

**Finnigan™  
SpectraSYSTEM™**

UV6000LP Detector  
Reference Manual

A0099-595 Revision F

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**SpectraSYSTEM UV6000LP Detector Serial #** \_\_\_\_\_ **Date Purchased** \_\_\_\_\_

**Tell us more...** Let us know more about how you use this product:

**My Organization Is:** (Check one only)

- ☐ Commercial (for profit) lab
- ☐ Government lab
- ☐ Hospital / Clinic
- ☐ Research Institute
- ☐ University / College
- ☐ Veterinary
- ☐ Other \_\_\_\_\_

**Job Function:** (Check one only)

- ☐ Administration
- ☐ Lab Management
- ☐ Operator
- ☐ Other \_\_\_\_\_

**My Primary Application Is:** (Check one only)

- ☐ Analytical
- ☐ Biomedical
- ☐ Clinical / Toxicology
- ☐ Energy
- ☐ Food / Agriculture
- ☐ Forensic / Toxicology
- ☐ Pharmaceutical
- ☐ Research / Education
- ☐ Other \_\_\_\_\_

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*Finnigan SpectraSYSTEM*

*UV6000LP Detector Reference Manual*

*Revision F*

*A0099-595*

	Strongly Agree	Agree	Disagree	Strongly Disagree
The manual is well organized.	1	2	3	4
The manual is clearly written.	1	2	3	4
The manual contains all of the information I need.	1	2	3	4
The instructions are easy to follow.	1	2	3	4
The instructions are complete.	1	2	3	4
The technical information is easy to understand.	1	2	3	4
The figures are helpful.	1	2	3	4
I was able to operate the system by using this manual. (If not, please comment below.)	1	2	3	4

Additional Comments: (Attach additional sheets if necessary.)

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Stamp  
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# Safety and EMC Information

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In accordance with our commitment to customer service and safety, these instruments have satisfied the requirements for the FCC and the European CE Mark including the Low Voltage Directive.

Designed, manufactured and tested in an ISO9001 Registered facility, this instrument has been shipped to you from our manufacturing facility in a safe condition.



**CAUTION!** This instrument must be used as described in this manual. Any use of this instrument in a manner other than described here may result in instrument damage and/or operator injury.

## IDENTIFYING SAFETY INFORMATION

This reference manual contains precautionary statements that can prevent personal injury, instrument damage, and loss of data if properly followed. All statements of this nature are called to your attention through the use of bold type and the following icons:



CAUTION!



HOT  
SURFACE!



HIGH  
VOLTAGE!

Every instrument has specific hazards, so be sure to read and comply with the following precautions. They will help ensure the safe, long-term use of your system.

1. Before plugging in any of the instrument modules or turning on the power, always make sure that the voltage and fuses are set appropriately for your local line voltage.
2. Only use fuses of the type and current rating specified. Do not use repaired fuses and do not short-circuit the fuse holder.
3. The supplied power cord must be inserted into a power outlet with a protective earth contact (ground). When using an extension cord, make sure that the cord also has an earth contact.
4. Do not change the external or internal grounding connections. Tampering with or disconnecting these connections could endanger you and/or damage the system.



**CAUTION!** The instrument is properly grounded in accordance with regulations when shipped. You do not need to make any changes to the electrical connections or to the instrument's chassis to ensure safe operation.

5. Never run the system without the housing on. Permanent damage can occur.
6. Do not turn the instrument on if you suspect that it has incurred any kind of electrical damage. Instead, disconnect the power cord and contact a Service Representative for a product evaluation. Do not attempt to use the instrument until it has been evaluated. (Electrical damage may have occurred if the system shows visible signs of damage, or has been transported under severe stress.)
7. Damage can also result if the instrument is stored for prolonged periods under unfavorable conditions (for example, subjected to heat, water, and so on).
8. Always disconnect the power cord before attempting any type of maintenance.
9. Capacitors inside the instrument may still be charged even if the instrument is turned off.
10. Never try to repair or replace any component of the system that is not described in this manual without the assistance of your service representative.

## **GOOD LABORATORY PRACTICES**

### ***Keep Good Records***

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

### ***Chemical Toxicity***

Although the large volume of toxic and flammable solvents used and stored in laboratories can be quite dangerous, don't ignore the potential hazards posed by your samples. Take special care to read and follow all precautions that ensure proper ventilation, storage,

handling, and disposal of both solvents and samples. Become familiar with the toxicity data and potential hazards associated with all chemicals by referring to the manufacturers' Material Safety Data Sheets (MSDS).

### ***Sample Preparation***

Always consider the solubility of your sample in the solvent/mobile phase. Sample precipitation can plug the column, tubing and/or flow cell causing flow restriction. This obstruction may result in irreparable damage to the system. Particulate matter can be avoided by filtering the samples through 0.45 or 0.2 micron (or less) filters.

### ***Solvent Requirements***

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

Choose a mobile phase that's compatible with the sample and column you've selected for your separation. Remember that some solvents are corrosive to stainless steel. Inert, biocompatible versions of instruments are also available from Thermo Electron.

### ***Degas the Eluents***

Degas your eluent solvents using either the vacuum degassing or the helium sparging technique. A complete description of these techniques is found in separate documentation provided with degassing accessories.

### ***Solvent Disposal***

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

### ***High-pressure Systems and Leaks***

LC systems operate at high pressures. Because liquids aren't highly compressible they do not store much energy. Accordingly, there is little immediate danger from the high pressures in an LC system. However, if a leak occurs, it should be corrected as soon as possible. Finally, we recommend that you always wear eye and skin protection when working on an LC system and that you always shut down the system and return it to atmospheric pressure before attempting any maintenance.





# Information sur la sécurité et la compatibilité électromagnétique (CEM)

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Selon notre engagement à assurer à nos clients service et sécurité, ces instruments sont déclarés conformes aux normes de la FCC et à la réglementation européenne (CE), y compris à la directive sur les basses tensions.

Conçu, fabriqué et testé dans une installation homologuée ISO9001, cet instrument a été livré à partir de notre usine de fabrication dans le respect des règles de sécurité.



**MISE EN GARDE !** Cet instrument doit être utilisé selon les instructions figurant dans ce manuel. Le non respect des consignes d'utilisation de cet instrument décrites dans le présent manuel risque d'endommager l'instrument et/ou d'infliger des blessures à l'opérateur.

## IDENTIFICATION DES INFORMATIONS SUR LA SÉCURITÉ

Ce manuel de référence contient des précautions d'usage afin de prévenir tout dommage corporel ou matériel ainsi que toute perte de données lorsque l'opérateur se conforme aux instructions indiquées. Ces instructions sont accompagnées des icônes suivantes et sont affichées en caractères gras pour attirer l'attention de l'opérateur :



MISE EN  
GARDE !



SURFACE  
BRÛLANTE !



HAUTE  
TENSION !

Chaque instrument présentant des dangers spécifiques, il incombe à l'opérateur de lire les précautions suivantes et de s'y conformer, afin de maintenir la durée de vie et la sécurité du système.

1. Avant de brancher un module d'instruments ou de le mettre sous tension, toujours s'assurer que la tension et les fusibles sont réglés de façon à correspondre à la tension locale du secteur.
2. N'utiliser que des fusibles du type et du courant nominal spécifiés. Ne pas utiliser de fusibles réparés et ne pas court-circuiter le porte-fusible.

3. Le cordon d'alimentation accompagnant l'instrument doit être branché à une prise de courant avec mise à la terre. En cas d'utilisation d'une rallonge électrique, s'assurer que celle-ci comporte également une mise à la terre.
4. Ne pas modifier les connexions de mise à la terre internes ou externes. La modification ou le débranchement de ces connexions représente un danger pour l'opérateur et/ou risque d'endommager le système.



**MISE EN GARDE ! Cet instrument est mis à la terre conformément aux règlements applicables lors de son expédition. Ne pas modifier les branchements électriques ou le châssis de l'instrument afin d'assurer un fonctionnement en toute sécurité.**

5. Ne jamais faire fonctionner le système sans son boîtier. Des dommages permanents pourraient en résulter.
6. Ne pas mettre l'instrument sous tension si celui-ci a subi des dommages électriques. Débrancher le cordon d'alimentation de l'appareil et consulter un représentant du service technique pour procéder à un examen du produit. Ne pas essayer d'utiliser l'instrument avant qu'il n'ait été examiné. (Des dommages électriques peuvent s'être produits si le système montre des signes visibles d'endommagement ou si les conditions de transport ont été extrêmement difficiles.)
7. L'instrument peut également être endommagé s'il est entreposé pendant une période de temps prolongée, dans de mauvaises conditions (par exemple, s'il est exposé à la chaleur, à l'humidité, etc.).
8. Toujours débrancher le cordon d'alimentation avant d'effectuer n'importe quel type d'entretien.
9. Les condensateurs présents à l'intérieur de l'instrument peuvent toujours être chargés, même si l'instrument est hors tension.
10. Ne jamais tenter de réparer ou de remplacer un composant du système non décrit dans ce manuel sans obtenir de l'aide auprès d'un représentant du service technique.

## **BONNES PRATIQUES DE LABORATOIRE**

### ***Bonne tenue des dossiers***

Pour permettre d'identifier et d'isoler les problèmes pouvant survenir avec l'équipement ou la méthodologie utilisés, il est recommandé de tenir correctement des dossiers de toutes les conditions du système (*p. ex.*, % CV sur les temps de rétention et les zones de pics, la forme et la résolution des pics). Il est recommandé tout au moins de conserver pour référence future un chromatogramme d'un échantillon type et d'un mélange standard, bien documenté et accompagné des conditions du système. Une comparaison précise des temps de rétention, des formes et de la sensibilité des pics ainsi que des bruits

de référence peuvent fournir des indices précieux pour l'identification et la résolution de problèmes futurs.

### ***Toxicité chimique***

Bien que l'utilisation et l'entreposage dans les laboratoires de grandes quantités de solvants inflammables et toxiques puissent représenter un danger, ne pas négliger les dangers potentiels posés par les échantillons. Veiller particulièrement à lire et à suivre toutes les précautions indiquées pour assurer la ventilation, le stockage, la manutention et l'élimination des solvants et des échantillons. Se familiariser avec les données sur la toxicité et les dangers potentiels associés à tous les produits chimiques en consultant les fiches techniques sur la sécurité des substances (FTSS) du fabricant.

### ***Préparation des échantillons***

Toujours considérer la solubilité de l'échantillon dans la phase mobile. La précipitation des échantillons peut boucher la colonne, les tubes et/ou la cellule de dilution, et en limiter le débit. Cette obstruction peut endommager le système de façon irréparable. L'accumulation de particules peut être évitée par la filtration des échantillons à travers des filtres de 0,45 ou 0,2 µm (ou moins).

### ***Caractéristiques des solvants***

Un grand nombre de fabricants de produits chimiques fournissent des réactifs de pureté élevée ou de qualité spectrographique dépourvue de toute impureté chimique. La filtration systématique de tous les solvants ou éluants à travers un filtre fluorocarboné de 0,45 ou 0,2 µm (ou moins) avant de les placer dans le réservoir de solvants prolonge de façon significative la durée de vie et l'efficacité des filtres d'entrée, des clapets et des joints d'étanchéité, de l'injecteur et de la colonne. De façon générale, les solvants pour chromatographie liquide sous haute pression ne nécessitent pas de filtration.

Choisir une phase mobile qui est compatible avec l'échantillon et la colonne sélectionnés pour la séparation. Noter que certains solvants sont corrosifs pour l'acier inoxydable. Des versions inertes et biocompatibles des instruments sont disponibles auprès de Thermo Electron.

### ***Dégazage des éluants***

Effectuer le dégazage des éluants selon la méthode de dégazage par le vide ou à l'hélium. Une description complète de ces méthodes est disponible dans la documentation fournie séparément avec les accessoires de dégazage.

### ***Élimination des solvants***

S'assurer qu'il existe un conteneur pour solvants à éliminer ou tout autre système de vidange au niveau de la table de travail ou au-dessous de celle-ci. La plupart des solvants doivent être éliminés dans des conditions particulières et ne doivent pas être évacués

directement par les canalisations. Respecter la réglementation en vigueur concernant l'évacuation des produits chimiques.

### ***Systèmes à haute pression et fuites***

Les systèmes de chromatographie liquide (CL) fonctionnent à des pressions élevées. Les liquides n'accumulent pas de grandes quantités d'énergie car ils ne sont pas hautement compressibles. Par conséquent, le risque d'un danger immédiat causé par les pressions élevées dans un système CL est faible. En revanche, si une fuite survient, il est nécessaire de la réparer le plus rapidement possible. Enfin, il est recommandé à l'opérateur de se protéger en permanence les yeux et la peau lorsqu'il travaille sur un système CL. De plus, il doit toujours mettre le système hors tension et le ramener à la pression atmosphérique avant de procéder à tout entretien.

# Informationen zu Sicherheit und Funkentstörung

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Wir sind dem Dienst am Kunden und der Sicherheit des Kunden verpflichtet. Diese Geräte entsprechen den Anforderungen für die FCC-Zulassung und für das CE-Zeichen sowie den Bestimmungen der Richtlinie für Niederspannungsgeräte.

Dieses Gerät wurde in einer nach ISO 9001 zertifizierten Fertigungsstätte entwickelt, hergestellt und getestet und hat unser Werk in sicherem Zustand verlassen.



**VORSICHT! Dieses Gerät darf nur nach den Vorschriften dieser Bedienungsanleitung benutzt werden. Wenn dieses Gerät auf andere Weise als hier beschrieben benutzt wird, kann dies zu Schäden am Gerät oder zur Verletzung des Bedieners führen.**

## ERKENNEN VON SICHERHEITS- INFORMATIONEN

Dieses Handbuch enthält Warnhinweise, deren genaue Befolgung Personenschäden, Schäden am Gerät oder Datenverluste verhindern kann. Auf alle derartigen Warnhinweise wird durch Fettschrift und durch Verwendung der nachfolgenden Symbole gesondert aufmerksam gemacht:



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**OBERFLÄCHE  
HEISS!**



**HOCHSPAN-  
NUNG**

Jedes Gerät kann unter bestimmten Umständen gefährlich sein. Lesen Sie daher in jedem Fall die nachstehenden Sicherheitshinweise, und ergreifen Sie die entsprechenden Maßnahmen. Auf diese Weise sorgen Sie für einen sicheren Betrieb und eine lange Lebensdauer des Geräts.

1. Bevor Sie eines der Gerätemodule einstecken oder das Gerät einschalten, überprüfen Sie in jedem Fall, ob die Nennspannung und die Sicherungen der Netzspannung der örtlichen Stromversorgung entsprechen.
2. Verwenden Sie nur Sicherungen des angegebenen Typs und der angegebenen Amperezahl. Verwenden Sie keine reparierten Sicherungen, und überbrücken Sie die Sicherung nicht.

3. Das mitgelieferte Netzkabel muß in eine Steckdose mit Schutzleiter eingesteckt werden. Wird ein Verlängerungskabel verwendet, muß auch hier der Schutzleiter durchgeführt sein.
4. Verändern Sie nichts an den externen oder internen Schutz- bzw. Erdungskontakten. Wenn Sie sich an diesen zu schaffen machen oder sie unterbrechen, können Sie sich selbst und andere gefährden, oder das Gerät könnte beschädigt werden.



**VORSICHT! Das Gerät ist bei der Auslieferung vorschriftsmäßig geerdet. Es brauchen keine Veränderungen an der elektrischen Verkabelung oder am Gerätechassis vorgenommen werden, um einen sicheren Betrieb zu gewährleisten.**

5. Nehmen Sie das Gerät nie mit geöffnetem Gehäuse in Betrieb, da dies zu irreparablen Schäden führen kann.
6. Schalten Sie das Gerät nicht ein, wenn Sie den Verdacht haben, daß an der Elektrik möglicherweise Schäden eingetreten sind. Ziehen Sie in diesem Fall den Netzstecker heraus, und lassen Sie das Gerät von einem Kundendiensttechniker untersuchen. Versuchen Sie bis zu dieser Untersuchung keinesfalls, das Gerät in Betrieb zu nehmen. (Eine Beschädigung der Elektrik kann z.B. eingetreten sein, wenn das Gerät äußere Schäden aufweist oder unter problematischen Umständen transportiert wurde.)
7. Schäden können auch eintreten, wenn das Gerät längere Zeit unter ungünstigen Umständen gelagert wurde (z.B. unter der Einwirkung von Hitze oder Wasser).
8. Ziehen Sie vor allen Wartungsmaßnahmen immer zuerst den Netzstecker aus der Steckdose.
9. Auch wenn das Gerät abgeschaltet ist, können die im Inneren befindlichen Kondensatoren nach wie vor unter Spannung stehen.
10. Versuchen Sie niemals, Gerätekomponenten zu reparieren oder auszutauschen, die nicht in diesem Handbuch beschrieben sind, ohne einen Kundendiensttechniker zu Rate zu ziehen.

## **GLP-VORSCHRIFTEN (GOOD LABORATORY PRACTICES)**

### ***Ordnungsgemäße Aufzeichnungen***

Damit Probleme mit Geräten oder Methoden erkannt und eingegrenzt werden können, empfehlen wir Ihnen, ordnungsgemäße Aufzeichnungen sämtlicher Gerätezustände (z.B. % RSDs zu Retentionszeiten, Kurvenflächen, Kurvenformen und Auflösung). Archivieren Sie als Minimum ein Chromatogramm einer typischen Probe und einer Standardmischung mit umfassender Dokumentation der Systembedingungen zum späteren Vergleich. Ein

sorgfältiger Vergleich von Retentionszeiten, Kurvenformen, Empfindlichkeitswerten und Hintergrundrauschen liefert wertvolle Hinweise für den Fall, daß zu einem späteren Zeitpunkt Probleme auftreten und eingegrenzt und behoben werden müssen.

### **Chemische Toxizität**

Die großen Mengen an toxischen oder brennbaren Lösungsmitteln, die im Labor verwendet und aufbewahrt werden, können ein erhebliches Gefahrenpotential darstellen, doch darf man hierüber nicht die mögliche Gefährdung durch die Proben selbst vergessen. Achten Sie insbesondere darauf, sämtliche Warnhinweise hinsichtlich ausreichender Belüftung, Lagerung, Handhabung und Entsorgung von Lösungsmitteln ebenso wie von Proben sorgfältig zu lesen und zu befolgen. Machen Sie sich mit den Toxizitätsdaten und den möglichen Gefahren sämtlicher verwendeter Chemikalien anhand der betreffenden Sicherheitsdatenblätter vertraut, die von den Produktherstellern zur Verfügung gestellt werden.

### **Probenvorbereitung**

Überprüfen Sie stets die Löslichkeit der Probe in der mobilen Phase. Durch das Ausfällen von Feststoffen können die Säule, die Leitungen oder die Durchflußzelle verstopfen und damit den Durchfluß hemmen. Durch eine solche Verstopfung können irreparable Schäden am System entstehen. Die Ablagerung von Partikeln läßt sich durch Filtrieren der Proben durch ein Filter mit einer Porengröße von 0,45 oder 0,2 µm (oder weniger) vermeiden.

### **Anforderungen an das Lösungsmittel**

Viele chemische Hersteller bieten eine Produktserie hochreiner Reagenzien in spektroskopisch reiner Qualität an, die frei von chemischen Unreinheiten sind. Die routinemäßige Filtrierung aller Lösungs- und Extraktionsmittel durch ein Fluorkohlenwasserstoff-Filter mit einer Porengröße von 0,45 oder 0,2 µm (oder weniger) vor dem Einfüllen in den Lösungsmittelbehälter verlängert die Lebensdauer der Einlaßfilter, der Ventile und Dichtungen, des Injektors und der Säule beträchtlich. Spezielle HPLC-Lösungsmittel brauchen normalerweise nicht filtriert zu werden.

Wählen Sie eine mobile Phase, die zur Probe und zur für die Separation verwendete Säule kompatibel ist. Dabei ist darauf zu achten, daß Edelstahl durch bestimmte Lösungsmittel korrodiert wird. Reaktionsträge, biokompatible Geräteausführungen werden ebenfalls von Thermo Electron Instruments angeboten.

### **Entgasen des Lösungsmittels**

Lösungs- und Extraktionsmittel sollten entgast werden, und zwar entweder durch Vakuum oder Heliumdurchperlung. Eine umfassende Beschreibung dieser Techniken finden Sie in dem separaten Handbuch, das dem Entgasungszubehör beiliegt.

### ***Entsorgung von Lösungsmitteln***

Sorgen Sie dafür, daß ein Auffangbehälter für Lösungsmittel oder eine andere Auffangvorrichtung in Höhe des Arbeitstisches oder darunter zur Verfügung steht. Für die meisten Lösungsmittel gelten besondere Entsorgungsvorschriften; eine Entsorgung über die Abwasserleitung ist hier nicht zulässig. Bei der Entsorgung von Chemikalien gleich welcher Art sind die einschlägigen Vorschriften streng zu beachten.

### ***Hochdrucksysteme und Undichtigkeiten***

Flüssigchromatographen arbeiten unter hohem Druck. Da Flüssigkeiten kaum komprimierbar sind, können sie nicht viel Energie speichern. Dementsprechend stellt der hohe Druck in einem Flüssigchromatographen auch kaum eine unmittelbare Gefahr dar. Jedoch sollten auftretende Undichtigkeiten umgehend beseitigt werden. Schließlich ist noch zu empfehlen, bei der Arbeit mit einem Flüssigchromatographen stets Augen und Haut zu schützen und vor allen Wartungsarbeiten darauf zu achten, daß das Gerät abgeschaltet und druckfrei gemacht wurde.



# General Information

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## Introduction

This chapter provides general information about this manual and your Thermo Electron, Finnigan UV6000LP Detector.

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## Scope of this Manual

This manual contains the information needed to install, calibrate, maintain, and troubleshoot the UV6000LP Detector. Detailed field service and repair procedures for factory trained technicians are also covered in Chapter 8 of this manual.

The UV6000LP is designed to be operated from a PC running either ChromQuest Ver. 2.1 software (or higher) or Atlas Ver. 2003, R1 software (or higher). Because the only controls on the detector are a power on switch and power indicator, there is no independent Operation chapter. Refer to the ChromQuest Software User's Guide or the Atlas SpectraSYSTEM Control manual for software operating procedures.

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## Manual Organization

This manual is organized as follows:

*Technical Assistance and Product Support* - Lists all of the phone numbers you will need for technical assistance, service, product support, and ordering parts and accessories.

*Safety Information* - Contains a statement of the detector's certifications, explains how safety items are presented in the manual, lists the specific hazards you should avoid, and includes a description of good laboratory practices. If you have not read this section, do so before installing and using your detector.

*Chapter 1, General Information* - Described in the preceding Introduction paragraph.

*Chapter 2, Installation* - Covers the complete initial installation of your UV6000LP Detector, including connection to other chromatographic instrumentation.

*Chapter 3, UV6000LP Quick Start* - Contains example procedures for running a standard on the UV6000LP using ChromQuest Ver. 4.1.

*Chapter 4, Routine Maintenance* - Recommends and includes procedures for routine maintenance to keep your detector in peak operating condition.

*Chapter 5, Diagnostics* - Describes the user interface and use of the UV6000LP Diagnostics program supplied with ChromQuest Ver. 4.1 and the Instrument Manager supplied with Atlas Ver. 2003, R2. Although this is part of the software, it is included here rather than in the software manual since it is specific to this detector. Several diagnostic procedures are recommended as routine maintenance in Chapter 4.

*Chapter 6, Troubleshooting* - Contains a table of symptoms, possible causes, and remedies for some common problems you may observe when using your detector.

*Chapter 7, Accessories and Replacement Parts* - Lists accessories and user spare parts for the detector and includes Thermo Electron part numbers.

*Chapter 8, Field Service Procedures* - provides detailed instructions for factory trained service personnel to perform field repairs.

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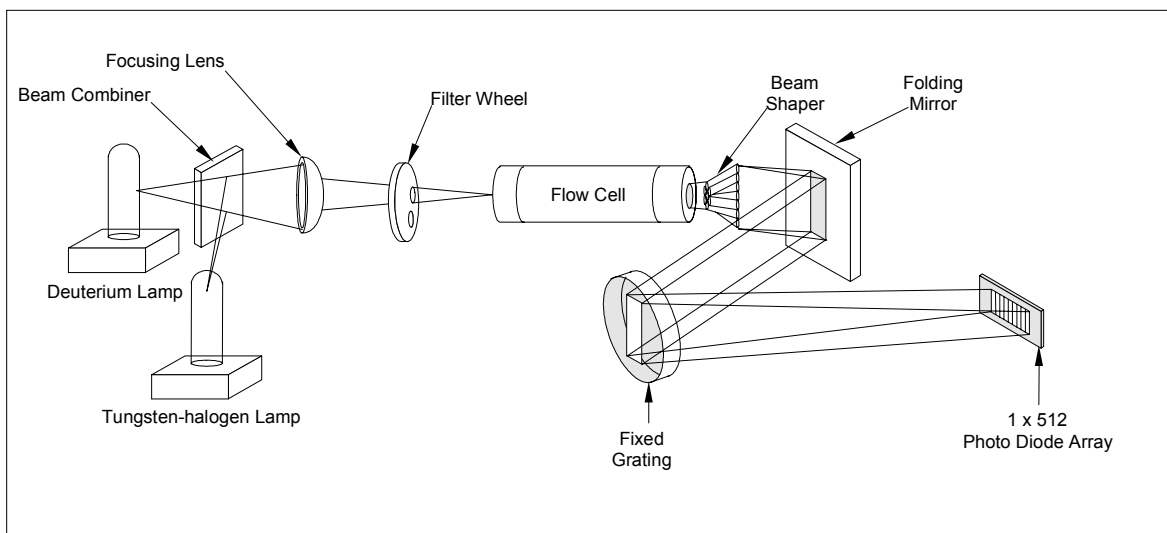
## UV6000LP Functional Description

This brief functional description of the UV6000LP is included to assist you with troubleshooting potential problems and performing routine maintenance on your detector. For more detailed information, contact your Thermo Electron representative.

The UV6000LP Detector is packaged as a bench-top unit for inclusion in a liquid chromatography system. It is designed to be remotely operated over a serial communications link from a PC using either Microsoft Windows NT/2000 based ChromQuest or Atlas software. The detector consists of a dual-light source, an optical bench, a photodiode array, a low voltage power supply, and several printed circuit board assemblies (PCBAs).

Figure 1.1 shows the optical system used in the detector. The dual-light source includes a deuterium lamp for detection in the ultraviolet wavelength range (190 nm to 350 nm) and a tungsten - halogen lamp for detection in the visible wavelength range (350 nm to 800 nm). There is some overlap between the two lamps in the 300 nm to 500 nm range.

The optical bench contains a beam combiner, focusing lens, filter wheel, 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. The combined beam is then focused on the inlet window of the flowcell through the filter wheel. The standard filter wheel has two positions. Position 1 (open) is used for normal operation. Position 2 contains a cuvette filled with a holmium oxide / perchloric acid solution, (NIST Traceable), for wavelength accuracy verification and calibration.



*Figure 1.1 The UV6000LP optical system*

The light focused on the inlet window of the 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 flowcell. The other end of the bundle is arranged to produce a narrow “slit” of light for the grating. The beam shaper transfers all of 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 is used to shorten the optical bench and thus reduce the physical size of the detector. The spectrum from the grating is focused on the 512 element photodiode array. Since the spectrum of light falling on the array is 611 nm, (190 to 800 nm), the effective spacing of the diodes is  $611 \text{ nm} / 512 = 1.2 \text{ nm}$ . Firmware resident in the detectors’ CPU PCBA automatically interpolates diode intervals to arrive at integer wavelengths.

The photodiode array is mounted on the Array Acquisition PCBA which also contains all of the analog detection circuitry. The diode array is continuously scanned at a 20-Hz rate, the light intensity at each diode is converted to a 20-bit digital word, and these are stored in a dual-port RAM (Random Access Memory) on the CPU PCBA. As the data points are stored through one RAM port, the CPU reads the data it needs (based on user parameters entered through the software) through the other RAM port, processes the data, and sends it to the personal computer.

The CPU PCBA also processes remote inputs and outputs through the Transition PCBA which functions as a rear panel. A dual, 20-bit, digital-to-analog converter on the CPU PCBA provides two, single-wavelength analog outputs on the detector's rear connectors. The detector also contains a low-voltage power supply and a lamp power supply.

# 2

## Installation

---

---

### Introduction

This chapter covers the initial installation of your Thermo Electron UV6000LP Detector, including connection to other chromatographic instrumentation. The Installation Checklist on the back of this page is an abbreviated version of this chapter and can be used as a quick reference of how to conduct a successful installation. Make a copy of the checklist and fill it out when the installation is complete. Include the completed checklist in your maintenance records.



*NOTE: Perform the installation in the sequence presented on the Installation Checklist and detailed in this chapter*

---

### Unpacking

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

The shipping container should contain: the detector; an accessory kit including the UV6000LP flowcell, inlet/outlet tubing and fittings, power cable, remote start cable, 2 signal cables, RJ45 cable, RJ45 9-pin adapter; and this manual.

Carefully check to make sure you received all the items listed on the packing list. If any items are missing, contact your Thermo Electron representative immediately.

# Installation Checklist

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*This is a brief summary of the steps that must be completed for the proper installation of your Thermo Electron Finnigan UV6000LP Detector.*

- ☐ Unpack and inspect your instrument (pg. 2-1)
- ☐ Read the Safety section (pg. vii)
- ☐ Position the detector appropriately (pg. 2-3)
- ☐ Gather the necessary tools (pg. 2-3)
- ☐ Select the voltage and check the fuses (pg. 2-4)
- ☐ Make initial rear panel connections (pg. 2-5)
- ☐ Connect and install the flowcell (pg. 2-9)
- ☐ Connect the power cord and turn on the instrument (pg. 2-11).
- ☐ Install appropriate software on the connecting PC (software manual).
- ☐ Download the firmware, if required (pg. 4-20).
- ☐ Adjust the sense of the remote communications outputs using the UV6000LP Diagnostics program in ChromQuest or Atlas, if required (pg. 2-11).
- ☐ Calibrate the detector using the UV6000LP Diagnostics program in ChromQuest (pg. 5-1) or the Instrument Manager in Atlas (pg. 5-23).

