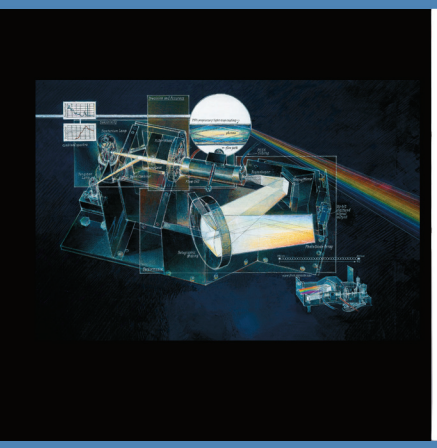
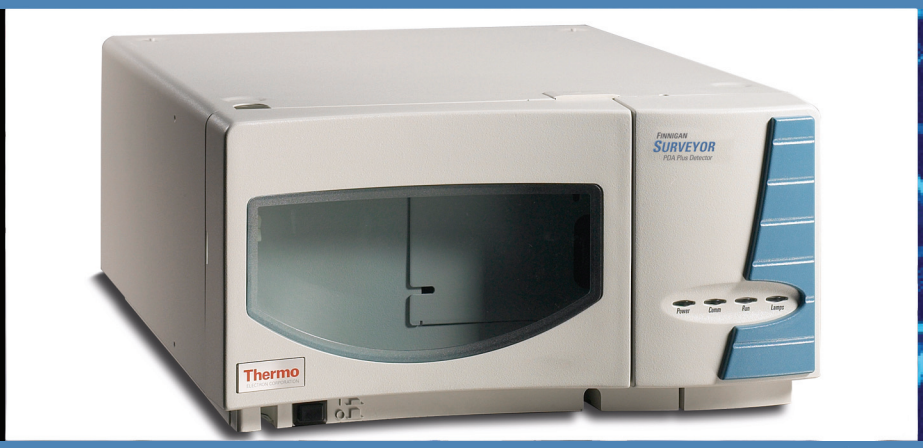
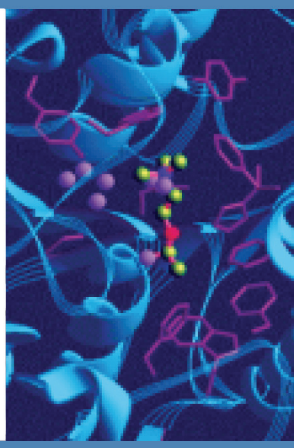
Surveyor™
PDA Plus Detector

Hardware Manual

60053-97107 Revision C September 2006







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Regulatory Compliance

Thermo Electron San Jose performs complete testing and evaluation of its products to ensure full compliance with applicable domestic and international regulations. When the system is delivered to you, it meets all pertinent electromagnetic compatibility (EMC) and safety standards as described below.

EMC Directive 89/336/EEC

EMC compliance has been evaluated by Underwriters Laboratories Inc.

EN 55011	1998	EN 61000-4-3	2002
EN 61000-3-2	1995, A1; 1998, A2; 1998, A14; 2000	EN 61000-4-4	1995, A1; 2001, A2; 2001
IEC 61000-3-2	2000	EN 61000-4-5	1995, A1; 2001
EN 61000-3-3	1995	EN 61000-4-6	1996, A1; 2001
IEC 61000-3-3	1994	EN 61000-4-11	1994, A1; 2001
EN 61326-1	1997		
EN 61000-4-2	1995 A1; 1998 A2; 2001	CISPR 11	1999, A1; 1999, A2; 2002
FCC Class A, CFR 47 Part 15 Subpart B: 2003			

Low Voltage Safety Compliance

This device complies with Low Voltage Directive 73/23/EEC and harmonized standard EN 61010-1:2001.

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

FCC Compliance Statement

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

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

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Notice on Lifting and Handling of Thermo Electron San Jose Instruments

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

Notice on the Proper Use of Thermo Electron San Jose Instruments

In compliance with international regulations: If this instrument is used in a manner not specified by Thermo Electron San Jose, the protection provided by the instrument could be impaired.

Notice on the Susceptibility to Electromagnetic Transmissions

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

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

Thermo Electron has contracted with one or more recycling/disposal companies in each EU Member State, and this product should be disposed of or recycled through them. Further information on Thermo Electron's compliance with these Directives, the recyclers in your country, and information on Thermo Electron products which may assist the detection of substances subject to the RoHS Directive are available at www.thermo.com/WEEERoHS.

WEEE Konformität

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

Thermo Electron hat Vereinbarungen getroffen mit Verwertungs-/Entsorgungsanlagen in allen EU-Mitgliederstaaten und dieses Produkt muss durch diese Firmen wiederverwertet oder entsorgt werden. Mehr Informationen über die Einhaltung dieser Anweisungen durch Thermo Electron, die Verwerter und Hinweise die Ihnen nützlich sein können, die Thermo Electron Produkte zu identifizieren, die unter diese RoHS Anweisung fallen, finden Sie unter www.thermo.com/WEEERoHS.

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

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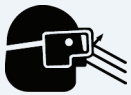
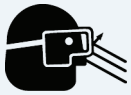
CAUTION Symbol	CAUTION	VORSICHT	ATTENTION	PRECAUCION	AVVERTENZA
	**Electric Shock:** High Voltages capable of causing personal injury are used in the instrument. The instrument must be shut down and disconnected from line power before service is performed. Do not operate the instrument with the top cover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

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

Contents

Preface

About This Guide

The Surveyor PDA Plus™ Detector is a member of the Surveyor Plus family of liquid chromatography instruments.

This *Surveyor PDA Plus Detector Hardware Manual* provides you with information on how to set up and maintain your Surveyor PDA Plus Detector.

Related Documentation

In addition to this guide, Thermo Electron provides the following documents for the Surveyor PDA Plus Detector:

- *Surveyor Plus Preinstallation Requirements Guide*
- *Surveyor Plus Getting Connected*
- *Surveyor Plus Getting Started with ChromQuest 4.2*
- *Surveyor Plus Getting Started with Xcalibur 2.0*

Safety and Special Notices

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

Safety and special notices include the following:

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

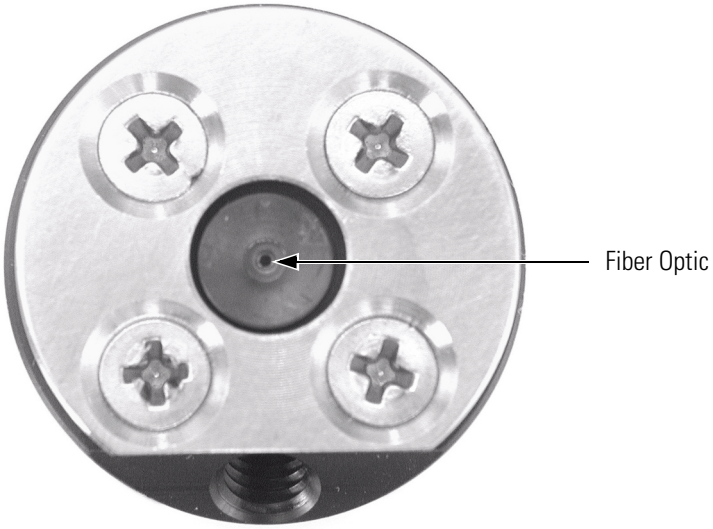
IMPORTANT Highlights information necessary to avoid damage to software, loss of data, invalid test results, or information critical for optimal performance of the system.

Note Highlights information of general interest.

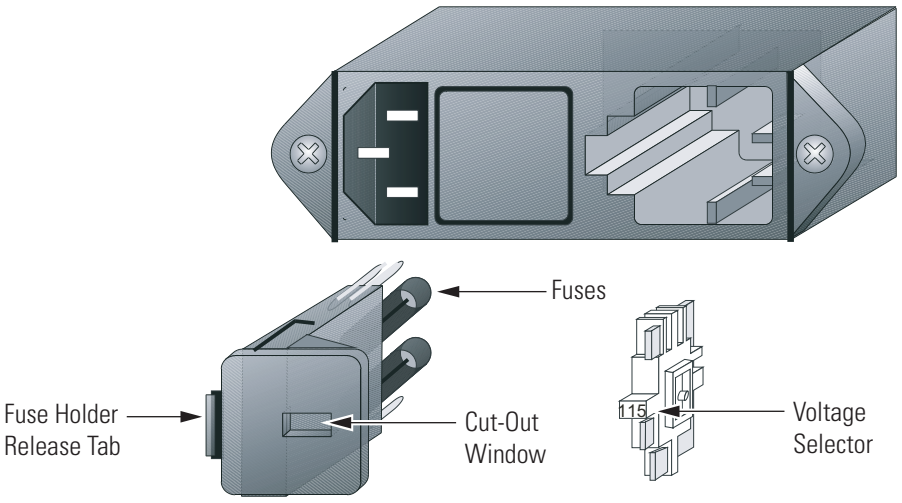
Tip Helpful information that can make a task easier.

Special Precautions for the Surveyor PDA Plus Detector

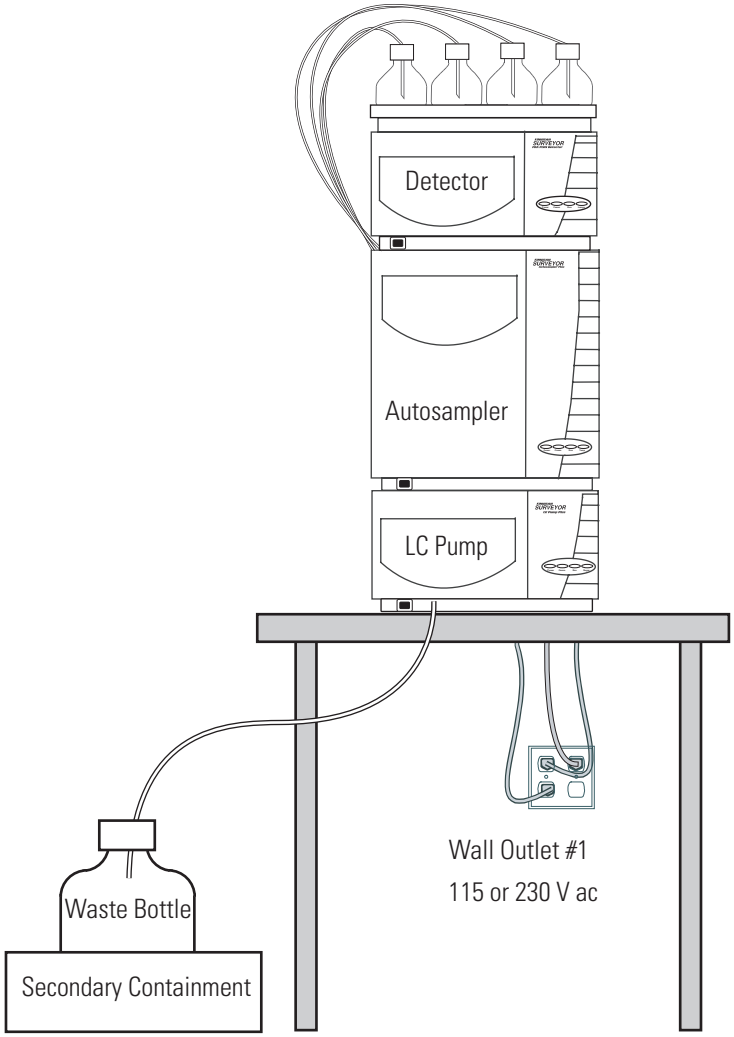
The Surveyor PDA Plus Detector contains a LightPipe flow cell that you can easily damage if you handle it by its ends. Do **not** to touch the fiber optics that are exposed at the ends of the flow cell.



The power entry module for the Surveyor PDA Plus Detector contains a voltage selector. Verify that the voltage is properly set for your location before you plug the detector into line power. See "Checking the Power Setting and Fuses" on page 13.



Ensure that the outlet tubing from the Surveyor PDA Plus Detector is inserted into the drainage system connected to a sealed waste bottle before you start the LC pump flow.



Contacting Us

There are several ways to contact Thermo Electron Corporation.

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Fax: 1-561-688-8736
E-mail: techsupport.finnigan@thermo.com

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

Contact Customer Service

In the US and Canada for ordering information:
Phone: 1-800-532-4752
Fax: 1-561-688-8731
Web site: www.thermo.com/finnigan

Changes to the Manual and Online Help

To suggest changes to this guide or to the online Help, use either of the following methods:

- Fill out a reader survey online at www.thermo.com/lcms-techpubs
- Send an e-mail message to the Technical Publications Editor at techpubs.finnigan-lcms@thermo.com

Chapter 1 Introduction

The Surveyor PDA Plus Detector shown in Figure 1 is a member of the Surveyor Plus™ family of LC instruments. This chapter provides an introduction to the Surveyor PDA Plus Detector and contains the following sections:

- Functional Description
- LightPipe Flow Cell
- Specifications

Figure 1. Surveyor PDA Plus Detector

Functional Description

The detector is a full-featured, time-programmable, photodiode array (PDA) detector capable of scanning the ultraviolet-visible wavelength range from 190 to 800 nm. You can acquire data across the entire spectral range (with an effective resolution of 1.2 nm) at a rate of 0.5 to 20 Hz with 20-bit digital conversion.

The PDA detector is a bench-top unit for inclusion in the Surveyor Plus liquid chromatography system. You control the detector through an Ethernet link to a data system computer that has either ChromQuest or Xcalibur installed. The detector consists of a dual-light source, an optical bench, a photodiode array, a low voltage power supply, several printed circuit boards (PCBs), and four status light emitting diodes (LEDs).

Optical System

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

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

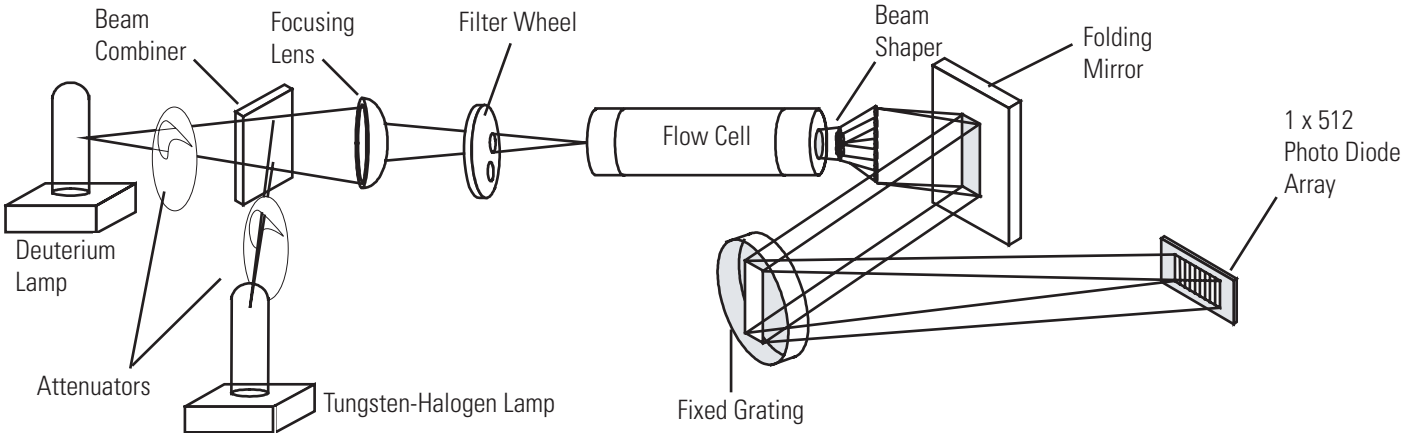

Figure 2. The Surveyor PDA Plus optical system

The light focused on the inlet window of the flow cell 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 flow cell. The other end of the bundle is arranged to produce a narrow "slit" of light for the grating. The beam shaper transfers all the light to the grating for greater light throughput than the mechanical slit used in conventional photodiode array detectors.

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

Printed Circuit Boards

The photodiode array is mounted on the array acquisition PCB, which also contains all the analog detection circuitry. The diode array is continuously scanned at a 20-Hz rate, the light intensity at each diode is converted into a 20-bit digital word, and these words are stored in a dual-port Random Access Memory (RAM) on the CPU PCB. 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 computer.

Status LEDs

Four status LEDs (light-emitting diodes)—labeled Power Comm, Run, and Lamps—are located on the right door of the detector. See Figure 3. The states of the status LEDs are listed in Table 1.

Figure 3. Surveyor PDA Plus Detector status LEDs

Table 1. States of the status LEDs

Status	Amber	Flashing Amber	Green	Flashing Green
Power LED	N/A	N/A	The detector is switched on and receiving power.	N/A
Comm LED	There is no communication with the data system.	The rotary switches are set to 00 and firmware is being downloaded to the CPU of the detector.	Communication to the data system PC has been established.	N/A
Run LED	An error has occurred while performing a run or during the startup initialization.	N/A	The detector is ready.	A run is in progress.
Lamps LED	The lamps are off or the D2 lamp is starting. It takes approximately 10 s for the D2 lamp to turn on.	N/A	One or both lamps are on.	N/A

LightPipe Flow Cell

The Surveyor PDA Plus Detector ships with either a 50 mm or 10 mm LightPipe flow cell.

The internal bore of the LightPipe flow cell is 50 mm long and has a volume of 10 µL. The 5 cm optical pathlength produces a signal five times that of a conventional 1 cm flow cell while the low internal volume of 10 µL minimizes band broadening. A special low refractive index coating of the internal bore ensures a high optical throughput and minimizes short-term noise.

Mobile phase enters the LightPipe flow cell through a port in the bottom of the flow cell and exits through a port in the top of the flow cell. See Figure 4. Directing the flow from the bottom to the top of the flow cell helps prevent the entrapment of air bubbles.

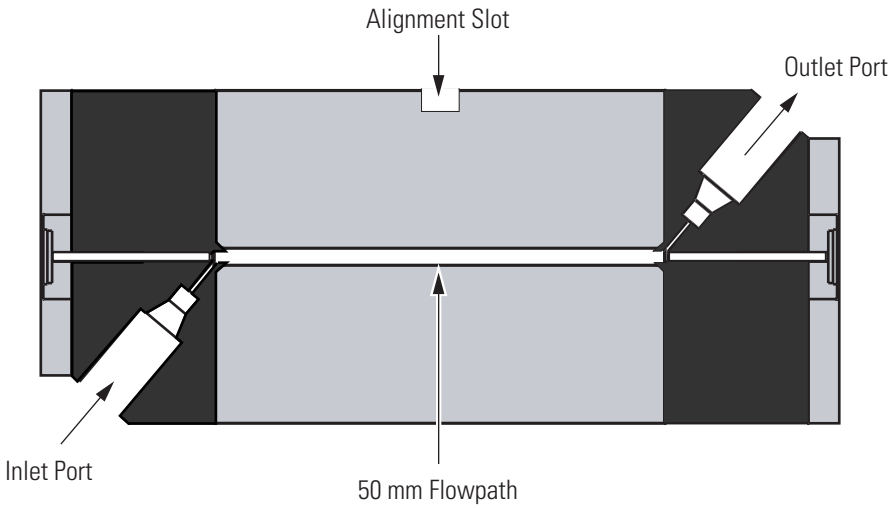

Figure 4. Schematic of LightPipe flow cell, showing the internal flow path

Sensitive optical fibers are exposed at both ends of the flow cell as shown in Figure 2. Thermo Electron ships the LightPipe flow cell with end caps to protect these optical fibers. See Figure 4. Leave these protective end caps in place until you install the LightPipe flow cell. Replace the protective end caps for storage if you remove the LightPipe flow cell from the detector.

CAUTION Do **not** touch the ends of the LightPipe flow cell. Doing so could damage the sensitive optical fibers. If you must grasp the ends of the LightPipe flow cell, wear clean, talc-free gloves.

