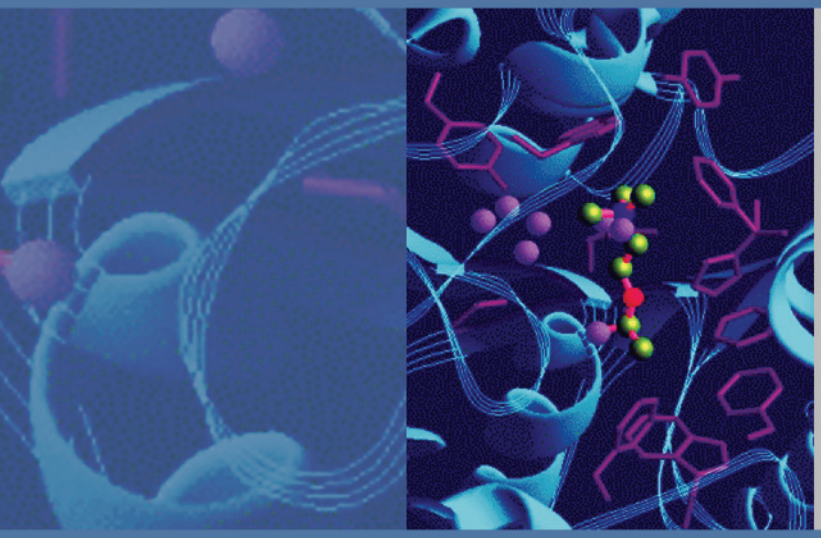

SpectraSYSTEM

UV8000 Degasser and PDA Detector

Hardware Manual

60060-97001 Revision A January 2010

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Release history: Revision A, January 2010

Software version: ChromQuest 5.0 and higher data system

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EN 55011: 2007, A2: 2007
EN 61000-3-2: 2006
EN 61000-3-3: 2005
EN 61326-1: 2006
EN 61000-4-2: 2001
FCC Class A, CFR 47 Part 15: 2007
EN 61000-4-3: 2006
EN 61000-4-4: 2004
EN 61000-4-5: 2005
EN 61000-4-6: 2007
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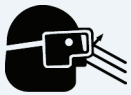
CAUTION Symbol	CAUTION	VORSICHT	ATTENTION	PRECAUCION	AVVERTENZA
	**Electric Shock:** This instrument uses high voltages that can cause personal injury. Before servicing, shut down the instrument and disconnect the instrument from line power. Keep the top cover on while operating the instrument. Do not 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 Wartungsarbeiten 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 lop 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 VorsichtsmaBnahmen, 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 mnipular 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 auBerdem 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 *SpectraSYSTEM UV8000 Degasser and PDA Detector Hardware Manual* describes how to set up and maintain the SpectraSYSTEM™ UV8000 Degasser and PDA Detector.

Related Documentation

In addition to this guide, the Thermo Scientific data system that you use to control the UV8000 module has a built-in Help system.

Safety and Special Notices

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

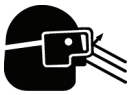
Safety and special notices include the following:

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

CAUTION Highlights hot surface hazards.

CAUTION Highlights electrical shock hazards.

CAUTION Highlights UV radiation hazards.



CAUTION Highlights hazards that require the use of eye protection.

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.

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

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Fax	561-688-8736
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Knowledge base	www.thermokb.com

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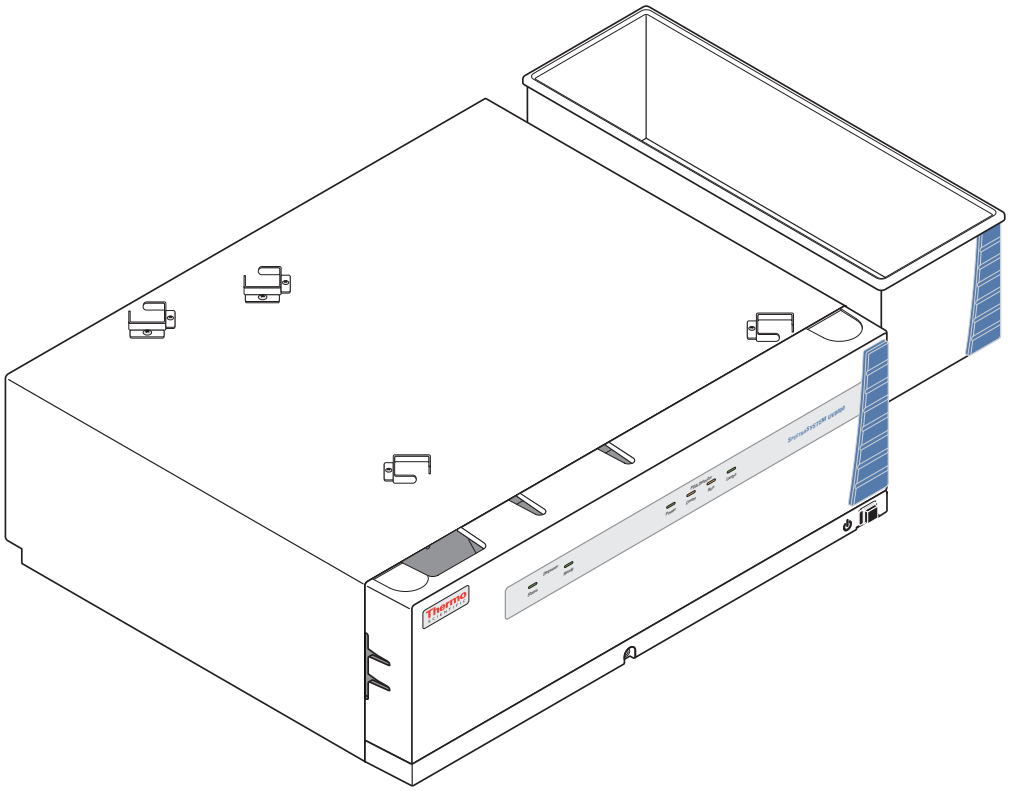
Introduction

The SpectraSYSTEM UV8000 Degasser and PDA Detector is a member of the SpectraSYSTEM family of high-performance LC instruments and is shipped with a solvent bottle holder (Figure 1).

Contents

Figure 1. SpectraSYSTEM UV8000 Degasser and PDA Detector with solvent bottle holder



Functional Description

The SpectraSYSTEM UV8000 Degasser and PDA Detector is a benchtop module for inclusion in the SpectraSYSTEM liquid chromatography system that consists of a photodiode array (PDA) detector, an SCM1000 vacuum membrane degasser, and a solvent bottle holder. You control the UV8000 module through an Ethernet link to a data system computer that has the ChromQuest™ data system installed.

This section contains the following topics:

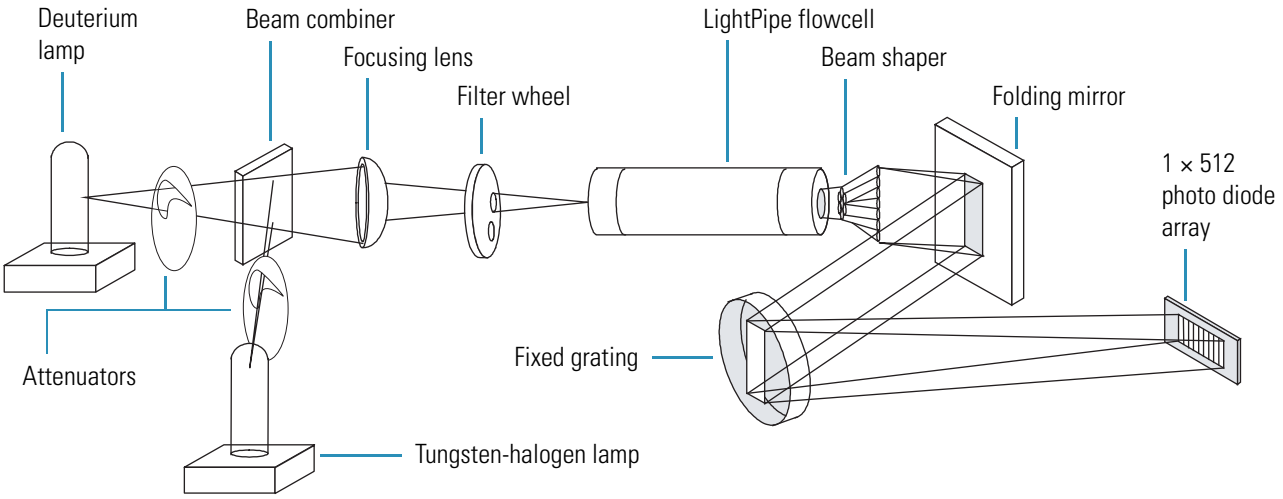
PDA Detector

The UV8000 module contains a full-featured, time-programmable PDA detector capable of scanning the ultraviolet-visible wavelength range from 190 to 800 nm. You can acquire data across the entire spectral range (with an effective resolution of 1.2 nm) at a rate of 0.5 to 80 Hz with 20-bit digital conversion. The PDA detector consists of a dual-light source, an optical bench, a photodiode array, a low voltage power supply, several printed circuit boards (PCBs), and four status light-emitting diodes (LEDs).

Figure 2 shows the optical system used in the detector. The dual-light source includes a deuterium lamp for detection in the ultraviolet wavelength range (190 to 360 nm) and a tungsten-halogen lamp for detection in the visible wavelength range (360 to 800 nm). The light output from the two lamps overlaps in the 300 to 500 nm range. You can increase or decrease the light intensity reaching the photodiode array by manually adjusting the attenuator for the deuterium lamp and the attenuator for the tungsten lamp.

The optical bench contains a beam combiner, focusing lens, filter wheel, LightPipe™ flowcell, beam shaper, folding mirror, and grating. The beam combiner reflects the light coming from the tungsten-halogen lamp so that it is parallel to and coincident with the light from the deuterium lamp. A lens focuses the combined beam on the inlet window of the LightPipe flowcell through the filter wheel. The standard filter wheel has two positions. For normal operation, leave the filter wheel in Position 1 (Open). Position 2 contains a sealed quartz cuvette filled with a holmium oxide/perchloric acid solution (traceable to NIST) used for wavelength accuracy verification and calibration.

Figure 2. The PDA detector optical system



The light focused on the inlet window of the LightPipe flowcell travels down the cell, is partially absorbed by the sample flowing through the cell, and exits into the beam shaper. The beam shaper is a fiber bundle. Its entrance aperture is circular to collect light from the LightPipe flowcell. The other end of the bundle is arranged to produce a narrow "slit" of light for the grating. The beam shaper transfers all the light to the grating for greater light throughput than the mechanical slit used in conventional photodiode array detectors.

The folding mirror between the output of the beam shaper and the grating shortens the optical bench, reducing the physical size of the detector. The grating disperses the light beam onto the 512-element photodiode array. Because the spectrum of light falling on the array is 611 nm (190 to 800 nm, inclusive), the effective spacing of the diodes is 611 nm/ 510 = 1.2 nm (two of the diodes in this array are not used). Firmware on the CPU PCB automatically interpolates diode intervals to arrive at integer wavelengths.

The photodiode array is mounted on the Array Acquisition PCB, which also contains all the analog detection circuitry. The PDA detector continuously scans the diode array at 20, 40, or 80 Hz (user selectable), converts the light intensity at each diode into a 20-bit digital word, and then stores these words in a dual-port Random Access Memory (RAM) on its CPU PCB. The CPU reads the data, processes the data based on the user parameters, and sends the processed data to the data system computer.

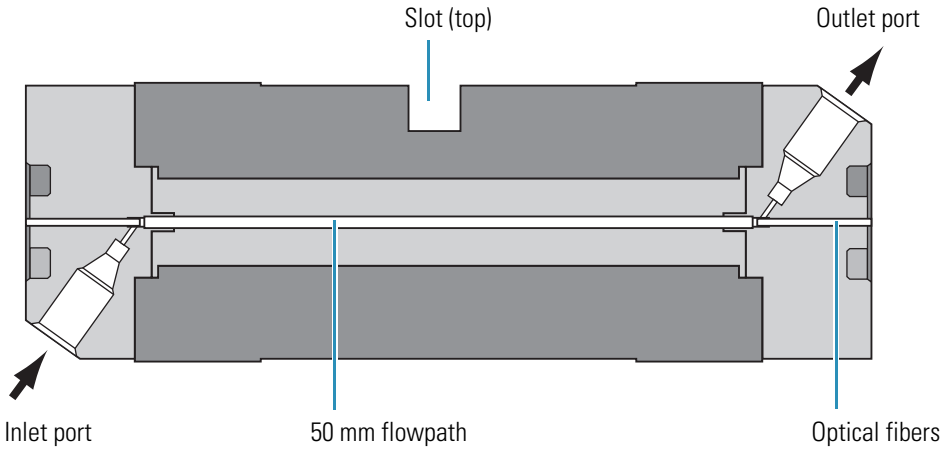
LightPipe Flowcell

The UV8000 module ships with a 50 mm LightPipe flowcell.

The internal bore of the LightPipe flowcell is 50 mm long and has a volume of 10 µL. A special, low refractive index coating of the internal bore ensures a high optical throughput and minimizes short-term noise.

The mobile phase enters the LightPipe flowcell through a port in the bottom of the LightPipe flowcell and exits through a port on the top of the LightPipe flowcell (Figure 3). Directing the flow upward helps prevent air bubble entrapment.

Figure 3. Schematic of 50 mm LightPipe flowcell



Sensitive optical fibers are exposed at both ends of the LightPipe flowcell (Figure 4). Thermo Fisher Scientific ships the LightPipe flowcell with end caps to protect these optical fibers (Figure 5). Do not remove the protective end caps until you install the LightPipe flowcell. Replace the protective end caps for storage if you remove the LightPipe flowcell from the detector.

CAUTION Do **not** touch the ends of the LightPipe flowcell. Touching the ends of the flowcell can damage the exposed optical fibers. If you must grasp the ends of the LightPipe flowcell, wear clean, talc-free gloves.

Figure 4. End of the LightPipe flowcell

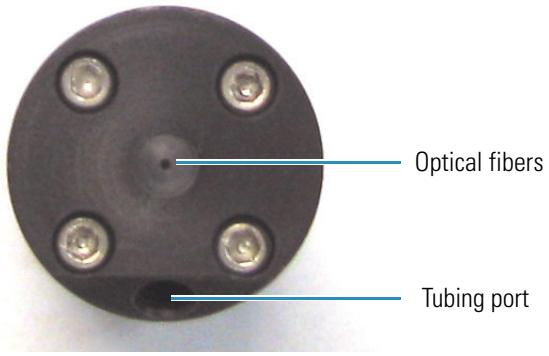
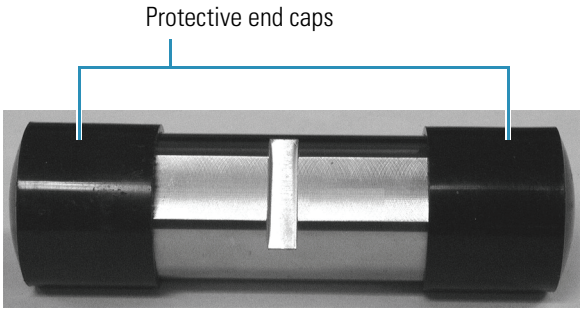


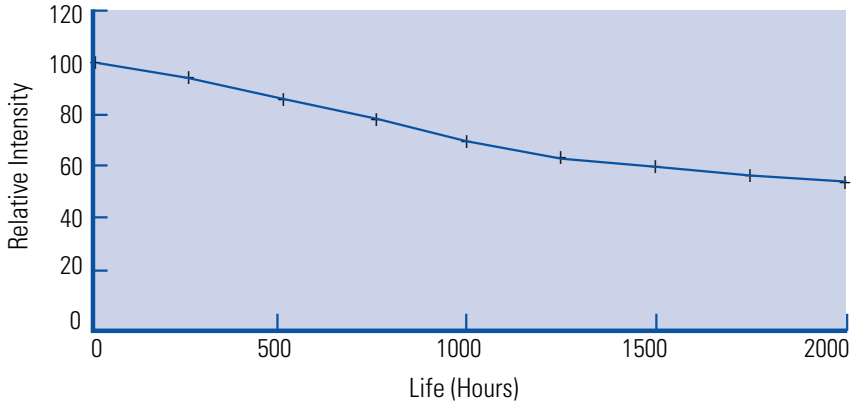
Figure 5. 50 mm LightPipe flowcell with protective end caps



Lamp Lifetime and Detector Noise

The UV8000 module has two lamps. The tungsten-halogen lamp emits light in the visible region, and the deuterium lamp emits light in the ultraviolet region. With use, the deuterium lamp emits less and less light before it fails to ignite (Figure 6). In contrast, the light output from the tungsten-halogen lamp remains relatively constant until the lamp fails.

Figure 6. Deuterium lamp intensity versus lamp usage hours



Detector noise is inversely proportional to the amount of light that reaches the diode array and the sampling time for the photodiodes of the diode array. Decreasing the amount of light that reaches the diode array and decreasing the sampling time both increase the detector noise level.

These topics provide guidance on minimizing detector noise and maximizing the useful lamp lifetime:

- "Controlling the Amount of Light that Reaches the Diode Array," next section
- "Selecting an Appropriate Diode Array Scan Rate" on page 6

Controlling the Amount of Light that Reaches the Diode Array

During a fixed sampling period, the amount of light reaching the diode array is proportional to the light output from the lamp and the aperture of the manual attenuators (partially open to completely open).

To compensate for the decreased light output caused by lamp aging, increase the aperture of the PDA detector's attenuators (see "Completing the Installation and Verifying Operation" on page 46).

Note At the 20 Hz diode array scan rate, you can compensate for the decreased light output from the deuterium lamp by increasing the attenuator aperture throughout the lamp's lifetime of approximately 2000 hours.

Selecting an Appropriate Diode Array Scan Rate

When you configure the PDA detector, you have three options for the diode array scan rate: 20, 40, and 80 Hz. The diode array scan rate is the rate at which the PDA detector samples the integrated intensity of the diodes.

IMPORTANT For validated HPLC methods, record the appropriate configuration setting for the diode array scan rate. The diode array scan rate affects the detector noise level.

The option you select affects the detector noise level, the useful lifetime of the deuterium lamp, and the available sampling rates in the data system method.

Note For information on creating methods to control the UV8000 module, refer to the data system Help.

As you increase the diode array scan rate, the sampling time per diode decreases. To achieve the same integrated light intensity, you must increase the light throughput to the diode array by opening the detector's attenuators ("Completing the Installation and Verifying Operation" on page 46). As the lamp ages, it emits less and less light (Figure 6 on page 5). Therefore, to achieve the same light throughput to the diode array, you must increase the attenuator aperture. Eventually, the attenuator aperture reaches a physical limit. When you can no longer increase the attenuator aperture, the integrated light intensity begins to decrease, and detector

noise level begins to increase. The attenuator aperture reaches this physical limit sooner at the higher diode array scan rates.

The useful lifetime of the lamp depends on the acceptable noise level for your application. At the 20 Hz diode array scan rate, you can compensate for the decreased light output from the deuterium lamp by increasing the attenuator aperture throughout the lamp's lifetime of approximately 2000 hours.

To maximize the useful lifetime of the deuterium lamp, select a diode array scan rate that is appropriate for your application:

- For standard chromatography applications, select the 20 Hz diode array scan rate. With this selection, you can acquire up to 20 data points per second per chromatogram and optimize integration for chromatographic peaks with baseline widths as narrow as 1.0 second.
- For most fast chromatography applications, use the default selection of 40 Hz. With this selection, you can acquire up to 40 data points per second per chromatogram and optimize integration for chromatographic peaks with baseline widths as narrow as 0.5 seconds.
- For fast chromatography applications that have chromatographic peaks with baseline widths of less than 0.5 seconds, select the 80 Hz diode array scan rate.

Vacuum Degasser

You can use the vacuum degasser within the SpectraSYSTEM UV8000 Degasser and PDA Detector in conjunction with any liquid chromatography system. The degasser uses the principle of inline vacuum degassing to remove dissolved gases from common HPLC solvents. The degasser contains four vacuum chambers, one for each outlet and inlet line pair, allowing multiple solvent degassing. Each vacuum chamber contains thin-walled tubular membranes maintained at partial pressure. When the chamber surrounding the membrane reaches the correct negative pressure (80 to 100 mm Hg), dissolved gases diffuse through the membrane into the vacuum. A vacuum-control circuit and a vacuum pump operate continually to maintain the optimum vacuum. In addition, a secondary inline check valve and solenoid valve seal the evacuated vacuum chamber from the pump. This design minimizes the load on the degasser motor when it powers up and while maintaining high vacuum over long periods. The degasser can achieve the desired vacuum pressure easily and efficiently. The high vacuum and thin-walled membranes provide efficient removal of dissolved gases.

Note The degasser does not pump solvent through the degassing membrane.

About Degassing

If dissolved gases are not removed from the eluant flow prior to the introduction of a chromatographic sample into the mobile phase, unstable flow through the pump, poor detector performance, reduced column life, and flow disturbances can adversely affect the quality of the chromatographic data you collect. Proper degassing minimizes these problems.

Vacuum Degassing

Compared to helium degassing techniques, vacuum degassing typically offers these advantages:

- Simpler setup and operation
- Minimal solvent loss through evaporation because there is no bubbling
- Easier replenishment of the solvent supply because sparging after filling the bottle requires no wait time

For best results, use vacuum degassing for flow rates of up to 4.0 mL/min, (2-channel operation, pump-proportioned 50:50 methanol/water) or less. For higher flow rates and the best results, use helium degassing, although higher flow rates can be achieved by degassing identical solvents, then T'ing together both solvents, routing them into the pump, and mixing them using solvent proportioning (gradient pumps). You can also briefly degas your solvent with helium, then route the solvent through the vacuum degasser. This technique provides flow rates as high a 6 mL/min.

Degassing Efficiency

The longer a solvent is in contact with the membrane, the more chance it has to reach equilibrium with the operating vacuum.

If you plan to use a particular solvent at a flow rate above 1 mL/min, you might consider a parallel flow arrangement. With this arrangement you connect two solvent IN lines to the same reservoir with a tee connector. A second tee connector joins the two corresponding solvent OUT lines to the HPLC pump. This arrangement doubles the amount of membrane available and decreases the flow resistance. If you generally work with three or fewer eluants, connecting at least one set in parallel is advantageous.

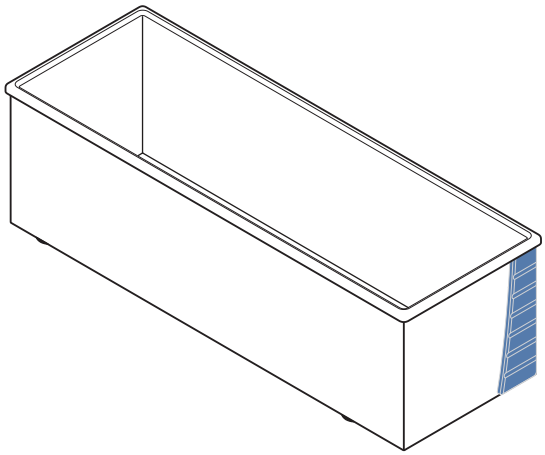
Thermo Fisher Scientific recommends that solvents with high gas solubility, for example, hexane and methanol, be run in parallel. A parallel flow arrangement also provides the best results when flow rates are greater than 2 mL/min at a head pressure of two feet. High flow rates tend to "starve" the pump of solvent due to the resistance through the membrane tubing.

Studies at Thermo Fisher Scientific using the SpectraSYSTEM UV8000 Degasser and PDA Detector indicate that it is very efficient at removing dissolved air from water. You need not consider water for parallel flow strictly from a need to remove its dissolved air. Instead, choose methanol and hexane, with their large capacity to dissolve air, for parallel flow configuration.

Solvent Bottle Holder

The SpectraSYSTEM UV8000 Degasser and PDA Detector is shipped with a solvent bottle holder that can hold four one-liter solvent bottles (Figure 7).

Figure 7. Solvent bottle holder



For information about installing the solvent bottle holder, see "Setting Up the UV8000 Module in a Stack of Instruments" on page 22.

Front and Back Panels

The front and back panels of the SpectraSYSTEM UV8000 Degasser and PDA Detector are shown in Figure 8 and Figure 9.

Figure 8. Front panel

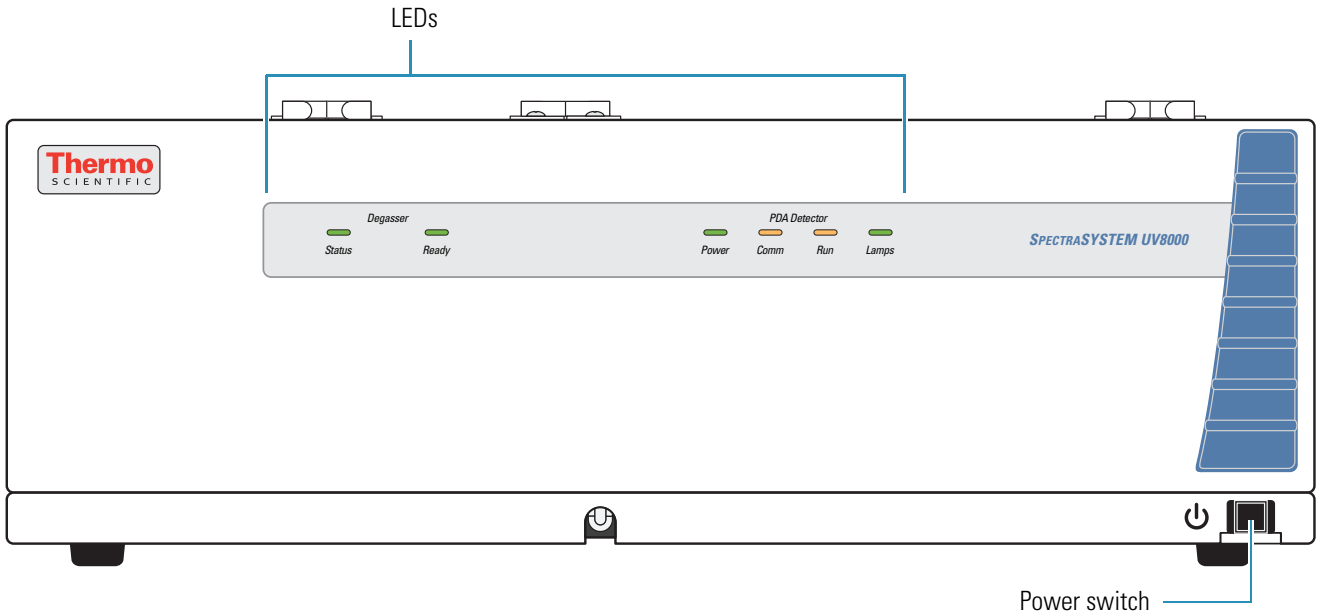
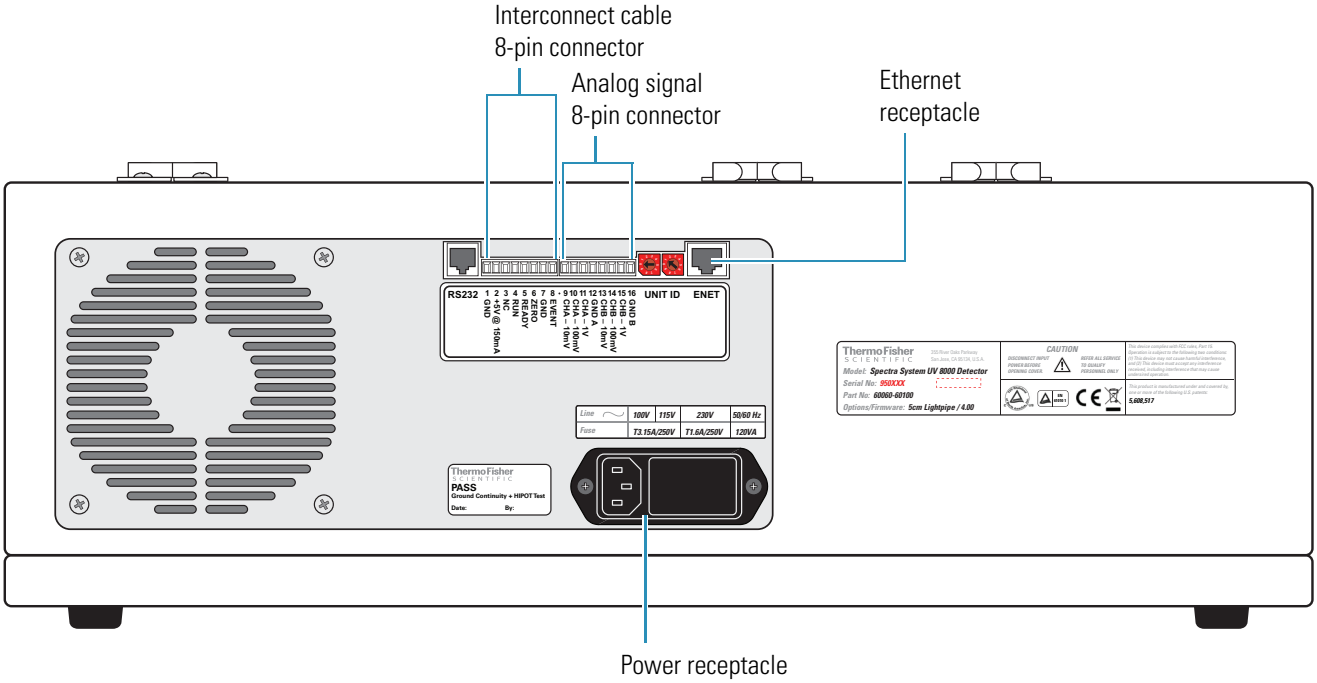


Figure 9. Back panel



Status LEDs

The SpectraSYSTEM UV8000 Degasser and PDA Detector has six light-emitting diodes (LEDs) on the front panel (Figure 10), two for the degasser and four for the PDA detector portions of the instrument as described in Table 1 and Table 2.

