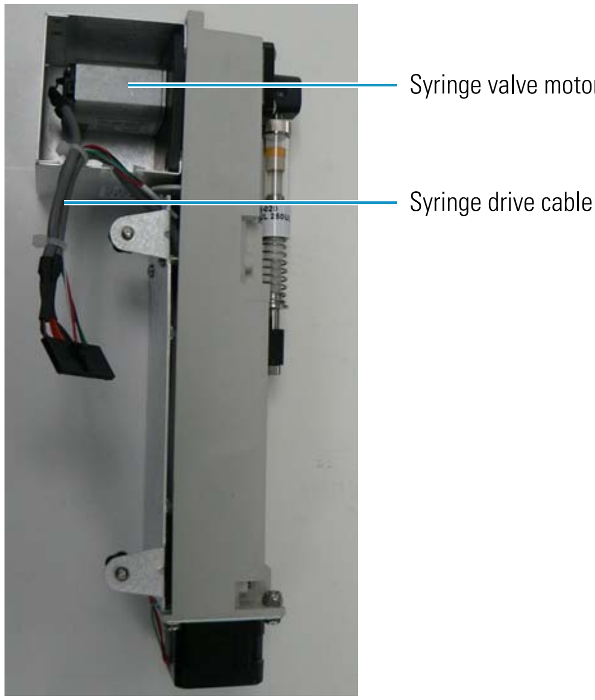
   **Figure 143.** Thumbscrews on the syringe drive assembly

2. Unplug the syringe drive cable hardwired to the syringe drive, shown in Figure 144, from the socket on the cover plate that interfaces with the flex cable interface PCB on the inside of the left front door.

   Figure 146 on page 166 shows the socket for the syringe drive cable.

**Figure 144.** Syringe drive assembly and cable




❖ **To replace the syringe drive assembly**

1. Plug the syringe drive cable into the socket that interfaces with the flex cable interface PCB in the inside of the left autosampler door. This socket is shown in Figure 146 on page 166.

2. Replace the syringe drive assembly on the autosampler, and insert and tighten the two thumbscrews that you removed in step 1 on page 161 (shown in Figure 143 on page 161).

## Removing and Replacing the Syringe

The syringe of the Accela Autosampler, shown in Figure 142 on page 160, draws sample from the vials in the vial tray and expels it into the injection system. Its part numbers are the following:

- F1100-010 for 100 µL volume, optional
- F1100-020 for 250 µL volume, standard
- F1100-030 for 500 µL volume, optional

For general information on the syringe, see “Syringe” on page 9.

To remove the syringe from the autosampler, see “Setting the Syringe to the Removal Position” on page 81 and “Removing the Syringe from the Autosampler” on page 81.

To replace the syringe, see “Installing the Syringe” on page 83.

## Removing and Replacing the Inner Plunger of the Syringe

To remove and replace the inner plunger of the syringe, see “Changing the Syringe or Replacing the Inner Plunger” on page 81.

## Lubricating the Syringe Drive

Earlier models of the syringe drive (PN 60357-60013) need periodic lubrication. You can identify these models by the lead screw type or coating. Those that require lubrication have lead screws with a bright, metallic appearance. More recent models do not require lubrication, and you can identify these by the black Teflon coating on their lead screws.

For instructions on lubricating the syringe drive, see “Maintaining the Syringe Drive Assembly” on page 63.

## Removing and Replacing the Syringe Drive Motor

The syringe drive motor (PN 00013-00021) provides power to the syringe drive. You can see the syringe drive motor at the bottom of Figure 142 on page 160.

You cannot replace the syringe drive motor by itself; you must replace the entire syringe drive assembly to replace this part. For instructions, see “Removing and Replacing the Syringe Drive Assembly” on page 161.

## Removing and Replacing the Syringe Valve

The syringe (drive) valve sits on top of the syringe itself and rotates to either its supply bottle or the needle, depending on whether it is picking up or delivering sample, wash solvent, and so forth. For general information on the syringe valve, see “Syringe Valve” on page 8.

Follow the procedures in this section to replace the syringe valve (PN A3630-010) and the coupler. The coupler goes on the syringe valve motor and connects the motor to the valve.

### ❖ To remove the syringe valve

1. Using a No. 2 Phillips screwdriver, remove the four screws holding the black plate where the syringe valve resides (see Figure 142 on page 160).
2. Pull out the syringe valve.
3. Remove the coupler if it needs replacing.

❖ **To replace the syringe valve**

1. Insert the new coupler.
2. Insert the new syringe valve, lining up the flat spot on the valve screw with the flat spot on the coupler.
3. Insert the four screws that you removed in step 1 on page 163, holding the plate where the syringe valve resides, and tighten them with a No. 2 Phillips screwdriver.

## Removing and Replacing the Syringe Valve Motor

The syringe valve motor (PN 00013-05010) turns the syringe valve. It appears in Figure 144 on page 162. Attached to it is the syringe valve motor cable (see Figure 142 on page 160 and Figure 144 on page 162), which plugs into the socket of the cover plate inside the front of the left door (see Figure 146 on page 166).

You cannot replace the syringe valve motor by itself; you must replace the entire syringe drive assembly to replace this part. For instructions, see "Removing and Replacing the Syringe Drive Assembly" on page 161.

## Removing and Replacing the Syringe Home Position Sensor

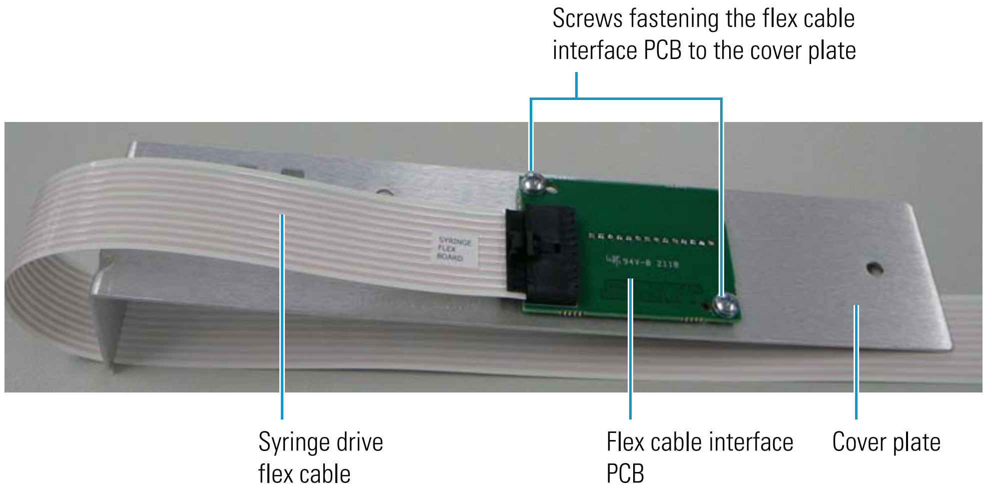
The syringe home position sensor (PN 5116-0031), shown in Figure 142 on page 160, senses when the syringe is in the home position.

You cannot replace this part by itself; you must replace the entire syringe drive assembly to replace this part. For instructions, see "Removing and Replacing the Syringe Drive Assembly" on page 161.

## Removing and Replacing the Flex Cable Interface PCB

The flex cable interface PCB (PN 60357-61000), shown in Figure 145, acts as an interface between the syringe drive flex cable (PN 60357-61000) and the CPU PCB (PN F9015-030). It resides on the inside of the cover plate on the inside of the autosampler's front left door.

**Figure 145.** Syringe drive flex cable connection to the flex cable interface PCB

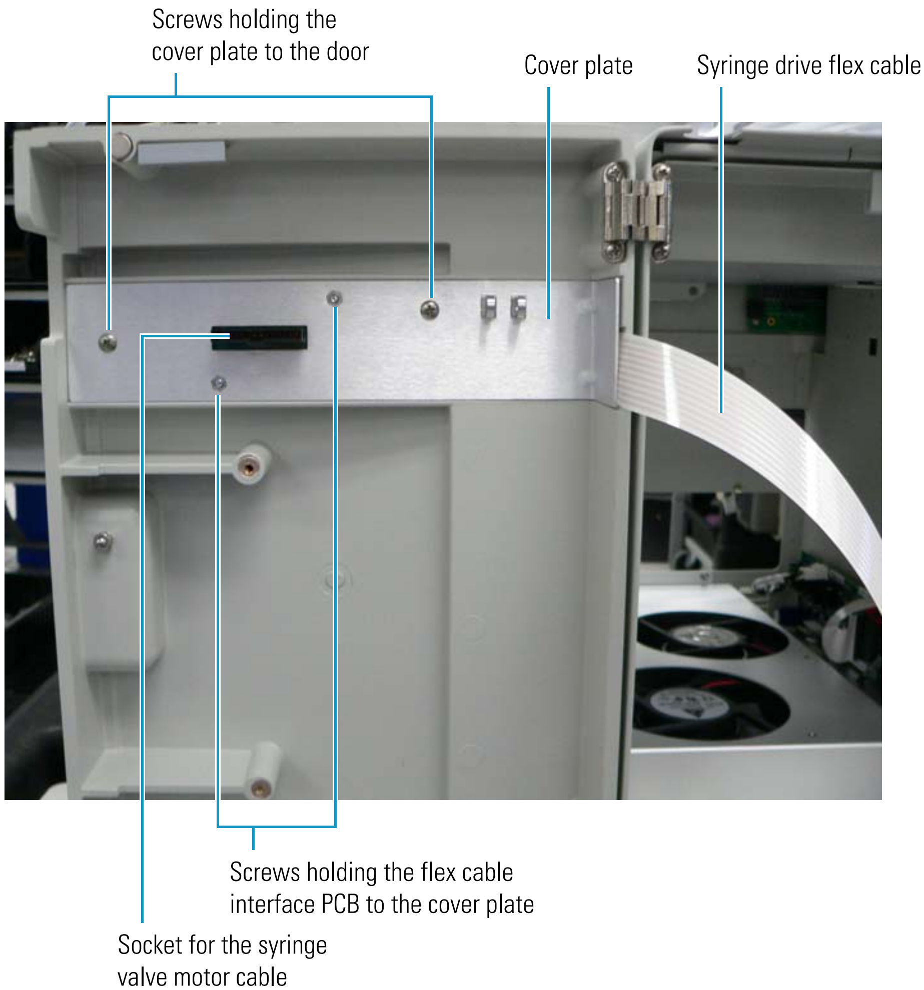



### ❖ To remove the flex cable interface PCB

1. Remove the syringe drive assembly by following the instructions in "To remove the syringe drive assembly" on page 161, and disconnect the syringe valve motor cable.

2. Remove the cover plate (PN 60057-10058) from inside the left door by using a No. 2 Phillips screwdriver to remove the two screws shown in Figure 146.

**Figure 146.** Cover plate on inside of front left door




3. Disconnect the syringe drive flex cable (PN 60357-61000) from the flex cable interface PCB.

4. Using a No. 2 Phillips screwdriver, remove the two screws that hold the flex cable interface PCB to the bracket (see Figure 145 on page 165).

### ❖ To replace the flex cable interface PCB

1. Insert the two screws that you removed in step 4 into the flex cable interface PCB and cover plate and tighten with a No. 2 Phillips screwdriver.

2. Connect location P1 on the syringe drive flex cable to location J1 on the flex cable interface PCB in the door (see Figure 145 on page 165).

3. Place the cover plate over the flex cable interface PCB and the syringe drive flex cable, leaving the unconnected end of the cable protruding from the bracket, as shown in Figure 146.

4. Insert the two screws that you removed in step 2 on page 165 into the door and the cover plate in the locations shown in Figure 146 on page 166 and tighten with a No. 2 Phillips screwdriver.

## Removing and Replacing the Syringe Drive Flex Cable

The syringe drive flex cable (PN 60357-61000) is a wide ribbon cable that connects to the flex cable interface PCB beneath the cover plate on the inside of the front left door and extends across the ceiling of the autosampler to connect to the CPU PCB.

### ❖ To remove the syringe drive flex cable

1. Disconnect the syringe drive flex cable from the CPU PCB.
2. Remove the CPU PCB (see “To remove the CPU PCB” on page 107 for instructions).
3. Remove the cover plate (PN 60057-10058) from inside the left door by using a No. 2 Phillips screwdriver to remove the two screws shown in Figure 146 on page 166.
4. Disconnect the syringe drive flex cable from the flex cable interface PCB.
5. Remove the cable clamp (PN 00007-12507) that goes over the syringe drive flex cable on the left doorway of the chassis by using a No. 2 Phillips screwdriver to remove the screw that attaches it to the chassis.
6. Remove the syringe drive flex cable from the brackets on the left side of the chassis and remove it from the autosampler.

### ❖ To replace the syringe drive flex cable

1. Bend the protruding end of the syringe drive flex cable at a 90-degree angle, as shown in Figure 147.
2. Thread the cable into the bracket on the left side of the chassis and into the bracket on the ceiling, as shown in Figure 147.
3. Pull the cable tight and flat.

   The end will still hang down towards the front of the autosampler.

**Figure 147.** Syringe drive flex cable bent at 90-degree angle


4. Place a cable clamp (PN 00007-12507) over the syringe drive flex cable on the left doorway of the chassis, as shown in Figure 148.

5. Insert the screw that you removed in step 5 on page 167 into the hole at the top of the bracket. Tighten with a No. 2 Phillips screwdriver.

**Figure 148.** Cable clamp installed over the syringe drive flex cable

6. Slide in the tray supporting the CPU PCB (PN F9015-030) on top of the two brackets on each side of the column compartment (oven), and align the two holes in the CPU PCB with the two cone-shaped pins on the back of the upper chassis wall.

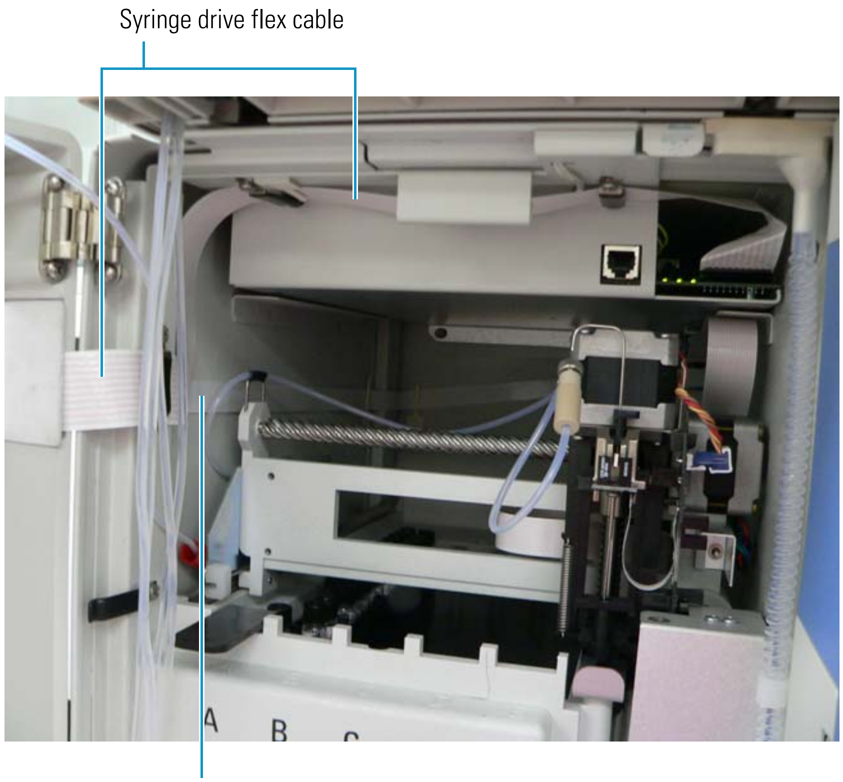
7. Insert two screws in the front ceiling of the autosampler at each side of the large metal tab, as shown in Figure 93 on page 107, to hold the tray in place and tighten with a No. 2 Phillips screwdriver.

8. Connect the remaining end of the syringe flex drive cable to the location J11 on the CPU PCB, as shown in Figure 149. Fold the cable as shown.

**Figure 149.** Connection of the syringe flex drive cable to the CPU PCB


**Note** The front panel LED cable (PN 60357-63002) also resides beneath the cover plate and extends into the vial tray compartment. It is thinner than the syringe drive flex cable. Figure 150 shows both the syringe drive flex cable and the front panel LED cable. For information on the front panel LED cable, see "Removing and Replacing the Front Panel LED Cable" on page 202.

**Figure 150.** Syringe drive flex cable and front panel LED cable




# Maintaining the Injector Drive Assembly

The injector drive assembly (PN 60357-60010) rotates the injection valve from inject position to load position and back. It includes the following components:

- Injector drive motor (PN 00013-01-00013) and its power leads
- Injector drive power cable (PN F1116-010), which connects the injector drive storage capacitor to the backplane PCB
- Injector position sensor PCB (PN 60360-61005R)
- Injector position sensor cable (PN A3513-010), which connects the injector position sensor PCB to the backplane PCB

The injector drive assembly does not include the following components, but this section includes instructions for removing and replacing them:

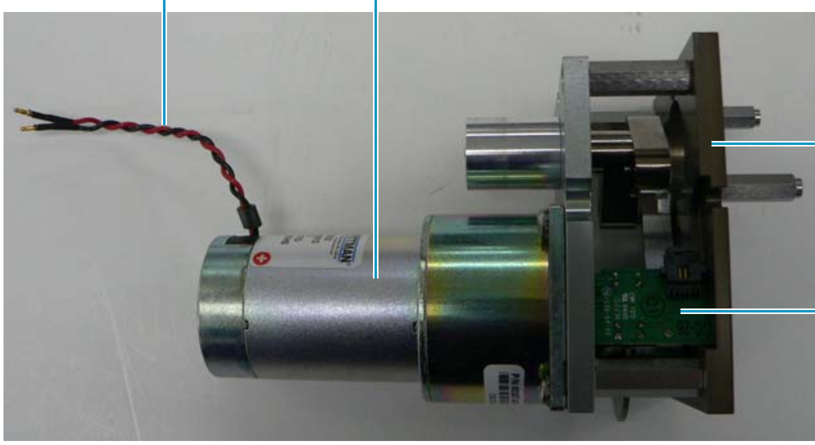
- Injector drive storage capacitor (PN 1505-3400)
- Injection valve (PN 60357-60018 for the 18 000 psi valve and PN 60357-60016 for a 15 000 psi valve).

- Rotor (PN 00110-03-00019 for an 18 000 psi valve and PN 00109-99-00021 for a 15 000 psi valve), which is part of the injection valve
- Needle assembly (PN 60357-60017)
- Sample loop (see “Consumables and Service Parts” on page 251 for the part numbers)
- Wash station (PN 60057-40012)
- Transfer tubing (PN 60053-60014)

## Removing and Replacing the Injector Drive Motor

The injector drive motor (PN 00013-01-00013) rotates the injector drive, which in turn rotates the injection valve. Figure 151 shows the injector drive motor; Figure 123 on page 141 shows it installed.

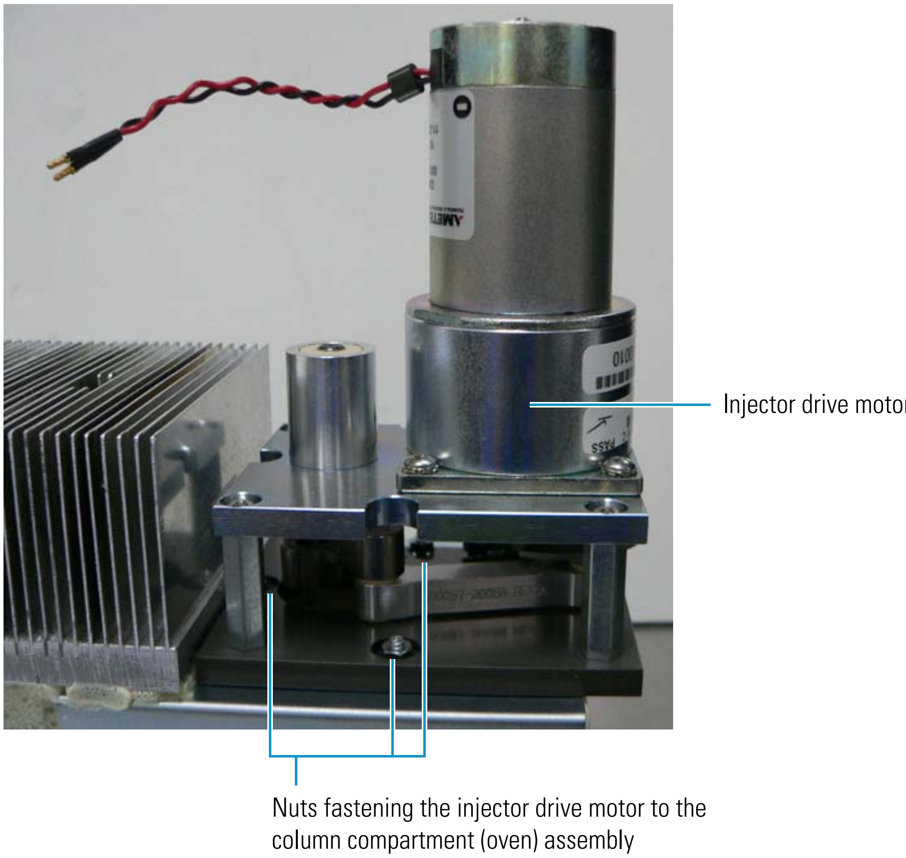
**Figure 151.** Injector drive motor




### ❖ To remove the injector drive motor

1. Remove the drip tray by following the instructions in “To remove the drip tray” on page 210.
2. Remove the column compartment (oven) assembly through the right front of the autosampler. Follow the instructions in “To remove the column compartment (oven) assembly” on page 141.
3. Disconnect the injector position sensor cable from the injector position sensor PCB (PN 60360-61005R).
4. Using a 1/4 inch nut driver, remove the three nuts along the edges of the framework shown in Figure 152.

**Figure 152.** Screws connecting the injector drive motor to the column compartment (oven) assembly




### ❖ To replace the injector drive motor

1. Place the injector drive motor on the column compartment (oven) assembly in the position shown in Figure 152.

2. Insert the three nuts that you removed in step 4 on page 171 into the locations in the injector drive motor assembly, place the bolts over them, and tighten the nuts with a 1/4 inch nut driver.

3. Connect location P11 on the injector position sensor cable to location J11 on the injector position sensor PCB.

4. Connect location P5 on the injector position sensor cable to location J5 on the backplane PCB.

5. Return the column compartment (oven) assembly to the autosampler by following the instructions in "To replace the column compartment (oven) assembly" on page 144.

6. Replace the drip tray by following the instructions in "To replace the drip tray" on page 211.

## Removing and Replacing the Injector Position Sensor PCB

The injector position sensor PCB(PN 60360-61005R), shown in Figure 151 on page 171, indicates when the drive (and the injection valve itself) has reached the desired position. The injector position sensor cable (PN A3513-010, shown in Figure 153 on page 173, is a long, thin ribbon cable that connects the injector position sensor PCB to the backplane PCB.

If the injector position sensor PCB fails, you must replace the entire injector drive assembly (see "Removing, Disassembling, and Replacing the Injection Valve" on page 175). However, you can replace just the injector position sensor cable without replacing the entire assembly.

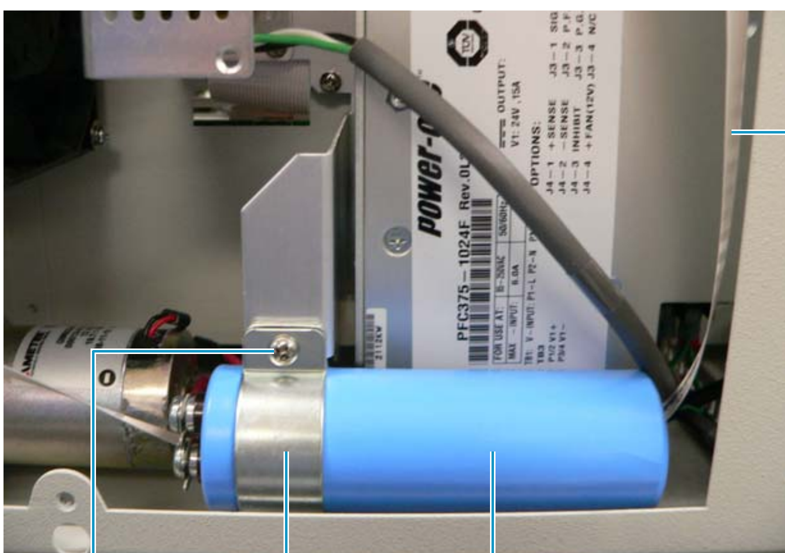
To remove and replace the injector position sensor cable, follow the procedures "To remove the column compartment (oven) assembly" on page 141 and "To replace the column compartment (oven) assembly" on page 144.

## Removing and Replacing the Injector Drive Storage Capacitor

The Accela Autosampler injector drive storage capacitor (PN 1505-3400) stores power for the injection valve drive system. It resides at the bottom of the right side of the column compartment (oven), as shown in Figure 153.

There is no test to determine when the capacitor is no longer storing charge and needs replacing. However, you might notice that the injection valve no longer turns sharply or only moves intermittently. The capacitor can also leak.

**Figure 153.** Injector drive storage capacitor



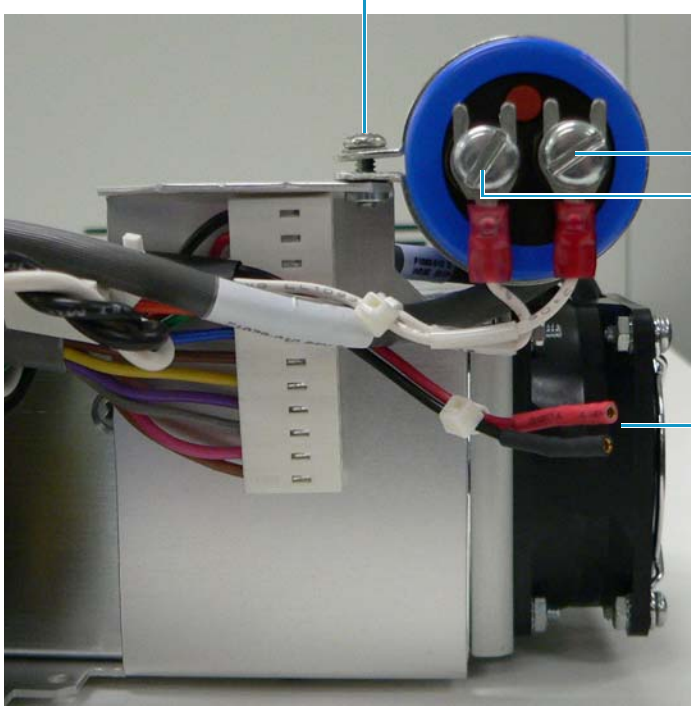
**CAUTION** The capacitor holds a hazardous residual charge. Wait 15 to 20 minutes after you cut power from the system before disconnecting the capacitor. Wear protective eyewear and insulating gloves during the process of handling the capacitor. Before handling or storing the capacitor, you *must* discharge it by shorting the positive to the negative terminal. Maintain the capacitor with positive and negative terminals shorted until you dispose of it.

### ❖ To remove the injector drive storage capacitor

1. Take off the panel on the right side of the autosampler by following the instructions in "To remove the right side panel of the autosampler" on page 97.
2. Disconnect the red and black power leads to the injector drive motor (PN 00013-01-00013), shown in Figure 154, from the injector drive storage capacitor.
3. Disconnect from the injector drive storage capacitor the power leads of the injector drive power cable (PN F1116-010) that connect to the backplane PCB.

   Figure 154 shows these power leads.

   **Figure 154.** Leads to the injector drive motor and the backplane PCB




4. Using a No. 2 Phillips screwdriver, loosen the screw that holds together the two sides of the capacitor clamp, shown in Figure 153 on page 173.
5. Remove the injector drive storage capacitor from the autosampler.

❖ **To replace the injector drive storage capacitor**

1. Insert the new injector drive storage capacitor into the clamp in the autosampler.
2. Tighten the screw in the clamp with a No. 2 Phillips screwdriver.
3. Reconnect the black and red power leads to the injector drive motor, shown in Figure 154, to the injector drive storage capacitor.
4. Reconnect the power leads of the injector drive power cable that goes to the backplane PCB, shown in Figure 154 on page 174.

   Location P7 on the cable connects to location J7 on the backplane PCB.
5. Replace the panel on the right side of the autosampler by following the instructions in "To replace the right side panel of the autosampler" on page 97.

## Removing, Disassembling, and Replacing the Injection Valve

The injection valve (PN 60357-60018 for an 18 000 psi valve and PN 60357-60016 for a 15 000 psi valve) is a six-port, two-position valve that introduces sample into the column by way of the sample loop. Figure 11 on page 12 illustrates this valve.

To remove the injection valve, see "Removing the Injection Valve from the Autosampler" on page 52.

To disassemble the injection valve, see "Disassembling the Injection Valve" on page 54.

To replace the injection valve, see "Reinstalling the Injection Valve" on page 56.

## Removing and Replacing the Rotor

The rotor (PN 00110-03-00019 for an 18 000 psi valve and PN 00109-99-00021 for a 15 000 psi valve) is part of the injection valve and forms a high-pressure seal with the stator (see Figure 39 on page 54). To remove and replace the rotor, see "Replacing the Rotor Seal in the Valco Injection Valve" on page 51.