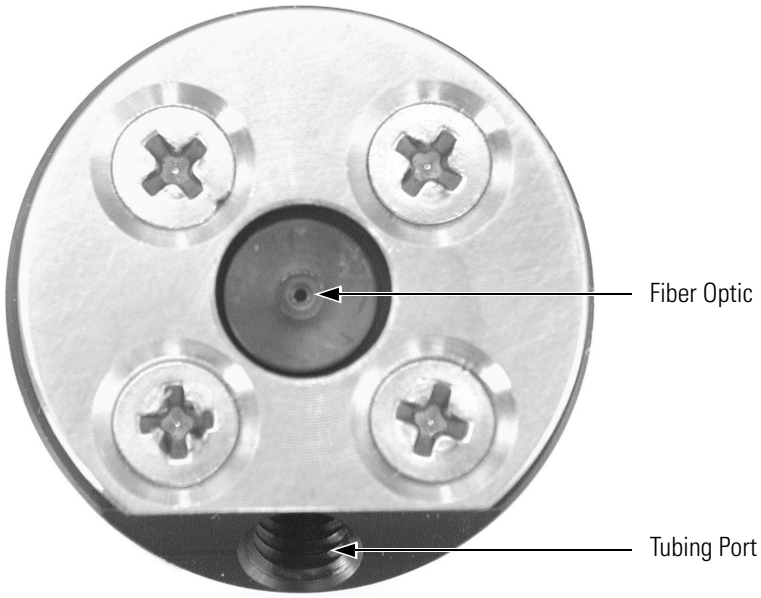

Figure 5. End of LightPipe flow cell, showing the sensitive optical fiber

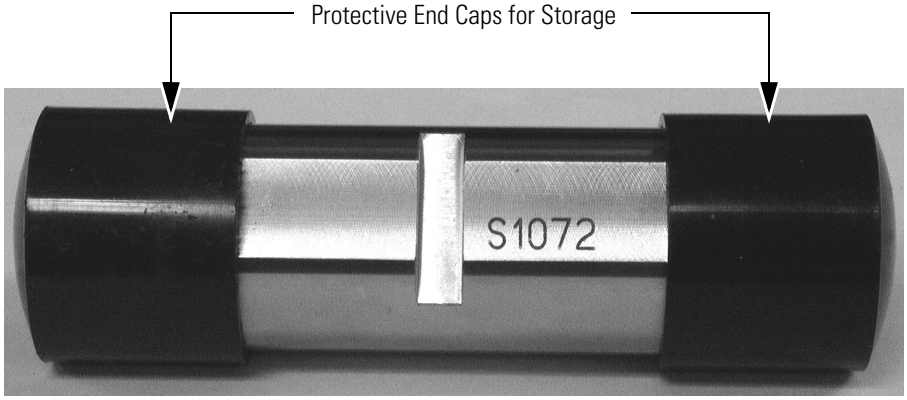

Figure 6. LightPipe flow cell with protective end caps

Specifications

Wavelength Range:	190 nm to 800 nm continuous
Wavelength Accuracy:	±1 nm at 254 nm and 656 nm
Digital Wavelength Resolution:	1.2 nm
Absorbance Range:	2.0 AU to +4. AU, 20-bit resolution
Short Term Noise*:	≤ 6 μAU/cm at 254 nm for the 50 mm LightPipe
Drift*:	≤ 1 mAU/h after warm up at 254 nm at a stable temperature (±1 °C)
Warm-up:	90 min to meet noise and drift specifications
Linearity:	deviation ≤ 5% up to 2.0 AU at 256 nm
Scan Rate:	0.5, 1, 2, 4, 5, 10, or 20 Hz (user selectable)
Rise Time:	0.0, 0.1, 0.2,0.5, 1, 2, 5, or 10 s (user selectable)
Cell Dimensions:	50 mm, 10 mm LightPipe
Cell Pressure Rating:	1000 psi
Diodes:	512
Diode Spacing:	1.2 nm
Light Source:	Deuterium and tungsten-halogen lamps, pre-aligned
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 digital / analog conversion, unattenuated at 10 mV/AU, 100 mV/AU, or 1.0 V/AU
Remote Controls:	Start, Zero, RJ45 Ethernet interface for ChromQuest
Dimensions:	18 cm (7.1 in.) × 36 cm (14.2 in.) × 47 cm (18.5 in.) (*h* × *w* × *d*)
Weight:	19.5 kg (43 lbs)
Power Requirements:	100/115 or 230 V ac; 50/60 Hz, 200 VA max.
Operating Temperature:	+10 to +30 °C
Storage Temperature:	- 40 to +70 °C
Operating Humidity:	5% to 95% non-condensing relative humidity
Product Certification:	CE, TUV-C/US, FCC (EMI)

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

Chapter 2 Installation

This chapter describes the initial installation of the Surveyor PDA Plus Detector, including the connections 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.

This chapter contains the following sections:

Installation Checklist

The following installation checklist is a brief summary of the steps that you need to complete, in sequence, for proper installation of your Surveyor PDA Plus Detector.

- ❑ Unpack and inspect your instrument. See page 11.
- ❑ Read the safety notices in the Preface.
- ❑ Make the initial instrument preparations. See page 12.
- ❑ Check the power settings and fuses. See page 13.
- ❑ Make the initial rear panel connections. See page 14.
- ❑ Connect and install the LightPipe flow cell. See page 21.
- ❑ Power on the detector for the first time. See page 25.
- ❑ Install software and connect remote communication outputs, as required. See page 26.
- ❑ Download the Surveyor PDA Plus Detector firmware, if required. See Appendix A, "Firmware."
- ❑ Configure the Surveyor PDA Plus Detector for control from your chromatography data system. See "Configuring an Instrument in ChromQuest" on page 32 or "Configuring an Instrument in Xcalibur" on page 37.
- ❑ Calibrate the Surveyor PDA Plus Detector. See "Calibrating the Detector with ChromQuest" on page 40 or "Calibrating the Detector with Xcalibur" on page 66.

This detector was installed by:

(Name) (Date)

Unpacking and Inspecting the Instrument

Carefully remove the detector from the shipping container and inspect both the detector and the packaging 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 Surveyor PDA Plus Detector and an accessory kit containing the following items:

- LightPipe flow cell
- Inlet tubing (insulated, red PEEK, 0.005-in. ID × 1/16-in. OD)
- Outlet tubing (blue PEEK, 0.010-in. ID × 1/16-in. OD)
- Fingertight PEEK fittings for 1/16-in. OD tubing
- Power cable
- System synchronization harness
- Two signal cables
- RJ12 serial communications cable
- RJ45 Ethernet communications cable
- RJ45 9-pin adapter

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.

Making Initial Instrument Preparations

Place the detector on a bench top as close as possible to the chromatographic column outlet (minimizing the length of tubing necessary for connection to the LightPipe flow cell inlet). Be sure to place the detector in a **draft-free** location away from an open window, air conditioner vents, or other circulating air source. A stable room temperature is necessary for applications requiring maximum detection sensitivity. Allow at least 15 cm (6 in.) of clear space between the rear panel of the detector and any wall or obstruction. This clear space provides access to the rear-panel connectors and a free flow of cooling air.

You must have the following tools for installation:

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

Checking the Power Setting and Fuses

The detector arrives with the voltage and fuses preset for your location. To verify the power setting, look through the cutout window on the power entry module located at the lower-right on the rear panel of the detector. See Figure 7.

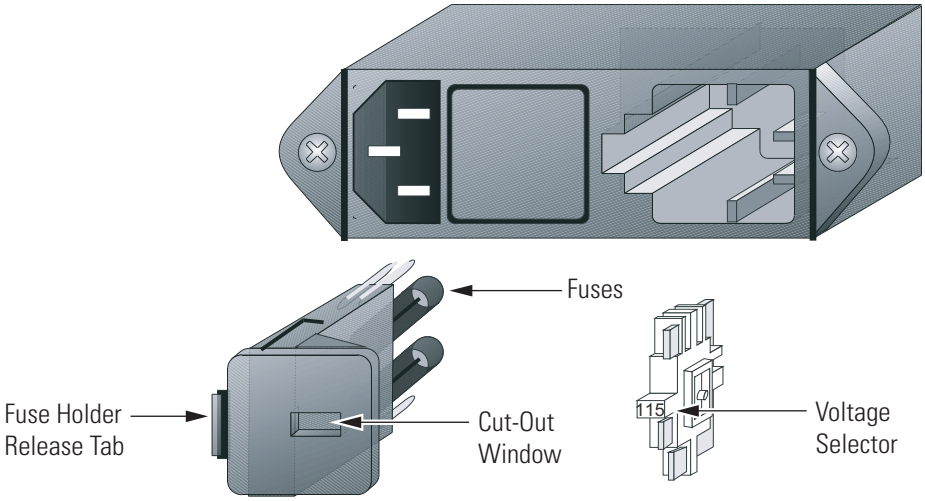

Figure 7. Power entry module, showing selection of the proper voltage

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

To check the fuses and change the voltage setting

1. Place the tip of a 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. Verify that the fuse holder contains the appropriate size fuses: T3.15 A for 100/115 V, or T1.6 A for 230 V.
4. If necessary, slide out the voltage selection PC board and reinstall it so that the desired voltage label is upright and readable. This voltage must agree with the incoming line voltage.
5. Slide the fuse holder back into the power entry module until it snaps in.

Making the Rear Panel Connections

Figure 8 shows the rear panel connections for the Surveyor Plus system. Use the cables provided in the Surveyor system accessory kit to make the connections to the rear panel of the detector. The part numbers for these cables are listed in Table 6 on page 123.

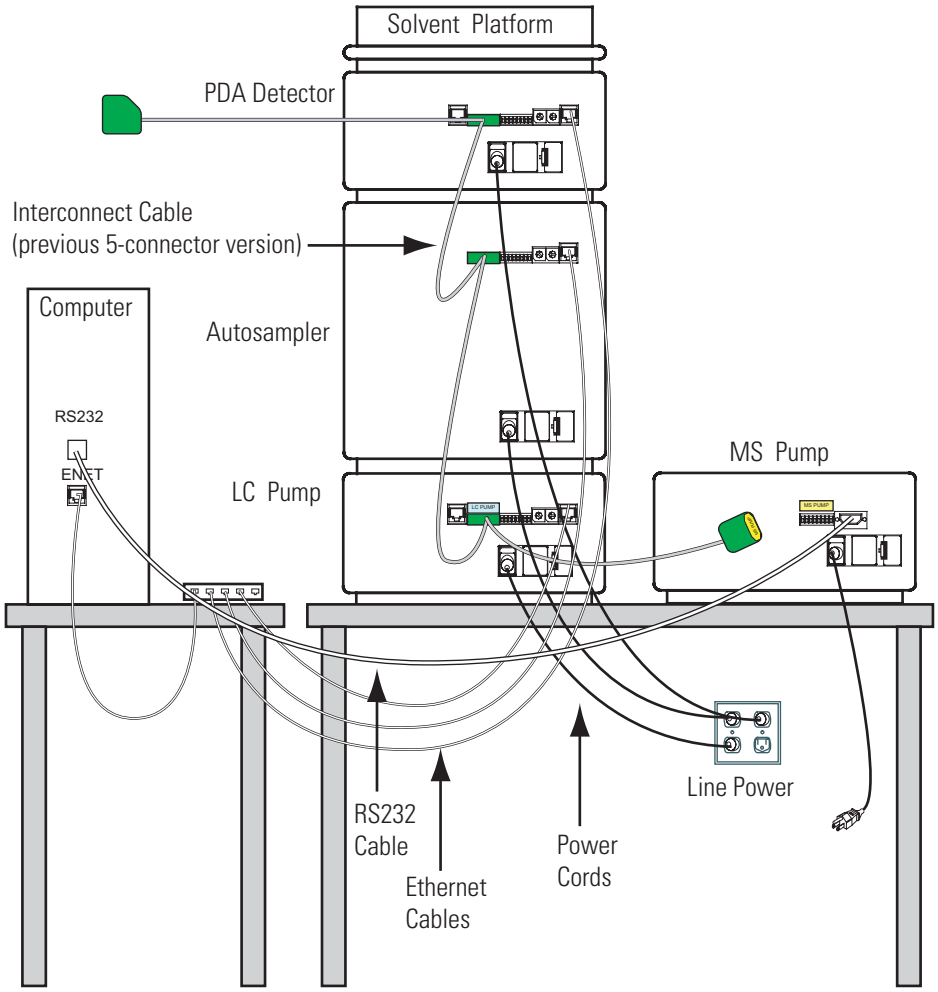

Figure 8. Rear panel connections for the Surveyor Plus LC system

This section contains the following topics:

- Ethernet Connection
- Interconnect Cable Connection
- Analog Output Connections
- Analog Output Settings
- Unit ID Settings

Ethernet Connection

Connect your Ethernet switch to the Ethernet connector port of the detector using the supplied CAT5, 7 ft. long, shielded Ethernet cable with ferrite clamp.

Interconnect Cable Connection

The interconnect cable coordinates the timing of the Surveyor modules during an injection sequence. There are two versions of this cable. The previous version of the cable, which you might have in your laboratory, contains five connectors labeled as follows: DET, M/S, A/S, LC PUMP, and MS PUMP. Figure 9 shows the new version of the interconnect cable, which contains the following connectors: three connectors labeled DET, two connectors labeled PUMP, one connector labeled A/S, and one connector labeled M/S.

Attach one of the connectors labeled DET to the 8-pin plug labeled pins 1 to 8 on the rear panel of the detector. See Figure 10. See the *Surveyor Plus Getting Connected* manual for information on connecting the pump, autosampler, and optional MS detector.

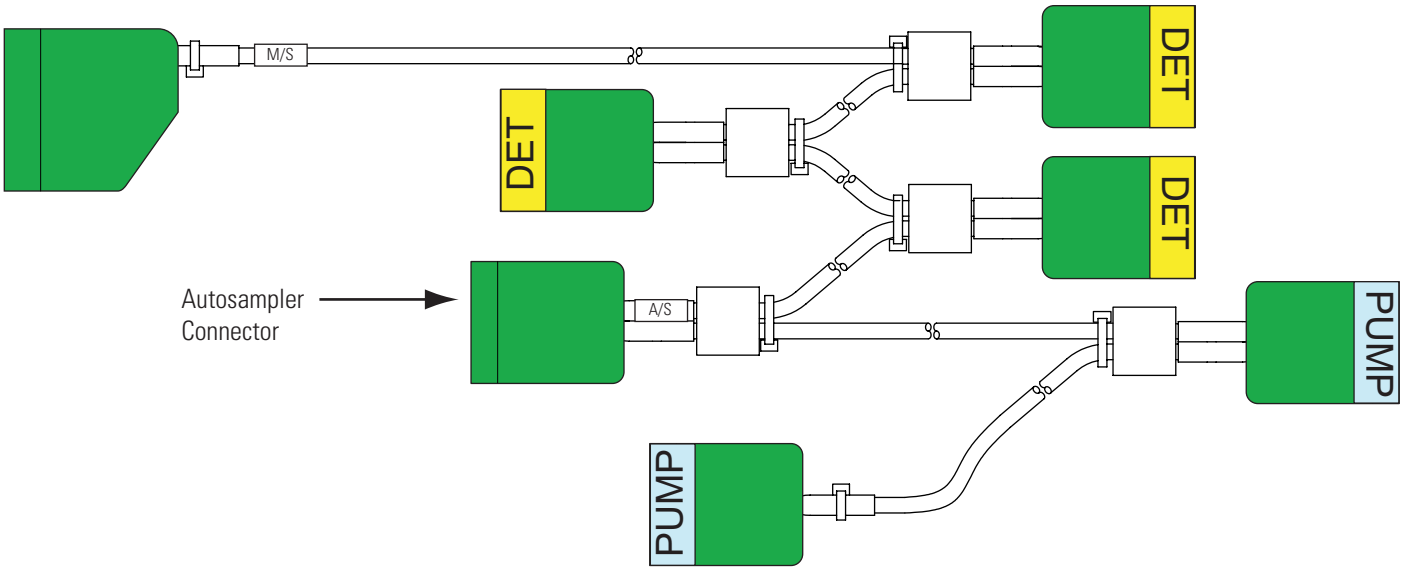

Figure 9. Seven-connector version of the system interconnect cable

IMPORTANT You can connect the PUMP connector to a Surveyor LC Pump Plus or an Accela Pump. You need an additional adaptor cable to connect the Surveyor MS Pump Plus.

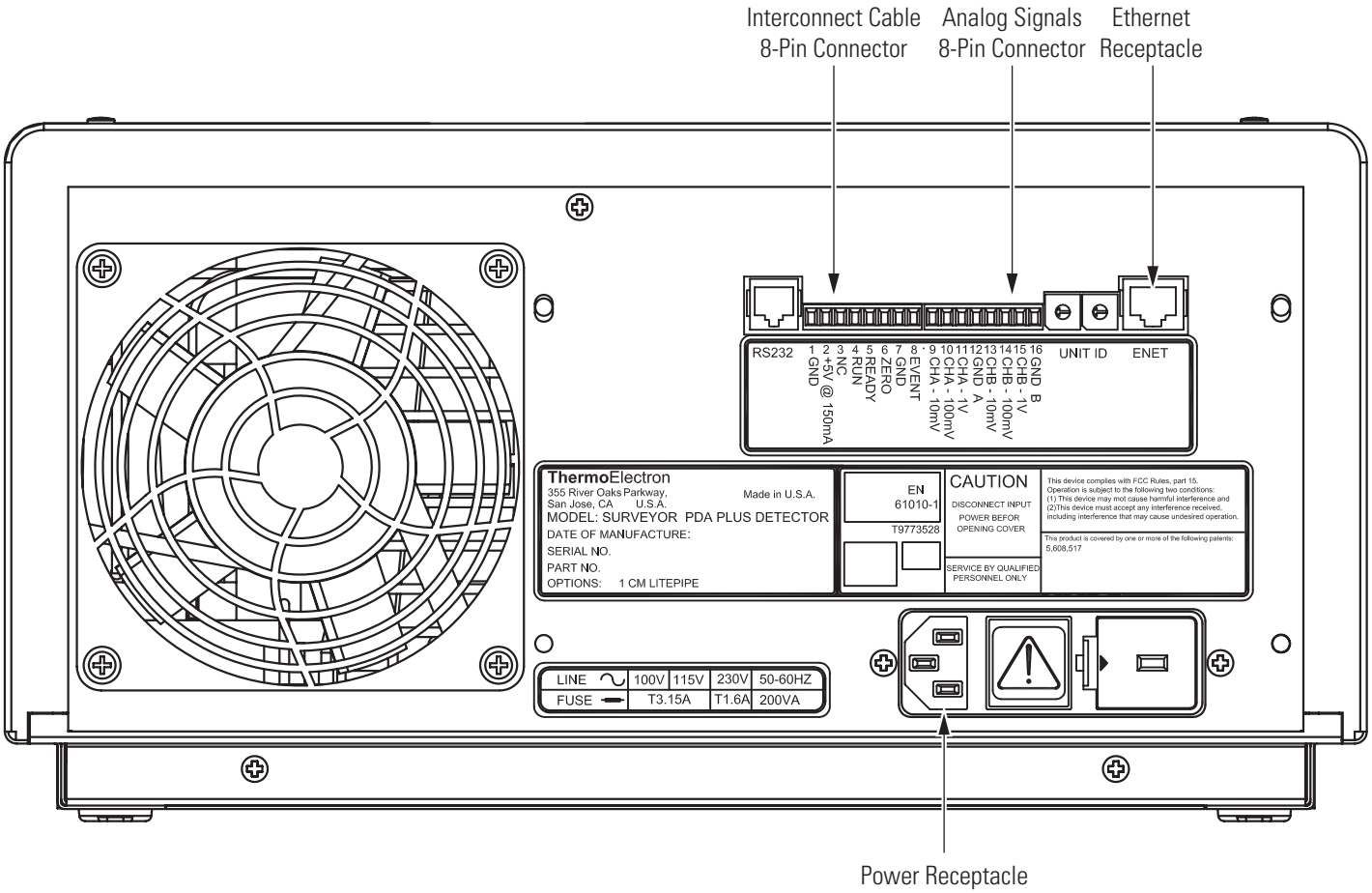

Figure 10. Rear panel of Surveyor PDA Plus Detector

Analog Output Connections

Two analog signal cables (twin-axial computer cables) are provided in the installation kit to use for connecting the analog outputs from the PDA detector to other data collection devices.

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

At the detector rear panel there are three different analog voltage outputs per channel: CHA – 10 mV, CHA – 100 mV, CHA – 1 V, CHB – 10 mV, CHB – 100 mV, CHB – 1 V; and a single ground per channel: GND A and GND B.

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

To make each electrical connection

1. Insert the end of the wire into the appropriate terminal in the 8-pin terminal connector. Hold the wire in place while you tighten the small terminal set screw firmly onto the wire.

2. Insert the terminal connector into the 8-pin analog connector numbered 9 through 16 at the back of the instrument. See Figure 11.

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

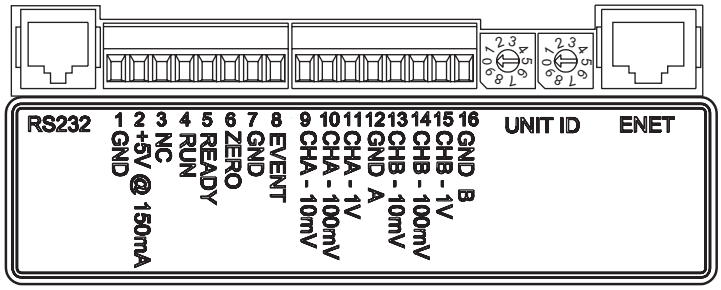

Figure 11. Back panel of Surveyor PDA Plus Detector

Analog Output Settings

The analog outputs are controlled by the wavelength, bandwidth, rise time, and zero functions of the detector. These outputs are made compatible with data collection systems using any of the three different voltages (10 mV, 100 mV, or 1 V) by selecting the appropriate terminal of the analog output terminal connector (Figure 11).

Unit ID Settings

The Surveyor PDA Plus Detector is shipped with the unit ID preset using the two rotary switches located on the back panel. See Figure 12. The range of values for the unit ID is 01 to 99. The value of 00 is reserved for special service functions. The unit ID must correspond with the stack ID specified in the Instrument Configuration application. For details on configuring your detector, see Chapter 3, "Configuration."