Figure 10. SpectraSYSTEM UV8000 Degasser and PDA Detector status LEDs

Table 1. Degasser status LEDs and meanings

LED	State	Meaning
Status	Green	The degasser is operating and pumping down.
	On for one second, off for two seconds	The vacuum level has risen above 800 mm Hg or has fallen below 10 mm Hg.
	On for one second, off for one second	One of the following errors has occurred: • The vacuum level has not reached 100 mm Hg within five minutes after the system was powered on. • The vacuum level in mm Hg multiplied by the motor speed in RPM has exceeded 6000 for more than two seconds. • The motor speed has not risen above 10 RPM.
Ready	Green	The proper vacuum level has been reached.

Table 2. PDA detector status LEDs and meanings

LED	State	Meaning
Power	Green	The detector is turned on and has downloaded the operational file.
	Amber	The detector is turned on but has not yet downloaded the operational file from the data system computer, or the Ethernet cable might be loose.
Comm	Green	Communication to the data system PC has been established.
	Amber	There is no communication with the data system.
Run	Green	The detector is ready for a run.
	Flashing green	A run is in progress and the detector is sending data to the data system computer.
	Amber	The PDA detector is not ready to start a run for one of these reasons: • A valid method has not been downloaded (following detector startup). • Both lamps are off, or one of the lamps is failing to turn on. • The lamp or wavelength calibration is not valid.
	Flashing amber	The PDA detector is in an error state while in the Run mode.
Lamps	Green	One or both lamps are turned on.
	Amber	The lamps are off or the D2 lamp is starting. The D2 lamp takes approximately 30 seconds to turn on.

Specifications

Table 3 lists the specifications for the SpectraSYSTEM UV8000 Degasser and PDA Detector. Table 4 on page 13 lists the specifications for the degasser portion of the system.

Table 3. SpectraSYSTEM UV8000 Degasser and PDA Detector specifications (Sheet 1 of 2)

Item	Specification
Dimensions	19.86 cm (7.82 in.) × 56.03 cm (22.06 in.) × 47.52 cm (18.71 in.) (*h* × *w* × *d*)
Weight	34.47 kg (76 lbs)
Power requirements	100/115 or 230 V ac; 50/60 Hz, 120 VA max
Operating temperature	+10 to +40 °C
Storage temperature	– 40 to +70 °C
Fuse size	• For 110 V ac: T3.15 A, 5×20 mm • For 220 V ac: T1.60 A, 5×20 mm
Operating humidity	5% to 95% non-condensing relative humidity
Wavelength range	190 nm to 800 nm continuous
Wavelength accuracy	±1 nm at 254 nm and 656 nm
Digital wavelength resolution	1.2 nm
Absorbance range	–2.0 AU to +4.0 AU, 20-bit resolution
Short-term noise*	≤ 6 µAU/cm (at 254 nm with the 50 mm LightPipe, a 1 mL/min flow rate (MeOH), 20 Hz diode array scan rate, 5 Hz data rate, 5 nm bandwidth, and 2 second rise time)
Drift*	≤ 1 mAU/hour after warmup at 254 nm at a stable temperature (±1 °C)
Warmup time	90 minutes to meet noise and drift specifications
Linearity	Deviation ≤ 5% up to 2.0 AU at 257 nm
Scan rate	0.5, 1, 2, 4, 5, 10, 20, 40, or 80 Hz (user selectable)
Diode array scan rate	20, 40, or 80 Hz (user selectable)
Rise time	0.0, 0.02, 0.05, 0.1, 0.2, 0.5, 1, 2, 5, or 10 s (user selectable)
Cell dimensions	50 mm LightPipe flowcell
Cell pressure rating	1000 psi
Diodes	512
Diode spacing	1.2 nm
Light source	Deuterium and tungsten-halogen lamps, prealigned

Table 3. SpectraSYSTEM UV8000 Degasser and PDA Detector specifications (Sheet 2 of 2)

Item	Specification
Filter wheels	Standard filter wheel: two-position wheel, one open position and one Holmium oxide/perchloric acid-filled cuvette, NIST traceable. Optional linearity verification wheel: five-position wheel, one with perchloric acid blank and four cuvettes with different concentrations of potassium dichromate in perchloric acid, NIST traceable
Analog outputs (2)	20-bit digital/analog conversion, three outputs/channel scaled to 10 mV/AU, 100 mV/AU, or 1.0 V/AU
Remote controls	Start, Zero

* According to ASTM E1657-98 "Standard Practice for Testing Variable-Wavelength Photometric Detectors Used in Liquid Chromatography"

Table 4. Degasser specifications

Item	Specification
Capacity, solvent bottle holder	Four one-liter bottles
Number of solvent channels	Four
Maximum flow rate per channel	10 mL/min
Volume/channel	470 µL
Solvent contact materials	Teflon™ (FEP and AF) and PEEK™
Maximum allowable tubing pressure	5 psig (0.35 kg/cm^2)
Liquid connections (provided)	8 Teflon FEP lines: • Four approximately 6 ft long (inlet) • Four approximately 1 ft long (outlet)

Installation

This chapter describes how to install the SpectraSYSTEM UV8000 Degasser and PDA Detector, including the connections to other chromatographic instruments.

Note Before proceeding with the installation, read the safety messages in the Preface.

Contents

Heavy Lifting Hazard

For your safety, and in compliance with international regulations, the physical handling of the SpectraSYSTEM UV8000 Degasser and PDA Detector requires a team effort.

CAUTION Heavy Lifting Hazard. Never attempt to lift or move the instrument by yourself. Doing so can cause personal injury or damage to the equipment.

Installation Checklist

The following installation checklist is a brief summary of the steps you must complete in sequence for the proper installation of the SpectraSYSTEM UV8000 Degasser and PDA Detector.

- ❒ Unpack and inspect your instrument. See page 17.
- ❒ Provide the proper location and environment. See page 17.
- ❒ Install the LightPipe flowcell. See page 18.
- ❒ Make the back panel connections. See page 22.
- ❒ Install and connect the solvent lines See page 31.
- ❒ Prime the degassing lines. See page 39.
- ❒ Reinstall the front covers. See page 41.
- ❒ Change the polarity of the output ports, as required. See page 43.
- ❒ Make the drainage connections. See page 43
- ❒ Power on the detector for the first time. See page 45.
- ❒ Complete the installation and verify operation. See page 46.

This SpectraSYSTEM UV8000 Degasser and PDA Detector was installed by:

(Name) (Date)

Unpacking and Inspecting

Carefully remove the SpectraSYSTEM UV8000 Degasser and PDA Detector from the shipping container and inspect both the module and the packaging for any signs of damage. If you find any damage, save the shipping materials and immediately contact the shipping company.

In addition to the UV8000 module, the shipping container should contain the following:

- A LightPipe flowcell
- A power cable
- A solvent bottle holder
- An accessory kit containing cables, tubing, and fingertight fittings (see "Accessory Kits" on page 105)

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

Placement and Environmental Requirements

Place the UV8000 module on a benchtop as close as possible to the chromatographic column outlet, This minimizes the length of tubing necessary for connection to the LightPipe flowcell inlet.

Ensure that the location meets the following requirements:

- A **draft-free** location away from an open window, air conditioner vents, or other circulating air source.
- A stable room temperature necessary for applications requiring maximum detection sensitivity.
- Clearance of at least 15 cm (6 in.) between the back panel of the UV8000 module and any wall or obstruction. This clear space provides access to the back-panel connectors and a free flow of cooling air.

These tools are required for installation:

- Narrow-blade screwdriver (2 mm wide)
- #2 Phillips screwdriver

Installing the LightPipe Flowcell

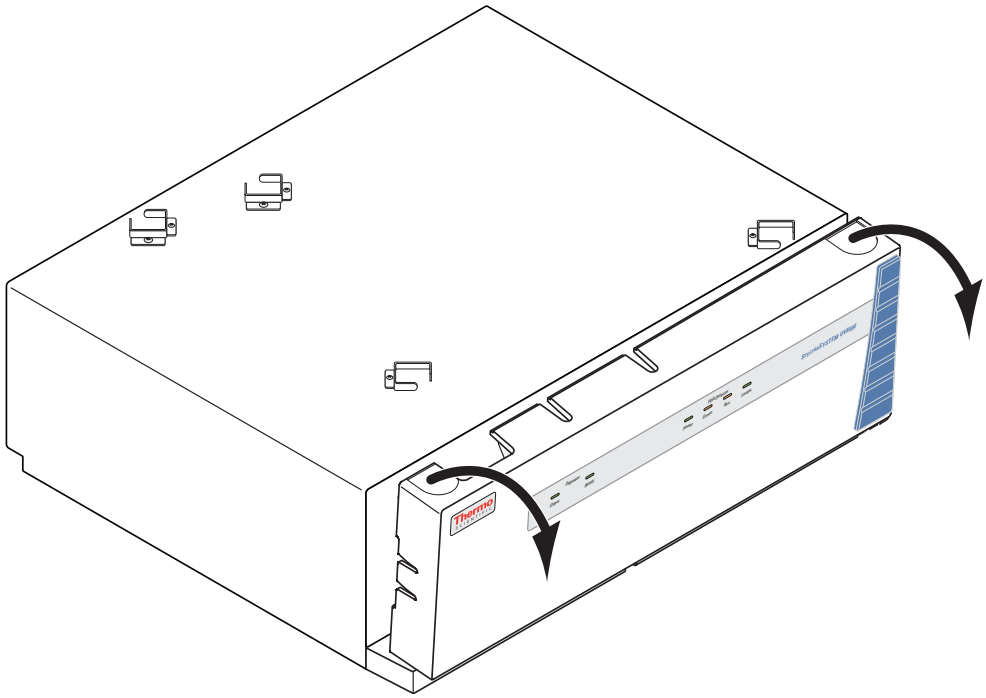
The LightPipe flowcell is packed in a small, separate box within the UV8000 module shipping carton. This small box contains the LightPipe flowcell (with a protective cap on each end) and a plastic bag containing the inlet and outlet tubing and fingertight fittings.

CAUTION Use only PEEK fittings to connect tubing to the flowcell. The appropriate PEEK fittings are included in the LightPipe flowcell accessory kit (see "Accessory Kits" on page 105).

❖ To install the LightPipe flowcell

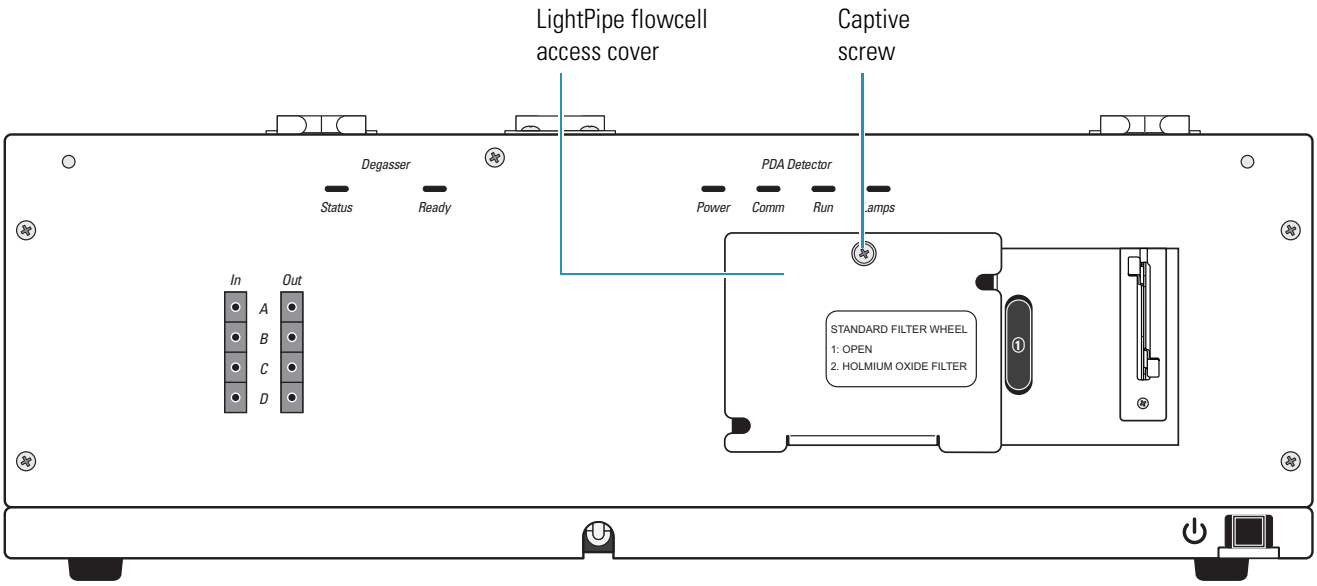
1. Grasp the front cover of the UV8000 module at the top outside corners and rotate it forward and down to remove it (Figure 11).

Figure 11. Removing the front cover



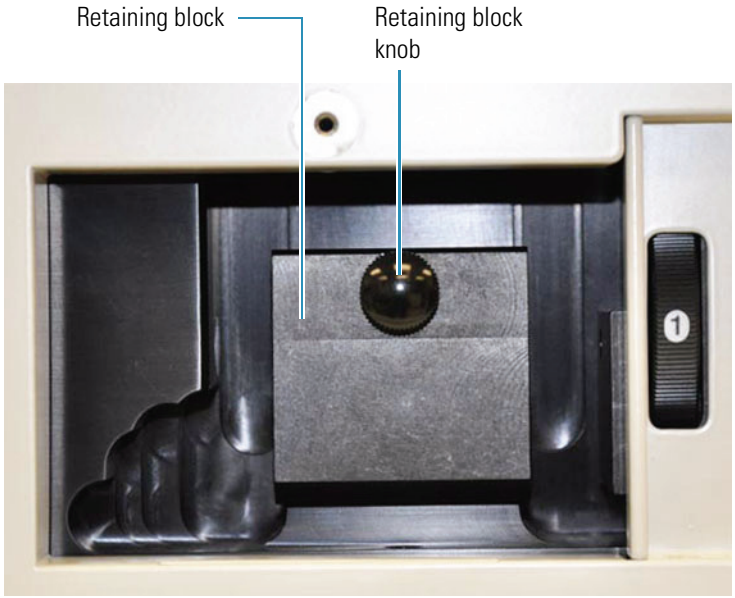
2. Unscrew the captive screw that secures the LightPipe flowcell access cover to the front panel of the detector and pull the cover off (Figure 12).

Figure 12. LightPipe flowcell access cover



3. Unscrew the retaining block knob and remove the retaining block (Figure 13).

Figure 13. View of the retaining block and the retaining block knob



4. Remove the protective end caps from the ends of the LightPipe flowcell.

5. Holding the LightPipe flowcell so that the slot on the top faces away from you, connect the inlet port (Figure 3 on page 4) of the LightPipe flowcell:
   a. Use the PEEK fitting in the LightPipe Flowcell Kit to connect one end of the red 0.010 in. ID inlet tubing to the flowcell inlet port.

      Note The insulating sleeve of the inlet tubing minimizes temperature fluctuations, which cause baseline drift.

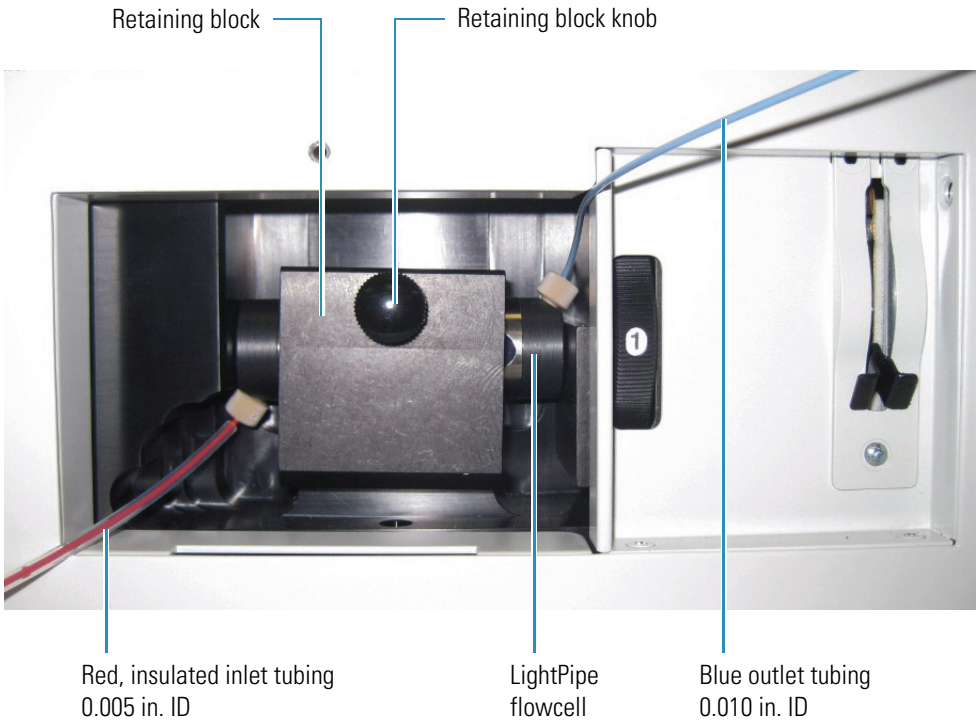
   b. Connect the other end of the tubing to the LC column outlet.

      IMPORTANT If you have several detectors (fluorescence, refractive index, electrochemical, and so on) hooked up in a series, place your UV8000 module closest to the column outlet. The LightPipe flowcell in the UV8000 module can withstand the greatest back pressure.

      Tip For best results, when you run the system at a low back pressure, use a back pressure regulator to prevent bubble formation in the PDA detector's LightPipe flowcell.

6. Holding the LightPipe flowcell so that the slot on the top faces away from you, connect the outlet port (Figure 5 on page 5) of the LightPipe flowcell:
   a. Use the PEEK fitting in the LightPipe Flowcell Kit to connect one end of the blue 0.010 in. ID outlet tubing to the flowcell outlet port.
   b. Connect the other end of the outlet tubing to the solvent waste container.
7. Position the slot located on the top of the LightPipe flowcell under the retaining bolt in the detector, and then slide the LightPipe flowcell into place.
8. Replace the retaining block.
9. Reinstall and hand tighten the retaining block bolt knob (Figure 14).

Figure 14. Inlet and outlet tubing connections for the LightPipe flowcell



10. Replace the flowcell access cover, ensuring that the inlet and outlet tubing pass through the slots (Figure 12 on page 19) without being pinched, by placing the tab on the lower edge of the cover into the slot in the case and rotating the cover gently into place.

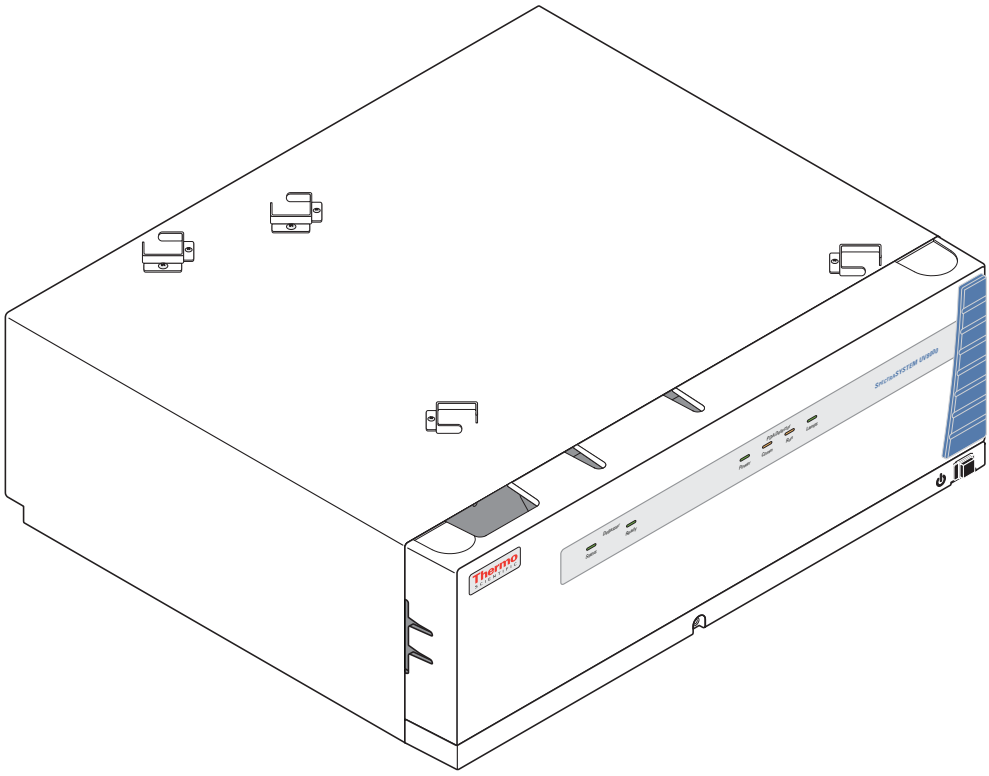
11. Tighten the captive screw to secure the flowcell access cover to the detector.

    Leave the front cover off and go on to the next procedure.

Setting Up the UV8000 Module in a Stack of Instruments

The SpectraSYSTEM UV8000 Degasser and PDA Detector is designed to be part of a stacked LC system that includes a pump and an autosampler. The UV8000 module is shipped with four brackets installed on the top (Figure 15) to secure the feet on the pump and autosampler.

Figure 15. Brackets on the top of the UV8000 module



The accessory kit contains two additional brackets (P/N 60060-10030) that you can install on top of a pump to secure the solvent bottle holder supplied with the UV8000 module.

Note Recent models of the SpectraSYSTEM P4000 pump have holes pre-drilled in the top of the pump cover for fastening the brackets. If your pump does not have holes in the cover, you can purchase a replacement cover (P/N 60060-10034). Only a Thermo Fisher Scientific field service engineer should replace the pump cover. NEVER drill your own holes.

If you do not want to replace the pump cover, do not use the solvent bottle holder supplied with the UV8000 module. Use a solvent bottle tray that will sit on top of the pump and the adjacent autosampler.

Note Solvent bottles larger than 1 L will not fit in the solvent bottle holder supplied with the UV8000 module. Use a larger solvent bottle holder.

❖ **To set up the UV8000 module as part of an LC stack**

1. Install two brackets on top of the pump (Figure 16) using a #2 Phillips screwdriver.

   Figure 16. Installed brackets on top of the pump

2. Position the pump on the top left area of the UV8000 module, placing two of the feet on the pump in the two brackets on the left.
3. Put the autosampler on the top right area of the UV8000 module, placing two of the rubber feet on the autosampler in the two brackets on the right.

Making the Back Panel Connections

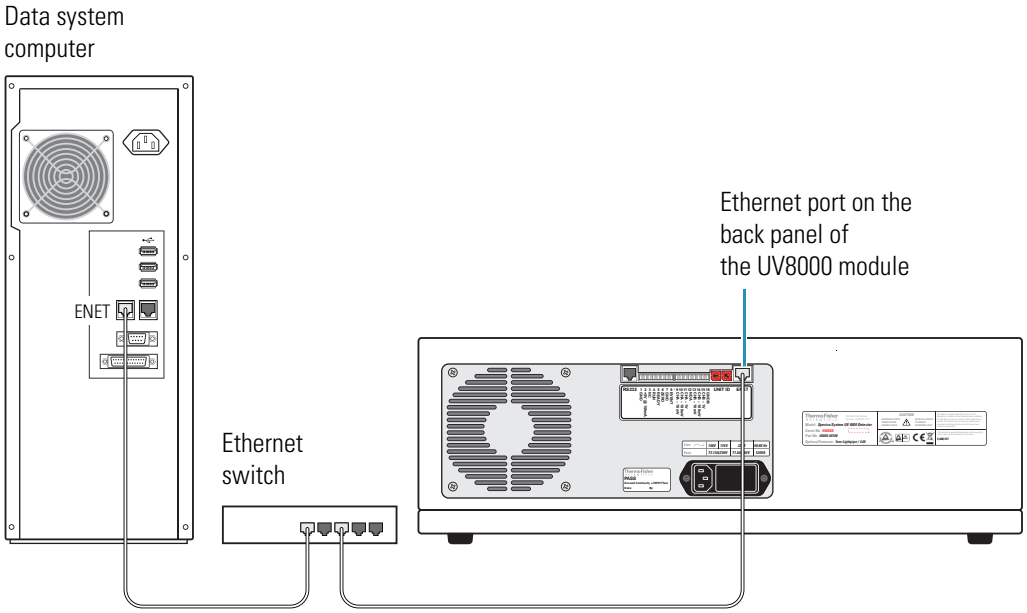
Use the cables provided in the UV8000 system accessory kit to make the connections to the back panel of the detector. The part numbers for these cables are listed in Appendix A, "Accessories and Maintenance Parts."

This section contains the following topics:

Connecting the UV8000 Module to the Data System Computer

The SpectraSYSTEM UV8000 Degasser and PDA Detector communicates with the data system computer through an Ethernet connection (Figure 17).

Figure 17. Ethernet connection



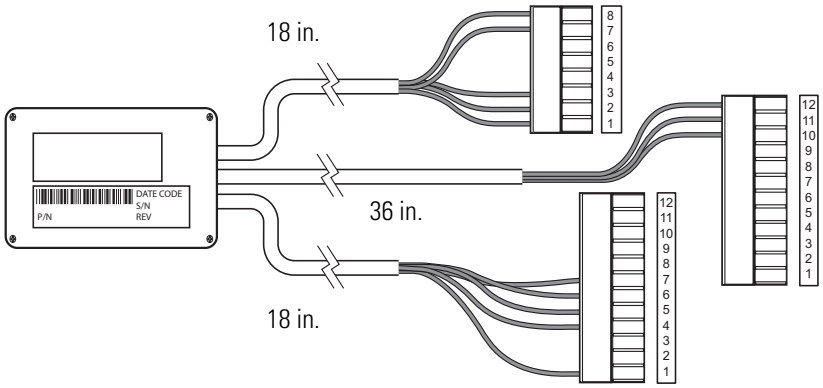
❖ **To connect the UV8000 module to the data system computer**

- Connect the Ethernet switch to the Ethernet connector port of the UV8000 module using the supplied CAT5, 7 ft long, shielded Ethernet cable with ferrite clamp.
- Connect the Ethernet switch to the data system computer using the supplied CAT5, 7 ft long, shielded Ethernet cable with ferrite clamp.

Synchronizing the Instrument Modules During an Injection Sequence

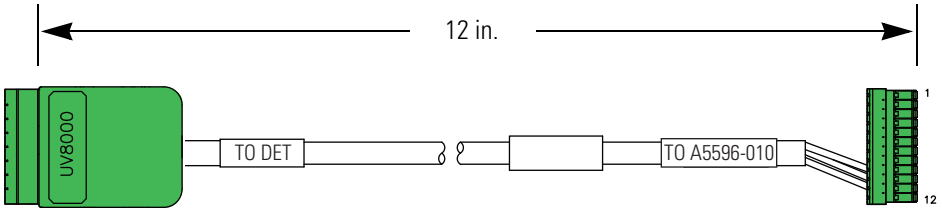
The timing of the instrument modules is synchronized through a system interconnect cable (Figure 18).

Figure 18. System interconnect cable (P/N A5596-010)



Connecting the UV8000 module requires an adapter cable (Figure 19).

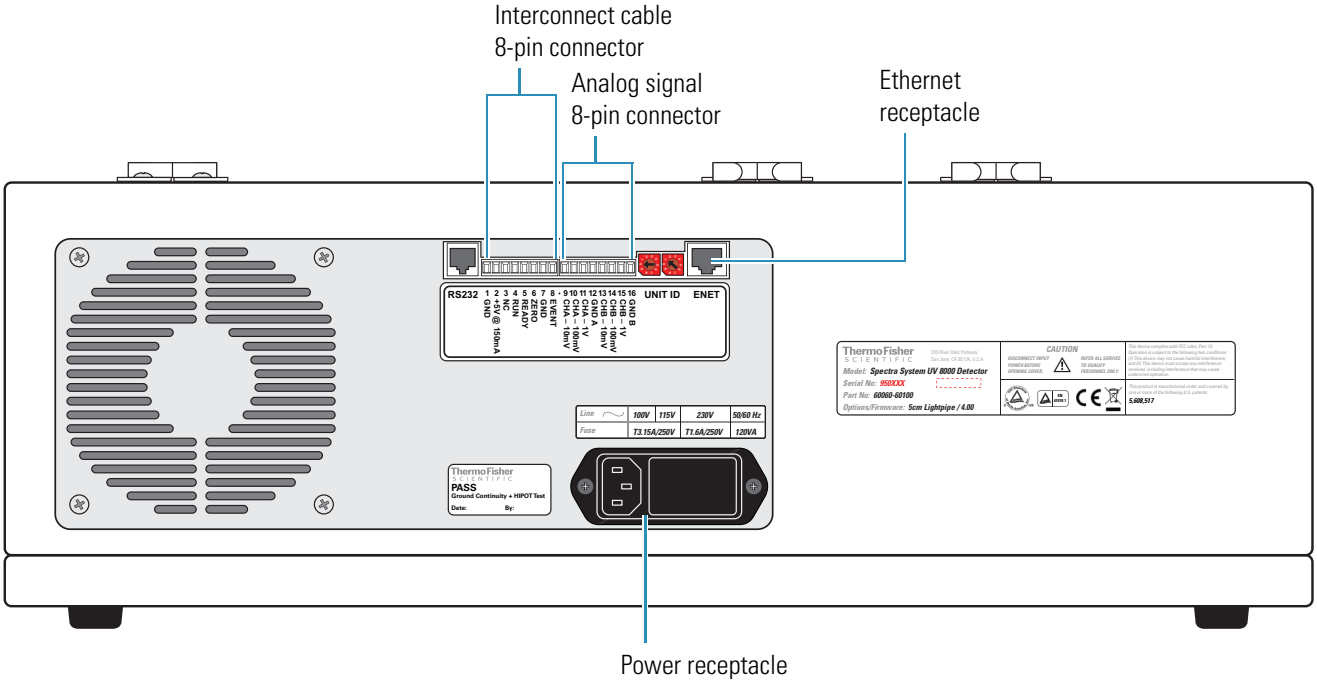
Figure 19. UV8000 adapter cable (P/N 60060-63004)



❖ To make the system connections

1. To connect the pump, connect the cable labeled PUMP to the 8-pin terminal on the back panel of the pump.
2. To connect the autosampler, connect the cable labeled AS to the 12-pin terminal on the back panel of the autosampler.
3. To connect the UV8000 module, do the following:
   a. To connect the UV8000 adapter cable to the system interconnect cable, connect the 12-pin combicon connector (labeled TO A5596-010) of the adapter cable to the combicon connector of the system interconnect cable labeled TO DET (Figure 20).