This detector was installed by:

\_\_\_\_\_  
(Name)

\_\_\_\_\_  
(Date)

---

## Making Initial Preparations

Place the detector on a bench top as close as possible to the chromatographic column outlet (This minimizes the length of tubing necessary for connection to the flowcell inlet). Be sure to place the detector in a draft-free location away from an opened window, air conditioner vents or other circulating air source. A stable room temperature is necessary for applications requiring maximum detection sensitivity. Allow at least five inches (13 cm) of clear space between the detector's rear panel and any wall or obstruction. This provides access to the rear-panel connectors and a free flow of cooling air.

You will need the following tools for installation:

- a narrow-tip screwdriver (2 mm wide)
- a #2 Phillips screwdriver
- a ¼" open end wrench

## Checking the Power Setting and Fuses



*NOTE: Do not connect the AC power cord to your instrument without first verifying that the voltage is properly set for your location! Never connect or operate the detector to an electrical line source with power drops or fluctuations 10% below the nominal rated line voltage!*

The detector is shipped with the voltage and fuses preset for your location. To verify the power setting, look through the cut-out window on the power entry module located at the lower right on the detector's rear panel (Figure 2.1). Use the following procedure to check the fuses and change the voltage setting if necessary.



*NOTE: Locations with 230V electrical power service may select a detector voltage setting of 220V or 240V for proper operation.*

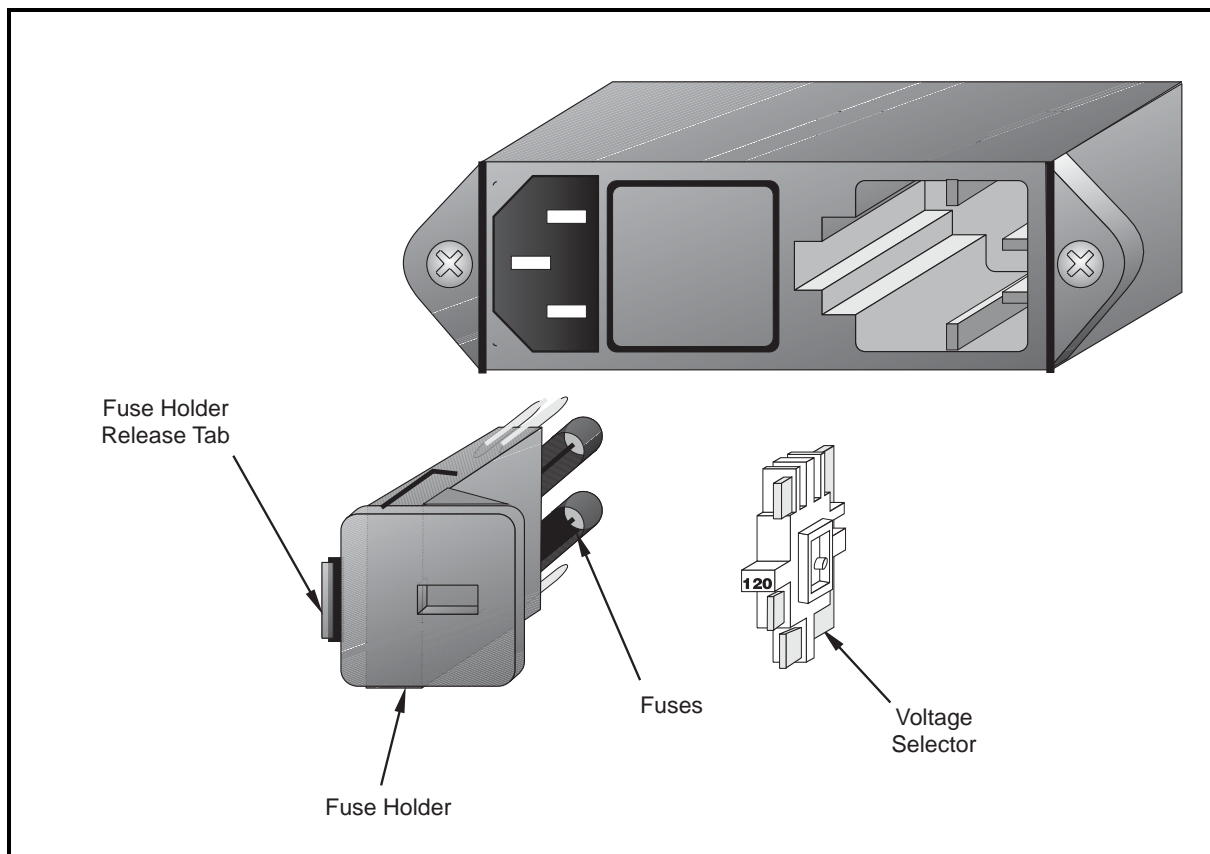


Figure 2.1 Selecting the proper voltage and checking the fuses

Select the desired operating voltage as follows:

1. Place the tip of the narrow-blade screwdriver in the small slot to the left of the fuse holder in the power entry module and push to the right. The fuse holder should pop out.
2. Pull the fuse holder out of the power entry module.



3. If necessary, remove the voltage selection PC board (it slides out) and install it with the desired voltage readable. This voltage must agree with the incoming line voltage.
4. Verify that the fuse holder contains the appropriate size fuses.
5. Slide the fuse holder back into the power entry module until it snaps in.



*NOTE: Do not connect the power cord and turn on the detector yet. Wait until the Power On section of this chapter.*

## Making Initial Rear Panel Connections

Use the cables supplied with your detector to make the connections described in this section (see Figure 2.2). For each connection, insert the cable's bare wire into the appropriate detector terminal. Hold the wire in place while you tighten the small terminal set-screw firmly onto the wire.

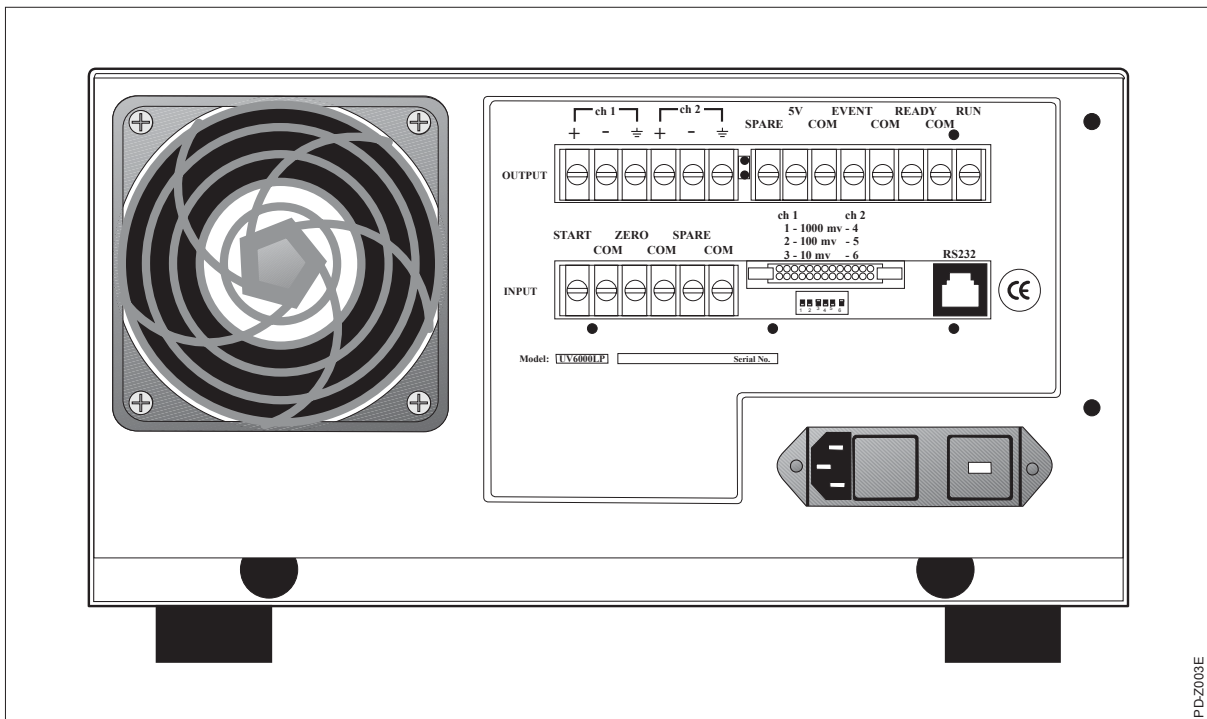


Figure 2.2 Detector rear-panel connections

## COMPUTER CONNECTION

Connect your computer to the detector's RS232 connector using the RS232 serial cable (P/N A3598 - 030) and the 9-pin adapter (P/N A3538-010).

## ANALOG OUTPUT CONNECTIONS

The analog signal cables are connected to the appropriate analog OUTPUT terminals located on the detector rear panel; ch1 and ch2 +, -, and ground ( $\frac{1}{\infty}$ ) terminals. The cables provided in the installation kit have 1/4-inch of bare wire at each end.



*NOTE: Do not connect the detector's ground terminals to any earth ground on your data system. This would lead to an increased noise level and a subsequent decrease in sensitivity.*

The data system should have a floating ground input. Typically, the positive and negative data system inputs are connected to the + and - terminals of the detector respectively. The ch1 and ch2 - output terminals of the detector are isolated from chassis ground and the ground ( $\frac{1}{\infty}$ ) terminals are connected to chassis ground.

## ANALOG OUTPUT SETTINGS

The analog outputs are controlled by the wavelength, bandwidth, rise time, and zero functions of the detector. These outputs can also be set for 10 mV, 100 mV, or 1000 mV per AU using the switches located on the rear panel and shown in Figure 2.3.

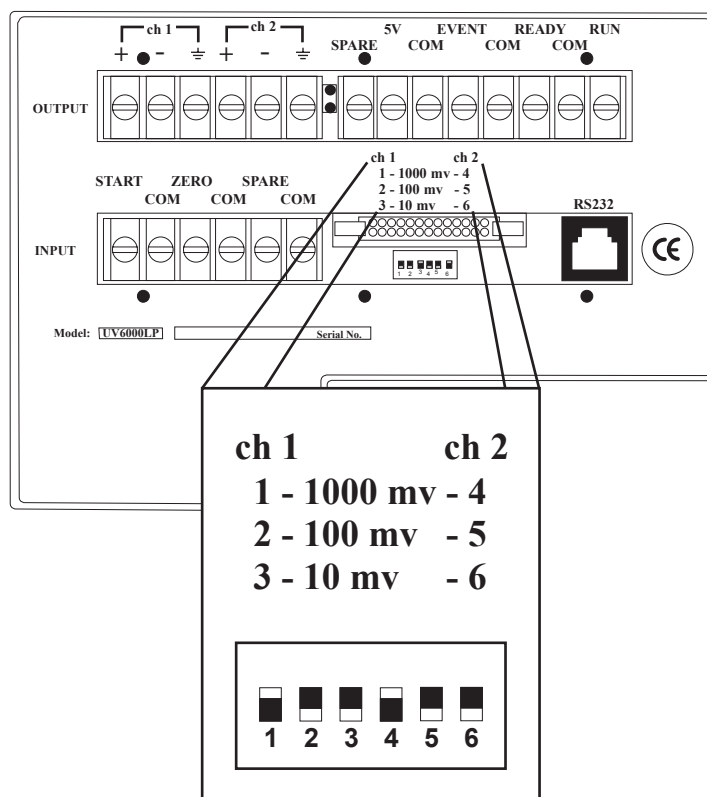


Figure 2.3 Recorder outputs full-scale voltage settings

The switches are numbered 1 through 6 from left to right, 1 to 3 for ch 1 and 4 to 6 for ch 2. For each channel, only the switch corresponding to the desired range should be up (ON). The other two switches for that channel should be down (OFF). Normally, the full-scale voltage should match the data system input span. Figure 2.3 shows both channels set to 1000 mV, (1 and 4 on, 2, 3, 5 and 6 off).



**NOTE:** If more than one switch for a given channel is set to the up (ON) position, the instrument will not work properly.

To change a range, move the appropriate switches using a small screwdriver or the tip of a pen. Remember, for each output channel, set one switch up (ON) and the other two switches down (OFF).

## REMOTE COMMUNICATIONS CONNECTIONS

The UV6000LP has the following remote communications inputs (Figure 2.2):

### Start

This input receives an inject signal from the autosampler or manual injector and sends a run-start signal to the PC-based software. During installation, you must hardwire this input to your autosampler or injector output. For Thermo Electron autosamplers, connect this input to the autosampler's Inject Out (pin 6) output, and the UV6000LP COM terminal to the autosampler ground (pin 1). If the autosampler or injector uses TTL to trigger the run, connect the TTL trigger to the detector's START terminal and the signal's ground or return to the detector's COM terminal. If the autosampler or injector uses a relay, connect the Normally Open output to the START terminal and the common output to the COM terminal. (Refer to the autosampler or injector documentation to determine whether TTL or a relay is used.)



*NOTE: All of the COM terminals on the rear of the detector are tied to a single digital ground or return line. You can use any COM terminal for any digital input or output signal return connection.*

### Zero

The ZERO connection on the rear panel is used to zero the detector from a remote source, generally at the start or end of each sample run. It can be triggered from a remote device by either a TTL low signal or a contact closure. If the remote instrument uses TTL to trigger the zero, then the TTL trigger is connected to the detector's ZERO terminal and the ground of the triggering device is connected to the COM terminal of the detector. If the remote instrument will be using a relay or contact closure, then the Normally Open output is connected to the detector's ZERO terminal and the common output is connected to the COM terminal.

### Outputs

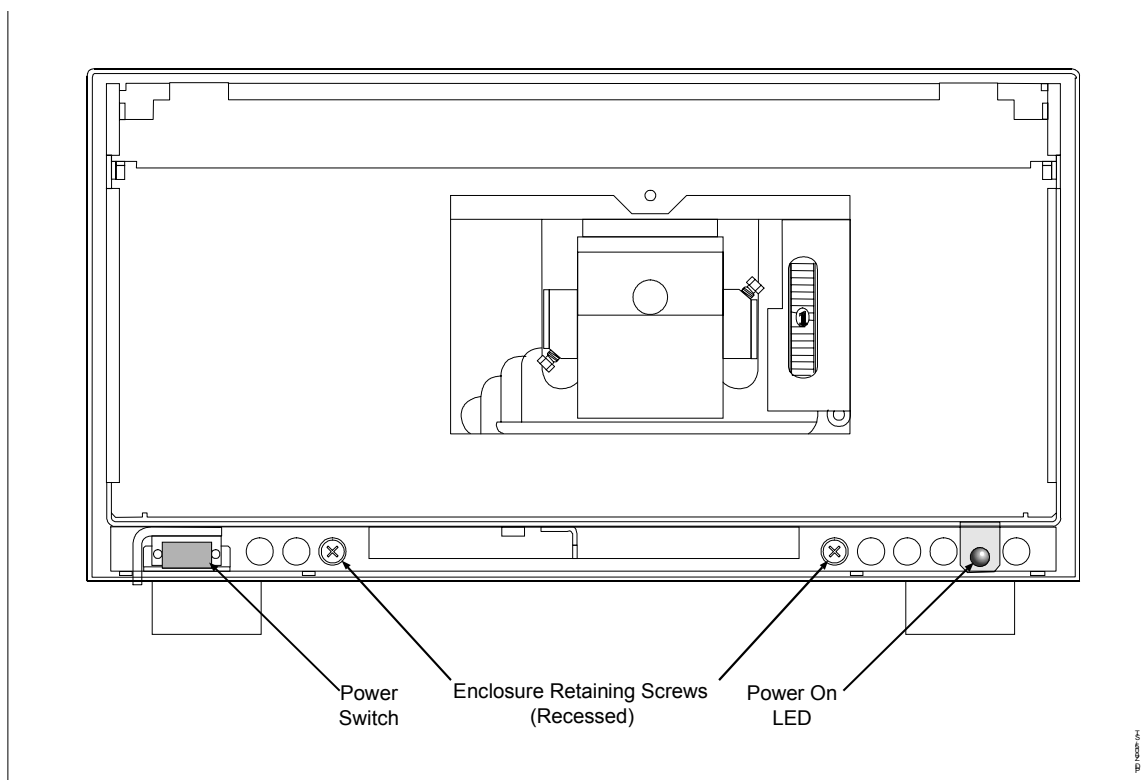


*NOTE: Do not connect the remote outputs of the detector (RUN, READY, and EVENT) to other equipment at this time. The senses (active high/active low) of these outputs must match those of the connecting equipment inputs. Wait until you power up the detector and adjust the senses as necessary with either ChromQuest or Atlas software.*

---

## Connecting and Installing the Flowcell

The front of the detector (Figure 2.4) has a power switch at the lower left and power on indicator light at the lower right. Access to the flowcell is made through the removable front panel and bezel.

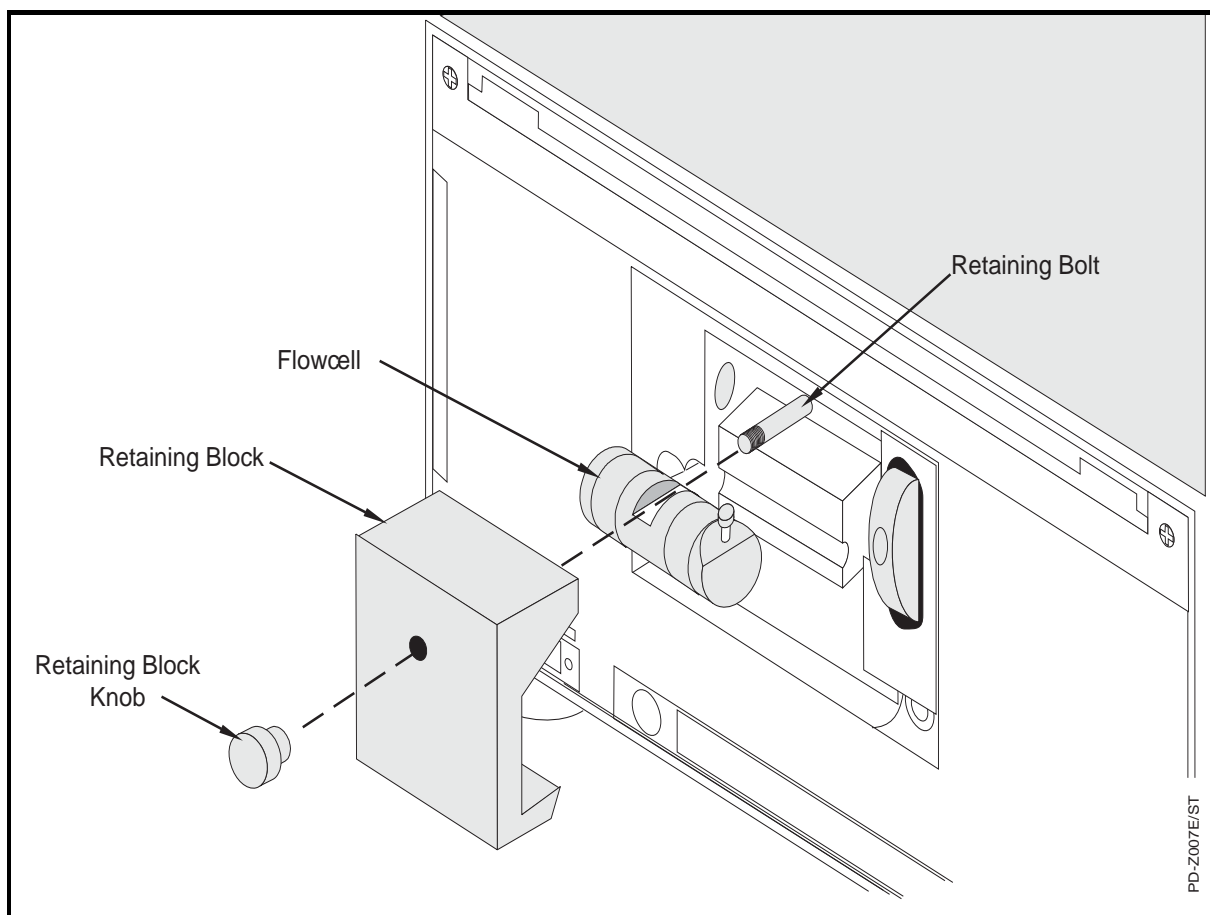


*Figure 2.4 Detector with front panel removed*

The flowcell is packed in a small, separate box within the detector shipping carton. This small box contains the flowcell (with protective caps on each end) and a plastic bag containing the inlet and outlet tubing and finger tight fittings.

Unpack the flowcell and install it as follows:

1. Remove the front cover of the detector by pulling out at the bottom edge and lifting up.
2. Remove the flowcell cover by gently pulling the snap latch to free the cover. Remove the retaining block knob and retaining block (Figure 2.5).



*Figure 2.5 Flowcell installation*

3. Use the supplied fingertight fittings and tubing sets included with the flowcell kit to connect the HPLC column outlet directly to the detectors' flowcell (fluid) inlet. The outlet of the flowcell is on the same side as the locating notch on the top of the flowcell. The flowcell inlet is on the opposite end.



*NOTE: The inlet tube is .005" I.D. and colored red with an external Teflon sheath. The outlet tube for the flowcell is .010" I.D. and colored blue.*

4. Place the detector's outlet line in the waste reservoir. When using an optional backpressure regulator (P/N 802259), connect the outlet line to the low-pressure union and waste tubing.



*HINT: If you have several detectors (fluorescence, refractive index, electrochemical, etc.) hooked up in series, place your UV6000LP detector closest to the column outlet, as its flowcell can withstand the greatest back-pressure. A back pressure regulator is often recommended to prevent bubble formation in the detector flow cell.*

5. Insert the flowcell in the detector with the retaining screw in the slot at the top of the flowcell. The inlet fitting should be on the bottom, left-hand side and the outlet fitting on the top, right-hand side. Replace the flowcell retaining block and hand tighten the retaining knob.
6. Replace the detector flow cell cover, making sure that the inlet and outlet tubing passes through the slots without being pinched.
7. Reattach the front cover of the detector.

---

## Powering On for the First Time

After the flowcell is installed, the detector is ready to be powered on. Use the following procedure:

1. Ensure that the power switch at the front of the unit is **OFF** (released or out position).
2. Attach the power cord to the power entry module on the rear panel of the detector and connect to the AC source.
3. Push the power on button to engage it (in position).

Note that the power indicator briefly lights red and then turns solid green. If it does not light at all, refer to the troubleshooting chart on page 6-3. If it stays red or flashes red or green, turn power off for several seconds and then back on again. If the indicator comes on as a flashing (rather than a solid) green light, the firmware must be downloaded. Refer to **Reloading the Firmware** in Chapter 4. Call your Thermo Electron service representative if you require assistance.

---

## Connecting the Remote Communications Outputs

The UV6000LP has three remote outputs; RUN, READY, and EVENT (see Figure 2.2). The outputs are open collectors and are each capable of sinking  $\leq 30$  mA at 30 Vdc, suitable for connecting to TTL and other families of ICs. The 5V connector supplies +5 Vdc at 150 mA maximum and can be used for testing the digital output signals. The sense settings (active high/active low) of these outputs must match those of the connecting equipment inputs.



*NOTE: The Thermo Electron AS1000 and AS3000 autosamplers require low active remote inputs.*

## **SETTING THE OUTPUT POLARITIES FROM CHROMQUEST**

To set the output polarities from ChromQuest, do the following:

1. From the Windows taskbar, open ChromQuest by selecting Start, Programs (or All Programs), Chromatography, ChromQuest.
2. From the Main Menu window of ChromQuest, double-click on the Instrument icon that represents your instrument to open the Instrument window.
3. Click Control from the menu bar. Then select Instrument Status from the drop-down menu.
4. Click the UV6000 tab to display the Instrument Status page for the UV6000 detector.
5. Right-click in the UV6000 Instrument Status page. Then, select Diagnostics from the pop-up menu.
6. Click the Control tab to display the Control page.

## **SETTING THE OUTPUT POLARITIES FROM ATLAS**

To set the output polarities from Atlas, do the following:

1. From the Windows taskbar, open the Instrument Manager by selecting Start, Programs (or All Programs), Atlas, Instrument Manager.
2. Right-click on the icon that represents your instrument. Then, choose Properties from the shortcut menu.
3. Click on the right-arrow at the top of the Instrument Properties dialog box until the Detector tab appears in the bank of tabs.
4. Click on the Detector tab to display the Instrument Status page for the UV6000 detector.
5. Change the polarities of the outputs to match the connecting equipment, if necessary.



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## Calibrating the UV6000LP

The UV6000LP was calibrated at the factory; however, it should be recalibrated after it is installed and before it is used for analysis. The calibration is dependent on the exact physical alignment of components on the optical bench within the unit. Bumps and jars, which might occur in shipping and during the installation process, can affect this alignment.

Easy calibration procedures are included in the UV6000LP Diagnostics section. Refer to Chapter 5 for information on performing the wavelength and dark current calibration procedures.

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## Operation Verification

Once the detector has been successfully installed, refer to **Operation Verification** in Chapter 4 to verify that the detector is working properly and to establish initial emission intensity spectra of the lamps.

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## Specifications

**Wavelength Range:**

190 nm to 800 nm continuous

**Wavelength Accuracy:**

±1 nm at 254 nm

**Absorbance Range:**

- 2.0 AU to + 4.0 AU, 20-bit resolution

**Short Term Noise\*:**

$\pm 3 \times 10^{-6}$  AU/cm @ 254 nm

**Drift\***

$\leq 1 \times 10^{-3}$  AU/hr @ 254 nm and a stable temperature ( $\pm 1$  °C)

**Warm-up:**

1.5 hour

**Linearity:**

$\geq 2.0$  AU @ 257 nm

**Scan Rate:**

20 Hz

**Data Rate Settings:**

0.5 to 20 Hz

**Cell Pathlength:**

50 mm

**Cell Volume:**

10  $\mu$ L

**Cell Pressure:**

1200 psi

**Diodes:**

512

**Diode Spacing:**

1.2 nm

**Rise Time:**

0.0 to 10.0 seconds

**Light Source:**

Deuterium and tungsten-halogen lamps, pre-aligned

\*According to ASTM E1657-94 "Standard Practice for Testing Variable -Wavelength Photometric Detectors Used in Liquid Chromatography" (for 50-mm flowcell, 5-nm bandwidth, 2-sec. rise time, and MeOH at 1 mL/min.).

**Filter Wheels:**

Standard Filter Wheel - 2 position wheel, 1 open position and 1 Holmium oxide/perchloric acid filled cuvette, NIST traceable;  
Optional Linearity Calibration Wheel - 5 position wheel, 1 with perchloric acid blank and 4 cuvettes with different concentrations of potassium dichromate in perchloric acid, NIST traceable

**Analog Outputs:**

(2), 20-bit unattenuated at 10 mV, 100 mV, or 1.0 V per AU

**Remote Controls:**

Start, Zero, RJ45 serial interface to ChromQuest or Atlas

**Dimensions:**

20 cm × 35 cm × 43 cm (H × W × D)

**Weight:**

15 kg

**Power Requirements:**

100/120/220/240 Vac; 50 to 60 Hz, 200 VA max.

**Operating Temperature:**

+10 to +40 °C

**Storage Temperature:**

- 40 °C to +70 °C

**Operating Humidity:**

5 to 95 % relative, non-condensing



## UV6000LP Quick Start

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### Introduction

This chapter will help you familiarize yourself in the basic use of the UV6000LP with ChromQuest. For a more detailed description of the software and their menus refer to the ChromQuest Ver. 4.1 Software User's Guide. This Quick Start chapter describes how to create a method for analyzing the Thermo Electron standard LC Test Mix using an HPLC system that includes the UV6000LP photodiode array detector.

Be sure you have installed your LC instruments according to the procedures described in their corresponding instrument manuals. Also, verify that your software is properly installed and that you have created a system configuration as described in the appropriate software reference manual.

---

### LC System Setup

In order to perform this quick start procedure, you will need one ampule of the Thermo Electron LC Test Mix, 75% methanol and 25% water as the mobile phase, and a Hypersil C8 column. If required, you can substitute other samples, solvents, and columns that are convenient for you. You will of course have to make appropriate changes in the method.

The Thermo Electron LC Test Mix contains 6 ppm tartrazine, 100 ppm toluene, 0.5 ppm anthracene, and 2 ppm acetophenone in 70% methanol and 30% water. It is available from Thermo Electron in packages of five ready-to-use 1 mL ampules (P/N A3469 -010). Fill an autosampler vial with the test mix and place the vial in the autosampler tray at position A01.

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## Configuring the System

Configure your LC system as you normally would. Because the UV6000LP connects directly to a serial port of the computer, it must be manually configured. In the Detector section of the System Configuration window, select the UV6000LP as the model of the detector you want to configure. Select the correct COM (serial) port for the UV6000LP along with both deuterium and tungsten lamps. Save the configuration.

If you are using the ChromQuest software package, create your LC Test Mix analytical method as described below. If you are using the Atlas software package, refer to the Atlas SpectraSYSTEM Control manual for information on creating instrument methods.

---

## Quick Start with ChromQuest

The following section describes the proper setup of the chromatographic method for running the Thermo Electron LC Test Mix with the Microsoft Windows NT/2000/XP-based ChromQuest software.

Click on the Windows taskbar Start button and move the cursor up the menu to Programs. Click on the ChromQuest icon located in the Chromatography program group. Select the appropriate system icon from the ChromQuest main menu window. The default ChromQuest windows will open automatically.

### INSTRUMENT SETUP

We begin to create the analytical method by specifying the operational parameters in the Instrument Setup section. To do this, select Method-Instrument Setup from the Menu Bar at the top of the Applications Window. Next, click on the appropriate tab for each instrument in the system (Figures 3.1 & 3.2) and enter the LC Test Mix run parameters listed below. It should look like the screens following this table. When all tabbed pages have been configured, save the method as LCTestMix.