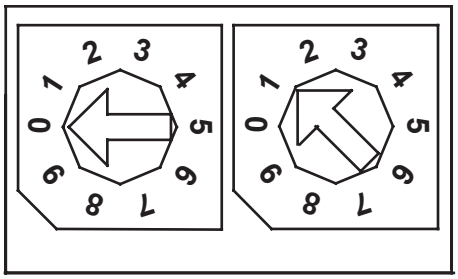

Figure 12. Unit ID rotary switches, showing a setting of 1

Remote Communications Connections

The Surveyor PDA Plus Detector has two remote communications inputs (RUN and ZERO), and one remote communications output (EVENT).

RUN

The RUN input receives an inject signal from the autosampler or a manual injector.

During installation, you must connect this RUN input to your autosampler or injector output. If your system contains a Surveyor Autosampler Plus, the interconnect cable (see Figure 9 on page 15) accomplishes this task.

For Thermo Electron autosamplers (other than the Surveyor Autosampler or Surveyor Autosampler Plus), connect the PDA RUN input to the autosampler Inject Out output, and connect the PDA GND terminal to the autosampler ground terminal.

For other autosamplers or injectors, first determine whether the device uses a TTL signal or a relay (a contact-closure) to remotely trigger detectors. Then wire the device to the PDA detector, using the appropriate procedure, as follows:

- If the autosampler or injector uses a TTL signal to trigger the run, connect the TTL trigger to the detector RUN terminal, and connect the signal ground terminal (or TTL return terminal) to the detector GND terminal.

- If the autosampler or injector device output relay consists of a single, normally open terminal, and subsequent common ground terminal, connect the normally open terminal to the detector RUN terminal, and connect the common ground terminal to the detector GND terminal. If both of the relay contacts are electrically isolated from each other, and from ground (the device simply closes a contact between the two relay terminals), connect either one of the relay terminals to the detector RUN terminal, and connect the other relay terminal to the detector GND terminal.

Note The detector ground (GND) terminals (pins 1 and 7) on the rear of the detector are tied to a single digital ground. You can use either ground terminal for digital input or output return connections.

ZERO

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

The Surveyor PDA Plus Detector can be zeroed remotely with either a TTL low signal or with a contact closure.

During installation, you must connect this ZERO input to your remote device output. When the Surveyor PDA Plus Detector is used with the Surveyor Autosampler, the interconnect cable accomplishes this task.

First determine whether the external device uses a TTL signal or a relay to remotely trigger detectors. Then wire the device to the Surveyor PDA Plus Detector, using the appropriate procedure, as follows:

- If the external device uses a TTL signal to zero the detector, connect the TTL trigger to the detector ZERO terminal, and connect the signal ground terminal (or TTL return terminal) to the detector GND terminal.
- If the external device uses a relay to zero the detector, connect the normally open terminal to the detector ZERO terminal, and connect the common ground terminal to the detector GND terminal. If both of the relay contacts are electrically isolated from each other (and from ground), then connect either one of the relay terminals to the detector ZERO terminal, and connect the other relay terminal to the detector GND terminal.

EVENT The EVENT output connection is used to trigger an external device such as a fraction collector. You can configure the parameters for this signal from the Instrument Setup portion of Xcalibur or ChromQuest.

If the external device is triggered using a TTL signal, connect the PDA EVENT terminal (pin 8) to the positive pin on the external device input, and connect one of the PDA GND terminals (either of pins 1 or 7) to the external device negative pin. The Surveyor PDA Plus Detector has open collector outputs that require a pull-up resistor (typically 10 kΩ) when connecting to TTL inputs.

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

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

Installing the LightPipe Flow Cell

The LightPipe flow cell is packed in a small, separate box within the detector shipping carton. This small box contains the LightPipe flow cell (with a protective cap on each end) and a plastic bag containing the inlet and outlet tubing and FingerTight fittings. The part numbers for these items are listed in Table 4 on page 123.

You gain access to the LightPipe flow cell by opening the two front doors of the detector and removing the flow cell access cover. See Figure 13.

To install the LightPipe flow cell

1. Open the front doors of the detector.

2. Unscrew the captive screw that secures the flow cell access cover to the front panel of the detector, and then pull the cover off.

3. Unscrew the retaining block knob and remove the retaining block. See Figure 14.

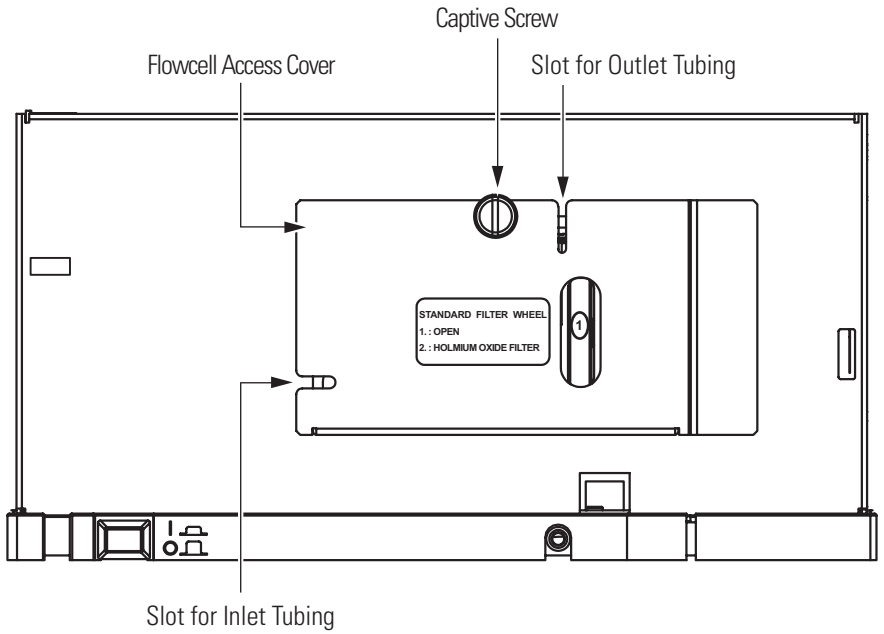

Figure 13. Surveyor PDA Plus Detector with doors open, showing the flow cell access cover

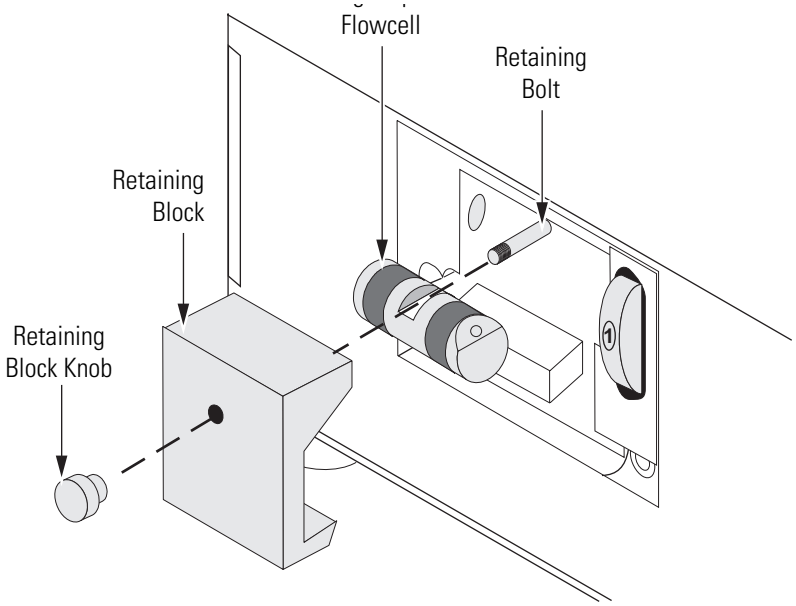

Figure 14. Surveyor PDA Plus Detector, showing LightPipe flow cell installation

Note The outlet port of the LightPipe flow cell is on the same side as the locating notch on the top of the flow cell.

4. Remove the protective end caps from the ends of the LightPipe flow cell. See Figure 15.

Figure 15. LightPipe flow cell with the protective end caps installed

5. Connect the inlet port of the LightPipe flow cell:

   a. Use the PEEK fittings included with the LightPipe flow cell kit to connect one end of the 0.005-in. ID, red insulated inlet tubing to the flow cell inlet port. Slide the protective insulating sleeve of the tubing as close as possible to the inlet port of the LightPipe flow cell.

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

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

6. Connect the outlet port of the LightPipe flow cell:

   - If you are not connecting to an MS detector, use a PEEK fitting to connect the 0.010-in. ID, blue outlet tubing to the LightPipe flow cell outlet. Place the other end of the outlet tubing into the waste reservoir. When you are using an optional backpressure regulator (see Table 5 on page 123), connect the outlet line to the low-pressure union and waste tubing.

   - If you are connecting the flow cell outlet to an MS detector, use the PEEK fittings to connect one end of the 0.005-in. ID, PEEK, red tubing, which is included in the MS detector accessory kit, to the outlet port of the flow cell and to connect the other end of the tubing to the inlet port of the MS detector.

   Note If you have several detectors (fluorescence, refractive index, electrochemical, and so on) hooked up in series, place your Surveyor PDA Plus Detector closest to the column outlet because its flow cell can withstand the greatest backpressure. A backpressure regulator is often recommended to prevent bubble formation in the detector flow cell.

7. Position the slot located on the top of the LightPipe flow cell under the retaining bolt in the detector, and then slide the LightPipe into place. The inlet fitting should be on the bottom, left-side and the outlet fitting on the top, right-side. Replace the LightPipe flow cell retaining block and hand tighten the retaining knob. See Figure 16.

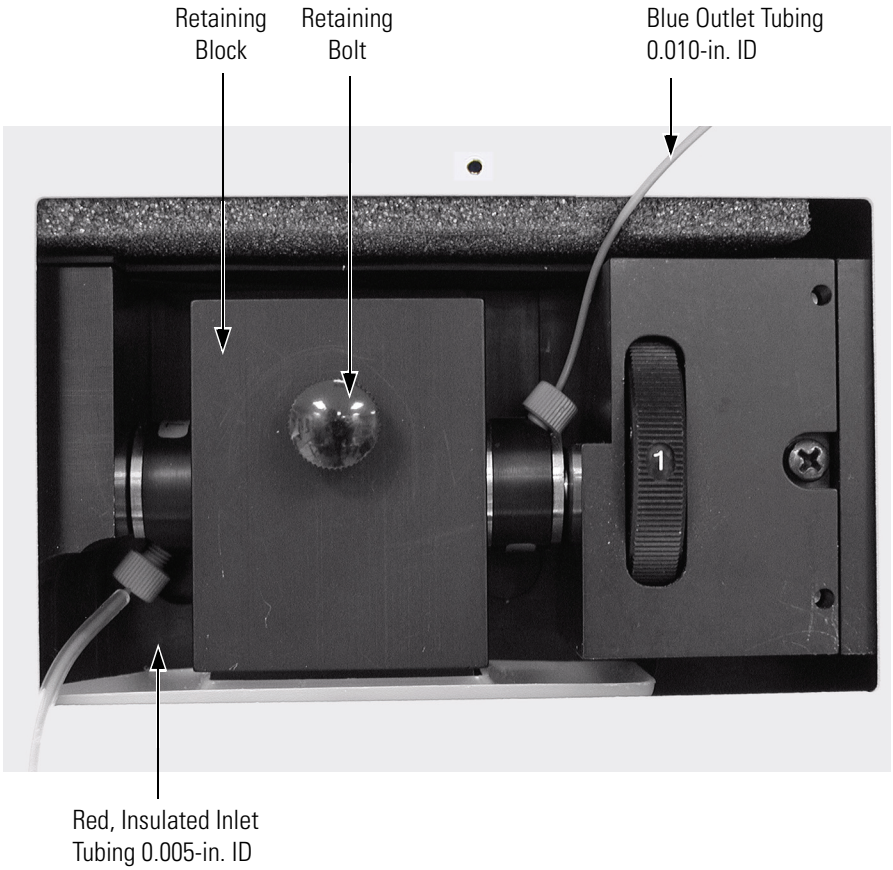

Figure 16. Flow cell, showing inlet and outlet tubing connections

8. Replace the detector flow cell access cover, making sure that the inlet and outlet tubing pass through the slots (see Figure 13 on page 21) without being pinched. Tighten the captive screw to secure the flow cell access cover to the detector.

9. Close the front doors of the detector.

Powering On the Detector for the First Time

To turn on the detector power for the first time

1. Place the power switch at the front of the unit in the Off position (released or out position).

2. Attach the power cord to the power entry module on the rear panel of the detector and connect it to the power source.

3. Turn the power on by pushing the power button in to engage it.

   Note that the Power LED turns solid green. If it does not light at all, see Chapter 7, "Troubleshooting."

   If the Comm LED is flashing amber, the Surveyor PDA Plus Detector has been powered up with the rotary switches set to 00. This setting is only appropriate for service functions, such as downloading a firmware upgrade. For instructions on downloading firmware, see Appendix A, "Firmware." If the switches have been set to 00, turn the PDA detector off and use a small flat head screwdriver to reset the switches to an appropriate value (01 to 99). See Chapter 3, "Configuration," for instructions on matching the Stack ID to the rotary switch settings. After you reset the switches, turn the PDA detector on for normal operation.

Connecting Remote Outputs

The Surveyor PDA Plus Detector has two remote outputs: READY and EVENT (see Figure 11 on page 17). The outputs are open collectors and are each capable of sinking < 30 mA at 30 V dc, suitable for connecting to TTL and other families of ICs. In addition, there is a 5 V output that supplies +5 V dc at 150 mA maximum that can be used for testing digital input signals. When connecting to TTL inputs, a pull-up resistor (typically 10 kΩ) is required across the +5 V output and the open collector input connection if one is not built into the external device.

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

This section contains the following topics:

Setting the Output Polarity in ChromQuest

To make the connections

1. If necessary, install the ChromQuest software on the computer.
2. Launch ChromQuest:
   - From the Windows desktop, double-click the ChromQuest icon.
   - Alternatively, choose **Start > All Programs > Chromatography > ChromQuest** from the Windows XP taskbar.
3. If necessary, add your instrument to the Enterprise, and then add the Surveyor PDA Plus Detector to your instrument configuration. For information on configuring your instrument, see "Configuring an Instrument in ChromQuest" on page 32.
4. Double-click the icon for your instrument to open the Instrument window.
5. On the menu bar, choose **Control > Instrument Status**.
6. In the **Instrument Status** dialog box, click the **Surveyor PDA Plus** tab to open the Surveyor PDA Plus page. See Figure 17.
7. In the **Output States** area, check the current settings of the outputs.

Note The Surveyor Autosampler Plus requires low active remote inputs.

8. Change the polarity settings of the output states to match the connecting equipment, if necessary.

9. Close the software and turn off the detector to make any necessary remote communication connections.

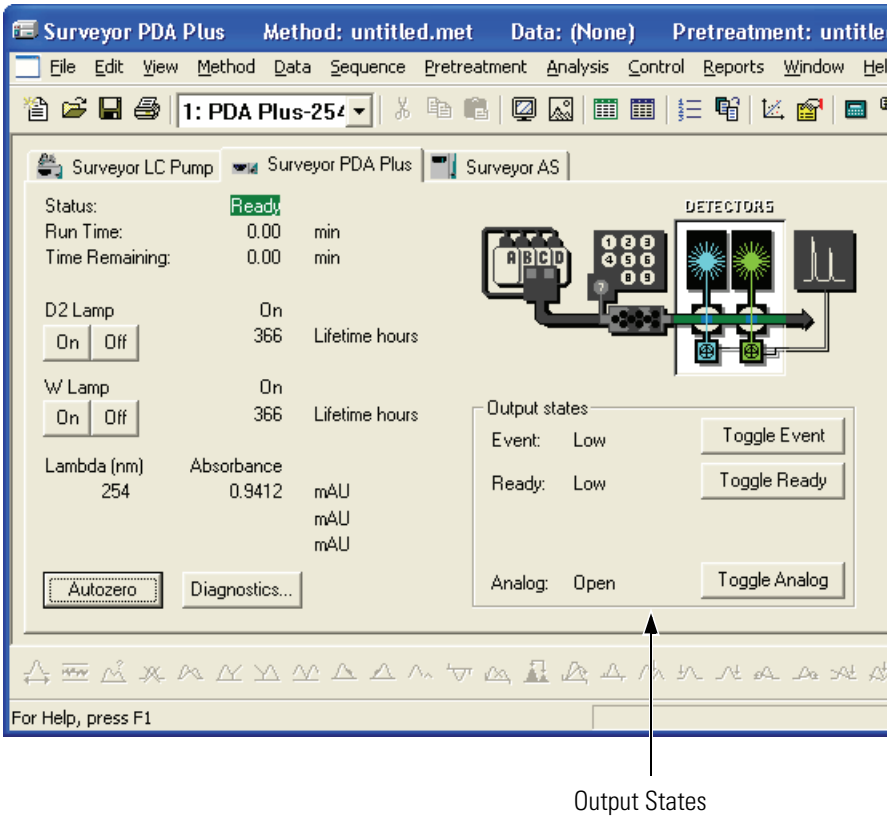

Figure 17. Surveyor PDA Plus Detector page of the ChromQuest Instrument Status window

Setting the Output Polarity in Xcalibur

To make the connections

1. Install the Xcalibur software, if necessary. Then add the Surveyor PDA Plus Detector to the configuration for your instrument. See "Configuring an Instrument in Xcalibur" on page 37.
2. Launch Xcalibur.
3. In the **Home Page – Roadmap** view, click the Instrument Setup icon.

4. In the viewbar of the Instrument Setup window, click the Surveyor PDA Plus icon.
5. On the menu bar, choose **Surveyor PDA Plus > Direct Control** to open the Surveyor PDA Plus Direct Control dialog box.

   Note The Surveyor Autosampler requires low active remote inputs.

6. Click the **Configuration** tab to open the Configuration page. See Figure 18.
7. In the **Analog Outputs** area of the Configuration page, check the current settings of the outputs.
8. Change the senses to match the connecting equipment, if necessary.
9. Close the software and turn off the detector to make any necessary remote communication connections.

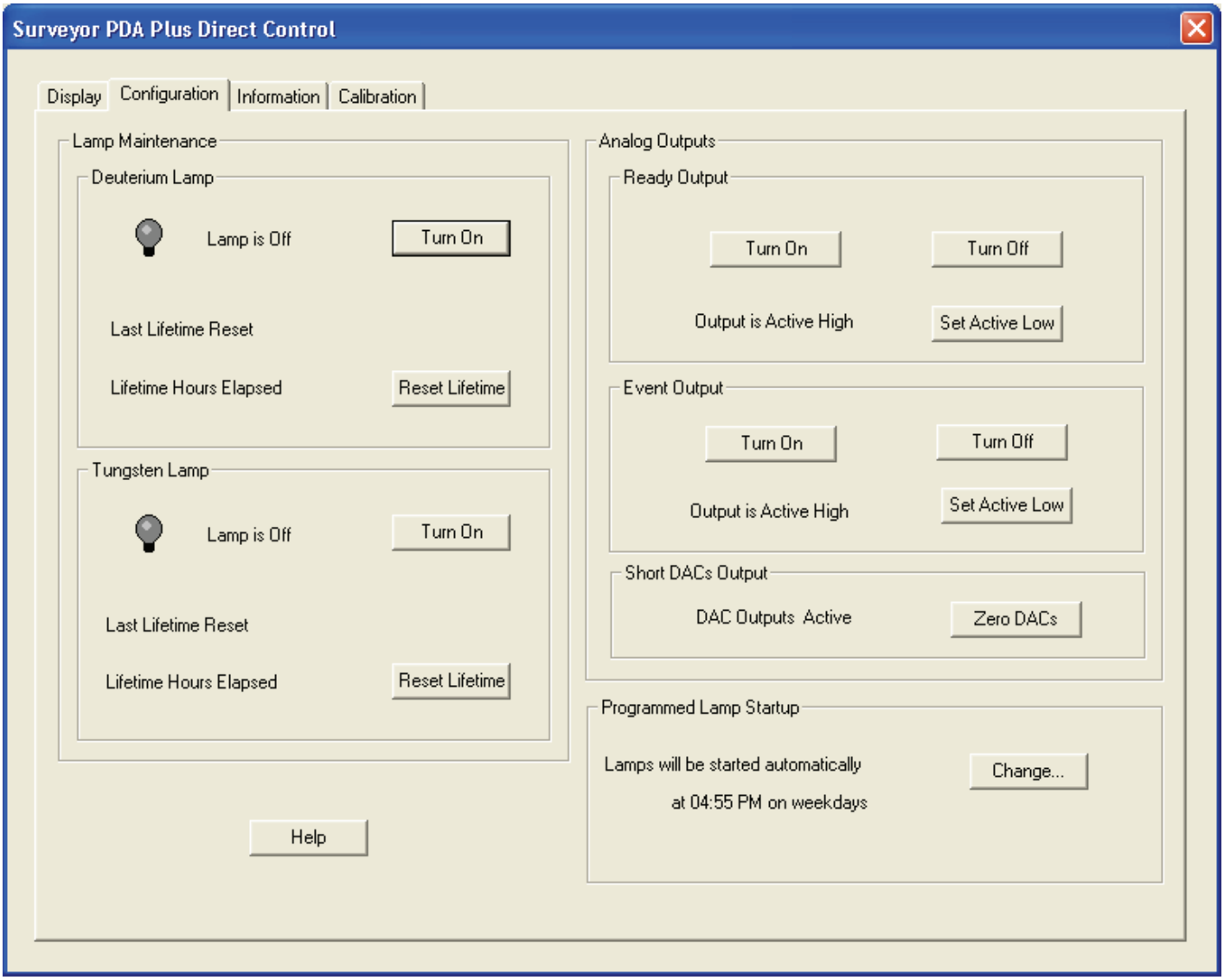

Figure 18. Surveyor PDA Plus Direct Control dialog box – Configuration page in Xcalibur

Completing the Installation

The Surveyor PDA Plus Detector is 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.