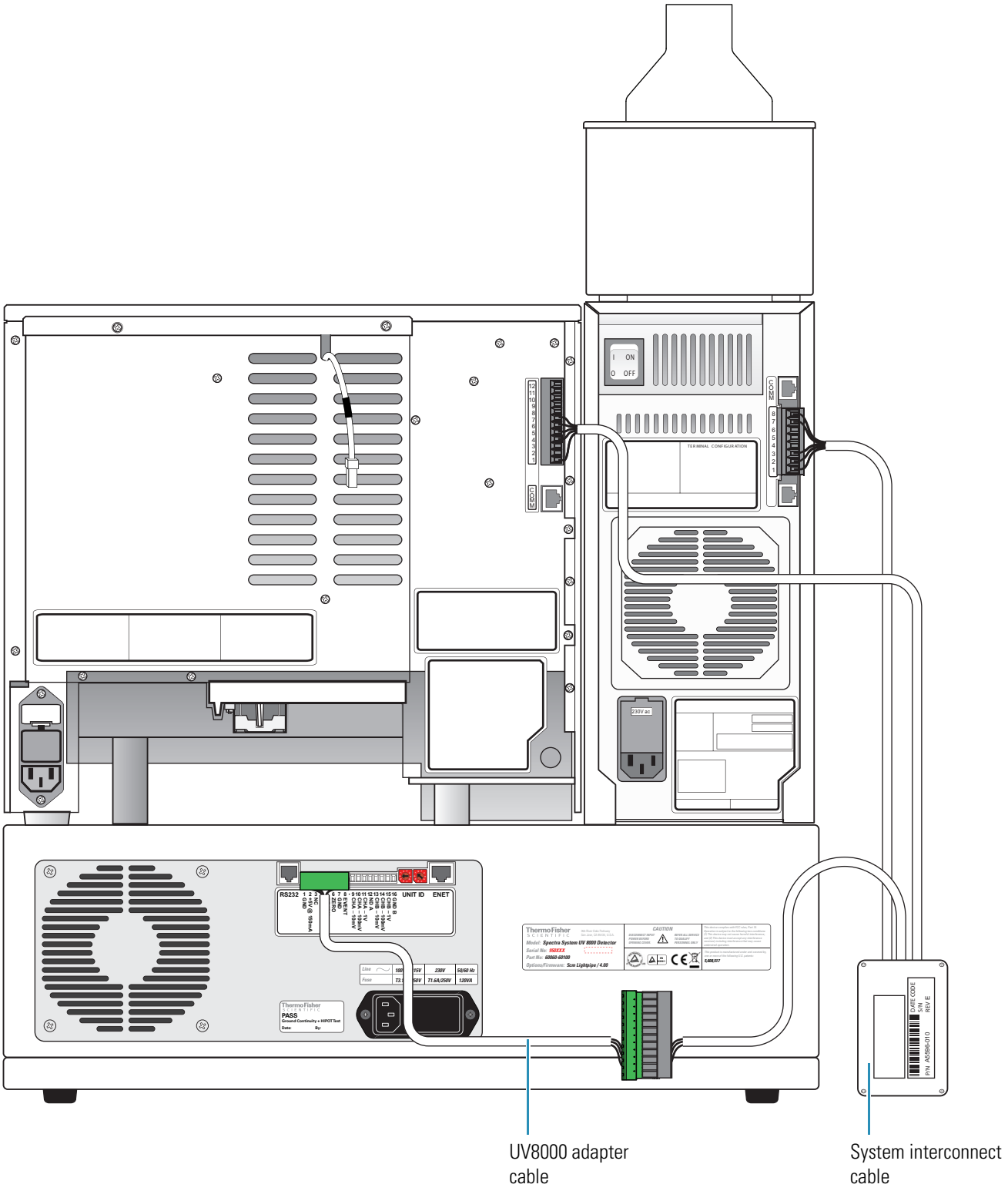
Figure 20. Back panel of SpectraSYSTEM UV8000 Degasser and PDA Detector



b. To connect the adapter cable to the UV8000 module, connect the 8-pin combicon connector (labeled To DET) to pins 1 through 8 on the back panel of the UV8000 module.

Figure 21 shows the back panel connections for the system interconnect cable and the UV8000 module adapter cable.

Figure 21. System interconnect and adapter cable connections



Connecting the Analog Outputs

The installation kit provides two analog signal cables (twin-axial computer cables) to connect the analog outputs from the UV8000 module to other data collection devices.

The analog signal cables have three wires protruding from the ends of the shielded cable. Two of these wires are electrically insulated and carry an analog signal to data collection devices. Typically, the wire with the clear insulation is connected to the positive analog output, and the wire with the black insulation is connected to the signal ground (sometimes referred to as the negative signal). The third wire is not insulated and grounds the cable shielding. The cable shielding reduces signal noise caused by radio frequency interference and is most effective if the bare wire is grounded at just one end.

The ends of the analog signal wires are stripped (1/4 in.) and soldered to allow electrical contact and to prevent fraying.

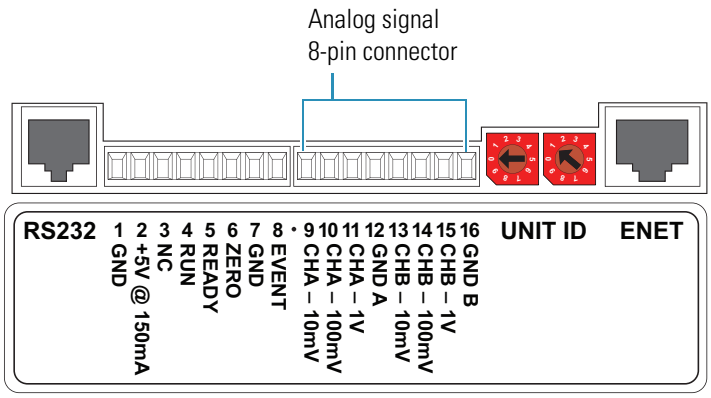
On the UV8000 module's back panel, there are two analog output channels with three different analog voltage outputs per channel: CHA – 10 mV, CHA – 100 mV, CHA – 1 V, CHB – 10 mV, CHB – 100 mV, CHB – 1 V; and a single ground per channel: GND A and GND B. Select the appropriate output voltage for your data collection system.

❖ To make each electrical connection

1. Insert the end of the wire into the appropriate terminal in the 8-pin terminal connector. Hold the wire in place while you tighten the small terminal set screw firmly onto the wire.
2. Insert the terminal connector into the 8-pin analog connector numbered 9 through 16 at the back of the instrument (Figure 22).

IMPORTANT Do **not** connect the detector ground terminals to any earth ground on your data system computer. Doing so leads to an increased noise level and a subsequent decrease in sensitivity.

Figure 22. Analog signal connectors



Setting the Analog Output Voltage

You control the analog outputs from the data system by selecting the acquisition wavelengths, bandwidth, rise time, and zero functions of the detector. These outputs are compatible with data collection systems using any of the three different voltages (10 mV, 100 mV, or 1 V) by selecting the appropriate terminal of the analog output terminal connector (Figure 22).

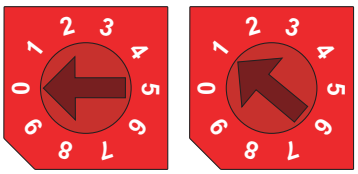
Setting the Unit ID

The UV8000 module is shipped from the factory with the unit ID preset using the two rotary switches located on the back panel. Figure 23 shows the rotary switches preset to a value of 01. The range of values for the unit ID is 01 to 99. The value of 00 is reserved for special service functions.

The unit ID must correspond with the stack ID specified in the Instrument Configuration application. Do not change the unit ID setting for your detector unless you are controlling more than one PDA detector from one computer. For details on configuring your detector, see Chapter 3, "Instrument Configuration," on page 49.

Use a small flathead screwdriver to change the setting of the rotary switches.

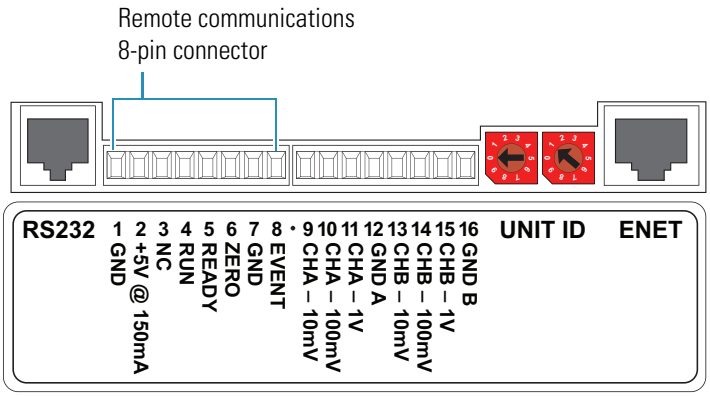
Figure 23. Unit ID rotary switches set to a value of 01



Making Remote Communications Connections

The UV8000 module has the remote communications inputs RUN and ZERO, and the remote communications output EVENT (Figure 24).

Figure 24. Remote communications signals



Tip When the UV8000 module is part of an LC system, connect the system interconnect cable to these terminals (see "Synchronizing the Instrument Modules During an Injection Sequence" on page 25).

RUN

The RUN input receives an inject signal from the autosampler. The system interconnect cable connects the RUN input to the signal from the autosampler.

ZERO

Use the ZERO connection on the back panel of the detector to zero the detector signal output from a remote device (generally at the start or end of each sample run).

You can remotely zero the UV8000 module with either a TTL low signal or with a contact closure.

The system interconnect cable connects the ZERO input to the signal from the autosampler.

EVENT

Use the EVENT output connection to trigger an external device such as a fraction collector. Set up the parameters for this signal in the instrument control method created in the ChromQuest data system.

If you use a TTL signal to trigger the external device, connect the PDA EVENT terminal (pin 8) to the positive pin on the external device input, and connect one of the PDA GND terminals (either pin 1 or 7) to the external device negative pin. The PDA detector portion of the UV8000 module has open collector outputs that require a pull-up resistor (typically 10 kΩ) when connecting to TTL inputs.

Note The external device input terminal might not have markings indicating positive and negative polarity. In this case, connect the PDA EVENT terminal to one of the pins, and connect a PDA GND terminal to the other pin.

If you trigger the external device by contact closure, connect the PDA +5 V output (pin 2) to the positive input terminal of the external device, and connect the PDA EVENT output (pin 8) to the negative input terminal of the external device.

Installing the Solvent Lines

The degassing system within the SpectraSYSTEM UV8000 Degasser and PDA Detector uses standard cap and tubing assemblies. Inlet and outlet tubing is included in the accessory kit.

Note Solvent bottles larger than 1 L will not fit in the solvent bottle holder supplied with the UV8000 module. Use a solvent bottle tray instead.

When shipped, the degasser's tubing may contain a small amount of an isopropyl alcohol-distilled water solution. Be sure that the first filtered, HPLC-grade solvent you use is miscible with water.

CAUTION In a well-ventilated laboratory, the vacuum degasser can safely degas the eluants commonly used in liquid chromatography.

This section contains the following topics:

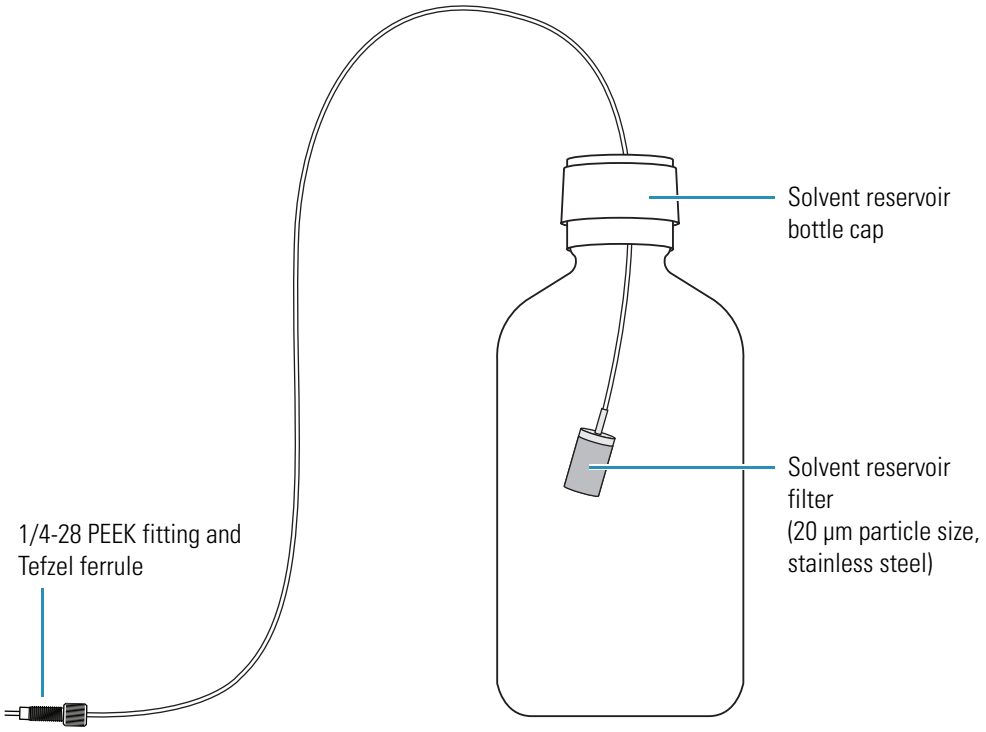
Assembling the Solvent Reservoir Bottles

❖ **To assemble the solvent reservoir bottles**

1. Label one of the four solvent reservoir bottle caps "A."
2. Pull the filter off the end of the solvent line, and then pass the tubing through the solvent reservoir bottle cap labeled A.
3. Reconnect the filter to the end of the solvent line (Figure 25).

IMPORTANT Only use stainless steel, 20 µm particle size sinker frits to terminate the solvent reservoir lines, as provided in the accessory kit.

Figure 25. Solvent reservoir cap assembly with the solvent line assembly



Note Each solvent line has a different color fitting. The colors are yellow, green, orange, and blue. Matching the color of the inlet line fitting to the outlet line fitting is important for ensuring that the correct solvent goes into and out of the degasser lines and on to the pump inlet ports.

4. Insert the solvent reservoir filter and inlet line into one of the solvent reservoir bottles, and screw the cap onto the solvent reservoir bottle until it is secure.

Tip The cap is a two-piece assembly. The upper section (Figure 25) snaps onto a threaded section. You can screw the threaded section onto the bottle and snap on the upper section after installing the tube, or, if you are replacing existing tubing, you can unscrew the entire cap from the bottle.

5. Position the bottle in the solvent bottle holder, allowing the solvent inlet line to hang down along the left side of the system.

6. Repeat step 1 through step 5 for solvents B, C, and D if applicable.

Note The bottles and caps are either supplied as part of the system you purchased, or are part of your current system. Because no additional bottles or caps are supplied with the SpectraSYSTEM UV8000 Degasser and PDA Detector, you might need to reuse the existing bottles and caps.

Connecting the Solvent Lines to the Degasser

Use HPLC-grade solvents that are free of particulate matter. To terminate the solvent reservoir lines, use the stainless steel, 20 µm particle size sinker frit provided in the inlet tubing kit located in the UV8000 module accessory kit.

CAUTION Do not use solvents containing Freon™ and perfluorinated solvents, such as Fluorinert™ and Fomblin™ perfluoro polyether solvents from Solvay. These solvents adversely affect the Teflon AF degassing membrane.

CAUTION To prevent personal injury, observe good laboratory practice when handling solvents, changing tube lines, or both. Consult the pertinent material safety data sheets for the solvents used for HPLC analysis.

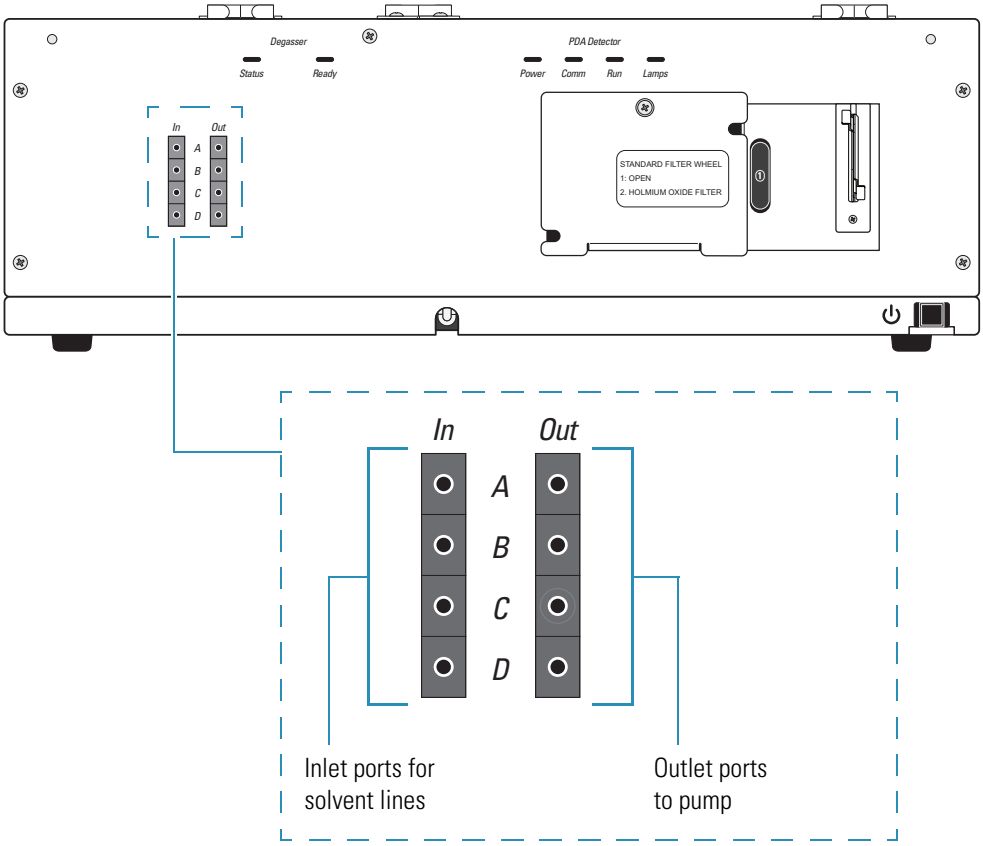
❖ To connect the solvent lines to the degasser

1. If the front cover of the UV8000 module is not already off, gently pull the front cover down and off to remove it (Figure 11 on page 18).
2. Open and remove the front panel of the pump by grasping the bottom of the panel and pulling it forward (Figure 26).

Figure 26. Opening the pump's front panel

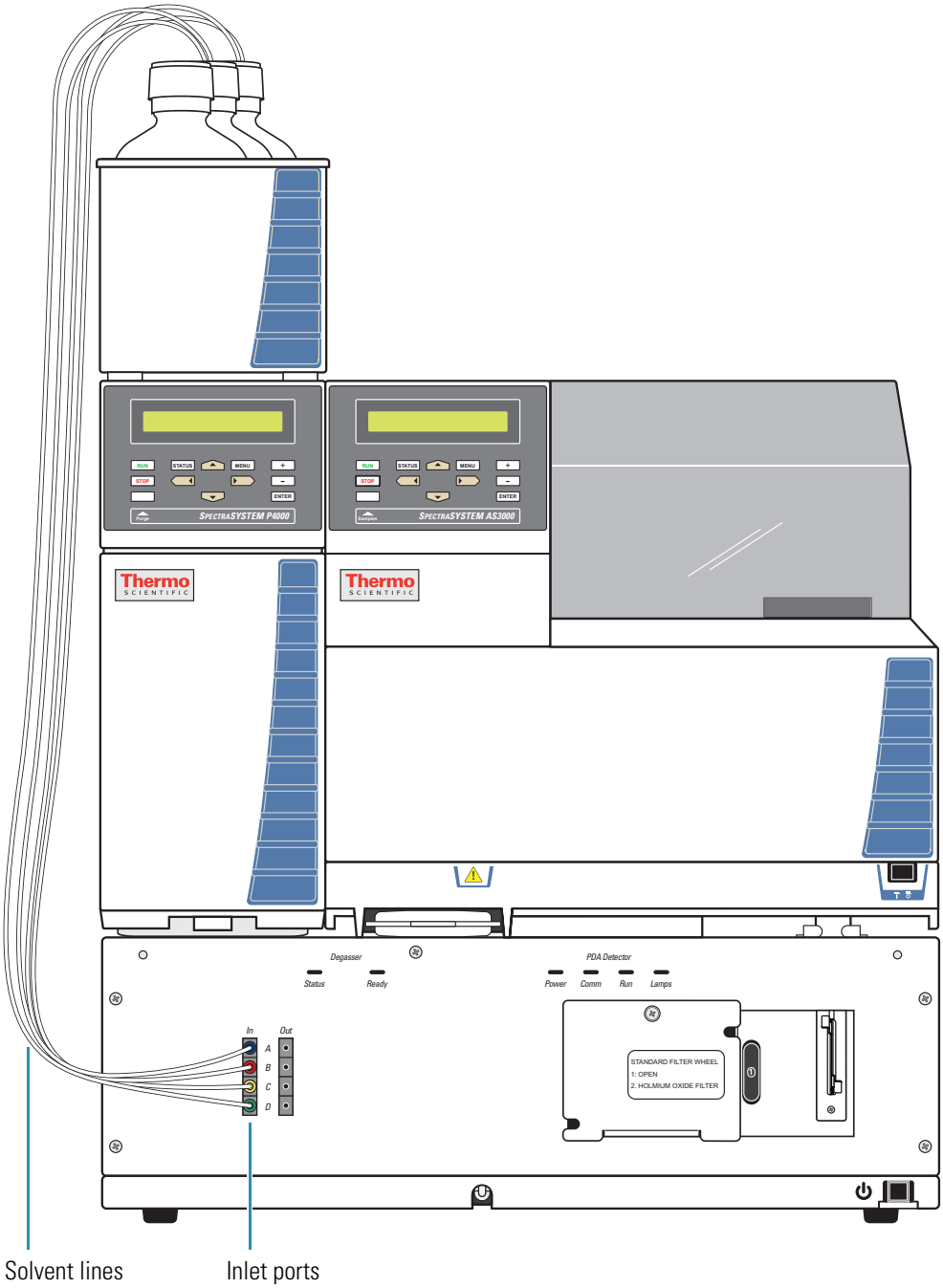
3. Remove the protective caps from the inlet and adjacent outlet ports of the degasser portion of the UV8000 module, which are labeled In and Out, and A through D (Figure 27).

Figure 27. Inlet and outlet ports



4. Connect the solvent lines with their colored flangeless fittings to the inlet ports of the degasser (Figure 28).

Figure 28. Solvent lines connected to the degasser portion of the UV8000 module



Note The bottles and caps are either supplied as part of the system you purchased, or are part of your current system. Because no additional bottles or caps are supplied with the SpectraSYSTEM UV8000 Degasser and PDA Detector, you might need to reuse the existing bottles and caps.

Connecting the Solvent Outlet Lines from the Degasser to the Pump

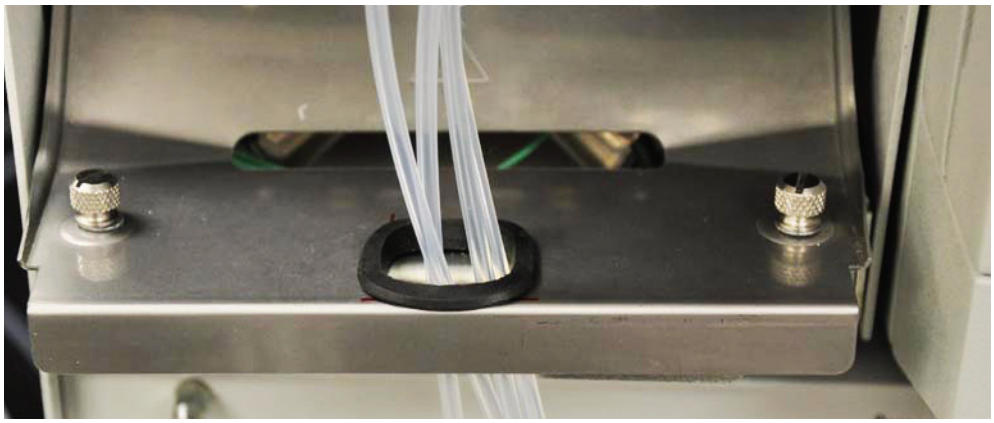
❖ **To connect the solvent outlet lines to a pump with an access port**

1. Cut the supplied 228.6 cm (90 in.) length of tubing into four pieces, each approximately 38 cm (15 in.).

   Note Vary the length depending on which ports you are connecting.

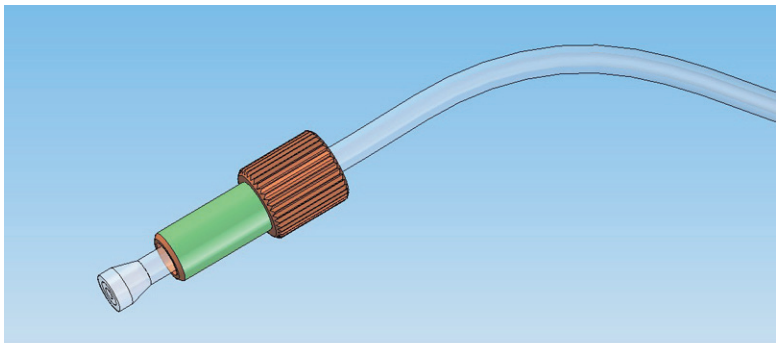
2. Carefully pass the four tubing pieces through the access hole on the pump (Figure 29).

   Figure 29. Degasser tubing routed through the access hole

3. Place a fitting (P/N 00109-02-0002x) onto one end of each tube, followed by a Tefzel™ ferrule (P/N 00101-18223) (Figure 30).

   Figure 30. Fittings on the end of a solvent line

   Note the orientation of the ferrule on the tubing.

4. Place a fitting of the corresponding color (yellow, green, orange, or blue) onto the other end of the outlet line, followed by a ferrule.

5. Connect the lower end of the outlet line to the outlet port on the degasser, matching the color of the fitting on the inlet line to the color of the fitting on the outlet line.

6. Connect up to four solvent lines to the degasser as necessary.

❖ **To connect the solvent lines to a pump without an access port**

1. Cut the supplied 228.6 cm (90 in.) length of tubing into four pieces, each approximately 53.3 cm (21 in.).

   Note Vary the length depending on which ports you are connecting.

2. Place a fitting (P/N 00109-02-0002x) onto each tube, followed by a Tefzel ferrule (P/N 00101-18223) (Figure 30 on page 36). Note the orientation of the ferrule on the tubing.
3. Place a fitting of the corresponding color onto the other end of each tube, followed by a ferrule.
4. Connect as many other solvent lines (up to four) to the degasser as necessary, following steps 1 through 3.

Multiple-solvent Connections

If you plan to use a particular solvent at a flow rate above 1 mL/min, you might consider a parallel flow arrangement. With this arrangement you connect two solvent IN lines to the same reservoir with a tee connector. A second tee connector joins the two corresponding solvent OUT lines to the HPLC pump. This arrangement doubles the amount of membrane available and decreases the flow resistance. If you generally work with three or fewer eluants, it is an advantage to connect at least one set in parallel.