#### Pump Program

Solvent(s)	75% methanol, 25% water
Flow rate	1 mL/min
Time	5 min

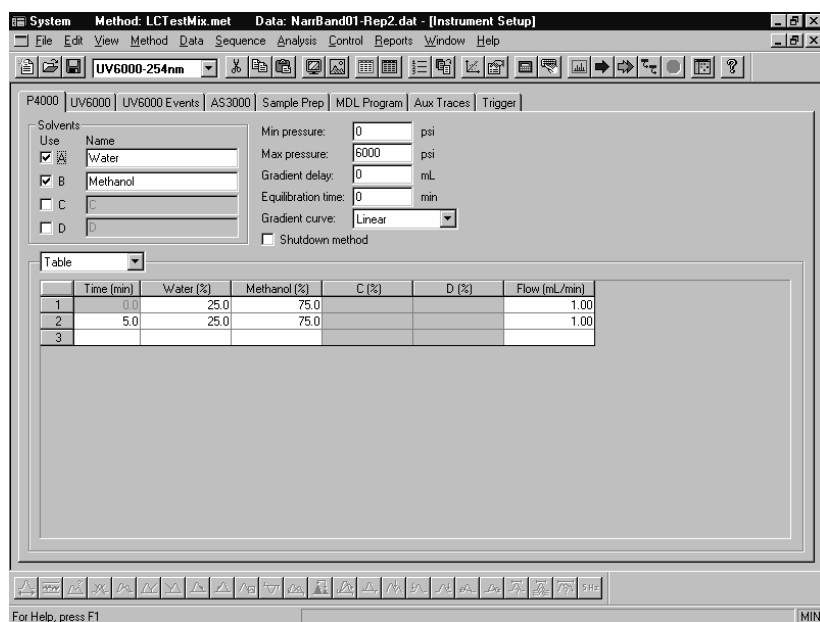
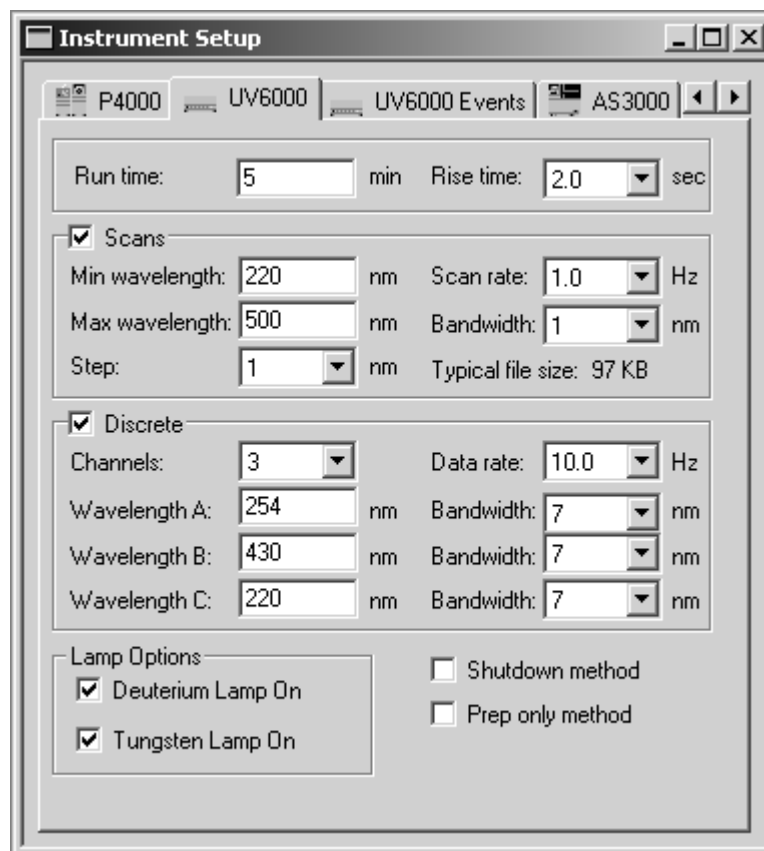


Figure 3.1 Pump Parameters

### UV6000LP detector program

Run Time	5 min
Rise Time	2 sec
Collect Scans	checked
Min Wavelength	220 nm
Scan Rate	1 Hz
Max Wavelength	500 nm
Bandwidth	1 nm
Step	1 nm
Discrete Channels	Three
Wavelength A	254 nm
Bandwidth A	7 nm
Wavelength B	430 nm
Bandwidth B	7 nm
Wavelength C	220 nm
Bandwidth C	7 nm
Scan Rate	10 Hz



*Figure 3.2 UV6000LP Parameters*

This method sets the UV6000LP detector for a 5.00 minute run time. The peaks will likely elute in less than 5 minutes when using a 10-cm, Hypersil, C8 column. The run time parameter must be adjusted if you will be using a different column.

The rise time is set to 2 seconds to minimize short-term noise. Spectral scans will be collected over the wavelength range from 220 to 500 nm in 1nm intervals at a scan rate of 1 Hz. Scans are collected from 220 to 500 nm to collect the complete spectrum of tartrazine, which is the compound that gives the LC Test Mix its yellow color. Tartrazine has a wavelength maximum at approximately 430 nm. The bandwidth setting for the scan data is 1 nm for optimal spectral resolution.

The discrete channels are set to monitor at 254, 430, and 220 nm with a bandwidth setting of 7 nm and a sample rate of 10 Hz. To increase spectral resolution, the bandwidth setting for the scan data should be set low. To decrease short-term noise, the bandwidth setting for the discrete channels can be set higher. Because the scan and discrete channel bandwidth filters are independent, the bandwidth of the discrete channels can be set appropriately to decrease baseline noise



and the bandwidth of the scan data can be set appropriately to maximize spectral resolution. This is extremely important when comparing detailed spectra for compounds at very low concentrations.



*NOTE: ChromQuest can automatically display three signals simultaneously. The UV6000LP configured as the only detector in an LC system can monitor three signals simultaneously, which are selected in the discrete channels section of the UV6000LP acquisition method page. If another detector is configured in the system, the UV6000LP will automatically be set up to monitor two channels. Other signals can be added after the run starts. If scan data is collected, individual chromatograms at other wavelengths can be viewed after the run.*

## CUSTOM REPORT

The ChromQuest Custom Reporting feature allows the analytical chemist to consolidate test results into a single report with a maximum amount of flexibility. To simplify the process, Thermo Electron has included four of the most common report formats as report templates. Additional reporting capabilities are described in the *ChromQuest Software User's Guide*.

To activate automatic reporting, select Custom Report from the Method pull-down menu. The Method Custom Report Window will open. Next, click on File-Report Template-Open and select the area % template from the ChromQuest folder by double-clicking on the file Area%.Srp (Figure 3.3).

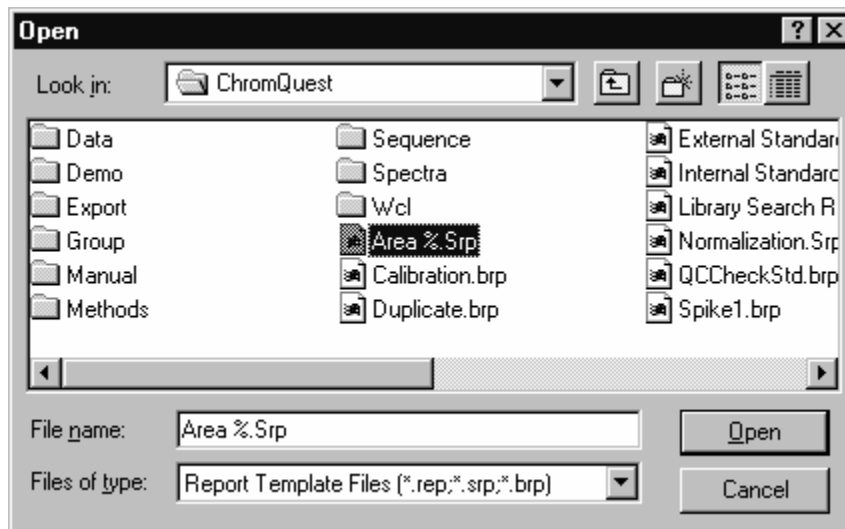
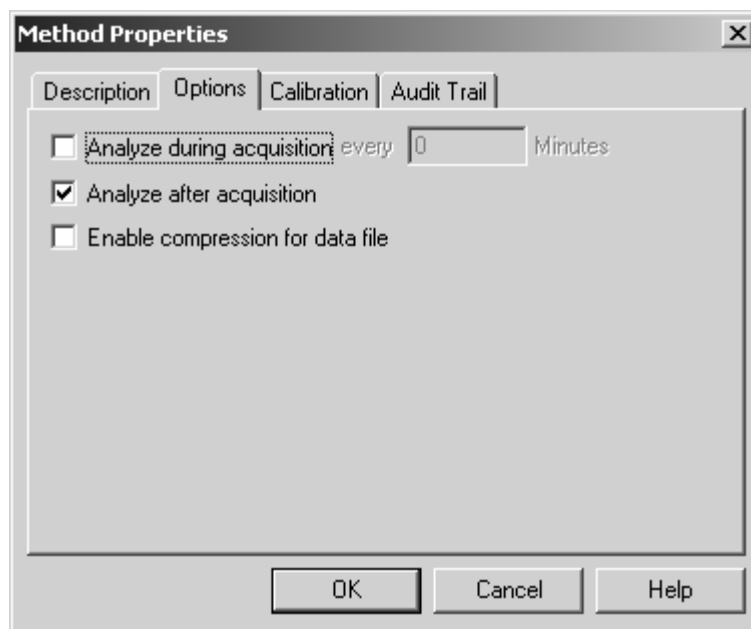


Figure 3.3 Custom Report Template

The template will now appear in the Method Custom Report Window.

Select Properties from the Method pull-down menu and click on the Options tab. Uncheck the 'Analyze during acquisition' item if it has a check in the check box (Figure 3.4). Place a check in the check box for 'Analyze after acquisition'.



*Figure 3.4 Method Properties – Options dialog box*

Close the Method Properties Window and click the save button on the Command Toolbar. Select Save Method and give the method a name if required. Close the Method Custom Report Window. Verify that the default printer is properly selected by clicking on File-Print from the Menu bar. If the correct printer is selected, click on the Cancel button.

## PREVIEW

Verify that the system is fully equilibrated by monitoring the baseline before the sample is injected. To monitor the baseline click on the Preview button on the Command Toolbar at the top of the Applications Window. The baseline is displayed in real-time for all signals configured in Method-Instrument Setup. Each discrete wavelength will have its own window. The scan surface will be displayed in the Mixed View screen as a contour plot, a real-time spectrum display, a wavelength-selectable chromatogram and the peak purity index window. The Mixed View screen is easily adjusted to emphasize any of the four displays.

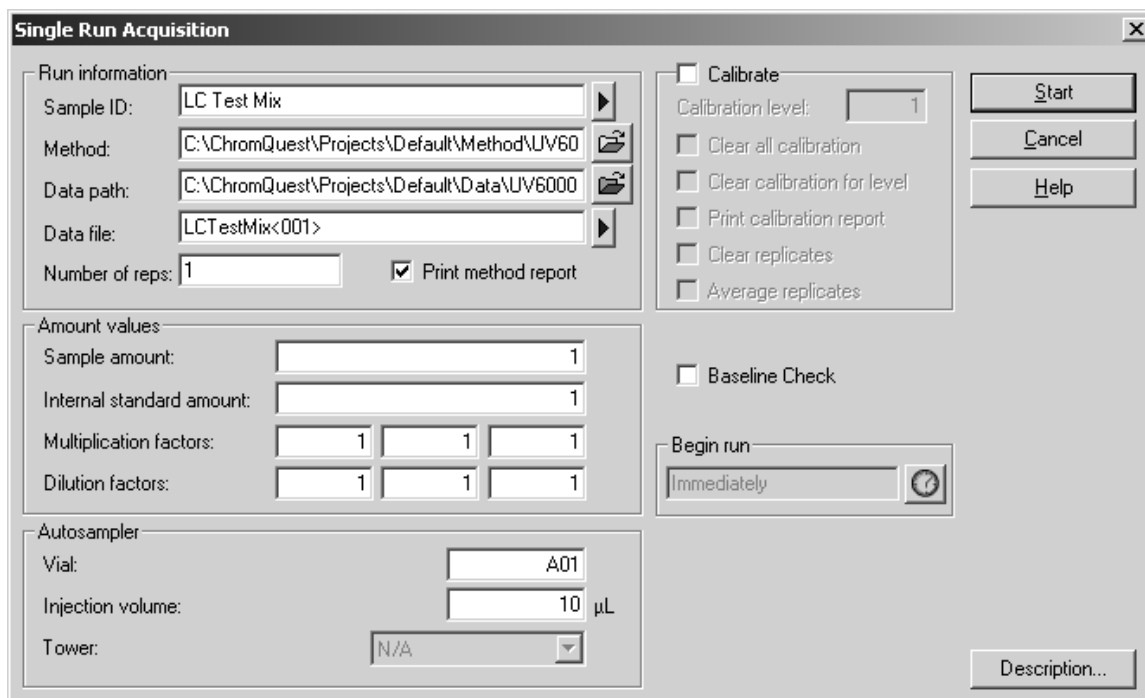
## RUN SAMPLE

When the baseline is stable, click the Stop button on the Command Toolbar to discontinue monitoring the baseline. To inject the LC Test Mix sample, click on the Run Sample button on the Command Toolbar. The Single Run Acquisition dialog box will open requesting information regarding this particular injection (Figure 3.5).

Enter the following information in the Single Run Acquisition dialog box:

Data file: LCTestMix  
Vial: A01  
Injection volume: 10 µl

Select the Print Method Report check box. Other fields can be left blank or at their default settings.



The image shows the 'Single Run Acquisition' dialog box. It is divided into several sections. The 'Run information' section contains fields for Sample ID (LC Test Mix), Method (C:\ChromQuest\Projects\Default\Method\UV60), Data path (C:\ChromQuest\Projects\Default\Data\UV6000), Data file (LCTestMix<001>), and Number of reps (1). There is a checked box for 'Print method report'. The 'Amount values' section has fields for Sample amount (1), Internal standard amount (1), Multiplication factors (1, 1, 1), and Dilution factors (1, 1, 1). The 'Autosampler' section has fields for Vial (A01), Injection volume (10 µL), and Tower (N/A). On the right, there is a 'Calibrate' section with a 'Calibration level' (1) and several unchecked checkboxes: 'Clear all calibration', 'Clear calibration for level', 'Print calibration report', 'Clear replicates', and 'Average replicates'. Below that is a 'Baseline Check' section with an unchecked checkbox. At the bottom right, there is a 'Begin run' section with a dropdown set to 'Immediately' and a clock icon. On the far right, there are 'Start', 'Cancel', and 'Help' buttons. At the bottom right, there is a 'Description...' button.

Figure 3.5 Starting a Single Analysis

When the sample is injected, the chromatogram(s) will be displayed in real-time. If the chromatograms for the UV6000LP are not displayed, verify that there is a run/start connection between the autosampler and the UV6000LP. (Because the UV6000LP plugs directly into the PC, it does not receive a start command from the SN4000 controller and must be “hard-wired” to the AS3000 autosampler.) At the end of the run the reports that were selected in

the Method Custom Report will print automatically. The system will then go to an idle state.

## EXPECTED RESULTS

The table 3.1 below shows the typical retention times and peak areas for the compounds in the LC Test Mix. Typical peak areas for a SpectraSYSTEM UV1000 detector are also included to show the increased sensitivity of the UV6000LP.

**Table 3.1 Expected Results for LC Test Mix**

Injection Amount (ng)	Compound	Ret. Time (min)	UV1000 Peak Area	UV6000 Peak Area
60	Tartrazine	0.61	150908	723005
20	Acetophenone	1.48	23336	119167
1000	Toluene	2.07	103254	526428
5	Anthracene	3.60	139472	688661

## VIEW REPORT

In addition to viewing the analysis on-screen in the discrete wavelength windows and the spectral analysis window, the complete LC Test Mix analysis is printed in the Area % Custom Report format. The report can be viewed by selecting Custom Report from the Method pull-down menu. The Method Custom Report window opens with your LC Test Mix analysis data.

# 4

## Routine Maintenance

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### Introduction

UV6000LP detectors are finely-tuned scientific instruments that we at Thermo Electron are proud to stand behind. Even so, routine maintenance is necessary to ensure optimal performance of your equipment.

Procedures described in this chapter must only be performed by personnel trained in the service and maintenance of this instrument.

If you have any questions on proper maintenance, or would like to arrange for a preventive maintenance program, please contact your local Thermo Electron representative.

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### Recommendations

Table 4.1 lists recommendations for routine maintenance of the UV6000LP Detector. Use the table as a basis for developing your maintenance program in accordance with your company's practices.

**Table 4.1 Recommended Routine Maintenance**

Procedure	Interval
Flowcell Cleaning	After each application and as needed.
Wavelength and Dark Current Calibration	After lamp replacement or as needed.
Error Log Printout	Weekly
Operation Verification	Semi-annually
Lamp Replacement (D2) Deuterium (W) Tungsten - halogen	Every 1000 hours or as required. Every 2500 hours or as required.

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## Tools Required

The following tools are called out in the maintenance procedures in this chapter.

- a narrow-tip screwdriver (2 mm wide)
- a #2 Phillips screwdriver
- 1/4 " open end wrench

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## Cleaning Detector External Surfaces

The external surfaces of the detector should be kept 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.

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## Flowcell

This section describes the general cleaning of your detector's flowcell. For other flowcell problems, such as a cracked window or leaks that occur in locations other than at the inlet/outlet fittings, contact your Thermo Electron representative.

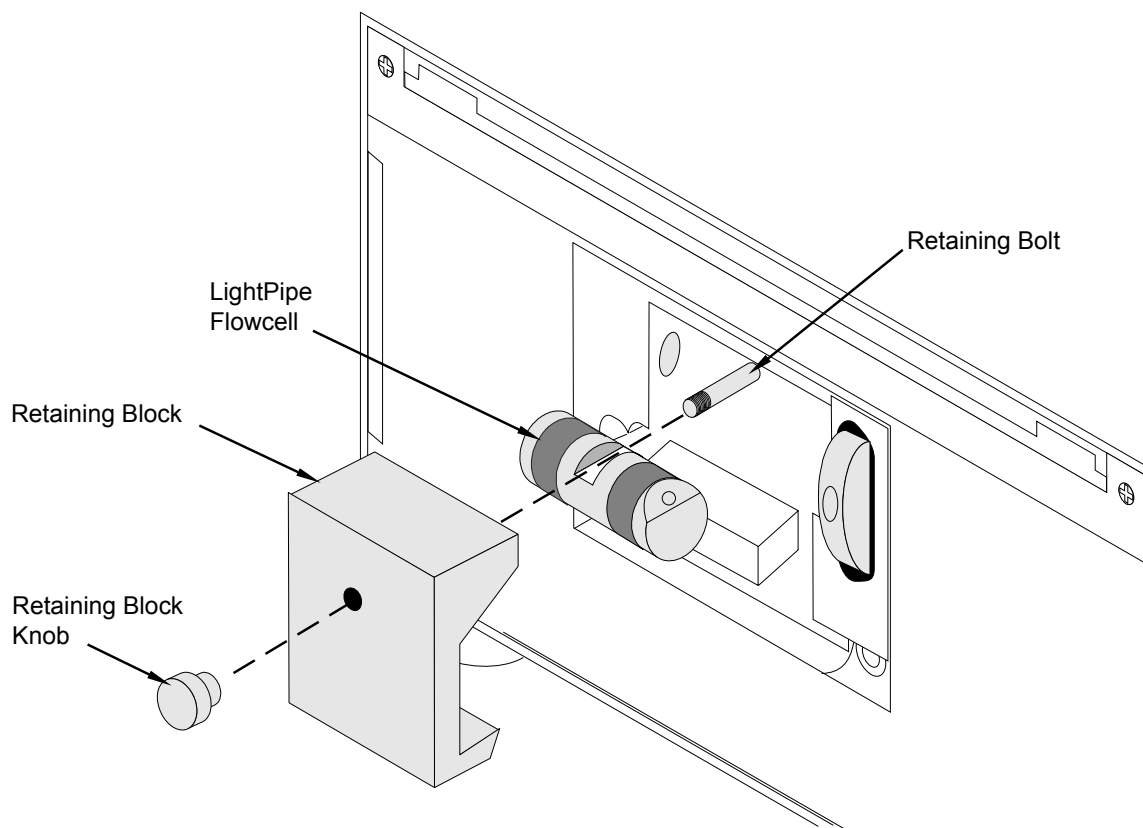


*NOTE: Flowcells are factory-assembled units that should not be disassembled under any circumstance.*

### REMOVING THE FLOWCELL

The flowcell must be removed to clean it. To access the flowcell, do the following:

1. Turn detector power off and disconnect the power cord from its rear panel.
2. Remove the front cover by pulling out on the bottom and lifting up.
3. The flowcell assembly is located behind the flowcell cover. Remove the flowcell cover by gently pulling the snap latch to free the cover.



*Figure 4.1 Detector Flowcell Removal*

4. Loosen and remove the retaining block knob that holds the flowcell retaining block in place and remove the retaining block (refer to Figure 4.1).
5. Disconnect the flowcell inlet tube from the column and disconnect the flowcell outlet tubing from the waste reservoir.



*NOTE: Avoid putting fingerprints or scratches on the flowcell windows. If dirty, the window surface should be cleaned only with spectroscopic-grade methanol (or isopropanol) and lint-free lens paper.*

6. Carefully pull the assembly toward you to remove it from the detector.

## CLEANING THE FLOWCELL

The exterior and/or interior surfaces of the flowcell can become contaminated. Flowcell contamination is usually caused by precipitation or solubility problems, (such as when the quality of your mobile phase solvent components and the cleanliness of your samples vary). Signs of a contaminated flowcell are increased baseline noise, signal spiking, erratic or drifting baselines, low light intensity and increased back-pressure.

## Cleaning with Organic Solvents

If you suspect that your flowcell needs to be cleaned, start with the following procedure using organic solvents:



*NOTE: Flowcells are factory-assembled units that should not be disassembled under any circumstance. If you encounter contamination problems that cannot be remedied by using this cleaning procedure, contact your local Thermo Electron representative to arrange for repair or replacement.*

1. Make certain that the cleaning solvent(s) you plan to use is/are miscible with the solvent already present in the flowcell and pump. Isopropanol is a good choice for most applications.



*NOTE: 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 equivalent) through the system to remove any salts before flushing with the cleaning solvent(s) in order to avoid precipitation problems.*

2. Flush the flowcell with 40 to 50 milliliters of solvent (HPLC-grade water, methanol, or isopropanol). You should *pump* the solvent through the flowcell with the chromatographic pump.
3. When using an LC pump to flush the flowcell, first remove the column from your chromatographic system to avoid column degradation. Replace the column with an appropriate length of tubing, ensuring that all connections are snug and leak-free. If you use a syringe, always draw the solution *through* the flowcell.



**CAUTION! Never use a syringe to force solvent through a flowcell. Pressurizing the syringe could cause a leak or rupture, resulting in a dangerous and uncontrolled spraying of solvent.**

## Cleaning with Nitric Acid

Methanol or isopropanol is generally sufficient for cleaning a flowcell. However, if the flowcell remains contaminated after flushing with organic solvents, clean it with dilute nitric acid.



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



To clean the flowcell with dilute nitric acid, do the following:

1. Remove the flowcell assembly from the detector housing before cleaning with a nitric acid solution. This will prevent possible leaks from harming the mechanical and electronic components of the detector.
2. Flush the flowcell with water before proceeding. This step is very important!
3. Prepare a 20 % (v/v) solution of nitric acid in HPLC-grade water.
4. Pump the nitric acid solution through the flowcell with the chromatographic pump.
5. When using an LC pump to flush the flowcell, be sure to replace your column with tubing and make sure water was the last solvent in the pump and solvent reservoir. If you use a syringe, always draw the solution *through* the flowcell.
6. After you have finished the cleaning procedure and before returning to the buffer solution and chromatographic solvents, pump another 25 to 40 mL of water through the flowcell to remove all traces of nitric acid. The pH of the outlet stream of the flowcell can be monitored to ensure that all of the acid has been completely flushed out.
7. Reinstall the flowcell assembly.

## **INSTALLING THE FLOWCELL**

To install the flowcell, do the following:

1. Connect the inlet and outlet tubing to the flowcell.
2. With the inlet tube on the bottom left and the flowcell slot on top, slide the flowcell assembly into the detector under the alignment pin, slide the retaining block over the alignment pin, and hand-tighten securely in place with the retaining block knob.
3. Connect the inlet tubing to the chromatographic column and the outlet tubing to the waste reservoir.
4. Guide the tubing through the slots in the flowcell compartment cover and secure the cover by pushing in on the snap latch at the top of the cover.
5. Connect the power cord to the rear panel of the detector.

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## **Wavelength and Dark Current Calibration**

Use the Wavelength Calibration and Dark Current Calibration procedures outlined in Chapter 5.

---

## Error Log Printout

The detector errors and major events, such as power-on self tests (POSTs), are logged to a dedicated area in memory in the detector. The log can hold 100 errors/events. When the log is full, the next entry replaces the first entry. Therefore, it is recommended that you print out the log and clear it periodically to keep a continuous record for your maintenance files. The memory is protected by battery back-up when the detector is turned off. Use the procedure in the diagnostics discussion in Chapter 5. A list of error messages that may be displayed in the Error Log printout along with suggested solutions are compiled in the Log Entries section of Chapter 6.

---

## Operation Verification



*NOTE: To run the procedures in this section, be sure to have 100% HPLC-grade water or methanol flowing through the cell at a constant flow rate of 1 ml/min.*

The following operation verification procedure uses the UV6000LP diagnostics suite described in Chapter 5 to verify the operation of the detector. You should become familiar with the diagnostics portion of the relevant software before attempting this verification. Because the UV6000LP can be used with either ChromQuest or Atlas we have included operation verification procedures for both software platforms. The ChromQuest 4.1 version immediately follows this paragraph. If you are using Atlas, proceed to page 4-9.

### OPERATION VERIFICATION USING CHROMQUEST

Verify the operation of your UV6000LP detector from the ChromQuest data system as follows:

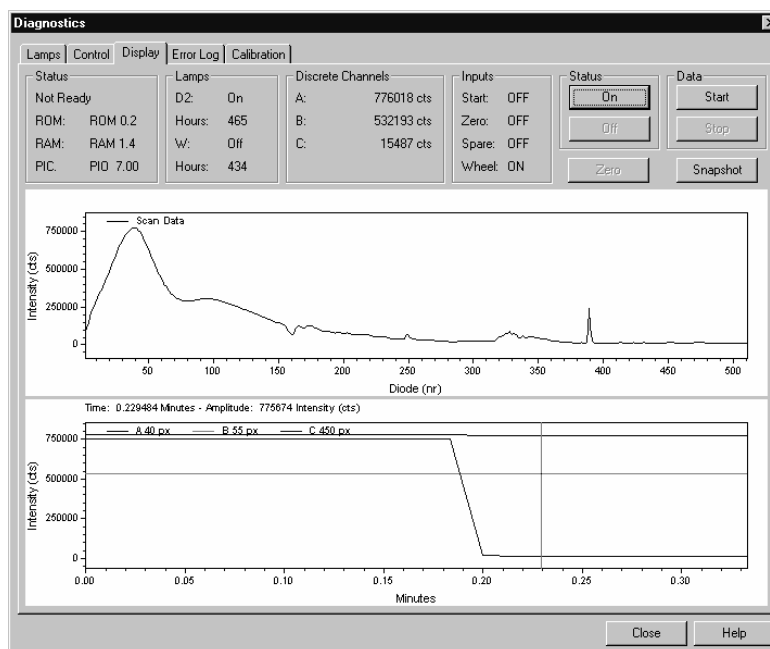
1. From the Instrument window, select Instrument Status from the Control pull-down menu on the Menu bar.
2. Click on the UV6000LP tab to display the UV6000LP Instrument status dialog box.
3. Open the diagnostics program by clicking on the right mouse button and then selecting Diagnostics from the pop-up menu. The Lamps page should appear.
4. Check each lamps' status and usage.
5. If they are not already on, turn on both deuterium (D<sub>2</sub>) and tungsten (W) lamps.

6. While the deuterium (D<sub>2</sub>) lamp is igniting and warming up, go to the Display page and click on the Status-On and Data-Start buttons.
7. Next, check the remote input lines. If they are connected to other equipment, activate them momentarily at the remote equipment and note that their state on the Display page of the diagnostics changes from **OFF** to **ON**. If they are not connected, short them to their COM connectors momentarily and note their status.
8. Rotate the filter wheel out of position 1 and note that its status on the Display page changes from **ON** to **OFF**. Put it back in position 1.
9. Check the remote output lines using the diagnostics Program. If they are connected to remote equipment, activate them momentarily and note the response at the remote equipment.



*NOTE: ChromQuest software will not initiate an analysis if the filter wheel is not in position 1.*

10. After both lamps have warmed up for 1 hour, perform a dark current calibration and a wavelength calibration as specified in Chapter 5. Use the wavelength calibration file appropriate for your normal operation. Don't forget to apply the results by clicking on the Apply button.
11. Turn the tungsten - halogen (W) lamp off.
12. After the deuterium (D<sub>2</sub>) lamp has warmed up, go to the Control page and set the mode to Intensity. Click on the Default and Load To Detector buttons. This will allow you to view the emission intensity spectrum of the deuterium (D<sub>2</sub>) lamp. Set the individual channels to monitor pixels 35, 52 and 77.
13. Go to the Display page and once again click on the Status-On and Data-Start buttons. See Figure 4.2. Use the Print Screen key to print out a copy of the intensity scan. This scan can be kept to compare with future scans to see if there is any intensity degradation. Date the printout and add it to your maintenance records.