The detector is calibrated from the data system you are using to control it. Before you can calibrate the detector, you must add it to the instrument configuration for your data system.

For details on adding the detector to your instrument configuration, see one of the following:

- "Configuring an Instrument in ChromQuest" on page 32
- "Configuring an Instrument in Xcalibur" on page 37

For details on calibrating your detector, see one of the following:

- "Calibrating the Detector with ChromQuest" on page 40
- "Calibrating the Detector with Xcalibur" on page 66

Chapter 3 Configuration

The only manual control on the Surveyor PDA Plus Detector is the On/Off switch below the left-front door of the unit. All other instrument control functions are performed from the chromatography data system (either ChromQuest or Xcalibur). To control the detector, you must add it to the instrument configuration for your data system.

This chapter contains the following sections:

Configuring an Instrument in ChromQuest

To calibrate your Surveyor PDA Plus detector, you need to create and configure an instrument with a Surveyor LC Pump Plus and a Surveyor PDA Plus Detector. You can add the Surveyor Autosampler Plus to your instrument configuration; however, instructions pertaining to the autosampler configuration parameters are not included in this manual.

To create and configure an instrument with ChromQuest

1. If the Enterprise does not already contain your instrument, add it.

   a. Double-click the ChromQuest icon on your desktop to open the Main Menu window. Alternatively, click **Start > All Programs > Chromatography > ChromQuest** to launch ChromQuest.

   b. If the instrument login feature has been enabled, log in by clicking the Enterprise Login button, and then typing your user name and password in the Login dialog box.

   c. Right-click The Enterprise icon to open a shortcut menu.

   d. On the shortcut menu, choose **New > Instrument**. See Figure 19.

      A new instrument icon appears in the right pane.

   e. Type a new name for the instrument in the box below the instrument icon, and then press **ENTER**.

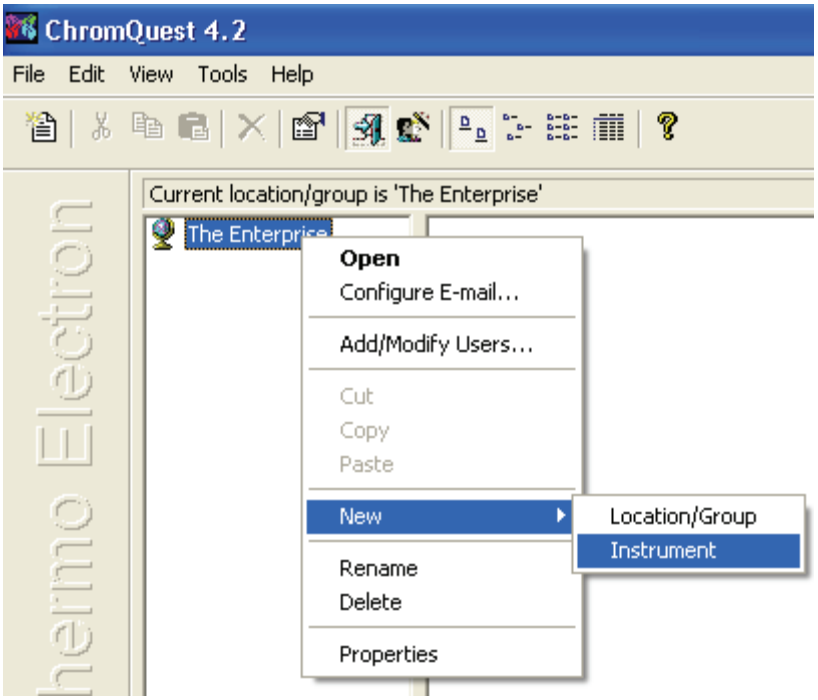

Figure 19. Main Menu window, showing the Enterprise shortcut menu

2. Open the Surveyor dialog box as follows:

   a. In the **Main Menu** window, right-click the icon of the instrument that you want to configure to open a shortcut menu. See Figure 20.

   b. On the shortcut menu, choose **Configure > Instrument** to open the Instrument Configuration dialog box.

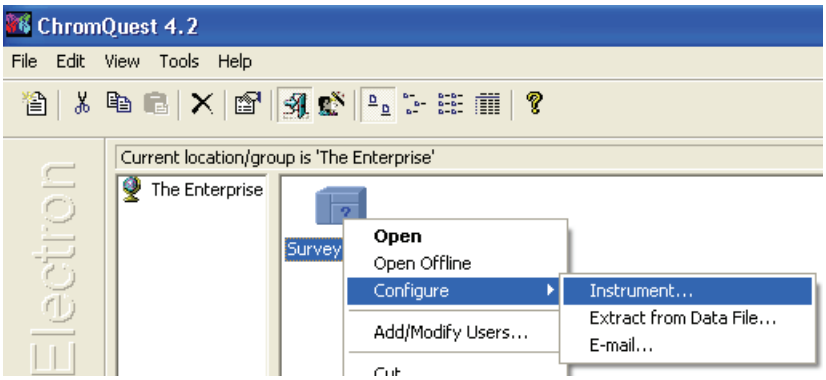

Figure 20. Main Menu window, showing Instrument shortcut menu

   c. In the **Instrument Configuration** dialog box, select **Surveyor** from the **Instrument Type** list if you are configuring a new instrument. See Figure 21.

   When you click **Surveyor,** a dialog box containing a warning message appears.

   d. Click **Cancel** if you want to modify the current configuration, rather than erase it.

   e. In the **Instrument Configuration** dialog box, click **Configure** to open the Surveyor dialog box.

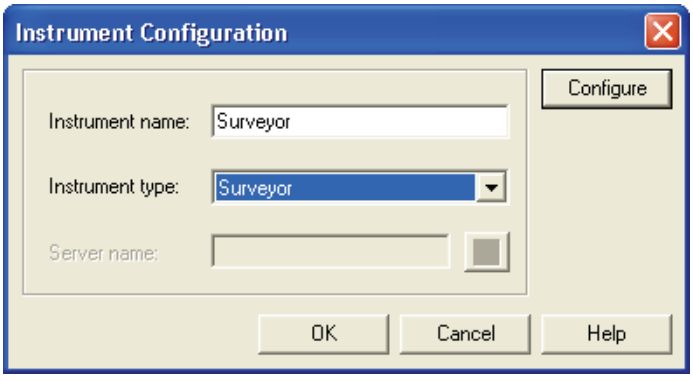

Figure 21. Instrument Configuration dialog box

3. In the **Surveyor** dialog box, double-click on the modules in the **Available modules** pane that you want to add to your instrument configuration.

   a. To add the Surveyor LC Pump Plus, double-click the **Surveyor LC Pump** button.

   b. To add the Surveyor PDA Plus Detector, double-click the **Detector** button.

   As Figure 22 shows, the Analog icon appears in the Configured modules pane.

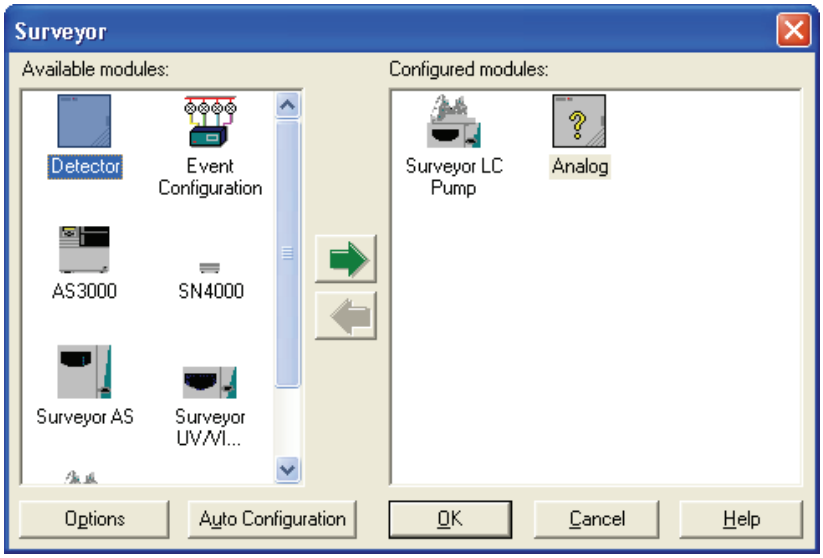

Figure 22. Surveyor dialog box, showing the Surveyor LC Pump and the Analog icon added to the Configured modules pane

4. Complete the configuration of the Surveyor LC Pump Plus:

   a. Double-click the **Surveyor LC Pump** button in the Configured Modules box to open the Surveyor LC Pump Configuration dialog box. See Figure 23.

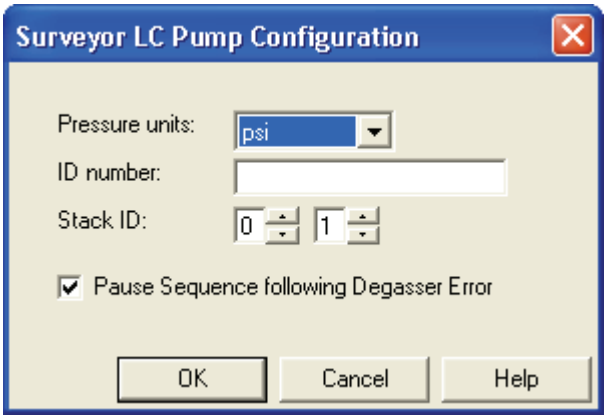

Figure 23. Surveyor LC Pump Configuration dialog box

b. In the **Pressure** list, select the Pressure units—MPa, Bar, or psi—that you prefer to use to display the backpressure of your system. 1 MPa = 10 Bar = 145 psi.

Note The system backpressure is displayed on the Surveyor LC Pump Instrument Status page and on the Surveyor LC Pump Instrument Setup page.

c. In the **Stack ID** box, type or select the Unit ID value for your pump.

The unit ID on the back panel of the pump consists of two rotary switches. Each switch has ten positions. The arrow on the left switch points to the "tens" digit of the unit ID. The arrow on the right switch points to the "ones" digit of the unit ID.

d. (Optional) In the **ID Number** box, type an identification number for your Surveyor PDA Plus Detector, such as its license number.

e. Select the **Pause Sequence Following Degasser Error** check box if you want ChromQuest to cease injections following an error condition for the LC pump's built-in degasser.

5. Complete the configuration of the Surveyor PDA Plus detector:

a. Double-click the **Analog** button in the **Configured modules** box to display the Detector Configuration dialog box shown in Figure 24.

b. In the **Detector Model** list, select **PDA Plus**.

Note After you select the PDA Plus option, the Acquisition Source list automatically lists the PDA Plus ACQ option. Leave the Y-axis Units set to mAU and Y-axis Multiplier set to 0.001. ChromQuest stores the absorbance data from the PDA in microvolts. The Y-axis Multiplier of 0.001 scales the display to mV (1 mV = 1 mAU).

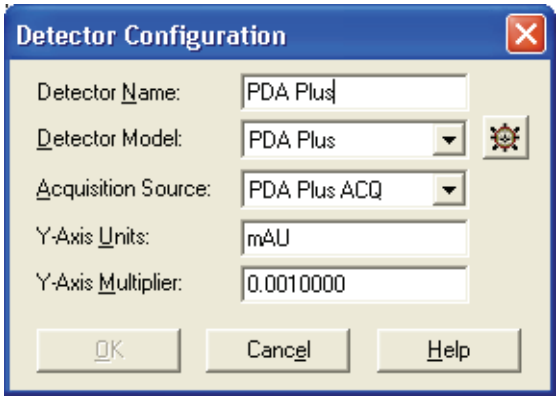

Figure 24. Detector Configuration dialog box

c. Click the button to the right of the Detector Model list to display the Surveyor PDA Configuration dialog box. See Figure 25.

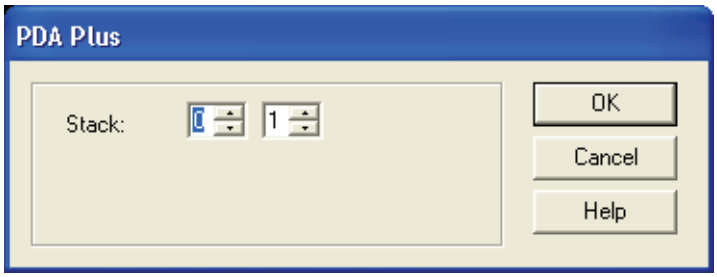

Figure 25. PDA Plus dialog box

d. In the **Stack** boxes, type or select the Unit ID value for your Surveyor PDA Plus Detector.

e. Click **OK** to exit the PDA Plus dialog box.

f. Click **OK** to exit the Detector Configuration dialog box.

6. To return to the Main Menu window, click **OK** to exit the Surveyor dialog box and click **OK** to exit the Instrument Configuration dialog box.

Configuring an Instrument in Xcalibur

To configure your instrument in Xcalibur

1. Open the Instrument Configuration dialog box by doing one of the following:

   - From the Windows XP taskbar, choose **Start > All Programs > Xcalibur > Instrument Configuration**.
   - From the Windows desktop, double-click the **Instrument Configuration** icon.

   The Instrument Configuration dialog box appears. The Instrument Configuration dialog box shown in Figure 26 contains a list of all the available devices that were installed with the Xcalibur data system when it was loaded onto your computer.

2. In the **Available Devices** list, double-click each of your Surveyor devices. As you double-click a device in the Available Devices list, it is added to the list of configured devices. You do not need an autosampler to calibrate your detector. Add the autosampler to your instrument configuration at your convenience.

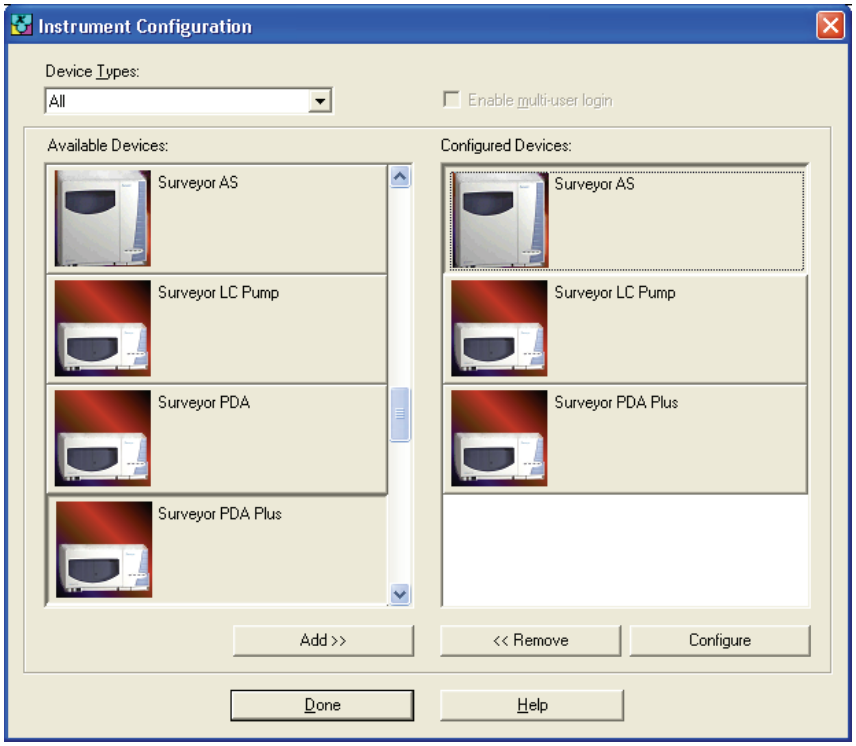

Figure 26. Instrument Configuration dialog box, showing added devices

3. Complete the configuration of the Surveyor PDA Plus detector as follows:

a. Double-click the **Surveyor PDA Plus** button to open the Surveyor PDA Plus Configuration dialog box. See Figure 27.

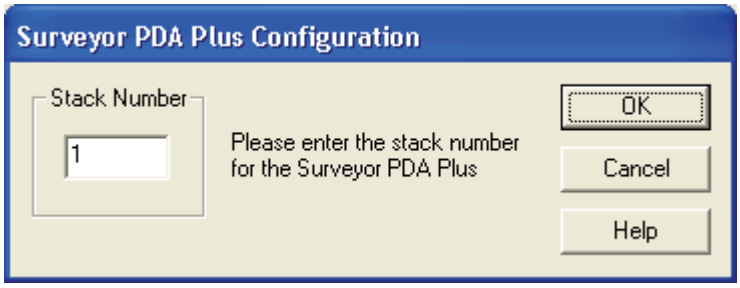

Figure 27. Surveyor PDA Configuration dialog box

b. In the **Stack Number** box, type the number that the unit ID rotary switches on the rear panel of the detector are set to.

c. Click on **OK** to close the Surveyor PDA Configuration dialog box.Surveyor PDA Configuration dialog box

4. Complete the configuration of your analytical pump.

5. If you added an autosampler to your instrument, complete its configuration. If your Surveyor Plus system contains a Surveyor LC Pump Plus or a Surveyor MS Pump Plus, you must select the two check boxes in the Input area of the Signal Polarity page.

6. Click **Done** to exit the Instrument Configuration dialog box.

Chapter 4 Diagnostics for ChromQuest Users

The diagnostics program lets you check the operation of the PDA detector, calibrate the PDA detector, and view the error log. To perform diagnostics from ChromQuest, your PDA detector must be connected to the data system computer, configured as part of an instrument in the ChromQuest Enterprise, and powered On. For information on configuring your Surveyor PDA Plus Detector, see "Configuring an Instrument in ChromQuest" on page 32.

This chapter contains the following sections:

Calibrating the Detector with ChromQuest

To calibrate the PDA detector from the ChromQuest data system, prepare the detector as described in the first topic of this section, and then perform a wavelength calibration, array calibration, or both.

Preparing the Detector for Calibration

To prepare the Surveyor PDA Plus Detector for calibration

1. Replace the LC column with a flow restrictor. Then pump HPLC-grade water or HPLC-grade methanol through the flow cell for at least one hour.

2. Turn on both lamps and wait one hour for the D2 lamp to equilibrate:

   a. In the menu bar of the online **Instrument** window, choose **Control > Instrument Status** to open the Instrument Status window.

   b. Click the **Surveyor PDA** tab to open the Surveyor PDA Plus page. See Figure 28.

   c. Click the D2 (deuterium) Lamp **On** button and the W (tungsten) Lamp **On** button.

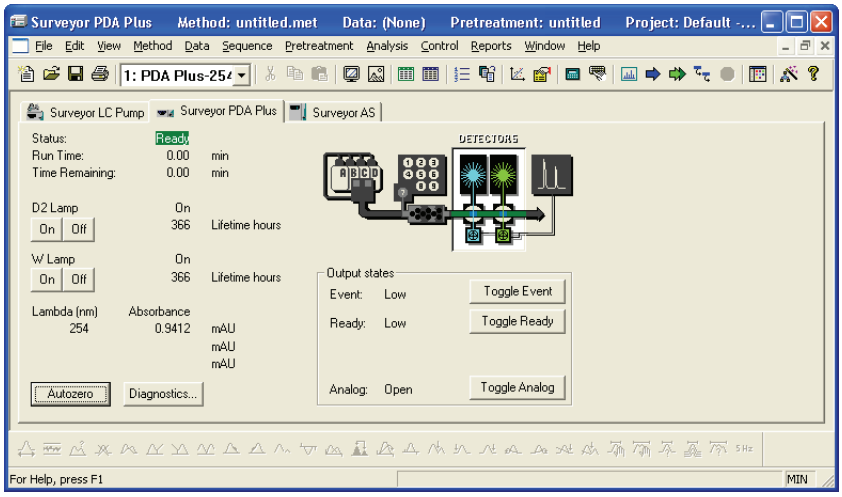

Figure 28. ChromQuest Instrument Status window, showing the Surveyor PDA Plus page

Performing a Wavelength Calibration

The alignment of the spectrum on the diode array is dependent upon the physical alignment of various components of the optical bench. The alignment can become offset if the detector is sharply jolted, for example, in shipping. Such bumps and jars can slightly change the wavelength of light reaching the photodiode array. The automated wavelength calibration determines the wavelength accuracy of the detector and uses the detector's wavelength algorithm to correct for any misalignment.

To perform a wavelength calibration with ChromQuest

1. In the **Instrument Status** page for the Surveyor PDA Plus, click **Diagnostics** to open the Surveyor PDA Plus Diagnostics dialog box.