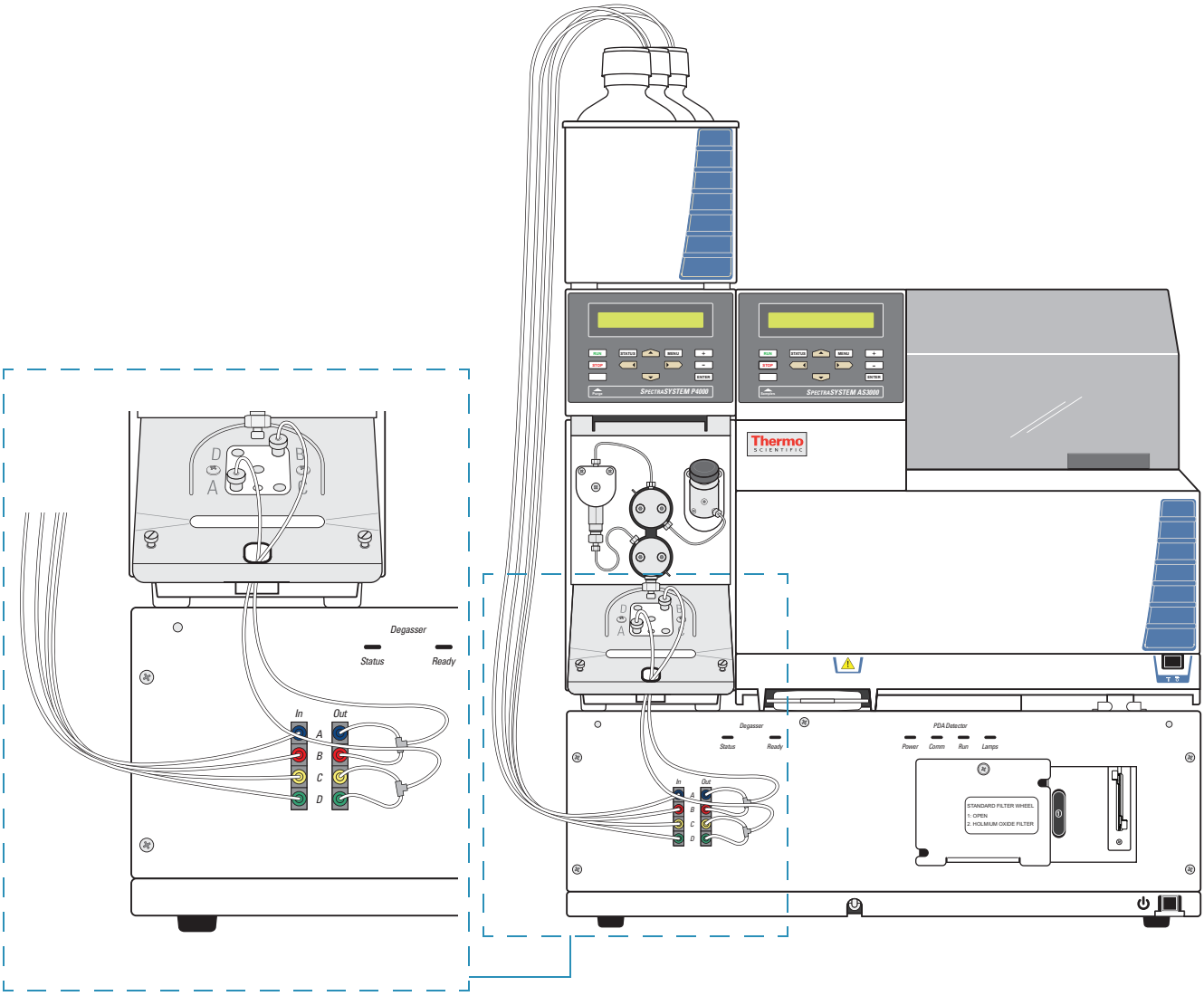
Note The inlet/outlet pairs are bidirectional. If it is more convenient for you to route undegassed solvent **in** on the right side and degassed solvent **out** on the left, you may do so for any inlet/outlet pair.

High flow rates are possible in two ways:

- By using identical solvents in more than one channel, and joining (T'ing) the solvent outlet lines together before they enter the pump.
- By connecting the outputs directly to a quaternary pump, and then adjusting solvent compositions as needed.

Figure 31 is an example of a two-solvent connection.

Figure 31. Typical two-solvent system connections



Priming the Degassing Lines

Follow the procedure below to ensure that the tubing is filled with solvent before attaching to a pump and turning on the degasser.

CAUTION To avoid damaging the degassing unit and the piston seals, prime the solvent lines by using a syringe to pull solvent through the solvent lines into the degassing unit.

Do not *push* the solvent into the degasser. Pushing the solvent can generate excessive pressure and rupture the degassing membranes. The maximum recommended pressure on the membrane is 145 PSI.

Do not use the pump to prime the solvent lines and the degassing membranes. Drawing excessive amounts of air through the liquid ends can damage the piston seals.

CAUTION Some solvent might spill in the process of connecting the solvent line to the pump. Take caution to wear eye protection and gloves during this process and wipe up any spills that occur.

❖ To prime the degassing lines

1. Screw the supplied luer fitting into outlet line “A” and finger tighten.
2. Attach the syringe to the luer fitting, making a leak-free connection (Figure 32).

Figure 32. Syringe attached to a degasser port outlet line

3. Slowly withdraw the syringe plunger so that air is drawn out of the degasser and solvent is drawn into the inlet tube.

   Each degassing channel holds ≈470 µL of solvent.

4. Continue to draw solvent until you are sure that the tubing is full of solvent and that there are no air bubbles in the solvent being drawn out.
5. Remove the syringe and luer fitting from the inlet tube and immediately connect the inlet tube to the corresponding port (A, B, C, or D) on the pump and finger tighten.

Note Ensure that the label on the port (A, B, C, or D) on the pump matches the corresponding port on the degasser.

A small amount of solvent might spill from the degasser's outlet as you connect the pump's tubing.

Note Because pumps differ, the fitting provided may not fit. You will need a special connector to provide a secure connection between the degasser's outlet and your pump's inlet. If you are not able to use the supplied connector, stop now. Obtain the proper connector before proceeding.

6. Repeat steps 1-5 for each solvent line.
7. Dispense any air and solvent into a waste container.

   To prevent contamination from entering the inside of the degas tubing, keep unused ports plugged with the protective caps shipped with the UV8000 module.

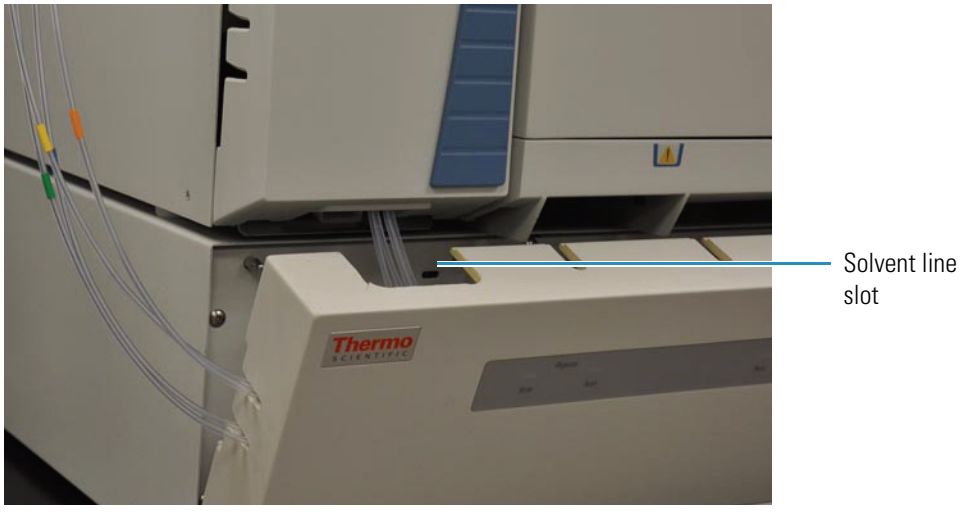
Note Due to the added flow resistance, Thermo Fisher Scientific does not recommend routing the solvent from the outlet of one channel to the inlet of another.

Reinstalling the Front Covers

❖ **To reinstall the front covers if the pump has a solvent line access port**

1. Replace the front panel of the UV8000 module by inserting the tabs on the bottom of the cover into the slots on the front lower edge of the chassis.
2. Route the solvent lines through the slot on the top of the cover (Figure 33).

   Figure 33. UV8000 module solvent line slot (top)



3. Snap the cover into place.
4. Replace the front cover of the pump by placing the top edge underneath the keypad panel and snapping the lower edge into place (Figure 26 on page 33).

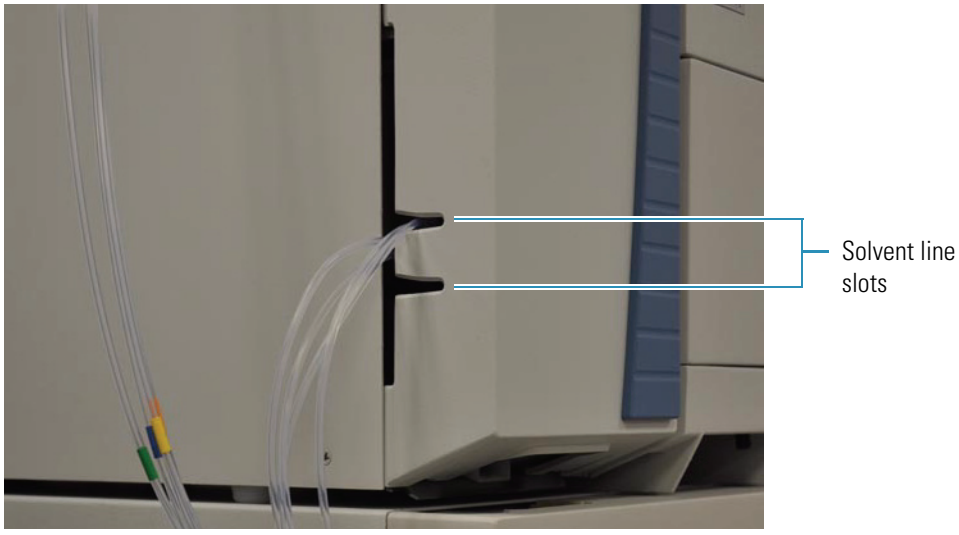
❖ **To reinstall the front covers if the pump does not have a solvent line access port**

1. Replace the front panel of the UV8000 module by inserting the tabs on the bottom of the cover into the slots on the front lower edge of the chassis.
2. Route the solvent lines through the slots on the left side of the cover (Figure 34).

Figure 34. UV8000 module solvent line slots (side)

3. Snap the cover into place.
4. Replace the front cover of the pump by placing the top edge underneath the keypad panel, routing the solvent lines through the slots on the left side of the front cover (Figure 35).

Figure 35. Solvent line slots on the left side of the pump cover



5. Press the lower edge of the pump cover into place.

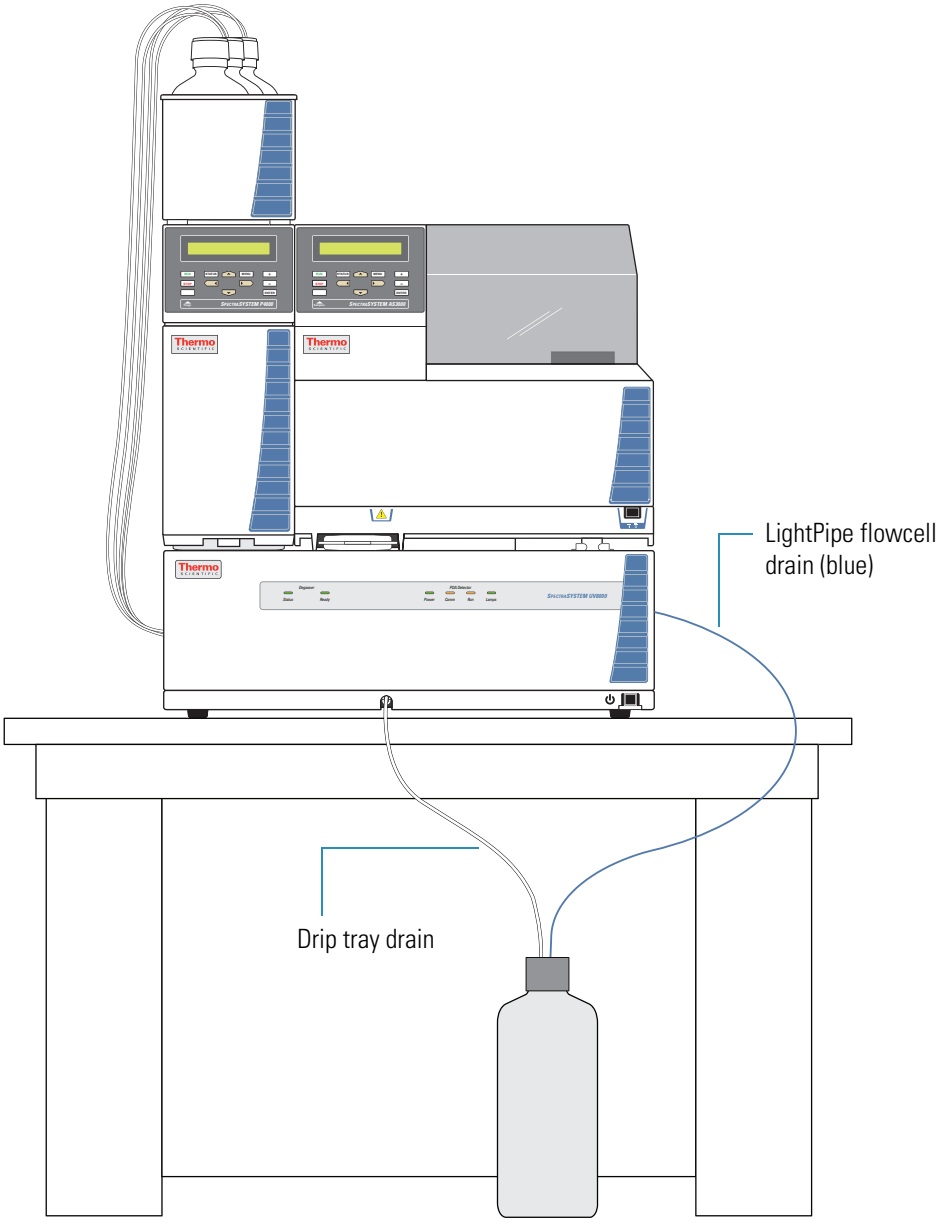
Making the Drainage Connections

Before you start the solvent flow from the pump, make sure that the solvent flow from the outlet end of the LightPipe flowcell is connected to a sealed waste system.

❖ To make the drainage connections

1. Connect the UV8000 module's drip tray drain to a sealed waste bottle using the waste tubing (P/N F5034-040) provided in the accessory kit (Figure 36).

   Figure 36. Drain connections to waste bottle



2. Connect the LightPipe flowcell outlet tubing to a sealed waste bottle (Figure 36).

Changing the Polarity of the Remote Outputs

The PDA detector portion of the UV8000 module has two remote outputs: READY and EVENT (Figure 22 on page 28). The outputs are open collectors and are each capable of sinking < 30 mA at 30 V dc, suitable for connecting to TTL and other families of ICs. In addition, there is a 5 V output that supplies +5 V dc at 150 mA maximum that you can use for testing digital input signals. When connecting to TTL inputs, a pull-up resistor (typically 10 kΩ) is required across the +5 V output and the open collector input connection if one is not built into the external device.

The polarity settings (active high or active low) of these outputs must match those of the inputs of connecting equipment.

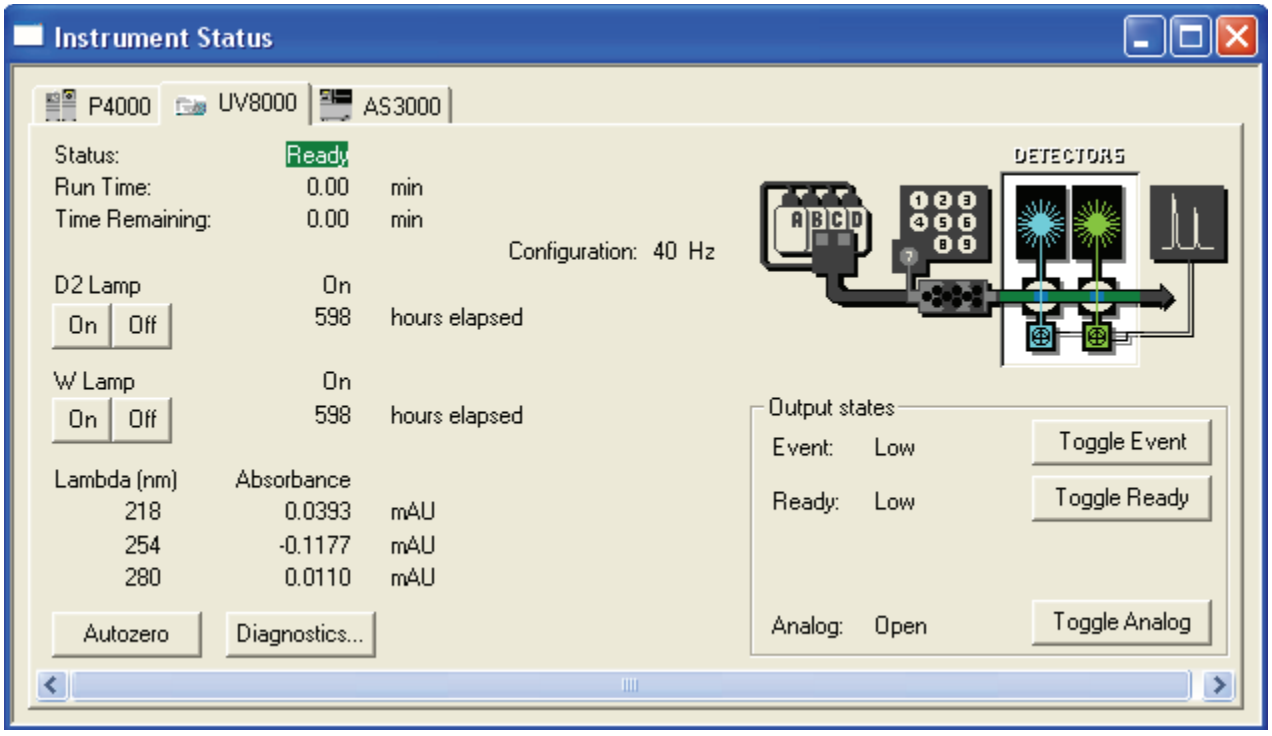
❖ To change the polarity of the remote outputs

1. Install the ChromQuest data system if you have not already done so.
2. Add the UV8000 module to the instrument configuration (see Chapter 3, "Instrument Configuration," on page 49).
3. Open the Instrument window.
4. Choose **Control > Instrument Status**.

   The Instrument Status window appears.
5. Click the **UV8000** tab.

   The UV8000 page of the Instrument Status window appears (Figure 37).

Figure 37. UV8000 page of the Instrument Status window



6. In the Output States area, click the appropriate button.

Turning On the UV8000 Module for the First Time

❖ **To turn on the UV8000 module for the first time**

1. Ensure that the power switch at the front of the module is in the Off position (released or out position).
2. Ensure that the UV8000 module is properly connected to the data system computer.
3. Ensure that the data system lists the appropriate configuration settings for the PDA detector.

   For information on instrument configuration, see Chapter 3, "Instrument Configuration," on page 49.
4. Check the fuse size.

   You can operate the PDA detector at 100/115V or 230V. However, you must ensure that the appropriate fuses are installed (Figure 38 and Table 5).

Figure 38. Power supply module and the power line label

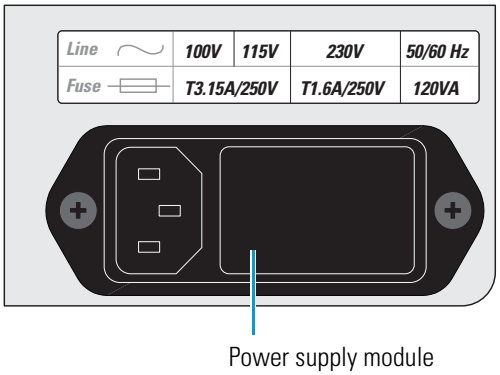


Table 5. Fuses

Line power voltage	Fuse size	Part #
100/115V	T3.15 A	00006-02-00010
230V	T1.6 A	00006-02-00011

5. Plug the power cord into the power entry module on the back panel of the UV8000 module and connect it to the power source.
6. Turn the power on by pushing in the power button on the front panel (Figure 8 on page 9).

   The Power LED turns amber as it downloads the operational file, and then turns solid green. If it does not light at all, see Chapter 6, "Troubleshooting."

Completing the Installation and Verifying Operation

The SpectraSYSTEM UV8000 Degasser and PDA Detector is calibrated at the factory. During installation, a Thermo Fisher Scientific field service engineer adjusts the light throughput and recalibrates the detector.

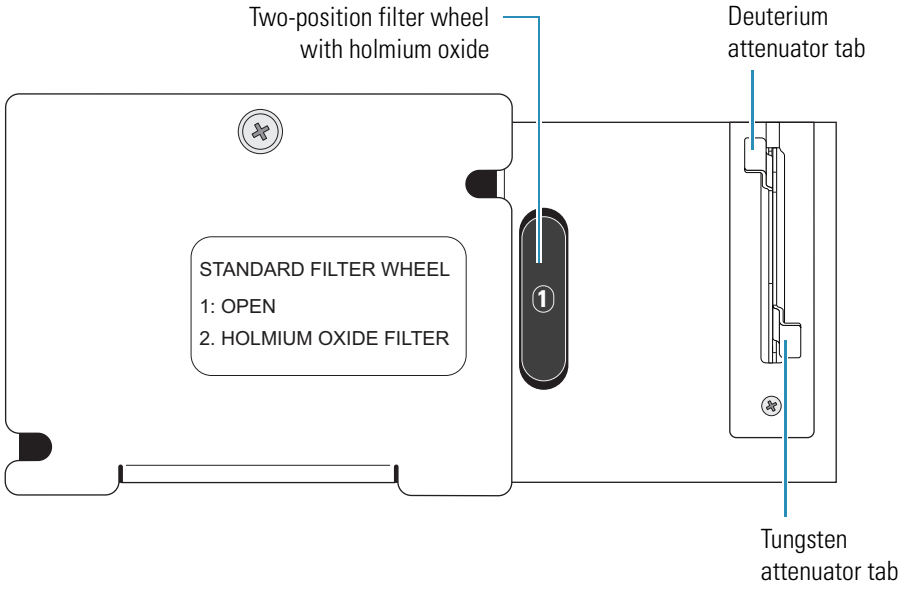
The PDA detector portion of the UV8000 module uses the holmium oxide spectrum to verify its wavelength accuracy. A two-position filter wheel (Figure 39), which is accessible from the front panel of the UV8000 module, contains this calibration solution.

For optimal performance, recalibrate the PDA detector and adjust its attenuators as part of a routine maintenance program and whenever you move the instrument, replace the LightPipe flowcell, or replace a lamp.

Because the deuterium lamp emits less light with use, monitor the integrated light intensity of the diodes as part of a routine maintenance program, and adjust the attenuators when you notice an increase in baseline noise. Because the diode array scan rate affects the integrated light intensity, you must also adjust the attenuators when you modify the PDA detector's configuration by changing the diode array scan rate (see Chapter 3, "Instrument Configuration," on page 49).

The tabs that control the position of the attenuators are located on the front panel of the UV8000 module (Figure 39). To adjust the light throughput, you push the attenuator tabs up or down as you view the light intensity from your data system. Pushing the left tab up or down controls the light throughput from the deuterium (D2) lamp. Pushing the right tab up or down controls the light throughput from the tungsten-halogen (W) lamp.

Figure 39. Attenuator tabs and filter wheel



For information on calibrating the PDA detector and adjusting the light throughput to the diode array, see Chapter 4, "Diagnostics for the PDA Detector."

Instrument Configuration

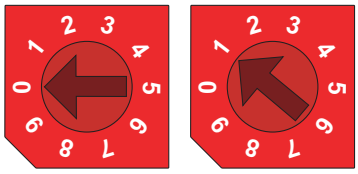
The SpectraSYSTEM UV8000 Degasser and PDA Detector has these manual controls:

- On/Off switch on the lower right corner of the front of the unit (Figure 1 on page 1).
- Manual attenuators for adjusting the light throughput from the lamps (Figure 39 on page 47).
- Holmium oxide wheel for verifying the calibration that you access from the front panel (Figure 39 on page 47).

The chromatography data system controls all other instrument control functions.

To control the detector, you must add it to the instrument configuration for your data system and specify its stack ID and diode array scan rate. You set the unit ID by adjusting the two rotary switches on the back panel of the detector. The switches are set to 01 at the factory (Figure 40). Do not adjust the switches unless you are controlling more than one PDA detector from the same data system computer.

Figure 40. Unit ID set to 01



The diode array scan rate is the unfiltered rate at which the PDA detector samples the light intensities for the diode array. You can set the UV8000 module to scan the array at a 20, 40, or 80 Hz sampling rate.

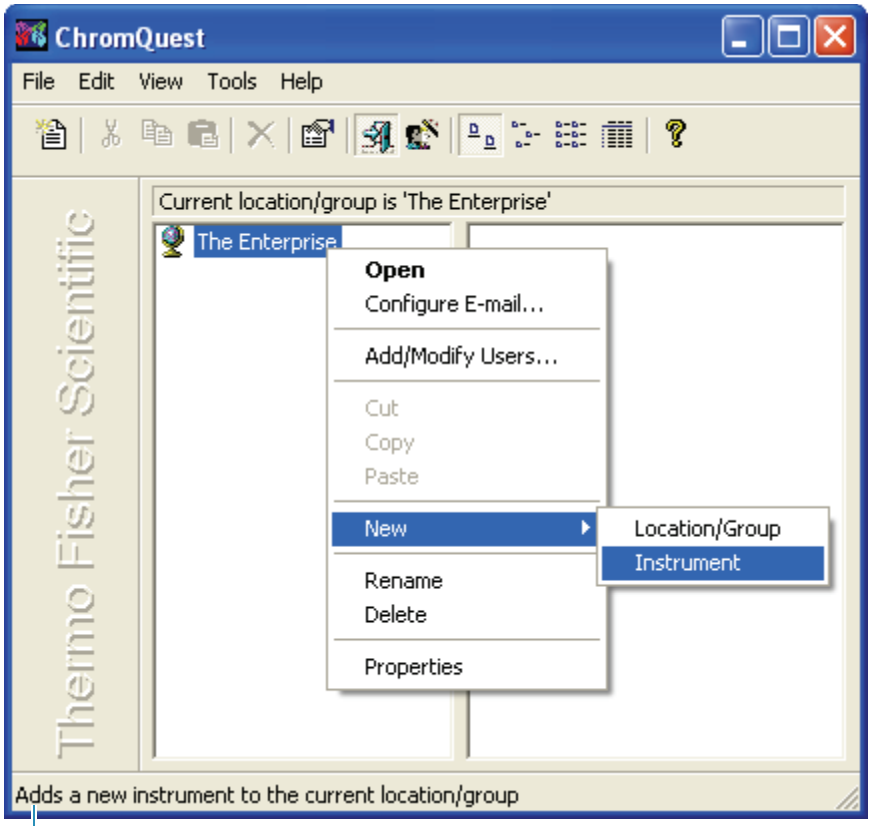
You add an instrument for each SpectraSYSTEM LC system that you want to control from the data system computer and specify the configuration options for the instrument's modules from the main window of the ChromQuest data system. You can configure as many systems as you want; however, you must have a license for every system that you want to run simultaneously.

Adding a New SpectraSYSTEM Instrument to the Enterprise

❖ **To add a new SpectraSYSTEM instrument to the Enterprise**

1. From the ChromQuest main window, right-click **The Enterprise**, and then choose **New > Instrument** from the shortcut menu (Figure 41).

Figure 41. Adding an instrument to the Enterprise



The New Instrument icon appears in the right pane.

2. To open the Instrument Configuration dialog box, do one of the following:

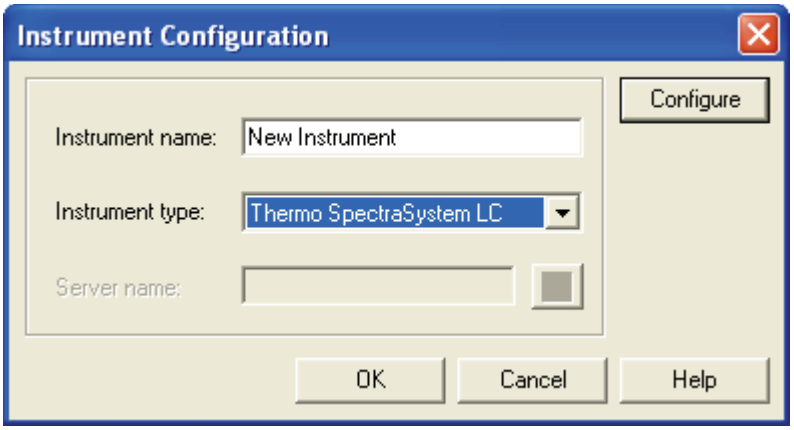
   - Select the new instrument icon, and then choose **File > Configure > Instrument**.

     –Or–

   - Right-click the new instrument icon and choose **Configure > Instrument** from the shortcut menu.

     The Instrument Configuration dialog box appears (Figure 42).

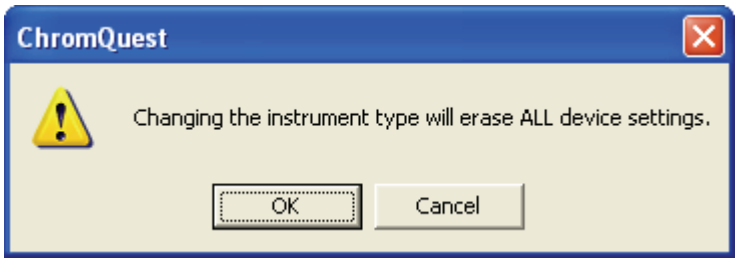
Figure 42. Instrument Configuration dialog box



3. In the Instrument Name box, type a name for the instrument to distinguish it from other instruments with different configurations or stack IDs.
4. In the Instrument Type list, select **Thermo SpectraSystem LC**.