*Figure 4.2 Intensity Scan with D<sub>2</sub> Lamp*

14. Figure Click on the Status-Off and Data-Stop buttons. Go to the Lamps page and turn the tungsten - halogen (W) lamp on.
15. Return to the Control page and changes the individual channels to monitor pixels 94, 177 and 260.
16. Go to the Display page and once again click on the Status-On and Data-Start buttons. See Figure 4.3. Use the Print Screen key to print out a copy of the scan. This scan should also be kept for future comparisons to see if there is any intensity degradation. Date the printout and add it to your maintenance records.

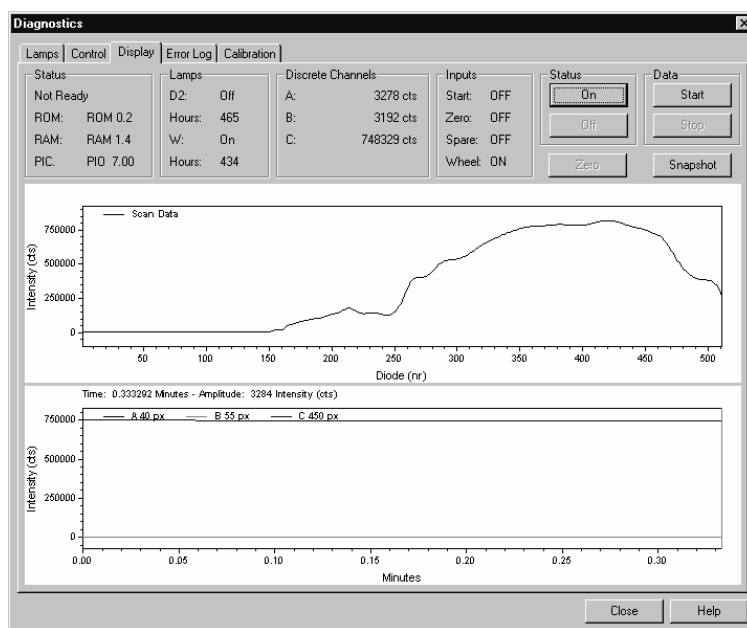


Figure 4.3 Intensity Scan with W Lamp

17. Turn the deuterium ( $D_2$ ) lamp off.
18. Repeat the above steps to display the emission intensity spectrum of the tungsten - halogen (W) lamp. See Figure 4.4. Set the individual channels to monitor pixels 219, 302, and 427.

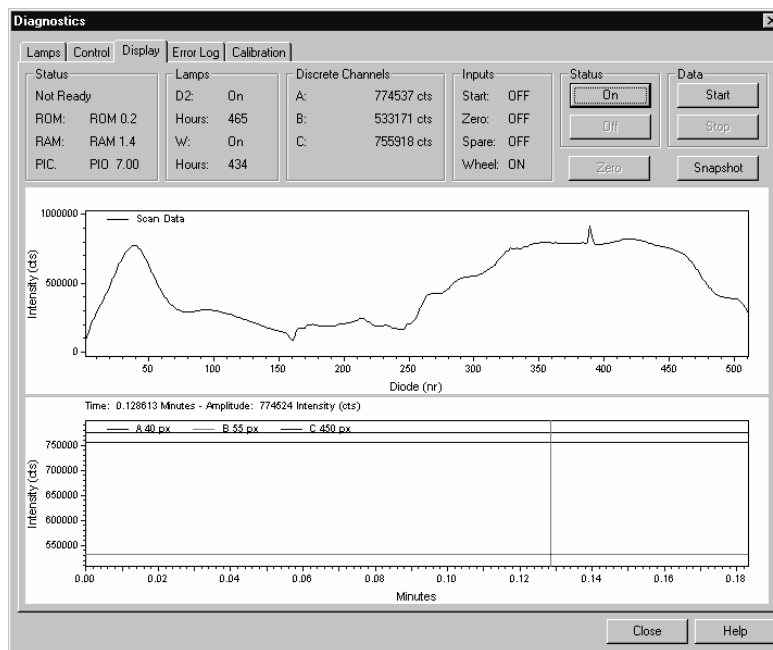


Figure 4.4 Intensity scan with both lamps

19. As with the D<sub>2</sub> and combined lamp spectra, save a copy of the scan for your maintenance records.
20. Turn the deuterium (D<sub>2</sub>) lamp on again and exit from the Diagnostics. Allow sufficient warm-up time before acquiring data.

## OPERATION VERIFICATION USING ATLAS

Verify the operation of your UV6000LP detector from the Atlas data system as follows:

1. Open the Maintenance page for the UV6000 detector (see Figure 4.5):
  - a. From the Windows taskbar, click on Start. Then go to Programs (or All Programs for Windows XP), Atlas, Instrument Manager.
  - b. Open the Instrument Status window for your instrument by double-clicking on its icon.
  - c. From the bank of tabs located at the bottom of the Instrument Status window, click on the Detector tab.
  - d. Click on the Maintenance tab at the top of the window to display the Maintenance page.
2. Check each lamps' status and usage.
3. If they are not already on, turn on both lamps by selecting their respective Lamp On checkboxes.



*NOTE: Atlas software will not initiate an analysis if the filter wheel is not in position 1.*

4. After both lamps have warmed up for 1 hour, perform a dark current calibration and then a wavelength calibration as specified in Chapter 5. Use the wavelength calibration file appropriate for your normal operation.
5. Turn the tungsten - halogen (W) lamp off. This will allow you to view the intensity spectrum of the deuterium (D<sub>2</sub>) lamp alone.

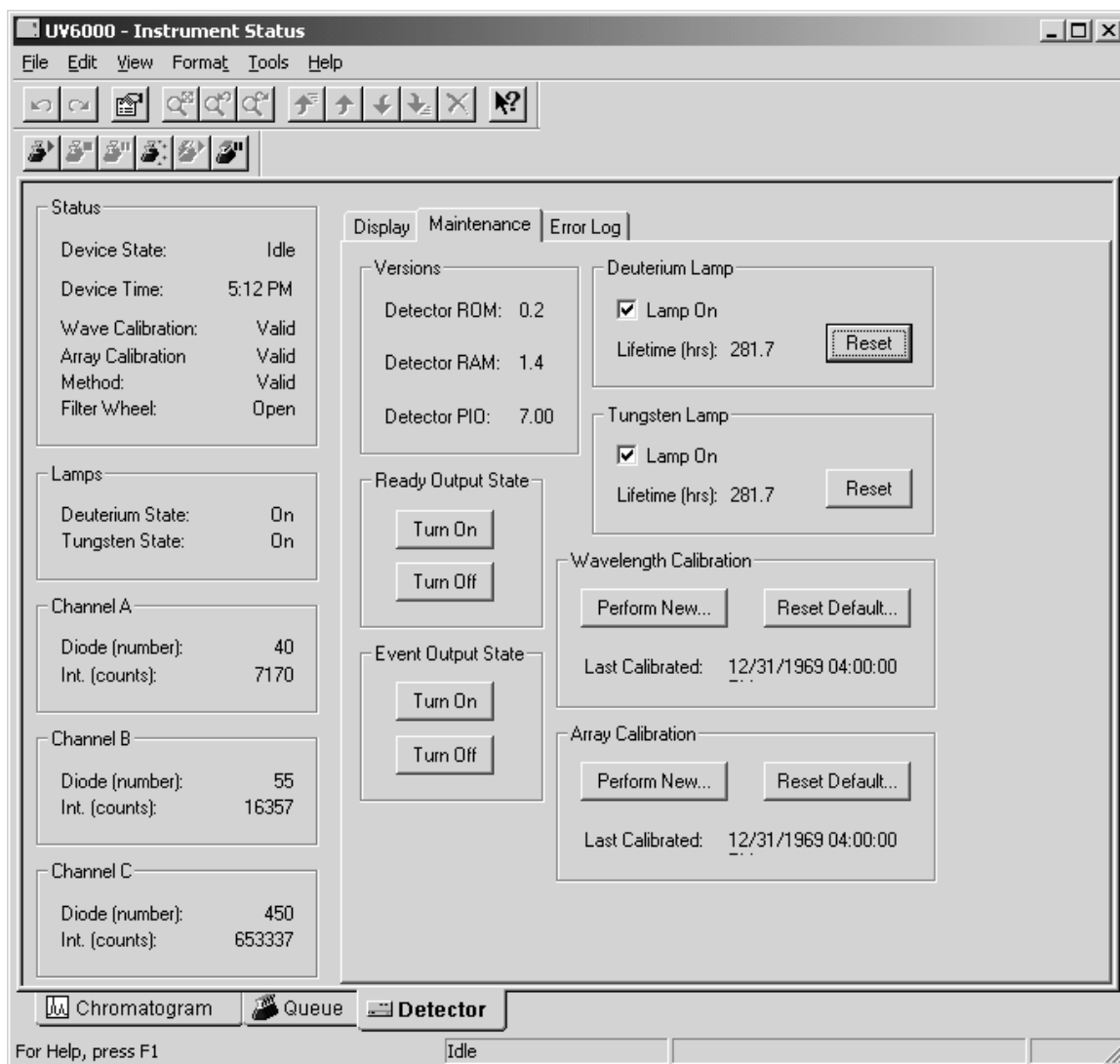


Figure 4.5 UV6000 Instrument Status – Maintenance page

6. Click on the Display tab to open the Display page. See Figure 4.6. (This tab is labeled *Operation* in Atlas version 2003 R2.)
7. Select the Diode Number Intensity option button.
6. Set the individual channels to monitor diodes 35, 52, and 77. Then, click on the Start button.
7. Return to the Maintenance page and turn the tungsten - halogen (W) lamp on.
8. Return to the Display page and set the individual channels to monitor diodes 94, 177, and 260. Then, click on the Start button.

9. Return to the Maintenance page and turn the deuterium (D<sub>2</sub>) lamp off. This will allow you to view the intensity spectrum of the Tungsten (W) lamp alone.
10. Return to the Display page and set the individual channels to monitor diodes 219, 302, and 427.
11. Return to the Maintenance page and turn the deuterium (D<sub>2</sub>) lamp on again. Exit the Instrument Manager application and allow sufficient warm-up time before acquiring data.

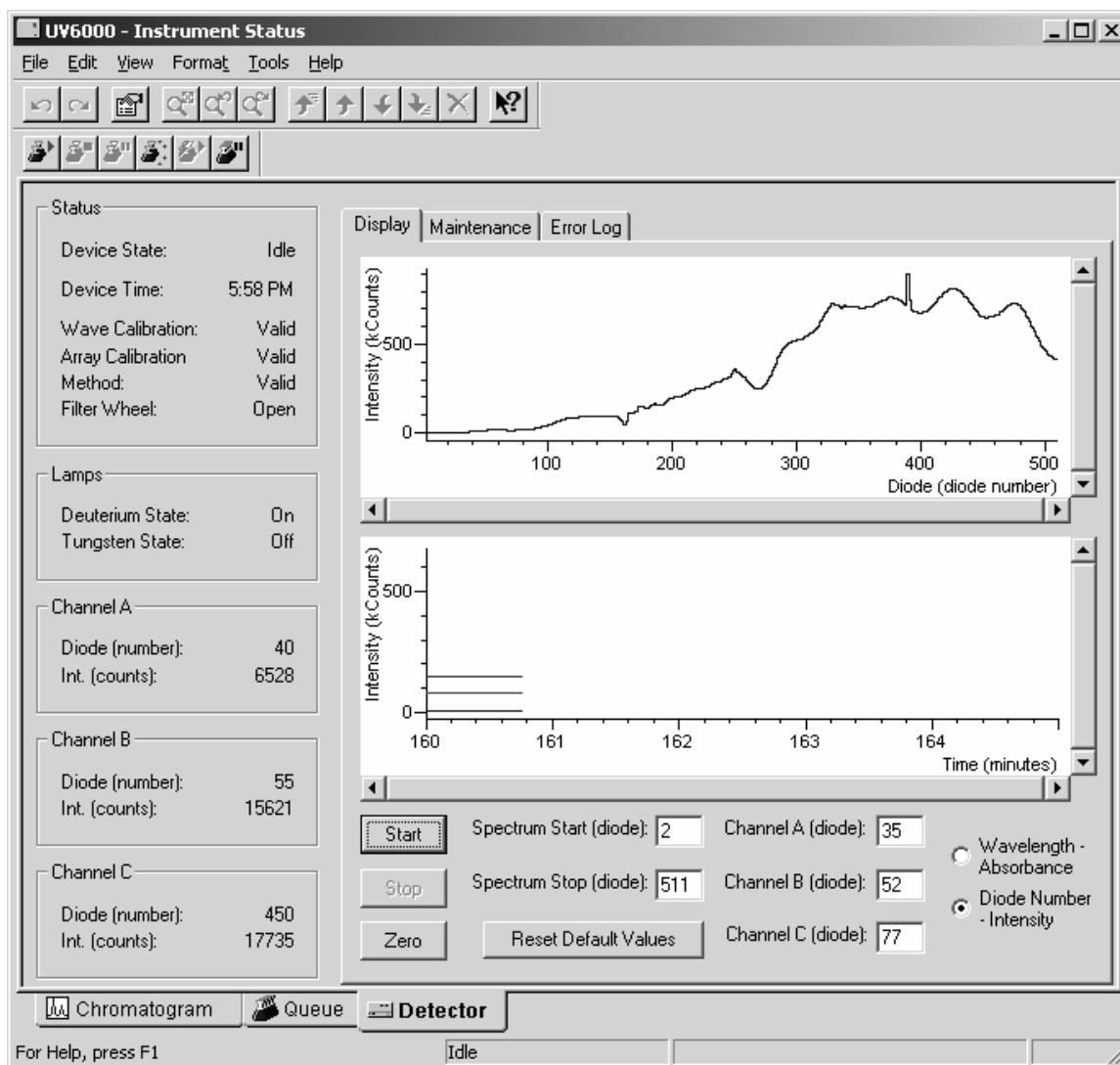


Figure 4.6 UV6000 Instrument Status – Display page (Atlas 2003, R1)



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## Replacing the Lamps

As lamps age, there is a reduction in light output that results in increased baseline noise. If the noise level on your detector's output signal is increasing and cleaning the flowcell doesn't help, determine the condition of the lamps. Check the light intensities from the Instrument Status section of the software. If a large decrease in light intensity is observed, adjust the attenuators to increase light throughput (refer to **Adjusting Attenuators** on page 4-16). If light intensities are still unacceptable, use the following procedure to change the appropriate lamp. Lamps are pre-aligned. The deuterium (D2) and tungsten - halogen (W) lamps are located in the lamp compartment to the right of the optical bench assembly, (viewed with the detector chassis open as shown in Figure 4.5).

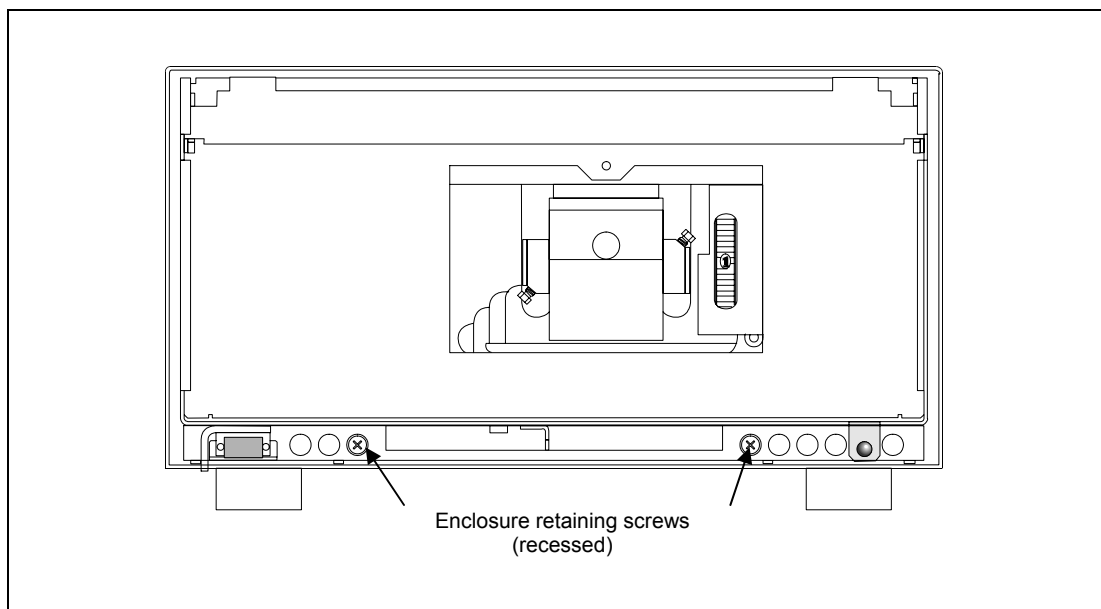
To access the deuterium and tungsten - halogen lamps:

1. Turn the power switch at the front of the detector to off (released position) and disconnect the power cord from the rear panel.
2. Remove the front cover by gently pulling out on the bottom of the cover and lifting up.
3. Remove the LightPipe assembly and secure its location.

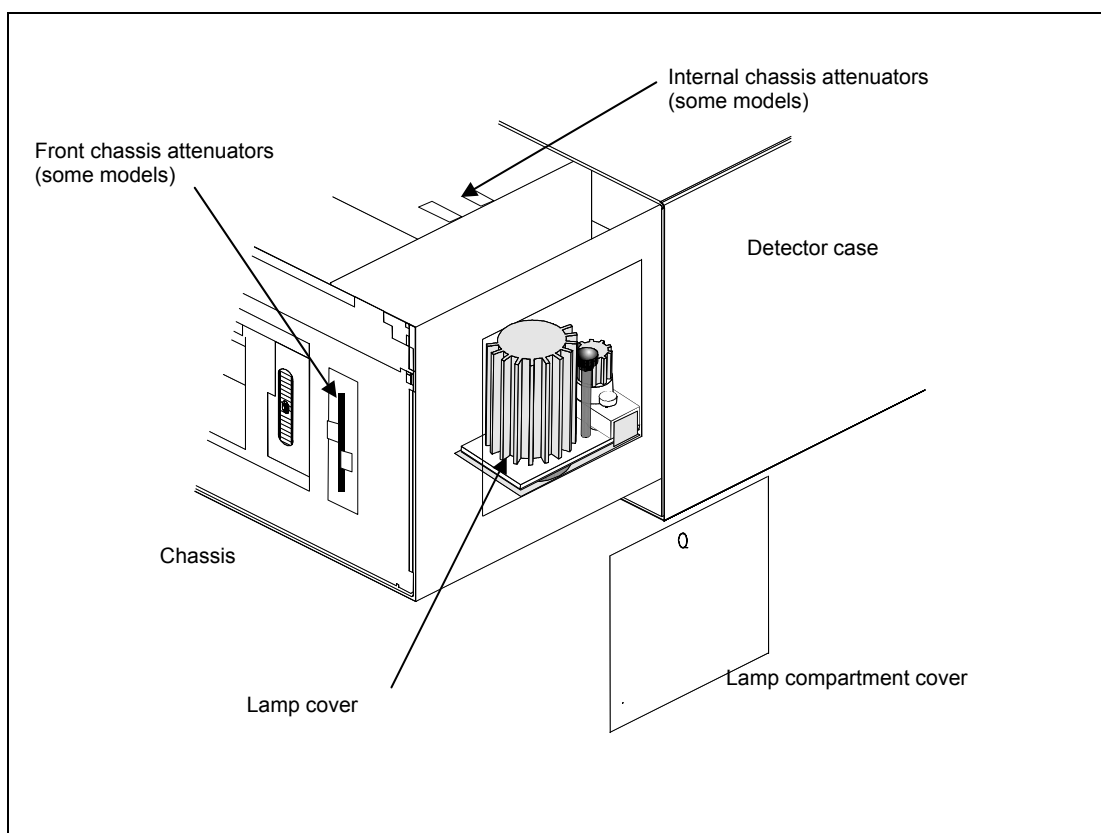


**CAUTION! Intense UV light can damage your eyes! Always disconnect the power cord before exposing the lamp and always allow sufficient time for the lamp to cool before removing it, as it gets quite hot when lit.**

4. To access the lamp compartment cover, loosen the two captive 3/16" Phillips screws that secure the chassis in place. These screws are in a recessed location in the base of the detector (Figure 4.8). The screws are spring loaded and will be retained when loosened.
5. Slide the chassis out of the detector case until the metal lamp compartment cover is accessible from the right side of the instrument (Figure 4.9).



*Figure 4.8 Detector with Front Panel Removed*

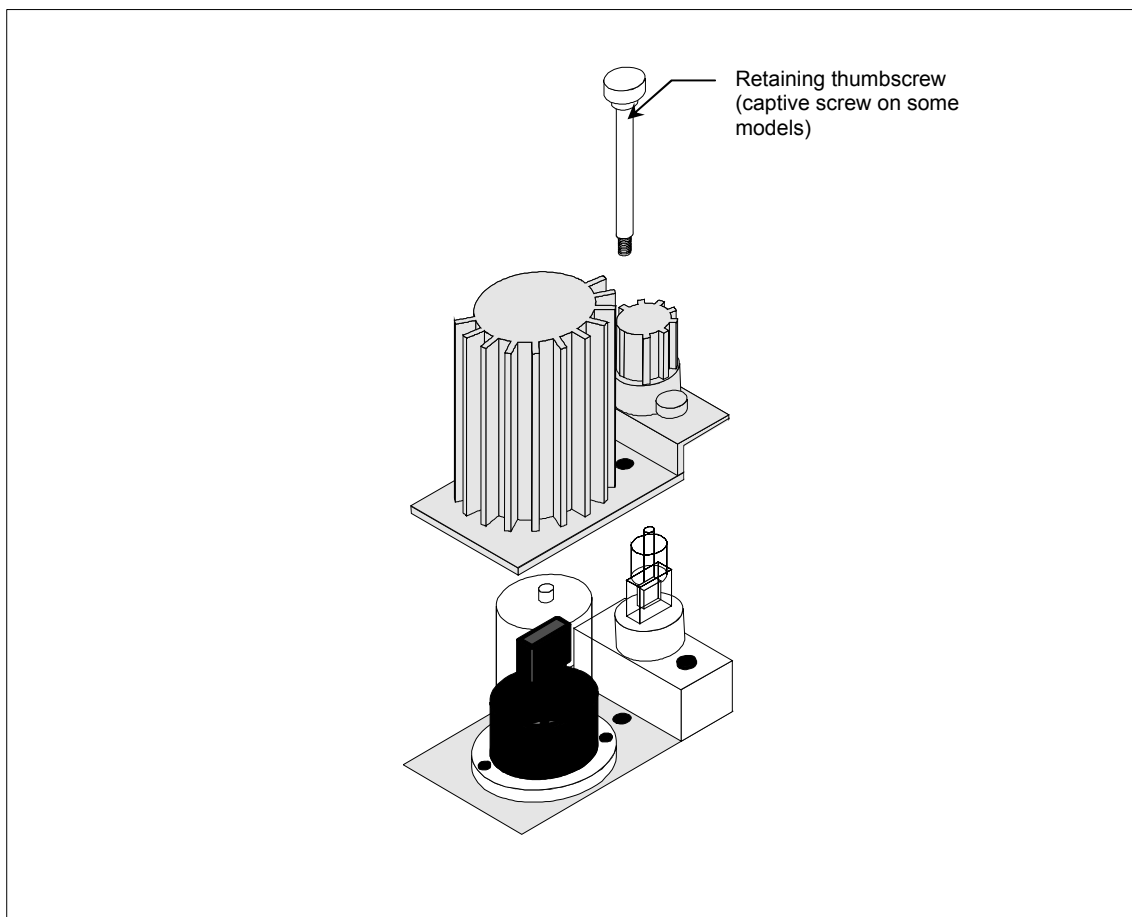


*Figure 4.9 Accessing Lamp Assembly*

6. Press on the cover's metal tab and push the cover from inside the lamp compartment to free it from the chassis wall.
7. Now remove the lamp cover by loosening and removing the knurled black knob of the retaining thumbscrew holding the cover to the lamp tray. Carefully lift off the lamp cover (Figure 4.10).
8. Note the cables and connectors behind the lamps, attached to the lamp power supply board. The larger connector is for the deuterium lamp (3 leads) and the smaller connector is for the tungsten-halogen lamp (2 leads).



*NOTE: Some models of the UV6000LP have a captive Philips head screw instead of the knurled black knob*



*Figure 4.10 Removing the Lamp Cover*



*NOTE: Do not try to remove the lamps from their mounting assemblies. Remove and replace a lamp, its mount, cable, and connector as an assembly as described in the following steps.*

6. To remove a lamp assembly, first disconnect its connector from the lamp power supply board by holding the connector and gently pulling the connector free from the contact pins on the PC board.
7. Next loosen and remove the single Phillips head screw securing the tungsten - halogen (W) lamp mounting block in place. In the case of the deuterium (D2) lamp, loosen (but do not remove) the two Phillips head screws, lift and gently twist the mounting flange to free the lamp.
8. Lift out the wiring between the connector and lamp socket from the compartment.

To install a lamp, perform the above removal procedure in reverse order.



*NOTE: The surfaces of both lamps must be kept free of fingerprints and smudges. If either lamp needs cleaning, use a lint-free lens paper moistened with methanol or isopropanol before replacing the lamp cover.*



*NOTE: When a lamp is replaced don't forget to reset the lamp hours. (Refer to the procedure for ChromQuest users on page 5-3 or the procedure for Atlas users on page 5-29.)*

---

## Adjusting Attenuators

During the lifetime of the UV6000LP it may be necessary to manually adjust the attenuators in order to increase the amount of light falling upon the array or to decrease the light levels to prevent saturation of the array. For optimal performance the light intensity values should fall within the following ranges in the region where analyses will be performed:

- Units with  $S/N \leq 107999$ : 300,000 to 650,000 counts
- Units with  $S/N \geq 109000$ : 300,000 to 800,000 counts

Light intensities should be within the above ranges to minimize baseline noise and prevent saturation of the diode array. (If the array is saturated the response from the UV6000LP will be a flat baseline.)

Attenuators may require adjustment when either of the lamps are replaced, or when a flowcell is replaced. When these items are replaced, check the light intensities by following the procedure on page 4-6 (Operation Verification) and adjust the attenuators to provide light intensities in the specified operating ranges.

As lamps age their light intensities will decrease slightly. If a significant drop in light intensity occurs, the attenuators can be opened up to compensate and increase the light intensity.

## ACCESSING THE ATTENUATORS

Use the following procedure to access the attenuators:

1. Remove the front cover by gently pulling out on the bottom of the cover and lifting up.



*NOTE: On some models of the UV6000LP the attenuators are located on the front of the chassis and do not require removing the chassis to adjust (see figure 4.9). If your detector has these front chassis attenuators, after removing the inner bezel door in step 2 go directly to step 8, it is not necessary to remove the LightPipe assembly.*

2. Remove the inner bezel door and LightPipe assembly.
3. To access the attenuators, loosen the two captive 3/16" Phillips head screws that secure the chassis in place. (These screws are in a recessed location in the base of the detector as shown in Figure 8.2.) The screws are spring loaded and will be retained when loosened.
4. Slide the chassis out of the detector housing until the metal lamp compartment cover is accessible from the right side of the instrument.
5. Free the lamp compartment cover from the detector chassis by pressing on the metal tab inside the chassis wall.
6. Remove the foam insulation located on top of the optical bench assembly.
7. Loosen the attenuator locking screw, which is a small Phillips head screw located in the center of the internal metal wall separating the optical bench from the lamp compartment.

The attenuators can now be adjusted. There are two black tabs attached to the attenuators. The longer tab (for front chassis attenuator models, the tab on the left) is for the (D<sub>2</sub>) Deuterium lamp attenuator, the shorter tab (for front chassis attenuator models, the tab on the right) is for the (W) Tungsten - halogen lamp attenuator. Pushing the attenuator tab slightly up or toward the rear of the detector will increase light throughput. Pulling the tab slightly down or toward the front of the detector will decrease light throughput to prevent saturation of the diode array.

8. Monitor the light intensity as you adjust the attenuators:
  - For Atlas, go to "Monitoring the Light Intensity from Atlas".
  - For ChromQuest, go to "Monitoring the Light Intensity from ChromQuest".

## MONITORING THE LIGHT INTENSITY FROM ATLAS

As you manually adjust the attenuators, monitor the light intensities by using the UV6000 Instrument Status - Display page, which is accessed from the Atlas Instrument Manager application.

To monitor the light intensity from Atlas, do the following:

1. Open the Display page for the UV6000 detector:
2. From the Windows taskbar, click on Start. Then go to Programs (or All Programs), Atlas, Instrument Manager.
3. Open the Instrument Status window for your instrument by double-clicking on its icon.
4. From the bank of tabs located at the bottom of the Instrument Status window, click on the Detector tab.
5. Click on the Display tab to open the Display page.
6. In the Display page, select the Diode Number Intensity option button. Then, verify the following settings:

Spectrum Start (Diode) = 2

Spectrum Stop (Diode) = 511

Channel A (Diode) = 40

Channel B (Diode) = 55

Channel C (Diode) = 450

7. Click on the Start button.
8. Adjust the attenuator with the longer black tab (left tab for front chassis attenuators) (UV attenuation) to achieve the following Channel A values:
  - Units with S/N 106000 to 107999: 640,000 to 660,000
  - Units with S/N  $\geq 109000$ : 780,000 to 800,000
9. Adjust the attenuator with the short black tab (right tab for front chassis attenuators) (Vis attenuation) to achieve a Channel C value within the ranges shown for step 4.

*Note: Pump HPLC-grade water or methanol through the LightPipe flowcell as you adjust the attenuators. When changing mobile phases, pump solvent through the flowcell and readjust light levels accordingly.*

10. Tighten the attenuator locking screw, replace the lamp compartment cover and foam insulation and slide the chassis back into the detector housing.