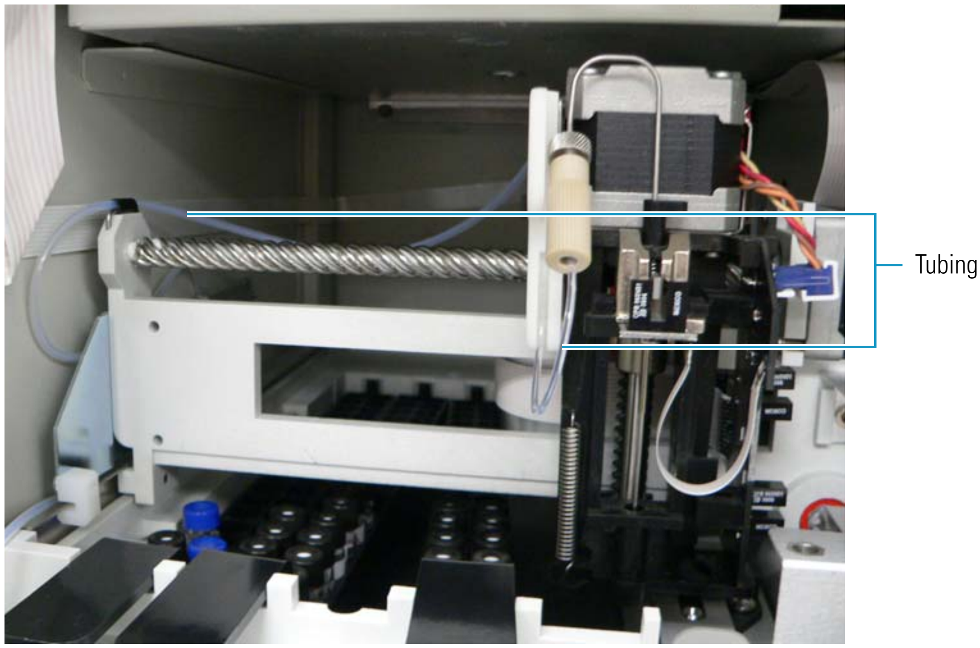
## Removing and Replacing the Needle Assembly

The needle assembly (PN 60357-60017) extracts the sample from the vials and delivers it into the injection valve through the transfer tubing, as shown in Figure 63 on page 79. To remove and replace the needle assembly, see "Replacing the Needle Assembly" on page 80.

## Checking the Tubing in the Needle Assembly

Make sure the tubing in the needle assembly shown in Figure 155 is not kinked. Perform a needle flush after connecting the needle to the syringe drive to make sure that fluid is flowing.

**Figure 155.** Tubing to check in the needle assembly




To replace the needle tubing, see "Replacing the Needle Tubing Assembly" on page 73.

## Removing and Replacing the Sample Loop

The Accela Autosampler sample loop, shown in Figure 11 on page 12, is a stainless steel tube with end fittings that holds the sample before its introduction into the column.

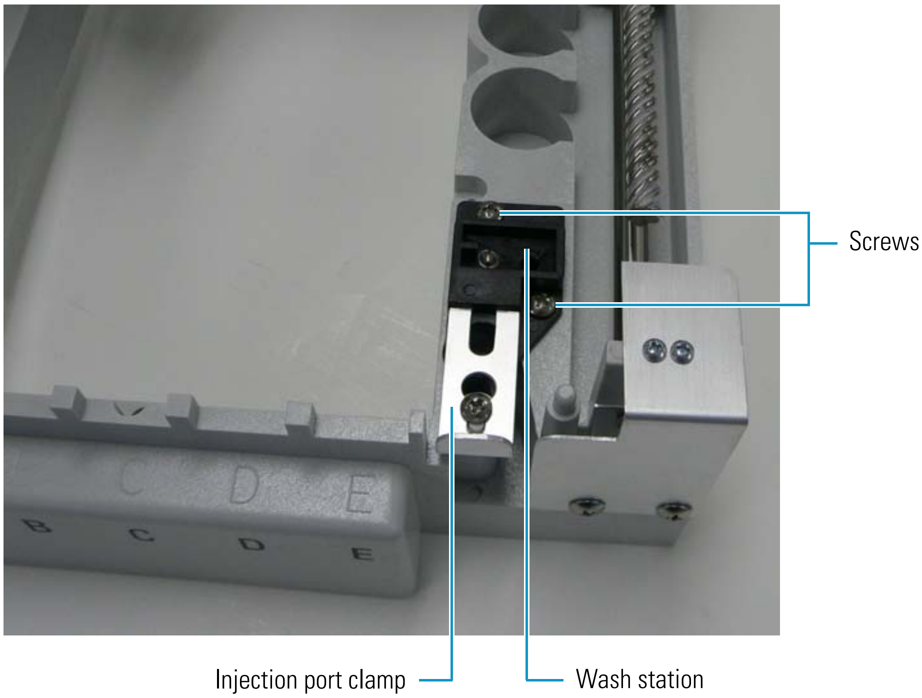
You can find sample loop part numbers in "Consumables and Service Parts" on page 251. All of the loop sizes listed are available, but the 25 µL size is standard.

For instructions on replacing the sample loop, see "Replacing the Rotor Seal in the Valco Injection Valve" on page 51.

## Removing and Replacing the Wash Station

The needle of the autosampler extracts the sample from the vials and enters it into the system for analysis. Because you do not want the next sample to contain any of the previous sample, the wash station (PN 60057-40012), shown in Figure 156, washes the needle between sample extractions.

**Figure 156.** Wash station




You might need to remove the wash station to clean, sonicate, or replace it.

### ❖ To remove the wash station

1. Slide back the injection clamp and remove it.
2. Using a No. 2 Phillips screwdriver, remove the two screws on the wash station shown in Figure 156.
3. Lift up the wash station, disconnect the waste tubing, and remove the wash station from the XYZ arm assembly.

### ❖ To replace the wash station

1. Insert the wash station into the XYZ arm assembly, and connect the waste tubing to it.
2. Insert the two screws shown in Figure 156 and tighten with a No. 2 Phillips screwdriver.
3. Slide the injection clamp forward, ensuring that the injection port is properly secured beneath the clamp.

## Removing and Replacing the Transfer Tubing

The transfer tubing (PN 60053-60014) takes the sample introduced by the needle and transfers it to the injection valve, as shown in Figure 10 on page 11. For instructions on removing and replacing the transfer tubing, see "Replacing the Transfer Tubing" on page 59.

## Calibrating the Internal Volume Value

The internal volume (also called the dead volume) of the transfer tubing can vary from 15 to 20 µL. You might need to recalibrate this internal volume for the following reasons:

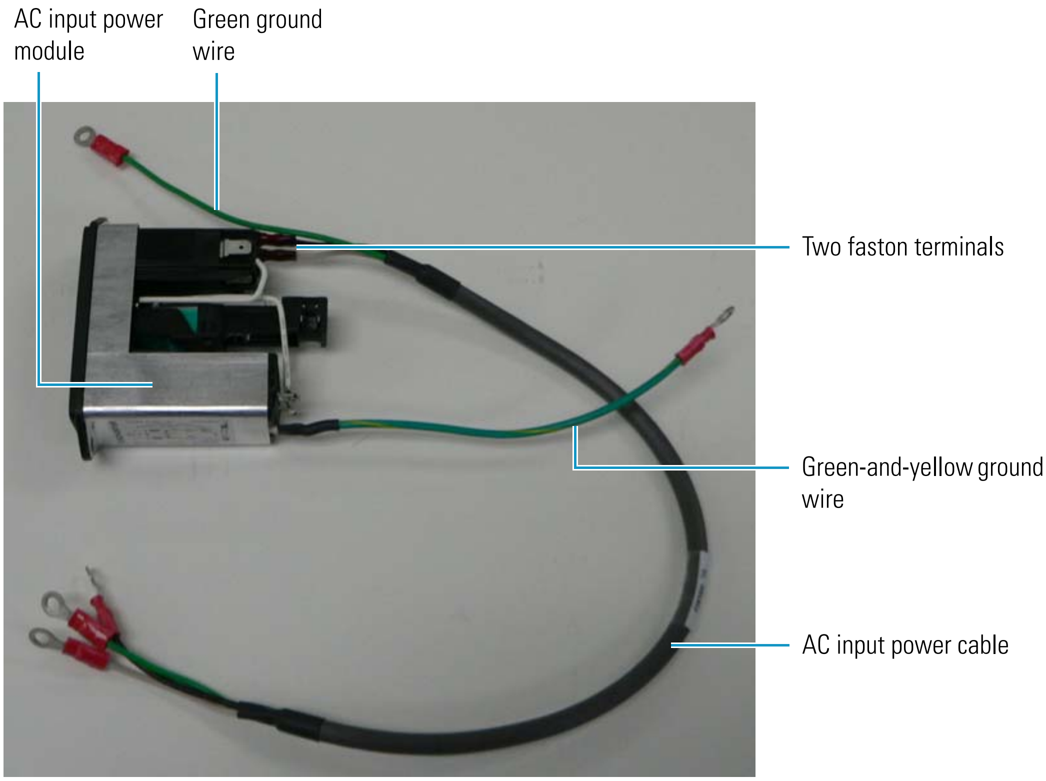
- The transfer tubing is new or has been replaced because it became clogged.
- If you perform no-waste or small-volume injections (for example, 1 µL), the amount of sample delivered to the column can vary. The no-waste injection method uses the Dead Volume parameter in the Accela Autosampler Configuration dialog box to position the sample bolus directly in front of the injection valve before the injection valve is turned to fill. If this positioning is not accurate, some of the sample bolus might not transfer to the loop during the fill step of the process. In many cases, you can increase the amount of sample delivered by optimizing the dead volume.

To optimize the dead volume, use the calibration procedure in "Determining the Transfer Tubing Volume" on page 232.

# Maintaining the AC Input Power Cable Assembly

The AC input power cable assembly (PN F1079-010), shown in Figure 157, supplies AC power to the Accela Autosampler's power supplies. These power supplies rectify the AC voltage and output DC voltage at various levels, such as 24 Vdc or 5 Vdc, depending on the power requirements of the instrument.

**Figure 157.** AC input power cable assembly




## Removing the AC Input Power Module

❖ **To remove the AC input power module**

1. Remove the drip tray by following the instructions in "To remove the drip tray" on page 210.

2. Remove the XYZ arm assembly, the vial tray temperature control assembly, and the vial tray fan assembly. For instructions on these procedure, see "To remove the XYZ arm assembly and vial tray temperature control assembly" on page 117 and "To remove the vial tray fan assembly" on page 135.

   The Bowden cable (PN 00302-99-00010), shown in Figure 158, has a metal tip at one end that connects to the AC input power module. The other end of the cable is the autosampler's On/Off button.

   **Figure 158.** Bowden cable

3. Detach the Bowden cable:

   a. With a long-nosed pliers, raise the silver metal clip on the AC input power module (see Figure 159).

   b. Using an X-Acto knife, carefully pry the insulated tip from the groove in the AC input power module.

4. Disconnect the two ground wires shown in Figure 157 on page 179.

5. Detach the two faston terminals of the AC input power module from the AC input power cable (PN F1079-010).

   Figure 157 on page 179 shows both the faston terminals and the AC input power cable.

6. Remove the two screws from the back of the autosampler chassis (see Figure 164 on page 183).

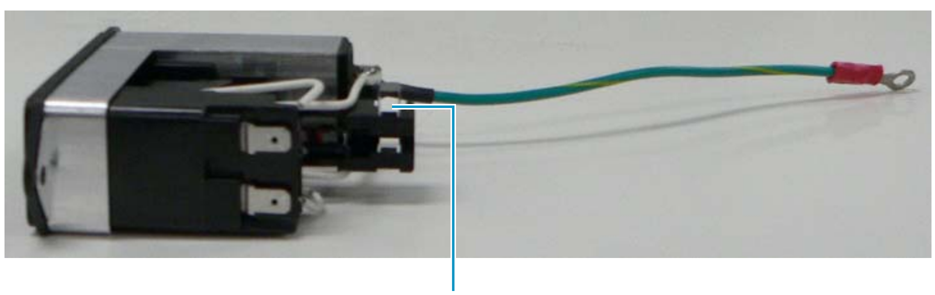
7. Remove the AC input power module from the autosampler.

## Replacing the AC Input Power Module

❖ **To replace the AC input power module**

1. With a long-nosed pliers, slightly raise the silver metal clip on the AC input power module, as shown in Figure 159.

   **Figure 159.** Clip on AC input power module




2. Connect the metal end of the Bowden cable to the AC input power module:

   a. Slightly separate the metal tip of the cable from the black casing of the cable.

   b. Place one end of a long-nosed pliers beneath the AC input power module and the other end of the pliers on top of the Bowden cable. Press the cable down into the groove between the two white wires, as shown in Figure 160, so that the cable does not move.

**Figure 160.** Metal tip of Bowden cable attached to the AC input power module

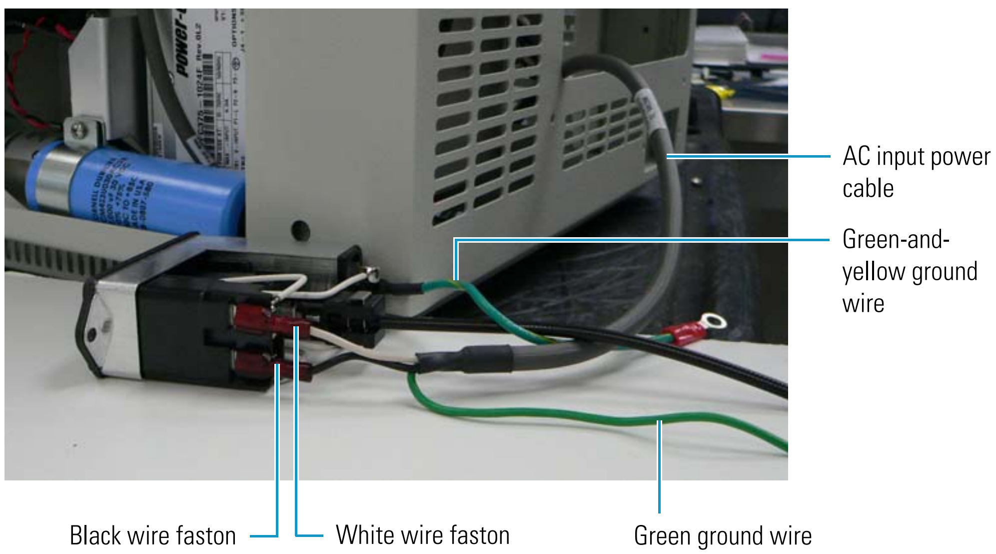
c. Push the On/Off switch at the other end of the Bowden cable to verify that it turns on and off (the switch remains in the depressed position when it is on).

3. Reconnect the AC input power cable to the AC input power module:

   a. Attach the faston terminal at the end of the black wire to the bottom terminal of the AC input power module.

   b. Attach the faston terminal at the end of the white wire to the top terminal of the AC input power module, as shown in Figure 161.

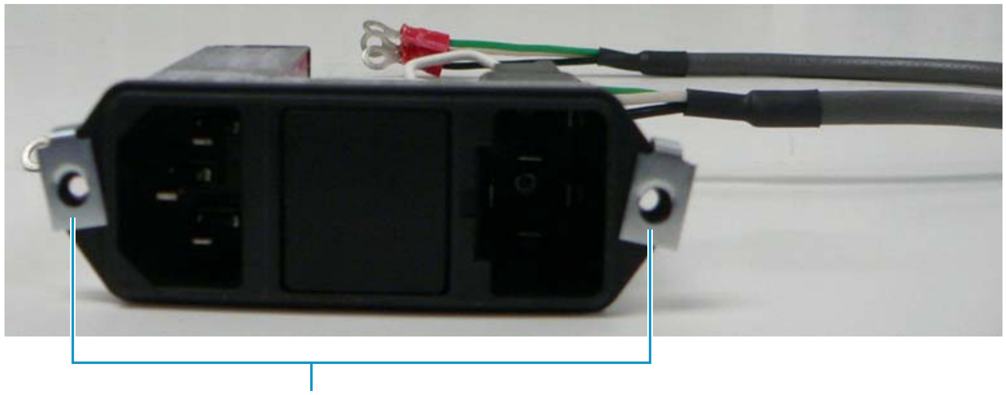
**Figure 161.** AC input power cable connection to the AC input power module




4. Place two fan clips (PN 2804-2750) on either side of the AC input power module.

   They will be crooked, as shown in Figure 162.

**Figure 162.** Fan clips on the AC input power module



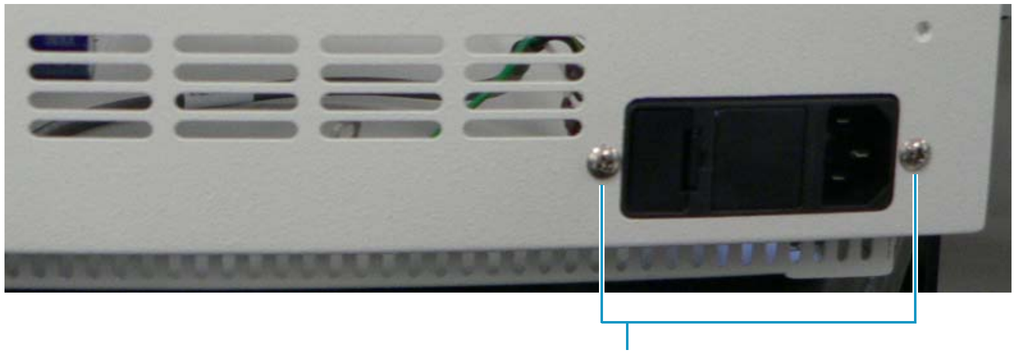

5. Place the AC input power assembly over the two holes near the square opening at the back of the autosampler chassis so that it fits, as shown in Figure 163.

**Figure 163.** AC input power cable assembly connected to the back of the chassis


6. Insert screws through the fan clips into the holes and tighten with a No. 2 Phillips screwdriver.

   Figure 164 shows these screws on the outside of the chassis.

**Figure 164.** AC input power cable assembly installed in rear of chassis

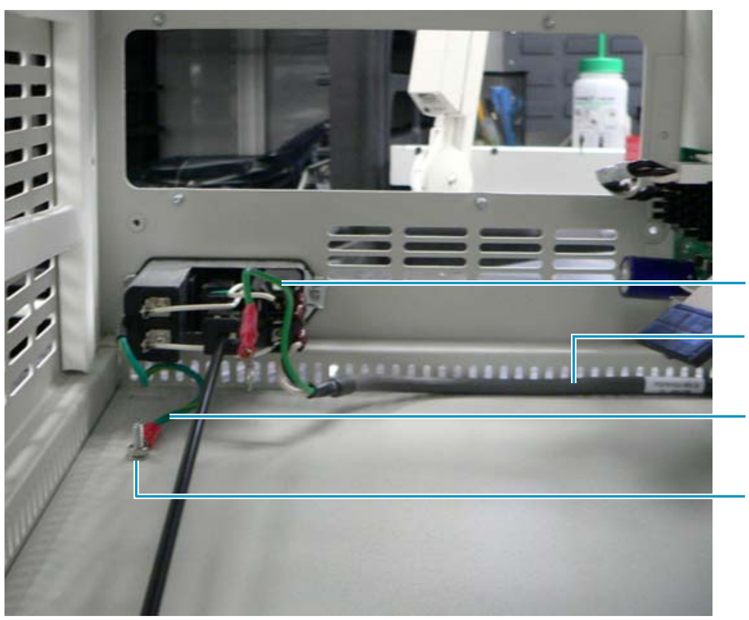



> **CAUTION** To prevent electric shock, it is important to ground the chassis. In the next step, you ground the chassis by connecting the green-and-yellow wire to the stud on the chassis floor.

7. Place the green-and-yellow ground wire of the AC input power cable assembly on the threaded stud on the floor of the chassis, place a kep nut over it, and tighten it with a 1/4 inch nut driver.

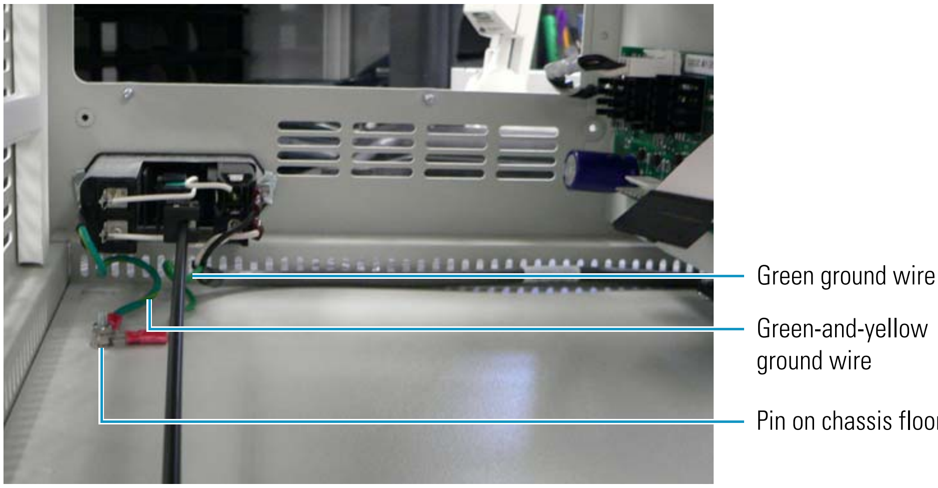
   Figure 165 shows the connected green-and-yellow ground wire.

   **Figure 165.** Green-and-yellow ground wire connection

8. Place the green ground wire of the AC input power cable assembly on top of the same threaded stud and fasten with another kep nut, as shown in Figure 166. Tighten with a 1/4 inch nut driver.

**Figure 166.** Green ground wire connection



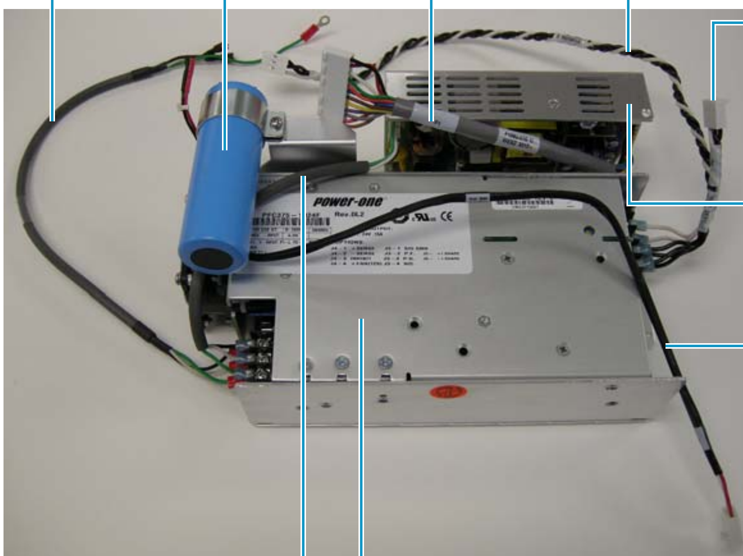

9. Replace the drip tray by following the instructions in "To replace the drip tray" on page 211.

10. Insert the black power switch (see Figure 127 on page 144) into the left side of the drip tray.

# Maintaining the Power Supply Module

The Accela Autosampler power supply module (PN 60357-60022), shown in Figure 167, controls the power to all units of the autosampler.

**Figure 167.** Power supply module




The power supply module consists of the following components:

- Logic voltage power supply (PN 4004-0662)
- Temperature control power supply (PN 4004-0663)
- These attached cables:
  - Backplane PCB power cable (PN F1082-010), which connects the logic voltage power supply to the backplane PCB
  - Short DC power cable (PN F1083-010), which provides power to the temperature control PCB for the column compartment (oven)
  - Long DC power cable (PN F1083-020), which provides power to the temperature control PCB for the vial tray compartment
  - AC input power cable (PN F1079-010), which provides power to the temperature control power supply
  - AC inlet module cable (PN F1080-010), which brings AC power from the temperature control supply to the logic voltage power supply

This section explains how to remove and replace the entire power supply module.

- To remove and replace just the logic voltage power supply, see “Removing and Replacing the Logic Voltage Power Supply” on page 192.
- To remove and replace just the temperature control power supply, see “Removing and Replacing the Temperature Control Power Supply” on page 193.
- To remove and replace just the injector drive storage capacitor, see “Removing and Replacing the Injector Drive Storage Capacitor” on page 173.

## Removing and Replacing the Power Supply Module

Unless otherwise noted, use Figure 167 on page 185 as a reference for this procedure.

❖ **To remove the power supply module**

1. Take off the panel on the right side of the autosampler by following the instructions in “To remove the right side panel of the autosampler” on page 97.
2. From the backplane PCB , disconnect the backplane PCB power cable (PN F1082-010), which connects the logic voltage power supply to the backplane PCB.
3. Disconnect the red and black power leads from the injector drive storage capacitor (see Figure 131 on page 146).
4. Remove the three ring lugs from the AC input power cable (PN F1079-010), which is connected to the AC input power cable assembly (see also Figure 157 on page 179), and disconnect the cable from the temperature control power supply.
5. Disconnect the injector drive power cable (PN F1116-010), which connects the injector drive storage capacitor to the backplane PCB.
6. Disconnect the short DC power cable (PN F1083-010), which provides power to the column compartment (oven) temperature control PCB.
7. Disconnect the long DC power cable (PN F1083-020), which provides power to the vial tray temperature control PCB.
8. Using a No. 2 Phillips screwdriver, remove the screws (shown in Figure 168) that attach the plate to the logic voltage power supply and the temperature control power supply. Remove the plate.

**Figure 168.** Screws holding the power supply module to the chassis


The plate rests on a tab, which is shown in Figure 171 on page 189.

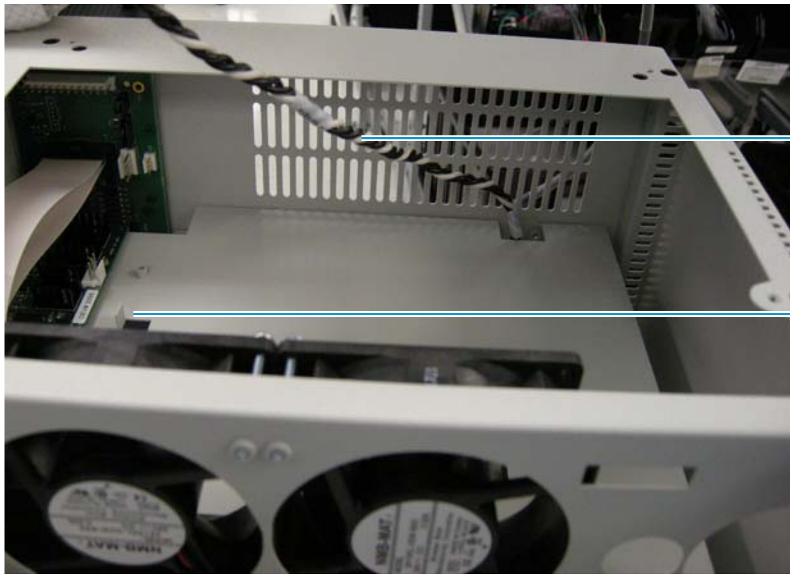
9. Remove the plate from the tab.

### ❖ To replace the power supply module

> **Note** The following procedure shows the autosampler at an angle for clarity.

1. Before you reinstall the power supply unit in the autosampler, pull the long DC power cable toward the temperature control PCB and drop it through the hole shown in Figure 169.

**Figure 169.** Position of the DC power supply cable



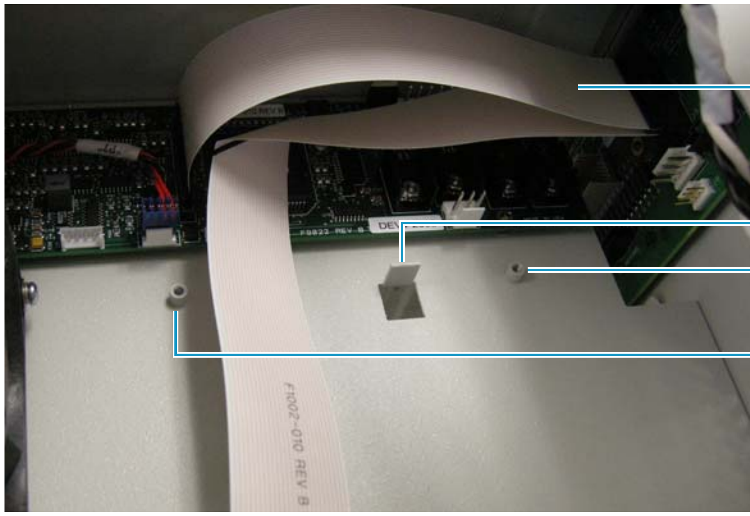

2. Run the AC input power cable along the floor of the autosampler beneath the wall, as shown in Figure 170.

**Figure 170.** Positioning the AC input power cable

3. Position the slot at the base of the power supply module over the tab near the temperature control PCB on the upper right wall. Position the holes in the power supply module over the two pins on either side of the tab.

   Figure 171 shows this tab and the two pins.