   The following message box appears (Figure 43).

   Figure 43. Message that appears when you select an instrument type



5. Do one of the following:
   - To create a new instrument, click **OK** to close the message box.

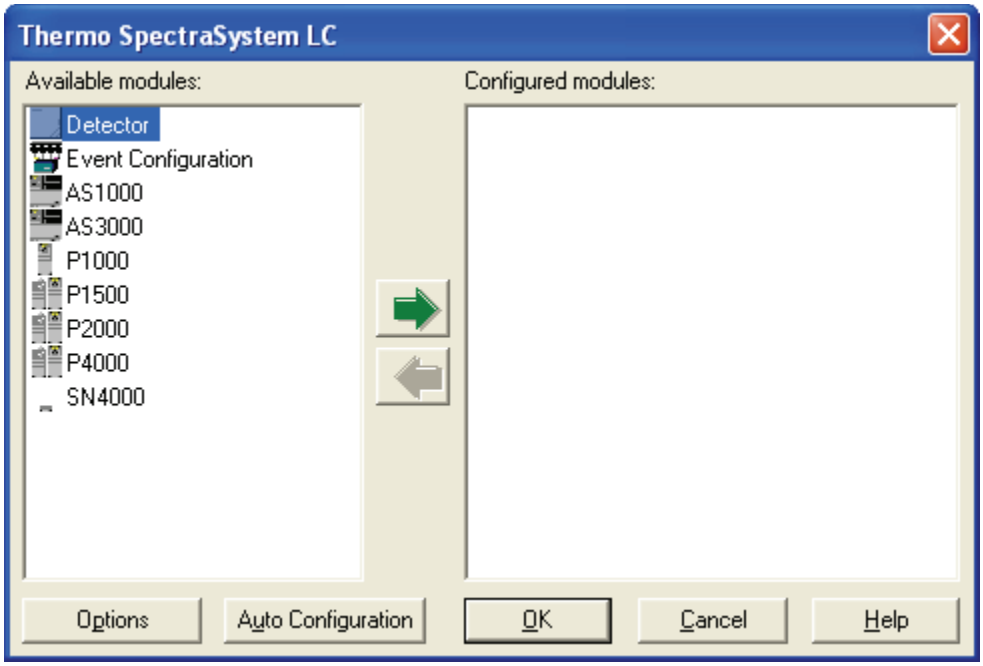
     –Or–

   - To modify the configuration of an existing instrument, click **Cancel** and do not make a selection in the Instrument Type list.

     IMPORTANT To change the instrument's configuration, close the Instrument window if it is open. You can modify the instrument's configuration without closing the Instrument window, but the changes will not take effect until you close the Instrument window.
6. Click **Configure**.

   The Thermo SpectraSystem LC dialog box appears (Figure 44).

Figure 44. Thermo SpectraSystem LC dialog box



7. To add a SpectraSYSTEM pump, in the Available Modules pane, double-click the icon for the pump.

   A copy of the pump icon appears in the Configured Modules pane.

8. To add a SpectraSYSTEM autosampler, double-click the icon for the autosampler.

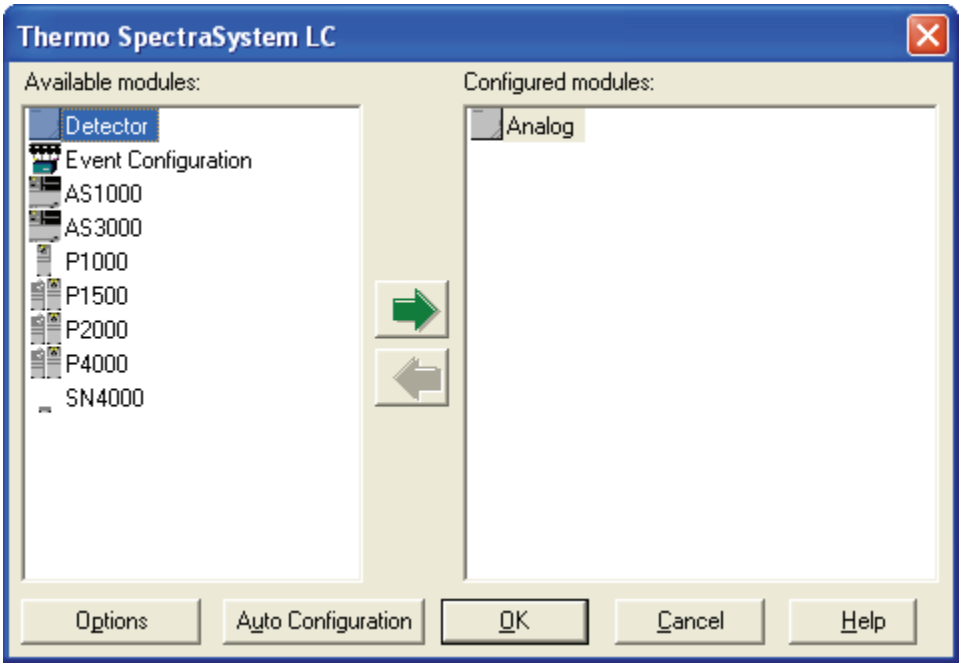
   A copy of the autosampler icon appears in the Configured Modules pane.

9. To add the UV8000 module, do the following:

   a. Double-click  (Detector).

      The Analog icon appears in the Configured Modules pane (Figure 45).

Figure 45. Thermo SpectraSystem LC dialog box with the Analog icon in the Configured Modules pane

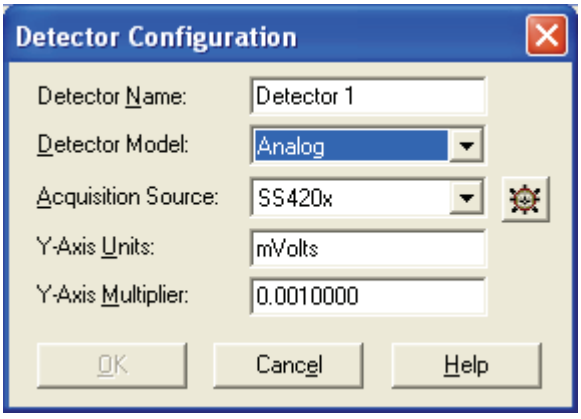


b. In the Configured Modules pane, double-click 

.

The Detector Configuration dialog box appears (Figure 46).

Figure 46. Detector Configuration dialog box

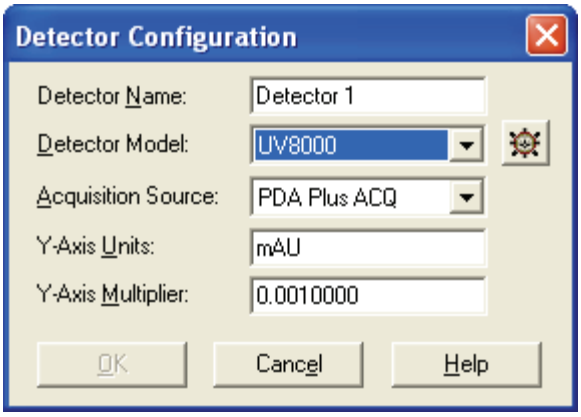


c. (Optional) In the Detector Name box, type a name for the UV8000 module.

d. In the Detector Model list, select **UV8000**.

In the Acquisition Source list, the selection automatically changes to PDA Plus ACQ (Figure 47).

Figure 47. Detector Configuration dialog box with the UV8000 selection



e. In the Y-Axis Units box, type the units to be displayed on the *y* axis of chromatograms.

For example, type microvolts or mAU, depending on the units of measurement. The ChromQuest data files store it in microvolts.

f. In the Y-Axis Multiplier box, type the appropriate conversion factor for the units you want to display.

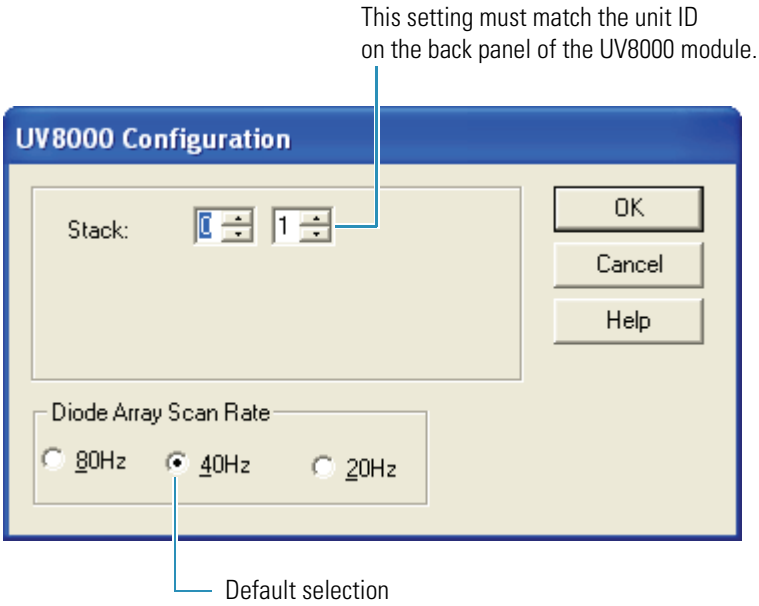
The ChromQuest data system normally displays the *y* axis for chromatograms in volts. If you want to display the data in another unit of measurement, enter the appropriate conversion factor. The following table shows commonly used *y*-axis labels and their corresponding *y*-axis multipliers.

***y*-Axis label**	***y*-Axis multiplier**
Volts or AU	0.000001
Millivolts or mAU	0.001
Microvolts or microAU	1

g. Click  .

The UV8000 Configuration dialog box appears (Figure 48).

Figure 48. UV8000 Configuration dialog box



h. Specify the configuration options for the UV8000 module.

   For information about the options in the dialog box, see the online Help.

i. Click **OK** to save the settings and close the UV8000 Configuration dialog box.

10. Specify configuration options for the other modules.
11. Click **OK** to accept the configuration and close the Thermo SpectraSystem LC dialog box.

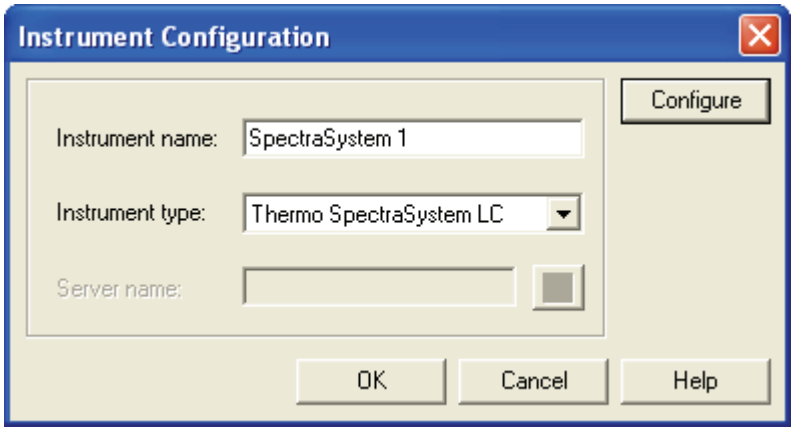
Configuring the UV8000 PDA Detector

❖ **To configure the PDA detector portion of the UV8000 module**

1. If you have not already created a SpectraSYSTEM instrument with a PDA Detector, see "Adding a New SpectraSYSTEM Instrument to the Enterprise" on page 50.
2. In the ChromQuest main window, right-click the icon for your SpectraSYSTEM instrument.
3. From the shortcut menu, choose **Configure > Instrument**.

   The Instrument Configuration dialog box appears. The Instrument name box contains the name of your instrument and the Instrument type list shows the selection of the Thermo SpectraSystem LC (Figure 49).

Figure 49. Instrument Configuration dialog box with the information for an existing SpectraSystem instrument

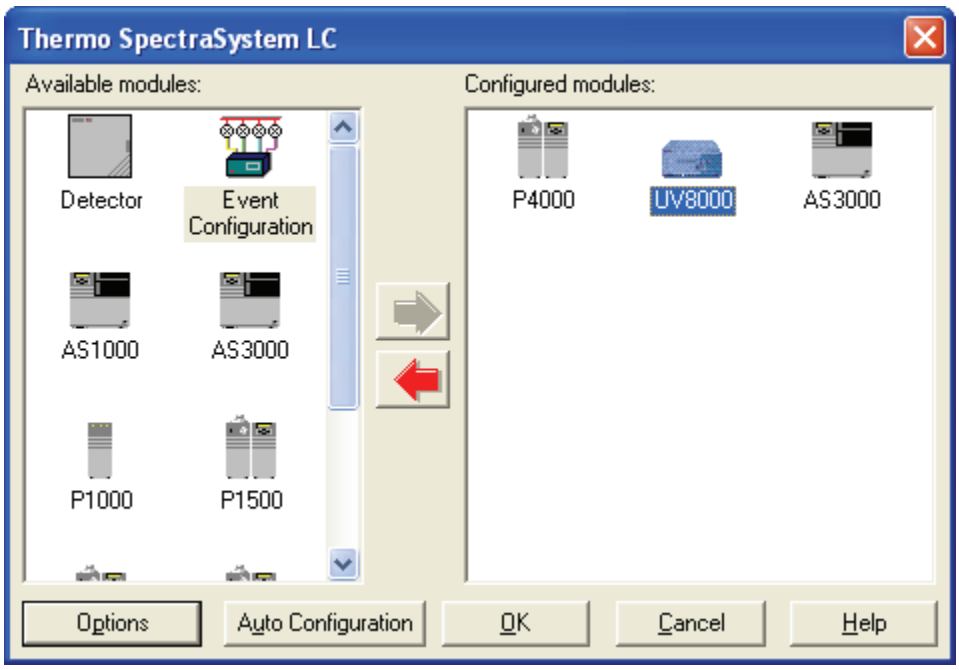


4. Click **Configure**.

   The Thermo SpectraSystem LC dialog box appears. The Configured modules pane contains the configured modules for the instrument (Figure 50).

Tip Figure 50 shows large icons for the modules. To change the display from small to large icons, right-click the pane and choose **Large icons** from the shortcut menu.

Figure 50. Thermo SpectraSystem LC dialog box with configured modules



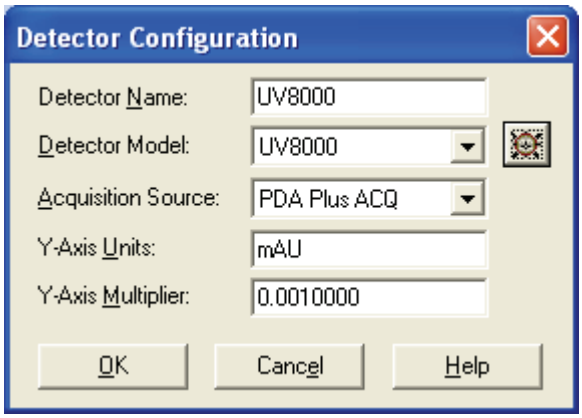
5. In the Configured modules pane, double-click 

.

If the Configured modules pane does not contain a UV8000 module, follow the instructions in step 9 of "Adding a New SpectraSYSTEM Instrument to the Enterprise" on page 50.

The Detector Configuration dialog box appears (Figure 51). The Detector Name box contains the user-specified name and the Detector Model list shows the selection of the UV8000 module.

Figure 51. Detector Configuration dialog box for an existing instrument configuration



6. Click  .

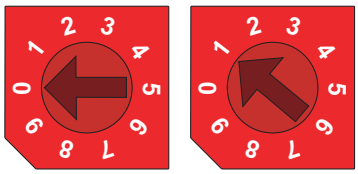
   The UV8000 Configuration dialog box appears (Figure 48 on page 55).

7. In the Stack boxes, type or select the stack address.

   The stack setting must match the unit ID setting on the back panel of the detector. The unit ID consists of a pair of rotary switches. If you are controlling a single UV8000 module from the data system computer, leave this setting at its factory default of 01.

IMPORTANT If the stack ID does not match the unit ID, the data system cannot establish communication with the detector. When you open the (online) Instrument window, the Comm LED on the left door of the detector remains amber.

Figure 52. Unit ID set to 01



8. In the Diode Array Scan Rate area, select the appropriate scan rate for your application.

   The default selection is 40 Hz.

   For best results, select the appropriate diode array scan rate based on the expected baseline peak widths for your application.To optimize peak detection and integration, set up the detector to acquire at least 20 data points across the baseline width (W_b) of the narrowest peak in your chromatograms.

Baseline peak width (seconds)	Data rate or scan rate (Hz)
$W_b \leq 0.5$	80
$0.5 < W_b < 1$	40
$1 \leq W_b < 2$	20

IMPORTANT When you change the diode array scan rate, you must adjust the light throughput to the diode array.

IMPORTANT The diode array scan rate affects the detector noise level. When you are developing a validated HPLC method, record the configuration setting for the diode array scan rate.

9. Click **OK** to accept the settings and close the UV8000 Configuration dialog box.
10. Click **OK** to accept the configuration and close the Thermo SpectraSystem LC dialog box.

Diagnostics for the PDA Detector

This chapter describes the diagnostics available from the ChromQuest data system. Use the diagnostics program to check the lamp performance, calibrate the SpectraSYSTEM UV8000 Degasser and PDA Detector, and view the PDA detector's error log.

To perform diagnostics from the ChromQuest data system, connect the UV8000 module to the data system computer, configure the UV8000 module as part of an instrument in the ChromQuest Enterprise, and turn on the UV8000 module.

If you move the UV8000 module, replace lamps, install a new LightPipe flowcell, or change the configured diode array scan rate for the detector, the system performance can change. With use, the deuterium lamp produces less and less light, so the system performance changes as the lamp's remaining lifetime hours decrease.

For information on configuring your SpectraSYSTEM UV8000 Degasser and PDA Detector, see Chapter 3, "Instrument Configuration," on page 49.

Contents

To verify the proper operation of the PDA detector, follow these procedures:

- "Monitoring Lamp Performance" on page 62
- "Adjusting the Light Throughput" on page 67
- "Calibrating the PDA Detector" on page 70

Accessing the Direct Controls for the SpectraSYSTEM UV8000 Module

❖ **To access the SpectraSYSTEM UV8000 module direct controls**

1. From the computer desktop, choose **Start > All Programs > Chromatography > ChromQuest**.

   The ChromQuest main window appears.

2. Double-click the instrument icon that represents your LC stack.

   The Instrument window appears.

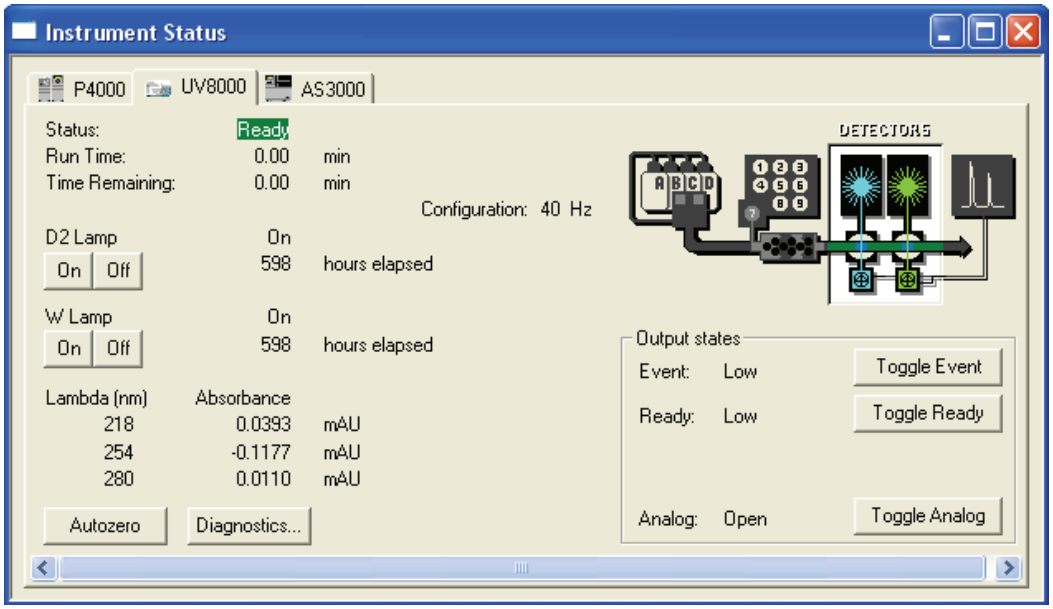
3. In the menu bar, choose **Control > Instrument Status**.

   The Instrument Status window appears.

4. Click the **UV8000** tab.

   The UV8000 page appears (Figure 53).

Figure 53. UV8000 page of the ChromQuest Instrument Status window

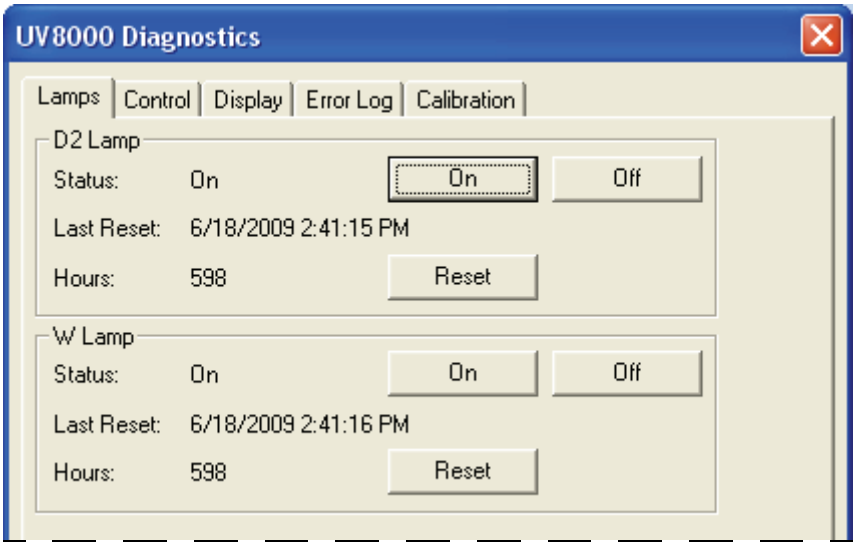


❖ **To access the diagnostics for the UV8000 module**

1. Open the UV8000 page of the Instrument Status window (see previous procedure).
2. Click **Diagnostics**.

   The UV8000 Diagnostics dialog box appears with the Lamps page displayed (Figure 54).

Figure 54. Lamps page of the UV8000 Diagnostics dialog box



Controlling the Lamps

From the ChromQuest data system, you can turn the lamps on or off and view the lamp's usage hours from the UV8000 page of the Instrument Status window or from the Lamps page of the UV8000 Diagnostics dialog box.

The UV8000 module keeps track of the number of hours each lamp has been operating. The deuterium lamp has a lifetime of approximately 2000 hours and the tungsten lamp has a lifetime of approximately 2500 hours. The useful lamp lifetime of the deuterium lamp depends on the acceptable level of detector noise for your application (see "Lamp Lifetime and Detector Noise" on page 5).

As deuterium lamps age, they emit less light, which results in increased baseline noise. If the noise level of your detector signal is unacceptable and cleaning the LightPipe flowcell does not help, use the diagnostic features of the software to determine the cause of the problem. If light output becomes too low and adjusting the attenuators as described in "Adjusting the Light Throughput" on page 67 does not help, replace the lamps (see "Replacing the Lamps" on page 88).

❖ **To control the lamps from the Lamps page**

1. Open the UV8000 Diagnostics dialog box (see "Accessing the Direct Controls for the SpectraSYSTEM UV8000 Module" on page 60).
2. Click the **Lamps** tab.

   The Lamps page appears (Figure 54).

   Note The intensity of the deuterium lamp falls off very slightly over a period of time after it is turned on. Plan to wait at least one hour for the lamp to stabilize after a cold start before collecting data in the UV region.

3. Record the status and usage of each lamp.

   Note Avoid indiscriminately clicking either Reset button. Click them only after you replace their associated lamp with a new one.

Use the Lamps page in the ChromQuest data system for lamp maintenance and control. Three direct control buttons for each lamp are available on this page: On, Off, and Reset.

❖ **To use the lamp controls on the Lamps page**

- In the D2 Lamp area, click **On** to ignite the deuterium lamp.

  The Status readback displays Starting during the 10-second ignition period, and then it changes to On. If there is a problem with the lamp, the Status readback displays Failed.

- In the W Lamp area, click **On** to turn on the tungsten lamp.

  The tungsten lamp turns on immediately. If there is a problem with the lamp, the Status readback displays Failed.

- To reset the stored total run time for the associated lamp to zero, click **Reset**. This updates the Last Reset readback to the current date and time, After you replace a lamp, reset its lamp usage hours to zero.

Monitoring Lamp Performance

With use, the deuterium lamp emits less and less light. As the light output from the deuterium lamp decreases, the detector noise increases. For information on the typical lamp lifetime, see "Controlling the Lamps" on page 61.

To monitor and track lamp performance from the ChromQuest data system, follow these procedures:

- "Viewing an Intensity Scan," next section
- "Recording the Performance of the Lamps" on page 66

Viewing an Intensity Scan

❖ To monitor lamp performance

1. Open the Instrument window for your LC system:
   a. From the computer desktop, choose **Start > All Programs > Chromatography > ChromQuest.**

      The ChromQuest main window appears.

   b. Double-click the icon that represents your LC stack.

      The Instrument window appears.
2. Create and download a method that pumps 100% HPLC-grade methanol or HPLC-grade water at a constant flow rate of 1 mL/min.
3. Turn on the lamps and check their status (see "Controlling the Lamps" on page 61).

   Wait for one hour for both lamps to equilibrate.
4. Open the UV8000 Diagnostics dialog box (see "Accessing the Direct Controls for the SpectraSYSTEM UV8000 Module" on page 60).
5. Click the **Control** tab.

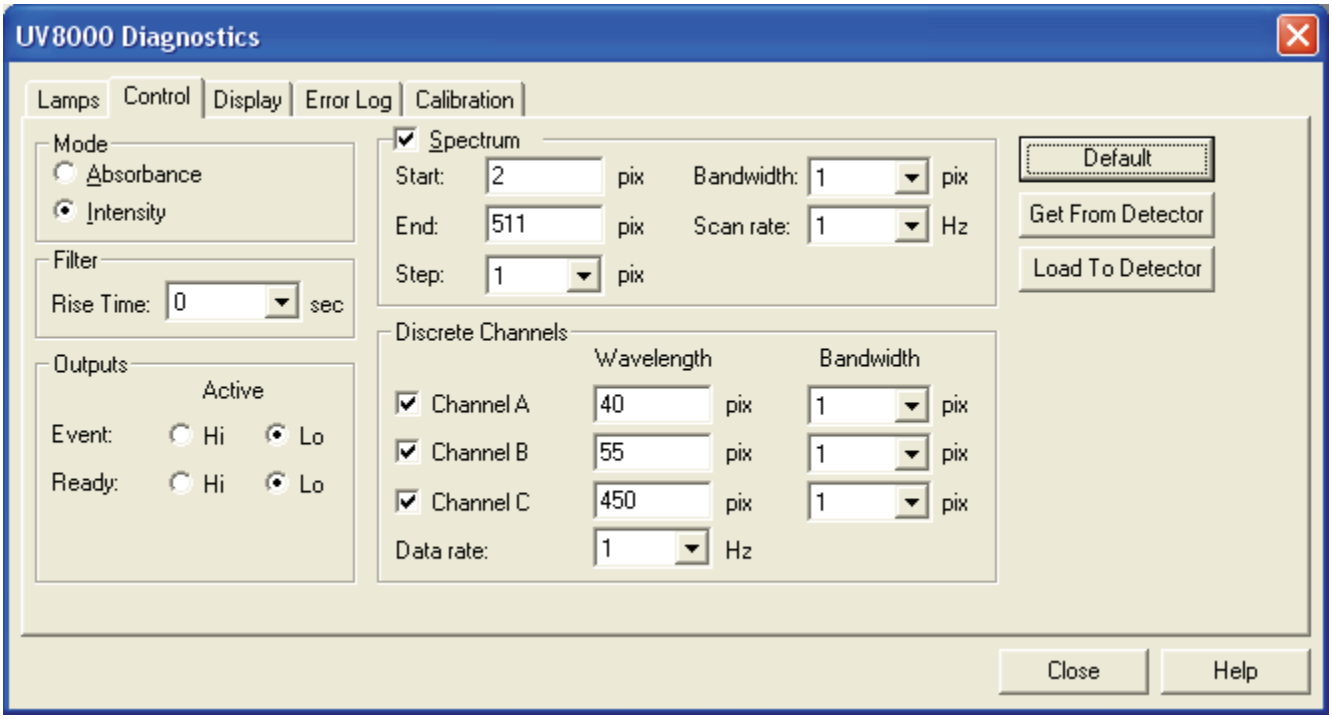
   The Control page appears.
6. In the Mode area, select the **Intensity** option.
7. Click **Default**, and then verify that the following parameters are specified in the Spectrum area (Figure 55):

   Start = 2

   End = 511

   Step = 1

Figure 55. Control page with the default Spectrum settings

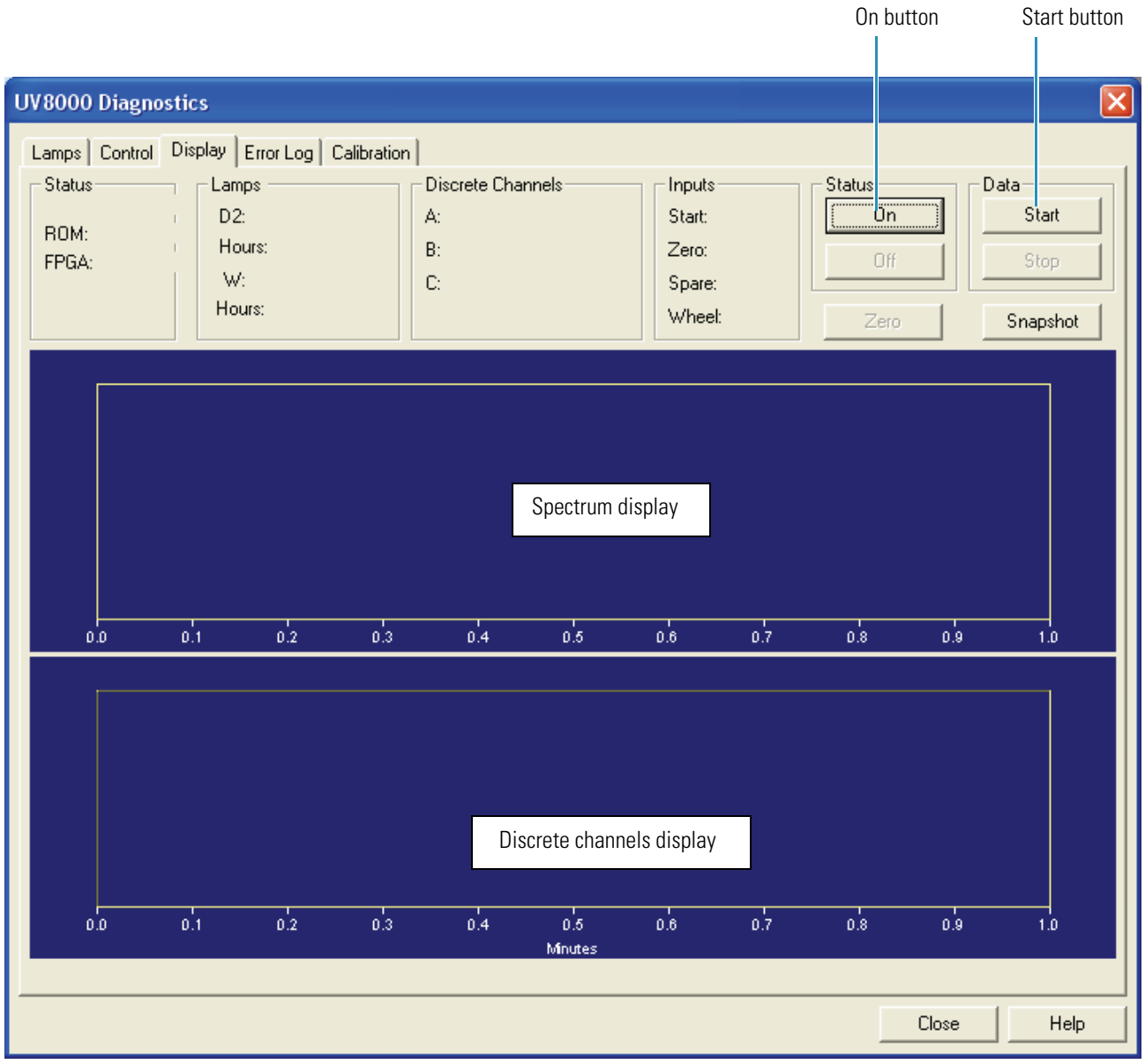


8. In the Discrete Channels area, use the default settings or specify the diodes that you want to monitor.
9. Click **Load To Detector**.