2. Click the **Calibration** tab to display the Calibration page. See Figure 29.

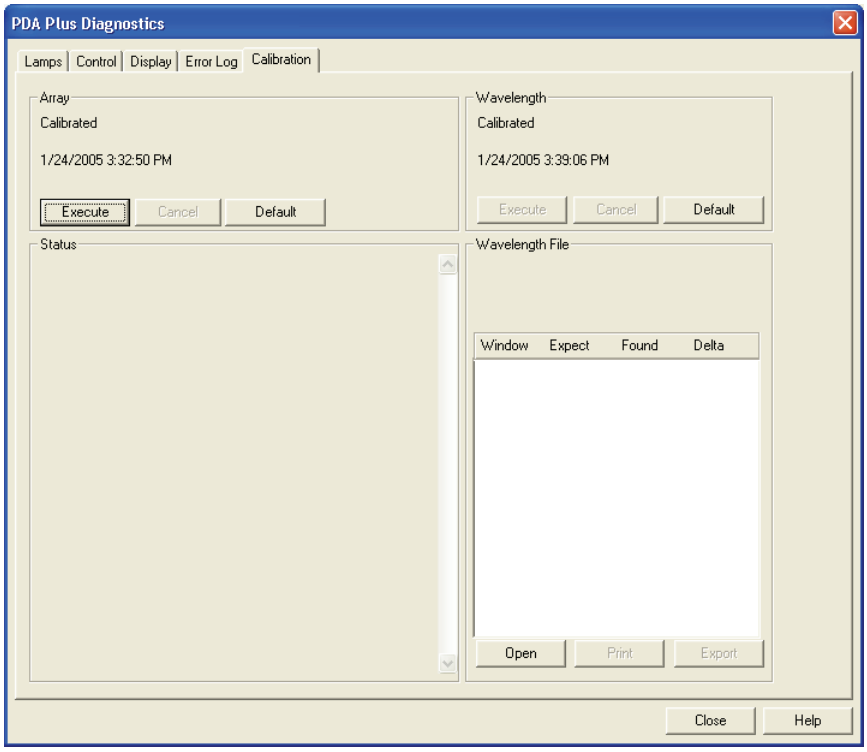

Figure 29. PDA Plus Diagnostics dialog box - Calibration page

3. Open a Wavelength Calibration file as follows:

   a. In the **Wavelength File** area, click **Open** to display the Select Wavelength Calibration dialog box.

b. In the **Select Wavelength Calibration** dialog box shown in Figure 30, select an appropriate wavelength calibration file from the list.

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

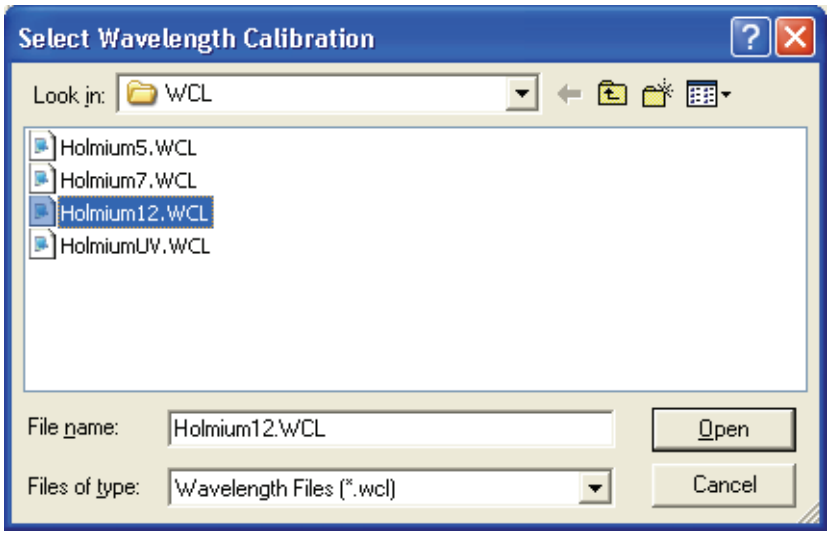

Figure 30. Select Wavelength Calibration dialog box

c. Click **Open**.

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

The holmium oxide bands of the selected file appear in the Wavelength File area as shown in Figure 31.

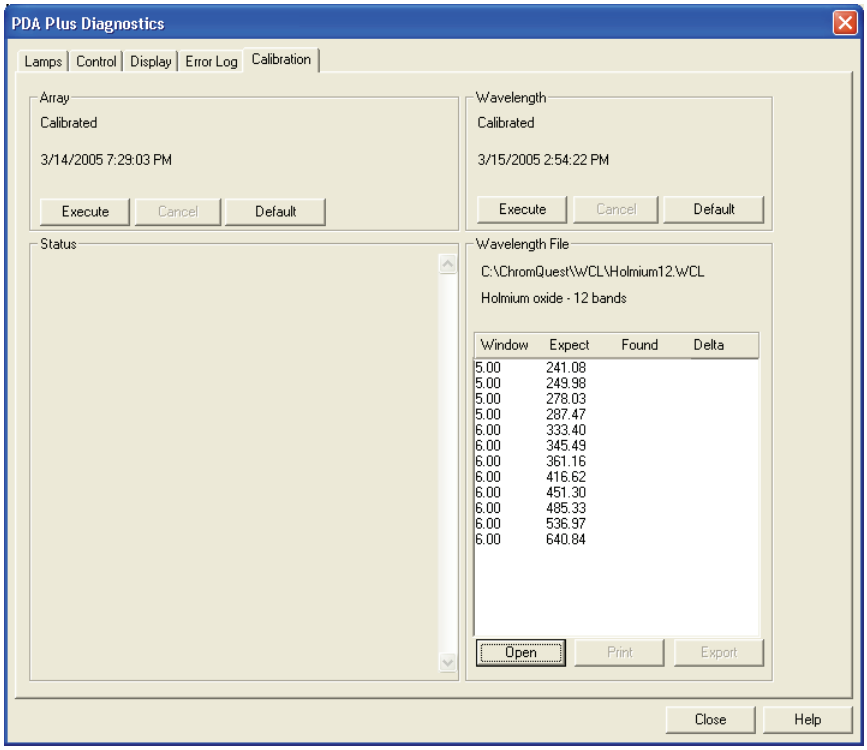

Figure 31. Diagnostics dialog box - Calibration page, showing the Holmium12 Wavelength Calibration File selected

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

   The dialog box shown in Figure 32 appears to remind you of the required preconditions.

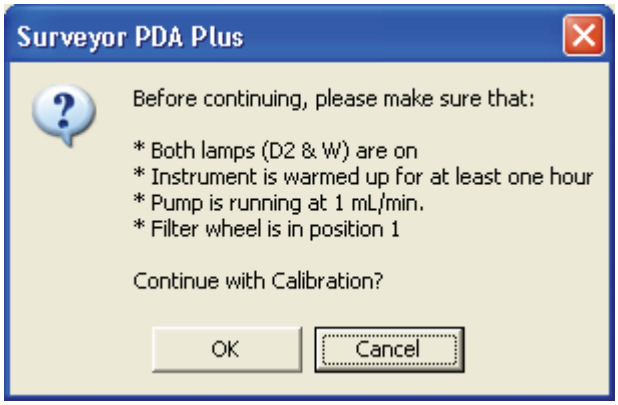

Figure 32. Calibration Preconditions

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

   ChromQuest collects a background spectrum, which it uses to remove the absorbance contribution of the mobile phase. When the background collection is complete, the dialog box shown in Figure 33 appears.

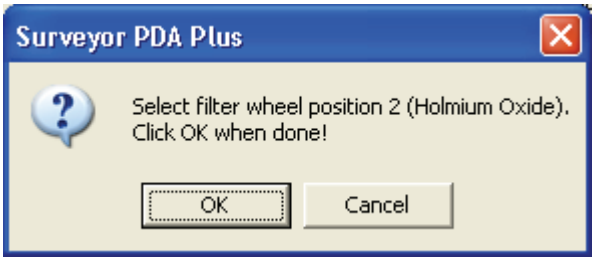

Figure 33. Message reminding you to move the filter wheel to position 2

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

   The detector takes a holmium oxide scan, performs iterative calculations while applying the rise time and bandwidth filters, and then displays a new message box. See Figure 34.

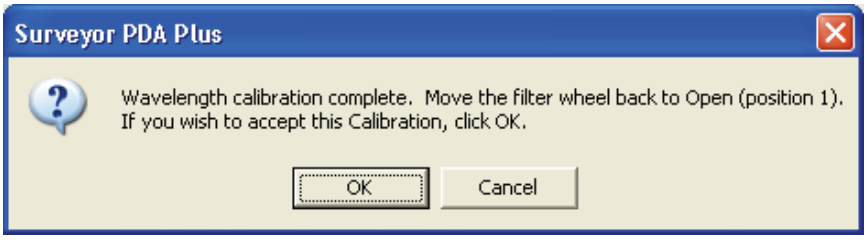

Figure 34. Calibration message reminding you to return the filter wheel to position 1

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

8. In the **Wavelength File** area, check the Delta values. See Figure 35.

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

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

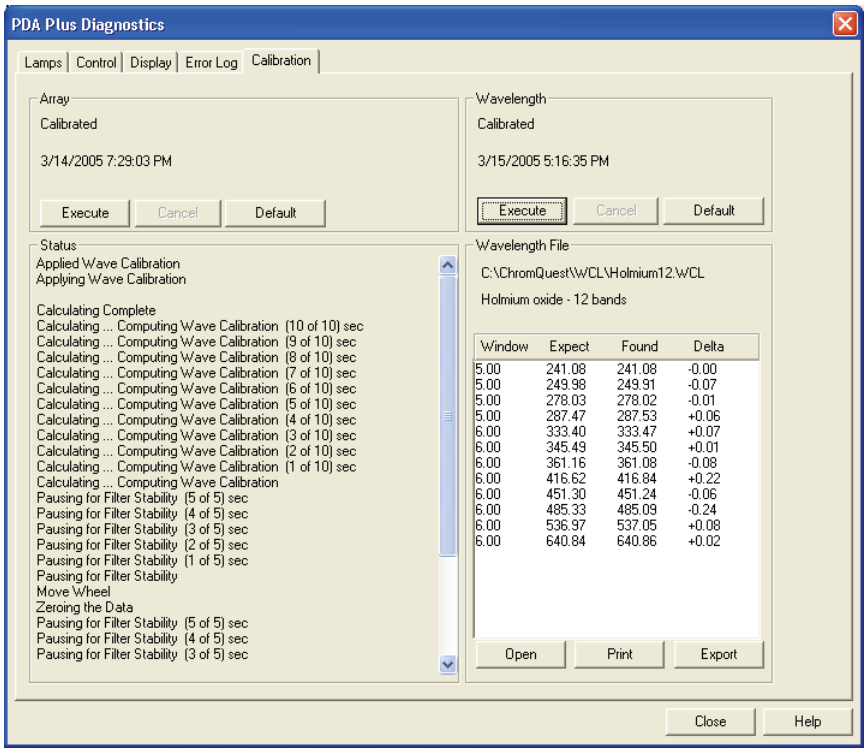

Figure 35. Diagnostics dialog box - Calibration page, showing acceptable Delta values

9. If your data system computer is connected to a printer, click **Print** to print a hardcopy report. To store the results, click **Export**.

The date and time of the wavelength calibration appear in the Wavelength area. This information is also stored by the PDA detector.

Note You can click **Cancel** in any of the Calibration dialog boxes at any time to abort the calibration process.

Performing an Array Calibration

The function of the array calibration is to measure and correct for the dark current produced by the diodes of the photodiode array. The dark current is the small amount of background signal that is produced by the diodes of the array even when both lamps are turned off. Typical dark current values range from 1500 to 3000 counts.

Because the environmental conditions of your laboratory can cause the dark current of the diode array to increase over time, Thermo Electron recommends that you perform an array calibration (dark current) after 100 hours of use or monthly, whichever comes first; whenever a significant temperature change occurs; after you move the detector; after you replace the lamps; and after you download a new firmware file.

Because the dark current produced by the diodes rises as the temperature within the detector rises, it is important to warm up the lamps for 1 hour before you perform a dark current calibration. Warming up the lamps for 1 hour allows the detector to equilibrate to its normal operating temperature.

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

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

To perform a dark current calibration of the diode array

1. Pump HPLC grade water or methanol at 1 mL/min through the flow cell for at least one hour.

2. Place the filter wheel of the Surveyor PDA Plus Detector in position 1 (Open).

3. Turn on both lamps and wait one hour for the D_2 lamp to equilibrate:

   a. In the menu bar of the online **Instrument** window, choose **Control > Instrument Status** to open the Instrument Status window.

   b. Click the **Surveyor PDA Plus** tab to open the Surveyor PDA Plus page. See Figure 28.

   c. Click the D2 (deuterium) Lamp **On** button and the W (tungsten) Lamp **On** button.

Equilibrating the lamps for one hour allows the detector to reach its normal operating temperature.

4. Click **Diagnostics** to open the Surveyor PDA Plus Diagnostics dialog box. Then click the **Calibration** tab to display the Calibration page. See Figure 31 on page 43.

5. In the **Array** area, click **Execute**.

   A message box opens to remind you of the necessary preconditions. See Figure 36.

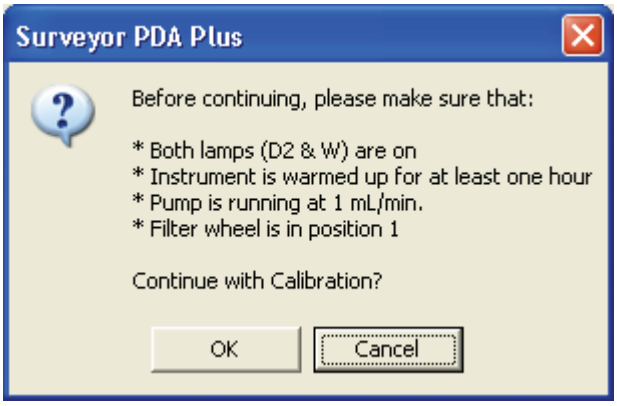

Figure 36. Calibration preconditions dialog box

6. If the preconditions have been met, click **OK**.

   The status of the calibration procedure appears by the Status readback area on the Calibration page. During the dark current calibration, ChromQuest turns the lamps off before collecting the intensity scans. After ChromQuest completes the last event, it turns the lamps back On.

7. Click **OK** to finish the calibration.

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

Displaying, Printing, and Clearing the Error Log

Detector errors and major detector events, such as power-on self-tests (POSTs), are logged to a dedicated area in the memory of the detector. The log can hold 100 errors/events. When the log is full, the next entry replaces the first entry. Therefore, Thermo Electron Corporation recommends 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 backup when the detector is turned Off. View, print and clear the log weekly as part of your regular maintenance routine. A list of error messages that can be displayed in the event log along with suggested solutions is compiled in "Log Entries" on page 121.

Use the Error Log page in ChromQuest, shown in Figure 37, to retrieve, view, print, and clear the event log for the detector. The event log collects messages regarding major events and errors occurring in the detector. These messages are created as part of the normal operation of the detector and can be helpful when attempting to troubleshoot communications problems.

To display, print, and clear the Error Log

1. Open the Error Log page in ChromQuest:

   a. From the Windows XP taskbar, choose **Start > All Programs > Chromatography > ChromQuest** to open ChromQuest.

      The Main Menu window appears.

   b. In the **Main Menu** window, double-click the icon for your instrument to display its Instrument window.

   c. Choose **Control > Instrument Status** to display the Instrument Status window.

   d. In the **Instrument Status** window, click the **Surveyor PDA Plus** tab to open the Surveyor PDA Plus Instrument Status page.

   e. Click **Diagnostics** to open the Surveyor PDA Plus Diagnostics dialog box.

   f. Click the **Error Log** tab to display the Error Log page.

      Note When you first open the Error Log page, the Event area might be blank.

2. Click **Get** to retrieve and display the error log information from the detector. Figure 37 shows a sample Error Log.

3. Click **Print** to print a copy of the displayed log.

4. Click **Clear Log** to clear the log.

   For a list of some common error messages that might appear in the log, see “Log Entries” on page 121.

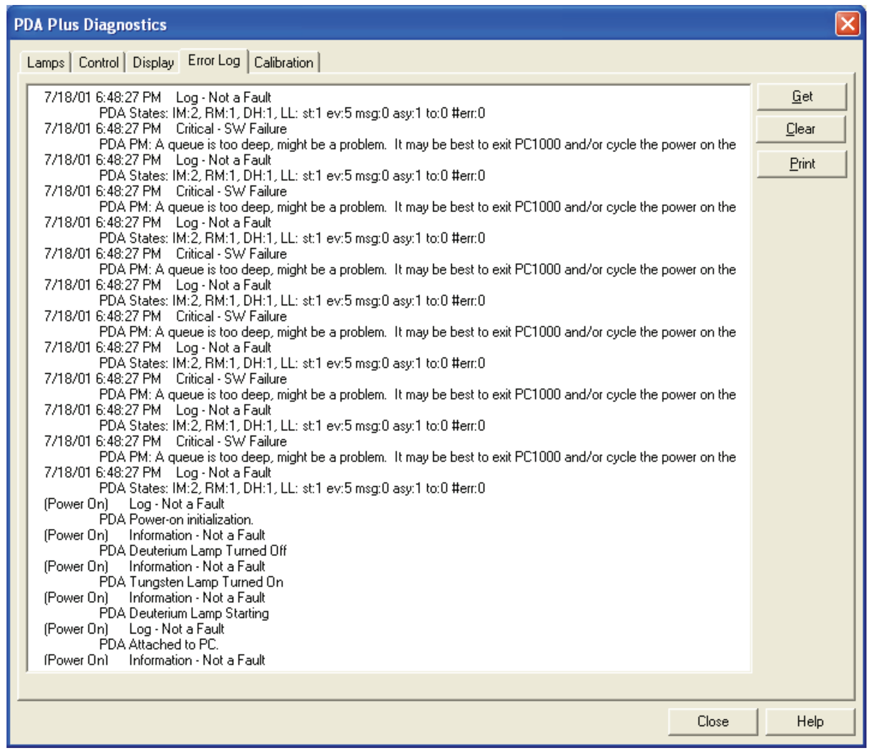

Figure 37. PDA Plus Diagnostics dialog box, showing the Error Log page

Verifying Operational Performance

If you move your PDA detector, replace lamps, or install a new flow cell, the system performance might change. Verify that the detector is running as desired by performing the following procedures:

- Verifying the Performance of the Detector
- Recording the Performance of the Lamps

Verifying the Performance of the Detector

To verify the proper operation of the detector from ChromQuest

1. Open the Instrument window for your LC system:
   a. From the Windows XP taskbar, choose **Start > All Programs > Chromatography > ChromQuest.** The Main Menu window of ChromQuest appears.
   b. In the **Main Menu** window, double-click the icon for your LC system to open the Instrument window.
2. Create and download a method that pumps 100% HPLC-grade methanol or HPLC-grade water at a constant flow rate of 1 mL/min.
3. Check the status of the lamps:
   a. On the menu bar, choose **Control > Instrument Status** to display the Instrument Status window.
   b. In the **Instrument Status** window, click the **Surveyor PDA Plus** tab to display the Surveyor PDA Instrument Status page.
   c. Click **Diagnostics** to open the Surveyor PDA Plus Diagnostics dialog box.
   d. In the **Diagnostics** dialog box, click the **Lamps** tab to display the lamps page. Note the status and usage for each lamp.
   e. If they are not already On, turn On the deuterium (D_2) and tungsten (W) lamps. Wait for 1 hour for both lamps to equilibrate.
4. Perform a dark current calibration, and then perform a wavelength calibration. Use the wavelength calibration file appropriate for your normal operation. Do not forget to apply the results by clicking **Apply.**
5. View an intensity scan of the deuterium (D_2) lamp:
   a. Click the **Lamps** tab to display the Lamps page.
   b. If the tungsten lamp is not off, turn it off.

c. Click the **Control** tab to display the Control page.

d. Click the **Intensity** option in the **Mode** area to set the units to intensity.

e. Click **Default**.

f. In the **Discrete Channels** area, set Channels A, B, and C to monitor diodes 35, 52, and 77 respectively. See Figure 38.

Note These diodes roughly correspond to the wavelengths of 230 nm, 250 nm, and 280 nm, respectively. The Discrete Channels area on the Display page contains a digital readout for the selected diodes. See Figure 39. Record these readout values to track the performance of the deuterium lamp. You can also use other diode values to track the performance of the deuterium lamp.

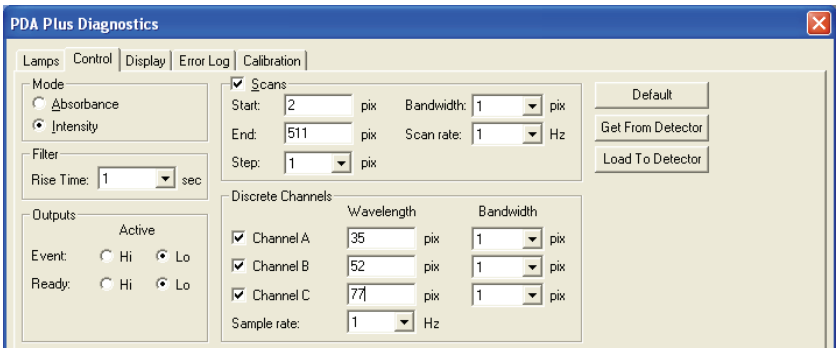

Figure 38. PDA Plus Diagnostics dialog box - Control page, showing discrete channels settings

g. Click **Load To Detector**. A dialog box containing the message Method Has Been Downloaded appears. Click **OK**.

h. Click the **Display** tab to open the Display page, and then click **Start** in the **Data** area to refresh the display. See Figure 39.

i. Save a printout or an electronic copy of the spectrum. Date the printout and add it to your maintenance records. To monitor any degradation in light intensity, compare this scan with similar scans that you obtain in the future See "Recording the Performance of the Lamps" on page 54.