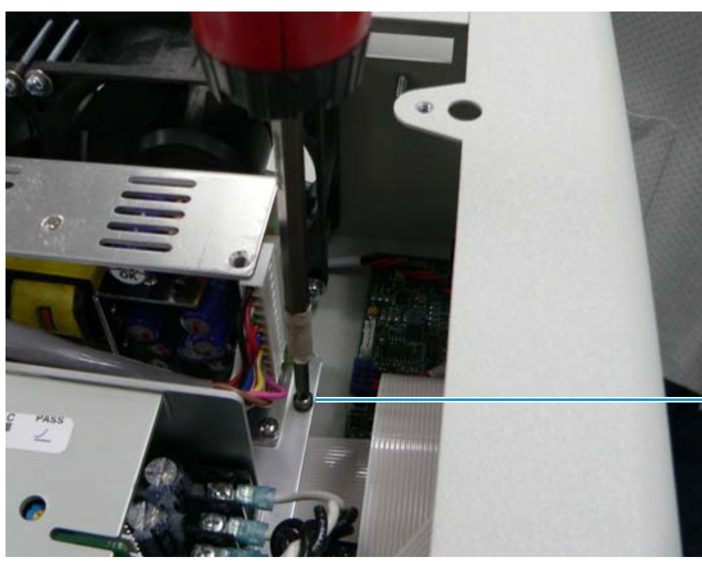
   **Figure 171.** Tab used to position power supply module




4. Insert the three screws in the following positions (these are also shown in Figure 168 on page 187) and tighten them with a No. 2 Phillips screwdriver:

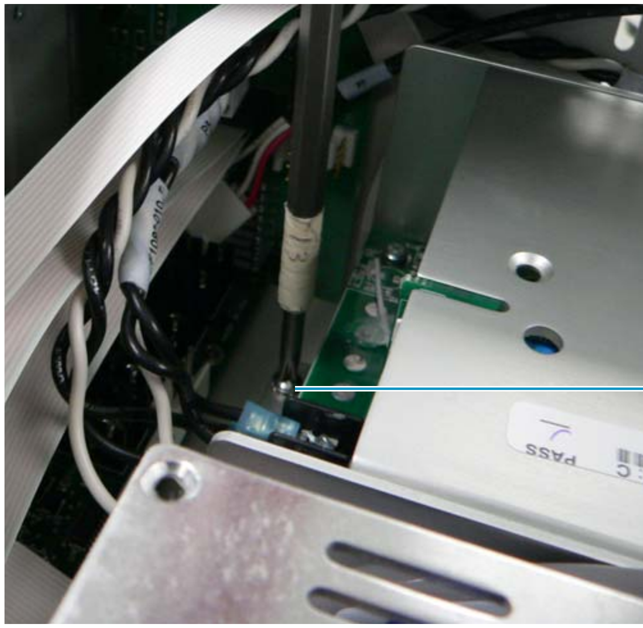
   - Between the logic voltage power supply and the temperature control PCB, as shown in Figure 172 (pin 1 in Figure 171)

     **Figure 172.** Inserting the screw between the logic voltage power supply and the temperature control PCB



- Between the temperature control PCB and the backplane PCB, as shown in Figure 173 (pin 2 in Figure 171)

**Figure 173.** Inserting the screw between the temperature control PCB and the backplane PCB

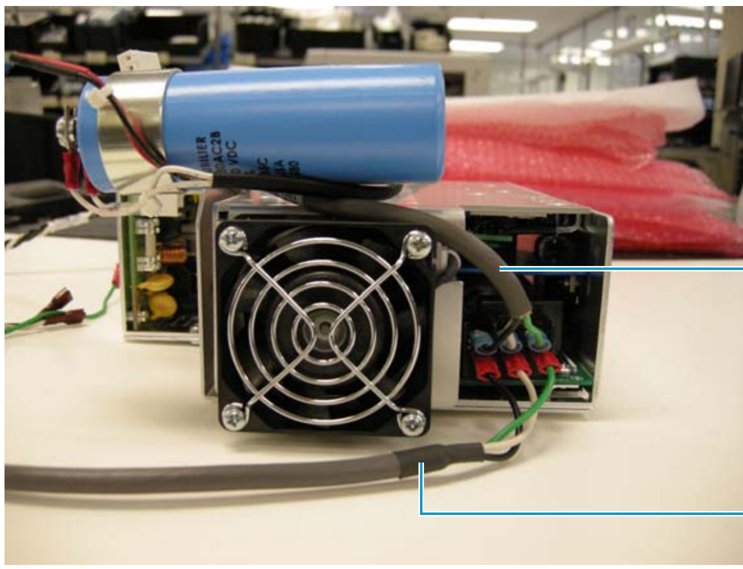



- Between the logic voltage power supply and the temperature control power supply near the injector drive storage capacitor, as shown in Figure 174

**Figure 174.** Inserting the screw between the logic voltage power supply and the temperature control power supply

5. Connect location P5 on the long DC power cable to location J5 on the vial tray temperature control PCB.
6. Connect location P5 on the short DC power cable to location J5 on the column compartment (oven) temperature control PCB.
7. Connect the AC input power cable to the temperature control power supply, as shown in Figure 175.
8. Connect the AC inlet module cable to the temperature control power supply, as shown in Figure 175.

**Figure 175.** AC inlet module cable and AC input power cable connected to temperature control power supply

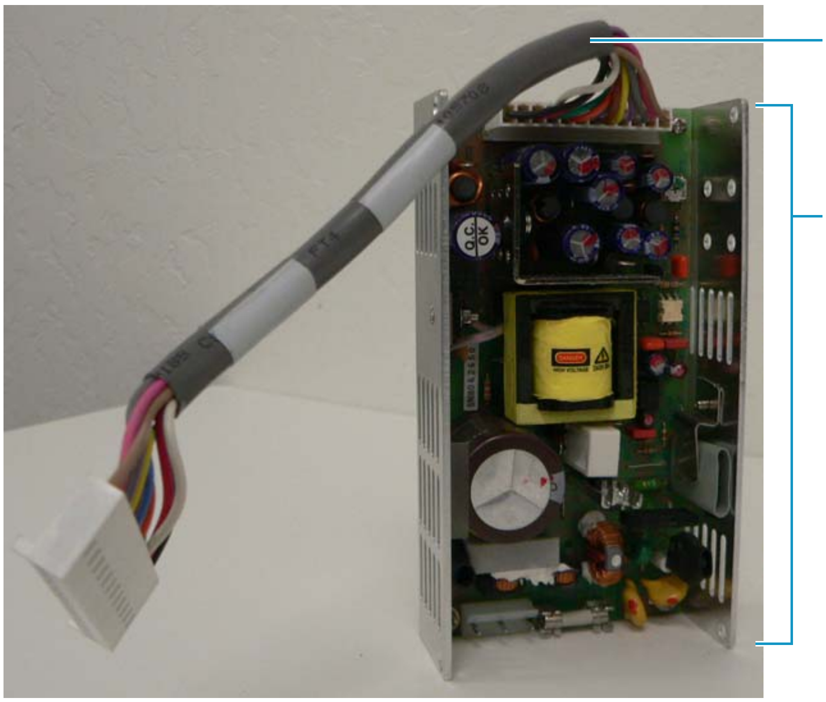



9. Connect location P7 on the injector drive power cable to location J7 on the backplane PCB.
10. Connect the red and black power leads to the injector drive storage capacitor (see Figure 131 on page 146).
11. Replace the panel on the right side of the autosampler by following the instructions in "To replace the right side panel of the autosampler" on page 97.

## Removing and Replacing the Logic Voltage Power Supply

The logic voltage power supply, shown in Figure 176, controls the power to all units of the autosampler except the temperatures zones. It resides on the right side of the autosampler next to the temperature control power supply (see Figure 86 on page 99). When it needs replacing, the Run light turns amber and blinks when you turn the power on to the autosampler. In addition, you will see an error in the HyperTerminal application, and the Xcalibur or ChromQuest software will terminate communication.

**Figure 176.** Logic voltage power supply




❖ **To remove the logic voltage power supply**

1. Take off the panel on the right side of the autosampler by following the instructions in "To remove the right side panel of the autosampler" on page 97.
2. Disconnect the backplane PCB power cable (PN F1082-010) from the backplane PCB, shown in Figure 176, but leave it connected to the logic voltage power supply.
3. Disconnect the AC input power cable (see Figure 175 on page 191) from the logic voltage power supply.
4. With a No. 2 Phillips screwdriver, remove the two screws that attach the logic voltage power supply to the plate (see Figure 176 for the location of these screws).
5. Remove the logic voltage power supply from the autosampler.

❖ **To replace the logic voltage power supply**

1. Insert the two screws at the top and bottom of the right side of logic voltage power supply that attach it to the plate and tighten with a No. 2 Phillips screwdriver.
2. Reconnect the AC input power cable to the logic voltage power supply.
3. Reconnect location P1 on the backplane PCB power cable to location J1 on the backplane PCB.
4. Replace the panel on the right side of the autosampler by following the instructions in "To replace the right side panel of the autosampler" on page 97.

## Removing and Replacing the Temperature Control Power Supply

The temperature control power supply, shown in Figure 177, sits next to the logic voltage power supply (see Figure 86 on page 99). It provides power to all the devices in the autosampler that require temperature control, including the vial tray compartment and the column compartment (oven).

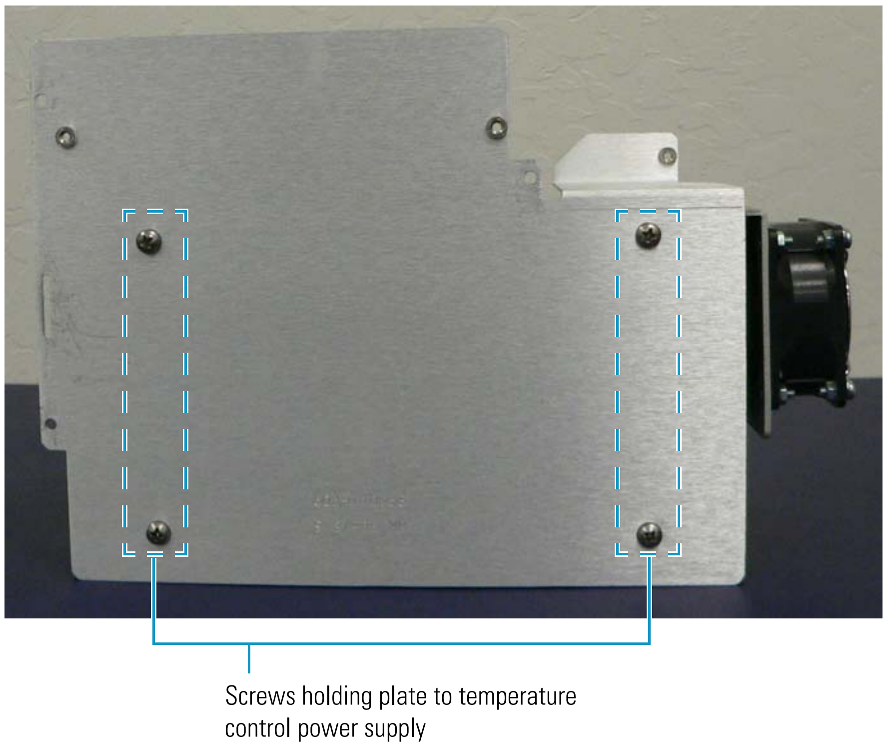
**Figure 177.** Temperature control power supply

### ❖ To remove the temperature control power supply

1. Remove the power supply module from the autosampler by following the instructions in "To remove the power supply module" on page 186.

2. Remove the plate from the temperature control power supply by removing the four screws on the back of the plate, as shown in Figure 178.

**Figure 178.** Plate on the temperature control power supply




### ❖ To replace the temperature control power supply

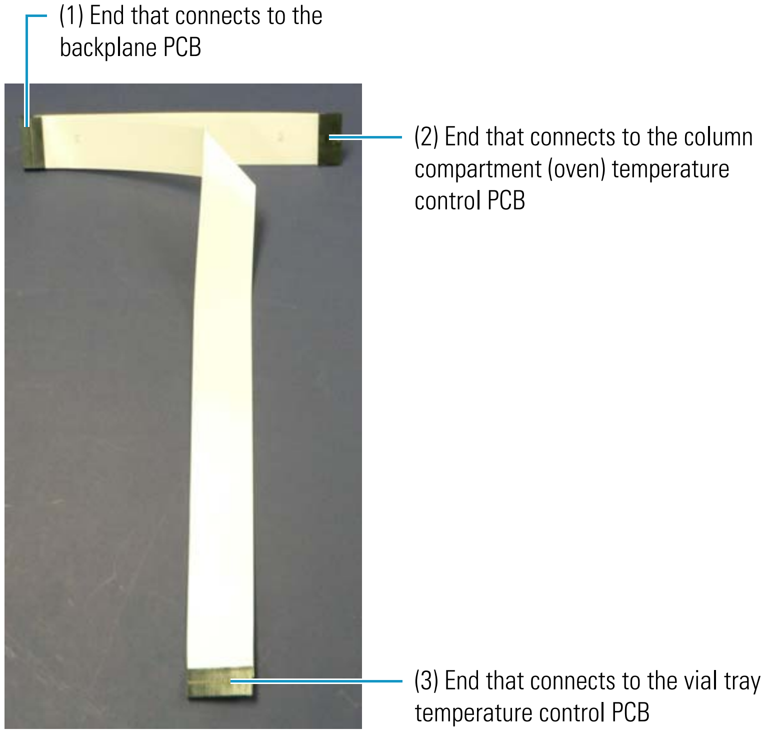
1. Reattach the plate to the temperature control power supply by inserting and tightening the four screws with a No. 2 Phillips screwdriver.

2. Replace the power supply module in the autosampler by following the instructions in "To replace the power supply module" on page 187.

# Removing and Replacing the Temperature Control Cable

The temperature control cable (PN F1002-010), shown in Figure 179, is a wide ribbon cable that connects the backplane PCB to the temperature control PCBs in the column compartment (oven) and the vial tray compartment.

**Figure 179.** Temperature control cable




### ❖ Removing the temperature control cable

1. Remove the XYZ arm assembly and the vial tray temperature control assembly by following the instructions in "To remove the XYZ arm assembly and vial tray temperature control assembly" on page 117.

2. Disconnect the temperature control cable from the vial tray temperature control PCB (see (3) in Figure 179) and push it through the large slit in the chassis into the column compartment (oven).

3. Take off the panel on the right side of the autosampler by following the instructions in "To remove the right side panel of the autosampler" on page 97.

4. Remove the two leftmost screws shown in Figure 168 on page 187 from the power supply module to make room behind the power supply module.

5. Pull the temperature control cable from the vial tray compartment up and behind the power supply module.

If you cannot pull the cable up behind the power supply module, you must remove the power supply module. Follow the instructions in "To remove the power supply module" on page 186.

6. Disconnect the temperature control cable from the column compartment (oven) temperature control PCB (see (2) in Figure 179 on page 195).

7. Disconnect the temperature control cable from the backplane PCB (see (1) in Figure 179).

### ❖ Replacing the temperature control cable

1. Bend the cable on the diagonal black line.

2. Connect location P9 on the temperature control cable to location J9 on the backplane PCB (see (1) in Figure 179 on page 195).

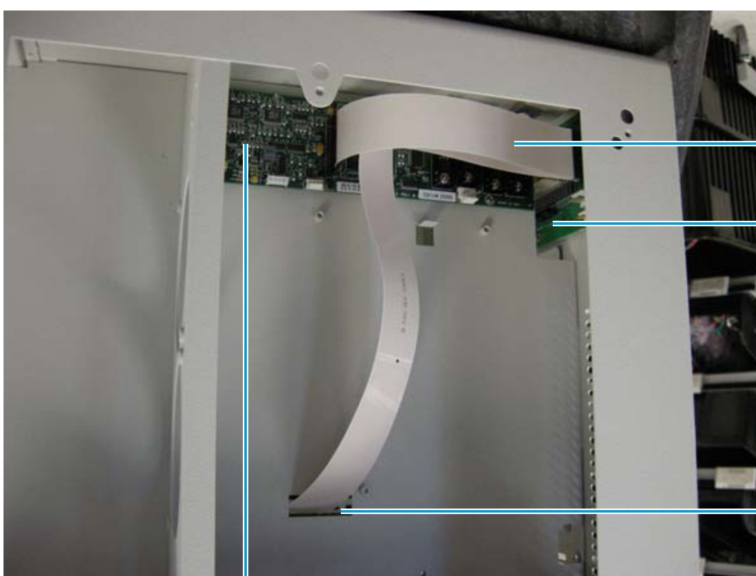
3. Connect location P8 on the temperature control cable to location J8 on the column compartment (oven) temperature control PCB (see (2) in Figure 179).

4. Push the cable (see (3) in Figure 179) through the large slit in the autosampler wall into the vial tray compartment, as shown in Figure 180.

5. Connect location P8 on the temperature control cable (see (3) in Figure 179) to location J8 on the vial tray temperature control PCB.

   The installed temperature control cable should resemble the example shown in Figure 180.

**Figure 180.** Installed temperature control cable



6. Insert the two leftmost screws into the power supply module and tighten with a No. 2 Phillips screwdriver.

7. Replace the panel on the right side of the autosampler by following the instructions in "To replace the right side panel of the autosampler" on page 97.

8. Replace the XYZ arm and the vial tray temperature control assembly by following the instructions in "To replace the XYZ arm assembly" on page 121.

# Removing and Replacing the Backplane PCB

The backplane PCB (PN 60357-61100), shown in Figure 181, serves as an interface between the CPU PCB and other connections. It resides on the upper side wall of the column compartment (oven) (see Figure 182). The backplane PCB is orthogonal to the column compartment (oven) temperature control PCB.

**Figure 181.** Backplane PCB

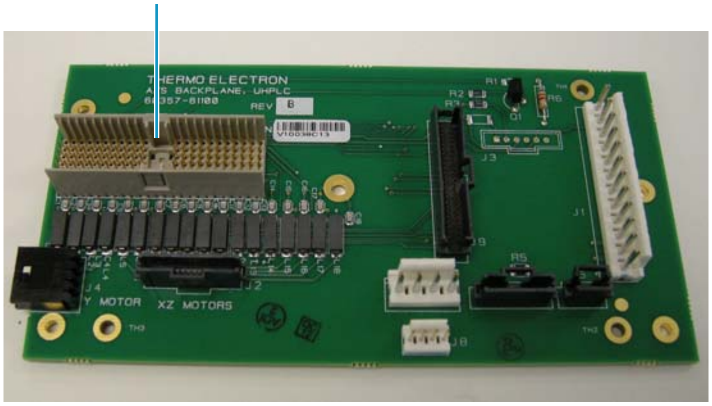



**Figure 182.** Backplane PCB installed

### ❖ To remove the backplane PCB

1. Remove the CPU PCB. For instructions, see “To remove the CPU PCB” on page 107.
2. Remove the plate that the logic voltage power supply and the temperature control power supply are affixed to by following the procedure outlined in “To remove the power supply module” on page 186.
3. Disconnect the following cables in the column compartment (oven):
   - Backplane PCB power cable (PN F1082-010), which connects the logic voltage power supply to the backplane PCB (Figure 176 on page 192)
   - Injector position sensor cable (PN A3513-010), which connects the injector position sensor PCB to the backplane PCB (Figure 126 on page 143)
   - Temperature control cable (PN F1002-010), which connects the temperature control PC in the column compartment to the backplane PCB (Figure 126 on page 143)
   - Injector drive power cable (PN F1116-010), which connects the injector drive storage capacitor to the backplane PCB (Figure 167 on page 185)
4. Disconnect the following cables in the vial tray compartment:
   - *Y*-axis motor cable, which connects the *y*-axis motor of the XYZ arm assembly to the backplane PCB (Figure 116 on page 131)
   - Ribbon cable to the XYZ arm interconnect PCB (Figure 116 on page 131)
5. Using a No. 2 Phillips screwdriver, remove the screw in the middle of the backplane PCB.
6. Use a flat-edged screwdriver to gently pry the board from the four pins holding it in place.

### ❖ To replace the backplane PCB

1. Align the four holes at the edges of the backplane PCB with the four pins on the autosampler wall.
2. Press the board down on the pins.
3. Insert the screw in the middle of the board and tighten with a No. 2 Phillips screwdriver.
4. Reconnect the following cables in the column compartment (oven):
   - Connect location P1 on the backplane PCB power cable to location J1 on the backplane PCB.
   - Connect location P5 on the injector position sensor cable to location J5 on the backplane PCB.
   - Connect location P9 on the temperature control cable to location J9 on the backplane PCB (see (1) in Figure 179 on page 195).
   - Connect location P7 on the injector drive power cable to location J7 on the backplane PCB.

5. Reconnect the following cables in the vial tray compartment:
    - Connect the *y*-axis motor cable to location J4 on the backplane PCB.
    - Connect position P2 on the XYZ arm interconnect PCB ribbon cable to location J2 on the backplane PCB.
6. Reattach the plate containing the logic voltage power supply and the temperature control power supply by following the procedure outlined in "To replace the power supply module" on page 187.
7. Reinsert the CPU PCB. For instructions, see "To replace the CPU PCB" on page 108.

# Maintaining the Front Panel LEDs

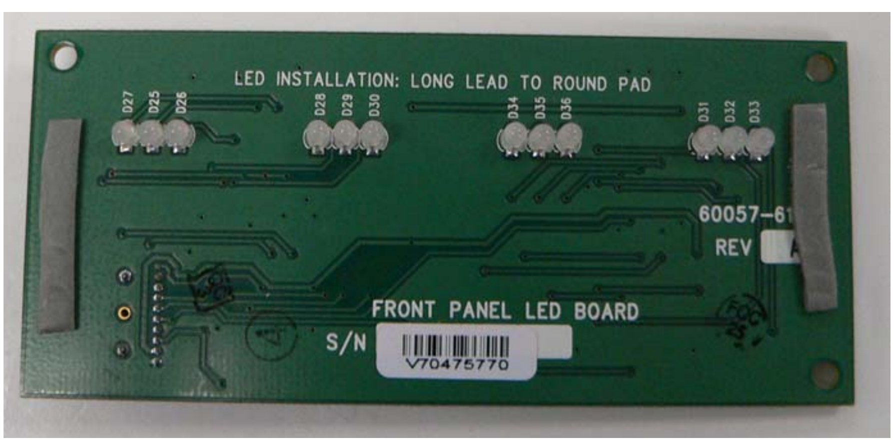
Four status LEDs reside on the front of the left door of the Accela Autosampler: Power, Communication, Run, and Temperature. For information on these LEDs, see "Status LEDs" on page 16. The LED system consists of the following components in addition to the LEDs themselves:

- Front panel LED PCB (PN 60057-61000)
- Front panel LED cable (PN 60357-63002)

## Removing and Replacing the Front Panel LED PCB

The front panel LED PCB (PN 60057-61000) resides on the inside of the left front door (see Figure 183). This board provides status information through the LEDs on the front of the autosampler (see Figure 87 on page 100). The front panel LED cable, shown in Figure 185 on page 201, connects the LED PCB to the backplane PCB.

**Figure 183.** Front panel LED PCB

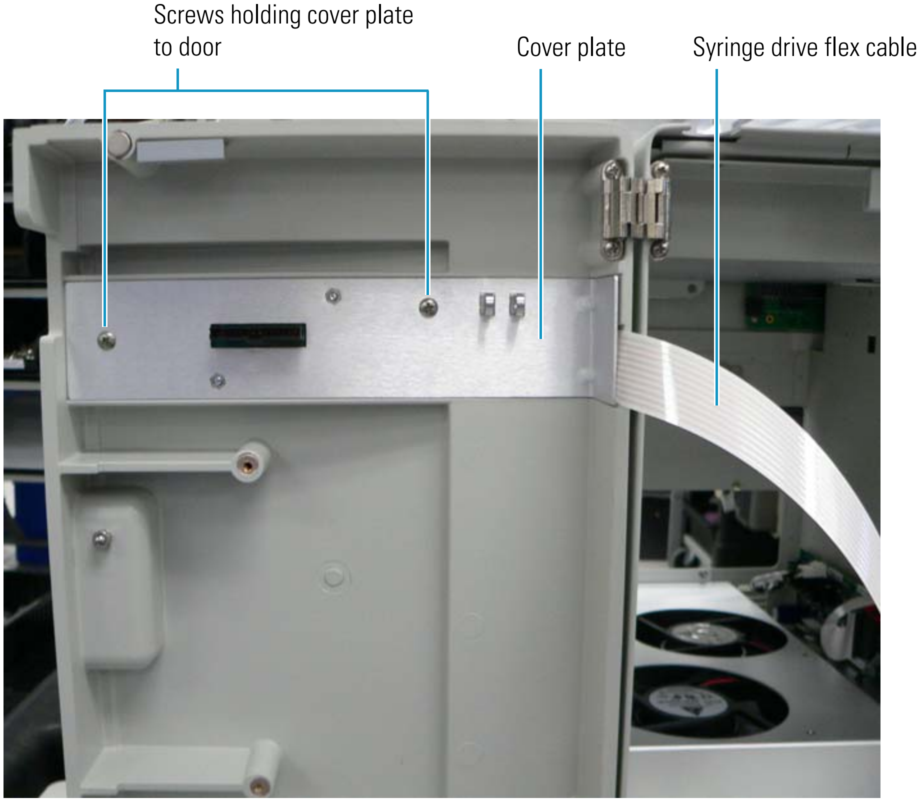


### ❖ To remove the front panel LED PCB

1. Using a No. 2 Phillips screwdriver, remove the two screws from the cover plate (PN 60057-10058) behind the LEDs on the inside of the front left door. Figure 184 shows the location of these screws.

   The front panel LED PCB, the front panel LED cable, the flex cable interface PCB, and the syringe drive flex cable reside beneath this cover plate.

   **Figure 184.** Cover plate on inside of front left door

2. Depress the cable tab at the end of the front panel LED cable that connects it to the front panel LED PCB and gently pull the end of the cable away.

   For a picture of this cable, see Figure 185 on page 201.

   The board is attached to the door with double-sided tape.

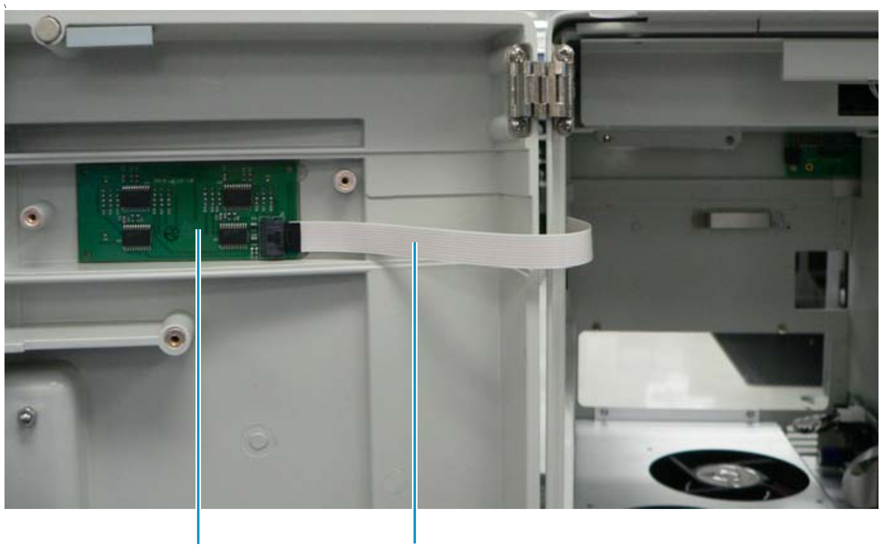
3. Along the edges of the front panel LED PCB, use a flat-sided screwdriver to pry the taped board from the inner door.

### ❖ To replace the front panel LED PCB

1. Attach the back of the new front panel LED PCB to the inside of the front door, pressing the double-sided tape to the door.

2. Attach location P1 on the front panel LED cable to location J1 in the lower right area of the front panel LED PCB, as shown in Figure 185.

**Figure 185.** Connection of the front panel cable to the front panel LED PCB




3. Replace the cover plate on the inside of the front door by inserting the two screws and tightening them with a No. 2 Phillips screwdriver.

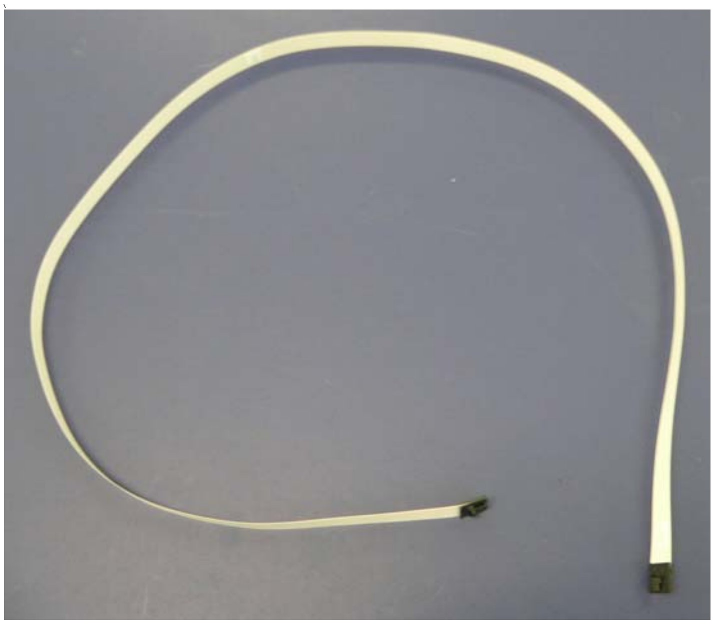
When you turn on the power to the system, look for the Communication LED to turn amber and the other three LEDs to turn green. For more information on the status of the front panel LEDs, see "Status LEDs" on page 16.