   A dialog box containing the message, Method Has Been Downloaded, appears.
10. Click **OK**.
11. Click the **Display** tab.

    The Display page appears (Figure 56).

Figure 56. Display page (after you click On in the Status area, but before you click Start)



12. On the right side of the page, in the Status area, click **On**.
13. In the Data area, click **Start** to refresh the display.
14. Save a printout or an electronic copy of the spectrum. Date the printout and add it to your maintenance records (see "Recording the Performance of the Lamps" on page 66).

Recording the Performance of the Lamps

Use following procedures to record the spectrum data on the Display page:

- "Using the Print Screen Button," next section
- "Using the Print Utility" on page 66
- "Taking a Snapshot" on page 66

Using the Print Screen Button

❖ **To store the spectral data using the print screen button**

1. As you collect the data stream on the Display page, press SHIFT+PRINT SCREEN.
2. Open the Microsoft Paint application and save the screen capture as a bitmap, or open the Microsoft Word application and paste the screen capture into a Word document.

Using the Print Utility

Use the ChromQuest print utility to print a copy of the Spectrum window.

❖ **To use the print utility**

1. On the Display page, place the cursor in the Spectrum window and right-click.
2. From the shortcut menu, choose **Utilities > Print**.

Taking a Snapshot

Use the snapshot option to create a Microsoft Excel™ comma-separated values (.csv) file that contains information about the spectrum on the Display page. The data system stores this file with the name WaveData.csv in the ChromQuest directory. The file has three columns: diode number, wavelength, and intensity value.

Note The data system appends the file with a date and time stamp. The data stamp consists of six digits; the first two digits are the month, followed by two digits for the day and two digits for the year. The time stamp consists of six digits; the first two digits are the hour in military time, followed by two digits for the minutes and two digits for the seconds.

❖ **To take a snapshot and view the stored information**

1. On the Display page, stop the data stream by clicking **Stop** in the Data area.
2. Click **Snapshot**.
3. Using Windows Explorer, browse to the ChromQuest directory.
4. Click the **WaveData.csv** file.

   The Excel application opens.

Adjusting the Light Throughput

The PDA detector portion of the UV8000 module has two attenuators that control the light throughput from the lamps.

Decreasing light throughput increases baseline noise. Increasing light throughput can saturate the diode array. When the array is saturated, the response from the PDA detector is a flat baseline.

Adjust the attenuators as the light output from the deuterium lamp decreases and whenever you do the following:

- Replace either lamp (see "Replacing the Lamps" on page 88).
- Replace the LightPipe flowcell (see "Installing the LightPipe Flowcell" on page 18).
- Change the configured diode array scan rate (see Chapter 3, "Instrument Configuration," on page 49).

Tip As the diode array scan rate increases, the sampling time per diode decreases. The integrated light intensity viewed on the Display page is a function of the light throughput to the diode array and the sampling time per diode. This means that when you change the diode array scan rate, you must adjust the light throughput.

- If you increase the diode array scan rate (for example, from 20 Hz to 80 Hz), you must increase the light throughput to achieve the same intensity counts.
- If you reduce the diode array scan rate (for example, from 80 Hz to 20 Hz), you must reduce the light throughput to avoid saturating the array.

Pushing the attenuator tabs upward increases the light throughput to the diode array. Pushing the attenuator tabs down decreases the light throughput to the diode array. (See Figure 39 on page 47.)

Check the light intensity by following the Operational Verification procedure and adjust the attenuators to provide light intensities in the specified operating ranges.

Note Before you adjust the attenuators, replace the column with a flow restrictor, and set the pump to deliver HPLC-grade water at a flow rate of 1 mL/min through the flowcell.

To adjust the light throughput from the lamps, follow these procedures:

- "Setting Up the Spectral and Discrete Channel Displays," next section
- "Adjusting the Attenuators" on page 69

Setting Up the Spectral and Discrete Channel Displays

❖ **To set up the spectral and discrete channel displays**

1. Open the Diagnostics dialog box for the UV8000 module (see "Accessing the Direct Controls for the SpectraSYSTEM UV8000 Module" on page 60).
2. Turn on both lamps (see "Controlling the Lamps" on page 61).
3. Download the parameters for the spectral display:
   a. Click the **Control** tab.

      The Control page appears (Figure 55 on page 64).
   b. In the Mode area, select the **Intensity** option.
   c. Click **Default**, and then verify that the following parameters are specified:

      Start = 2

      End = 511

      Step = 1
   d. Click **Load To Detector**.
4. Determine the diodes of maximum output for the lamps as follows:
   - From the spectrum displayed, determine and record the pixel of maximum intensity within the 10 to 40 diode range. This is the diode of maximum output for the deuterium lamp.
   - From the spectrum displayed, determine and record the pixel of maximum intensity within the 340 to 440 diode range. This is the diode of maximum output for the tungsten lamp. Ignore the spike at approximately diode number 380. This spike is an emission line of the deuterium lamp.
5. Turn off the data stream as follows:
   a. In the Status area, click **Off**.
   b. In the Data area, click **Stop**.
6. Set the discrete channel displays as follows:
   a. Click the **Control** tab to return to the Control page.
   b. In the Channel A box, type the value for the diode of maximum intensity for the deuterium lamp.
   c. In the Channel C box, type the value for the diode of maximum intensity for the tungsten lamp.
   d. Click **Load to Detector**.

Adjusting the Attenuators

Use the attenuator tabs (Figure 39 on page 47) on the front panel of the PDA detector to adjust the light throughput to the diode array.

❖ To adjust the attenuators

1. Set up the spectral and discrete channel displays (see "Setting Up the Spectral and Discrete Channel Displays" on page 68).
2. Click the **Display** tab.

   The Display page appears.
3. Assuming a default scan rate of 40 Hz, as you view the discrete channel display (Figure 57), do the following:
   - Adjust the left attenuator tab (UV attenuation) to achieve a Channel A value as close as possible to 900000 intensity counts without saturating the array.
   - Adjust the right attenuator tab (Visible attenuation) to achieve a Channel C value as close as possible to 900000 intensity counts as possible without saturating the array.

     Figure 58 and Figure 59 on the next page show saturation of the diode array.

Figure 57. Display page (after you click On in the Status area and Start in the Data area)

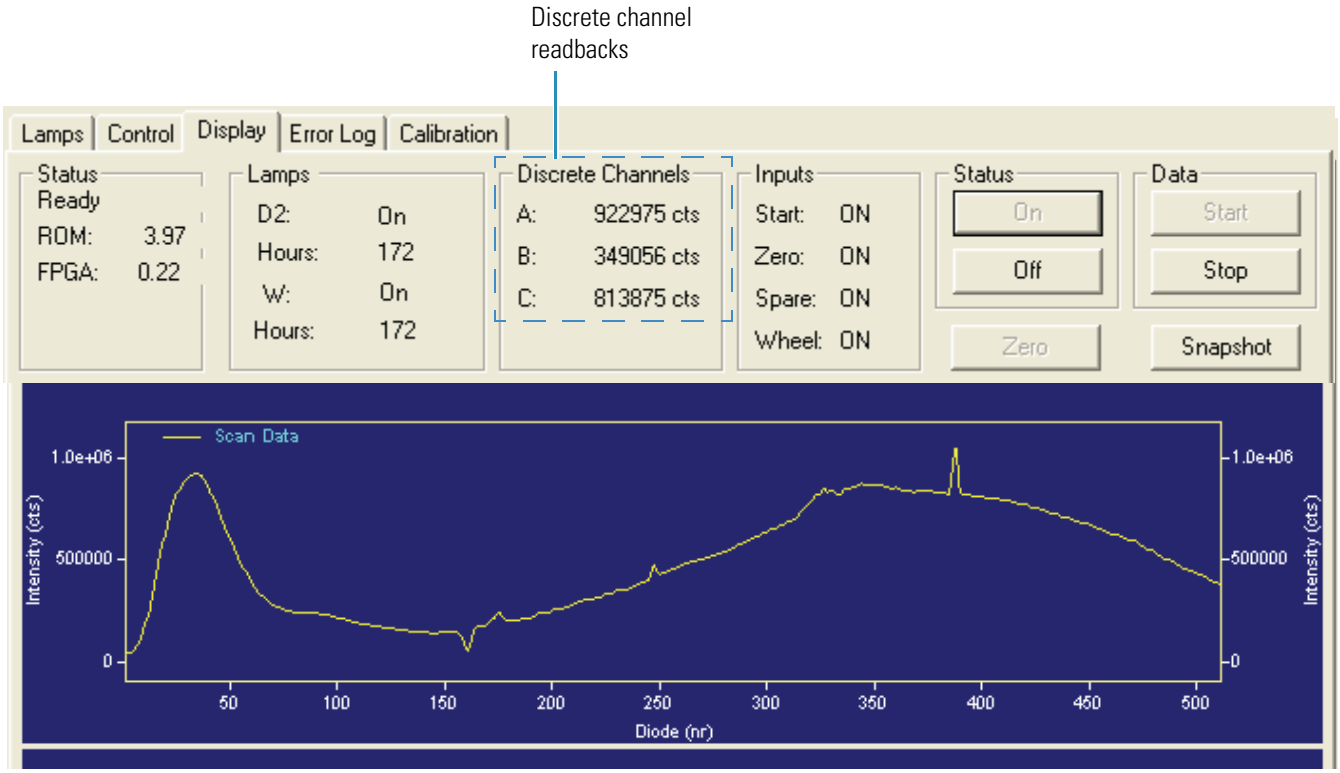


Figure 58 shows a saturated array in the UV region.

Figure 58. Saturated diode array (UV region)

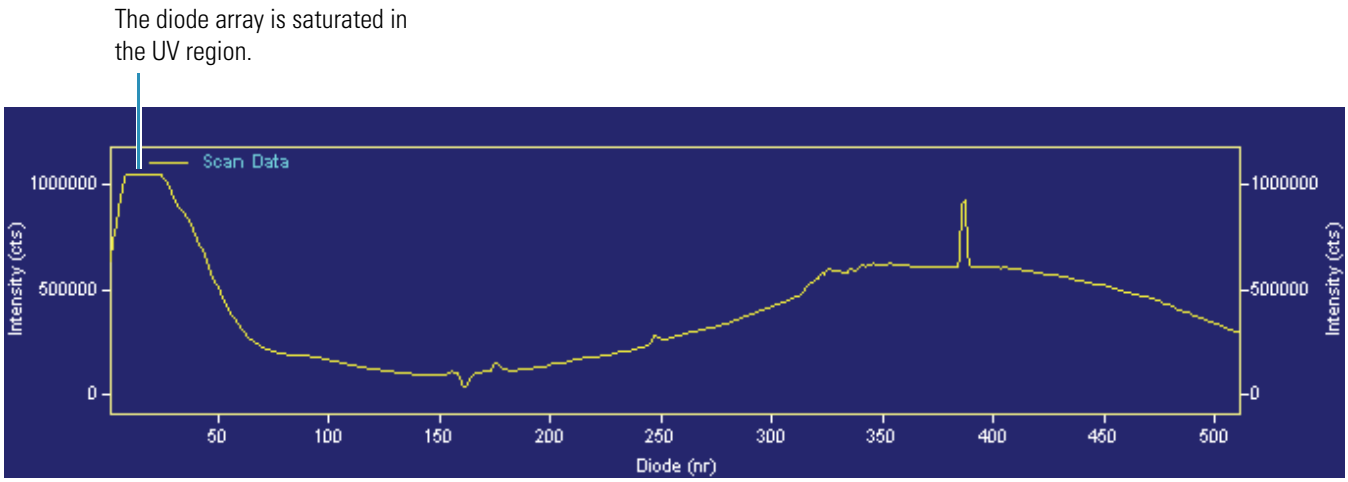
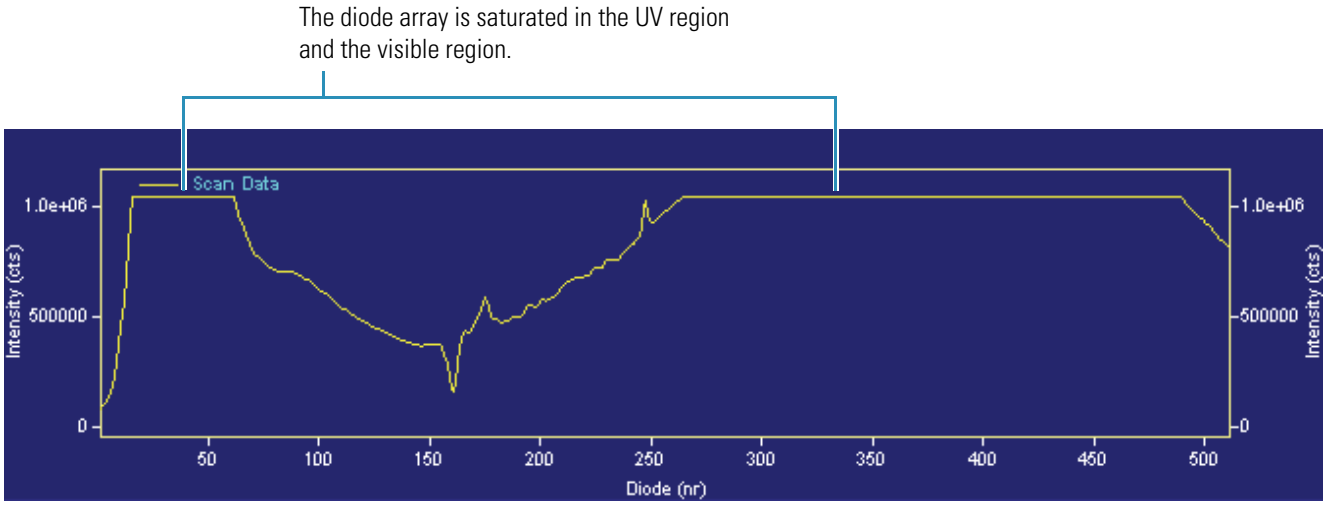


Figure 59 shows a diode array that is saturated in both the UV and visible regions. The configuration is set to a 20 Hz diode array scan rate and the attenuators are completely open.

Figure 59. Saturated diode array (UV region and visible region)



4. After you finish adjusting the attenuators, replace the front cover.

Calibrating the PDA Detector

To calibrate the PDA detector from the ChromQuest data system, follow these procedures:

- "Preparing the UV8000 Module for Calibration," next section
- "Performing an Array Calibration" on page 71
- "Performing a Wavelength Calibration" on page 73

Preparing the UV8000 Module for Calibration

❖ **To prepare the UV8000 module for calibration**

1. Replace the LC column with a flow restrictor.
2. Set up the system to pump HPLC-grade water or HPLC-grade methanol through the flowcell, at a flow rate of 1 mL/min.
3. Turn on both lamps and wait 1 hour for the D2 lamp to equilibrate (see "Controlling the Lamps" on page 61).
4. Verify that the diode array is not saturated (see "Adjusting the Light Throughput" on page 67).

Performing an Array Calibration

The Array calibration measures and corrects for the dark current produced by the diodes of the photodiode array. The dark current is the small amount of background signal that is produced by the diodes of the array even when both lamps are turned off. Typical dark current values range from 2000 to 4000 counts.

The environmental conditions of your laboratory can cause the dark current of the diode array to increase over time. For best results, perform an array calibration (dark current) after any of the following events occurs:

- After 100 hours of use or monthly, whichever comes first
- Whenever a significant temperature change occurs
- After you move the detector
- After you replace the lamps

Because the dark current produced by the diodes rises as the temperature within the detector rises, make sure that you warm up the lamps for one hour before you perform a dark current calibration. Warming up the lamps for one hour equilibrates the detector to its normal operating temperature.

The PDA detector briefly turns the lamps off as it performs the dark current calibration routine. After it completes the dark current calibration, the PDA detector turns the lamps back on.

Note The dark current calibration program does not run when data collection is enabled on the Display page.

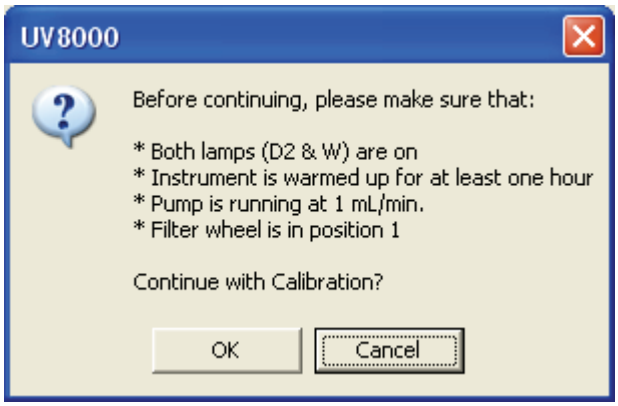
❖ To perform a dark current calibration of the diode array

1. Prepare the PDA detector for calibration (see "Preparing the UV8000 Module for Calibration" on page 71).
2. Open the Diagnostics dialog box for the UV8000 Detector (see "Accessing the Direct Controls for the SpectraSYSTEM UV8000 Module" on page 60).
3. Click the **Calibration** tab.

   The Calibration page appears.
4. In the Array area, click **Execute**.

   A message box appears listing the preconditions for a dark current calibration (Figure 60).

   Figure 60. Calibration preconditions dialog box



5. Make sure that the lamps are warmed up, that the pump is running at 1 mL/min, and that the filter wheel is in position 1 (Figure 39 on page 47).
6. Click **OK**.

   The status of the calibration procedure appears by the Status readback area on the Calibration page. During the dark current calibration, the lamps turn off before the data system collects the intensity scans. After the last calibration event, the lamps turn back on.
7. Click **OK** to finish the calibration.

   The date and time of the calibration appear in the Array area of the Calibration page and are stored in the PDA detector's memory.

Performing a Wavelength Calibration

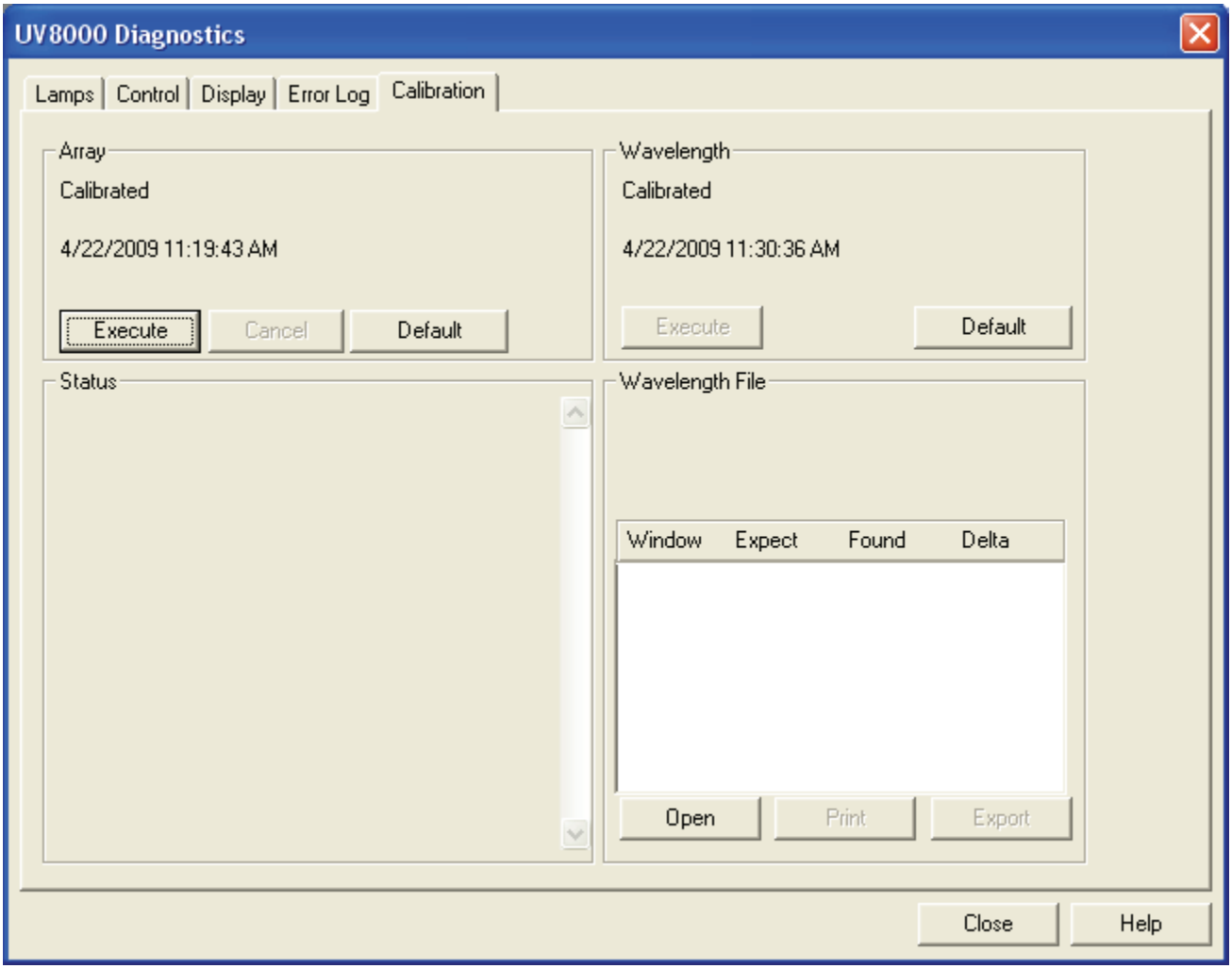
Aligning the spectrum on the diode array depends on physically aligning various components of the optical bench. A sharp jolt to the detector in shipping, for example, can offset the alignment. Such bumps and jars can slightly change the wavelength of light reaching the photodiode array. The automated wavelength calibration determines the wavelength accuracy of the detector and uses the detector's wavelength algorithm to correct any misalignment.

❖ To perform a wavelength calibration

1. Open the UV8000 Diagnostics dialog box (see "Accessing the Direct Controls for the SpectraSYSTEM UV8000 Module" on page 60).
2. Click the **Calibration** tab.

   The Calibration page appears (Figure 61).

Figure 61. Calibration page of the UV8000 Diagnostics dialog box

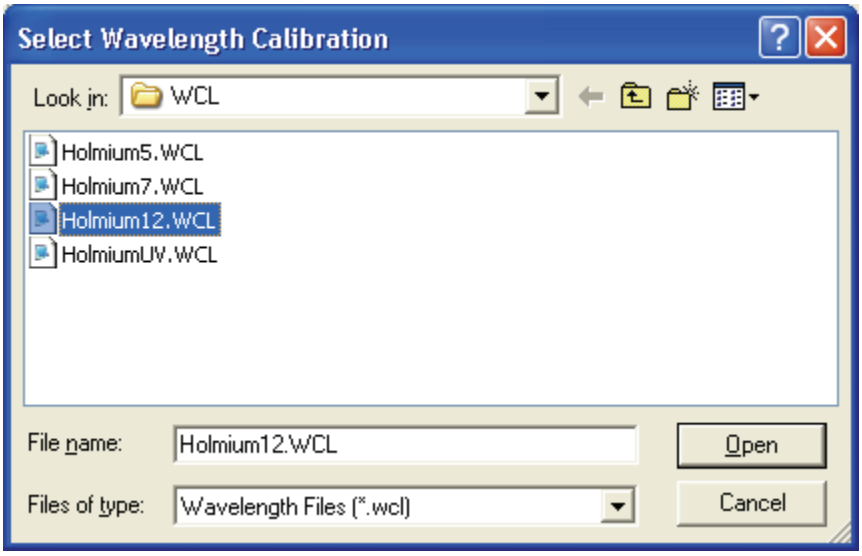


3. Open a wavelength calibration file:

   a. In the Wavelength File area, click **Open**.

   The Select Wavelength Calibration dialog box appears (Figure 62).

   Figure 62. Select Wavelength Calibration dialog box



   b. Select an appropriate wavelength calibration file from the list.

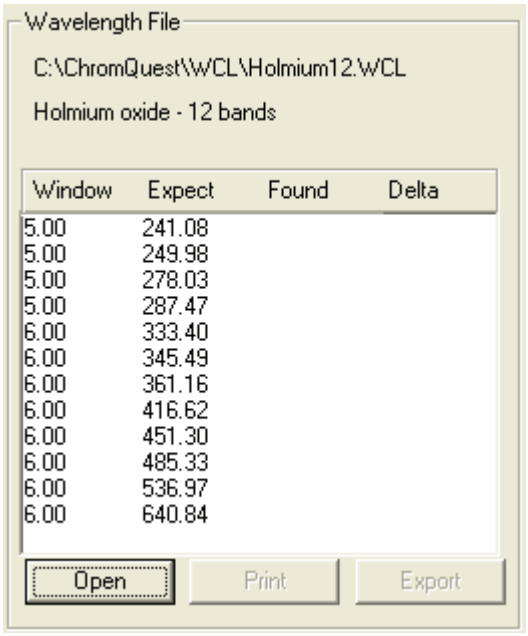
   An appropriate wavelength file should include the range of wavelengths that you use under normal operating conditions.

   c. Click **Open**.

> **Note** ChromQuest has four calibration files to choose from. The HolmiumUV file contains five wavelengths in the UV region while the other files, such as Holmium12, use sets of wavelengths from both the UV and Visible wavelength regions. The holmium oxide absorbance maxima are selected from a spectrum published in "Holmium Oxide Solution Wavelength Standard from 240 to 640 nm - SRM 2034 (NIST Special Publication 260-54)."

   The holmium oxide bands of the selected file appear in the Wavelength File area (Figure 63).

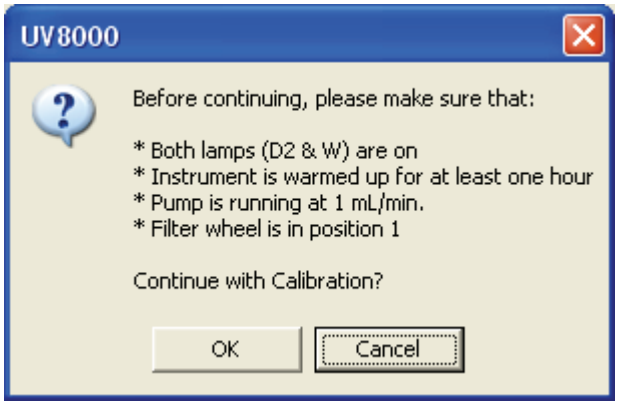
Figure 63. Wavelength File area with the Holmium12 Wavelength Calibration File selected



4. In the Wavelength area, click **Execute**.

   A message box appears listing several calibration preconditions (Figure 64).