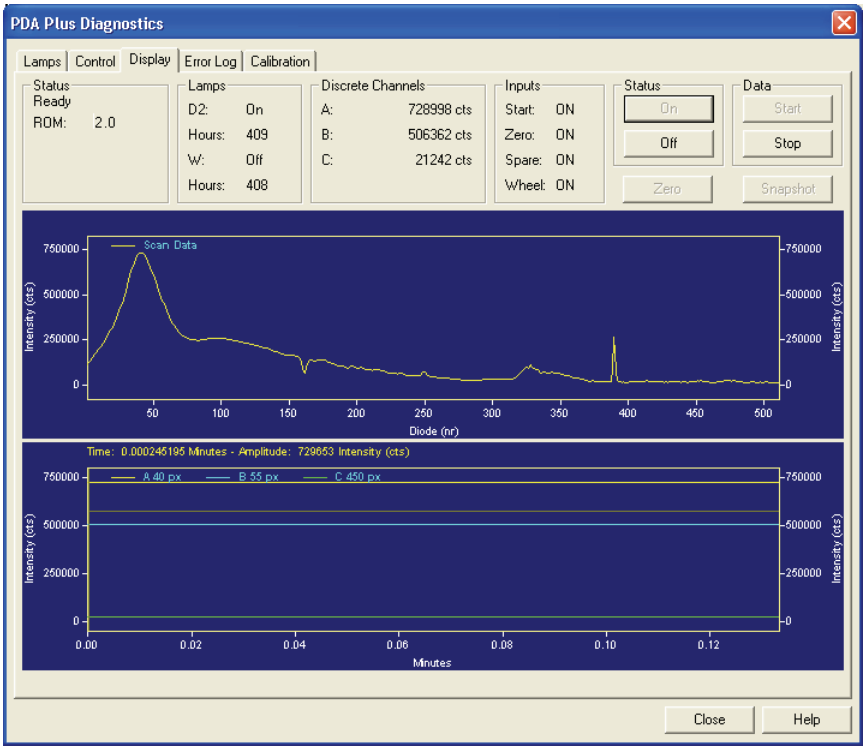

Figure 39. PDA Plus Diagnostics dialog box - Display page, showing an intensity scan with the deuterium lamp

6. View an intensity scan of the deuterium (D_2) and tungsten (W) lamps together:

   a. Open the Lamps page and turn on the tungsten (W) lamp. Leave the deuterium (D_2) lamp On.

   b. Return to the Control page and change the Discrete Channels settings to monitor diodes 94, 177, and 260.

   c. Click **Load To Detector**. A dialog box containing the message Method Has Been Downloaded appears. Click **OK**.

   Note These diodes roughly correspond to the wavelengths of 300 nm, 400 nm, and 500 nm, respectively. The Discrete Channels area on the Display page contains a digital readout for the selected diodes (Figure 39). Record these readout values to track the performance of both lamps.

   d. Open the Display page and click **Start** to refresh the display. See Figure 40.

e. Save a printout or an electronic copy of the spectrum. Date the printout and add it to your maintenance records. See "Recording the Performance of the Lamps" on page 54.

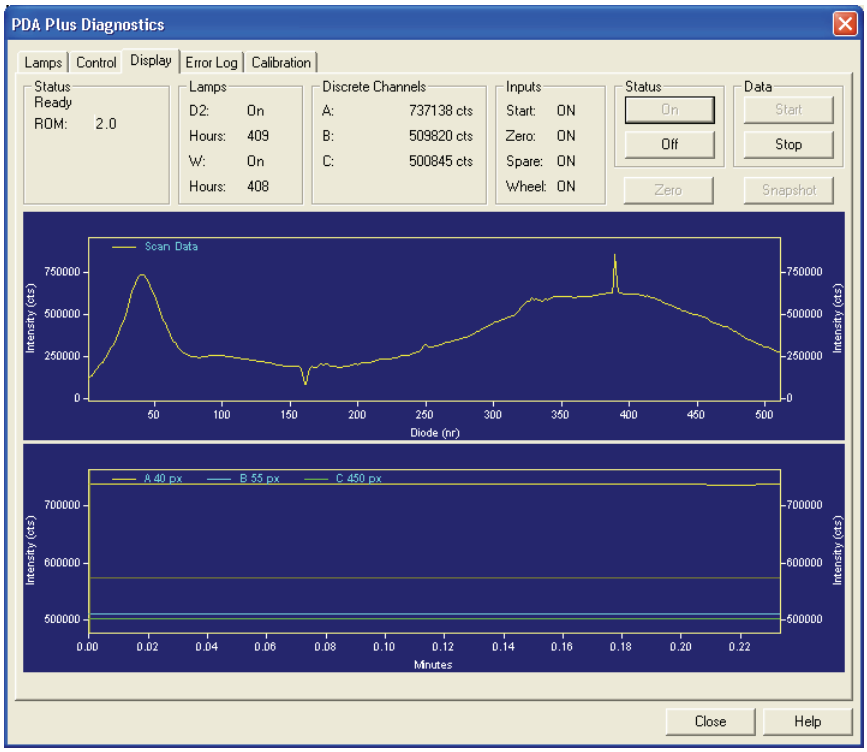

Figure 40. PDA Plus Diagnostics dialog box – Display page, showing an intensity scan with both lamps

7. View an intensity scan of the tungsten (W) lamp:

   a. In the **Lamps** page, turn Off the deuterium (D_2) lamp.

   b. Return to the Control page and change the Discrete Channels settings to monitor diodes 219, 302, and 427.

   c. Click **Load To Detector**. A dialog box containing the following message "Method Has Been Downloaded" appears. Click **OK**.

> **Note** These diodes roughly correspond to the wavelengths of 450 nm, 550 nm, and 699 nm, respectively. The Discrete Channels area on the Display page contains a digital readout for the selected diodes. See Figure 39. Record these readout values to track the performance of the tungsten lamp. You can also use other diode values to track the performance of the Tungsten lamp.

d. Open the Display page and click **Start** to refresh the display.

e. As with the D_2 and combined lamp spectra, save a copy of the scan for your maintenance records. See Figure 41.

8. Turn on the deuterium lamp again and allow sufficient warm-up time before you begin acquiring data.

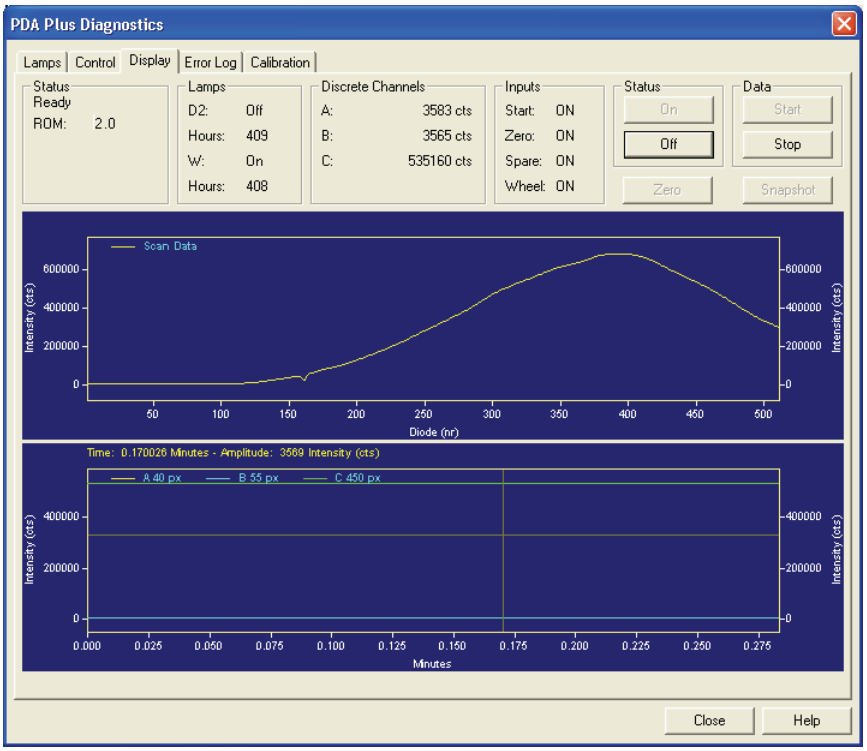

Figure 41. PDA Plus Diagnostics dialog box - Display page, showing an intensity scan with just the tungsten lamp

Recording the Performance of the Lamps

The following procedures allow you to record the spectrum data on the Display page:

- Using the Print Screen Button
- Using the Print Utility
- Taking a Snapshot

Using the Print Screen Button

To store the spectral data using the print screen button

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

Using the Print Utility

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

To use the print utility

1. In the **Display** page, place the cursor in the Spectrum window.
2. Right-click to open the shortcut menu.
3. Choose **Utilities > Print**.

Taking a Snapshot

Use the snapshot option to create a Microsoft Excel Comma Separated Values file that contains information about the spectrum in the Display page. This file, which is overwritten each time you click the Snapshot button, is stored in the ChromQuest directory and is named WaveData.csv. The file contains three columns: diode number, wavelength, and intensity value.

To take a snapshot and store its information

1. In the Display page, stop the data stream by clicking **Stop** in the **Data** area.
2. Click **Snapshot**.
3. Using Explorer, browse to the ChromQuest directory.
4. Click the *WaveData.csv* file. Microsoft Excel opens.
5. In Microsoft Excel, save the file with an appropriate name.

Controlling the Lamps with ChromQuest

As lamps age, they emit less light, which results in increased baseline noise. If the noise level of your detector signal is unacceptable, and cleaning the flow cell does not help, use the diagnostic features of the software to determine the cause of the problem. If light output becomes too low and adjusting the attenuators as described in "Adjusting the Light Output from the Lamps" on page 58 does not help, replace the lamps. See Chapter 6, "Routine Maintenance."

The detector keeps track of the number of hours each lamp has been operating. The deuterium lamp has a lifetime of approximately 1000 hours and the tungsten lamp has a lifetime of approximately 2500 hours. Lamp lifetime varies depending upon the application.

In ChromQuest, the lamp controls are in the Lamps page of the PDA Plus Diagnostics.

To open the Lamps page in ChromQuest

1. From the Windows XP taskbar, choose **Start > All Programs > Chromatography > ChromQuest** to open ChromQuest
2. In the **Main Menu** window, double-click your instrument icon to open the Instrument window.
3. In the menu bar of the Instrument window, choose **Control > Instrument Status** to open the Instrument status window.
4. In the **Instrument Status** window, click the **Surveyor PDA Plus** tab to open the Surveyor PDA Plus Instrument Status page.
5. Click **Diagnostics** to open the Surveyor PDA Plus Diagnostics dialog box.
6. Click the **Lamps** tab to open the Lamps page, and then note the status and usage of each lamp. See Figure 42.

Note Avoid indiscriminately pressing either Reset button. They should be pressed only after their associated lamp has been replaced with a new one.

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 h for the lamp to stabilize after a cold start before collecting data in the spectral range of the deuterium lamp.

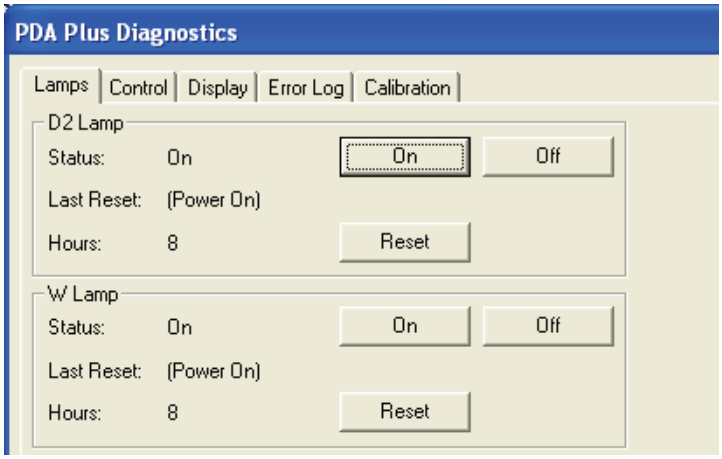

Figure 42. PDA Plus Diagnostics dialog box – Lamps page

The Lamps page in ChromQuest is used for lamp maintenance and control. Three direct control buttons for each lamp are available on this page: On, Off, and Reset.

To use the lamp controls

- Click **On** to ignite the deuterium lamp. The Status readback reads *Starting* during the 10 second ignition period, and then it changes to *On*. If there is a problem with the lamp, its Status readback will read *Failed*.
- Click **On** to turn on the tungsten lamp. The tungsten lamp turns on immediately. If there is a problem with the lamp, its Status readback will read *Failed*.
- Click **Reset** to reset the stored total run time for the associated lamp to zero and update the Last Reset readback to the current date and time. After you replace a lamp, reset its lamp usage hours to zero.

Adjusting the Light Output from the Lamps

The Surveyor PDA Plus Detector has two attenuators that control the light output from the lamps. During the lifetime of the Surveyor PDA Plus Detector it might be necessary to adjust the attenuators to increase or decrease the amount of light falling onto the array.

Decreasing light output increases baseline noise. Increasing light output can cause saturation of the diode array. If the array is saturated the response from the Surveyor PDA Plus Detector will be a flat baseline.

The attenuators require adjustment when either lamp is replaced or when the flow cell is replaced. When any of these items are replaced, check the light intensity by following the Operational Verification procedure and adjust the attenuators to provide light intensities in the specified operating ranges.

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

To adjust the light output from the lamps, perform the following procedures in the order listed:

1. Setting the Spectral Display
2. Determining the Diode of Maximum Intensity for the UV Range
3. Determining the Diode of Maximum Intensity for the Visible Range
4. Setting the Discrete Channel Displays
5. Accessing the Attenuators
6. Adjusting the Attenuators

Setting the Spectral Display

To set up the spectral display

1. To open the Diagnostics dialog box for the Surveyor PDA Plus Detector:
   a. From the Windows XP taskbar, choose **Start > All Programs > Chromatography > ChromQuest** to open ChromQuest.
   b. In the ChromQuest Main Menu, double-click the icon for your instrument to display the Instrument window.

c. From the menu bar, choose **Control > Instrument Status** to display the Instrument Status window.

d. In the **Instrument Status** window, click the **Surveyor PDA Plus** tab to open the Surveyor PDA Plus Instrument Status page.

e. Click **Diagnostics** to open the Surveyor PDA Plus Diagnostics dialog box.

2. To turn both lamps on:

a. In the **Diagnostics** dialog box, click the **Lamp**s tab to open the Lamps page.

b. Note the usage hours for each lamp.

c. Verify that both lamps are On. If they are not On, click **On** for both lamps.

3. To set the parameters for the spectral display:

a. Click the **Control** tab to open the Control page. See Figure 38 on page 51.

b. In the **Mode** area, click the **Intensity** option.

c. Click **Default**, and then verify that the following parameters are specified:

Start = 2

End = 511

Step = 1

Bandwidth = 1

Scan rate = 1

d. Click **Load To Detector**.

Determining the Diode of Maximum Intensity for the UV Range

To determine the diode of maximum intensity for the UV Range

1. Click the **Display** tab to open the Display page.

2. Click **Start,** which is located in the upper right corner of the Display page.

3. Right-click in the top pane, which displays the intensity spectrum, to open the shortcut menu.

4. From the shortcut menu, choose **Axis Setup** to open the Axis Properties dialog box. See Figure 43.

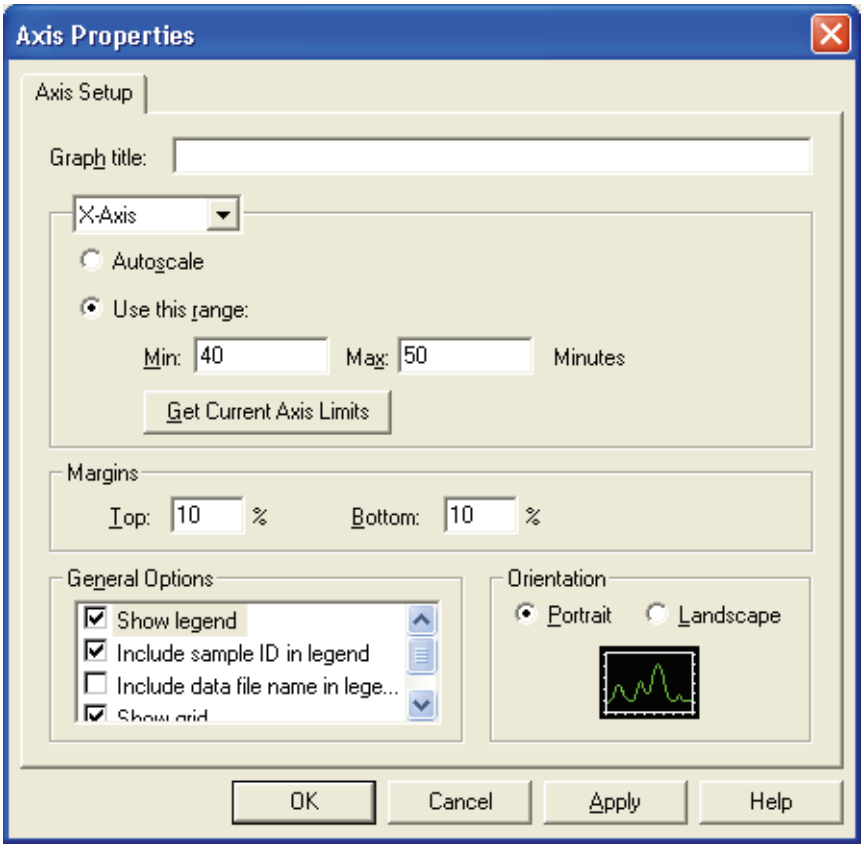

Figure 43. Axis Properties dialog box

5. In the **Axis Properties** dialog box, do the following:

   a. Select **X-axis** from the list

   b. Click the **Use This Range** option.

   c. In the **Min** box, type **30**.

   d. In the **Max** box, type **50**.

   e. Click **OK** to close the dialog box and to update the scaling of the Spectrum view.

6. From the spectrum displayed, determine and record the pixel of maximum intensity within the 30 to 50 diode range. This is the diode of maximum output for the deuterium lamp.

Determining the Diode of Maximum Intensity for the Visible Range

To determine the diode of maximum intensity for the visible range

1. Open the Axis Setup dialog box.
2. In the **Axis Properties** dialog box, do the following:
   a. In the **Min** box, type **400**.
   b. In the **Max** box, type **500**.
   c. Click **OK** to close the dialog box and to update the scaling of the Spectrum view.
3. From the spectrum displayed, determine and record the pixel of maximum intensity within the 400 to 500 diode range. This is the diode of maximum output for the tungsten lamp.

Setting the Discrete Channel Displays

To set the discrete channel displays

1. Turn off the data stream by clicking on **Off** for Status and **Stop** for Data.
2. Set the discrete channel displays as follows:
   a. Return to the Control page.
   b. In the **Channel A** box, type the value for the diode of maximum intensity for the deuterium lamp.
   c. In the **Channel C** box, type the value for the diode of maximum intensity for the tungsten lamp.
   d. Click **Load to Detector**.

Accessing the Attenuators

The controls for the attenuators are located on the front panel of the detector behind the flow cell cover.

To access the attenuators

1. Open the front doors of the detector.
2. Unscrew the captive screw, and then remove the flow cell cover. See Figure 13 on page 21.

The attenuators are located on the right side of the front panel. There are two black tabs attached to the attenuators for manual adjustments. See Figure 44.

The left tab is the deuterium lamp attenuator and the right tab is the tungsten lamp attenuator. Pushing the attenuator tab up increases light output and pulling the tab down decreases light output.

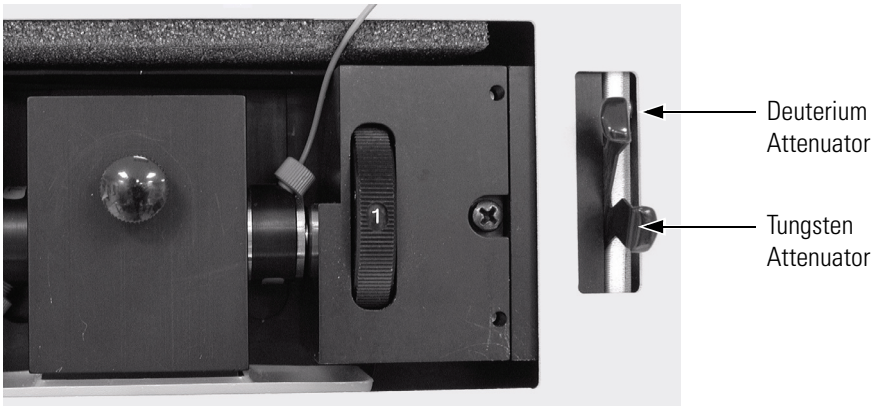

Figure 44. Front view of the detector, showing the attenuators

Adjusting the Attenuators

To adjust the attenuators

1. Return to the Display page.
2. Adjust the attenuator with the left tab on the PDA (UV attenuation) to achieve a Channel A value of between 750000 and 775,000 intensity counts.
3. Adjust the attenuator with the right tab (Visible attenuation) to achieve a Channel C value of between 750000 and 775000 intensity counts.
4. After you finish adjusting the attenuators, replace the flow cell access cover and close the front doors of the detector.