# Removing and Replacing the Front Panel LED Cable

The front panel LED cable (PN 60357-63002) (see Figure 186) is a long, thin ribbon cable that connects the backplane PCB to the front panel LED PCB, which resides beneath the cover plate on the inside of the left front door of the autosampler.

**Note** Do not confuse the front panel LED cable with the syringe flex drive cable, which also resides beneath the cover plate on the inside of the left front door. See Figure 150 on page 170 to distinguish these two cables.

**Figure 186.** Front panel LED cable



### ❖ To remove the front panel LED cable

1. Remove the CPU PCB by following the instructions in "To remove the CPU PCB" on page 107.
2. Using a No. 2 Phillips screwdriver, remove the two screws from the cover plate behind the LEDs on the inside of the front left door.

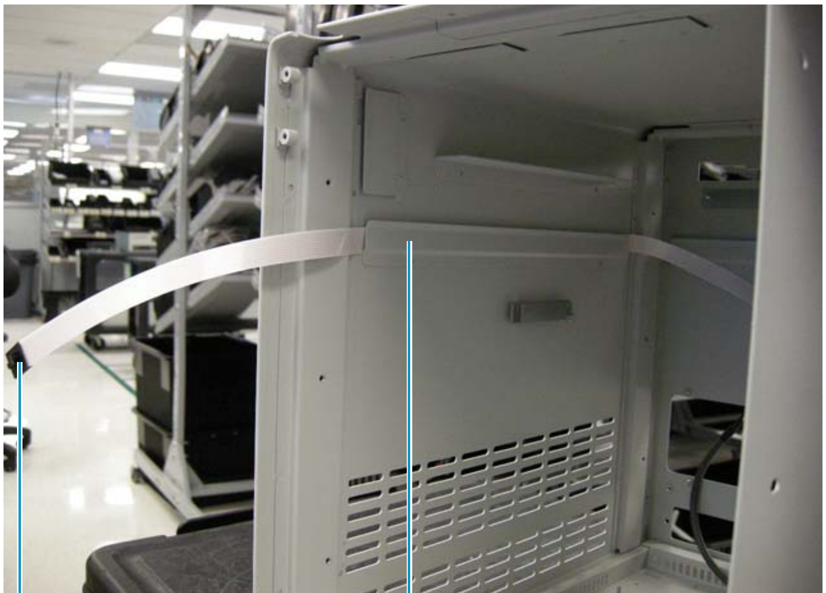
   Figure 184 on page 200 shows the location of these screws.
3. Depress the cable tab at the end of the front panel LED cable that connects it to the front panel LED PCB and gently pull the end of the cable away.

   Figure 185 on page 201 shows the cable connection to the front panel.
4. Detach the front panel LED cable from the backplane PCB.
5. Remove the cable from the bracket along the autosampler chassis wall that holds the cable.

### ❖ To replace the front panel LED cable

1. Press the cable into the long bracket on the side wall of the autosampler, as shown in Figure 187.

**Figure 187.** Bracket holding the front panel LED cable onto the autosampler's side wall




2. Press the cable into the long bracket on the back wall of the autosampler, as shown in Figure 188.

**Figure 188.** Bracket holding the front panel LED cable onto the autosampler's back wall

3. Attach location P1 on the front panel LED cable, shown in Figure 186 on page 202, to location J1 in the lower right area of the front panel LED PCB.

4. Connect position P11 on the front panel LED cable to location J11 on the backplane PCB.

5. Replace the cover plate on the inside of the front door by inserting the two screws in the cover plate and tightening them with a No. 2 Phillips screwdriver.

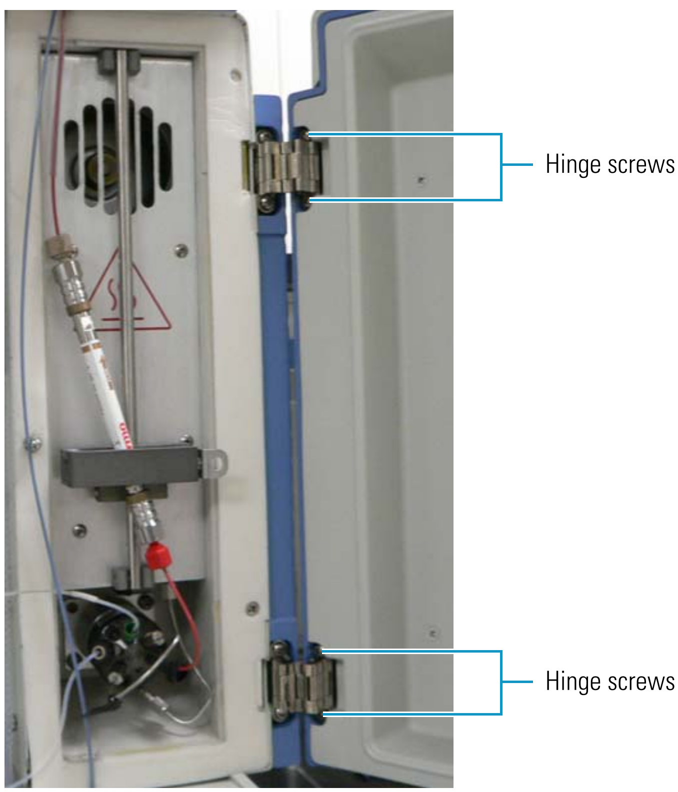
# Removing and Replacing the Autosampler Doors

The Accela Autosampler has a larger left door (PN 60057-60011) and a smaller right door (PN 60057-60015). You might need to replace one or both autosampler doors if they become damaged. The flex cable interface PCB(PN 60357-61000) and the front panel LED PCB (PN 60057-61000) are preinstalled on the left front door. (As noted in earlier sections, these two PCBs are available separately.)

### ❖ To remove the right door

Using a No. 2 Phillips screwdriver, remove the four screws in the hinges of the right door, shown in Figure 189.

**Figure 189.** Hinge screws in the right door



### ❖ To replace the right door

1. Aligning the hinges in the left-hand part of the door with the hinges on the right side of the chassis, insert the four screws into the holes on the hinges in the right door.
2. Tighten the screws with a No. 2 Phillips screwdriver.

### ❖ To remove the left door

1. Disconnect the syringe drive flex cable from the flex cable interface PCB and the CPU PCB by following the instructions in "To remove the flex cable interface PCB" on page 165.
2. Disconnect the front panel LED cable (PN 60357-63002) from the front panel LED PCB and the backplane PCB by following the instructions in "To remove the front panel LED cable" on page 202.
3. Using a No. 2 Phillips screwdriver, remove the four screws in the hinges of the left door.

### ❖ To replace the left door

1. Aligning the hinges in the right-hand part of the door with the hinges on the left side of the chassis, insert two screws into the holes in each hinge (PN 00415-63205) and tighten with a No. 2 Phillips screwdriver.
2. Connect the syringe drive flex cable to the flex cable interface PCB and the CPU PCB by following the instructions in "To replace the flex cable interface PCB" on page 166.
3. Connect the front panel LED cable to the front panel LED PCB and the backplane PCB by following the instructions in "To replace the front panel LED cable" on page 203.
4. If you have removed the CPU PCB (PN F9015-030) but have not yet returned it when you connected the flex cable interface PCB to the autosampler, follow these instructions:
   a. Slide in the tray supporting the CPU PCB on top of the two brackets on each side of the column compartment (oven), and align the two holes in the CPU PCB with the two cone-shaped pins on the back of the upper chassis wall.
   b. Insert two screws in the front ceiling of the autosampler at each side of the large metal tab to hold the tray in place, and tighten with a No. 2 Phillips screwdriver.
   c. Connect the remaining end of the syringe flex drive cable to the location J11 on the CPU PCB, folding the cable as shown in Figure 190.

**Figure 190.** Connection of the syringe flex drive cable to the CPU PCB


# Maintaining the Magnetic Switch Assembly

The magnetic switch assembly indicates when the autosampler door has been opened during analysis. This information is important when you maintain the vial tray at a set temperature. You can choose to bypass the warning through the graphical user interface. For example, if you are not applying temperature control to the vial trays, you might want to override the warning.

The magnetic switch assembly consists of the following parts:

- Magnetic door switch on the right front door of the autosampler (PN A3520-020)
- Round door magnet on the left front door of the autosampler (PN 4001-0270)
- Oblong door magnet on the left front door of the autosampler (PN 4001-0270)

Figure 191 and Figure 192 show these components.

**Figure 191.** Door magnets installed on the left front door

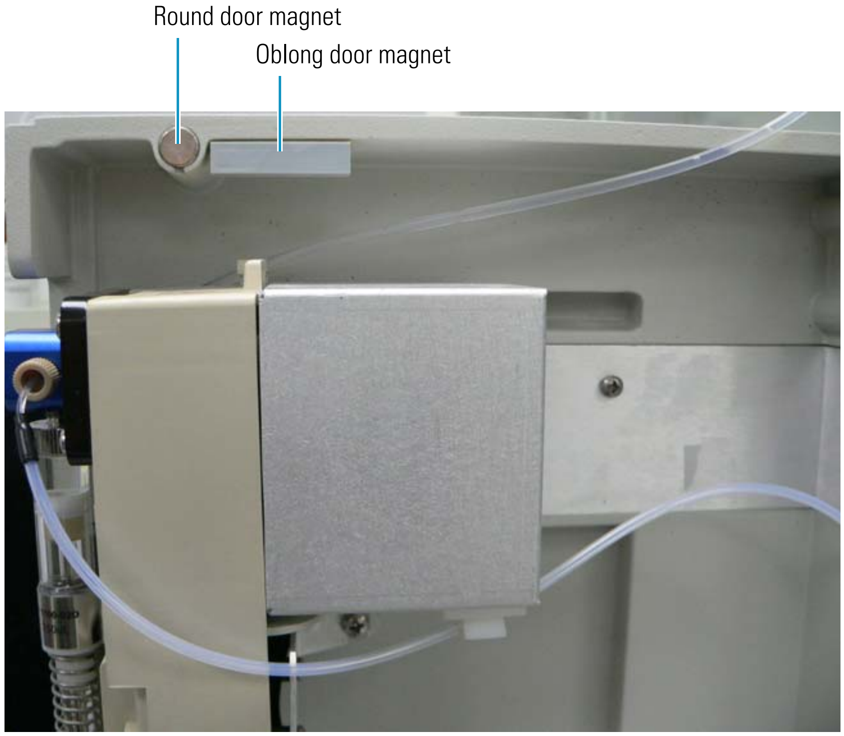
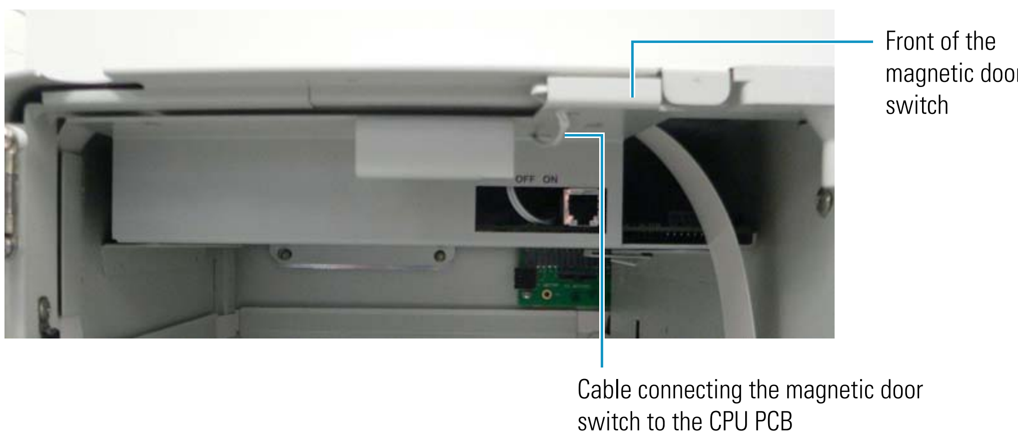



**Figure 192.** Magnetic door switch installed on the right front door



## Removing and Replacing the Magnetic Door Switch

The magnetic door switch (PN A3520-020) on the front of the autosampler's chassis senses when the door is open during operation and causes the XYZ arm to move to the back of the machine. It is attached to the tray that holds the CPU PCB, as shown in Figure 193.

**Figure 193.** Magnetic door switch

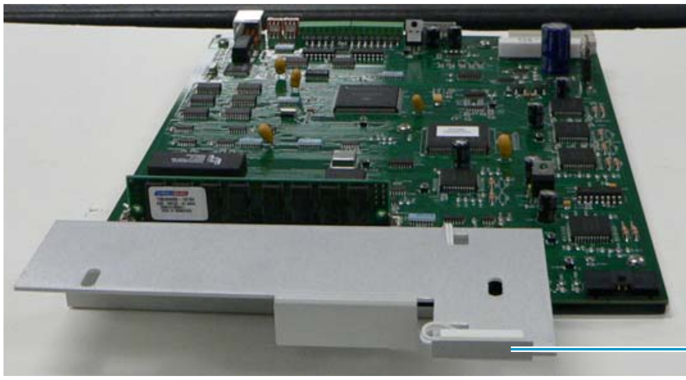



Figure 192 on page 207 shows the door switch installed.

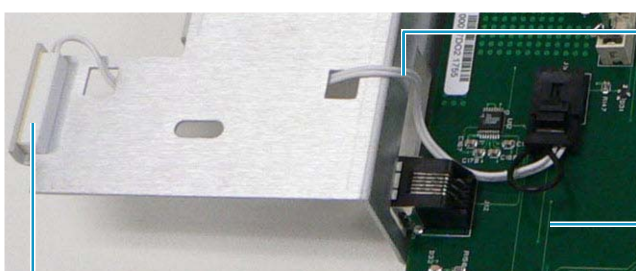
### ❖ To remove the magnetic door switch

1. Disconnect the wire on the magnetic door switch from the CPU PCB.
2. Gently pry off the magnetic door switch with a flat-sided screwdriver.

### ❖ To replace the magnetic door switch

1. Press the adhesive side of the switch onto the back of the designated area of the tray that holds the CPU PCB, as shown in Figure 194.

   **Figure 194.** Wire connecting the magnetic door switch to the CPU PCB


2. Thread the cable through the holes of the tray holding the CPU PCB.
3. Connect the end of the cable to the location on the CPU PCB shown in Figure 194; for a broader view of the CPU PCB, see Figure 90 on page 103.

## Removing and Replacing the Door Magnets

The door magnets are a small round door magnet (PN 4001-0270) and an oblong door magnet (4001-0270) on the front of the autosampler's inner left door. These magnets, shown in Figure 191 on page 207, latch onto the magnetic door switch to close the autosampler during processing.

The small round magnet keeps the door latched when it is in the closed position. The oblong magnet works in conjunction with the magnetic switch assembly and the sensor that detects when the door is open. When you open the door, this magnet breaks contact with the magnetic switch assembly and sends a signal to the data system through the CPU PCB that the door is open. You cannot replace either the round door magnet or the oblong door magnet without replacing the entire door assembly. For information on this procedure, see "Removing and Replacing the Autosampler Doors" on page 204.

# Maintaining the Drip Tray

The drip tray (PN 60057-40021), shown in Figure 195, catches condensation, solvents leaking from the waste system, and liquid residues from other parts of the autosampler. The front of the tray has black on/off symbols next to the On/Off button (see Figure 196).

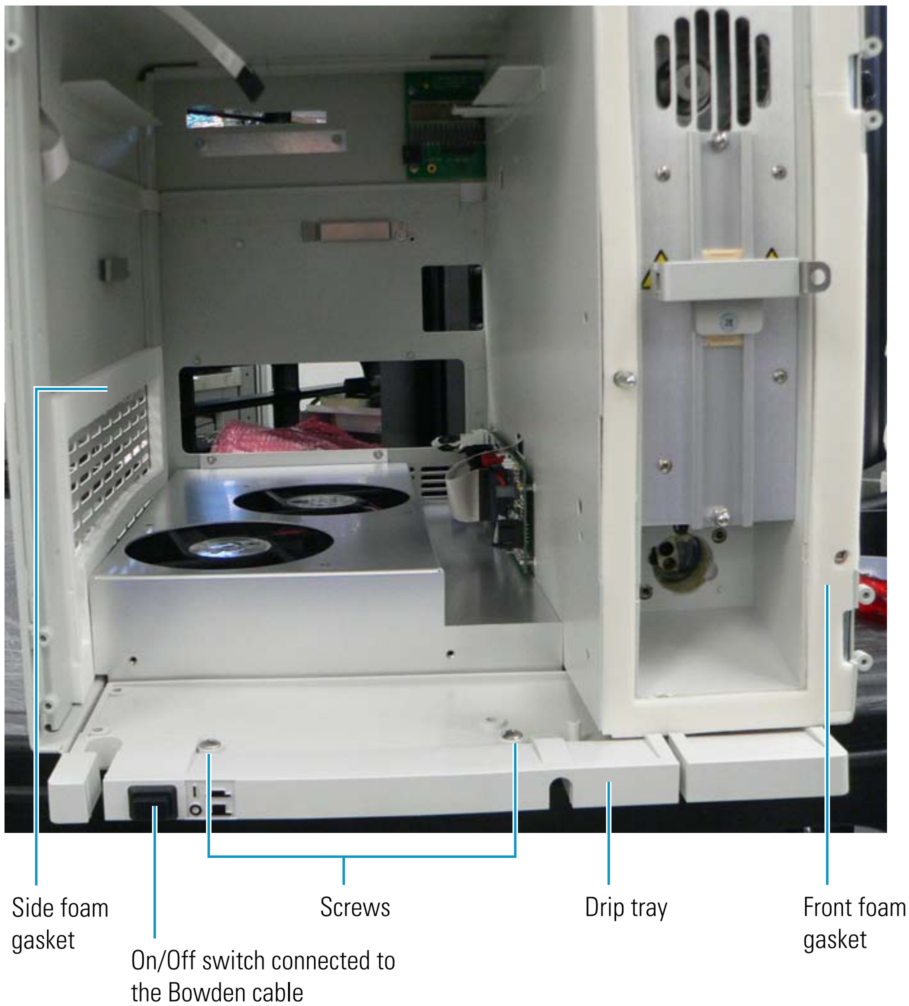
**Figure 195.** Drip tray

## Removing the Drip Tray

❖ **To remove the drip tray**

1. Using a No. 2 Phillips screwdriver, remove the two screws from the drip tray (PN 00405-01-00025) shown in Figure 196.

**Figure 196.** Installed drip tray




2. Push the On/Off button down, and gently detach the drip tray from the chassis of the autosampler.

## Replacing the Drip Tray

❖ **To replace the drip tray**

1. Position the drip tray in front of the vial tray fan assembly, aligning the two holes in the drip tray with the two holes on the front floor of the autosampler.
2. Slide in the tray.
3. Insert the two screws into the drip tray holes and tighten with a No. 2 Phillips screwdriver.
4. Gently pull the Bowden cable toward you so that the On/Off switch is protruding from the tray.
5. Carefully push the On/Off switch upward and inward so that the bulges on either side of it fit within the small rectangular area in the chassis intended for the On/Off switch.

The installed drip tray resembles that shown in Figure 196 on page 210.

5

# Diagnostics

Use the Accela Autosampler diagnostics to test the major electronic circuits within the instrument and to indicate whether the circuits pass or fail the tests. If the instrument electronics fail, the diagnostics can often locate the problem. However, to distinguish a hardware failure from an electronic failure, someone who is familiar with system operation and basic hardware theory must run the diagnostics.

You can use the diagnostics to test many of the Accela Autosampler components. The Thermo Fisher Scientific service philosophy is to troubleshoot the problem to the lowest part, assembly, PCB, or module listed in Appendix A, "Consumables and Service Parts." You can replace the parts listed in "Consumables" on page 252, and a Thermo Fisher Scientific field service engineer can replace the parts listed in "Service Parts" on page 253.

**Contents**



## Power Up Diagnostics

Accela Autosampler power up diagnostics run automatically when you turn on the autosampler and take about 2 minutes to run. Most of the time required for the power up diagnostics is occupied testing the RAM.

If there is a memory error of a fatal type, the right three lights of the Status LEDs turn amber. If this happens, contact Thermo Fisher Scientific Technical Support. The CPU PCB probably needs to be replaced.

If diagnostics detect any other type of error, the Run Status LED illuminates amber and the autosampler records the error in its persistent memory log. You can access this error log through the data system.

Table 8 lists the startup diagnostics error messages. The left column lists the error messages that your Thermo Scientific field service engineer can view from HyperTerminal™ (or equivalent application). The right column lists the error messages that might appear in the autosampler error log.

When the startup test passes, the error log displays this message: No error. No other events occur.

**Table 8.** Autosampler startup error messages (Sheet 1 of 2)

| HyperTerminal error messages | Error log messages |
|---|---|
| EC_SDIAGS_BAD_Z_FLAG | The *z*-axis home flag failed. |
| EC_SDIAGS_BAD_S_FLAG | The *s*-axis home flag failed. |
| EC_SDIAGS_BAD_X_FLAG_INT | The *x*-axis interrupt failed. |
| EC_SDIAGS_BAD_Y_FLAG_INT | The *y*-axis interrupt failed. |
| EC_SDIAGS_BAD_Z_FLAG_INT | The *z*-axis interrupt failed. |
| EC_SDIAGS_BAD_S_FLAG_INT | The *s*-axis interrupt failed. |
| EC_SDIAGS_BAD_1_MOTION_TIMER | Motion Timer A failed. |
| EC_SDIAGS_BAD_2_MOTION_TIMER | Motion Timer B failed. |
| EC_SDIAGS_BAD_3_MOTION_TIMER | Motion Timer C failed. |
| EC_SDIAGS_BAD_4_MOTION_TIMER | Motion Timer D failed. |
| EC_SDIAGS_BAD_Z_BOTTOM_FLAG | The *z*-bottom flag failed. |
| EC_SDIAGS_TIMER_SETUP_ERROR | Occurs if an error status is returned by the disable interrupt call. |
| EC_SDIAGS_NO_INJ_CABLE | The injector motor cable is not connected. |
| EC_SDIAGS_BAD_INJ_POS | The injection valve did not change position. |
| EC_SDIAGS_BAD_SYRINGE_VALVE_INT | The syringe valve interrupt did not occur. |
| EC_SDIAGS_BAD_FLUSH_VALVE_INT | The flush value interrupt did not occur. |
| EC_SDIAGS_BAD_CAPACITOR | The capacitor did not charge to the acceptable level. |
| EC_SDIAGS_X_MOTOR_NOT_PRESENT | The *x*-axis motor was not detected. |
| EC_SDIAGS_Y_MOTOR_NOT_PRESENT | The *y*-axis motor was not detected. |
| EC_SDIAGS_Z_MOTOR_NOT_PRESENT | The *z*-axis motor was not detected. |
| EC_SDIAGS_S_MOTOR_NOT_PRESENT | The *s*-axis motor was not detected. |
| EC_SDIAGS_XZ_CONNECTOR_NOT_ CONNECTED | The cable that connects the *x*- and *z*-axis motors is not connected. |
| EC_SDIAGS_BAD_REG_VALUE | One of the memory registers is not set correctly. |

**Table 8.** Autosampler startup error messages (Sheet 2 of 2)

| HyperTerminal error messages | Error log messages |
|---|---|
| EC_SDIAGS_MOTOR_ERROR | The motor diagnostic bits did not change to the correct state. |
| EC_SDIAGS_ISR_TIMEOUT | The interrupt did not occur before the interrupt timeout did. |
| EC_SDIAGS_METAL_OUTOF_RANGE | The oven or tray metal readings were not within the specified low and high. |
| EC_SDIAGS_OVEN_AIR_OUTOF_RANGE | The oven air readings were not within the specified low and high. |
| EC_SDIAGS_24V_OUTOF_RANGE | The oven or tray 24 V readings were not within the specified low and high. |
| EC_SDIAGS_12V_OUTOF_RANGE | The oven or tray 12 V readings were not within the specified low and high. |
| EC_SDIAGS_OVEN_MIRROR_OUTOF_RANGE | The readings for the oven mirror were not within the specified low and high. |
| EC_SDIAGS_UNKNOWN_DEVICE | A call was made to the temperature diagnostics with an unknown device. |
| EC_SDIAGS_VIAL_MIRROR_OUTOF_RANGE | The readings for the tray mirror were not within the specified low and high. |
| EC_SDIAGS_HOME_ERROR | A move to the home flag did not set the home flag bit correctly. |

# Error Log in the Xcalibur Data System

The error log in the Xcalibur data system lists the diagnostic error messages. You can access the error log through the status page of the Information View. The Information View is normally displayed on the left side of the Home Page window and contains two pages: Status and Acquisition Queue. If the Home Page window does not display this view, it has been turned off.

### ❖ To open the Information View

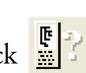
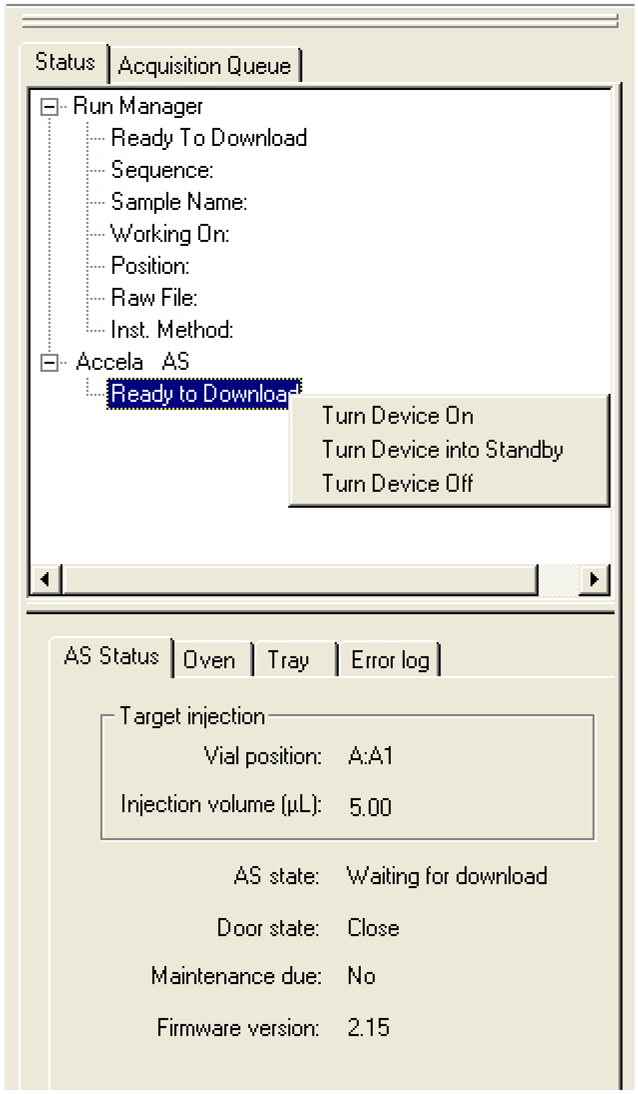
From the Home Page window, choose **View > Info View** or in the tool bar, click  to turn the Information View on and off. See Figure 197.

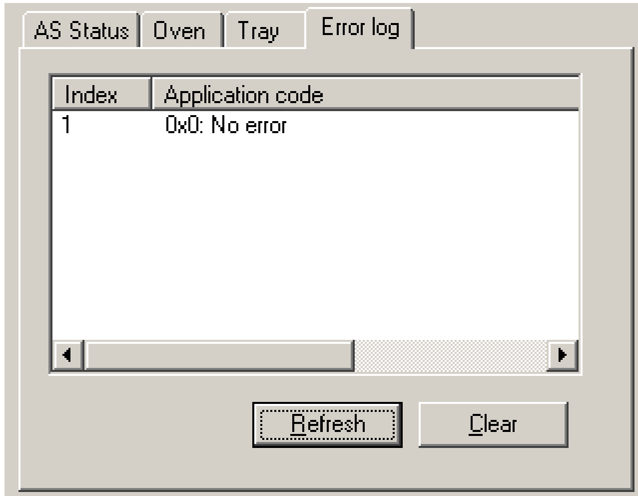
**Figure 197.** Status page of the Information View with the Accela AS selected in the directory tree




### ❖ To access the error log for the Accela Autosampler

1. Click the **Accela AS directory** in the Status window to activate its status pages.
2. Click the **Error Log** tab to open the Error Log page (see Figure 198).

**Figure 198.** Error log for the Accela Autosampler




3. Click **Refresh** to display the list of errors.
4. After reviewing the error list, click **Clear** to erase the list.

# Error Log in the ChromQuest Data System

The error log in the ChromQuest data system lists the diagnostic error messages.

### ❖ To open the error log

1. From the Instrument window, choose **Control > Instrument Status** to display the Instrument Status window.
2. Click the **Accela AS** tab to display the Accela AS page of the Instrument Status window.
3. Click **Diagnostics** to display the Diagnostics dialog box.
4. Click the **Error Log** tab to display the error log for the Accela Autosampler.
   - To view the error log, click **Refresh**.
   - To clear the error log, click **Clear**.

# Autosampler Validation Information

The Xcalibur data system keeps track of validation information. Use the Validation Information dialog box to enter the date when the validation occurred and the name of the person who performed the validation.