## MONITORING THE LIGHT INTENSITY FROM CHROMQUEST

As you manually adjust the attenuators, monitor the light intensities from the ChromQuest data system as follows:

1. Open the UV6000 Diagnostics - Control page.
2. In the Control page, make the following selections and entries:
3. Set the UNITS to INTENSITY.
4. Enter the following settings for the scan data:
  - Start = 2
  - End = 511
  - Increment = 1
  - Bandwidth = 1
  - Rate = 1
5. Enter the following settings for the discrete channels:
  - Channel A - Wavelength = 40 Bandwidth = 1
  - Channel B - Wavelength = 55 Bandwidth = 1
  - Channel C - Wavelength = 450 Bandwidth = 1
6. Click on the LOAD TO DETECTOR button, (a confirmation message box will appear). Click on OK.
7. Go to the Status page and click on both green buttons, (Status On and Data On).
8. Adjust the attenuator with the longer black tab (left tab for front chassis attenuators) (UV attenuation) to achieve the following Channel A values:
  - Units with S/N 106000 to 107999: 640,000 to 660,000
  - Units with S/N 109000 and higher: 780,000 to 800,000
9. Adjust the attenuator with the short black tab (right tab for front chassis attenuators) (Vis attenuation) to achieve a Channel C value within the ranges shown for step 7.

*Note: When installing a UV6000, use water or methanol to set the attenuators. When changing mobile phases, flow solvent through the cell and readjust light levels accordingly.*
10. Tighten the attenuator locking screw, replace the lamp compartment cover and foam insulation and slide the chassis back into the detector housing.

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## Reloading the Firmware

The detectors' firmware (file pda.cof) must be downloaded anytime the backup battery is disconnected from the detector CPU PCBA or whenever the LED on the front panel is not a steady green signal. If the indicator light is flashing green upon detector power up or if the diagnostics software will not 'attach' (see Chapter 5), reload the detector firmware, pda.cof.



*NOTE: HyperTerminal or the EXE960 utility are used to reload the UV6000LP firmware (HyperTerminal is included with Windows NT/2000/XP. Every time the pda.cof file is downloaded, the dark current and wavelength accuracy must be recalibrated.*

If you are using Chromquest, proceed with the following section, "Chromquest and HyperTerminal". If you are using Atlas, follow the instructions in the section "Atlas and the EXE960 Utility" on page 4-19.

### CHROMQUEST AND HYPERTERMINAL

The Windows NT/2000/XP HyperTerminal® utility is a program that allows you to transfer files from one computer to another. In this case, you will be transferring a firmware file that is supplied with your chromatography data system to the CPU board in the UV6000 detector. The firmware file for the CPU of your UV6000 detector is the PDA\*.cof file. You can find the PDA\*.cof file on the ChromQuest CD.

To download the PDA cof file, do the following:

1. Launch Hyperterminal:
  - a. For Windows NT, from the Windows taskbar click on the Start button and go to Programs, Accessories, HyperTerminal and then click on the HyperTerminal menu item.
  - b. For Windows 2000 /XP, from the Windows taskbar click on the Start button and go to All Programs, Accessories, Communications, HyperTerminal. Then, click on the HyperTerminal menu item.
  - c. Ensure that the detector is connected to the correct COM port and that it is turned on.
    - If you have not already set up a connection for the UV6000 detector, go to step 2.
    - If you have already set up a connection for the UV6000 detector, go to step 3.



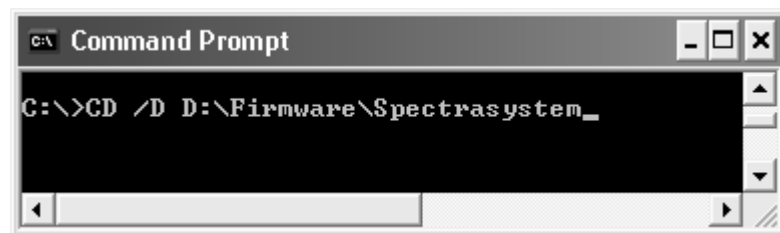
2. Set up a new connection called UV6000LP by following the instructions on the screen (Select NO if prompted to install a modem.):
  - a. In the Connection Description dialog box, enter UV6000LP for Name, select an appropriate icon, and then click OK.
  - b. In the Connect To dialog box, select the COM port to which the UV6000 is connected. Then, click OK.
  - c. In the COM Properties dialog box, set the Bits per second to 115,200, Data bits to 8, Parity to None, Stop bits to 1 and Flow control to None.
3. Initiate communication between the UV6000 detector and the data system computer:
  - a. Turn the UV6000 detector off. Wait 5 seconds and then turn the detector back on. The connection should be live as indicated in the bottom left corner.
  - b. Strike the <Enter> key on the computer keyboard three times. You will see it echo back from the UV6000LP to the computer monitor. (You will see a  $\Rightarrow$  symbol every time you press Enter).
4. Initiate the download process:
  - a. At the last  $\Rightarrow$  prompt, type the following download command: **do** (for download).
  - b. Then press <Enter>. The system will echo back information (a series of squares) from the UV6000LP. Immediately proceed with the next step, otherwise an error message will appear – “Download failed: communication error”.
  - c. Immediately start downloading the firmware by choosing Transfer, followed by Send File. The Send File dialog box opens.
5. Send the file to the CPU of the UV6000 detector:
  - a. In the Send File dialog box, browse to the PDA.COF file. Normally it will be found in D:\CHROMQUEST where D:\ is the CD-ROM drive containing the ChromQuest installation CD.
  - b. Select protocol X-modem. (Do not try Z-modem) Then, click Send.
  - c. After a few seconds the file should start downloading. It will require approximately six minutes to download the file at the 115,200 data rate.
6. When the transfer is complete, save the UV6000LP session and close HyperTerminal. Power OFF the UV6000LP and power it back ON.

7. Re-calibrate the dark current and wavelength accuracy according to the procedures in Chapter 5. Once you have completed diagnostics or maintenance procedures, repeat the Operation Verification procedures on page 4-6.

## **ATLAS AND THE EXE960.EXE UTILITY**

To download the PDA cof file, do the following:

1. Turn off the UV6000LP detector.
2. Connect the UV6000LP detector to a COM port on the data system computer by way of a serial communication cable.
3. If the data system computer is acting as a DataServer, stop the DSController service to prevent communication conflicts by way of the COM port.
4. Turn on the UV6000LP detector.
5. Insert the Atlas installation CD-ROM into the CD drive on the data system computer.
6. Open the Command Line window:
  - For Windows NT or Windows 2000, click on the Windows taskbar Start button and go to Programs, Accessories, Command Prompt.
  - For Windows XP, click on the Windows taskbar Start button and go to All Programs, Accessories, Command Prompt.
7. Change the directory to the folder that contains the EXE960 utility and the PDA cof file (<CD Drive>:\Firmware\Spectrasystem). See Figure 4.11.



*Figure 4.11 Changing the directory (D: = CD ROM drive label)*

8. Enter the following command:  
Exe960 -baud 1152000 -port com<COM\_Number>  
-noexec pda.cof  
Where:  
<COM\_Number> is the number of the COM port to which the UV6000 is connected

The download should take about two minutes.

9. After the file is downloaded, turn the UV6000LP detector off. Reconnect it for normal use. Then, turn it back on.

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## Operation Re-verification

Once you have completed diagnostics or maintenance procedures, repeat the Operation Verification procedures on page 4-6.



# Diagnostics

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## Introduction

The chromatography data system (Atlas or ChromQuest) allows you to check the operation of the UV6000LP, calibrate the detector, and view the error log.

The Diagnostics program in ChromQuest is described below in the topic, **The Diagnostics Program in ChromQuest**. In Atlas, diagnostics are performed from the Instrument Manager application. Refer to the topic, **The Atlas Instrument Manager** on page 5-23.



*NOTE: To prevent communications conflicts and protect data integrity during an analysis, ChromQuest disables the UV6000LP diagnostics program during an analysis.*

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## The Diagnostics Program in ChromQuest

To use the UV6000LP diagnostics software, the detector must be powered on and its RS232 port connected to a serial port on the data system computer.

From the Diagnostics dialog box in ChromQuest, you can do the following:

- Check lamp status and usage
- View lamp intensity or absorbance spectra
- Test the digital inputs and outputs
- Calibrate the dark current
- Perform a wavelength calibration
- View and print the error log

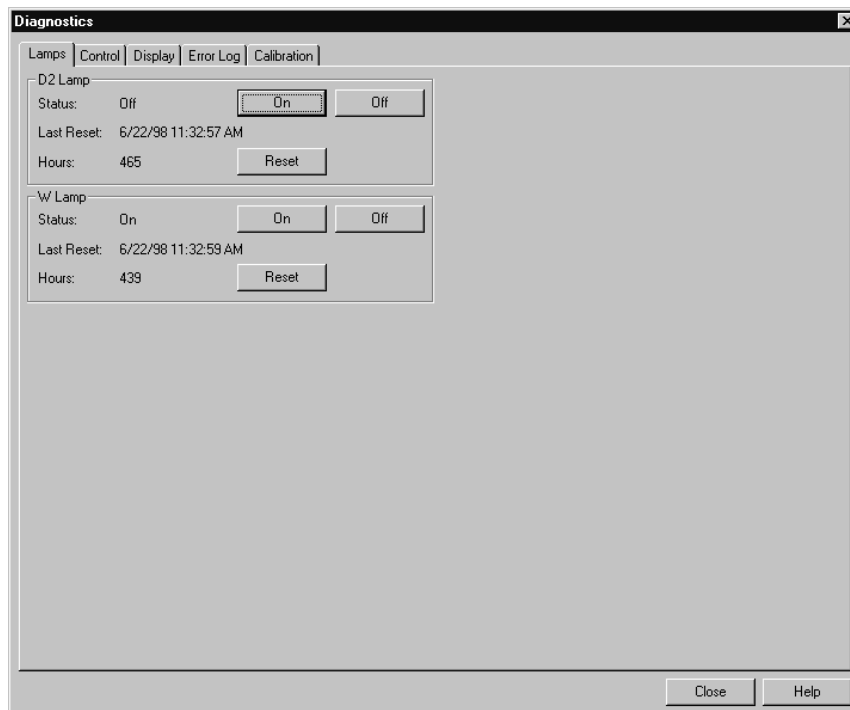
Most of the above actions are described in Chapter 4, Routine Maintenance.

### ACCESSING THE DIAGNOSTICS PROGRAM

To access the Diagnostics program, do the following:

1. From the Windows taskbar, select Start, Programs (or All Programs in Windows XP), Chromatography, ChromQuest.

2. Double-click on the Instrument icon that represents your HPLC instrument. An applications window will open with a default data file displayed.
3. From the menu bar, click on Control. Then, select Instrument Status from the drop-down menu.
4. Right-click in the UV6000 Instrument Status window to open a shortcut menu. Select Diagnostics from the shortcut menu. The UV6000LP Diagnostics program will open with the Lamps page displayed (Figure 5.1).



*Figure 5.1 The Diagnostics dialog box*

Note that there are five diagnostic areas organized into pages with tabs across the top for ease of selection. The pages are Lamps, Control, Display, Error Log and Calibration.

The tabs at the top of each page can be used to quickly move from page to page. Each time you open the diagnostics program it automatically defaults to the Lamp page.

## **THE LAMPS PAGE**

The Lamps page displays the status of the detector's two lamps and the total run time of each lamp. Buttons permit you to manually turn either lamp on or off and to reset each lamp's run time to zero following lamp replacement (Figure 5.2).

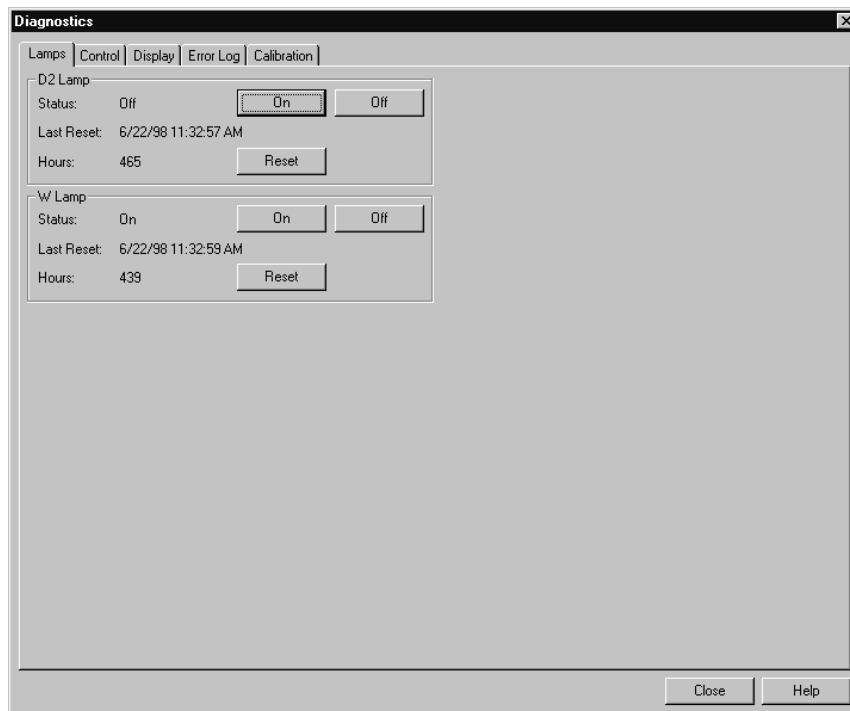


Figure 5.2 The Lamps page



*NOTE: Avoid indiscriminately pressing either Reset button in this group. They should be pressed only after their associated lamp has been replaced with a new one.*

This page is typically used for lamp maintenance. The detector keeps track of the number of run-time hours for each lamp. The deuterium lamp has a lifetime of approximately 1000 hours and the tungsten-halogen lamp's lifetime is about 2500 hours. Lamp lifetime will vary depending upon the application.

When you press either Reset button, the stored total run time for the associated lamp is reset to zero and the Last Reset field is updated to the current date and time. After you replace a lamp, press the Reset button.

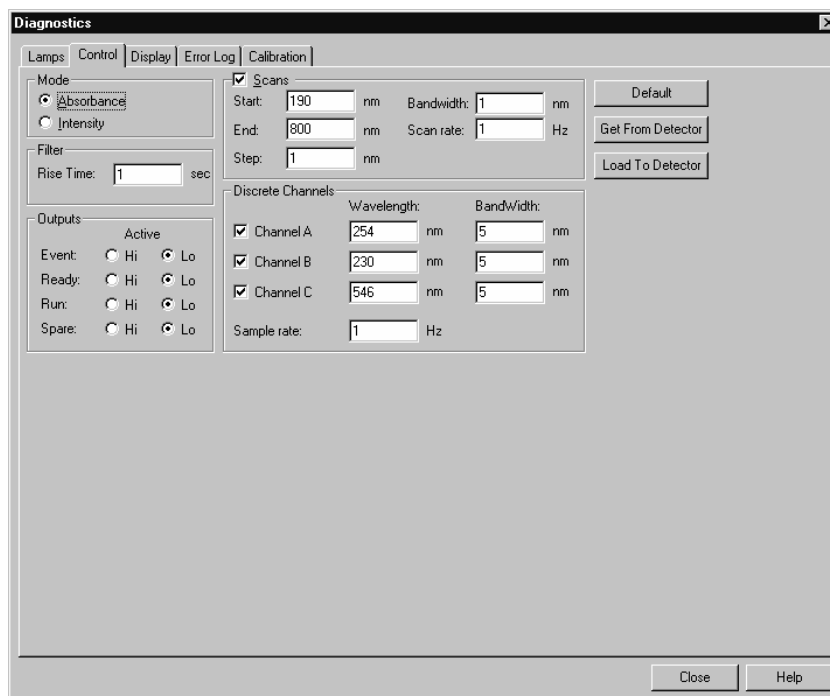
The lamp buttons also provide on/off control. When you turn on the deuterium lamp, its Status field reads **Starting** during the 30-second ignition period and then changes to **On**. If there is a problem with either lamp, its Status field will read **Failed**.



*NOTE: The intensity of the deuterium lamp falls off very slightly over a period of time after it is turned on. You should wait at least 1 ½ for the lamp to stabilize after a cold start before collecting data in the UV range.*

## THE CONTROL PAGE

Parameters found on this page define the data that will appear on the Display page. These values must be specified and downloaded to the detector before viewing real-time data on the Display page. The Control page parameters are organized into five groups. There are also 3 buttons for loading the parameters to and from the UV6000LP. Figure 5.3 shows the default settings for operation in the Absorbance mode. Figure 5.4 shows the default settings for the Intensity mode.



*Figure 5.3 The Control Page - Absorbance Mode*

### Mode Group

The Mode group contains two radio buttons for selecting either intensity mode or absorbance mode. In the absorbance mode (see Figure 5.5) the following apply:

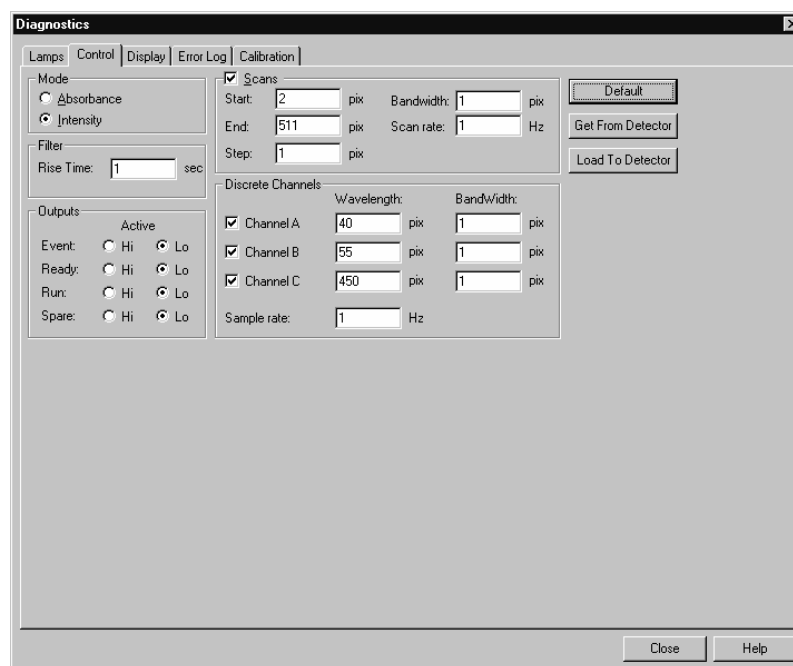
- A bandwidth filter is used in the wavelength axis
- A rise time filter is used in the time axis
- Spectral scans and chromatogram plots are automatically zeroed at the start of data collection
- Wavelength units are nanometers (190 to 800 nm)
- The Y axis is in milli-absorbance units (mAU)



The Savitsky-Golay bandwidth filter improves the signal-to-noise ratio, (at the compromise of spectral resolution). The 2<sup>nd</sup> - order Bessel rise time filter reduces short-term noise in the time-axis with minimal impact on the shape or height of a peak.

In the intensity mode (Figure 5.4) the default controls are slightly different. The major differences include:

- No bandwidth or rise time filtering
- The wavelength units are pixels (diodes 2 to 511)
- The Y axis units are intensity levels



*Figure 5.4 The Control Page - Intensity Mode*

There are 512 photodiodes in the detector's array. The first two diodes (0 and 1) are not used. Diode 2 is at 190 nm and diode 511 is at 800 nm when the detector is properly calibrated. This gives a diode spacing of 611 nm/509 diodes = 1.2 nm/diode. In the absorbance mode, the detector interpolates between diodes to store absorbance at integer wavelengths.

## Filter Group

The Rise Time field in this group allows you to specify the desired rise time for the chromatogram plot(s) when the absorbance mode is selected. To change a displayed value, place the text cursor in the field and use the backspace or delete key and number keys. The acceptable values are 0, 0.1, 0.2, 0.5, 1.0, 2.0, 5.0, and 10.0 seconds where 0 means no filtering.

## Outputs Group

The Outputs Group allows users to specify the state (high or low) of the output signal, when activated. There are three remote outputs available: Run, Ready and Event. Spare is not used.



*NOTE: Do not change the sense of any output signal connected to external equipment without knowing the equipment's requirements. This can cause permanent damage to both pieces of equipment.*

Two radio buttons are associated with each output signal. When the High button is activated, the associated signal transitions from a low level to a high level when it is turned on and from high to low when it is turned off. The on/off sense is reversed when the Low button is activated.

To test the outputs, set a voltmeter to its 10 V scale and connect it between +5V and an output terminal. Alternatively you can connect an LED and 100 Ohm resistor in series. The LED's cathode should be connected to the output terminal and the other end of the resistor connected to the +5V terminal. The meter should read +5V or the LED should light when the output is ON and its Sense is Low or the output is OFF and its Sense is High. Remember that you are changing the sense of the return line, not the +5V.

To toggle the remote outputs, first select Instrument Status from the Control drop-down menu. Right-click anywhere in the Instrument Status window and select Output from the pop-up menu. The remote outputs will then appear in a drop-down menu. Select the desired output by clicking on that menu item. A check mark will appear indicating that the output has been activated. Repeat this process to test the other remote outputs.

## Scans Group

To display spectral scans, select the Scans check box and fill in the scan parameters for the desired range, frequency, etc.



*NOTE: The scan start and end values must not be set closer to their respective limits than the  $(\text{bandwidth} - 1)/2$ . That is, with a bandwidth of 3 the scan limits are 199 and 799 nm and with a bandwidth of 5 the limits are 192 and 798 nm.*

### Start

Enter the wavelength or pixel for the start (lower value) of the scans in this field. The range of acceptable values is from 190 to 800 nm or from 2 to 511 pixels. The default is 200 nm in the absorbance mode and pixel 2 for the intensity mode.

### **End**

Enter the wavelength or pixel for the end (upper value) of the scans in this field. The range of acceptable values is from 190 to 800 nm or from 2 to 511 pixels. The default is 800 nm for absorbance and pixel 511 for intensity.

### **Step**

Enter the scan data increment value here. The default is 4, i.e., the detector will send data to the diagnostics at every 4<sup>th</sup> nm or pixel in the scan range. The acceptable range of interval values is from 1 to 10 (nm or pixels).

### **Bandwidth**

In this field, enter the desired bandwidth for the Savitsky-Golay filtering when the absorbance mode is selected in the Operations group. Acceptable values are 1, 3, 5, 7,..., 99 where 1 is equivalent to no filtering. The default setting is 5 nm for absorbance and 1 nm for intensity.

If the Start, End, and Bandwidth values conflict, an error message will automatically be displayed when they are downloaded to the detector.

### **Scan Rate**

Enter the scan rate in this field. The acceptable values are 0.5, 1, 2, 4, 5, 10, and 20 Hz with 2 Hz being the default for absorbance and 1 Hz for intensity.



*NOTE: The actual scanning of the diode array occurs at a fixed 20-Hz rate. When you select slower scan rates and/or increments larger than 1, the data values collected at the intermediate scans and increments are not used.*

## **Discrete Channels Group**

This group contains a single data rate field, in addition to a wavelength and a bandwidth field for each of the three chromatogram channels, A, B, and C.

### **Sample Rate**

Enter the desired data-sampling rate for all channels in this field. The acceptable values are the same as the Scans Rate; 0.5, 1, 2, 4, 5, 10, and 20 with the default at 10 Hz.

### **Channel A/B/C Select**

You must select the Channel check box to collect data for that channel. You can select any combination of channels or none.



*NOTE: The data for Channel A and B, when selected, is converted back to analog form and made available at the ch1 and ch2 connectors on the rear panel of the detector. Refer back to the Installation chapter for further information on these outputs.*

### **Wavelength**

Enter the desired wavelength in these fields. The acceptable range of values is from 190 nm to 800 nm in absorbance mode or pixel number 2 to 511 in the intensity mode. The default for channel A is 254 nm for absorbance and pixel 40 for intensity.

### **Bandwidth**

Enter the desired bandwidth for the Savitsky-Golay filtering in these fields when the absorbance mode is selected. The acceptable range is from 1 to 99 nm in odd-number increments with 1 meaning no filtering. The default is 5 nm.



*NOTE: The Channel Wavelength value must not be set closer to the limits than the (Bandwidth value - 1)/2.*



*HINT: Enter a wider bandwidth to improve signal-to-noise ratio.*

## **Default, Get and Load Buttons**

The Default button sets all parameters to the default values applicable to the specified mode. The Get From Detector button uploads and displays the parameters currently stored in the detector. The Load To Detector button downloads the currently displayed parameters to the detector. Once a method is downloaded to the UV6000LP a confirmation message is displayed indicating that the method was sent.

## **THE DISPLAY PAGE**

The Display page (Figure 5.5) displays status information across the top portion, spectral scans in the middle graph area, and chromatograms in the lower graph area. Light intensity scans or absorbance spectra can be displayed in real time, or frozen for closer inspection. Data display parameters are specified on the Control page. The four buttons located in the upper right corner of the display control when and how the information is updated. They are grouped as either Status or Data.

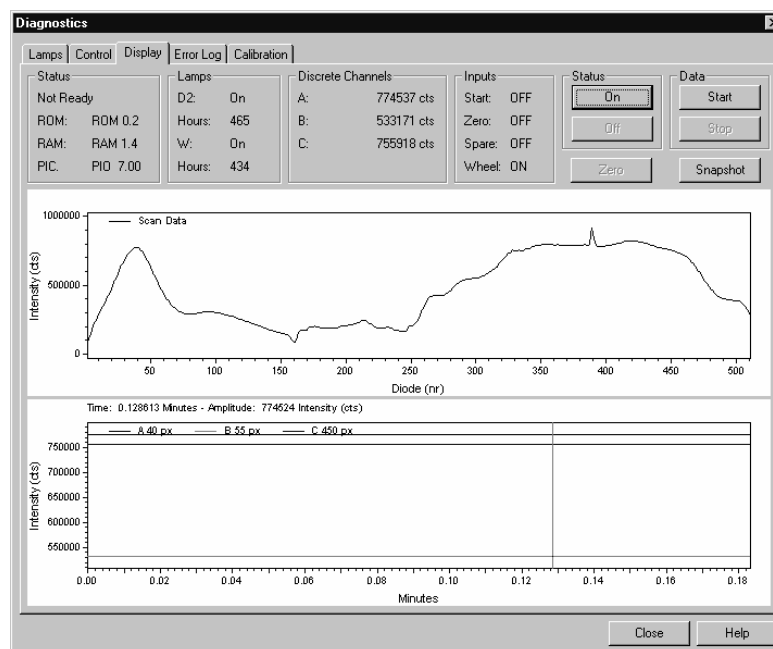


Figure 5.5 The Display Page

## Status Group

The Status fields are located in the upper left corner of the Control page and indicate the status of the detector. The upper-most area displays **Ready** when the detector is ready to collect data and **Not Ready** if it is not.

There are three additional fields that display the detector's firmware version numbers. The version information is for the boot ROM, the firmware stored in battery backed-up RAM, and the I/O (Input / Output) driver. After the Status – On and Data –Start buttons are clicked, the diagnostics software reads and displays the current version numbers from the detector.

## Lamps Group

The D<sub>2</sub> and W Lamp fields indicate the status of the lamps; **Starting**, **On**, **Off**, **Dim**, or **Failed**. The amount of time that each lamp has been used is also displayed.

## Discrete Channels Group

The A, B, and C Counts/mAU fields display the intensity or absorbance of the respective channels as selected in the Control page. These fields are continuously updated when the Status-On button is clicked.

## Inputs Group

The current states of the START and ZERO input signals are displayed in this group. These signals are activated or turned on by a contact closure between them and their COMMON terminals on the rear panel.

You can test an input by connecting a jumper between input's rear panel terminal and its COMMON terminal. It should indicate **On** in this condition.

In addition to the START, ZERO and SPARE inputs, there is also a status item labeled WHEEL. A magnetic sensor on the standard filter wheel senses if the filter wheel is in the open position (# 1). When the Wheel is in position #1 the status reads **On**. If the wheel is in any other position, the status reads **Off** and the detector status reads **Not Ready**.

## Status Buttons Group

The buttons in the Status group control the display of information in the Status fields at the top of the page.

The Status-On button initiates a continuous update of the status fields. The Status-Off button stops the continuous update and freezes the status information in the fields.

## Data Buttons Group

The Data button group affects both scan and chromatogram plots.

The Data-Start button turns the data on and begins a real-time update of the spectral scan and the chromatogram plots for the channels selected on the Control page. The Status field should indicate **Ready** to display actual data.

The Data-Off button stops the data update and freezes the plots. You must turn data off to download values to the detector from the Control page.

## Zero and Snapshot Buttons

When the absorbance mode is selected and data is on, the Zero button zeroes both spectral scan and chromatogram plots. (The Zero button is not available when in the Intensity mode). It takes the next scan and subtracts it from the succeeding scans. You can use this button to bring the scan back down to the baseline. This function is automatic at the start of data collection if the absorbance method is selected on the Control page.

The Snapshot button allows the operator to record an intensity or absorbance scan. This button is only active after the Data Stop button has been clicked.



*NOTE: The Snapshot button can be used to collect a single intensity or absorbance spectrum. This can be helpful in monitoring light levels throughout the lifetime of the lamps. If the Snapshot button is selected, the data is stored in the ChromQuest directory as a .csv file which can be renamed and opened in Excel. The scan is named data0.csv, the second scan is named data1.csv and so on. Each time the diagnostics program is opened, the .csv file counter will be reset and any .csv files which have not been renamed will be overwritten.*

## Scan Display

The Scan display allows viewing and adjustment of the spectral scans in the middle display area. The Scan fields located on the Control page determine what wavelength range is displayed. The Scan display is updated every few seconds.

By clicking the right mouse button and selecting Properties from the pop-up menu, you can adjust the display's wavelength axis and also set the minimum and maximum Counts or mAU for the respective intensity or absorbance axis. The Scan display color scheme can also be adjusted from the Properties box.