Checking the Firmware Version

Occasionally, upgraded firmware becomes available for the Surveyor PDA Plus Detector. Ask your Thermo Electron Service Representative about the availability of new firmware. If it is necessary to update the firmware, see Appendix A, "Firmware."

In ChromQuest, you can view the current firmware version for the detector in the Surveyor PDA Plus Diagnostics – Display page.

To open the Display page

1. On the menu bar in the Main Menu window, choose **Control > Instrument Status**.
2. Click the **Surveyor PDA Plus** tab to open the Surveyor PDA Plus Instrument Status window.
3. In the **Instrument Status** window, click **Diagnostics** to open the PDA Plus Diagnostics dialog box.
4. In the **PDA Plus Diagnostics** dialog box, click the **Display** tab to show the Display page. See Figure 45.
5. In the **Display** page, click **On** to display the firmware version in the Status area.

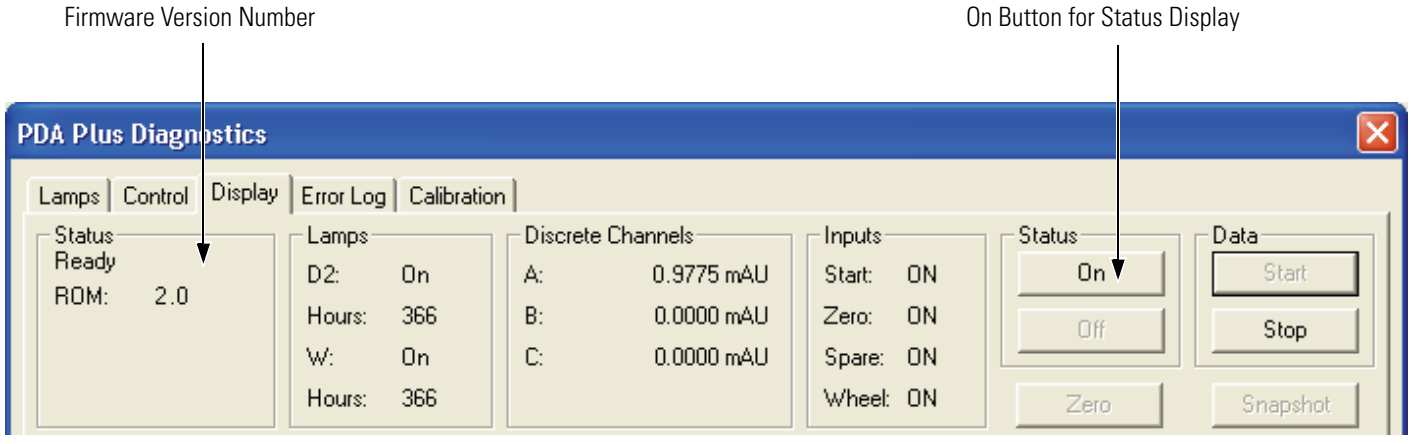

Figure 45. PDA Plus Diagnostics dialog box - Display page, showing the firmware version numbers

Chapter 5 Diagnostics for Xcalibur Users

The diagnostics program lets you check the operation of the Surveyor PDA Plus Detector, calibrate the detector, and view the event log. To perform diagnostics from Xcalibur, your detector must be connected to the data system computer, configured as part of an instrument in the ChromQuest Enterprise, and powered On. For information on configuring your Surveyor PDA Plus Detector, see "Configuring an Instrument in Xcalibur" on page 37.

This chapter contains the following sections:

Calibrating the Detector with Xcalibur

To calibrate your Surveyor PDA Plus detector from the Xcalibur data system, perform the following procedures:

- Performing a Wavelength Calibration
- Performing a Dark Current Calibration

Performing a Wavelength Calibration

The alignment of the spectrum on the diode array is dependent upon the physical alignment of various components of the optical bench. The alignment can become offset if the detector is sharply jolted, for example, in shipping. Such bumps and jars can slightly change the wavelength of light reaching the photodiode array. The automated wavelength calibration determines the wavelength accuracy of the detector and uses the detector's wavelength algorithm to correct for any misalignment.

To perform a wavelength calibration with Xcalibur

1. Pump HPLC-grade methanol at 1 mL/min through the flow cell:
2. Turn On both lamps and wait one hour for the lamps to equilibrate:
   a. From the Instrument Setup window, click the Surveyor PDA Plus button in the View Bar to open the Surveyor PDA Plus Instrument Setup window.
   b. On the menu bar of the Surveyor PDA Plus Instrument Setup window, choose **Surveyor PDA Plus > Direct Control** to open the Surveyor PDA Plus Direct Control dialog box.
   c. Click the **Configuration** tab to open the Configuration page.
   d. In the **Deuterium Lamp** area of the Configuration page, turn on the deuterium lamp by clicking **Lamp On**.
   e. In the **Tungsten Lamp** area of the Configuration page, turn on the tungsten lamp by clicking **Lamp On**.
3. After the detector has reached a stable temperature (approx. one hour after you turn on the lamps), start the Wavelength Calibration Wizard and follow the instructions on each page:
   a. Click the **Calibration** tab to open the Calibration page. See Figure 46.

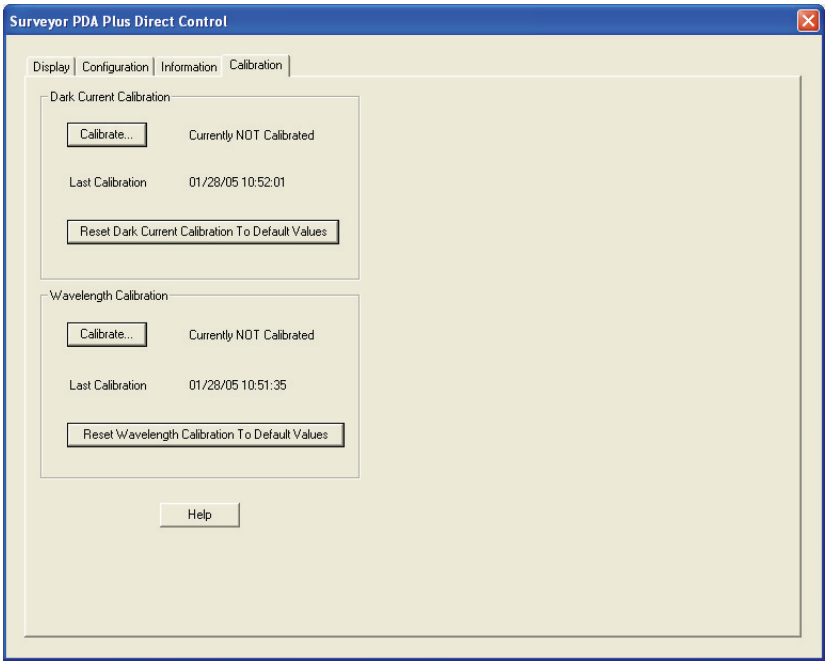

Figure 46. Surveyor PDA Plus Direct Control – Calibration page

b. In the **Wavelength Calibration** area, click **Calibrate** to start the Wavelength Calibration wizard. The Wavelength Calibration wizard contains nine pages.

   The first page of the Wavelength Calibration wizard, the preconditions page appears. See Figure 47.

c. Read the preconditions and verify they have been met:

   - If the preconditions have been met, click **Next** to proceed with the calibration and move on to the second page of the wizard where you will be prompted to choose a wavelength file. See Figure 48.

   - If the preconditions have not been met, click **Cancel** to exit the wizard and prepare the Surveyor PDA Plus detector for calibration.

Note The Cancel buttons on the pages of the Wavelength Calibration Wizard can be pressed at any time a calibration is in process to stop it.

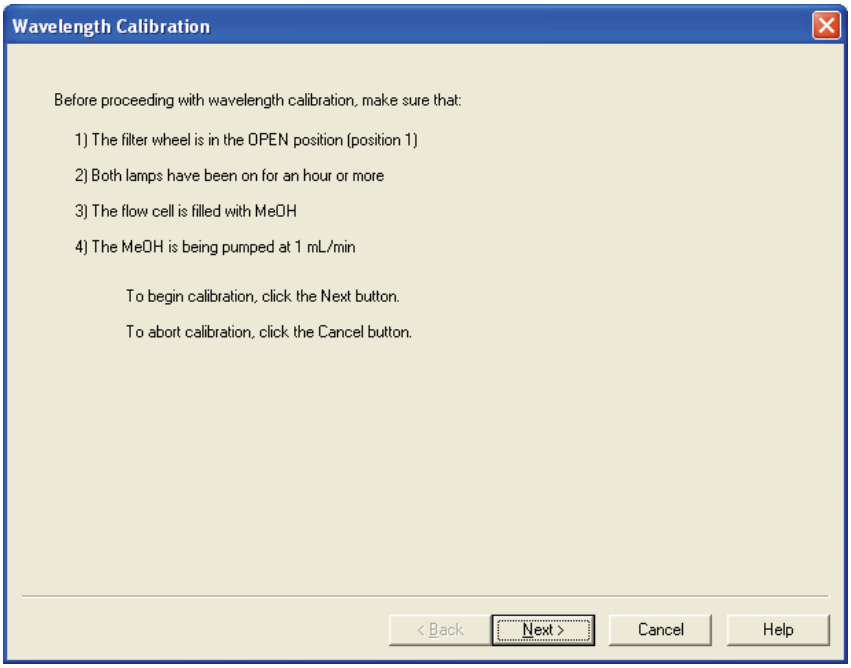

Figure 47. Wavelength Calibration wizard – page one, listing required preconditions

4. In the second page of the Wavelength Calibration wizard (see Figure 48), choose a peak set from the list. The peak set should span the wavelengths you use under normal operation conditions. Then click **Next** to display the Calibration Status page.

   In Figure 48, you can see that the Holmium Oxide 5 peak set has been chosen. This wavelength list instructs the program to calibrate the detector at each of the five wavelengths shown.

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

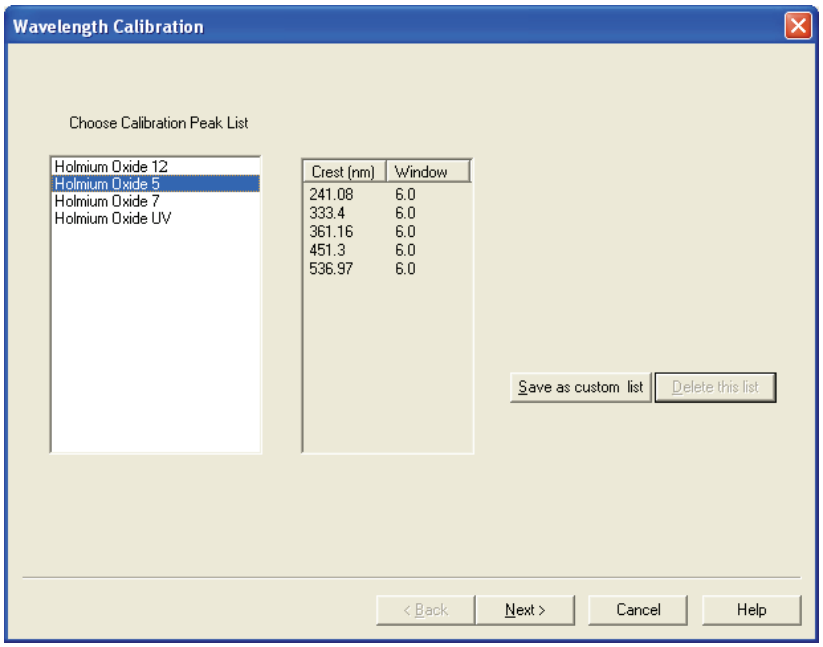

Figure 48. Wavelength Calibration wizard – page two, showing a list of calibration files

5. In the third page of the Wavelength Calibration wizard, do the following:

   a. Observe the status screen that tells you the wavelength file is being downloaded. See Figure 49.

   b. After the "Click the Next button to proceed with calibration" message appears, click **Next** to display the fourth page of the Wavelength Calibration wizard shown in Figure 50.

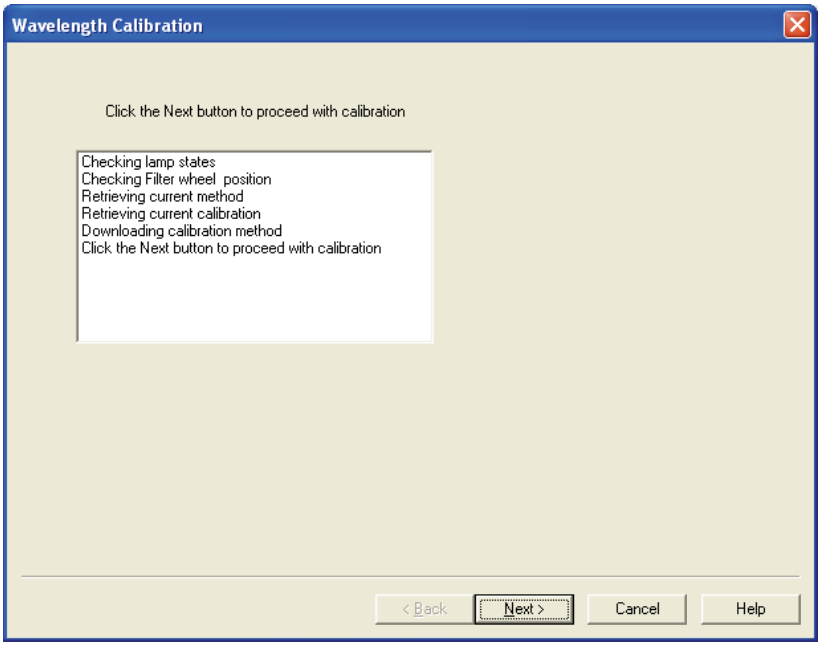

Figure 49. Wavelength Calibration wizard – page three

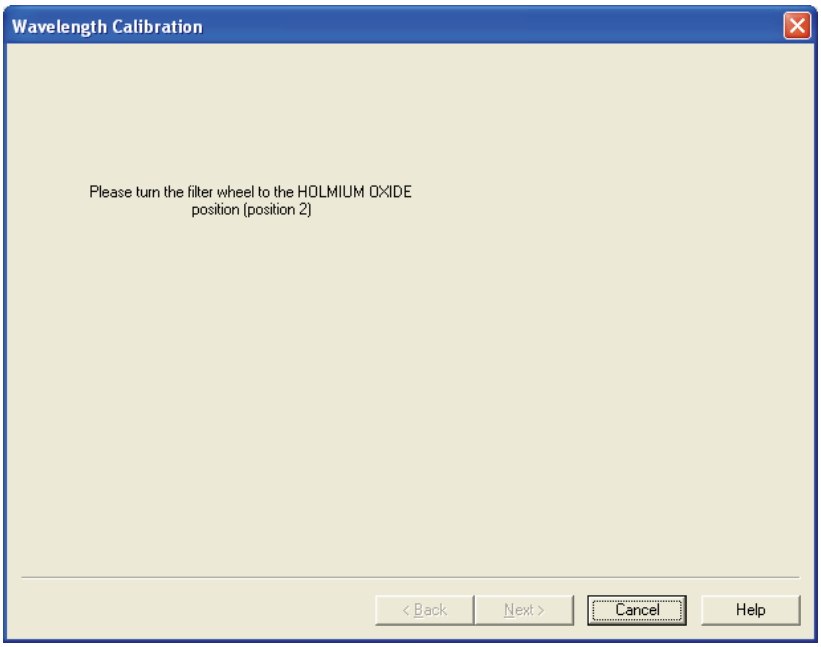

Figure 50. Wavelength Calibration wizard – page four, directing you to turn the filter wheel

6. Rotate the Holmium Oxide filter wheel to position 2 as directed in the fourth page of the Wavelength Calibration wizard. After you turn the wheel, the Next button becomes active. Click **Next** to proceed.

   Note The Next button is unavailable until the filter wheel is in position 2.

7. In the fifth page of the Wavelength Calibration wizard, observe the status screen that tells you the calibration is being performed. See Figure 51. After the "Click the Next button to proceed with calibration" message appears, click **Next** to proceed.

   The diagnostics program waits for a few seconds for the rise time filter to equilibrate and takes a holmium oxide scan.

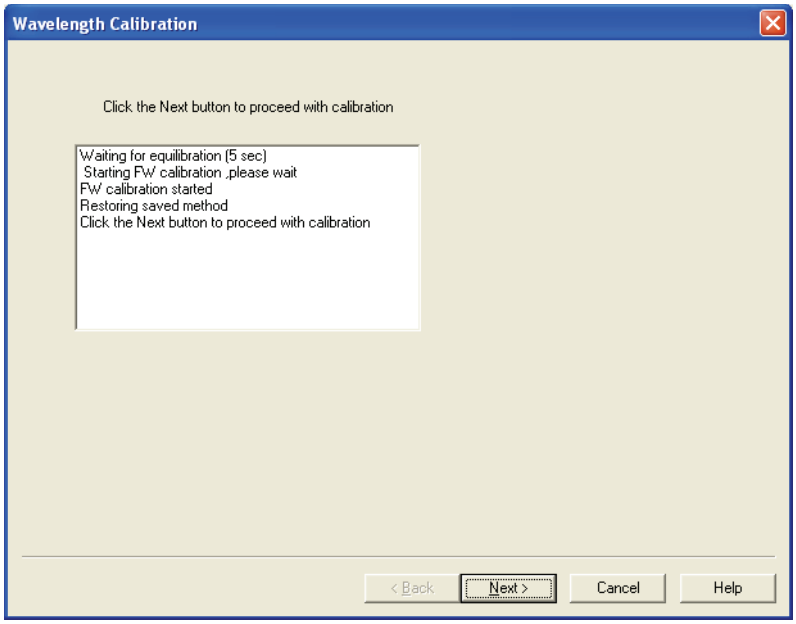

Figure 51. Wavelength Calibration wizard – page five, showing the status of the rise time filter calibration

8. Rotate the wheel back to position 1 (Open) as instructed on the sixth page of the Wavelength Calibration wizard. See Figure 52. After you rotate the wheel, the next button becomes active as shown in Figure 53. Click **Next** to proceed.

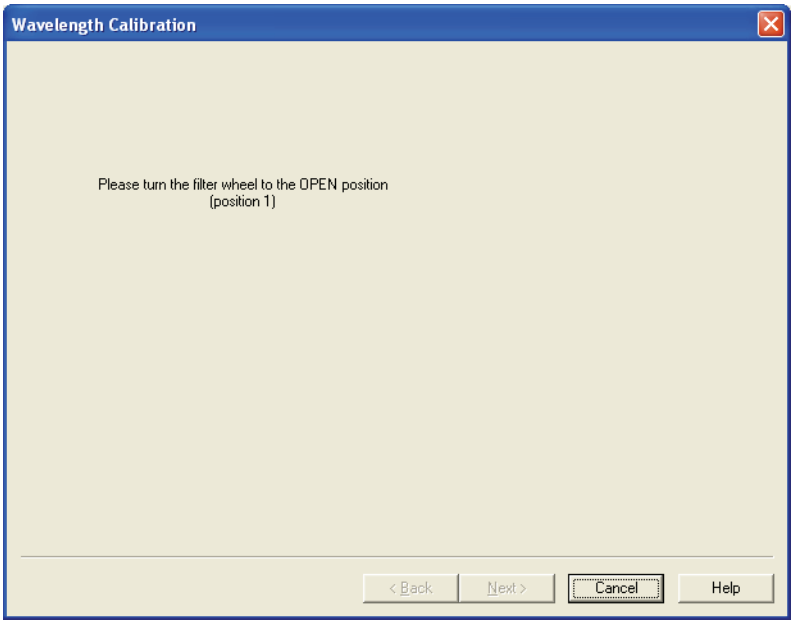

Figure 52. Wavelength Calibration wizard – page six, directing you to turn the Holmium Oxide filter wheel back to position 1

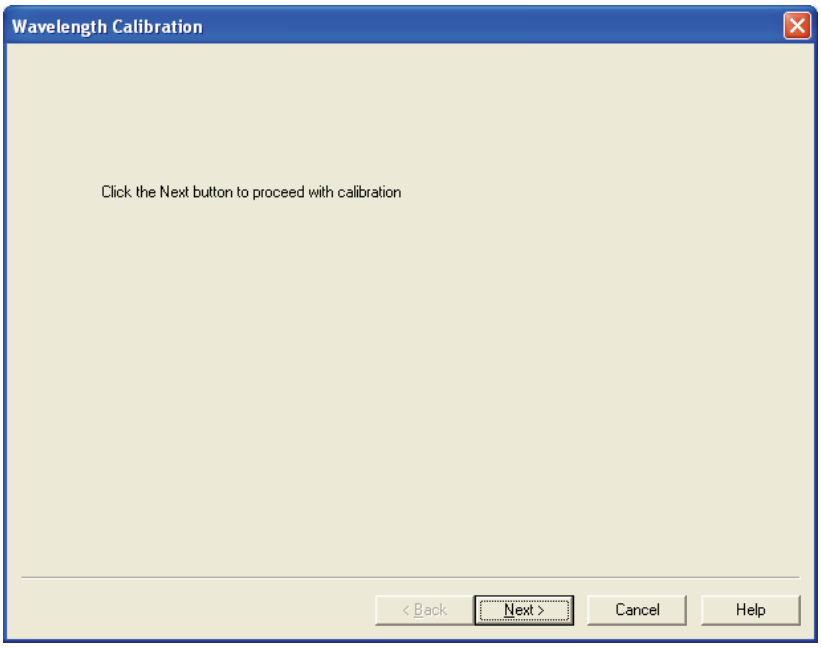

Figure 53. Wavelength Calibration wizard – page six with active next button

9. In the seventh page of the Wavelength Calibration wizard shown in Figure 54 verify that the delta values are within ±1 nm, and then do one of the following:

   - If the Delta values are acceptable, proceed to step 10.
   - If the delta values are not within the range of ±1 nm, do not export the results, and proceed to step 12. Complete the calibration procedure, and then repeat the wavelength calibration. If, after applying a second calibration, the Delta values are still not within the range of ±1 nm, call your Thermo Electron service representative for assistance.