### ❖ To open the Validation Information dialog box

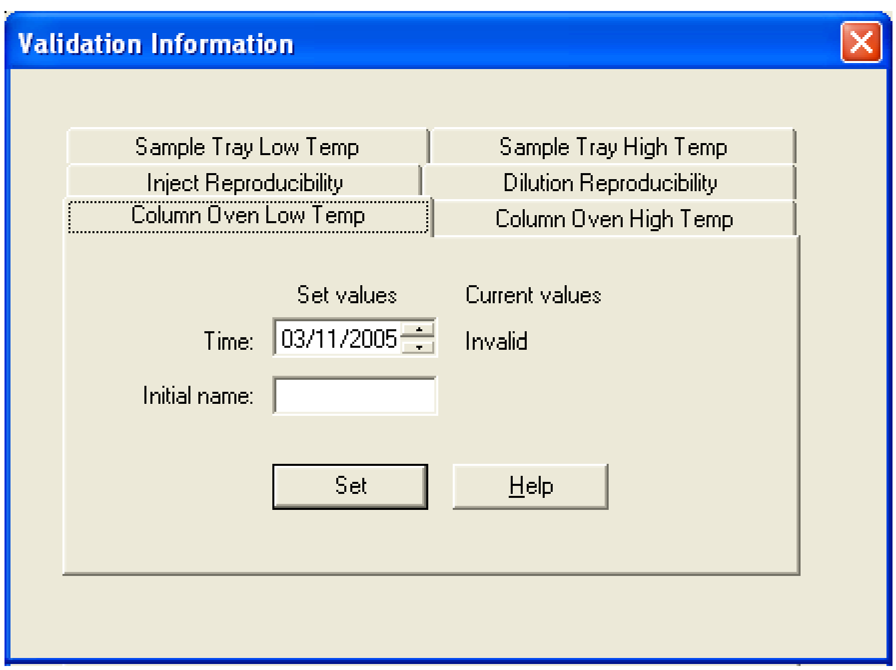
From the Instrument Setup window, choose **Accela AS > Validation**.

The Validation Information dialog box has the following pages:

- Sample Tray Low Temp
- Sample Tray High Temp
- Column Oven Low Temp
- Column Oven High Temp
- Inject Reproducibility
- Dilution Reproducibility

Use these pages to enter the calendar dates when the validation occurred and the initials of the person who performed the validation (see Figure 199).

**Figure 199.** Validation Information dialog box



# Routine Troubleshooting

This chapter provides information to help you troubleshoot possible autosampler problems.

When troubleshooting, consider the following:

- Did the system fail when you were running samples?
- Did problems occur after you performed maintenance on the instrument?
- Did you change the system configuration, cables, or peripherals just before the problem occurred?

If the answer is yes to the first question above, the issue might be a hardware failure.

If the answer is yes to one of the latter two questions above, the issue is probably mechanical, not electrical. Verify that alignment, configurations, and cable connections are correct.

If, after reviewing the troubleshooting table included in this chapter, you would like additional assistance in troubleshooting a particular problem, contact Thermo Fisher Scientific Technical Support or your service representative.

**Contents**

# General Chromatography Troubleshooting

Table 9 lists general chromatographic problems. For more information about chromatographic troubleshooting, refer to any HPLC troubleshooting reference book, or contact technical support or your service representative.

**Table 9.** General chromatography troubleshooting table (Sheet 1 of 2)

| Symptom | Remedy |
|---|---|
| No flow | • Check the mobile phase connections.<br>• Check for leaks.<br>• Refer to the hardware manual for your pump. |
| High backpressure | • Check the flow rate and system/column specifications.<br>• Check for tubing or column blockage.<br>• Refer to the hardware manual for your pump. |
| Unstable baseline or drift | • System/column not equilibrated; allow more time.<br>• Refer to the detector troubleshooting guide. |
| Baseline noise | • Check for air bubbles in system, degas solvents.<br>• Check for system/solvent contamination.<br>• Check the hardware manual for your pump. |
| No peaks | • Check the detector and data system computer connections.<br>• See "Autosampler-Specific Troubleshooting."<br>• Check sample retention with chromatographic conditions. |
| Contamination/ghost peaks | • Clean the system and column.<br>• See "Autosampler-Specific Troubleshooting."<br>• Refer to the hardware manual for your pump. |
| Poor peak shape | • Check the system for leaks.<br>• Check fittings and tubing lengths.<br>• Check column performance.<br>• See "Autosampler-Specific Troubleshooting."<br>• Refer to the hardware manual for your pump.<br>• Refer to the hardware manual for your detector. |
| Poor retention time reproducibility | • Check the system for leaks and bubbles.<br>• System/column not equilibrated; allow more time.<br>• Check column performance.<br>• Check the hardware manual for your pump.<br>• See "Autosampler-Specific Troubleshooting." |
| Poor peak area reproducibility | • Check column performance.<br>• See "Autosampler-Specific Troubleshooting." |

**Table 9.** General chromatography troubleshooting table (Sheet 2 of 2)

| Symptom | Remedy |
|---|---|
| Non-integrated peaks or too many peaks | • Refer to the hardware manual for each of the modules in your LC system.<br>• Refer to the data system manual for information on setting peak identification and integration. |
| No instrument or device control | • Check the cable connections.<br>• Check the system configuration.<br>• Refer to the hardware manuals for each of the modules in your LC system. |

# Autosampler-Specific Troubleshooting

This section focuses on problems that might occur with the autosampler portion of your HPLC system. It contains the following topics:

- Chromatography Problems
- Hardware Problems

# Chromatography Problems

Table 10 lists potential chromatography problems associated with the autosampler.

**Table 10.** Chromatography problems (Sheet 1 of 4)

| Symptom | Possible problem | Remedy |
|---|---|---|
| 1. Baseline drift when the injection valve changes from inject to fill | a. Lack of thermal stability in the column oven compartment, detector, or mobile phase | a. Eliminate drafts around the column compartment. Wait until the column oven has reached thermal equilibrium. If the problem persists, contact your Thermo Fisher Scientific service representative. |
| 2. Shifting retention times | a. Temperature variations in the lab | a. Stabilize the temperature. |
| | b. Column heater problems | b. Contact your Thermo Fisher Scientific service representative. |
| 3. Sensitivity changes | a. Inconsistent sample injection volumes | a. Check for a partially blocked injection valve and observe the pressure. If the problem persists, see “Replacing the Rotor Seal in the Valco Injection Valve” on page 51. |
| | b. Leaks between the injection valve and the column causing inconsistent sample volume injection | b. Tighten or change the fitting. |
| | c. Air bubbles aspirated into the lines along with sample | c. Replenish/prepare fresh sample and repeat the injection.<br><br>Decrease the syringe speed. |
| | d. Incomplete sample mixing during sample preparation | d. Thaw frozen samples completely before sample preparation to prevent sample "layering." |
| | e. Sample adsorption to the walls of the injection valve or sample loop | e. Change the mobile phase composition. |
| | f. Sample solvent incompatible with the mobile phase | f. Change the solvent. Use a different mobile phase if possible. |
| | g. Sample insoluble in solvent | g. Be sure the sample solvent has a lower elution strength than the mobile phase. |
| | h. Air in syringe/sample lines | h. Flush sample lines. |

**Table 10.** Chromatography problems (Sheet 2 of 4)

| Symptom | Possible problem | Remedy |
|---|---|---|
| 4. Irregular peak shapes | a. The volume of sample injected exceeds the column's capacity. | a. Decrease the volume injected or dilute the sample. |
| | b. The strength of the solvent used to dilute the sample exceeds the initial concentration of the mobile phase. | b. If appropriate for your application, ensure that the flush solvent is of the same composition as the solvent used to dissolve the sample and that its organic content never exceeds the initial composition of the mobile phase. |
| | c. Degradation of sample components | c. Prepare fresh sample and repeat the injection. |
| 5. Band broadening | a. Fitting problem at the injection valve-column connection | a. Inspect for damage, mismatch, or incorrect assembly. |
| | b. Tubing ID too large | b. Use 0.010 in. ID tubing from the injection valve to the column and from the column to the detector. |
| 6. Smaller than expected peak heights | a. Small injection due to incorrect size syringe in configuration | a. Check the syringe size in the autosampler device driver configuration. |
| | b. Incorrect injection volume for the injection mode | b. Check the injection volume value in the file. For partial loop injections, limit the maximum injection volume to half the sample loop size. For no waste injections, limit the maximum injection volume to 5 µL less than the sample loop size. |
| | c. Incorrect value for the transfer tubing | c. Check the dead volume value in the configuration. The dead volume for the transfer tubing is specified on its attached label. See Figure 10 on page 11. |
| | d. Air in lines | d. Perform a Needle Wash direct command to remove air from the wash bottle tubing and the syringe. |
| | e. Incorrectly adjusted syringe drive mechanism | e. Contact your Thermo Fisher Scientific service representative. |

**Table 10.** Chromatography problems (Sheet 3 of 4)

| Symptom | Possible problem | Remedy |
|---|---|---|
| 7. Peaks during a blank injection (from a previous injection) | a. Sample carryover due to residual sample in the sample loop | a. Increase flush volume. Increase injection volume, add a blank vial between sample vials, or use a stronger flush solvent. |
| | b. Sample carryover due to incorrectly assembled sample loop fittings (adding dead volume that can contain residual sample) | b. Check and redo connections. |
| | c. Sample carryover due to a contaminated needle guide | c. Clean the needle guide. |
| | d. Sample too concentrated | d. Dilute the sample. |
| 8. No peaks | a. Empty wash bottle or excessive air in the wash tubing | a. Fill the wash bottle with solvent. Remove air from the wash tubing and the syringe. |
| | b. Plugged or bent needle | b. Clean or replace the needle. Tighten the fittings and the syringe. |
| | c. Leaking syringe valve fitting at the wash tubing connection | c. Tighten the fitting. |
| | d. Plugged or leaking tubing | d. Replace faulty tubing. |
| 9. Lack of precision, accuracy, or both on a sample of known content-random error | a. Air leak | a. Tighten all fittings and repeat the run. |
| | b. Worn out syringe | b. Replace the syringe (see “Changing the Syringe or Replacing the Inner Plunger” on page 81). |
| | c. Worn out rotor (Valco injection valve) | c. Replace the rotor (see “Replacing the Rotor Seal in the Valco Injection Valve” on page 51). |
| | d. Worn out rotor seal (Rheodyne injection valve) | d. Replace the rotor seal (see “Replacing the Rotor Seal in the Rheodyne Valve” on page 263). |

**Table 10.** Chromatography problems (Sheet 4 of 4)

| Symptom | Possible problem | Remedy |
|---|---|---|
| 10. Irreproducibility of peak areas | a. Plugged or bent needle | a. Clean/replace needle (see "Replacing the Needle Assembly" on page 80). Tighten fittings and syringe. |
| | b. Leaking flush valve fitting | b. Tighten fitting. |
| | c. Plugged or leaking tubing | c. Replace faulty tubing. |
| | d. Sample viscosity too low or too high | d. Change viscosity setting. |
| | e. Wash solvent viscosity too low or too high | e. Change wash solvent or flush speed. |

## Hardware Problems

Table 11 lists the potential hardware problems associated with the autosampler.

**Table 11.** Hardware problems associated with the Accela Autosampler (Sheet 1 of 4)

| Symptom | Possible problem | Remedy |
|---|---|---|
| **Startup** | | |
| 1. Nothing works when instrument is turned on. | a. Power cord unplugged or faulty | a. Plug in or replace the power cord. |
| | b. Blown fuse | b. Replace the fuse (see "Replacing a Fuse" on page 86). |
| | c. Defective power switch, driver, transformer | c. Contact your Thermo Fisher Scientific service representative. |
| **Communications** | | |
| 2. No Ethernet communication | a. Incorrect computer NIC settings | a. Check the address. Use only TCP/IP protocol. |
| | b. Ethernet hardware problem | b. Check the Ethernet switch and Ethernet cables. |
| 3. External devices are not triggered. | a. Incorrect timed event settings in the acquisition method | a. Check the timed event settings in the acquisition method. |
| | b. Interface equipment problem | b. See "Connecting the System Interconnect Cable" on page 37 or refer to the *Accela Getting Connected Guide* for information on contact closure connections. |
| **Vials** | | |
| 4. Instrument cannot locate vial. | a. Incorrect vial position entered into sample sequence | a. Check the sample sequence. |
| | b. Sample incorrectly placed in sample tray | b. Check the tray arrangement. |
| | c. XYZ arm misaligned | c. Recalibrate the XYZ arm. Refer to the data system Help. |
| | d. XYZ arm movement restricted | d. Remove restriction and home arm. See "Important Precautions for Sample Loading" on page 54. |
| | e. Loose left-hand guide bracket | e. Ensure that the bracket is tightly attached and level. |
| 5. Vials do not fit in tray. | a. Incorrect vials | a. Check that the vial diameter is 11 to 12 mm (0.43 to 0.47 in.). |

**Table 11.** Hardware problems associated with the Accela Autosampler (Sheet 2 of 4)

| Symptom | Possible problem | Remedy |
|---|---|---|
| 6. Torn septum | a. Bent needle | a. Replace the needle (see “Replacing the Needle Tubing Assembly” on page 73). |
| 7. Septum pushed into vial | a. Incorrect vial caps | a. Use only recommended vials and vial caps. See “Recommended Vials, Microplates, and Microplate Covers” on page 55. |
| | b. Loose vial caps | b. Ensure that the vial caps are fully tightened. |
| **Injection valve** | | |
| 8. Injection valve will not switch. | a. Slipping injector drive | a. Contact your Thermo Fisher Scientific service representative. |
| 9. Injection valve continues to rotate until fault is generated. | a. Loose or faulty sensor cable | a. Contact your Thermo Fisher Scientific service representative. |
| 10. Injection valve does not rotate to the proper position. | a. Valve requires excessive torque. | a. Contact your Thermo Fisher Scientific service representative. |
| 11. Motor fails to stop after syringe is fully returned. | a. Possible defective sensor | a. Contact your Thermo Fisher Scientific service representative. |
| 12. Sample loop will not fill. | a. Blocked injection valve | a. Follow “Troubleshooting a Blockage in the Injection System” on page 67 to isolate blockage. DO NOT clean valve with a cleaning wire or you could damage the valve. |
| 13. Valve seal wears rapidly. | a. Too much valve seal pressure against valve | a. Decrease LC system pressure. |
| | b. Particulate matter in valve | b. Use an inline filter before the injection valve. |
| | c. Inadequately filtered sample | c. Filter with a 0.5 m filter before injection. |
| | d. Buffer crystallization | d. Do not allow buffers to stand in the system. Run a flush sequence when the system is not in use. |

**Table 11.** Hardware problems associated with the Accela Autosampler (Sheet 3 of 4)

| Symptom | Possible problem | Remedy |
|---|---|---|
| **Needle** | | |
| 14. Needle bent or broken | a. Incorrect vials | a. See the list of recommended replacement parts in Appendix A, “Consumables and Service Parts.” |
| | b. Alignment problem | b. Contact your Thermo Fisher Scientific service representative. |
| | c. Arm sticking | c. Contact your Thermo Fisher Scientific service representative. |
| 15. Needle plugging | a. Multiple/incorrect septum | a. Verify a single septum of the type recommended (see “Recommended Vials, Microplates, and Microplate Covers” on page 55). |
| | b. Worn needle | b. Replace the needle (see “Replacing the Needle Assembly” on page 80). |
| **Needle Tubing** | | |
| 16. Blockage in the needle tubing | a. Crimped needle tubing | a. Replace the needle tubing (see “Replacing the Needle Tubing Assembly” on page 73). |
| **Syringe** | | |
| 17. Loud buzzing from syringe drive | a. Plugged lines or needle | a. Clear lines or needle (see “Troubleshooting a Blockage in the Injection System” on page 67). |
| | b. Defective limit switch | b. Contact your Thermo Fisher Scientific service representative. |
| **Transfer tube** | | |
| 18. Lack of injection precision and accuracy, lack of precision or blank injections | a. Constricted or plugged transfer tube | a. Replace the damaged transfer tube. Avoid overtightening the fitting to port 2 of the injection valve (see “Replacing the Transfer Tubing” on page 59). |
| **Leaks** | | |
| 19. Leakage during loop filling | a. Blocked loop or waste line, or valve not deflected far enough | a. Flush or replace the sample loop; check and flush the waste line. |

**Table 11.** Hardware problems associated with the Accela Autosampler (Sheet 4 of 4)

| Symptom | Possible problem | Remedy |
|---|---|---|
| 20. Cross-port leakage | a. Worn rotor seal (Rheodyne injection valve) or rotor (Valco injection valve | a. Replace the rotor seal (see "Replacing the Rotor Seal in the Rheodyne Valve" on page 263). Replace the rotor (see "Replacing the Rotor Seal in the Valco Injection Valve" on page 51). |
| 21. Liquid on vial caps | a. Leaky syringe valve | a. Replace the syringe valve. |
| | b. Leaky injection valve | b. Replace the rotor seal (see "Replacing the Rotor Seal in the Rheodyne Valve" on page 263). Replace the rotor (see "Replacing the Rotor Seal in the Valco Injection Valve" on page 51). |
| **Other** | | |
| 22. Contaminated sample | a. Dirty vials | a. Replace vials. |
| | b. Improper septum made of silicone or other rubber-like material | b. Use the recommended septum (see "Recommended Vials, Microplates, and Microplate Covers" on page 55). |
| 23. Elevated system pressures | a. Block between column and autosampler | a. Check for blockage and tubing restrictions. |

# Common Operator Errors

Operator errors can compromise the performance of the Accela Autosampler.

These are the most common operator errors:

- Letting the wash bottle run dry
- Routing the needle tubing incorrectly
- Selecting an incorrect syringe type in the Accela Configuration Autosampler dialog box
- Requesting an inappropriate injection volume for the sample loop size and the injection mode
- Entering an incorrect dead volume for the transfer tubing
- Overtightening the transfer tube fitting to port 2 or the waste tube fitting to port 3 of the autosampler injection valve

## Insufficient Wash Solvent

Allowing the wash bottle to run dry disrupts the ability of the syringe to draw liquid into the needle tubing, which consequently results in blank injections. Fill the wash bottle with solvent, and remove air from the wash line tubing before running a sequence of injections.

## Damaged Needle Tubing

Because the needle tubing is easily damaged, routing the needle tubing correctly is critical to the performance of the Accela Autosampler. Take care to avoid kinking the tubing as you route it through the bracket on the XYZ arm.

## Incorrect Syringe Type

Because the autosampler cannot detect the syringe type connected to the syringe drive assembly, confirm that the syringe type in the Accela Configuration Autosampler dialog box matches the autosampler syringe.

The injection volume algorithm used by the autosampler depends on the syringe type that you select when you configure the data system. The distance that the inner syringe plunger must descend to draw the specified injection volume increases as the syringe size decreases. For example, to draw 10 µL of sample, the inner plunger of a 100 µL syringe must descend farther than the inner plunger of a 250 µL syringe. If you replace the 250 µL syringe with a 100 µL syringe, but neglect to modify the data system configuration, the autosampler injects a smaller than expected injection volume because the syringe plunger does not descend far enough to draw the requested injection volume.

## Inappropriate Injection Volume

For best results, follow these rules:

- For no waste injections, limit the maximum injection volume to 5 µL less than the sample loop volume. Limit the minimum injection volume to 1 µL of sample.
- For partial loop injections, limit the maximum injection volume to 40 percent of the nominal sample loop volume.

## Incorrect Dead Volume

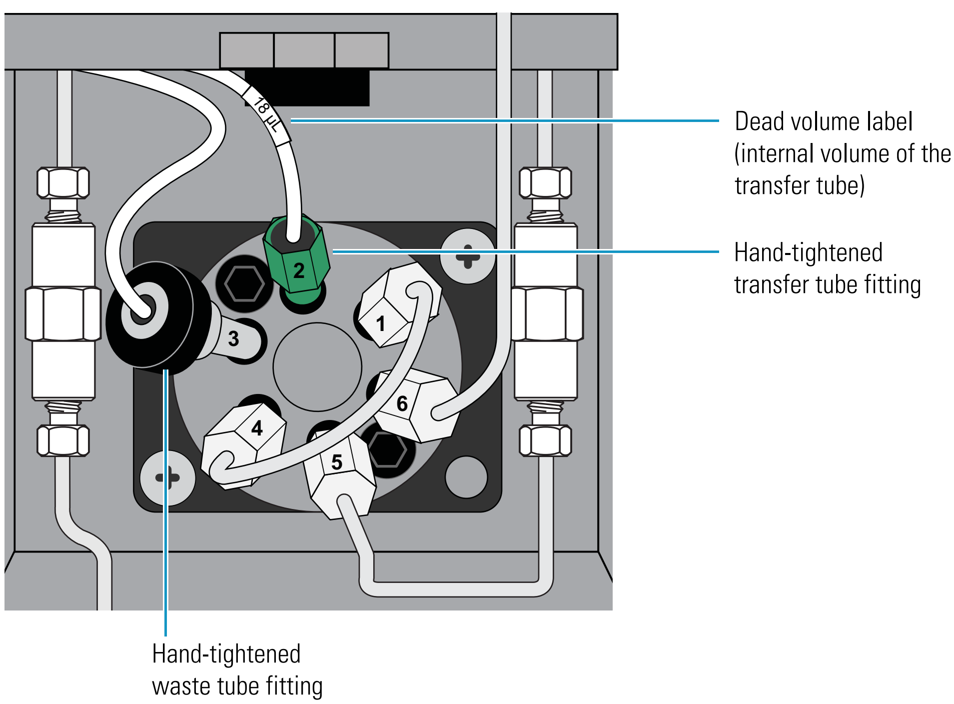
The dead volume of the 0.012 in. ID transfer tubing is specified on the label attached to the tubing. Entering an incorrect dead volume when you specify the configuration options for the autosampler can result in lower than expected peak areas or blank injections.

## Overtightened Transfer Tube or Waste Tube Fittings

Avoid overtightening the low-pressure fittings to the injection valve (see Figure 200):

- Overtightening the transfer tube fitting constricts the transfer tube, causing a lack of injection precision. Eventually, the constricted transfer tube becomes plugged.
- Overtightening the waste tube fitting constricts the waste tube, increasing the backpressure in the injection system.

**Figure 200.** Transfer tubing connection to port 2 of the injection valve



# Determining the Transfer Tubing Volume

The Dead volume configuration parameter is critical for the no waste injection mode. Specifying an incorrect dead volume value can result in lower than expected peak areas or blank injections. For best results, the specified dead volume must equal the actual volume of the transfer tubing that connects the autosampler injection port to port 2 of the injection valve.

### ❖ To determine the volume of the transfer tubing

1. From the Xcalibur or ChromQuest data system, set up an acquisition method for an analyte that you know the chromatographic conditions for.

   Use chromatographic conditions that result in a relatively short retention time for the analyte (to minimize the run time). In the method, select the **No Waste Injection** option.

   You can also use the autosampler test mix (0.5 percent toluene in methanol) that comes with the autosampler. With the chromatographic conditions listed in Table 12, toluene elutes at approximately two minutes.

   **Table 12.** Chromatographic conditions for toluene

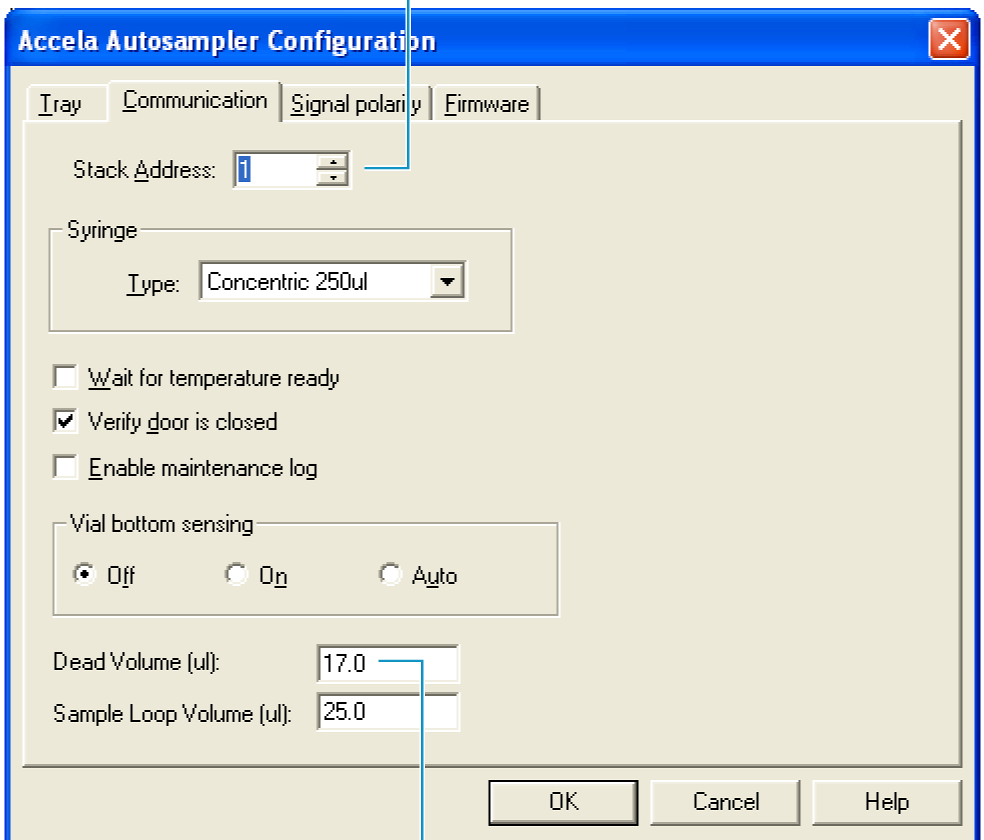
   | Parameter | Setting |
   |---|---|
   | Mobile phase | 80:20 methanol/water |
   | Flow rate | 1 mL/min |
   | Column | 100 × 4.6 mm, C-18 column, 5 µm particle size, or equivalent |
   | Temperature | Ambient |
   | Wavelength | 260 nm, 1 nm bandwidth for the PDA detector |

2. Change the value for the Dead Volume autosampler configuration parameter. Start with a value of **15**.

   Figure 201 shows the Communication page of the Accela Autosampler Configuration dialog box for Thermo Foundation Instrument Configuration, and Figure 202 on page 234 shows the Accela AS Configuration dialog box in the ChromQuest data system. The default dead volume value is 17.0. The manufacturer determines the volume of the tubing used to produce each lot of transfer tubes (see Figure 200 on page 231) and places a label on each tube.

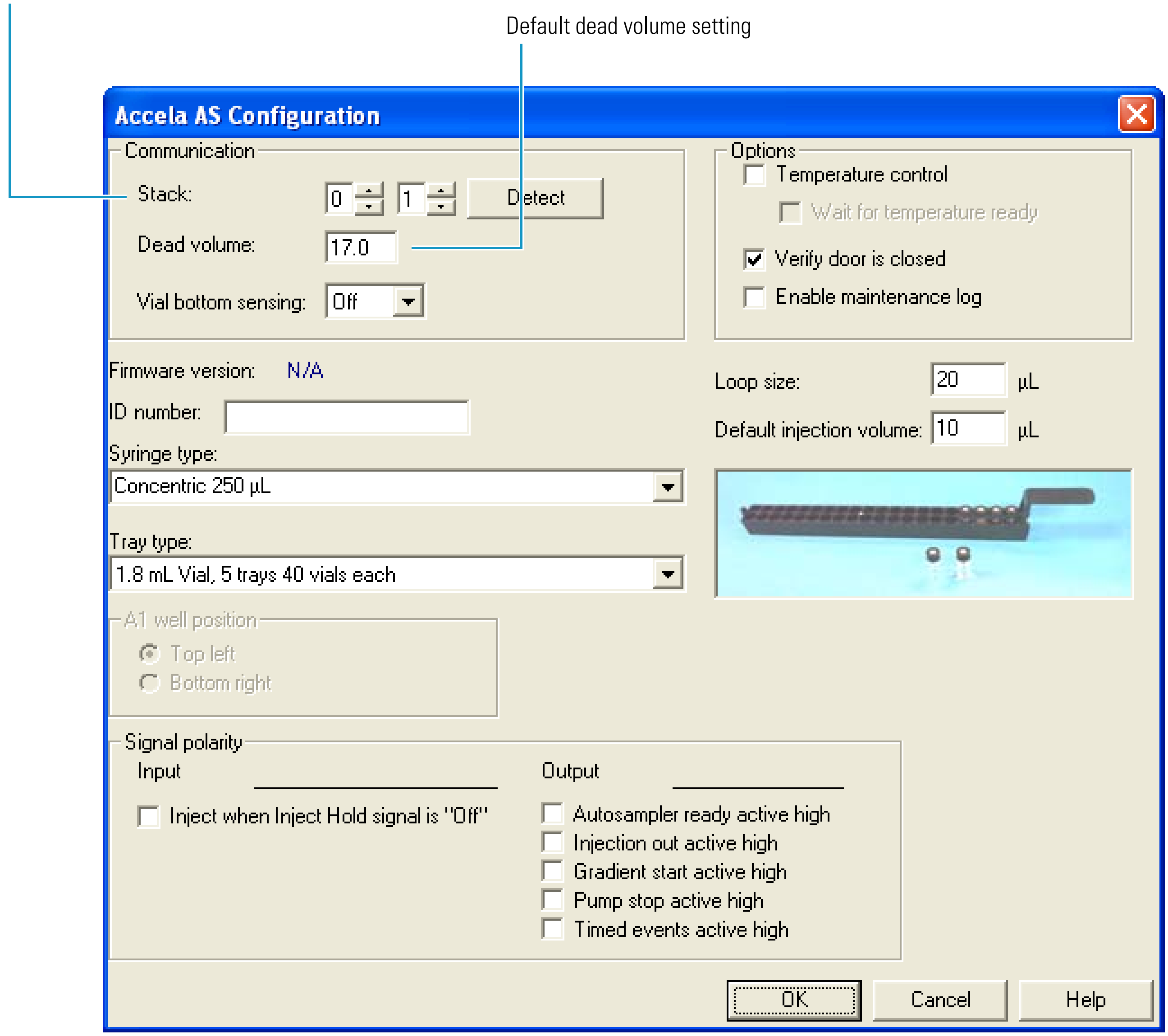
**Figure 201.** Communication page (Thermo Foundation Instrument Configuration)

The Stack Address value
must match the unit ID setting
on the back panel of the autosampler.