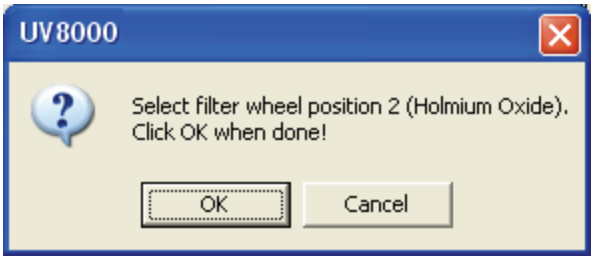
Figure 64. Calibration preconditions



5. If all of the preconditions are met, click **OK**.

   The data system collects a background spectrum, which it uses to remove the absorbance contribution of the mobile phase. When the background collection is complete, another message box appears (Figure 65).

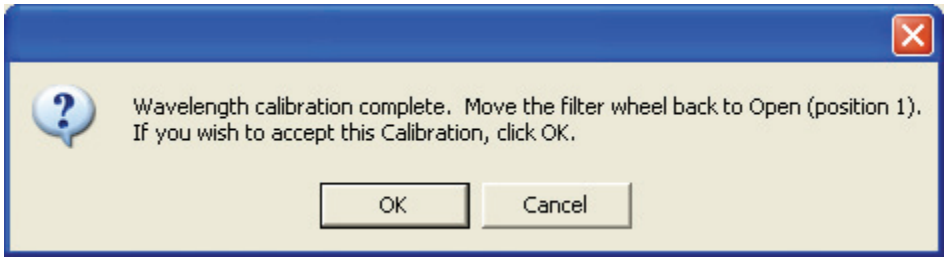
Figure 65. Message prompt to move the filter wheel to position 2



6. Move the filter wheel to position 2 as directed, and then click **OK**.

   The detector takes a holmium oxide scan, performs iterative calculations while applying the rise time and bandwidth filters, and then displays a new message box (Figure 66).

Figure 66. Message prompt to return the filter wheel to position 1



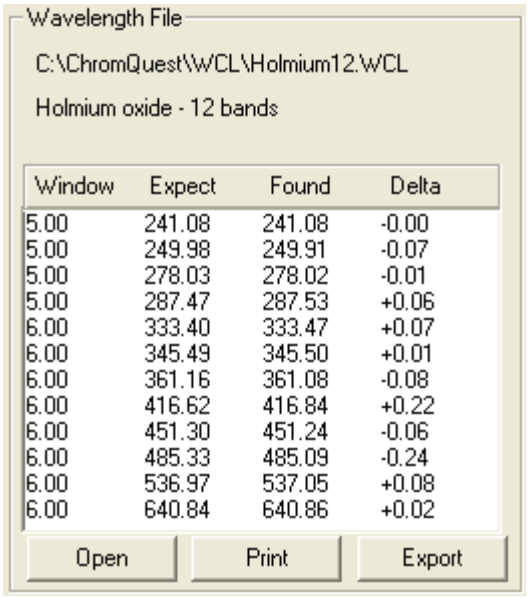
7. Move the filter wheel back to position 1, and then click **OK** to close the message box and view the results.

8. In the Wavelength File area, check the delta values (Figure 67).

   a. If the delta values are not within the range of ±1 nm, repeat the wavelength calibration procedure for verification.

   b. If, after applying a new calibration, the delta values are still not within the range of ±1 nm, call your Thermo Fisher Scientific service representative for assistance.

Figure 67. Wavelength File area with a list of acceptable delta values



9. To print a hardcopy report, click **Print**.

   Your data system computer must be connected to a printer.

10. To store the results, click **Export**.

The date and time of the wavelength calibration appear in the Wavelength area. The PDA detector also stores this information.

Note To cancel the calibration process, click Cancel in any of the Calibration dialog boxes.

Displaying, Printing, and Clearing the Error Log

Detector errors and major detector events, such as power-on self-tests (POSTs), are logged to a dedicated area in the memory of the detector. These messages are created as part of the normal operation of the detector and can be helpful when attempting to troubleshoot communications problems.

The log can hold a maximum of 100 errors/events. When the log is full, the newest entry replaces the oldest entry. To keep a continuous record for your maintenance files, print out the log and clear it periodically. View, print, and clear the log weekly as part of your regular maintenance routine.

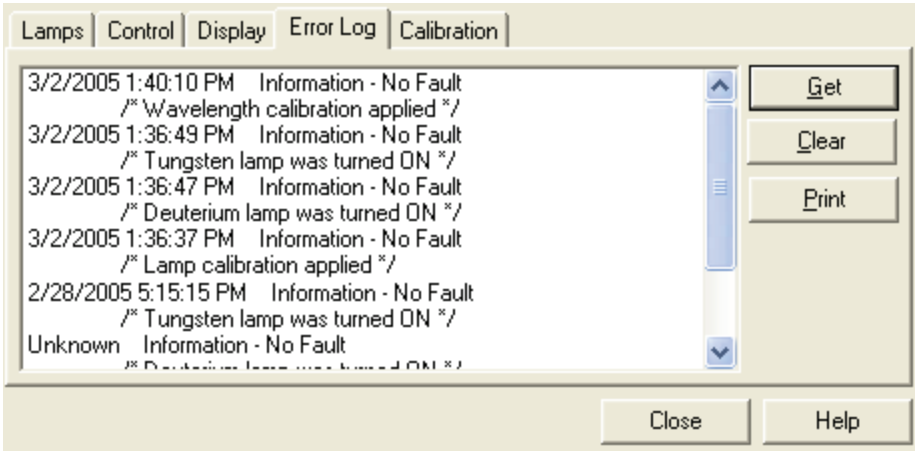
For a list of some common error messages that might appear in the log, see "Log Entries" on page 102.

❖ **To display, print, and clear the error log in the ChromQuest data system**

1. Open the Error Log page:
   a. Open the Diagnostics dialog box (see "Accessing the Direct Controls for the SpectraSYSTEM UV8000 Module" on page 60).
   b. Click the **Error Log** tab.

      The Error Log page appears (Figure 68).

      Figure 68. Error Log page



2. Use the buttons on the Error log page to do the following:
   - Click **Get** to retrieve and display the error log information from the detector. Figure 68 shows a sample Error Log.
   - Click **Print** to print a copy of the displayed log.
   - Click **Clear** to clear the log.

Checking the Firmware Version

Occasionally, upgraded firmware becomes available for the SpectraSYSTEM UV8000 Degasser and PDA Detector. Ask your Thermo Fisher Scientific field service engineer about the availability of new firmware.

❖ **To check the firmware version in the ChromQuest data system**

1. Open the Diagnostics dialog box (see "Accessing the Direct Controls for the SpectraSYSTEM UV8000 Module" on page 60).
2. Click the **Display** tab.

   The Display page appears.
3. Click **On**.

The firmware version of the UV8000 appears in the Status area on the left side of the Display page (Figure 56 on page 65).

Routine Maintenance

This chapter describes how to maintain the major components of the SpectraSYSTEM UV8000 Degasser and PDA Detector.

Proper maintenance ensures the optimum performance of the UV8000 module. You are responsible for maintaining your UV8000 module by properly performing the maintenance procedures on a regular basis. If you have any questions on proper maintenance, or would like to arrange for a preventive maintenance program, contact your Thermo Fisher Scientific service representative.

For maintenance procedures requiring the use of the data system, see Chapter 4, "Diagnostics for the PDA Detector," on page 59.

Contents

PDA Detector Maintenance

Recommended Maintenance

Table 6 lists recommendations for routine maintenance for the PDA detector portion of the UV8000 module. Use the table as a basis for developing your maintenance program in accordance with your company practices.

Table 6. Recommended routine maintenance for the PDA detector

Procedure		Interval
Cleaning external surfaces		As needed
LightPipe flowcell cleaning		As needed* (See "Cleaning the LightPipe Flowcell" on page 83.)
Wavelength calibration		After lamp replacement or as needed
Dark current calibration (Calibrating the dark current increases the linearity of the detector at the high end of its operating range. The dark current does not significantly affect absorbance values between 0.2 AU and 0.8 AU. The dark current is a function of temperature.)		After 100 hours of use or monthly, whichever comes first. (See "Performing an Array Calibration" on page 71.)
		After significant changes (> 4 °C) in ambient room temperature
		After lamp replacement
Event log printout		Weekly
Operation verification		Semi-annually
Lamp replacement	Deuterium (D2)	Replace the deuterium lamp when the detector noise reaches an unacceptable level. (See "Lamp Lifetime and Detector Noise" on page 5 and "Replacing the Lamps" on page 88.) The useful lamp lifetime is approximately 1000 hours at a diode array scan rate of 40 Hz and 2000 hours at a diode array scan rate of 20 Hz.
	Tungsten (W)	Every 2500 hours or as required. (See "Replacing the Lamps" on page 88.)
Adjust attenuators		As needed
Update firmware		As needed and as updates become available

* Good Laboratory Practice (GLP) dictates flushing the LightPipe flowcell with clean solvent after every use. This practice reduces the frequency of cleaning the LightPipe flowcell.

Cleaning the External Surfaces of the Detector

Keep the external surfaces of the detector clean and dry. To clean the outside of the detector, wipe with a dust-free cloth or a damp cloth (moistened with water only) to remove dirt or stains.

Cleaning the LightPipe Flowcell

This section is limited to the general cleaning of the detector's LightPipe flowcell. For other LightPipe flowcell problems, such as leaks that occur in locations other than at the inlet/outlet fittings, contact your Thermo Fisher Scientific field service engineer.

The exterior and interior surfaces of the LightPipe flowcell can become contaminated. Flowcell contamination is usually caused by precipitation or by solubility problems, such as when the quality of your mobile phase varies or the cleanliness of your samples varies. Signs of a contaminated LightPipe flowcell are increased baseline noise, signal spiking, erratic or drifting baselines, low light intensity, or increased backpressure.

CAUTION Do **not** disassemble the LightPipe flowcell housing, tighten the screws on the housing, or touch the optical fibers at the ends of the LightPipe flowcell. Doing so damages the LightPipe flowcell. Thermo Fisher Scientific is not responsible for any damage done to the LightPipe flowcell by attempts to disassemble the housing or tighten the screws. Contact your Thermo Fisher Scientific field service engineer with any questions regarding LightPipe flowcell maintenance or service.

This section contains the following procedures:

- "Removing the LightPipe Flowcell," next section
- "Cleaning the LightPipe Flowcell with Organic Solvents" on page 86
- "Cleaning the LightPipe Flowcell with Nitric Acid" on page 87

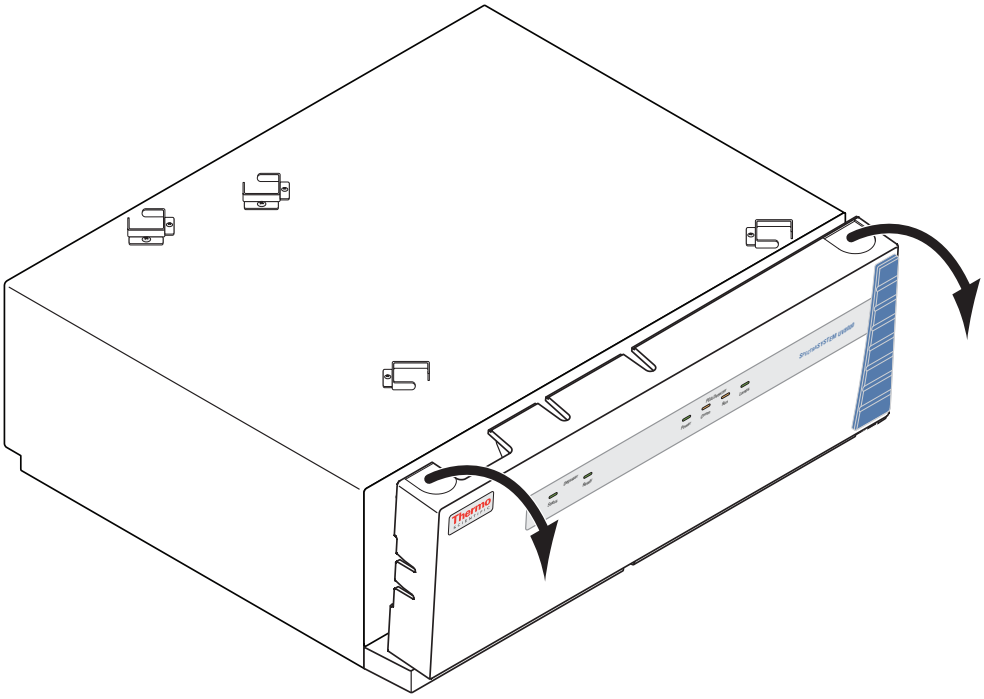
Removing the LightPipe Flowcell

To clean the LightPipe flowcell, remove it from the UV8000 module.

❖ **To remove the LightPipe flowcell**

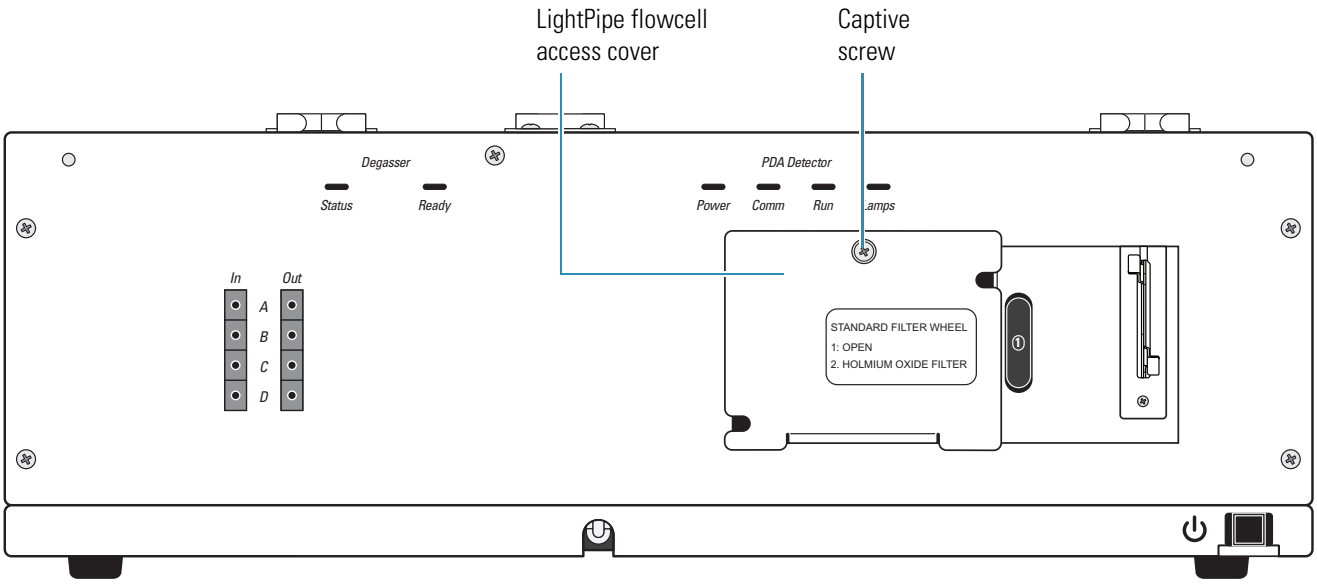
1. Turn the detector power off and disconnect the power cord from the back panel of the detector.
2. Gently pull the front cover of the UV8000 module down and off to remove it (Figure 69).

Figure 69. Removing the front cover



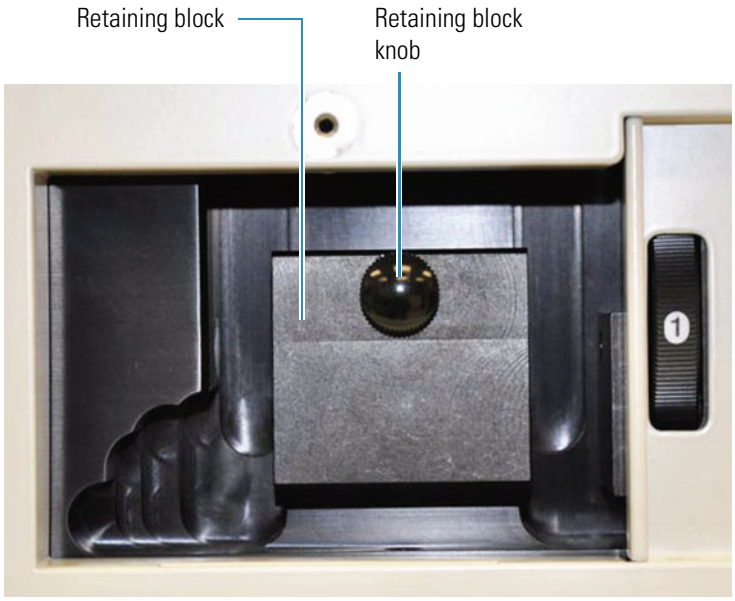
3. Unscrew the captive screw that secures the LightPipe flowcell access cover to the front panel of the detector and pull the cover off (Figure 70).

Figure 70. LightPipe flowcell access cover



4. Unscrew the retaining block knob and remove the retaining block (Figure 71).

Figure 71. View of the retaining block and the retaining block knob



CAUTION To prevent damage, do **not** touch the ends of the LightPipe flowcell as you remove it from the flowcell compartment.

5. Being careful not to touch the optical fibers at the ends of the LightPipe flowcell, pull the flowcell out of the flowcell compartment.
6. Depending on how you plan to clean the LightPipe flowcell, do one of the following:
   - To store the flowcell, disconnect the liquid lines. Then place the protective end caps on the ends of the LightPipe flowcell.
   - To temporarily remove the flowcell from the system, disconnect the LightPipe flowcell inlet tube from the column.
   - To clean the LightPipe flowcell by pumping solvent through it, disconnect the flowcell inlet tube from the column and reconnect it directly to the pump. Leave the outlet tubing connected to the waste reservoir.

Cleaning the LightPipe Flowcell with Organic Solvents

If you suspect that your LightPipe flowcell needs cleaning, start with the following procedure using organic solvents.

CAUTION Do **not** disassemble the LightPipe flowcell housing, tighten the screws on the housing, or touch the optical fibers at the ends of the LightPipe flowcell. Doing so damages the LightPipe flowcell. Thermo Fisher Scientific is not responsible for any damage done to the LightPipe flowcell by attempts to disassemble the housing or tighten the screws. Contact your Thermo Fisher Scientific field service engineer with any questions regarding LightPipe flowcell maintenance or service.

❖ To clean the LightPipe flowcell with an organic solvent

1. Remove the column from the chromatographic system to avoid column degradation. Connect the inlet of the LightPipe flowcell directly to the chromatographic pump.

   IMPORTANT Ensure that the cleaning solvents you plan to use are miscible with the solvent already present in the LightPipe flowcell and pump. Isopropanol is a good choice as a cleaning solvent for most applications. If the last solvent in the pump was an aqueous buffer solution, be sure to pump 25 to 40 mL of HPLC-grade water (or its equivalent) through the system to remove any salts before you flush the pump with the cleaning solvents. This wash helps to avoid precipitation problems.

2. If necessary, flush the LightPipe flowcell with water to prevent a reaction between the last solvent used in the chromatographic system and the cleaning solvent that will be used to clean the flowcell.

   CAUTION Thermo Fisher Scientific does not recommend using a syringe to force solvent through the flowcell. Pressurizing the syringe could cause a leak or rupture, resulting in a dangerous and uncontrolled spraying of solvent.

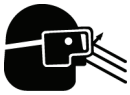
3. Flush the flowcell with 40 to 50 mL of cleaning solvent, for example, isopropanol or methanol.

4. Flush the flowcell with water to prevent a reaction between the cleaning solvent and the mobile phase that is used in your application.

For instructions on how to reinstall the LightPipe flowcell, see "Installing the LightPipe Flowcell" on page 18.

Cleaning the LightPipe Flowcell with Nitric Acid

Isopropanol or methanol is generally sufficient for cleaning a LightPipe flowcell. However, if the LightPipe flowcell remains contaminated after flushing it with organic solvents, perform the following procedure using nitric acid.



CAUTION Nitric acid is a strong oxidizing acid, and it can react vigorously with alcohols (especially methanol). Be sure to wear protective clothing and eye protection and adhere to safety procedures at your company for the proper handling and disposal of corrosive acids. Flush the flowcell with water to remove all traces of alcohol before flushing it with nitric acid.

❖ To clean the LightPipe flowcell with nitric acid

1. Completely remove the LightPipe flowcell from the detector housing by following the procedure in "Removing the LightPipe Flowcell" on page 83. (This prevents possible leaks from harming the mechanical and electronic components of the detector.)
2. Ensure that the column is removed from the chromatographic system to avoid column degradation. Connect the LightPipe flowcell inlet directly to the chromatographic pump.
3. Flush the LightPipe flowcell with water. This prevents a reaction between the last solvent used in the chromatographic system and the nitric acid solution will be used to clean the flowcell.
4. Prepare a 20% (v/v) solution of nitric acid in HPLC-grade water.

CAUTION Thermo Fisher Scientific does **not** recommend using a syringe to force acid solutions through the flowcell. Pressurizing the syringe could cause a leak or rupture, resulting in a dangerous and uncontrolled spraying of acid.

CAUTION Before you pump nitric acid solution through the LightPipe flowcell, ensure that the column has been removed from the chromatographic system and that water was the last solvent in the pump and solvent reservoir.

5. Using the chromatographic pump, pump the nitric acid solution through the LightPipe flowcell.
6. After you have finished the cleaning procedure and before you return to the chromatographic solvents, pump another 25 to 40 mL of water through the flowcell to remove all traces of nitric acid. Monitor the pH of the outlet stream of the LightPipe flowcell to ensure that the acid has been completely flushed out.

For instructions on reinstalling the flowcell, see "Installing the LightPipe Flowcell" on page 18.

Replacing the Lamps

The light output from the deuterium lamp decreases with age, which results in increased baseline noise. If the noise level on your detector output signal is unacceptable, and cleaning the flowcell does not help, use the data system's diagnostic features to determine the cause of the problem. If the light output becomes too low and adjusting the attenuators does not help, replace the deuterium lamp. The light output from the tungsten-halogen lamp is relatively stable as the lamp ages.

The detector keeps track of the number of hours each lamp has been operating. The deuterium lamp has a lifetime of approximately 2000 hours and the tungsten lamp has a lifetime of approximately 2500 hours. Lamp lifetime varies depending upon the application.

The deuterium (D2) and tungsten (W) lamps are located in the lamp compartment (Figure 73 on page 90).

CAUTION Intense UV light can damage your eyes. Always turn off the PDA detector and disconnect the power cord before you expose the lamp.

CAUTION There are electrical shock hazards inside the PDA detector's housing. Always turn off the PDA detector and disconnect the power cord before you pull the chassis out of the housing.

CAUTION The lamp cover becomes very hot when the lamps are on. After you turn off the lamps and the PDA detector, wait 30 minutes for the lamp cover to cool before removing it.

To replace the lamps, you must have a #2 Phillips head screwdriver.

❖ To replace the deuterium and tungsten lamps

1. From the data system, turn off the lamps. (See "Controlling the Lamps" on page 61.)
2. Wait approximately 30 minutes for the lamp compartment to cool to room temperature.
3. Turn the power switch at the front of the UV8000 module to Off (released position) and disconnect the power cord from the back panel.

   Note If you did not turn off the lamps before you turned off the PDA detector, wait approximately 30 minutes for the lamp compartment to cool to room temperature.

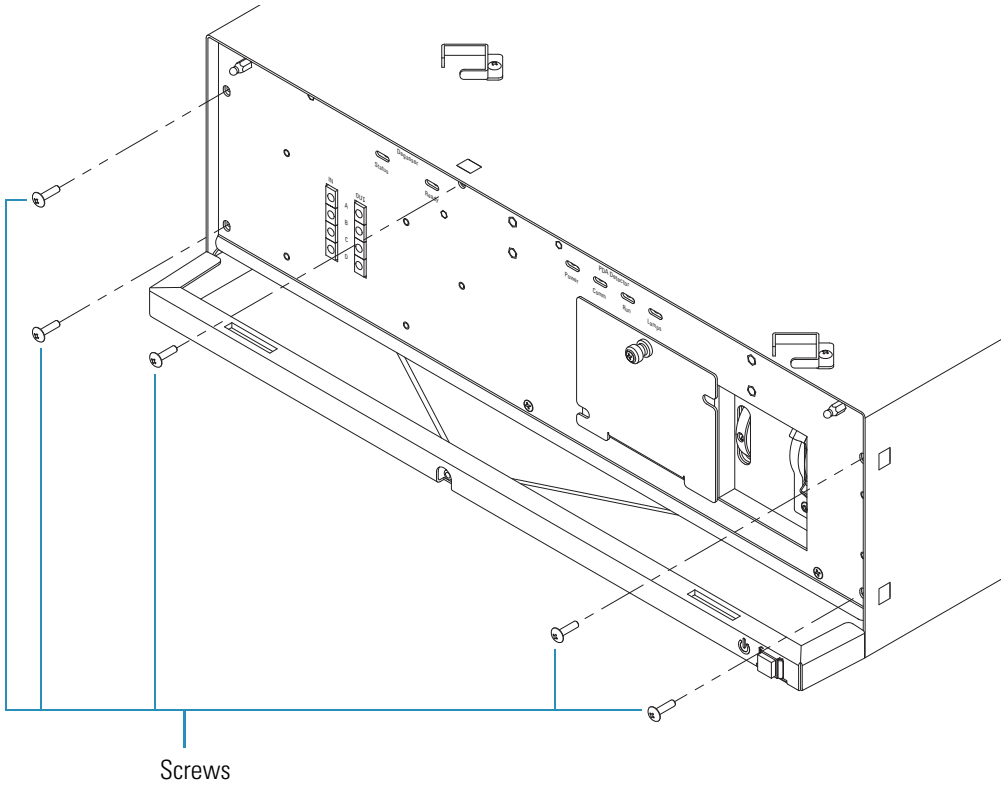
4. Gently pull the front cover of the UV8000 module down and off to remove it (Figure 11 on page 18).
5. Pull the sinkers at the end of the solvent lines in the solvent bottles out above the solvent level.

6. Hold up the solvent lines to drain as much solvent as possible back into the bottles.

CAUTION To prevent personal injury, observe good laboratory practice when handling solvents, changing tube lines, or both. Consult the pertinent material safety data sheets for the solvents used for HPLC analysis.

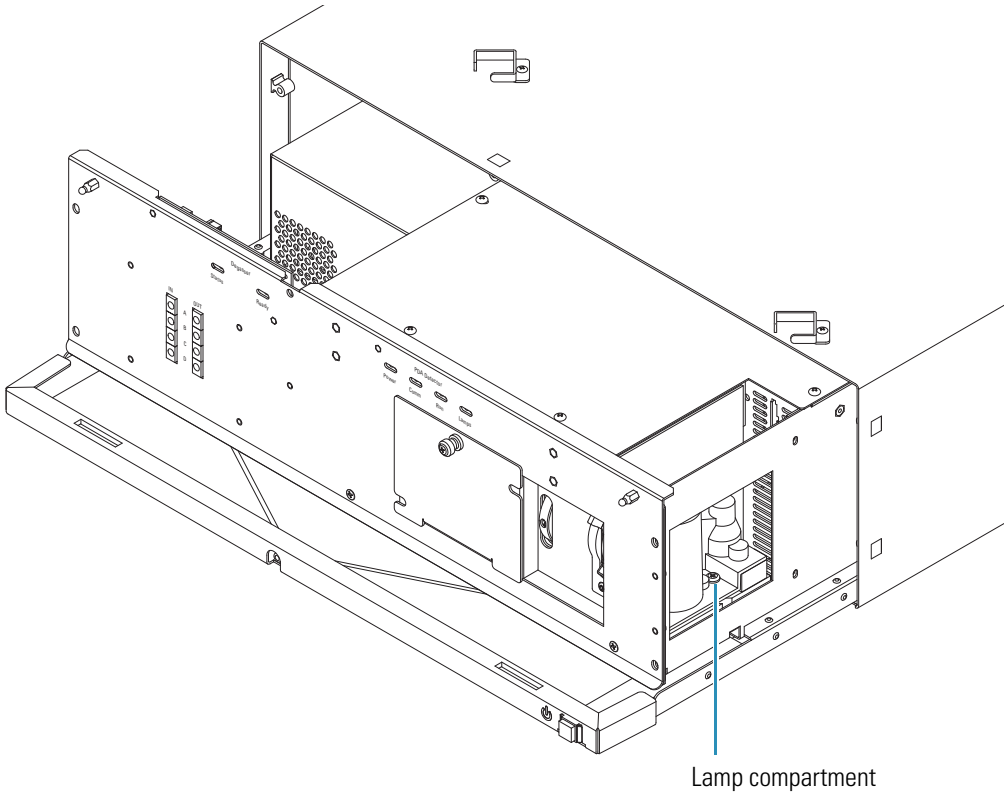
7. Detach the inlet tubing line or lines from the degasser inlet ports.
8. Detach the outlet tubing line or lines from the degasser outlet ports.
9. Using a #2 Phillips screwdriver, remove the five screws that secure the front cover to the chassis (Figure 72).