## Discrete Channel Display

The Discrete Channel display allows viewing and adjustment of the chromatograms in the lower display area. The Channel check boxes on the Control page determine which channel or channels will be displayed. The Discrete Channel display is continuously updated as specified in the Control page. If there is an interruption, any data points collected since the last update are automatically updated on the display.

By clicking the right mouse button and selecting Properties from the pop-up menu, you can adjust the display's time axis and also set the minimum and maximum Counts per mAU for the intensity versus absorbance axis. The Discrete Channel display color scheme can also be adjusted from the Properties box.

## USING CONTROL AND DISPLAY PAGES

After reading the descriptions on the previous two pages, you have probably gotten a fair idea of their interdependence. The Control page is used to configure the data collection parameters of the detector, while the Display page is used to view the display of data.



*NOTE: You cannot download a method from the Control page to the detector when the data is turned on at the Display page. Likewise, you cannot display real-time data on the Display page unless the Control parameters have been downloaded to the detector.*

The parameters on the Control page that are downloaded to the detector determine whether the plots on the Display page will be intensity scans or absorbance spectra and therefore determine the units applied to the Y-axis of the plot.

The general procedure for using the Control and Display pages is as follows:

1. Specify the parameters listed in the Control page and download them to the detector.
2. Go to the Display page and click the Status-On button.
3. Verify that the detector Status field reads **READY**.
4. When the detector is ready, click the Data-On button to begin data collection and view the results.
5. Adjust the display parameters as desired.
6. To change parameters, turn the data off on the Display page, go back to the Control page, make the desired changes, download the new parameters to the detector, return to the display page, turn the data on, and adjust the display parameters as desired.

In the following example, the Control and Display pages will be used to display the holmium oxide absorbance spectrum. Set up the parameters as shown in Figure 5.6. In the Mode group box, choose Absorbance units. Select the Scans checkbox. Set the scan to start at 220 nm and end at 800 nm. Monitor 241, 361, and 536 nm as channels A, B, and C. These three wavelengths are used in the wavelength calibration program. Then, click on Load To Detector to send settings to the UV6000LP detector.





Figure 5.6 Control page for Holmium oxide scan



**NOTE:** Have HPLC-grade water or methanol flowing during this procedure.

Once the method parameters have been downloaded to the UV6000LP, go to the Display page to view the data. Click both Status-On and Data-Start buttons. With the standard filter wheel in the open position (position #1), click the Zero button. The absorbance spectrum (upper display) should now be a relatively flat line, and the chromatogram display (lower display) will be monitoring the detector baseline at the three wavelengths that were specified on the Control page. The mAU readings for the three discrete wavelengths are displayed in the top, center section of the Display page (Figure 5.7). Notice when the filter wheel is in position #1, all three channels read approximately zero. The status indicator for the filter wheel also reads **On** when the wheel is in position #1.

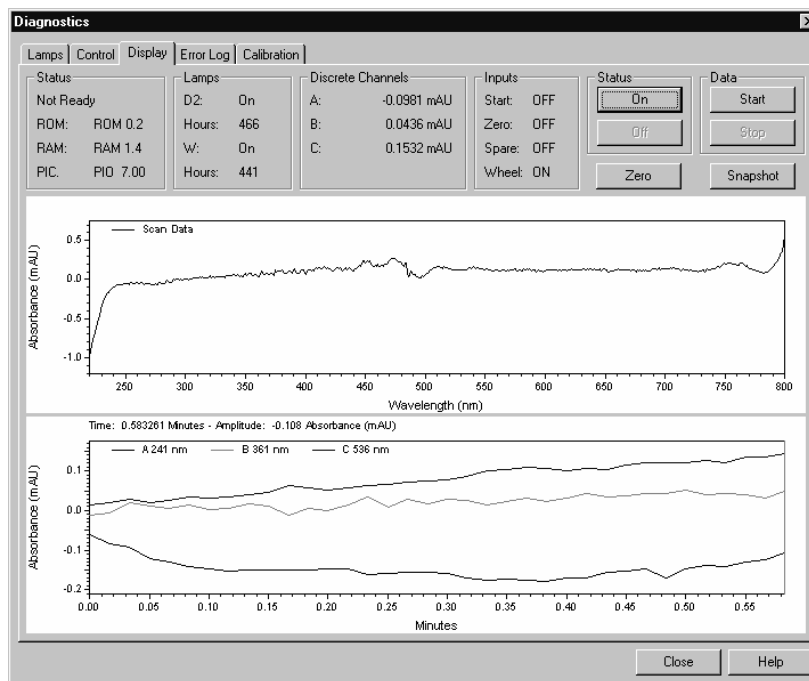


Figure 5.7 Baseline monitoring on Display page

Rotate the standard filter wheel to position #2. This places the holmium oxide-filled cuvette in the optical path. It is not necessary to turn data collection off before you rotate the wheel. Once the wheel is in position #2, the holmium oxide absorbance spectra will be displayed as shown in Figure 5.8. Notice that the status indicator for the filter wheel now reads **Off** because the filter wheel is no longer in position #1.

After inspecting the holmium oxide spectrum, be sure to return the filter wheel to the open position (position #1).

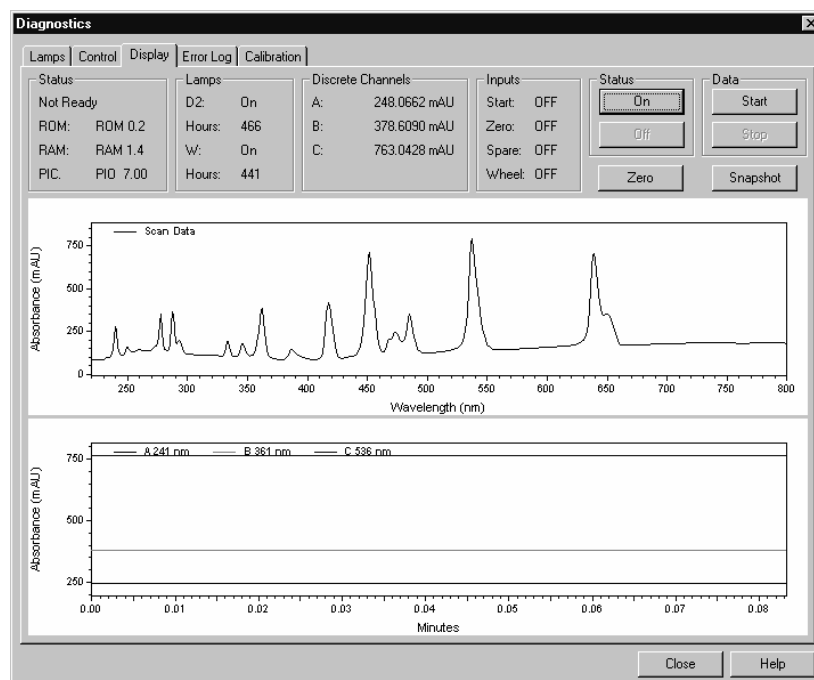


Figure 5.8 Holmium oxide absorbance spectrum

## THE ERROR LOG PAGE

The Error Log page allows you to retrieve, view, print and clear the detector's status log. The status log collects major events and errors occurring in the detector. It holds 100 events and operates on a first-in-first-out basis. That is, after filling with 100 events, the next event in pushes the first event collected out. The Routine Maintenance chapter recommends viewing, printing, and clearing the on a weekly basis.

When you first open the Error Log page, the event area will be blank. Click on the Get button to retrieve the information from the detector and display it. Figure 5.9 shows a sample log.

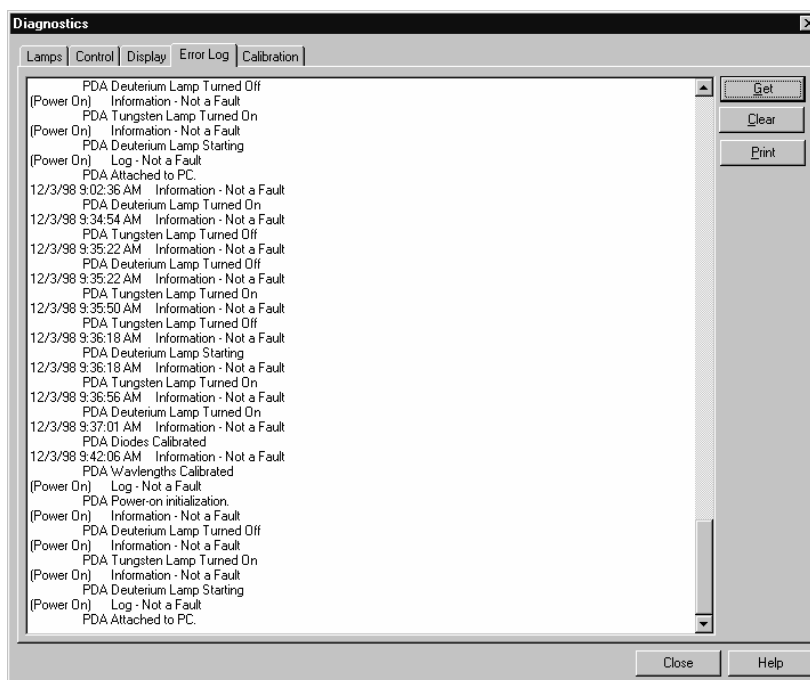


Figure 5.9 The Error Log page

Note that the viewing area has horizontal and vertical scroll bars so you can view all of the entries. Press the Print button to print a copy of the displayed log. Press the Clear button to clear the log. The Cancel button lets you escape if there is a problem in retrieving the log. For a list of some common error messages that may appear in the log, refer to the Log Entries section in Chapter 6 this manual .

## THE CALIBRATION PAGE

### Array Group

One of the two functions of the Calibration page (Figure 5.10) is to measure and correct for dark current produced by the photodiode array. Even when both lamps are turned off, the array still produces a small amount of background signal that is referred to as dark current. Typical dark current values range from 1,500 - 3,000 counts.

Before intensity values can be converted to absorbance units, the dark current must be subtracted from the intensity measurements. Following dark current calibration, light intensity values will be automatically corrected for dark current. Remember that both lamps must be turned on during calibration.



*NOTE: Neither calibration program will run when data collection is enabled on the Display page.*



*HINT: Be sure to check light intensities before performing the dark current or wavelength calibration procedures to ensure that the array is not saturated. Refer to the Operation Verification section on page 4-6.*

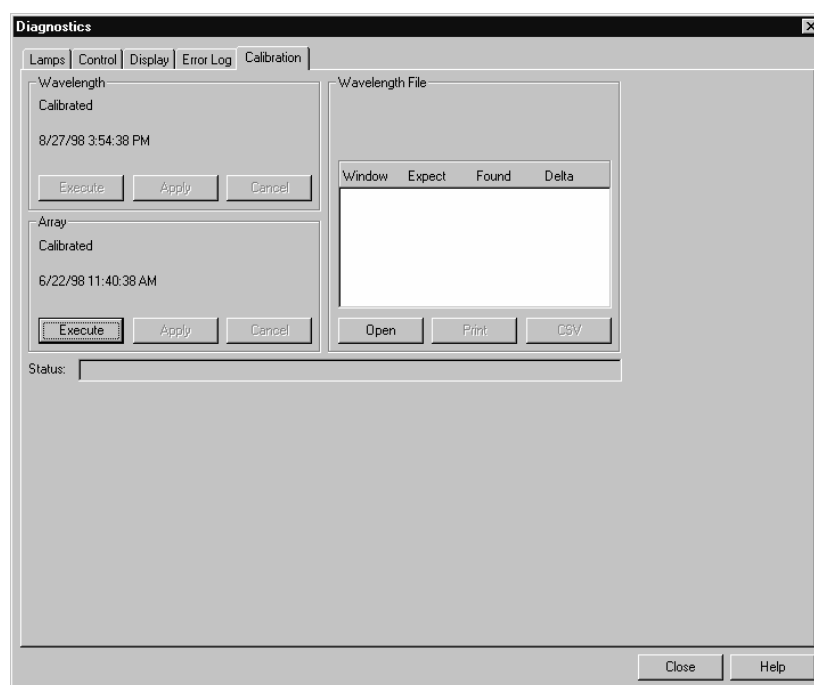
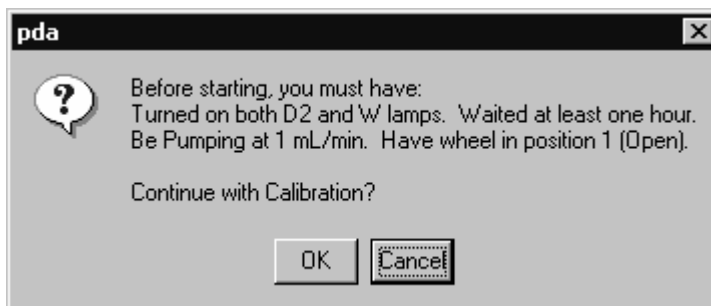


Figure 5.10 The Calibration Page

## PERFORMING A DARK CURRENT CALIBRATION

To perform the dark current calibration, do the following:

1. Turn on both lamps and wait 1 hour for the lamps to warm-up. Because the dark current is a function of temperature, you want to perform this calibration after the detector has reached its typical operating temperature.
2. Pump water at 1 mL/minute through the flowcell.
3. Place the filter wheel in position 1, Open.
4. Press the Execute button. An information box opens (Figure 5.11) to remind you of the necessary pre-conditions.
5. If all of the pre-conditions have been met, press the OK button.



*Figure 5.11 Dark Current Calibration Start*

As the calibration proceeds, its status is shown in the status group at the bottom of the page. During the dark current calibration, intensity scans are collected under four sets of conditions; with both lamps on, D<sub>2</sub> lamp only on, W lamp only on and both lamps off. After the last event is completed, the lamps are turned back on and the Calibration Complete info box shown in Figure 5.12 appears.



*Figure 5.12 Dark Current Calibration Complete*

6. Click on the OK button.
7. Press the Apply button to apply the calibration results to the detector. Date and time of calibration are displayed and stored in memory.

## Wavelength Group

The second function of the Calibration page (Figure 5.13) allows the operator to determine wavelength accuracy and correct any errors if necessary.

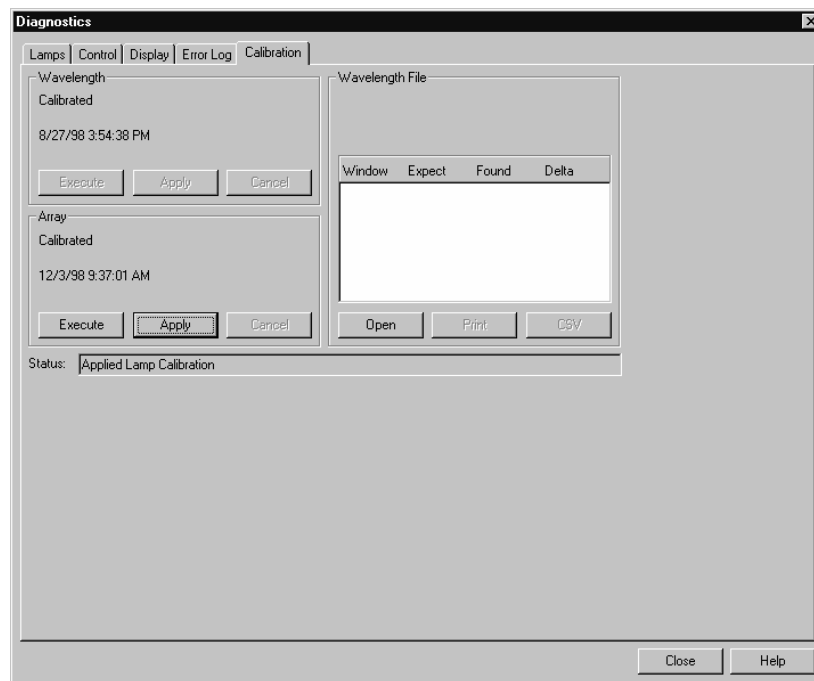


Figure 5.13 The Calibration Page

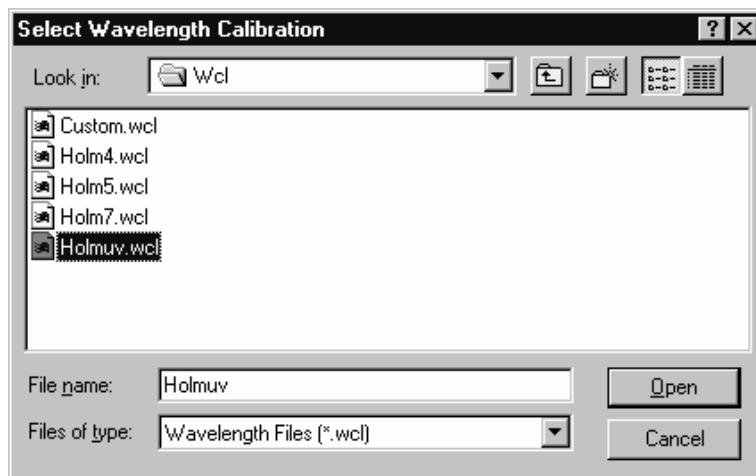
The alignment of the spectrum on the diode array is dependent upon the physical alignment of various components of the optical bench and can become off set if the detector is sharply jolted, for example, in shipping.

## PERFORMING A WAVELENGTH CALIBRATION

To perform a wavelength calibration, proceed as follows:

1. Turn on both lamps and wait 1 hour for the deuterium (D<sub>2</sub>) lamp to warm up.
2. Pump water at 1 mL/minute through the flowcell.
3. Place the filter wheel in position 1, Open.
4. Click the Open button in the Wavelength File group.

This opens the Select Wavelength Calibration dialog box shown in Figure 5.14. There are 5 calibration files to choose from. The holmuv.wcl uses 5 wavelengths in the UV region of the spectrum for calibration. Files holm4.wcl, holm5.wcl and holm7.wcl use different sets of wavelengths from both the UV and Vis regions. The Custom.wcl file can be modified using a text editor program to create a calibration file for a specific compound of interest.

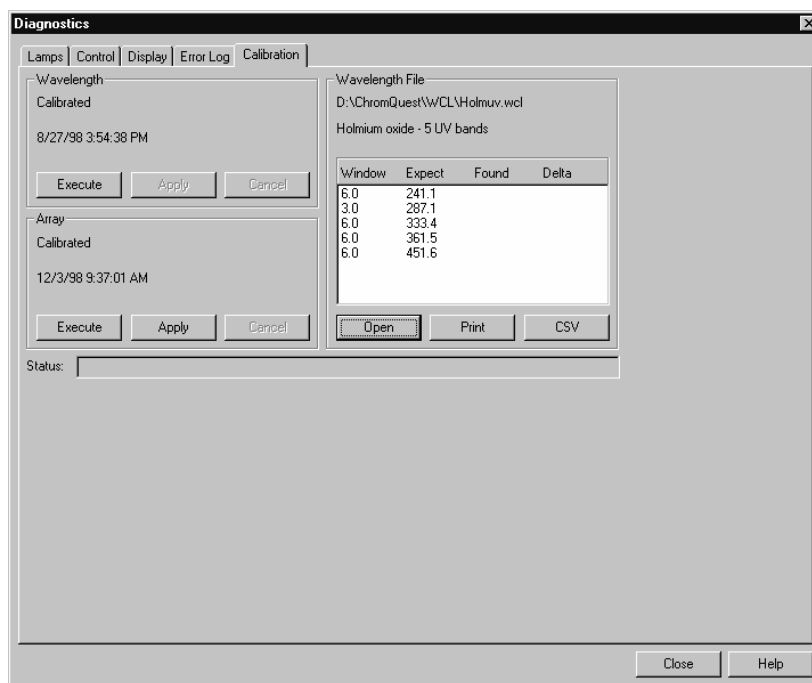


*Figure 5.14 Select Wavelength Calibration File*

The expected holmium oxide absorbance maxima are selected from a spectrum published in the ASTM Method E275-83 “Standard Practice for Describing and Measuring Performance of Ultraviolet, Visible, and Near Infrared Spectrophotometers.”

5. Double-click on the desired file or highlight it and press the Open button.
6. The dialog box closes and the file name and its peaks are displayed in the Wavelength File group as shown in Figure 5.15.

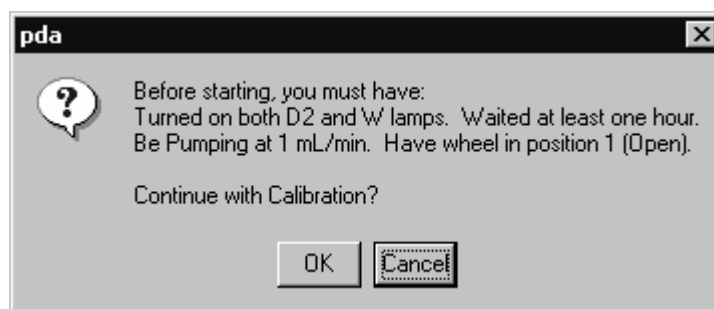




*Figure 5.15 Wavelength File Opened*

7. Press the Execute button in the Wavelength group.

An info box (Figure 5.16) opens to remind you of all of the pre-conditions (steps 1, 2, and 3).



*Figure 5.16 Wavelength Calibration Pre-conditions*

8. If all preconditions are met, press the OK button in the info box.

A background spectrum is now collected. It is used to remove the mobile phase absorbance contribution. The status box at the bottom of the page will display various pieces of information describing the calibration process.

When the background collection is complete, the info box shown in Figure 5.17 opens.



*Figure 5.17 Change Filter Position*

9. Move the filter wheel as directed and click the OK button in the info box.

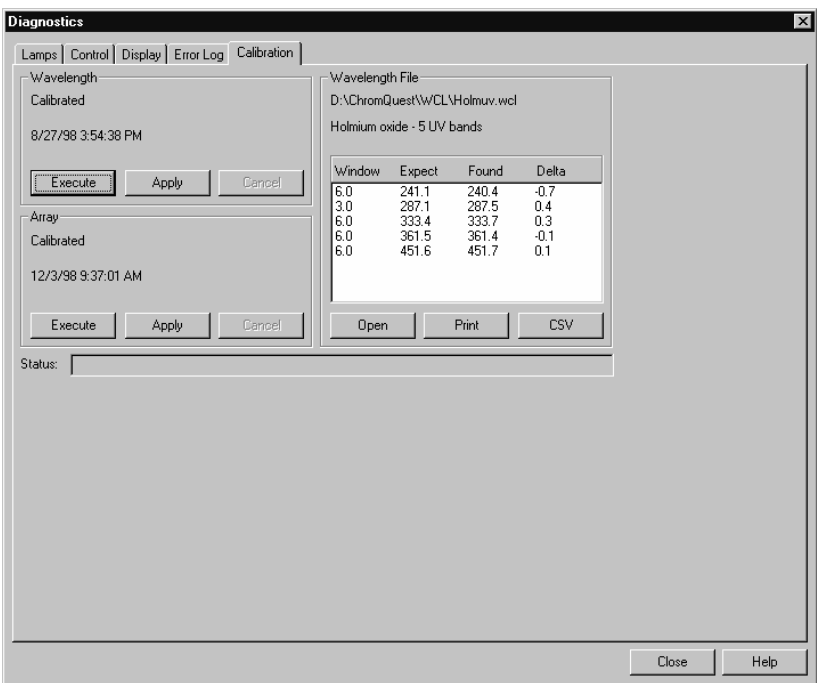
Again the steps are shown in the Status line. A method is downloaded, the diagnostics program waits for a few seconds for the rise time filter to equilibrate, takes a holmium oxide scan, and then displays a new info box as shown in Figure 5.18.



*Figure 5.18 Wavelength Calibration Complete*

10. Click on the OK button (Figure 5.18) to close the info box and view the results as shown in Figure 5.19.

All of the Delta values should be less than or equal to  $\pm 1$  nm. If the Delta values exceed  $\pm 1$  nm, click on the “Apply” button and repeat the wavelength calibration for verification. If, after applying a new calibration, the Delta values still exceed  $\pm 1$  nm, call your Thermo Electron representative for assistance. Don’t forget to apply the new calibration results after each calibration.



*Figure 5.19 Wavelength Calibration Results*

11. Click on the Print button to print a copy of the Calibration Page.
12. Clicking on the CSV button will save the calibration table to disk in a csv format that can be imported into a spreadsheet program.

The Cancel button on the Wavelength Calibration page can be pressed at any time a calibration is in process to abort it. The Reset button calls up default calibration values.

## The Atlas Instrument Manager

The Atlas Instrument Manager lets you check the operation of the UV6000LP, calibrate the detector, and view the error log. From the UV6000 Instrument Status window of the Instrument Manager, you can do the following:

- Check lamp status and usage
- View lamp intensity or absorbance spectra
- Calibrate the dark current
- Perform a wavelength calibration
- View and print the error log

## **ACCESSING THE UV6000 INSTRUMENT STATUS WINDOW**

Access the UV6000 Instrument Status window as follows:

1. From the Windows taskbar, click on the Start Button.
2. Then choose Programs (Windows NT/2000) or All Programs (Windows XP), Atlas, and Instrument Manager.
3. Double-click on the icon for your instrument to open the Instrument Status window.
4. From the bank of tabs located at the bottom of the Instrument Status window, click on the Detector tab.

The left-side of the UV6000 Instrument Status window consists of a set of read-only fields that allow you to monitor the status of the UV6000 detector. The right-side of the UV6000 Instrument Status window contains three pages that are accessed by clicking on their respective tabs.

The pages are: Operation (labeled as Display in Atlas 2003, R1), Maintenance, and Error Log.

## **STATUS**

The status section of the UV6000 Instrument Status window contains five group boxes: Status, Lamps, Channel A, Channel B, and Channel C.

### **Status Group Box**

#### ***Device State***

The Device State read-back displays the status of the UV6000 detector. The possible states for the detector are: Not Connected, Idle, or Acquiring.

#### ***Device Time***

The Device Time read-back displays the time of day according to the on-board CPU in the UV6000 detector.

#### ***Wavelength Calibration***

The Wavelength Calibration read-back displays the current wavelength calibration status. The possible states are: Valid or Not Valid. If the status of the wavelength calibration is Not Valid, you must either perform a new wavelength calibration or reset the calibration to its default setting.

### **Array Calibration**

The Array Calibration read-back displays the current array calibration status. The possible states are: Valid or Not Valid. If the status of the array calibration is Not Valid, you must either perform a new wavelength calibration or reset the calibration to its default setting.

### **Method**

The Method read-back displays the status of the current method. The possible values are Valid or Not Valid. If the value is Not Valid, you must download a method.

### **Filter Wheel**

The Filter Wheel read-back displays the status of the Holmium Oxide wavelength calibration filter wheel. The possible states are Open and Filter. Open corresponds to position 1 and Filter corresponds to position 2.

## **Lamps Group Box**

The Deuterium State read-back displays the status of the deuterium lamp (D<sub>2</sub>). The possible states are: On, Starting, Off, Failed, or Unknown. The deuterium lamp takes approximately 30 seconds to ignite and approximately 60 minutes to warm-up.

The Tungsten State read-back displays the status of the tungsten lamp (W). The possible states are: On, Starting, Off, Failed, or Unknown.

## **Channel A/B/C**

The status for the discrete wavelength channels can be displayed in either the absorbance mode or the intensity mode. The mode option is selected from the Display page.

The Wavelength (nm) read-back displays the current wavelength setting and the Diode (number) read-back displays the current diode number setting for the respective channel.

The Abs. (mAU) read-back displays the absorbance value for a specific wavelength setting and the Int. (Counts) read-back displays the current intensity value a specific diode number.

## **THE OPERATION PAGE**

The Operation page allows you to monitor detector output when data is not being acquired, for example, when the Instrument status is Idle. See Figure 5.20.

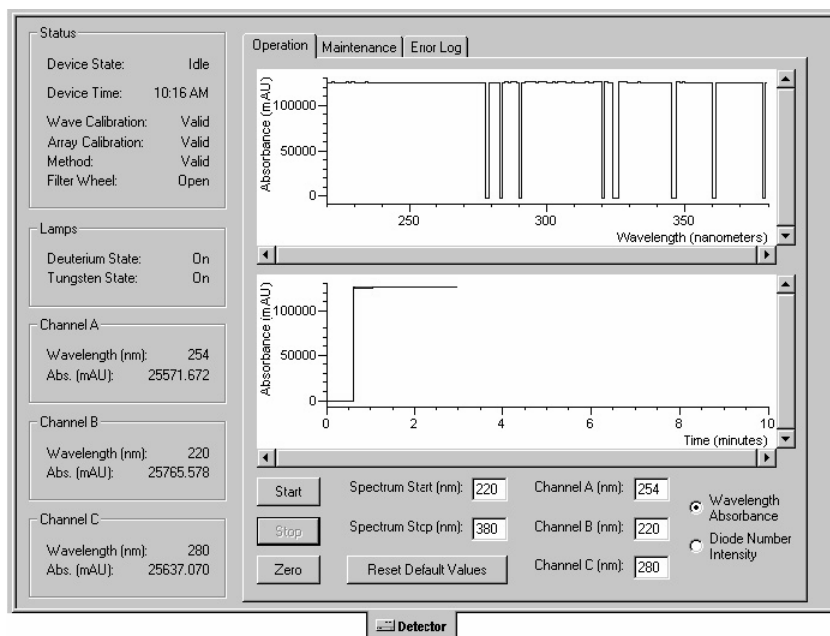


Figure 5.20 Operation page (Atlas version 2003, R2)

## Data Displays

The Operation page contains two data displays. Scan data is displayed in the upper pane and the discrete channel data is displayed in the lower pane. The controls for these displays are located at the bottom of the window.

### Wavelength Option Button

The Wavelength option button allows you to display the absorbance values for up to 3 discrete wavelengths and a scan range as wide as 190 nm to 800 nm.

### Intensity Option Button

The Intensity option button allows you to display the intensity counts for up to 3 diode numbers and a scan range as wide as diode number 2 to diode number 511.

### Spectrum Start Text Box

The Spectrum Start text box allows you to specify the beginning value of the scan range. The allowable values are 190 nm to 799 nm in the absorbance mode and diode number 2 to diode number 510 in the intensity mode.