Default dead volume setting

**Figure 202.** Accela AS Configuration dialog box (ChromQuest data system)




3. From the Xcalibur or ChromQuest data system, inject 1 µL of sample using the no waste injection mode.

4. Repeat step 2 and step 3, increasing the dead volume by 1 µL each time until you have data points from 15 to 23 µL.

5. Plot the peak area versus dead volume. Check for an increase in peak area until it reaches a plateau.

   Due to injection variability, the plateau might not be flat. Select the dead volume where the maximum is first reached.

# 7

# Advanced Troubleshooting

"Routine Troubleshooting" on page 219 lists common Accela Autosampler problems that customers might encounter. This chapter lists Accela Autosampler problems that field service engineers might encounter in the field. Both chapters note possible solutions.

**Contents**



## Advanced Accela Autosampler Problems

**Table 13.** Advanced Accela Autosampler problems (Sheet 1 of 13)

| Symptom | Possible problem | Remedy |
|---|---|---|
| **General chromatography** | | |
| Decreasing system pressure | Air bubble in the sample loop | Flush the sample loop. See "Cleaning the Injection Valve or the Sample Loop" on page 71. |
| | The fittings of the injection valve leak. | Check the injection valve and replace it, if necessary. See "Removing the Injection Valve from the Autosampler" on page 52, "Disassembling the Injection Valve" on page 54, and "Reinstalling the Injection Valve" on page 56. |
| | Leaking rotor. | Check for scratches and replace rotor, if necessary. See "Installing a New Rotor Seal" on page 55. |

**Table 13.** Advanced Accela Autosampler problems (Sheet 2 of 13)

| Symptom | Possible problem | Remedy |
|---|---|---|
| High backpressure | Blockage | • Flush the sample loop and monitor the flow, replacing the sample loop, if necessary. See “Cleaning the Injection Valve or the Sample Loop” on page 71.<br>• Check the tubing lines from the pump and to the column. Flush or replace tubing lines, if necessary.<br>See “Troubleshooting a Blockage in the Injection System” on page 67.<br>• Check and replace the rotor. See “Installing a New Rotor Seal” on page 55.<br>• Disconnect the high-pressure line between the pump and the heat exchanger outlet. |
| | Faulty injection valve drive motor, causing valve not to reach desired position. | • Check and tighten the injector drive motor.<br>• Repair or replace the injector drive motor. See “Removing and Replacing the Injector Drive Motor” on page 171. |
| | Pump is pumping at a higher pressure as a result of the introduction of new solvent with a higher viscosity because of changes in gradient program. The backpressure might be exceeding the system backpressure limits. | Change the gradient program to either reduce flow rate or reduce the percentage of high-viscosity solvent.<br>Change the column to one that produces less backpressure. |
| Baseline drift when the injection valve changes from inject to fill | Lack of thermal stability in the column oven compartment, detector, or mobile phase | • Check sensor and oven connections.<br>• Replace the column compartment (oven) assembly. See “Removing and Replacing the Column Compartment (Oven) Assembly” on page 141. |

**Table 13.** Advanced Accela Autosampler problems (Sheet 3 of 13)

| Symptom | Possible problem | Remedy |
|---|---|---|
| No peaks | Insufficient sample in vial | • Check and adjust the Needle Height from Bottom parameter in the appropriate instrument method dialog box in the Xcalibur or ChromQuest software. Refer to the following manuals:<br>• Xcalibur data system: *Accela User Guide for LC Devices*<br>• ChromQuest data system: *Accela User Guide for the ChromQuest Data System*<br>• Add more sample (volume should be approximately 400 µl with standard vials). |
| | Plugged or leaking tubing | Tighten the fittings or replace the tubing. See “Replacing the Transfer Tubing” on page 59 and “Replacing the Needle Tubing Assembly” on page 73. |
| | Leaking syringe | Tighten or replace the syringe. See “Replacing the Inner Plunger of the Syringe” on page 82. |
| | Plugged needle | • Flush the needle and observe the flow. See “Testing the Needle for Blockage” on page 70.<br>• Replace the needle assembly. See “Replacing the Needle Assembly” on page 80. |
| | Injection valve is not rotating. | Check and replace the injection valve and drive motor. To replace the injection valve, see “Removing the Injection Valve from the Autosampler” on page 52, “Disassembling the Injection Valve” on page 54, and “Reinstalling the Injection Valve” on page 56. To replace the injector drive motor, see “Removing and Replacing the Injector Drive Motor” on page 171. |
| | Injection valve is plugged or leaking. | • Check for blockages related to the injection valve. See “Troubleshooting a Blockage in the Injection System” on page 67.<br>• Check and replace the rotor. See “Installing a New Rotor Seal” on page 55. |
| | Injection valve plumbed incorrectly. | Check and reconnect the injection valve plumbing. |
| Contaminated or ghost peaks | Sample carryover | Increase the flush volume. |

**Table 13.** Advanced Accela Autosampler problems (Sheet 4 of 13)

| Symptom | Possible problem | Remedy |
|---|---|---|
| | Flush solvent contamination | If you are using partial loop injections, check the flush solvent for miscibility or contamination, or replace with solvent that is miscible or uncontaminated. |
| | Liquid path contamination | Check the needle, tubing, or syringe degradation and replace needle, tubing, or syringe. To replace the needle, see "Replacing the Needle Assembly" on page 80; to replace the tubing, see "Replacing the Transfer Tubing" on page 59 and "Replacing the Needle Tubing Assembly" on page 73; to replace the syringe, see "Changing the Syringe or Replacing the Inner Plunger" on page 81. |
| | Injection valve contamination | • Check for trapped air bubble.<br>• Check and replace the rotor. See "Installing a New Rotor Seal" on page 55. |
| | Needle is defective or deformed. | • Check the needle assembly to determine if the needle is being forced up into the plastic housing.<br>• Replace the needle assembly. See "Replacing the Needle Assembly" on page 80. |
| | Air is trapped in injection valve. | Flush the injection valve and all autosampler tubing. See "Troubleshooting a Blockage in the Injection System" on page 67. |
| Poor peak shape (symmetry) | Column is overloaded. | Decrease the injection volume. |
| | Sample solvent is different than the mobile phase. | Use the mobile phase as the sample solvent and flush the solvent, if appropriate. |
| | Tubing diameter is too large. | Tubing diameter after the injection valve should be 0.005 inch ID. |
| Poor retention time or reproducibility | Column oven instability | • Check sensor and oven connections.<br>• Replace column compartment (oven) assembly. See "Removing and Replacing the Column Compartment (Oven) Assembly" on page 141. |
| | Intermittent injection valve leak | Check and replace the rotor, if necessary. See "Installing a New Rotor Seal" on page 55. |
| Poor peak area and height reproducibility | Needle is plugged. | Flush the needle and replace it, if necessary. See "Replacing the Needle Assembly" on page 80. |

**Table 13.** Advanced Accela Autosampler problems (Sheet 5 of 13)

| Symptom | Possible problem | Remedy |
|---|---|---|
| | Tubing is plugged or leaking. | Flush the tubing and replace it, if necessary. See “Testing the Needle for Blockage” on page 70. |
| | Leaking syringe. | Tighten or replace syringe if necessary. To remove the syringe from the autosampler, see “Setting the Syringe to the Removal Position” on page 81 and “Removing the Syringe from the Autosampler” on page 81. To install a syringe, see “Changing the Syringe or Replacing the Inner Plunger” on page 81. |
| | Air bubble is in syringe, sample valve, or tubing. | • Flush the syringe while “flicking” with finger.<br>• Add MeOH to flush the solvent and repeat flushing.<br>• Adjust the syringe speed in the configuration software.<br>• Loosen or remove the syringe and manually expel the bubble. |
| | Wrong syringe speed | Adjust the syringe speed in the configuration software. |
| | Sample adsorption or precipitation | • Check and change the sample solvent.<br>• Check and change the sample mobile phase compatibility. |
| | Sample evaporation | • Check and change the sample compartment temperature, if possible.<br>• Replace worn vial septum. |
| | Sample integrity | Check sample integrity at tray compartment temperature and cool if necessary. |
| | The tubing or injection valve leaks. | • Check and replace the tubing. See “Replacing the Transfer Tubing” on page 59 and “Replacing the Needle Tubing Assembly” on page 73.<br>• Flush the injection valve. See “Troubleshooting a Blockage in the Injection System” on page 67.<br>• Replace the rotor. See “Installing a New Rotor Seal” on page 55. |

**Table 13.** Advanced Accela Autosampler problems (Sheet 6 of 13)

| Symptom | Possible problem | Remedy |
|---|---|---|
| | Needle is defective or deformed. | • Check the needle assembly to determine if the needle is being forced up into the plastic housing.<br>• Replace the needle assembly. See "Replacing the Needle Assembly" on page 80. |
| | The injection volume is too large. | For partial loop injections, do not exceed 50 percent of the sample loop volume. |
| | Calibration of dead volume is not set accurately for no-waste injections. | Recalibrate the dead volume more precisely. See "Determining the Transfer Tubing Volume" on page 232. |
| | No timed events | Check and change the method, then run a diagnostic test. See "Diagnostics" on page 213. |
| | Wrong input/output states | Check and change the input/output settings in the configuration software. |
| Smaller than expected peak area or height | Wrong injection volume | Check and change the injection volume in the method. |
| | Insufficient sample volume in vial | • Check and adjust the Needle Height from Bottom parameter in the appropriate instrument method dialog box in the Xcalibur or ChromQuest software. Refer to the following manuals:<br>  ◦ Xcalibur data system: *Accela User Guide for LC Devices*<br>  ◦ ChromQuest data system: *Accela User Guide for the ChromQuest Data System*<br>• Add more sample (approximately 400 µl). |
| | Air bubbles in tubing | Flush all tubing. See "Troubleshooting a Blockage in the Injection System" on page 67. |
| | Wrong syringe size | Check and replace the syringe. See "Setting the Syringe to the Removal Position" on page 81 and "Removing the Syringe from the Autosampler" on page 81. To replace the syringe drive, see "Installing the Syringe" on page 83. |
| | Misadjusted syringe drive | Check and replace the syringe drive. See "Removing and Replacing the Syringe Drive Assembly" on page 161. |

**Table 13.** Advanced Accela Autosampler problems (Sheet 7 of 13)

| Symptom | Possible problem | Remedy |
|---|---|---|
| | The volume of the transfer tubing is improperly set. | Use the Dead Volume parameter of the Communications page of the Accela Autosampler Configuration dialog box to set the volume of the transfer tubing. See “Determining the Transfer Tubing Volume” on page 232. |
| Sample carryover | Inappropriate flush solvent | Change and replace the flush solvent. |
| | Insufficient flush solvent | Replenish the flush solvent reservoir. |
| | Excessive sample in vial (above the shoulder) | Verify that the vial is filled to the shoulder. |
| | Loose valve fittings | Reseat valves and tighten fittings. |
| | Incorrect vial liner or septa | Replace as needed with liner or septa recommended in “Consumables and Service Parts” on page 251. |
| **Startup** | | |
| Run status LED is amber and blinking. | Unknown hardware error | Plug the RJ45 cable into computer to diagnose problem. Plug the RJ45 cable into the input, not the output, at the back of the system. See “Determining If the CPU PCB Has Failed” on page 104. |
| Autosampler does not start or starts too soon. | The polarity of the input signals selected in the configuration software does not match the output polarity of the signals in the pump. | Use the defaults for the input/output configurations in the data system. Refer to the following manuals:<br>• Xcalibur data system: *Accela User Guide for LC Devices*<br>• ChromQuest data system: *Accela User Guide for the ChromQuest Data System* |
| **Communication** | | |
| Arm does not move when you open the tray compartment door. | The sensor that indicates whether the door is open is not disabled, or the autosampler has a faulty magnetic switch assembly sensor. | Close the door or disable the sensor. |
| The autosampler does not connect to the software. | The Xcalibur software is not installed correctly. (This problem does not occur with the ChromQuest software). | Uninstall and reinstall the Xcalibur software. |

**Table 13.** Advanced Accela Autosampler problems (Sheet 8 of 13)

| Symptom | Possible problem | Remedy |
|---|---|---|
| | The NIC card is erroneous. | Reprogram the NIC card to set the NIC address correctly. Set TCP/IP to 172.16.0.101, and set the subnet mask to 255.255.0.0. |
| | The Ethernet cable is damaged or not working. | Replace the cable. |
| | The Ethernet switch is damaged or not working. | Replace the switch. |
| | The setting of the two rotary dials in the instrument is not the same as the setting in the configuration software. | Change the settings in the configuration software, or change the dial settings in the instrument. |
| No Ethernet communication | The cable is not plugged in or is faulty. | Check and replace the Ethernet cable. |
| | The NIC card is erroneous. | Reprogram the NIC card to set the NIC address correctly. Set TCP/IP to 172.16.0.101, and set the subnet mask to 255.255.0.0. |
| | The Ethernet cable is damaged or not working. | Replace the cable. |
| | The Ethernet switch is damaged or not working. | Replace the switch. |
| | The setting of the two rotary dials in the instrument is not the same as the setting in the configuration software. | Change the settings in the configuration software, or change the dial settings in the instrument. |
| `Mechanical failure detected` message appears on the screen. | The syringe is not working.<br><br>The needle is blocked or not moving properly.<br><br>The injector drive motor is not turning the injector valve to either the load or the inject position. | Syringe: Repair or replace the syringe. To remove the syringe from the autosampler, see "Setting the Syringe to the Removal Position" on page 81 and "Removing the Syringe from the Autosampler" on page 81. To install a syringe, see "Changing the Syringe or Replacing the Inner Plunger" on page 81.<br><br>Flush the needle: See "Testing the Needle for Blockage" on page 70.<br><br>Replace the injector drive motor: See "Removing and Replacing the Injector Drive Motor" on page 171. |

**Table 13.** Advanced Accela Autosampler problems (Sheet 9 of 13)

| Symptom | Possible problem | Remedy |
|---|---|---|
| **XYZ arm** | | |
| The arm jams in the sample compartment. | The arm is not aligned. | Align the arm. For information on this procedure, see the "Arm Calibration" section of the *Accela User Guide for LC Devices*. |
| | There is an obstruction on the track. | • Check and remove any obstructions in the arm's path.<br>• Clean and lubricate the *x*-axis arm. See "Cleaning the X and Y Arms" on page 116 and "Lubricating the XYZ Arm" on page 116. |
| | The track is not properly aligned. | Reinstall the XYZ arm using the alignment tool. See "Removing and Replacing the XYZ Arm Assembly" on page 117 and "Aligning the XYZ Arm" on page 127. |
| | The needle tubing is routed incorrectly. | Reroute the needle tubing per the instructions in the hardware manual. |
| | The *y*-axis motor cable is caught on the connector to the needle assembly. | Reroute the cabling, install a new needle assembly, or install a new XYZ arm sensor PCB. |
| | The vials are too high, causing the arm to hit the vials. | |
| | The wrong vial type is being used. | Use the correct vial type. |
| | The trays are not set in properly, and the vials are too high, causing the arm to hit the vials. | Make sure that trays "snap" in, and use the correct vials—that is, those given in "Consumables and Service Parts" on page 251. |
| **Injection valve** | | |
| Injection valve does not rotate. | Injector drive motor malfunction | • Check and retighten the valve screws.<br>• Check and repair the optical sensor.<br>• Replace the injector drive motor. See "Removing and Replacing the Injector Drive Motor" on page 171. |

**Table 13.** Advanced Accela Autosampler problems (Sheet 10 of 13)

| Symptom | Possible problem | Remedy |
|---|---|---|
| Injection valve rotates improperly. | Excessive friction on drive-valve interface | • Check and repair the optical sensor in the drive-valve interface.<br>• Replace the injector drive motor. See "Removing and Replacing the Injector Drive Motor" on page 171.<br>• Repair or replace the injection valve. See "Removing the Injection Valve from the Autosampler" on page 52, "Disassembling the Injection Valve" on page 54, and "Reinstalling the Injection Valve" on page 56. |
| | The stator is overtightened. | • Loosen the stator and retighten it to the proper torque. |
| | Buffer has hardened onto the stator. | • Clean the stator and the rotor seal if they are not damaged.<br>• Replace the injection valve. |
| Rapid rotor seal wear | Particulates in valve | • Check and clean the rotor.<br>• Use inline filter.<br>• Filter the sample before injections.<br>• Use precolumn (guard).<br>• Replace the rotor. See "Replacing the Rotor Seal in the Valco Injection Valve" on page 51. |
| **Needle** | | |
| Plugged needle | Multiple vial septa or wrong vial septa material | Check the septum and remove the blockage in the needle or replace the needle assembly. Use only vials and septa approved by Thermo Fisher Scientific. See "Testing the Needle for Blockage" on page 70 or "Replacing the Needle Assembly" on page 80. |
| | Particulates in sample | • Flush the needle (match sample miscibility with solvent) and replace it, if necessary. Filter the sample before adding to vials. See "Testing the Needle for Blockage" on page 70.<br>• Replace the needle assembly. See "Replacing the Needle Assembly" on page 80. |

**Table 13.** Advanced Accela Autosampler problems (Sheet 11 of 13)

| Symptom | Possible problem | Remedy |
|---|---|---|
| **Syringe** | | |
| Sample syringe is not drawing sample or flush solvent. | Plugged flush solvent inlet filter | Check and replace the inlet filter, if necessary. See "Replacing the Inlet Filter for the Wash Bottle Solvent Line" on page 59. |
| | Air in sample loop | • Flush with more than 5 ml flush solvent.<br>• Check for tubing, valve, or syringe leaks.<br>• Tighten the sample loop fittings or replace the sample loop. See "Replacing the Rotor Seal in the Valco Injection Valve" on page 51. |
| | Syringe valve not turning | Repair or replace the syringe valve motor. See "Removing and Replacing the Syringe Drive Assembly" on page 161. |
| | Defective or broken syringe drive motor | Repair or replace the syringe drive. See "Removing and Replacing the Syringe Drive Assembly" on page 161. |
| | Tubing is plugged or kinked. | Flush the tubing or replace the tubing. See "Replacing the Transfer Tubing" on page 59 and "Replacing the Needle Tubing Assembly" on page 73. |
| | Flushing is faster than the viscosity of the solvent allows. | Change the solvent in the flush bottle, or use a slower flushing speed in the method. |
| Syringe is not drawing the correct amount of solvent or sample. | Air bubbles in syringe | • Flush syringe while "flicking" it with your finger.<br>• Add MeOH to flush solvent and repeat flushing.<br>• Adjust syringe speed.<br>• Loosen or remove the syringe and manually expel the bubbles. |
| Wrong volume, irreproducible injection, or the volume is smaller than the expected injection. | The Teflon coating in the inner syringe is loose, causing air bubbles. | Replace inner syringe. To remove the syringe from the autosampler, see "Setting the Syringe to the Removal Position" on page 81 and "Removing the Syringe from the Autosampler" on page 81. To install the syringe, see "Changing the Syringe or Replacing the Inner Plunger" on page 81. |

**Table 13.** Advanced Accela Autosampler problems (Sheet 12 of 13)

| Symptom | Possible problem | Remedy |
|---|---|---|
| Fluid is inside the syringe barrel, and the syringe does not deliver the correct volume of solvent. | Leaking outer syringe. | Replace the syringe. To remove the syringe from the autosampler, see "Setting the Syringe to the Removal Position" on page 81 and "Removing the Syringe from the Autosampler" on page 81. To install a syringe, see "Changing the Syringe or Replacing the Inner Plunger" on page 81. |
| Outer syringe does not move, and the seal is bigger than the opening. | Flush solvent causes the polyethylene seal to swell. | Replace the syringe. To remove the syringe from the autosampler, see "Setting the Syringe to the Removal Position" on page 81 and "Removing the Syringe from the Autosampler" on page 81. To install a syringe, see "Changing the Syringe or Replacing the Inner Plunger" on page 81. |
| **Column compartment (oven)** | | |
| Column compartment (oven) does not go into READY mode. | Wrong configuration | Check and change the configuration. Refer to the following manuals:<br>• Xcalibur data system: *Accela User Guide for LC Devices*<br>• ChromQuest data system: *Accela User Guide for the ChromQuest Data System* |
| | Column compartment (oven) door is not closed. | Close column compartment (oven) door. |
| | Stabilizes at wrong temperature. | Replace column compartment (oven) temperature PCB. See "Removing and Replacing the Column Compartment (Oven) Temperature Control PCB" on page 155. |
| | Will not cool below 10 °C. | • Check temperature distribution of column compartment.<br>• Replace column compartment (oven) assembly. See "Removing and Replacing the Column Compartment (Oven) Assembly" on page 141. |
| | Connection to the fan motor is loose. | • Check the oven fan motor connection.<br>• Replace the oven fan motor. |
| | Connection to the temperature control PCB is loose. | Check cable connections at column compartment temperature control PCB. |

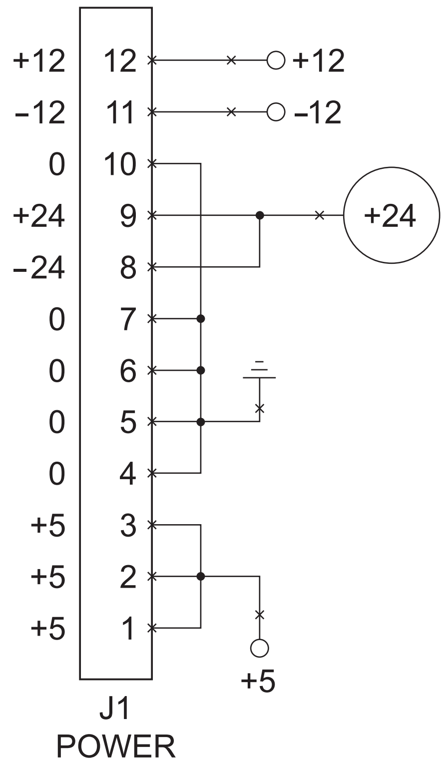
**Table 13.** Advanced Accela Autosampler problems (Sheet 13 of 13)

| Symptom | Possible problem | Remedy |
|---|---|---|
| **Valves (except injection valves)** | | |
| Syringe valve rotates improperly. | Defective motor | Replace the syringe drive assembly. For information on the latter procedure, see “Removing and Replacing the Syringe Drive Assembly” on page 161. |
| | Defective valve | Replace the coupler. |
| | Loose or worn coupler | Repair or replace the valve motor. |
| Syringe valve leaks. | Loose fittings | Tighten or replace fittings. |
| | Syringe fitting leaks. | Tighten or replace the syringe. To remove the syringe from the autosampler, see “Setting the Syringe to the Removal Position” on page 81 and “Removing the Syringe from the Autosampler” on page 81. To replace the syringe, see “Installing the Syringe” on page 83. |
| | Too much pressure is put on the syringe by a plug downstream. | Find the blockage and replace that section of the tubing. |
| | Connection between the syringe and the syringe valve is loose. | Tighten the connection or replace the syringe. To remove the syringe from the autosampler, see “Setting the Syringe to the Removal Position” on page 81 and “Removing the Syringe from the Autosampler” on page 81. To replace the syringe, see “Installing the Syringe” on page 83. |
| | The barrel of the syringe has pulled away from the metal jacket. | Replace the syringe. To remove the syringe from the autosampler, see “Setting the Syringe to the Removal Position” on page 81 and “Removing the Syringe from the Autosampler” on page 81. To replace the syringe, see “Installing the Syringe” on page 83. |

# Troubleshooting the Accela Autosampler Power Supplies

You can check the DC voltage outputs of the Accela Autosampler’s temperature control power supply and logic voltage power supply. Performing this procedure requires you to have a digital multimeter. The long and short DC power cables that connect to the temperature control power supply should have DC voltage outputs of 24 volts. The backplane PCB power cable that connects the logic voltage power supply to the backplane board should have the DC voltage outputs shown in Figure 203.

**Figure 203.** Logic power supply DC output voltages



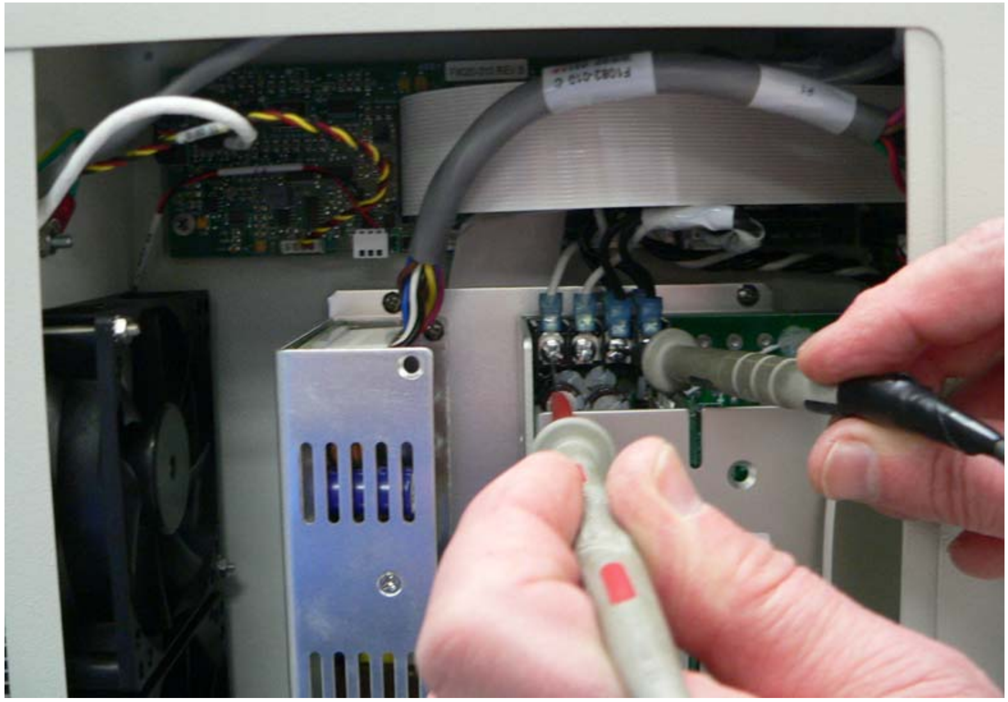

**CAUTION** When measuring the voltage outputs of the temperature control power supply and the logic voltage power supply, do not touch the power supplies except with the terminal and probe of the digital multimeter to avoid exposure to live AC and DC voltages.

### ❖ To check the DC voltage output of the temperature control power supply

1. Turn the digital multimeter to the DC voltage setting, V ⎓.
2. Place the terminal of the digital multimeter on the head of one of the screws where the two black wires of the long and short DC power cables (PN F1083-010) connect to the temperature control power supply, as shown in Figure 204.
3. Place the probe on the head of either of the screws where the two white wires of the long and short DC power cables connect to the temperature control power supply, as shown in Figure 204, and note the reading on the digital multimeter. Place the probe on the head of the other screw and note the reading on the digital multimeter.

   The readings should be approximately 24 Vdc ± 1.2 V.

**Figure 204.** Checking the DC voltage output of the temperature control power supply



### ❖ To check the DC voltage output of the logic voltage power supply

1. Turn the digital multimeter to the DC voltage setting, V ---.
2. Place the terminal of the digital multimeter on ground, such as a screw head on the logic voltage power supply or on the temperature control power supply, as shown in Figure 205.
3. Place the probe into each of the 12 small sockets of the connector on the end of the backplane PCB power cable that connects to the backplane PCB, as shown in Figure 205. Note the readings on the digital multimeter.

   Figure 203 on page 248 shows what the output of each wire in the cable should be.

**Figure 205.** Checking the DC voltage output of the logic voltage power supply

# Consumables and Service Parts

A consumable item is an item that is expected to wear with use or that comes in contact with system fluids or samples. As a result, you must periodically replace a consumable item. A service part is a subassembly of the autosampler. Normally, Thermo Fisher Scientific service representatives or other qualified personnel replace a service part. This chapter provides a comprehensive listing of consumables and Accela Autosampler service parts that you can order and replace.

This chapter also includes an itemized list of the parts in the Accela System Kit. This kit contains the hardware required to interconnect the system modules and the instrument device drivers required to operate the modules. The Accela System Kit is not packaged with the Accela Autosampler. You must order it separately or as part of a system bundled with either the Xcalibur or ChromQuest data system.