Figure 72. Removing the front cover screws



10. Carefully pull the chassis out of the housing until the lamp compartment on the right is accessible (Figure 73).

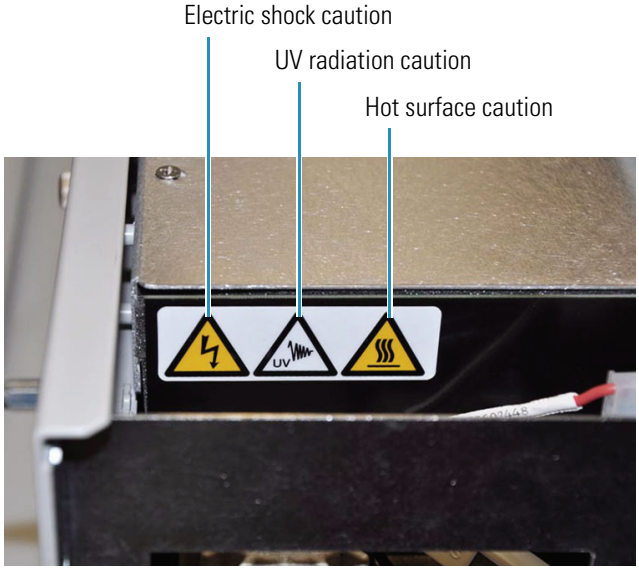
Figure 73. Lamp compartment



CAUTION After you turn off the lamps and the PDA detector, wait 30 minutes for the lamp cover to cool before removing it. The lamp cover becomes very hot when the lamps are on.

Before proceeding, note the safety warning labels inside the lamp compartment (Figure 74).

Figure 74. Lamp compartment safety warnings

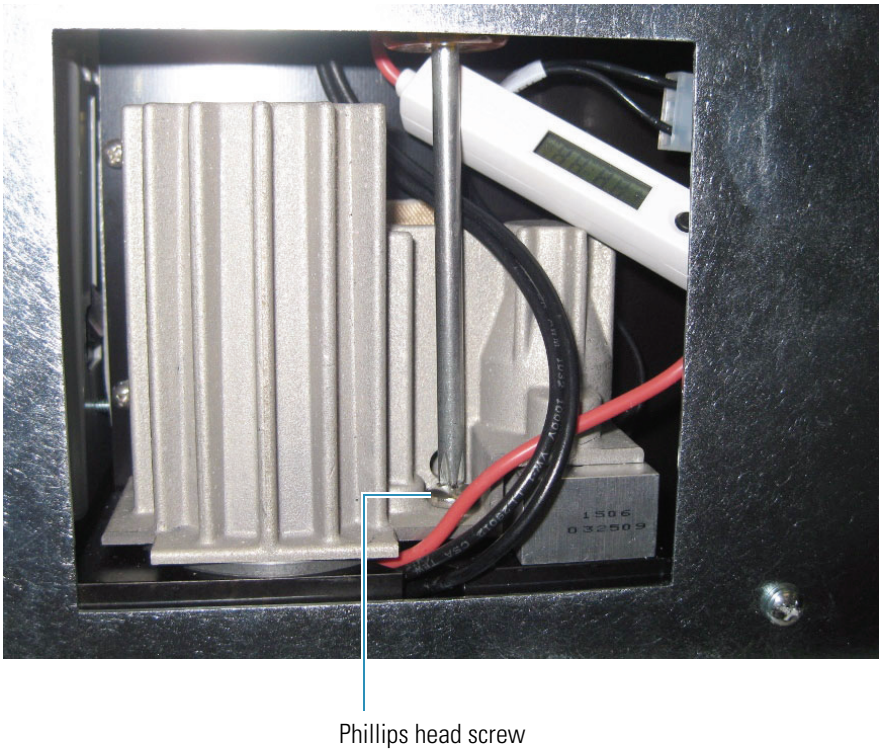


11. Remove the lamp cover as follows:

    a. Make sure that you have allowed sufficient time for the lamp cover and the lamps to cool to room temperature.

    b. Remove the lamp cover by loosening the large, captive Phillips head screw enough to free the lamp cover from the lamp tray (Figure 75).

Figure 75. Removing the Phillips head screw



c. Lightly touch the lamp cover to make sure that it has cooled to room temperature, and then carefully lift the lamp cover out of the detector.

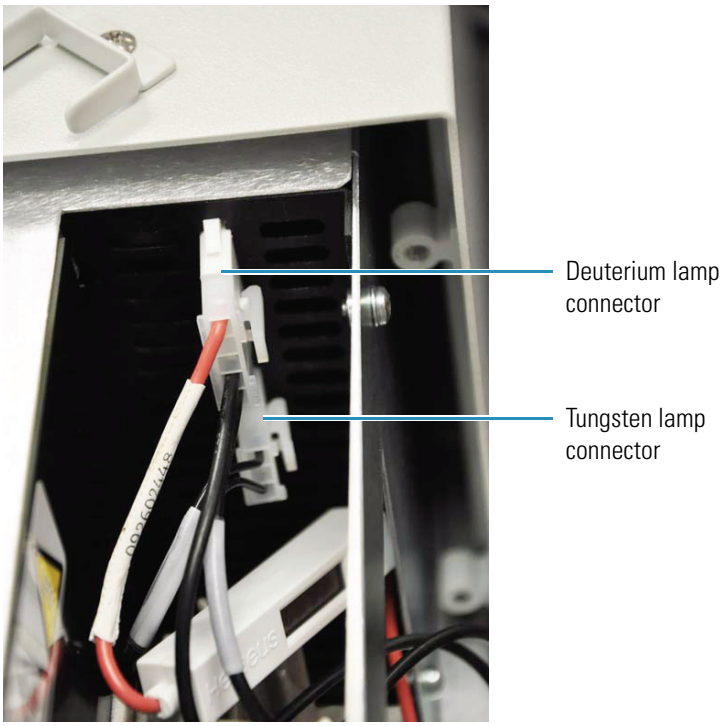
IMPORTANT Do **not** try to remove the lamps from their mounting assemblies. Remove and replace the lamp together with its mount, cable with elapsed time meter, and connector as described in the following steps.

IMPORTANT The surfaces of both lamps must be free of fingerprints and smudges, which cause performance problems. For this reason, wear clean, talc-free gloves when you handle the lamps. If either lamp requires cleaning, use a lint-free lens paper moistened with methanol or isopropanol before replacing the lamp cover.

12. To remove the deuterium lamp assembly:

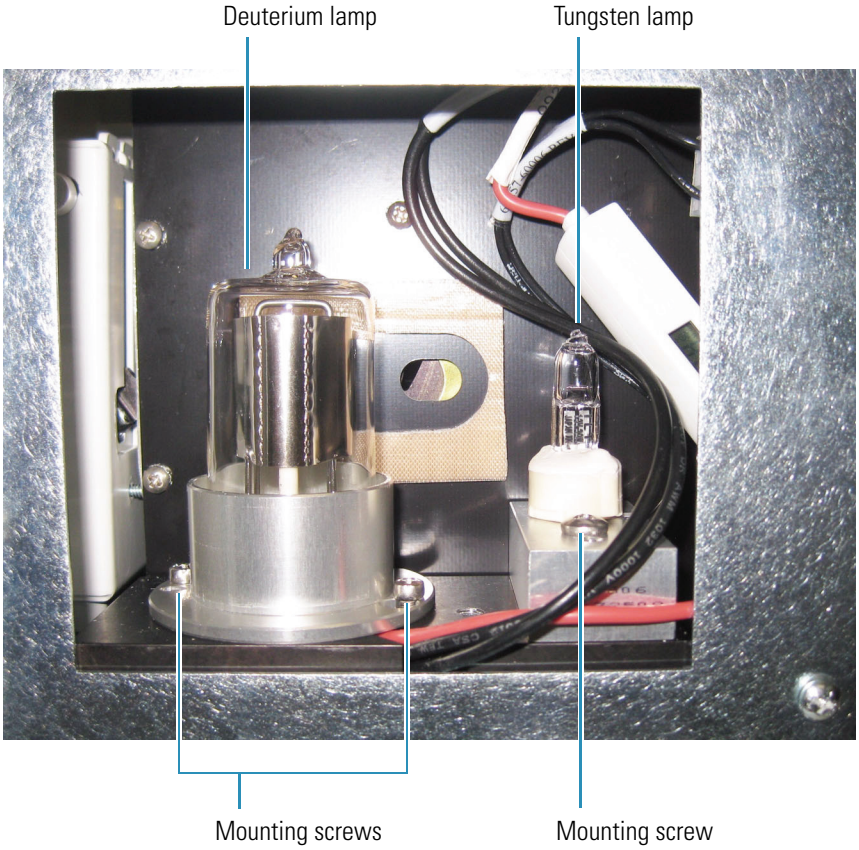
a. To disconnect the lamp cable, squeeze the connector latch, and then gently pull the connector free from the receptacle on the lamp compartment wall (Figure 76).

Figure 76. Lamp connections



b. Loosen but do not remove the two Phillips head screws that secure the deuterium lamp by turning them approximately four turns.

Figure 77. Lamps compartment



c. Lift and gently twist the mounting flange counterclockwise to free the lamp.

13. To remove the tungsten (W) lamp:

    a. To disconnect the lamp cable, squeeze the connector latch, and then gently pull the connector free from the receptacle on the lamp compartment wall (Figure 76).

    b. Loosen and remove the single Phillips head screw that secures the lamp-mounting block (Figure 77).

14. To install new lamps, perform the previous steps in reverse order.

15. On the Lamps page, in the D2 Lamp and W Lamp areas, click **Reset**.

    See "Controlling the Lamps" on page 61.

    IMPORTANT Always remember to reset the elapsed lamp hours after replacing a lamp (see "Controlling the Lamps" on page 61).

16. Gently push the chassis back into the housing.

17. Using a #2 Phillips screwdriver, reinstall the five screws that secure the front cover to the chassis.
18. Reattach the outlet tubing line or lines from the degasser outlet ports.
19. Reattach the inlet tubing line or lines from the degasser inlet ports.
20. Align the tabs on the bottom of the front cover with the slots in the chassis and press the cover back into place.

    Ensure that the inlet and outlet tubings from the LightPipe flowcell are threaded through the access slots on the flowcell cover (Figure 14 on page 21).
21. Put the sinkers at the end of the solvent lines in the solvent bottles back into the solvent bottles.

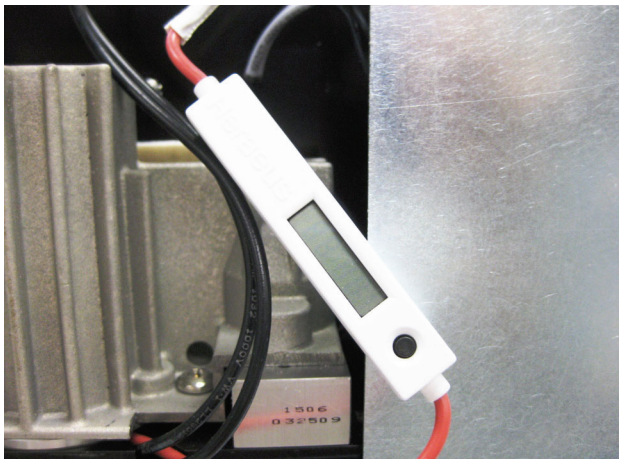
Viewing the Deuterium Lamp Elapsed Time Meter

An elapsed time meter built into the cable for the deuterium lamp provides the exact number of hours that the lamp has been on. If the usage hours on the Lamps page (Figure 54 on page 61) indicates usage that does not seem to correlate with how the lamp is operating, check the elapsed time meter and adjust the Lamps page accordingly.

❖ To view the elapsed time meter

1. Follow steps 1 through 11 in "Replacing the Lamps" on page 88 to access the lamp compartment as shown in Figure 73 on page 90.
2. Gently pull the deuterium lamp cable with the elapsed time meter far enough out of the lamp compartment so that you can view the LCD panel (Figure 78).

   Figure 78. Elapsed time meter on the deuterium lamp cable

   
3. Press the black button on the meter once to view the hours on the meter's LCD panel.
4. Make a note of the hours in your lab notes to compare to the number of hours shown in the Lamps page.

5. If the number of hours shown on the meter corresponds to the number of hours on the Lamps page and the performance is poor, it might be time to replace the lamp. See "Replacing the Lamps" on page 88.

Replacing the Fuses

You can operate the PDA detector at 100/115V or 230V. However, you must make sure that the appropriate fuses are installed (Table 7).

Table 7. Fuses

Line power voltage	Fuse size
100/115V	T3.15 A
230V	T1.6 A

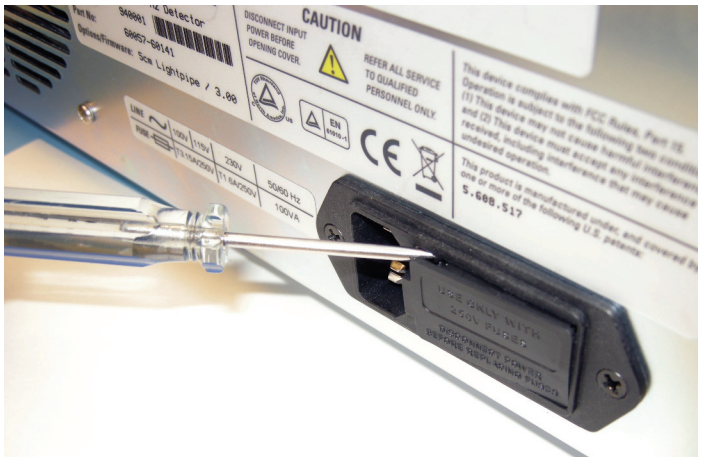
❖ To replace the fuses

1. Turn off the power to the UV8000 module and unplug it from line power.

CAUTION To avoid an electrical shock, before you replace the fuses, turn off the power to the UV8000 module and unplug it from line power.

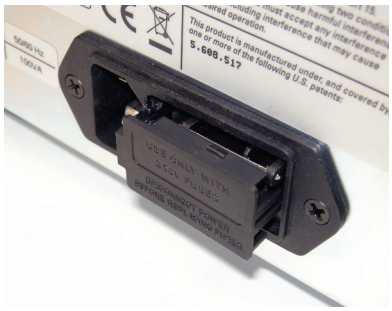
2. Insert the tip of a narrow-blade screwdriver into one of the two openings on the exterior surface of the power entry module, and then apply leverage to loosen the power entry module's door (Figure 79).

Figure 79. Loosening the power entry module's door



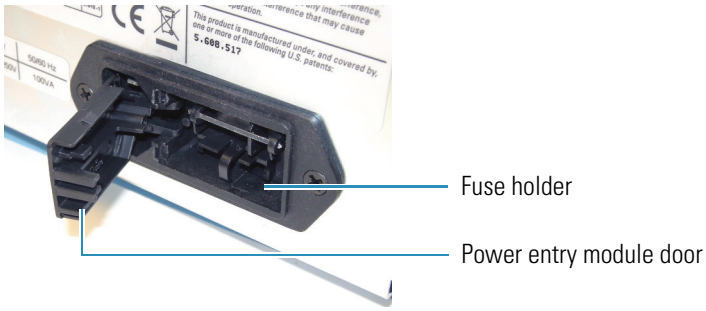
When you apply a sufficient amount of leverage, the door pops out (Figure 80).

Figure 80. Power entry module door loosened



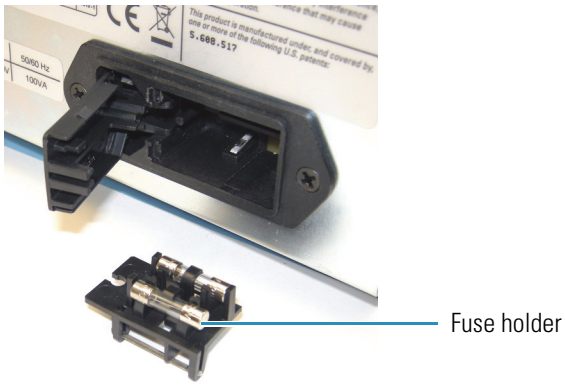
3. Open the door (Figure 81).

Figure 81. Power entry module door opened



4. Take the loose fuse holder out of the power entry module (Figure 82).

Figure 82. View of the fuse holder



5. Replace the fuses.
6. Put the fuse holder back into the power entry module, and then close the power entry module door until it snaps in.
7. Plug the power cord into the power entry module on the back panel of the UV8000 module and connect it to the power source.
8. Turn the power on by pushing in the power button on the front panel (Figure 8 on page 9).

Cleaning the Solvent Bottle Holder

Occasionally check the solvent bottle holder and clean it of spilled solvents as necessary.

❖ **To check and clean the solvent bottle holder**

1. Remove solvent bottles from the holder.
2. Remove the solvent holder from the top of the pump.
3. Clean as necessary, and return.
4. Return solvent bottles to the holder.

Changing Solvents

You may occasionally want to change the solvent flowing through a particular channel. Depending on the last solvent used, and the solvent you are planning to use, you must flush the degas tubing with one or more intermediary solvents.

❖ **To change solvents**

1. Turn off the power to the UV8000 module.
2. Remove the bottle cap and pull out the inlet tubing of the solvent you no longer want to use.
3. If desired, allow approximately 10 mL of air to be introduced into the tubing. (This separates the new solvent from the previous solvent.)
4. Replace the cap and tubing inside the new bottle of solvent.
5. Pump approximately 40 mL of solvent through the degasser (to eliminate any air introduced into the tubing).
6. Turn the UV8000 module back on and proceed as usual.

To change solvents, you can also attach a syringe to an outlet tube, and pull all the solvent out of the degasser with the syringe. Once the solvent is removed, prime the tubing with a new solvent as described in "Priming the Degassing Lines" on page 39.

Troubleshooting

This chapter contains helpful information for troubleshooting possible SpectraSYSTEM UV8000 Degasser and PDA Detector, chromatographic system, and degasser problems. Because many of the problems attributed to the detector might actually be due to other components in the chromatographic system, references and potential solutions to these types of problems are also included.

Contents

PDA Detector-Related Problems

Table 8 lists detector-related problems along with suggestions for corrective action.

Table 8. PDA detector-related problems (Sheet 1 of 4)

Symptom	Cause	Solution
Spikes on baseline	Continuous gas bubbles in the LightPipe flowcell	Degas the mobile phase. Connect a backpressure device to the LightPipe flowcell (check back pressure rating).
	Immiscible solvent bubbles following mobile phase changeover	Flush the LightPipe flowcell with 2-propanol, then with mobile phase.
	Electrical interference	Check the electrical lines for good connections, interference from broadcast radiation, or both. Check for ground loops.
	Extremely large fluctuations in voltage on power line	Remove systems that can cause voltage fluctuations, for example, ovens; isolate the detector to a “quiet” circuit; or use an uninterruptible power supply (UPS) that is safety certified (UL, TÜV, SEMKO, DEMKO, and so on).

Table 8. PDA detector-related problems (Sheet 2 of 4)

Symptom	Cause	Solution
Random noisy baseline	Contaminated LightPipe flowcell	Flush the flowcell with cleaning solvents. See "Cleaning the LightPipe Flowcell" on page 83. Check for leaks.
	Leak in sample inlet line	Check all the fittings from the column outlet to the flowcell inlet for leaks.
	Bubble trapped in LightPipe flowcell	Increase the flow rate until you remove the bubble. Connect a backpressure device to the flowcell outlet (check the pressure rating to avoid rupturing the flowcell).
	Leaking LightPipe flowcell	Replace the flowcell.
	Insufficient lamp warm-up	Allow a 30 minute warm-up for normal operation and a 1½ hour warm-up for maximum sensitivity.
	Aging or defective lamp	Replace the lamp.
	Ground loop problem between integrator and detector	Check the cable connections to the detector output; do not ground at both ends of the cable.
	Dirty LightPipe flowcell or lamps	Clean the dirty component.
	Integrator input voltage and detector output voltage not matching	Verify that the integrator is connected to the appropriate Analog Output connections on the back panel of the detector. See Chapter 2, "Installation." Check the attenuation setting on the integrator.
Deuterium lamp hours on Lamps page showing fewer usage hours than the lamp performance indicates	Lamp hours may not have been reset after the lamp was replaced	View the elapsed time meter connected to the lamp and adjust the Lamps page accordingly. See "Viewing the Deuterium Lamp Elapsed Time Meter" on page 94.

Table 8. PDA detector-related problems (Sheet 3 of 4)

Symptom	Cause	Solution
Excessive baseline drift	Contaminated LightPipe flowcell	Flush the flowcell with cleaning solvents as described in "Cleaning the LightPipe Flowcell" on page 83. Check for leaks.
	Mobile phase contamination	Replace the mobile phase with fresh mobile phase that is made with high-purity solvents.
	Material bleeding from column	Clean or replace the column.
	Leaks in system or the LightPipe flowcell	Check all the fittings for leaks. Replace the flowcell.
	Tiny bubble trapped in LightPipe flowcell	Increase the flow rate until you remove the bubble. Connect a backpressure device to the flowcell outlet (check the backpressure rating to avoid rupturing the flowcell).
	Excessive temperature fluctuations	Remove the system from drafts. Thermostatically control the column temperature.
No peaks, or peaks much smaller than expected	Incorrect wavelength setting	Check the wavelength setting. Make sure the correct file is selected.
	Lamp not on or defective	Make sure the lamp is lit. Verify the lamp performance. See"Monitoring Lamp Performance" on page 62. Replace the lamp if necessary. See "Replacing the Lamps" on page 88.
	Integrator input voltage and detector output voltage not matching	Verify that the integrator is connected to appropriate Analog Output connections on the UV8000 module's back panel. See Chapter 2, "Installation." Check the attenuation setting on the integrator.
	Insufficient sample reaching the detector	Check the entire chromatographic system for leaks. Check the sample injection volume.
Broad, tailing peaks	Excessive rise time	Lower the rise time selection.
	Poor connection at LightPipe flowcell inlet	Check the end of the inlet tubing for a clean, flat surface that is free of obstructions.
UV8000 module failing to power up	Tripped circuit breaker at power outlet	Reset the circuit breaker.
	Blown detector fuse	Replace the fuse. See "Replacing the Fuses" on page 95.
	Power cord not connected	Connect the power cord.
Module not running upon injection	Module not receiving Start signal	Check the connection to the Run contacts on the back panel of the detector.

Table 8. PDA detector-related problems (Sheet 4 of 4)

Symptom	Cause	Solution
Flat baseline, portion of spectrum missing	Saturation of photodiode array	Adjust the attenuators. See "Adjusting the Light Throughput" on page 67.
Power LED is amber	Possible loose Ethernet connection	Check the Ethernet connection to the data system computer.
Comm LED is amber	Lost connection to the data system computer	Check the Ethernet connection to the data system computer.
Run LED is amber	An error during a run	See the software to determine the nature of the error, or begin the run again.
Lamps LED is amber	Both lamps off	Turn on the lamps and allow 1½ hours for warm-up.

Log Entries

This section describes the various log entries that are possible when operating the SpectraSYSTEM UV8000 Degasser and PDA Detector from your Thermo Scientific data system.

Note For further information, document the log entry and contact Thermo Fisher Scientific technical support.

The diagnostics Event Log chronologically records messages relating to detector or system problems. The messages fall into three categories:

- "Critical Failure Messages," next section
- "Warning Messages" on page 103
- "Information Messages" on page 103

Critical Failure Messages

Critical failure messages indicate that the PDA detector portion of the UV8000 module cannot perform its function properly. If a chromatographic run is in progress when a critical failure occurs, the data might be corrupted or lost, and the run terminates. Possible critical failure messages include the following:

- Filter wheel misaligned
- Failed to turn on the Deuterium lamp
- Failed to turn on the Tungsten lamp

Warning Messages

Warning messages indicate problems that should not affect a chromatographic run. Possible warning messages include the following:

- Run started while instrument not calibrated
- Error trying to send to a null queue
- Error trying to receive from a null queue
- Socket failed to receive data
- Socket failed to send data
- Data in EEPROM was corrupted
- Failed to calibrate dark current
- Failed to calibrate wavelength
- No fault

Information Messages

Information messages include the following:

- Deuterium lamp was turned on
- Deuterium lamp was turned off
- Tungsten lamp was turned on
- Tungsten lamp was turned off
- Wavelength calibration reset
- Lamp calibration reset
- Wavelength calibration applied
- Lamp calibration applied

Degasser Troubleshooting

If you encounter any problems with the degasser portion of the UV8000 module, refer to this troubleshooting section. If the problem persists after you have tried the solutions suggested, contact your Thermo Fisher Scientific field service engineer.

Table 9. Degasser problems

Symptom	Problem	Solution
Solvent is not being delivered from outlet line	Solvent filter is dirty or missing	Replace.
	Bubbles or obstructions in outlet line	Test flow using a syringe.
	Inlet line improperly connected	Reconnect properly.
	Insufficient solvent in the solvent bottle	Replenish the solvents.
Vacuum gradually decreases	No solvent in the solvent lines	Ensure that all unused solvent lines are filled with a 50:50 methanol/water solution or are tightly capped.
Small bubbles continue to enter the degasser	Loose or faulty reservoir connector	Tighten connector. Be sure that ferrule is oriented correctly and tightened sufficiently. Note that plastic ferrules orient in the opposite way from metal ferrules.
	Dirty solvent filter	Replace the filter.
	Flow rate too high for degasser to work efficiently	Use a parallel flow arrangement.
	Fittings overtightened from repeated use	Replace fittings.
Instrument does not turn on	Blown fuse	Replace the fuse.
Status LED flashes on for 1 second and off for 2 seconds	The vacuum level has risen above 800 mm Hg or has fallen below 10 mm Hg	Contact your Thermo Fisher Scientific field service engineer.
Status LED flashes on for 1 second and off for 1 second	The vacuum level has not reached 100 mm Hg within 5 minutes	Contact your Thermo Fisher Scientific field service engineer.
	The vacuum level in mm Hg multiplied by the motor speed in RPM has exceeded 6000 for more than 2 seconds	Contact your Thermo Fisher Scientific field service engineer.
	The vacuum level in mm Hg multiplied by the motor speed in RPM has exceeded 6000 for more than 2 seconds	Contact your Thermo Fisher Scientific field service engineer.

CAUTION If a leak occurs, contact your Thermo Fisher Scientific field service engineer immediately. Allowing solvent to remain in the vacuum system overnight could soften the plastic (PPS) vacuum chambers, causing an internal leak and instrument damage.

Accessories and Maintenance Parts

This chapter contains the lists of accessories and replaceable parts that are shipped with the SpectraSYSTEM UV8000 Degasser and PDA Detector and that you can order from Thermo Fisher Scientific.

Accessory Kits

The UV8000 module is shipped with the LightPipe flowcell kit (Table 10) and an accessory kit containing the necessary cables, tubing, and fittings to connect the UV8000 module to the data system and to a pump and an autosampler (Table 11).

Table 10. LightPipe flowcell kit (P/N 803237-01)

Part number	Description
----------*	50 mm LightPipe flowcell
2522-0285	Fingertight, 10-32, one-piece PEEK fitting
803260	Inlet tubing, with insulation, PEEK 1/16 × 0.005 in. ID (red), 33 in.
703950	Outlet tubing, PEEK 1/16 × 0.01 in. ID (blue), 60 in.

* The LightPipe flowcell is only available as part of this kit. It cannot be ordered separately.

IMPORTANT Use only PEEK fittings with the LightPipe flowcell.

Table 11. UV8000 module accessory kit (Sheet 1 of 2)

Part number	Description
CHROM-98032	UV8000 CD
00825-01-00024	5-port Ethernet switch
97355-98006	Ethernet cable, straight patch with ferrite, 7 ft
6040-0103	Analog cable, detector
00004-02511	Cable connector
60060-63004	Adapter cable
A5596-010	Interconnect cable (three-connector cable)

Table 11. UV8000 module accessory kit (Sheet 2 of 2)

Part number	Description
60157-62008	Inlet tubing kit
00006-02-00010	Fuse, T3.15 A (5 × 20 mm) (for 100/115 V operation)
00006-02-00011	Fuse, T1.6 A (5 × 20 mm) (for 230 V operation)
F5034-040	Tubing, convoluted, solvent waste
3219-2004	Tubing, 0.063 in. ID, 228.6 cm (90 in.), FEP Teflon
3301-0151	Luer-Lok syringe
00109-02-00028	Luer adapter for the syringe
60060-10030	Brackets (2)
00405-01-00026	Truss head screws for brackets, 6/32 × 1/4 in. (4)
00109-02-00023	Fingertight fitting, blue (2)
00109-02-00024	Fingertight fitting, yellow (2)
00109-02-00025	Fingertight fitting, green (2)
00109-02-00026	Fingertight fitting, orange (2)
00101-18223	Ferrule, Tefzel (8)

Table 12 lists optional accessories that can be purchased with the UV8000 module.

Table 12. Optional accessories

Part number	Description
60257-60008	Filter wheel for linearity verification, (five-positions; one position with perchloric acid blank and four positions with different concentrations of potassium dichromate in perchloric acid solution, NIST traceable)
802259	Backpressure regulator

Maintenance Parts

Replacement parts for routine maintenance of the UV8000 module are listed in Table 13.

Table 13. Maintenance parts

Part number	Description
00010-01-00015	Deuterium lamp assembly (pre-aligned)
60257-60006	Tungsten-halogen (W) lamp assembly (pre-aligned)
803237-01	LightPipe flowcell kit (Table 10 on page 105)
00006-02-00010	Fuse, T3.15 A (5 × 20 mm) (for 100/115 V operation)
00006-02-00011	Fuse, T1.6 A (5 × 20 mm) (for 230 V operation)

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