### **Spectrum Stop Text Box**

The Spectrum Stop text box allows you to specify the end of the scan range. The allowable values are 191 nm to 800 nm in the absorbance mode and diode number 3 to diode number 511 in the intensity mode.

### **Channels A/B/C**

The channel text boxes allow you to specify a wavelength value from 190 nm to 800 nm or a diode number from 2 to 511.

### **Start Button**

Clicking on the Start button starts the collection and display of data from the detector.

### **Stop Button**

Clicking on the Stop button ends the collection of data.

### **Zero Button**

Clicking on the Zero button clears the displays and empties the data buffers of the detector.

## **THE MAINTENANCE PAGE**

The Maintenance page allows you to turn the lamps on and off, perform a wavelength calibration and an array calibration, turn the Ready Outputs on or off, and turn the Event Outputs on or off. See Figure 5.21.



*Figure 5.21 Maintenance page*

## Versions

This group box contains read-backs for the current versions of the UV6000 firmware: Detector ROM, Detector RAM, and Detector PIO. For Atlas 2003 R2, the cof file for the detector must be version 1.8. See the Firmware Download section of this manual for information on downloading a PDA cof file.

## Ready Output State

### **Turn On Button**

Click on this button to turn on the Ready Output state. The Polarity of the Ready Output is set when the UV6000 detector is configured (using the Add Instrument Wizard).

### **Turn Off Button**

Click on this button to turn off the Ready Output state.

## Event Output State

### **Turn On Button**

Click on this button to turn on the Event Output state. The Polarity of the Event Output is set when the UV6000 detector is configured (using the Add Instrument Wizard).



### ***Turn Off Button***

Click on this button to turn off the Event Output state.

## **Deuterium Lamp**

### ***Lamp On Checkbox***

Select this checkbox to turn on the deuterium lamp and deselect this checkbox to turn off the deuterium lamp. The deuterium lamp takes approximately 30 seconds to ignite and approximately 60 minutes to warm-up.

### ***Deuterium Lamp Lifetime Read-back***

This read-back displays the passage of time in hours that the deuterium lamp has been turned on since the last time the Reset button was clicked. (The Reset button allows you to zero the read-back. Click on the Reset button after you install a new deuterium lamp.) The maximum lifetime of the deuterium lamp is typically 2000 hours. In general, as the hours of usage increases, the baseline noise increases.

### ***Reset Button***

After you replace the deuterium lamp, click on this button to reset the time clock to zero.

## **Tungsten Lamp**

### ***Lamp On***

Select this checkbox to turn on the Tungsten lamp and deselect this checkbox to turn off the Tungsten lamp.

### ***Tungsten Lamp Lifetime Read-back***

This read-back displays the passage of time in hours that the tungsten lamp has been turned on since the last time the Reset button was clicked. (The Reset button allows you to zero the read-back. Click on the Reset button after you install a new tungsten lamp.)

### ***Reset Button***

After you replace the tungsten lamp, click on this button to reset the time clock to zero.

## **Wavelength Calibration**

The Wavelength Calibration group box contains two buttons: Perform New and Reset Defaults. Click on the Perform New button to perform a new wavelength calibration. Perform a wavelength calibration after you adjust the attenuators or install a new lamp.

## **Array Calibration**

The Array Calibration group box contains two buttons: Perform New and Reset Defaults. Click on the Perform New button to perform a new dark current calibration. Perform a dark current calibration monthly as part of your regular maintenance routine. In addition, perform a dark current calibration after you adjust the attenuators or install a new lamp.

## **THE ERROR LOG PAGE**

This page displays the UV6000 error log. Error numbers and associated text messages are displayed in the Log window. A maximum of 100 messages is retained by the error log. Once this number is reached, the older messages are overwritten by the new ones. Messages accrued during the run are copied to the Workbook instrument log file when the run has finished.

Click on Get Error Log button to download the error log messages from the detector. Click on the Clear Error Log button to clear the error messages from the detector and the Error Log page.

## **PERFORMING A WAVELENGTH CALIBRATION**

To perform a wavelength calibration from the Atlas data system, do the following:

1. Prepare the detector for a wavelength calibration:
  - a. Replace the column with a flow restrictor.
  - b. Start pumping HPLC-grade water through the flowcell at a flow rate of 1 mL/min.
  - c. Turn on both lamps and wait for one hour to allow the temperature of the detector to equilibrate.
2. In the Wavelength Calibration group box, click on the Perform New button to start the calibration open the Select Calibration File dialog box.

3. In the Select Calibration File dialog box, browse to the folder that contains the peakset files. They are normally stored in Atlas\_Root\sys. Select an appropriate peakset file, for example, SNetUV6000Calibration.cal. Then, click on the Open button. This launches the wavelength calibration wizard. Click on the Next button to proceed to the second page of the wizard.

*NOTE: If you choose a peakset file containing invalid data or information, an error message is displayed. When you click on the OK button, the wizard is aborted.*

4. In the second page of the wizard, choose a set of peaks to be used in the calibration from the list in the left hand pane. The characteristics of the set are displayed in the right hand pane when you make a selection. These details are read from the peakset file selected at the start of the wizard. Click on the Next button to proceed to the third page of the wizard.
5. In the third page of the wizard, the progress of the calibration is indicated with the following steps:

- Checking lamp states
- Retrieving current method
- Retrieving current calibration
- Downloading calibration method

The Next button is not active until these steps are complete. Click on the Next button to proceed to the fourth page of the wizard.

6. In the fourth page of the wizard, you are instructed to turn the filter wheel of the UV6000 detector to position 2. The Next button is not active until this has been done. Click on the Next button to proceed to the fifth page of the wizard.
7. In the fifth page of the wizard, the following calibration steps are performed:

- Waiting for equilibration (5 sec)
- Getting calibration data
- Restoring saved method

The Next button is not active until the steps are complete. Click on the Next button to proceed.

8. In the sixth page of the wizard, you are instructed to turn the filter wheel of the UV6000 detector to position 1. The Next button becomes active once you have done this. Click on the Next button to proceed to the seventh page of the wizard.
9. In the seventh page of the wizard, the results of the calibration are shown. The results table lists how close the calibration got to each peak in the calibration peak set. Click on the Apply button to accept the calibration.

10. On the eighth and final page of the wavelength calibration wizard, the Finish button is enabled after the new wavelength settings are downloaded to the detector. Click on the Finish button to complete the wavelength calibration procedure.

## **PERFORMING AN ARRAY CALIBRATION FROM ATLAS**

To perform an array calibration from the Atlas data system, do the following:

1. Prepare the detector for a wavelength calibration:
  - a. Replace the column with a flow restrictor.
  - b. Start pumping HPLC-grade water through the flowcell at a flow rate of 1 mL/min.
  - c. Turn on both lamps and wait for one hour to allow the temperature of the detector to equilibrate. The dark current that is compensated for by performing an array calibration is a function of temperature.
2. In the Array Calibration group box, click on the New Calibration button to launch the Array Calibration wizard.
3. In the first page of the wizard, click on the Next button to proceed.
4. In the second page of the wizard, the following steps are performed as indicated:
  - Checking lamp states
  - Retrieving current calibration
  - Shutting off lamps
  - Getting calibration data
  - Restoring lamp states
  - Retrieving current method
  - Downloading calibration method
  - Waiting for equilibration (5 sec)
  - Restoring saved method
  - Calibration complete

The Next button is enabled after the program completes the steps listed above. Click on the Next button to proceed to the third page of the wizard.
5. On the third page of the wizard, click on the Apply button to accept the calibration.
6. Click on the Finish button to exit the wizard.

# 6

## Troubleshooting

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### Introduction

This chapter provides you with helpful information for troubleshooting possible detector and chromatographic system problems. The information is organized in a table of symptoms, possible causes, and remedies. Because many of the problems attributed to the detector may actually be due to other components in the chromatographic system, we have also included references and potential solutions to these types of problems.

---

### Troubleshooting Table

<u>Symptom</u>	<u>Cause</u>	<u>Remedy</u>
1. Spikes on baseline.	a. Continuous gas bubbles in the flowcell.	a. Degas mobile phase. Connect back-pressure device to flowcell (check back-pressure rating).
	b. Immiscible solvent bubbles following mobile phase changeover.	b. Flush flowcell with 2-propanol, then with mobile phase.
	c. Electrical interference.	c. Check electrical lines for good connections and/or interference from broadcast radiation. Check for ground loops.
	d. Extremely large fluctuations in voltage on AC line.	d. Remove systems ( <i>e.g.</i> , ovens) that cause voltage fluctuations, isolate the detector to a “quiet” circuit, or use UPS (Uninterruptable Power Supply).

---

## Troubleshooting Table (continued)

<u>Symptom</u>	<u>Cause</u>	<u>Remedy</u>
2. Random noisy baseline.	a. Contaminated flowcell.	a. Flush flowcell with cleaning solvents as described in Chapter 3. Check for leaks.
	b. Leak in sample inlet line.	b. Check all fittings from column outlet to flowcell inlet for leaks.
	c. Bubble trapped in flowcell.	c. Increase flow rate until bubble is removed. Supply back-pressure device to flowcell (check back-pressure rating to avoid rupturing flowcell).
	d. Leaking flowcell.	d. Replace flowcell.
	e. Insufficient lamp warm-up.	e. Allow a 30 minute warm-up for normal operation; 1 1/2 hours for maximum sensitivity.
	f. Lamp aging or defective.	f. Replace lamp.
	g. Ground loop problem between integrator and detector.	g. Check for proper cable connections for detector output; do not ground at both ends of cable.
	h. Flowcell or lamps dirty.	h. Clean dirty component as described in Chapter 3.
	i. Integrator input voltage does not match detector output voltage.	i. Connect integrator to appropriate output connectors on detector. Check attenuation setting on integrator.
3. Excessive baseline drift, see <i>Baseline Problems</i>	a. Flowcell contaminated.	a. Flush flowcell with cleaning solvents as described in Chapter 3. Check for leaks.
	b. Mobile phase contamination.	b. Replace with fresh mobile phase made with high-purity solvents.
	c. Material bleeding from column.	c. Clean or replace column.
	d. Leaks in system, or flowcell.	d. Check all fittings for leaks. Replace flowcell.

## Troubleshooting Table, continued

<u>Symptom</u>	<u>Cause</u>	<u>Remedy</u>
3. Excessive baseline drift, see <i>Baseline Problems</i> (cont.)	e. Tiny bubble trapped in flowcell.	e. Increase flow rate until bubble is removed. Connect back-pressure device to flowcell outlet (check back-pressure rating to avoid rupturing flowcell).
	f. Large temperature fluctuations.	f. Remove system from drafts. Thermostatically control column temperature.
4. No peaks, or peaks much smaller than expected.	a. Incorrect wavelength setting.	a. Check wavelength setting. Make sure the correct file is selected.
	b. Lamp not on, or defective.	b. Make sure lamp is lit. Run detector's diagnostic tests to check lamp. Replace lamp if necessary.
	c. Integrator input voltage does not match detector output voltage.	c. Connect integrator to appropriate output connectors on detector. Check attenuation setting on integrator.
	d. Insufficient sample reaching the detector.	d. Check entire chromatographic system for leaks. Verify sample injection volume.
5. Broad, tailing peaks.	a. Rise time is too large (too slow).	a. Lower the rise time selection.
	b. Poor connection at flowcell inlet.	b. Check end of inlet tubing for a clean, flat surface free of obstructions.
6. Detector will not power up.	a. Tripped circuit breaker at AC wall outlet.	a. Resolve problem, reset circuit breaker.
	b. Blown detector fuse.	b. Resolve problem, replace fuse.
	c. Incorrect voltage selected.	c. Reset detector for correct incoming line-voltage (see Chapter 1).
	d. Power cord not connected.	d. Connect power cord.
7. Detector does not go into run upon injection.	a. Detector not receiving START signal.	a. Check connection to Run contacts on back panel.

---

## Troubleshooting Table (continued)

<u>Symptom</u>	<u>Cause</u>	<u>Remedy</u>
8. Flat baseline, portion of spectrum missing.	a. Saturation of photodiode array.	a. Adjust attenuators.
10. Status LED States	a. Red - Power On, performing post.	a. No action required.
	b. Flashing Red - Failed POST or fatal error afterwards.	b. Power-on Self Test.
	c. Flashing Green - Passed Post.	c. Needs firmware download.
	d. Green - OK, software loaded, ready to connect to PC.	a. No action required.

---

## Error Messages

For information on error messages that occur as part of the UV6000LP diagnostics program, refer to the Log Entries section below.

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## Log Entries

The diagnostics Error Log page chronologically records messages relating to detector/system problems. There are three categories of messages; *Warning* messages, *Critical Error* messages and *Crash Error* messages.

### WARNING MESSAGES

*Warning* messages indicate a problem that should not affect the chromatographic run. Possible *Warning* messages include;

“PM: A message is improperly addressed.”

“PM: Free buffers back to acceptable level. You may have to lower your data rate to continue without further errors.”



“PM: Detach from dispatcher failed. You may have already been detached.”

“PM: Queue deregistration failed.”

“PM: Queue destruction failed.”

“PM: Queue destruction failed, invalid queue.”

“PM: Receive returned null message. This could be critical. It may be best to exit the software and/or cycle the power on the UV6000LP to ensure future data integrity.”

“Attach: Requested com port does not match internal data. You may have tried to connect to two different com ports in one session. Exit and retry.”

“Attach: Could not attach because communications are already active. If you have lost communications, please exit and reconnect.”

“Attach: Could not query UV6000LP version. You may have to exit and reconnect. In some cases you may have to cycle power on the detector.”

“Attach: Could not negotiate baud rate with UV6000LP. You may have to exit and reconnect. In some cases you may cycle power on the detector.”

“Attach: No response to version query was received for UV6000LP ROM. You may have to exit and reconnect. In some cases you may have to cycle power on the detector.”

”Attach: No response to version query was received for UV6000LP RAM. You may have to exit and reconnect. In some cases you may have to cycle power on the detector.”

“Attach: Incorrect version was received.”

“Attach: The UV6000LP did not receive its startup signal (gp) from the PC.”

“Reattach: Could not send version info to PC.”

“Reattach: Could not read startup message (gp).”

“Reattach: An invalid startup message was received.”

“Reattach: Could not echo startup message (gp).”

“Write: Could not transmit a packet header. Communications are probably lost.”

“Write: Could not transmit a packet message. Communications are probably lost.”

“Write: Could not transmit an ack or nak. Communications are probably lost.”

“DH Unknown calibration query.”

“DH Unknown calibration query msg type.”

“DH Unknown calibration reset msg. type.”

“Filter Wheel Misaligned!”

## **CRITICAL ERROR MESSAGES**

*Critical Error* messages indicate that the PDA can not perform its function properly. If a chromatographic run is in progress when a *Critical Error* occurs the data may be corrupted or lost, and the run will be terminated. Possible *Critical Error* messages include:

“PM: Attach has failed. There may be an existing connection.”

“PM: Queue creation failed; exceeded maximum values.”

“PM: The UV6000LP is running out of internal buffers. Most probable cause: data rate too high. Injection will be aborted to prevent message depletion.”

“PM: Could not write to a queue. You should probably exit the software and/or cycle the power on the UV6000LP to ensure future data integrity.”

“PM: A queue is too deep, might be a problem. It may be best to exit the software and/or cycle the power on the UV6000LP to ensure future data integrity.”

“ PM: Could not transmit; Communications have been lost. You will have to reconnect .”

“State: Communications have been lost, tossing packets.”

“Tungsten Lamp Failure.”

“Deuterium Lamp Failure.”

## CRASH ERROR MESSAGES

*Crash Error* messages indicate a hardware or system failure has occurred. Generally, *Crash Error* messages are associated with system communication failures. Possible *Crash Error* messages include:

“PM: Could not initialize MT! mem pool.”

“PM: Could not create Link Layer. See previous messages for more information.”

“ PM: Queue registration failed.”

“PM: Queue creation failed.”

“PM: Failed to get message buffer. The UV6000LP has run out of internal message buffers.”

“PM: Could not release a message buffer. This is a critical situation. You should cycle power on your detector and reconnect to ensure future data integrity.”

“Init: Exceeded number of allowed Link Layers. You may have tried to connect to two different com ports in one session. Exit and retry.”

“Init: Creation of Physical Layer failed. Make sure the com port exists and is available.”

“Init: Could not create Transmit queue. Please exit the application and retry.”

“Init: Could not register Transmit Queue. Please exit the application and retry.”

“Init: Creation of Queue Watcher failed. Please exit the application and retry.”

“ Init: Creation of Writer failed. Please exit application and retry.”

“Init: Creation of Reader failed. Please exit application and retry.”

“Init: Creation of Timer failed. Please exit the application and retry.”

“Attach: Could not get a msg to finish the attach process. You may have to exit and reconnect. In some cases you may have to cycle power on the detector.”

“Attach: Could not inform message system of attach. You may have to exit and reconnect. In some cases you may have to cycle power on the detector.”

“Read: Could not allocate PM message buffer. The UV6000LP will be unable to start.”

**TECHNICAL  
ASSISTANCE WITH  
ERROR LOG  
MESSAGES**

For further information, document the log entry and contact Thermo Electron Technical Support.

# 7

## Accessories and Replacement Parts

Table 7.1 lists the accessories and replacement parts that you can order from Thermo Electron.

**Table 7.1 Accessories and Replacement Parts**

### *Optional Accessories*

803264	Filter Wheel for linearity calibration, (5 position; 1 cuvette with perchloric acid blank and 4 cuvettes with different concentrations of potassium dichromate in perchloric acid solution, NIST traceable)
803265	10 mm Flowcell
A5514-010	PDA Stand
802259	Backpressure regulator

### *Manuals*

A0099-595	UV6000LP Detector Reference/Service Manual (English)
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### *Maintenance Parts*

108052	Deuterium Lamp Assembly (pre-aligned)
803247	Tungsten-halogen (W) Lamp Assembly (pre-aligned)
2522-0285	Finger tightening PEEK Ferrule Nuts
803260	Inlet tubing, w/insulation, PEEK 1/16 x .005" I.D. (Red)
703950	Outlet tubing, PEEK 1/16 x .010" I.D. (Blue)
803237-01	Flowcell Assembly, w/ inlet/outlet tubing & fittings
126078	Fuse, T 3.15A (5 x 20 mm) (for 100/120V operation)
126079	Fuse, T 1.6A (5 x 20 mm) (for 220/240V operation)
803113	External Run/Auto Zero/Analog Signal Cables
A3598-030	RJ-45 cable
A3538-010	9 pin to RJ-45 adapter
106012	TL-5242/W Tadrian Lithium memory back-up battery

### *Repair and Service Parts*

803214	CPU PCBA (for units with S/N 106000 – 107999)
60052-61010	CPU PCBA (for units with S/N 109000 and above)
803261	Transition PCBA
803212	Lamp Power Supply PCBA
106013	Low Voltage Power Supply PCBA
104092	Lamp Power Supply Transformer
138018	Cooling Fan
803219	Power Entry Module Assembly
112210	Power Switch
803231	LED Assembly
803246S	Standard Filter Wheel
803229	Cable, ribbon, CPU to Array Acquisition PCBA
803222	Cable, ribbon, CPU to Transition PCBA
803226	Cable, ribbon, CPU to Lamp Power Supply PCBA



# 8

## Field Service & Repair Procedures

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### Introduction

This chapter contains the step-by-step procedures necessary for factory trained service technicians to remove and replace the major mechanical and electrical assemblies of the detector.



**CAUTION!** Before beginning any of the following field service procedures be sure that the instrument is turned off and the power cord is disconnected from the instrument's rear panel. Attempting repairs with the instrument turned on or connected to an AC power supply could result in serious injury.



*NOTE: Some components in the detector can be damaged by static electricity. Before beginning any of the following procedures, prepare a non-conductive work surface for the detector and put on a properly grounded anti-static wrist strap.*

---

### Tools Required

Except where noted, detector field service and repair procedures require the following hand tools:

- # 2 Phillips head screwdriver
- # 1 Phillips head screwdriver with 10 inch shaft
- narrow-tip (2 mm wide) standard screwdriver
- corner-to-corner SMT EPROM chip removal tool (P/N 5401-1553)
- 5/64 " Allen head wrench

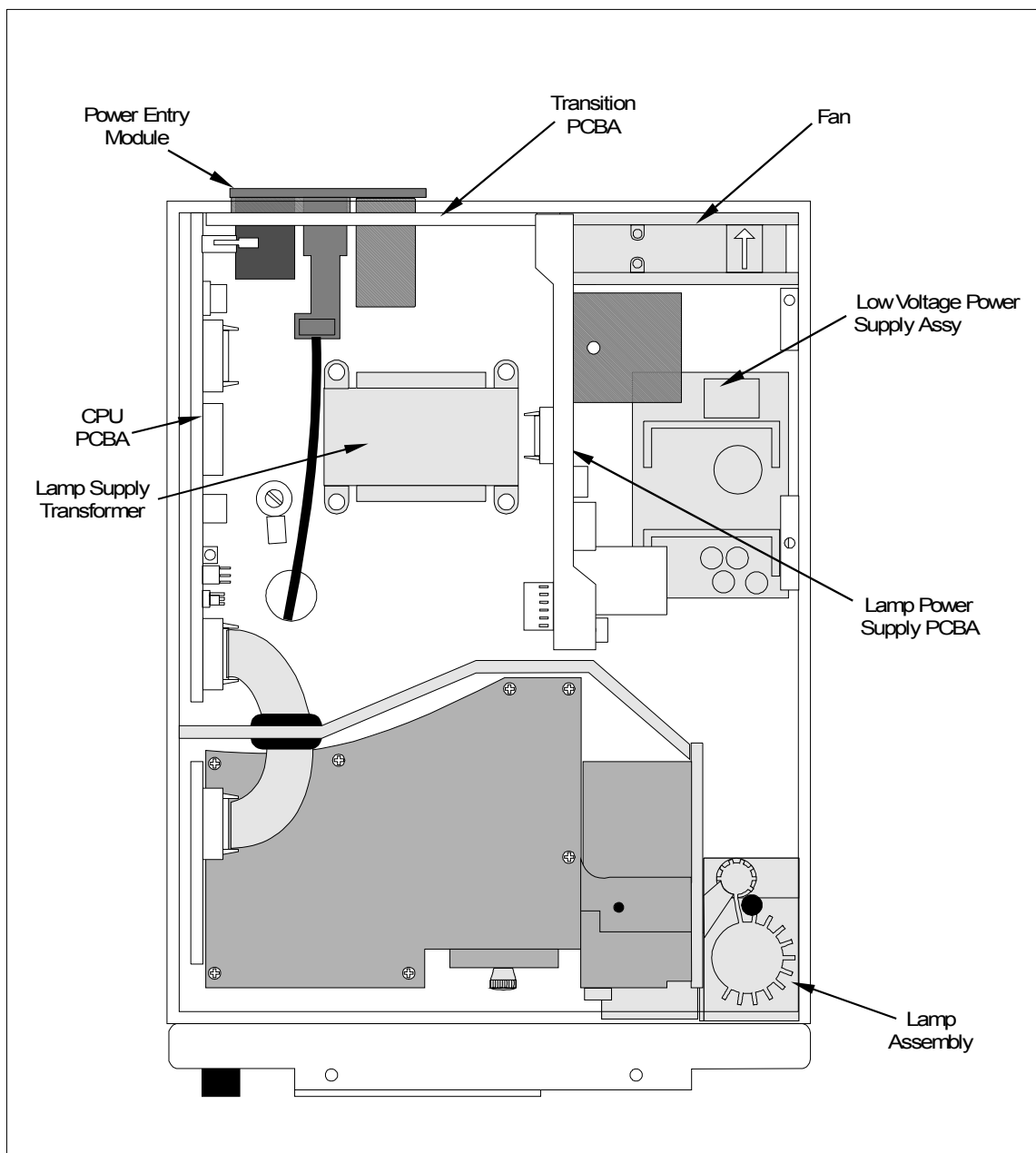
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## Removing and Replacing UV6000LP Detector Assemblies

The replaceable internal assemblies of the UV6000LP detector are identified in Figure 8.1 and include:

- the CPU PCBA (Printed Circuit Board Assembly)
- the transition PCBA
- the lamp power supply PCBA
- the lamp power supply input transformer
- the low voltage power supply
- the power entry module assembly
- the LED assembly
- the cooling fan assembly
- various connector cables



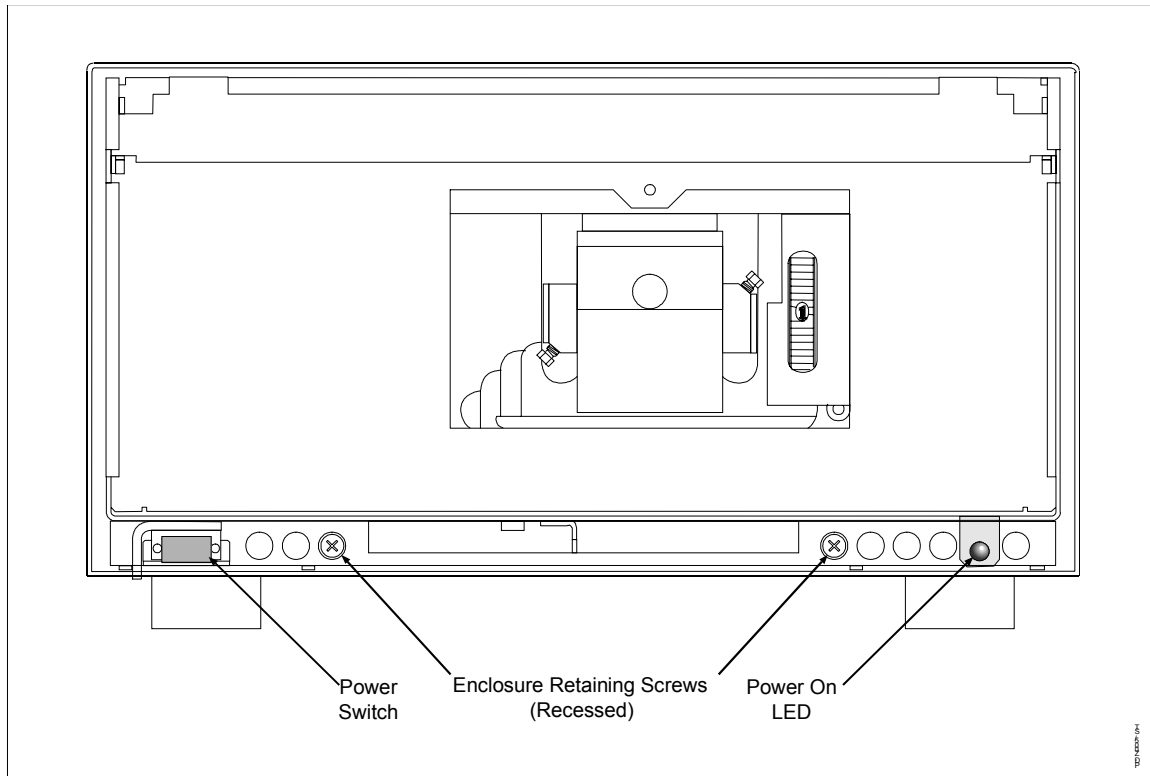


*Figure 8.1 Replaceable Assemblies and Components*

## Interior Access

To access the interior of the detector:

1. Turn the power switch at the front of the detector OFF (released position) and disconnect the power cord from the rear panel.
2. Remove the front cover by gently pulling out the bottom of the cover and lifting up.
3. Loosen the two captive 3/16" Phillips head screws that secure the chassis to the detector housing. These screws are in a recessed location in the base of the detector (Figure 8.2). The screws are spring loaded and will be retained when loosened.
4. Slide the chassis out of the detector and place it on a non-conductive work surface.

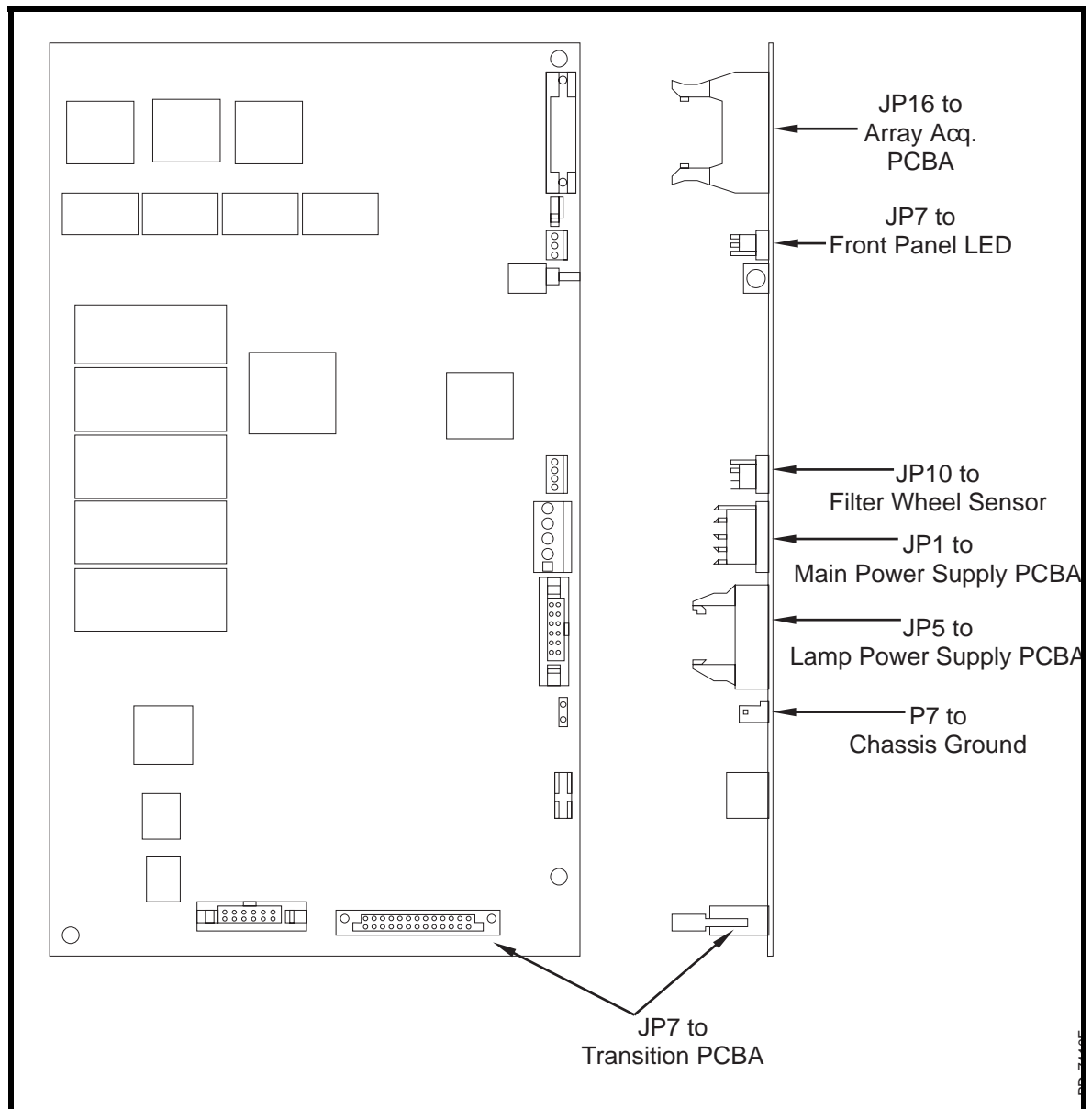


*Figure 8.2 Accessing the interior of the UV6000LP*

## CPU PCBA

Use the following procedure to remove the CPU PCBA:

1. Disconnect the eight connectors across the top of the PCBA, (Figure 8.3) For the three ribbon-cable connectors, open and spread the retaining clips prior to removing.
2. Using the flat of a small screwdriver blade gently push the two black snap latches free from their sockets at the top corners of the PCBA.
3. Lift the PCBA out of the chassis.