**Note** To control the Accela Autosampler, you must have the Xcalibur or ChromQuest data system and the Accela device drivers.

- For the Xcalibur data system, the Accela device drivers are provided on the LC Devices software CD.
- For the ChromQuest 4.2 data system, the Accela device drivers are provided on the Accela Add-On Device Drivers CD.
- For the ChromQuest 5.0 data system, the Accela drivers are provided on the ChromQuest data system CD.

**Contents**

# Consumables

These parts are consumables for the Accela Autosampler. The sample loops are compatible with the Valco injection valve.

Accessory Kit, Accela Autosampler . . . . . . . . . . 60357-62001
Assembly, needle, inert . . . . . . . . . . 60357-60017
Assembly, needle tubing . . . . . . . . . . 60053-60102
Assembly, syringe valve . . . . . . . . . . A3692-010
Assembly, transfer tube, 0.012 in. ID . . . . . . . . . . 60053-60014
Assembly, wash bottle kit. . . . . . . . . . 60053-60041
Cooling adapter, 96 well . . . . . . . . . . 60053-20002
Ferrule, Valco zero dead volume for 1/16 in. OD tubing, . . . . . . . . . . 00101-18122
Filter, flush solvent . . . . . . . . . . A4258-010
Grease, silicon/Teflon (for lead screw) . . . . . . . . . . 00301-01910
Kit, Maintenance Accela AS . . . . . . . . . . 60357-62002
Kit, Needle Tubing . . . . . . . . . . 60053-62043
Kit, Wash Bottle . . . . . . . . . . 60053-62009
Lubricant, Tri-flow . . . . . . . . . . 1611-0030
Nut, compression, long, 10-32, 1/16 in. OD tube, Rheodyne. . . . . . . . . . .00101-07-00001
Nut, compression, 0.45 in. length, for 1/16 in. OD tubing, 10-32 thread,
stainless steel . . . . . . . . . . 2522-1880
Plunger, replacement, concentric, 100 µL . . . . . . . . . . F1123-010
Plunger, replacement, concentric, 250 µL . . . . . . . . . . F1123-020
Plunger, replacement, concentric, 500 µL . . . . . . . . . . F1123-030
Port, needle . . . . . . . . . . 60053-20031
Reservoir vials, 16 mL . . . . . . . . . . 00301-07527
Retainer, needle port (injection port). . . . . . . . . . 60053-10035
Ring, bearing (Rheodyne injection valve) . . . . . . . . . .00109-99-00022
Syringe, dual concentric, 100 µL. . . . . . . . . . F1100-010
Syringe, dual concentric, 250 µL. . . . . . . . . . F1100-020
Syringe, dual concentric, 500 µL. . . . . . . . . . F1100-030
Syringe, standard, 2500 µL (with needle tubing extension) . . . . . . . . . . 60053-62002
Syringe, 2.5 mL. . . . . . . . . . 60053-60006
Sample loop, 5 µL . . . . . . . . . .00109-99-00007
Sample loop, 10 µL . . . . . . . . . .00109-99-00008
Sample loop, 20 µL . . . . . . . . . .00109-99-00009
Sample loop, 25 µL . . . . . . . . . .00109-99-00010
Sample loop, 50 µL . . . . . . . . . .00109-99-00011
Sample loop, 100 µL . . . . . . . . . .00109-99-00012
Sample loop, 500 µL . . . . . . . . . .00109-99-00013
Sample loop, 1000 µL . . . . . . . . . .00109-99-00014
Seal, rotor (for Rheodyne injection valve) . . . . . . . . . .00109-99-00021
Seal, rotor (for Valco injection valve) . . . . . . . . . .00110-03-00019
Stripper, vial . . . . . . . . . . F1034-010
Valve, injection (Valco) . . . . . . . . . . 60357-60018S
Vial caps, 100 µL . . . . . . . . . . 60053-40009
Tubing assembly, 2.5 mL syringe. . . . . . . . . . 60053-60005

Consumables (continued)
Vial kit, 1.8 mL w/250 µL insert, 100 per pack. . . . . . . . . . . . . . . . . . . . . . . . 60053-62017
Vial kit, 2 mL, 100 count, includes caps and septa (2 each). . . . . . . . . . . . . . . . . A4954-010

## Service Parts

Normally, Thermo Fisher Scientific service representatives replace these service parts:
Assembly, XYZ arm . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60357-60015
Assembly, tray compartment cooler . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60357-60014
Assembly, tray compartment cooler fan . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . F1110-010
Assembly, door left . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60057-60011
Assembly, door right . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60057-60015
Assembly, column oven . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60357-60011
Assembly, column oven fan . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60357-63006
Assembly, column oven sensor. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . F9050-010
Assembly, injection valve driver . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60357-60010
Assembly, syringe drive . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60357-60013
Assembly, tray compartment temperature sensor . . . . . . . . . . . . . . . . . . . . . . . . F9090-010
Base, pod, *z*-axis . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . F1033-010
Cable, injector sensor . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . A3513-010
Cable, door LED. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60357-63002
Cable, temperature control . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . F1002-010
Cable, DC column oven motor . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . F1017-010
Cable, A/C to power supply for the temperature controlled zones . . . . . . . . . . . . F1079-010
Cable, input power to the power supply module . . . . . . . . . . . . . . . . . . . . . . . . F1080-010
Cable, backplane power. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . F1082-010
Cable, DC power to the column oven . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . F1083-010
Cable, DC power to the tray compartment cooler. . . . . . . . . . . . . . . . . . . . . . . . F1083-020
Cable, power to the injection valve driver . . . . . . . . . . . . . . . . . . . . . . . . . . . . F1116-010
Column clamp . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60357-60012S
Enclosure for the autosampler chassis . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60057-10055
Gasket, oven door . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60057-40003
Heat exchanger . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60057-20087
Kit, Autosampler Calibration . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60053-62001
Kit, Adjustable Arm Lifting Stop Bracket . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60053-62028
PCB, CPU spare . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60053-60049
PCB, Interconnect . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . F9040-010
PCB, LED . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60057-61000
PCB, Column oven temperature control (Accela and Surveyor) . . . . . . . . . . 60053-61071R
PCB, Tray compartment temperature control (Accela and Surveyor). . . . . . . 60053-61084R
PCB, XYZ arm motor . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . F9045-010
Power supply, main . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 4004-0662
Power supply, option . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 4004-0663
Switch, tray compartment door. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . A3520-020
Wash station . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60057-40012

# Accela AS Accessory Kit

The Accela AS Accessory Kit includes consumables (such as vials, fittings, and test mixtures) as well as durable accessories (such as microplates, tray adapters, tools, and a power cord). The Accela AS Accessory Kit, P/N 60357-62001, contains the following items:

Bottle, 16 mL, includes cap for sample prep (4 each) . . . . . . . . . . . . . . . . . . . 00301-07527
Cable, shielded, ethernet, CAT-5, 7 ft length. . . . . . . . . . . . . . . . . . . . . . . . . . 70111-63302
Carrier, microwell, short, 0.32 in. height. . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60053-20004
Carrier handle for microwell carrier. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60053-20003
Carrier, microtitre, 1.26 in. height. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60053-20062
Carrier handle for microtitre carrier. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60065-20061
Clamp, waste tube. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 00007-07612
Clip, microwell handle . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . F1072-010
Connector, plug, 8-position, 3.8 mm pitch, minicombicon (2 each) . . . . . . . . 00004-02511
Fuse, 5 A, 250 V, 5 × 20 mm, time lag, (4 each) . . . . . . . . . . . . . . . . . . . . . . . . 5101-1856
Procedure, microplate carrier assembly instructions. . . . . . . . . . . . . . . . . . . . . 60053-97024
Screw, cross-recessed, 100 degree, flat countersunk head, type 1,
6–32 × 0.375 in. length . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 2816-4216
Screw, 4–40 × 1/4 in. length, pan head, stainless steel . . . . . . . . . . . . . . . . . . . . 2851-1044
Screw, pan head, 4–40 × 1/4 in. length, stainless steel,
for tray adapters (5 each) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 7111-0404
Test mixture, pkg., 1 mL, 5 count, for performance qualification . . . . . . . . . . . . A4991-010
Test mixture, pkg., 1 mL, 5 count, dilution, for performance qualification . . . . . A5135-010
Tray adapter for 300 µL vial (5 each). . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . F1124-010
Tray adapter plate for microcentrifuge tubes (5 each) . . . . . . . . . . . . . . . . . . . . F1008-020
Tubing, 1 L bottle . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60053-60041
Tubing, convoluted, for autosampler solvent waste . . . . . . . . . . . . . . . . . . . . . . . F5034-050
Vial kit, screw top, 2 mL, 100 count, includes caps and septa (2 each) . . . . . . . . A4954-010
Wrench, combination, 1/4 × 5/16 in. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 5401-0400

**Note** The Accela Autosampler ships with five sample vial trays installed in the tray compartment. Each tray holds 40 standard, 1.8 mL vials arranged in two rows of 20.

The part number for the tray is F1094-010S.

# Accela System Kit

The Accela System Kit, P/N 60057-60060 revision F, contains the cables, tubing, fittings, and so on used to interconnect the system modules.

5-port Ethernet switch, 5 port, 10/100 Base-T, 100 - 240 V . . . . . . . . . . .00825-01-00024
Cable, Ethernet with two ferrites. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 97355-98006
Cable, system interconnect cable, 7-connector . . . . . . . . . . . . . . . . . . . . . . 60053-63034
Ferrule, Valco zero dead volume for 1/16 in. OD tubing,
(quantity 12) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 00101-18122
Marker letter A, clip on for 1/8 in. OD tubing . . . . . . . . . . . . . . . . . . . . . . . .608250001
Marker letter B, clip on for 1/8 in. OD tubing . . . . . . . . . . . . . . . . . . . . . . . .608250002
Marker letter C, clip on for 1/8 in. OD tubing . . . . . . . . . . . . . . . . . . . . . . . .608250003
Marker letter D, clip on for 1/8 in. OD tubing. . . . . . . . . . . . . . . . . . . . . . . .608250004
Nut, compression, 0.45 in. length, for 1/16 in. OD tubing,
10-32 thread, stainless steel (quantity 12) . . . . . . . . . . . . . . . . . . . . . . . . . 2522-1880
Solvent bottle, 1 liter (quantity 4) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1413-0430
Solvent bottle caps (outer portion) (quantity 4). . . . . . . . . . . . . . . . . . . . . . . . A0343-010
Solvent bottle cap adapter (inner portion) (quantity 4. . . . . . . . . . . . . . . . . . . . A3191-010
Solvent bottle label set. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . A4158-020
Solvent bottle holder, solvent platform . . . . . . . . . . . . . . . . . . . . . . . . . . . . 60057-60014
Tubing, stainless steel, 0.005 in. ID × 1/16 in. OD, 10 cm length . . . . . . . .00301-01-00008
Tubing, stainless steel, 0.005 in. ID × 1/16 in. OD, 20 cm length
(to connect the Accela Pump outlet to the inlet
of the Accela Autosampler heat exchanger) . . . . . . . . . . . . . . . . . . . . . .00301-01-00009
Tubing, stainless steel, 0.005 in. ID × 1/16 in. OD, 26 cm length . . . . . . . .00028-01-00035
Tubing, stainless steel, 0.005 in. ID × 1/16 in. OD, 60 cm length . . . . . . . .00028-01-00039
Vial kit, clear vials with 1.8 mL capacity, black screw-on caps,
100 vials and caps per package (quantity 2) . . . . . . . . . . . . . . . . . . . . . . . . A4954-010
Instrument control software, LC Devices
(for use with the Xcalibur data system and
several other Thermo Scientific mass spectrometry applications) . . . . . . . 60257-62005
Instrument control software,
Thermo pumps add-on for the ChromQuest 5.0 data system . . . . . . . .CHROM-93034
Instrument control software,
Accela detectors add-on for the ChromQuest 5.0 data system. . . . . . . .CHROM-98036
Instrument control software,
Accela Open Autosampler add-on
for the ChromQuest 5.0 data system . . . . . . . . . . . . . . . . . . . . . . . . .CHROM-98037
Instrument control software, data system independent
for the Accela Open Autosampler
(PAL loader and object manager) . . . . . . . . . . . . . . . . . . . . . . . . . . .CHROM-98035

B

# Firmware Updates

Periodically, upgrades to the Accela Autosampler firmware might become available. In anticipation of future upgrades, both the Xcalibur and ChromQuest data systems come with the Accela Firmware Upgrade utility, which you can use to download firmware files to your Accela instrument modules. Firmware upgrade files have a .bin extension.

For the Xcalibur 2.0.7 or earlier data system and the Thermo Foundation application, the current firmware files and the Accela Firmware Upgrade utility are automatically installed to your personal computer during the installation of the data system.

For the ChromQuest data system, you can access the utility by choosing **Start > Programs > Chromatography > Accela Firmware Upgrade Utility**.

**Contents**



## Preparing the Autosampler for a Firmware Download

❖ **To prepare the autosampler for a firmware download**

1. Make sure you have the Accela AS firmware files that you intend to download and the Accela Firmware Upgrade Utility on your computer.

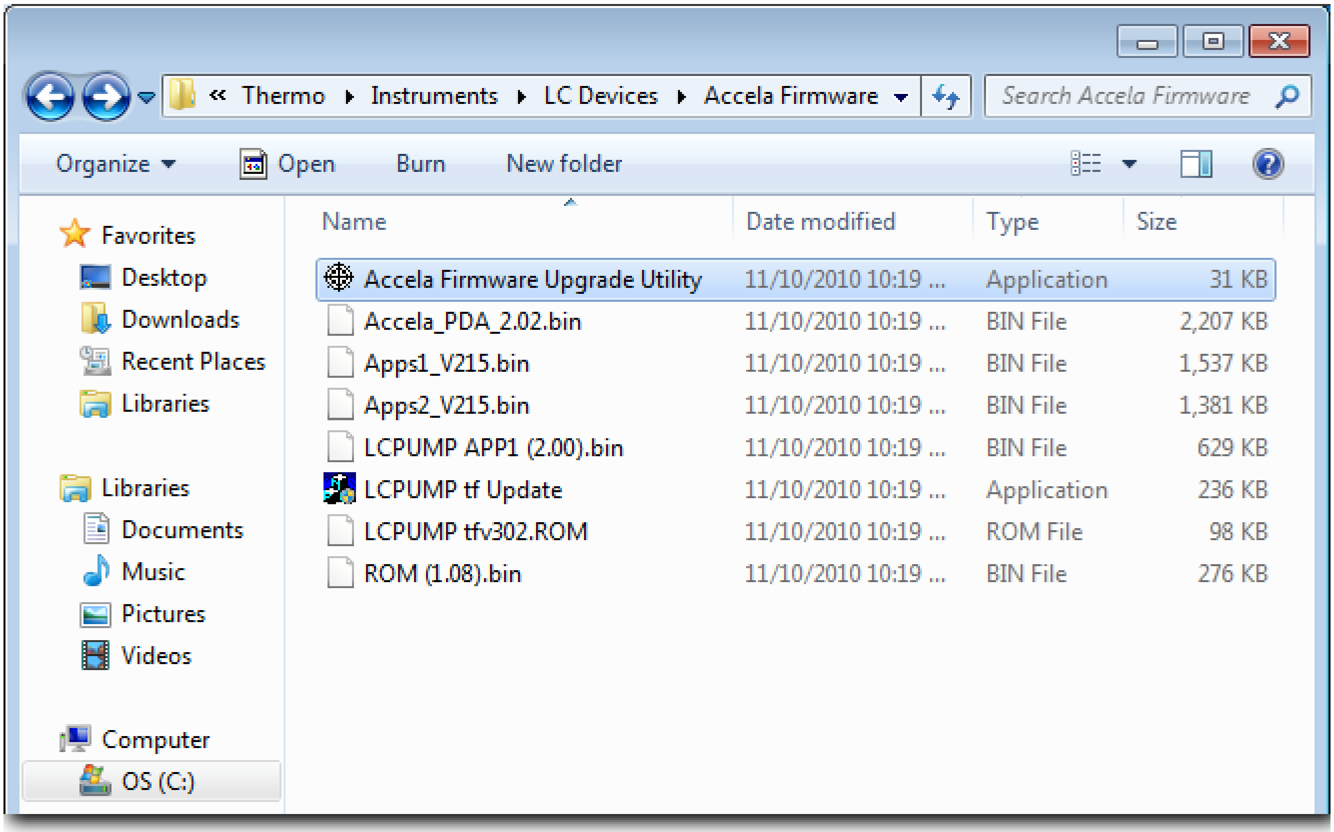
   For the Xcalibur 2.0.7 or earlier data system, these files reside in the following folder:

   *drive*:\Xcalibur\system\Accela Firmware

   For the Thermo Foundation 1.0 or later application, these files reside in the following folder (see Figure 206):

   *drive*:\Thermo\Instruments\LC Devices\Accela Firmware

**Figure 206.** Accela Firmware folder installed with the Accela devices on the LC Devices CD




2. Make a note of the current settings of the rotary switches on the back panel of the Accela Autosampler.

   At the conclusion of this procedure, you return the switches to these settings.

3. Make sure that your autosampler is connected to the computer through the standard Ethernet connection.

4. Turn off the power to the Accela Autosampler.

5. Use a small, flat-head screwdriver to set the rotary switches on the back panel of the autosampler to 00.

6. Turn the autosampler power on.

   The Communication LED blinks amber to confirm that the Accela Autosampler is configured for downloading the firmware.

# Downloading Firmware to the Autosampler

### ❖ To download firmware to the Accela Autosampler

1. Start the Accela Firmware Upgrade Utility by doing one of the following:

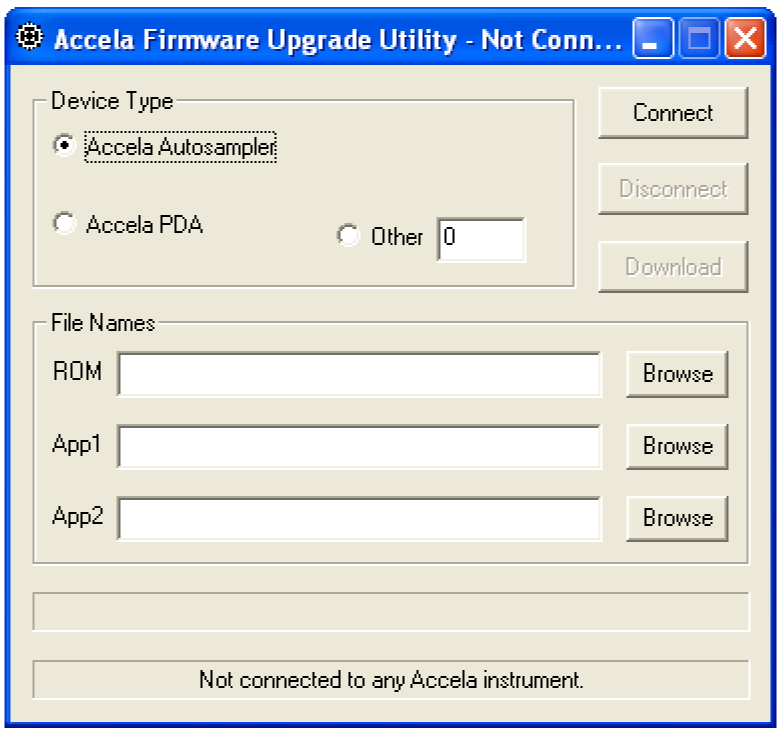
   - For the Xcalibur data system, browse to the following directory, and then double-click **Accela Firmware Upgrade Utility.exe** file.

     *drive*:\Xcalibur\system\Accela Firmware

   - For the ChromQuest data system, from the computer desktop, choose **Start > Programs > Chromatography > Accela Firmware Upgrade Utility**.

   The Accela Firmware Upgrade Utility window opens (see Figure 207).

   **Figure 207.** Accela Firmware Upgrade Utility window, showing the Accela Autosampler device selected




**CAUTION** Avoid interrupting the firmware download process. After you click Connect, do not turn off the power to the Accela Autosampler Plus or close the Accela Firmware Upgrade Utility window until the download process is finished. If you terminate the connection during the download process or lose power to the autosampler, contact your local Thermo Fisher Scientific representative. The firmware board will need to be reprogrammed.

2. In the Accela Firmware Upgrade Utility window, initiate communication between the utility and the Accela Autosampler:

   a. Under Device Type, select the **Accela Autosampler** option (see Figure 207).

   b. Click **Connect**.

      The status display at the bottom of the Accela Firmware Upgrade Utility window indicates that a connection has been made.

3. Under File Names, select the appropriate firmware files for the Accela Autosampler:

   a. For the ROM box, click **Browse** and select **ROM(108).bin**.

      The file name appears in the ROM box.

   b. For the App1 box, click **Browse** and select **Apps1_V2.15.bin**.

      The file name appears in the App1 box.

   c. For the App2 box, click **Browse** and select **Apps2_V2.15.bin**.

      The file name appears in the App2 box.

      **IMPORTANT** You must select a *ROM* file, an *APP1,* and an *APP2* file. If you do not download these files together, your Accela AS will not work properly when you return it to normal operation.

4. After you select the appropriate firmware files, click **Download** and wait for the download to finish.

   The utility notifies you when the download is complete.

   **Note** When the Download Completed Successfully message appears, you can safely turn off the power to the autosampler and close the Accela Firmware Upgrade Utility.

5. Return the autosampler to normal operation after you finish upgrading the firmware as follows:

   a. Close the Accela Firmware Upgrade Utility to terminate the connection with the Accela Autosampler.

   b. Turn off the power to the Accela Autosampler.

      **IMPORTANT** Make sure to turn the Accela Autosampler power off before adjusting the rotary switches.

   c. Set the rotary switches back to their original settings.

      **IMPORTANT** The Accela Autosampler will not connect to the Xcalibur data system when the rotary switch address is set to 00.

   d. Turn on the Accela Autosampler power to resume normal operation.

# Quick Reference Guides

This appendix contains the following two-page quick reference guides:



Replacing the rotor seal in the injection valve requires these tools and materials:

| Tools and materials | Part number |
|---|---|
| Rotor seal for the Rheodyne injection valve | 00109-99-00021 |
| Rotor seal for the Valco injection valve | 00110-03-00019 |
| 9/64 in. L-hex wrench | N/A |
| #2 Phillips screwdriver | N/A |
| 1/4 in. open-end wrench | N/A |

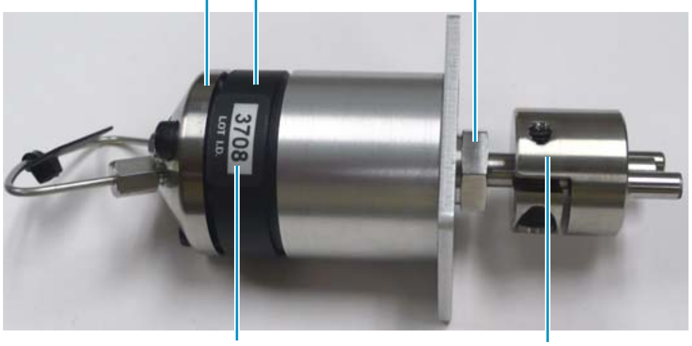
# Replacing the Rotor Seal in the Rheodyne Valve

Rheodyne valves shipped with earlier versions of the autosampler.

To replace the rotor seal, follow these steps:

- Step 1: Removing the Injection Valve
- Step 2: Disassembling the Injection Valve
- Step 3: Installing a New Rotor Seal
- Step 4: Reassembling the Injection Valve
- Step 5: Reinstalling the Injection Valve

The rotor seal forms a high-pressure seal between the stator and the rotor. Replace the rotor seal when leaking occurs between the stator and the stator ring or when you notice a decrease in injection precision.




The lot ID sticker on the stator ring identifies the week and year (*WWYY*) of the manufacture date.

Each valve has a pressure adjustment nut that is factory adjusted to the optimal pressure setting. Depending on the manufacture date, you can identify the optimal pressure setting as follows:

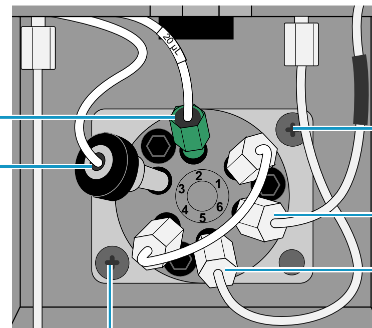
- For valves manufactured on week 38 of 2009 or later, the pressure adjustment nut is fixed at the optimal pressure setting.
- For injection valves manufactured from week 37 of 2008 to week 37 of 2009, the alignment of the factory-applied, red mark on the valve body and the dimple on the pressure adjustment nut corresponds to the optimal pressure setting for the valve.
- For injection valves manufactured before week 37 of 2008, the factory-applied red marks do not correspond to the optimal pressure setting. You must make your own marks.

| Manufacture date | Alignment markings | Adjustable pressure nut |
| --- | --- | --- |
| Initial release to week 36 of 2008 | No | Yes |
| Week 37 of 2008 to week 37 of 2009 | Yes | Yes |
| Week 38 of 2009 or later | No | No |

## Step 1: Removing the Injection Valve

❖ **To remove the injection valve from the autosampler**

1. Disconnect the fingertight fittings from ports 2 and 3.
2. Using a 1/4 in. open-end wrench, loosen and remove the swaged fittings from ports 5 and 6.
3. Using a #2 Phillips screwdriver, loosen and remove the two screws that secure the valve to the autosampler, and then pull the valve out of the autosampler.

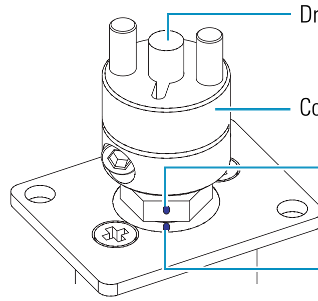



## Step 2: Disassembling the Injection Valve

❖ **To disassemble the injection valve**

1. Determine the manufacture date of the valve.
2. For valves manufactured before week 37 of 2008, make reference marks on the pressure adjustment nut and the valve body to identify the current alignment.

   After you replace the rotor seal and reassemble the valve, check the alignment of these marks to ensure that the position of the pressure adjustment nut is unchanged.

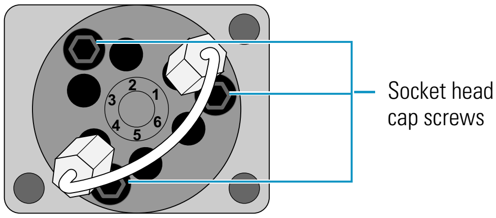



**CAUTION** Do not remove the coupling unit from the drive shaft of the injection valve. If you do remove the coupling unit, return the valve to Thermo Fisher Scientific for realignment.



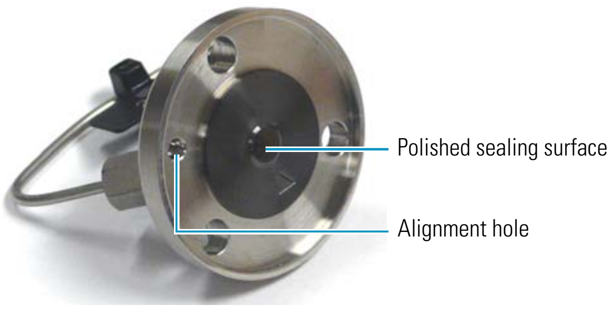
Thermo SCIENTIFIC

3. Using a 9/64 in. hex wrench, remove the three socket head cap screws that secure the stator to the valve.




**CAUTION** The polished (sealing) surface of the stator contains six easily damaged ports. Avoid touching this polished surface as you remove the stator from the injection valve. Do not place the polished surface face down on a hard surface.

4. Pull the stator off the valve. Place it on its side on a clean surface.

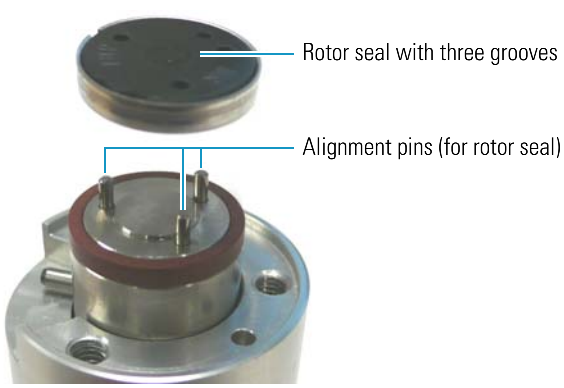



5. If the polished surface of the stator is scratched, replace the valve.
6. Pull the stator ring off the valve.
7. Pull the rotor seal off the three pins on the drive shaft.
8. Inspect the valve components for contamination. Clean as necessary.

## Step 3: Installing a New Rotor Seal

❖ **To install a new rotor seal**

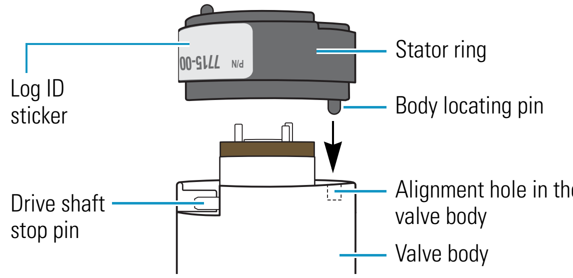
Hold the rotor seal with the engraved flow passages facing away from the drive shaft and mount the rotor seal onto the drive shaft's three alignment pins. The pins align with the rotor seal in only one way.