*Figure 8.3 CPU PCBA Connector Layout*

Replace the CPU PCBA as follows:

1. Connect the ground lead to the PCBA.
2. Place the bottom edge of the PCBA on the foam insert between the two sets of alignment/retaining tabs on the bottom of the chassis.
3. Line up the black snap latches with the sockets at the top corners of the PCBA and push the pins through to secure the PCBA to the chassis. (It may be necessary to press down slightly on the top edge of the PCBA to engage the retaining pins.



*NOTE: Support the PCBA on its upper edge with your fingertips to avoid flexing the board when reconnecting the connectors.*

4. Reconnect all cables, using Figure 8.3 to identify the proper connector locations. (All connectors are keyed and will only engage in one direction).

## Transition PCBA

To remove the Transition PCBA, do the following (Figure 8.1):

1. Disconnect all external rear panel connections to the detector.
2. Disconnect the green and yellow ground lead.
3. Disconnect the ribbon cable by spreading the retaining clips open and disengaging the connector.
4. Gently pull the six black snap latches holding the Transition PCBA to the detector rear panel free and remove the board.

Replace the Transition PCBA using the preceding procedure in reverse order.

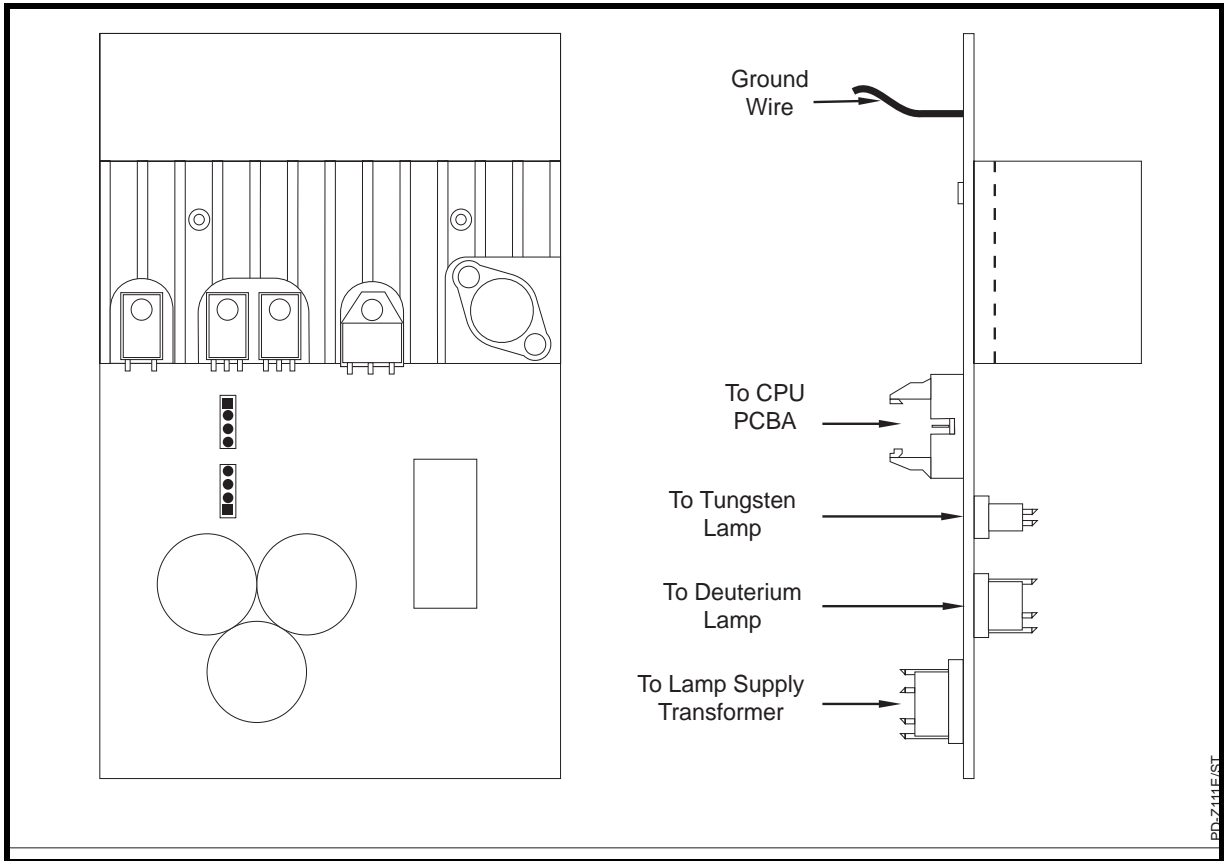
## Lamp Power Supply PCBA

The Lamp Power Supply PCBA is located in the center of the detector under an aluminum retaining bar (Figure 8.1). To remove this PCBA:

1. Gently pull the black snap latches free from the sockets securing the aluminum retaining bar in place and remove the bar.
2. Disconnect the green and yellow ground lead from the Lamp Power Supply PCBA.
3. Disconnect all four connectors across the top edge of the PCBA. (Two connectors are located on each side of the PCBA.)

- Slide the PCBA out of the alignment slots and free from the detector chassis.

Replace the Lamp Power Supply PCBA using the preceding procedure in reverse order. Be sure to slide the new PCBA into the black alignment slots. Use Figure 8.4 to identify the proper location of connectors.



*Figure 8.4 Lamp Power Supply PCBA connector layout*

## Lamp Power Supply Transformer

The Lamp Power Supply Transformer is located in the center of the detector chassis (Refer to Figure 8.1).

To remove this transformer, do the following:

- Disconnect the connector in the cable bundle between the power entry module and the inlet side of the transformer. (This connector block has a small latch which must be pressed to disconnect the two sides of the connector).

2. Disconnect the connector from the transformer outlet to the Lamp Power Supply PCBA. Lift up the small tab on this connector slightly using a screwdriver and pull the connector free.
3. Remove the four Phillips head screws holding the transformer to the bottom of the detector chassis and lift the transformer out.
4. Remove the four mounting brackets from the transformer and set them aside. (These brackets are required to install the new transformer).

Install a new transformer using the preceding procedure in reverse order.

## **Low Voltage Power Supply PCBA**

The Low Voltage Power Supply PCBA is mounted to the floor of the chassis on the right side of the detector (Refer to Figure 8.1).

To remove this PCBA, do the following:

1. Disconnect the green and yellow ground lead to the PCBA, located at the left rear of the PCBA.
2. Disconnect the two lead connector at rear of the PCBA.
3. Disconnect the five lead connector at the front of the PCBA.
4. Grasp the PCBA by its edges and lift the PCBA straight up and free from the mounting/retaining pins on the chassis floor.

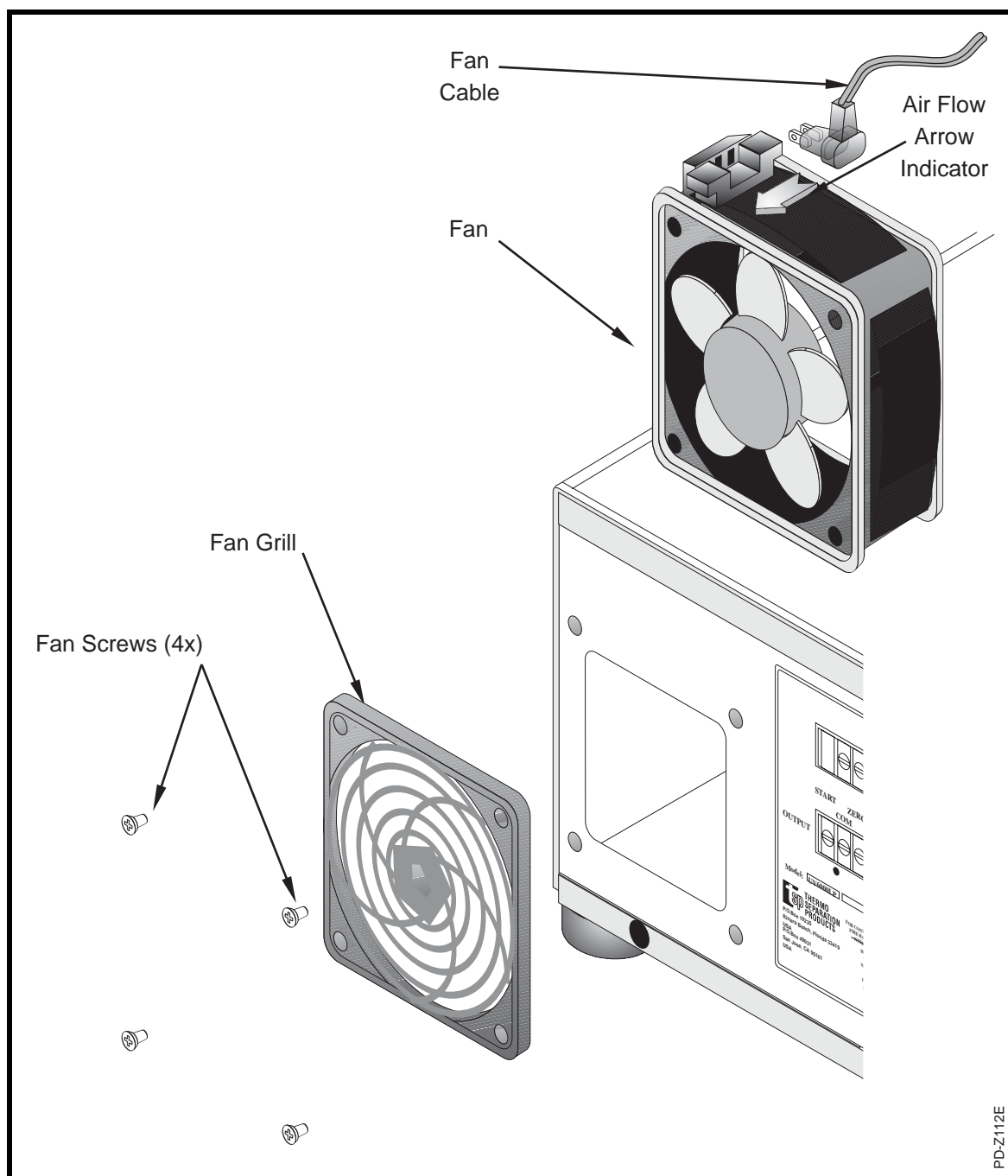
Install a new PCBA using the preceding procedure in reverse order. Be sure to route the cable from the five lead connector under the PCBA spacer and retaining screw. The PCBA must be pressed securely on to the mounting pins on the chassis floor. (The PCBA is properly mounted if the lower edge of the vertical brackets on the PCBA are positioned lower than the mounting pins protruding through the PCBA.)

## **Cooling Fan**

The Cooling Fan is located in the right rear corner of the detector.

To remove the cooling fan (refer to Figure 8.5), do the following:

1. Remove the four Phillips head screws holding the fan guard and fan in the back panel of the chassis.
2. Disconnect the power cable from the top of the fan.
3. Slide the fan forward slightly and lift it out of the chassis.



*Figure 8.5 Cooling Fan Removal*

Install a new fan using the preceding procedure in reverse order.  
Clean the fan guard before reinstalling it.

## Power Entry Module

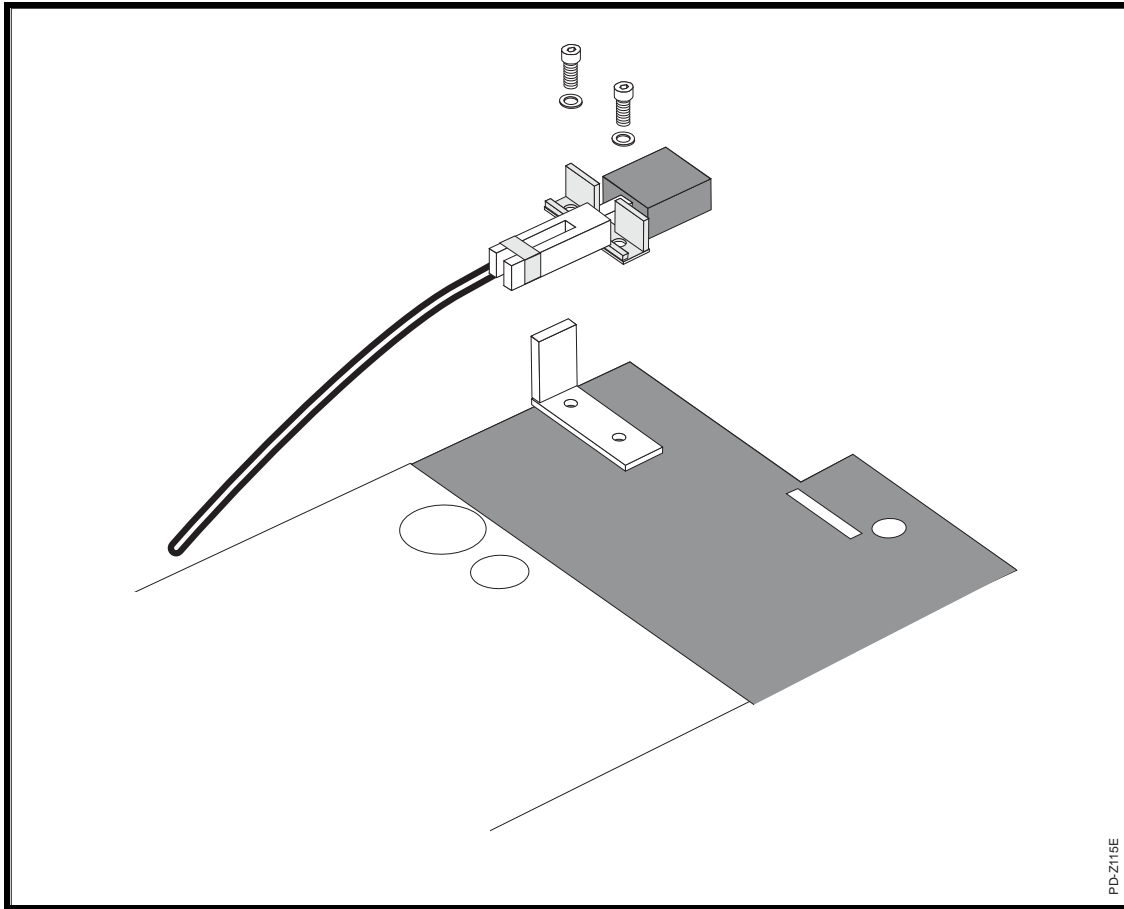
The Power Entry Module and Front Power Button/Mechanical Cable are replaced as an assembly. To remove this assembly:



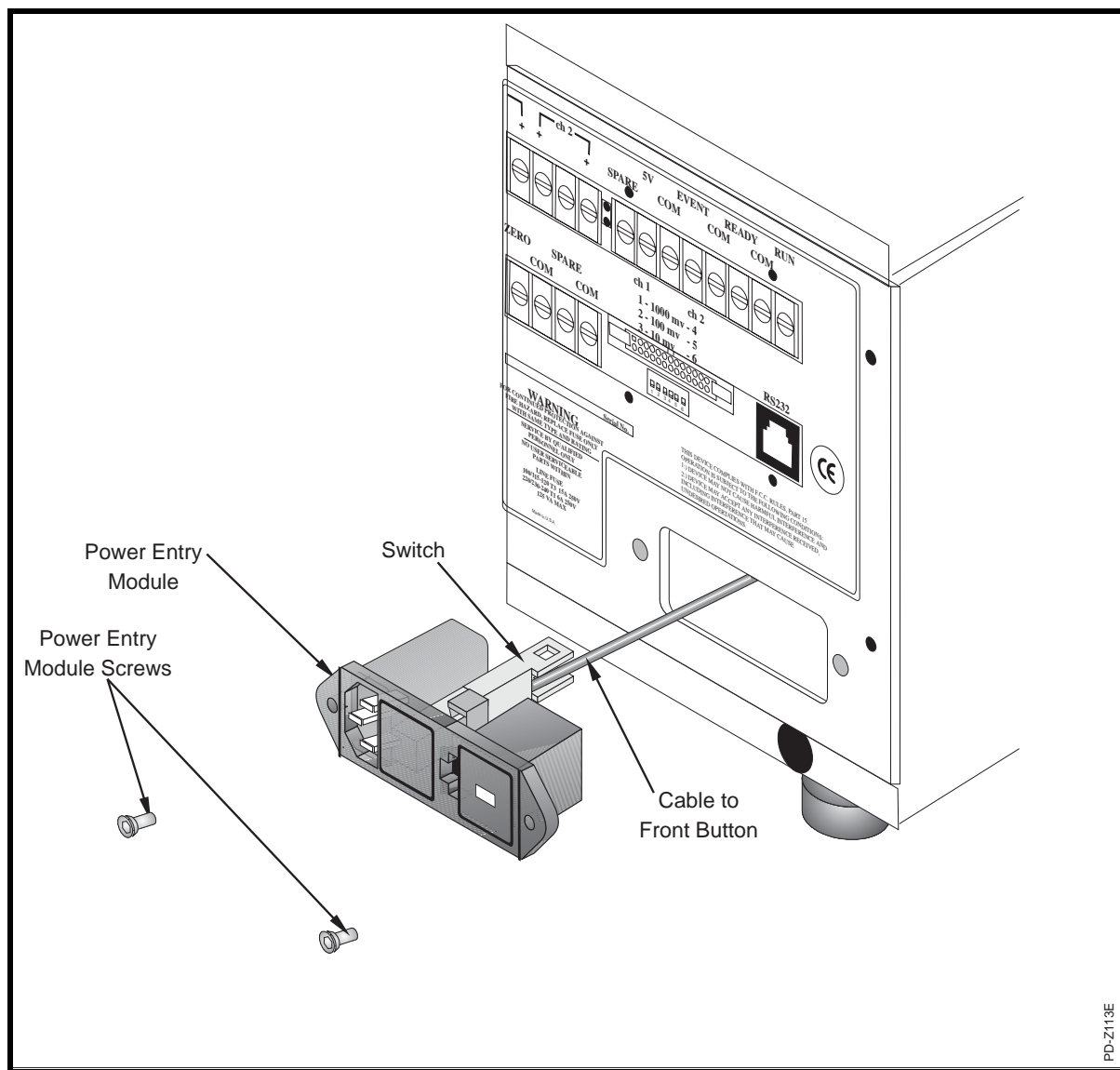
*HINT To gain easier access to the Power Entry Module, you may want to remove the Transition PCBA on the rear panel of the detector chassis.:*

1. Disconnect the green and yellow ground lead on the right side of the Power Entry Module.
2. Disconnect the leads (P3 through P10) connected to the voltage selector.
3. Carefully turn the detector on to its side and remove the two 5/64" Allen head screws holding the Front Power Button and bracket to the chassis (Figure 8.6). (Pull the "L" shaped button protector aside to allow installation of the replacement assembly.)
4. Cut the plastic tie wrap holding the mechanical cable to the plastic mounting fixture on the underside of the chassis.
5. Pull the mechanical cable, bracket and power button through the cutout opening in the underside of the chassis.
6. Loosen the two 5/64" Allen head screws holding the Power Entry Module in the rear panel (Figure 8.7) and slide the entire assembly out through the rear of the chassis.





*Figure 8.6 Power button and bracket removal*



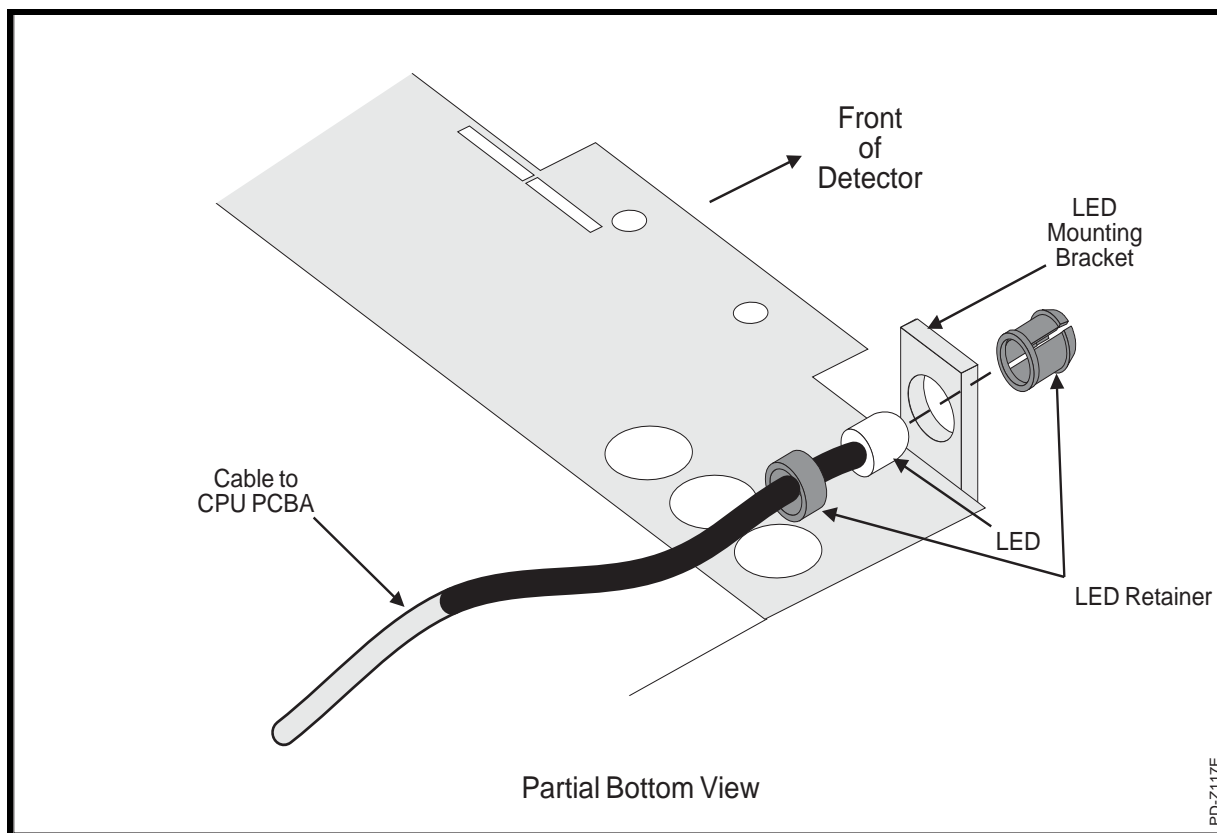
*Figure 8.7 Removal of Power Entry Module*

Install a new Power Entry Module and Front Power Button assembly using the preceding procedure in reverse order. Connect Leads P3 through P10 to terminals 3 through 10 on the new power module. Remember to reinstall the “L” shaped button protector under the power button bracket. Secure the mechanical cable to the mounting fixture on the underside of the detector chassis with a plastic tie wrap.

## LED Assembly

The front panel LED and its cable are replaced as an assembly using the following procedure:

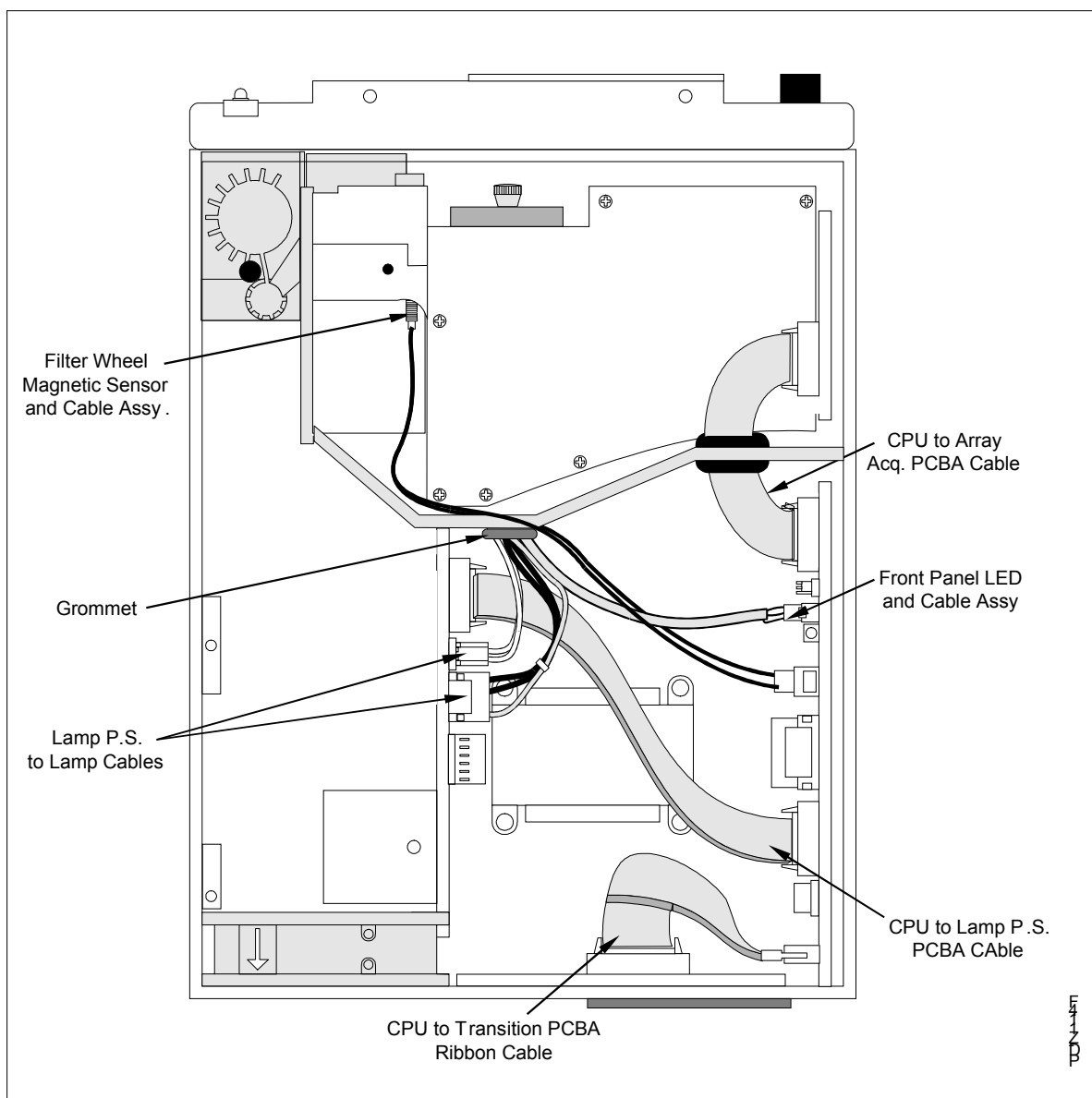
1. Disconnect the LED cable from the JP7 connector on the CPU PCBA.
2. Cut the three wire leads from the connector.
3. Tie the replacement LED assembly (LED end) to the wire ends. (You will use the existing cable to pull the new one through the chassis.
4. Turn the detector on its side.
5. Pull the plastic collar off the retainer (Figure 8.8) and slide it down the cable a short distance.
6. Pull the LED out of the retainer socket using the cable.
7. Remove the plastic collar from the cable and set it aside for installation on the replacement LED.
8. Cut the plastic tie wrap holding the cable to the mounting fixture on the underside of the chassis.
9. Pull the old cable through the hole in the chassis bottom while guiding the new LED and cable through the grommated hole in the inner chassis wall until the replacement LED comes through the hole in the chassis bottom.
10. Untie the old cable from the new one.
11. Slide the plastic collar over the new LED and cable.
12. Push the LED into the retainer bracket and slide the plastic collar back on to the retainer bracket.
13. Secure the LED cable to the mounting fixture on the underside of the chassis with a plastic tie wrap.
14. Connect the other end of the cable to the JP7 connector on the CPU PCBA (Figure 8.3).



*Figure 8.8 LED and cable removal*

## Cable Assemblies

Figure 8.10 identifies the replaceable cable assemblies inside the detector. Refer to Figures 8.3 and 8.4 to identify the proper PCBA connector locations.



*Figure 5.9 Replaceable cable assemblies in UV6000LP detector*



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