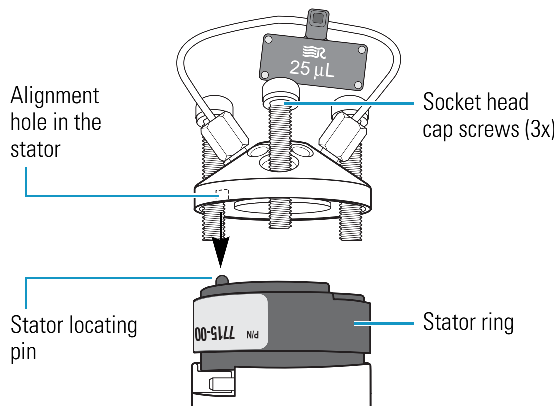

## Step 4: Reassembling the Injection Valve

❖ **To reassemble the injection valve**

1. Ensure that the drive shaft stop pin is positioned within the slot in the valve body.
2. To mount the stator ring onto the valve body, align the body locating pin with the alignment hole in the valve body. Then insert the body locating pin into the alignment hole.




3. To mount the stator onto the stator ring, hold the stator with its polished surface facing the stator ring. Align the alignment hole in the stator with the stator locating pin on the stator ring. Then insert the locating pin into the alignment hole.

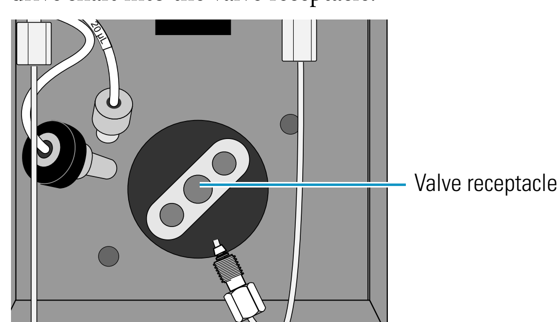



4. Insert the three socket head cap screws into the stator.
5. Using a 9/64 in. L-hex wrench, tighten each screw a little at a time, keeping the stator surface parallel to the stator ring surface.
6. If you have an adjustable torque wrench with a 1/4 in. shaft and a hex driver attachment, evenly torque the three socket head cap screws to 20 inch-pounds.
7. For valves manufactured before week 38 of 2009, ensure that the position of the pressure alignment nut is unchanged.

## Step 5: Reinstalling the Injection Valve

❖ **To reinstall the injection valve**

1. Align the holes in the valve plate with the two small holes to the left and right of the valve receptacle, and then insert the valve drive shaft into the valve receptacle.




2. Using a #2 Phillips screwdriver, tighten the screws that secure the valve to the autosampler.
3. Reconnect the transfer tubing to port 2 and the waste tubing to port 3. Hand-tighten the fittings.
4. Reconnect the heat exchanger outlet to port 5. Hand-tighten the fitting, and then tighten the fitting an additional 90 degrees (1/4 turn) with a 1/4 in. open-end wrench.
5. Start the solvent flow from the LC pump, and check for leaks.

# Replacing the Rotor Seal in the Valco Valve

The rotor seal is a disk with three engraved slots that forms a high-pressure seal with the stator. Replace the rotor seal when you notice a leak between either the stator and the rotor or the adjacent ports of the injection valve, or when you notice a decrease in injection precision.

**Contents**



Replacing the rotor seal requires these tools.

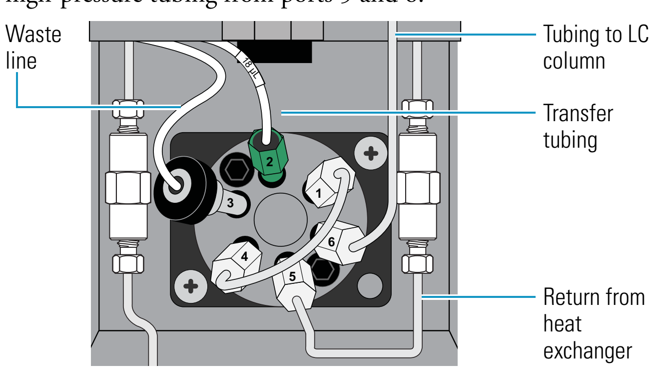
| Tool | Use |
|---|---|
| 1/4 in. open-end wrench | To remove the tubing from injection valve ports 5 and 6 |
| 9/64 in. hex wrench | To disassemble the injection valve |
| #2 Phillips screwdriver | To disconnect the valve from the autosampler |

**IMPORTANT** Because component cleanliness affects the useful life of the injection valve, replace the rotor seal in a clean environment.

## Step 1: Removing the Injection Valve

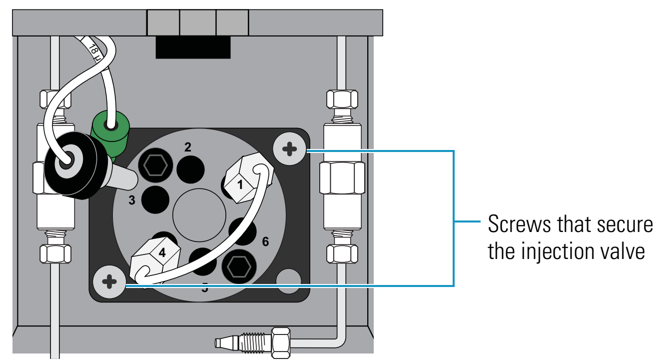
❖ **To remove the injection valve**

1. Disconnect the waste tubing from port 3 of the injection valve.
2. Disconnect the transfer tubing from port 2 of the injection valve.
3. Using a 1/4 in. open-end wrench, disconnect the 1/16 in. ID high-pressure tubing from ports 5 and 6.




Note: This drawing shows the current heat exchanger.

4. Using a #2 Phillips screwdriver, remove the two screws that secure the injection valve to the autosampler.




5. Slide the injection valve out of the autosampler.

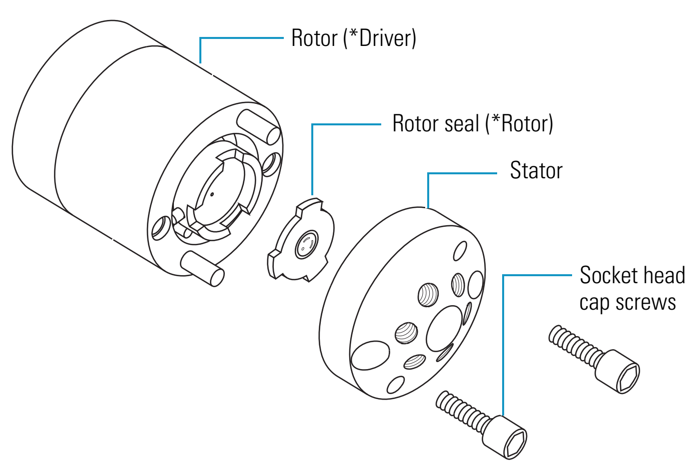
## Step 2: Disassembling the Injection Valve

❖ **To disassemble the injection valve**

1. Using a 9/64 in. L-hex wrench, remove the two socket head cap screws that secure the stator to the stator ring and the valve body.

**CAUTION** The polished (sealing) surface of the stator contains six ports that excess handling can easily damage. As you remove the stator from the injection valve, avoid touching this polished surface, and never place the polished surface face down on a hard surface.

*Valco Instruments Co. terminology




2. Gently pry the rotor seal away from the rotor.
3. Examine the sealing surface of the rotor seal for scratches. If scratches are visible, replace the rotor seal.



Thermo SCIENTIFIC

## Step 3: Cleaning the Stator

### ❖ To clean the stator

1. Inspect the stator to determine if it requires cleaning.
2. If the stator is dirty, swab it with HPLC-grade methanol. If more stringent cleaning is required, use a sonication bath.
3. Inspect the remaining valve components for contamination. Clean as necessary.

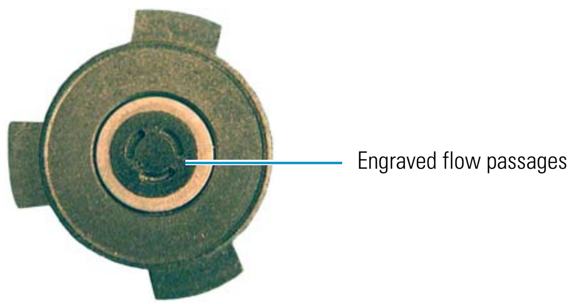
> **IMPORTANT** If the stator is scratched, replace it. Scratches can damage the rotor seal and cause cross-port leaks.

## Step 4: Installing the Rotor Seal

### ❖ To install a new rotor seal

1. Replace the rotor seal in the rotor, making sure that the rotor sealing surface with its engraved flow passages is facing out.

   The pattern is asymmetrical to prevent improper placement.

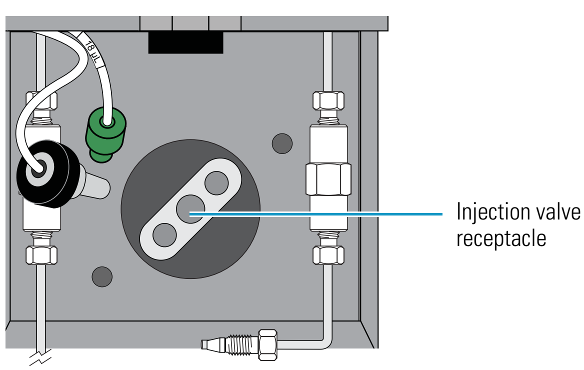



2. Replace the stator.
3. Insert the two socket head screws.
4. Alternating between the screws, slowly tighten the screws until both are snug. Do not overtighten them.

## Step 5: Reinstalling the Injection Valve

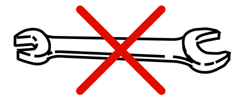
### ❖ To reinstall the injection valve

1. Align the drive shaft and the two prongs of the coupling unit with the three holes in the injection valve port located in the lower portion of the column oven compartment. Then insert the injection valve into the receptacle.




2. Align the holes in the steel plate of the injection valve with the small holes next to the injection valve receptacle.
3. Using the two screws that you removed in step 4 on page 265, secure the injection valve to the autosampler.
4. Reconnect the solvent lines as follows:

   - Hand-tighten the transfer tube fitting to port 2 and the waste tube fitting to port 3. Never use a wrench to tighten these fittings.



> **CAUTION** Never use a wrench to tighten the transfer tube fitting. Over-tightening the fitting can do the following:
>
> - Restrict the end of the tubing, which leads to less sample reaching the sample loop and results in smaller than expected peak areas or blank injections. A restriction in the end of the tubing can also cause the syringe to make a grinding sound during an injection sequence.
> - Strip the threads on the fitting, which leads to solvent leaks.

   - Hand-tighten the waste tube fitting to port 3.
   - Press the end of the return tubing from the heat exchanger to the bottom of port 5 as you hand-tighten the high-pressure fitting. Then use a wrench to tighten the fitting by an additional 1/4 turn.
   - Using high-pressure tubing and two high-pressure fittings, reconnect the LC column to port 6 of the injection valve.

> **Note** To reconnect tubing with a pre-swaged stainless steel fitting to a valve port, hand-tighten the fitting as you press the tubing against the bottom of the port, and then use a wrench to tighten the fitting by an additional 1/4 to 1/2 turn.
>
> To connect tubing with a two-piece stainless steel fitting to a mating port, press the tubing against the bottom of the port as you hand-tighten the fitting. Then tighten the fitting by an additional 3/4 turn with a wrench. Once you use the wrench to tighten the fitting, the ferrule portion of the two-piece fitting is permanently connected to the tubing.

5. Turn on the solvent flow from the LC pump and check for leaks.

# Using the Xcalibur Direct Control Commands

The On/Off switch is the only manual control provided with the Accela Autosampler. To perform tasks, such as moving the XYZ arm to the back of the tray compartment, use the direct control commands in the Instrument Setup window or the tune application for your Thermo Scientific mass spectrometer.

## Direct Control Commands

| Command | Description |
|---|---|
| Position arm to access tray | Moves the XYZ arm to the back of the tray compartment so that you can remove trays from or place trays into the tray compartment. |
| | **Note**. If the tray compartment door is open and you selected the Verify Door Is Closed check box when you configured the autosampler, the autosampler does not execute this command until you close the tray compartment door. |
| Flush syringe | Flushes the needle tubing and the interior of the needle with flush solvent. |
| Flush syringe at Fill position | Flushes the needle tubing, the interior of the needle, and the sample loop with flush solvent. |
| Wash needle | Washes the exterior of the needle with solvent. |
| Needle removal | Sets the needle to the needle removal position. |
| | **CAUTION**. To avoid damaging the needle, execute this command before you remove the needle. |
| Set oven temperature | Sets the temperature of the column oven compartment without downloading an instrument method. The allowable temperature range is 5 to 95 °C. |
| | **Important**. Avoid setting the temperature above the boiling point of the mobile phase. |
| Set tray temperature | Sets the temperature of the tray compartment without downloading an instrument method. The allowable temperature range is 0 to 60 °C. |
| Turn off oven temperature | Turns off the oven temperature control, allowing the temperature of the column oven compartment to return to ambient. |
| Turn off tray temperature | Turns off the tray temperature control, allowing the temperature of the tray compartment to return to ambient. |
| Inject sample | Injects a sample. The available parameters are Vial, Volume, and Injection Mode.<br><br>The allowable vial or well entries depend on the tray configuration:<br>• For conventional trays, the allowable entries are A:01 to E:40.<br>• For 96-well plates, the allowable entries are A:A1 to C:H12.<br>• For 384-well plates, the allowable entries are A:A1 to C:P24. |
| Move needle | Moves the XYZ arm to a specific vial or well location. |
| Set injector position | Switches the position of the injection valve. The injection valve has two positions: fill and inject. |
| Set syringe to removal position | Sets the syringe to its removal position. |
| Set syringe to home position | Sets the syringe to its home position. |
| Set Arm to Home Position | Moves the XYZ arm to its home position, which is just above the injection port. |



Thermo SCIENTIFIC

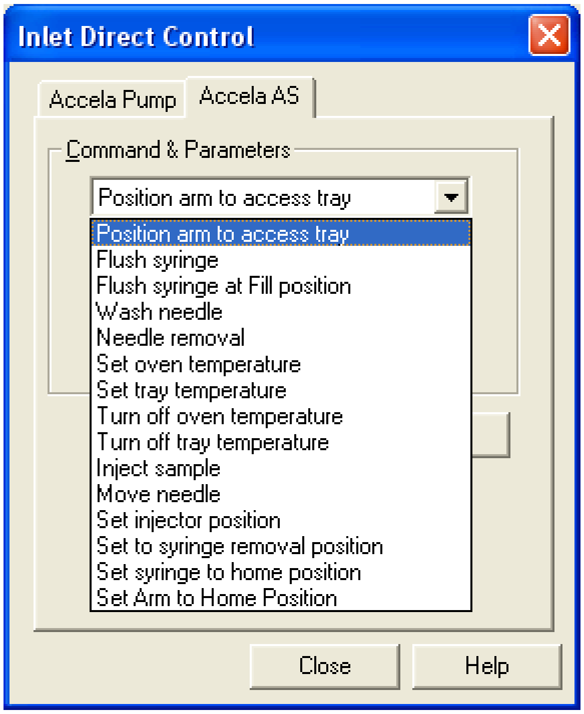
## Applying a Direct Command

You can access the direct control commands from the Xcalibur data system or the tune application for your mass spectrometer.

### ❖ To open the Inlet Direct Control dialog box from the tune application

1. In the Tune window, choose **Setup > Inlet Direct Control**. The Inlet Direct Control dialog box appears with tabbed pages for each configured LC device.
2. Click the **Accela AS** tab.

   The Accela AS page appears.




### ❖ To open the Direct Control dialog box from the Xcalibur Roadmap view

1. Click the **Instrument Setup** icon.

   The Instrument Setup window appears. The view bar on the left side of the window displays the configured instruments.
2. In the view bar, click the **Accela AS** icon. The Instrument Setup window for the autosampler appears.
3. From the menu bar, choose **Accela AS > Direct Control**. The Direct Control dialog box appears.


### ❖ To apply a direct command

1. In the Commands list, select a command.

   If the command requires additional parameters, these parameters appear below the Commands list. Make the appropriate entries and selections.
2. To execute the command, click **Apply**.

# Using the ChromQuest Direct Commands

The On/Off switch is the only manual control provided with the Accela Autosampler. To perform tasks, such as moving the XYZ arm to the back of the tray compartment, use the direct commands.

## Direct Commands

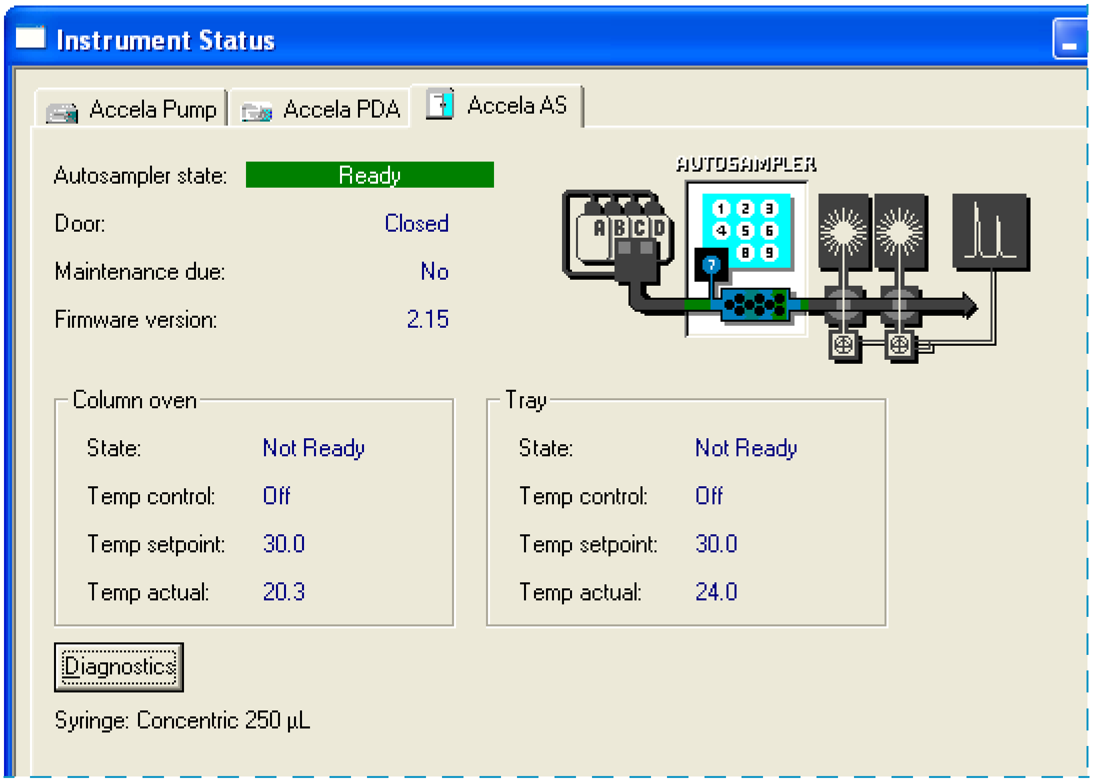
| Command | Description |
|---|---|
| Position arm to access tray | Moves the XYZ arm to the back of the tray compartment so that you can remove trays from or place trays into the tray compartment. |
| | **Note**. If the tray compartment door is open and you selected the Verify Door Is Closed check box when you configured the autosampler, the autosampler does not execute this command until you close the tray compartment door. |
| Flush Syringe | Flushes the needle tubing and the interior of the needle with flush solvent. |
| Flush With Injection In Fill Position | Flushes the needle tubing, the interior of the needle, and the sample loop with flush solvent. |
| Set Oven Temperature | Sets the temperature of the column oven compartment without downloading an instrument method. The allowable temperature range is 5 to 95 °C. |
| | **Important**. Avoid setting the temperature above the boiling point of the mobile phase. |
| Set Tray Temperature | Sets the temperature of the tray compartment without downloading an instrument method. The allowable temperature range is 0 to 60 °C. |
| Turn Off Column Oven | Turns off the oven temperature control, allowing the temperature of the column oven compartment to return to ambient. |
| Turn Off Tray Temperature | Turns off the tray temperature control, allowing the temperature of the tray compartment to return to ambient. |
| Temperature Control Upload | Determines if the autosampler has the optional temperature control feature. |
| Wash Needle | Washes the exterior of the needle with solvent. |
| Move Needle | Moves the XYZ arm to a specific vial or well location. |
| Set Injector Position | Switches the position of the injection valve. The injection valve has two positions: fill and inject. |
| Initialize Hardware | Performs the following sequence of operations:<br>1. Switches the two-way syringe valve to the flush bottle position.<br>2. Homes the syringe.<br>3. Sets the syringe plunger back to the ready position.<br>4. Switches the two-way syringe valve back to the needle position.<br>5. Homes the syringe.<br>After the autosampler initializes, it goes into the Waiting for Download state. |
| Position Arm to Replace Needle | Sets the needle to the needle removal position. |
| | **CAUTION**. To avoid damaging the needle, execute this command before you remove the needle. |
| Position Syringe to Home | Sets the syringe to its home position. |
| Position Syringe for Removal | Sets the syringe to its removal position. |
| Go to Home | Moves the XYZ arm to its home position, which is just above the injection port. |

## Submitting a Direct Command

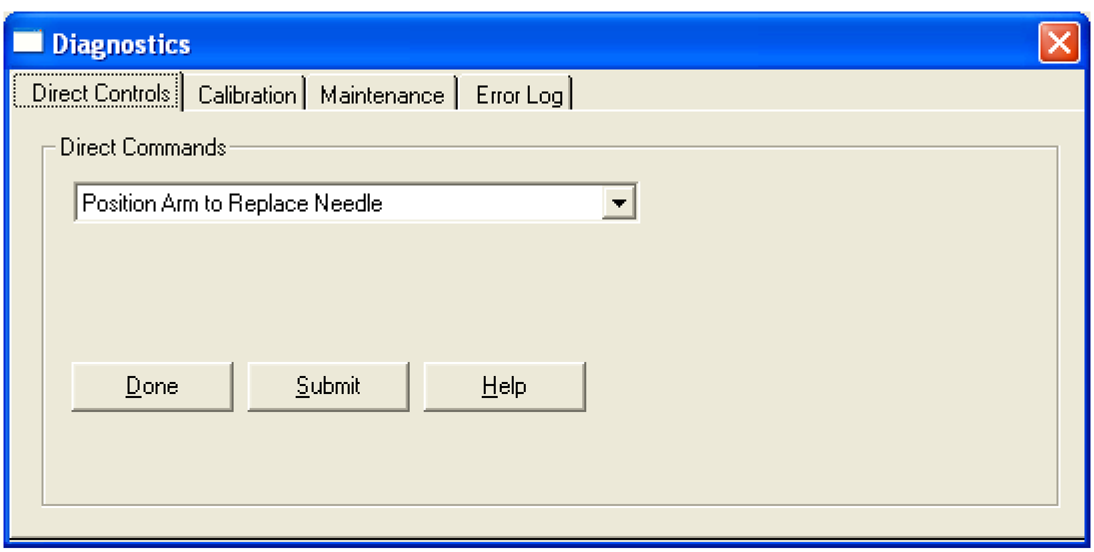
You can access the direct control commands from the Instrument Status window.

❖ **To submit a direct command**

1. In the online Instrument window, choose **Control > Instrument Status**. The Instrument Status window appears.
2. Click the **Accela AS** tab. The status page for the autosampler appears.




3. Click **Diagnostics**. The Diagnostics dialog box appears with the Direct Controls page displayed.




4. In the Direct Commands list, select a command.

   If the command requires additional parameters, these parameters appear below the Commands list.
5. Make the appropriate entries and selections.
6. To execute the command, click **Submit**.

# Legacy Versions of the Accela Autosampler

For information about legacy versions of the Accela Autosampler, see these topics:

**Content**



## Hardware Changes

Since the introduction of the Accela Autosampler, Thermo Fisher Scientific has replaced the Rheodyne injection valve with a Valco injection valve and modified the heat exchanger design.

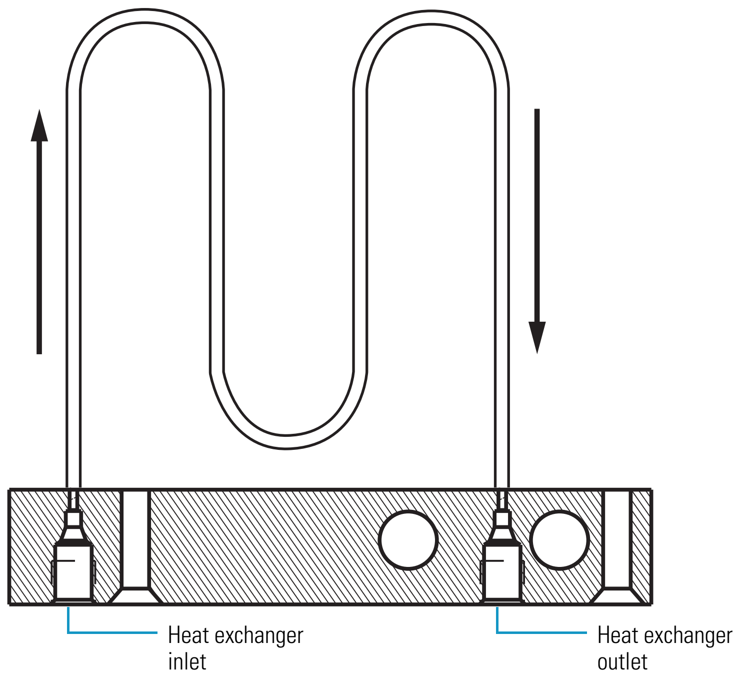
For information about maintaining the Rheodyne injection valve, see "Replacing the Rotor Seal in the Rheodyne Valve" on page 263. You cannot replace the Rheodyne injection valve with the current Valco injection valve.

For information about making the plumbing connections to the original heat exchanger, see the next topic. If the heat exchanger requires replacement, order the current heat exchanger (P/N 60057-20087).

## Heat Exchanger Plumbing

The heat exchanger is located above the injection valve behind the metal plate that covers the column oven heater. The original heat exchanger had female fittings at each end of the tubing.

**Figure 1.** Heat exchanger schematic (original)




Follow these procedures to do the following:

- To connect tubing to the heat exchanger inlet
- To remove a plug from the heat exchanger tubing

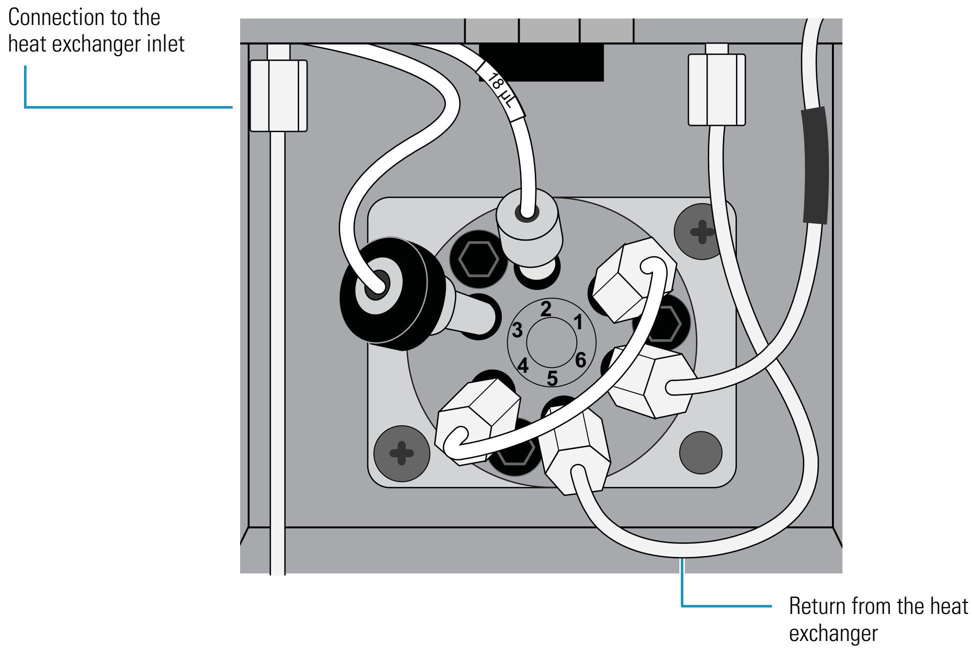
### ❖ To connect tubing to the heat exchanger inlet

1. Using a stainless steel, high-pressure fitting, connect a length of stainless steel 1/16 in. OD tubing to the heat exchanger inlet.

   The heat exchanger inlet is an internally threaded port on the left side of the column oven compartment just above the injection valve.

2. Using a 0.25 in. open-end wrench, tighten the nut.

**Figure 2.** Heat exchanger plumbing connections




### ❖ To remove a plug from the heat exchanger tubing

1. Using a 1/4 in. open-end wrench, detach the tubing connected to both the inlet and the outlet of the heat exchanger.
2. Connect the tubing from the pump to the port on the right side of the heat exchanger.
3. Set the flow rate from the pump to 1 mL/min.
4. After you clear the plug, reconnect the pump to the inlet of the heat exchanger and reconnect the outlet of the heat exchanger to port 5 of the injection valve.

# Index

# D

## I



## K



## L

## T

## U



## V



## W

## X



## Y



## Z