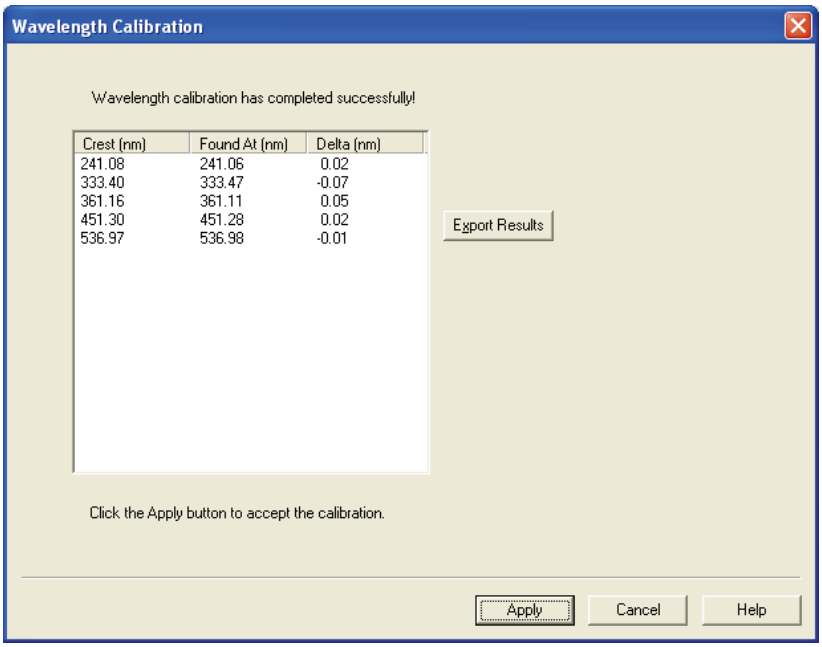

Figure 54. Wavelength Calibration wizard – page seven, showing the Delta values

10. (Optional) Print a report of the calibration results:

    a. Click **Export Results** to print the results to a file.

    The Save As dialog box shown in Figure 55 appears.

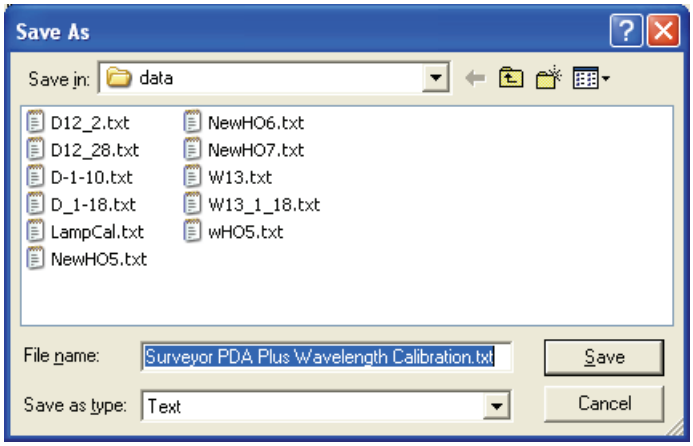

Figure 55. Save As dialog box

b. In the **Save As** dialog box, type a name, and then click **Save**.

Once you have saved the file with a name of your choice, you can view or print the contents of the file using any text editing program. See Figure 56.

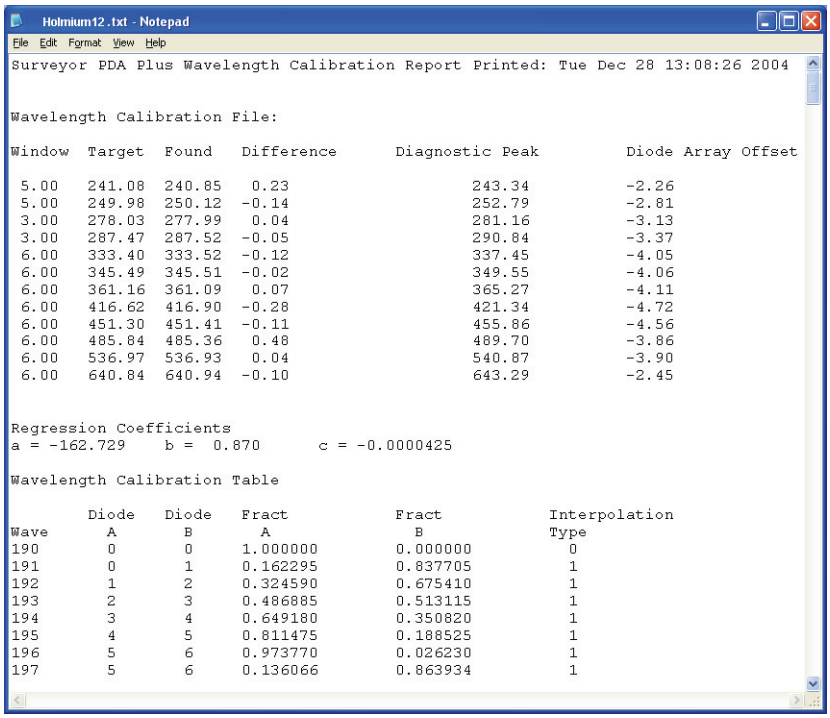

Figure 56. Wavelength Calibration file, viewed in Notepad

11. Click **Apply** in the Delta Values page (see Figure 54) to apply the calibration results to the detector.

    The final page of the Wavelength Calibration wizard appears. See Figure 57.

12. In the eighth and final page of the Wavelength Calibration wizard, click **Finish** to complete the calibration.

    The calibration is saved. The date and time of the calibration appear in the Wavelength Calibration area of the Calibration page. See Figure 46 on page 67.

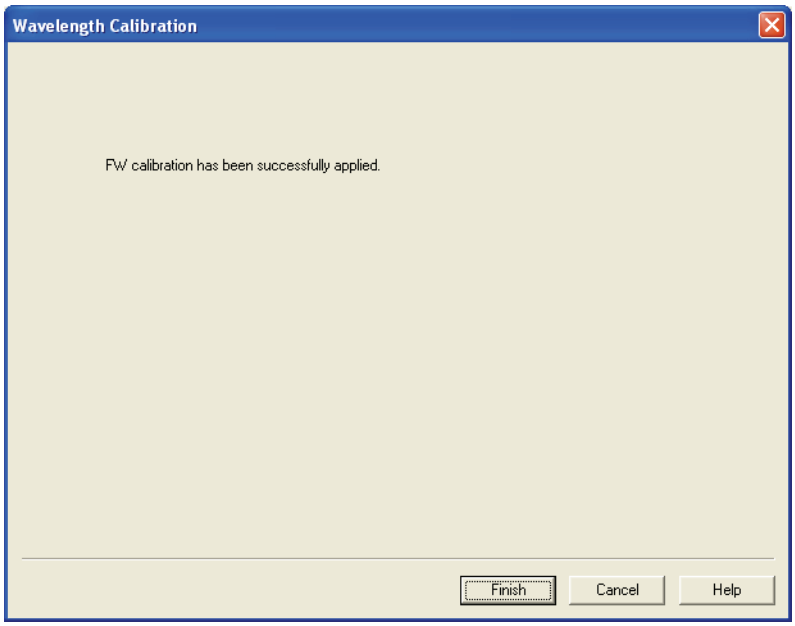

Figure 57. Wavelength Calibration wizard – page eight

Performing a Dark Current Calibration

The function of the array calibration is to measure and correct for the dark current produced by the diodes of the photodiode array. The dark current is the small amount of background signal that is produced by the diodes of the array even when both lamps are turned off. Typical dark current values range from 1500 to 3000 counts.

The environmental conditions of your laboratory can cause the dark current of the diode array to increase over time. Therefore, Thermo Electron recommends that you perform an array calibration (dark current) after any of the following events occurs:

- After 100 hours of use or monthly, whichever comes first
- Whenever a significant temperature change occurs
- After you move the detector
- After you replace the lamp
- After you download a new firmware file

Because the dark current produced by the diodes rises as the temperature within the detector rises, it is important to warm up the lamps for 1 hour before you perform a dark current calibration. Warming up the lamps for 1 hour allows your detector to equilibrate to its normal operating temperature.

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

To perform the dark current calibration

1. Pump methanol through the flow cell at 1 mL/min.
2. Turn On both lamps and wait 1 h for the lamps to equilibrate.
3. On the menu bar of the Surveyor PDA Plus Instrument Setup window, choose **Surveyor PDA Plus > Direct Control**. Then click the **Calibration** tab to open the Calibration page. See Figure 58.

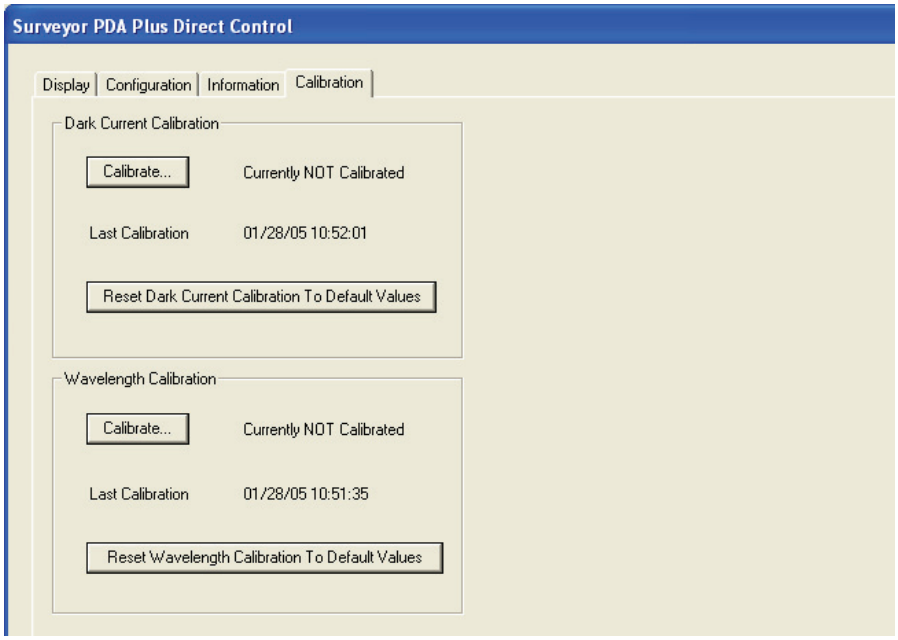

Figure 58. Calibration page, showing that the detector is currently Not calibrated

4. To start the Dark Current Calibration wizard, click **Calibrate** in the **Dark Current Calibration** area.

   The Dark Current Calibration wizard contains four pages. the first page of the Dark Current Calibration wizard, the Preconditions page shown in Figure 59 appears.

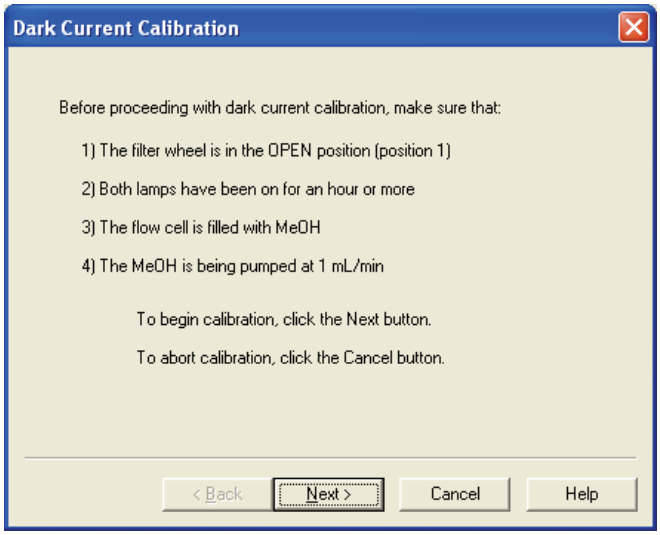

Figure 59. Dark Current Calibration wizard – page one

5. Read the Preconditions page and verify that they have been met:

   - If the preconditions have been met, click **Next** to proceed with the calibration.

   - If the preconditions have not been met, click **Cancel** to exit the wizard. Then prepare the Surveyor PDA Plus Detector for calibration and begin this procedure again.

6. From page two of the Dark Current Calibration wizard, observe the status readback as the calibration proceeds. See Figure 60. After the calibration is complete, click **Next**.

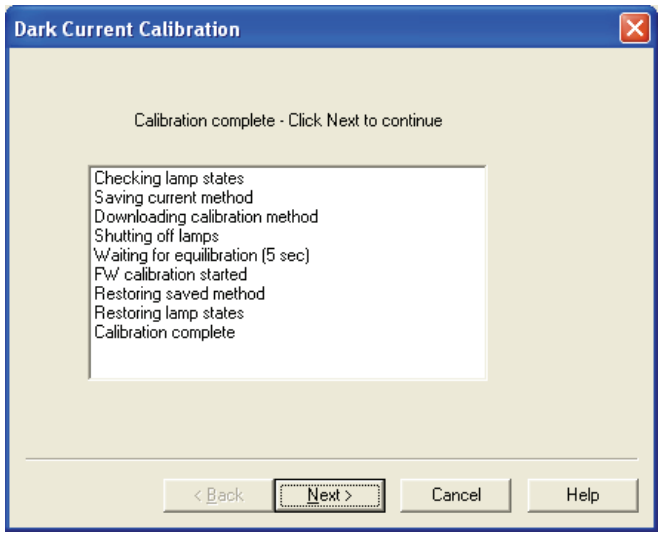

Figure 60. Dark Current Calibration wizard – page two

The third page of the Dark Current Calibration wizard shown in Figure 61 appears. You can export the results of the calibration from this page.

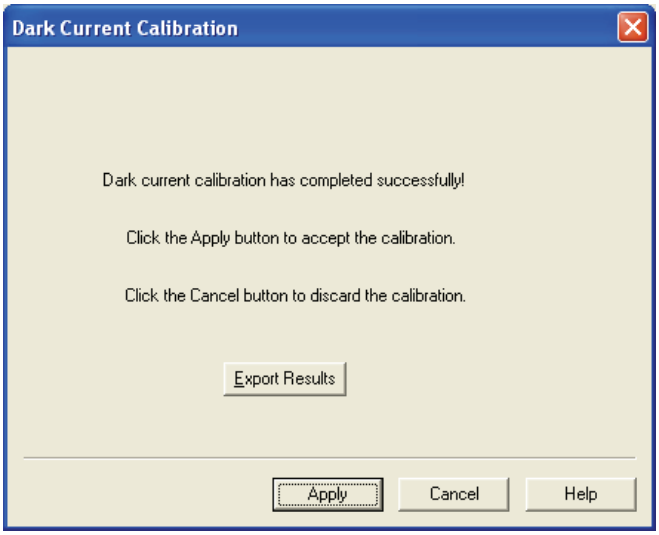

Figure 61. Dark Current Calibration wizard – page three

7. To print a record of the Dark Current calibration:

   a. Click **Export Results**.

      The Save As dialog box shown in Figure 62 appears.

   b. In the **Save As** dialog box, type a name, and then click **Save**.

      Once you have saved the file with a name of your choice, you can view or print the contents of the file using any text editing program. See Figure 63.

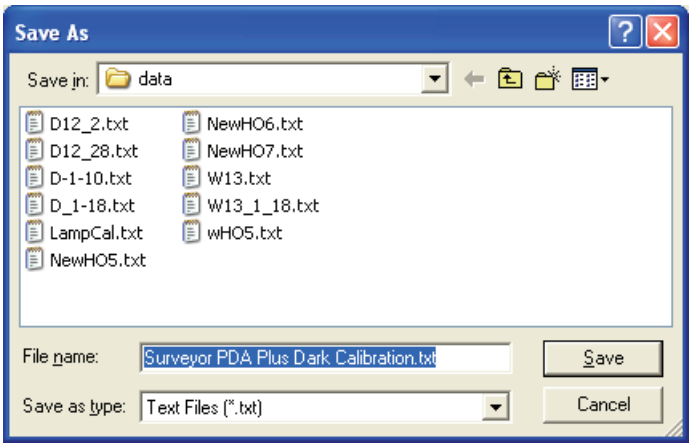

Figure 62. Save As dialog box

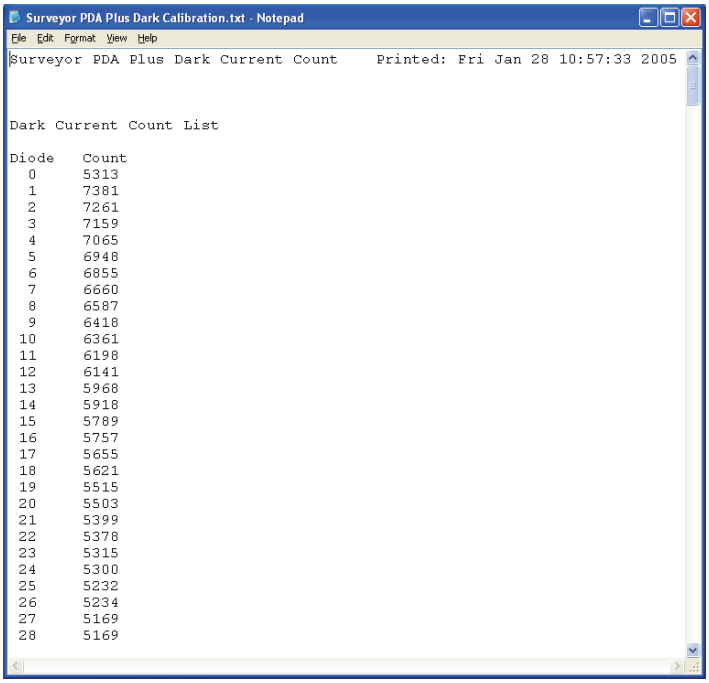

Figure 63. Surveyor PDA Plus Dark Calibration text file

8. In the third page of the Dark Current Calibration wizard, click **Apply** to apply the calibration results to the detector.

9. The Dark Current Calibration wizard proceeds to its fourth and final page. See Figure 64.

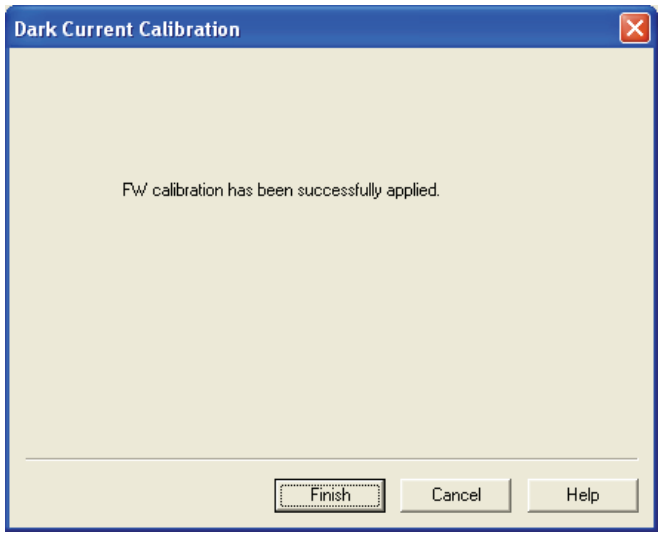

Figure 64. Dark Current Calibration wizard – final page

10. In the final page of the Dark Current Calibration wizard shown in Figure 64, click **Finish** to complete the calibration.

    The detector stores the calibration results. The date and time that the calibration was performed appears in the Dark Current Calibration area of the Calibration page as the Last Calibration. See Figure 65.

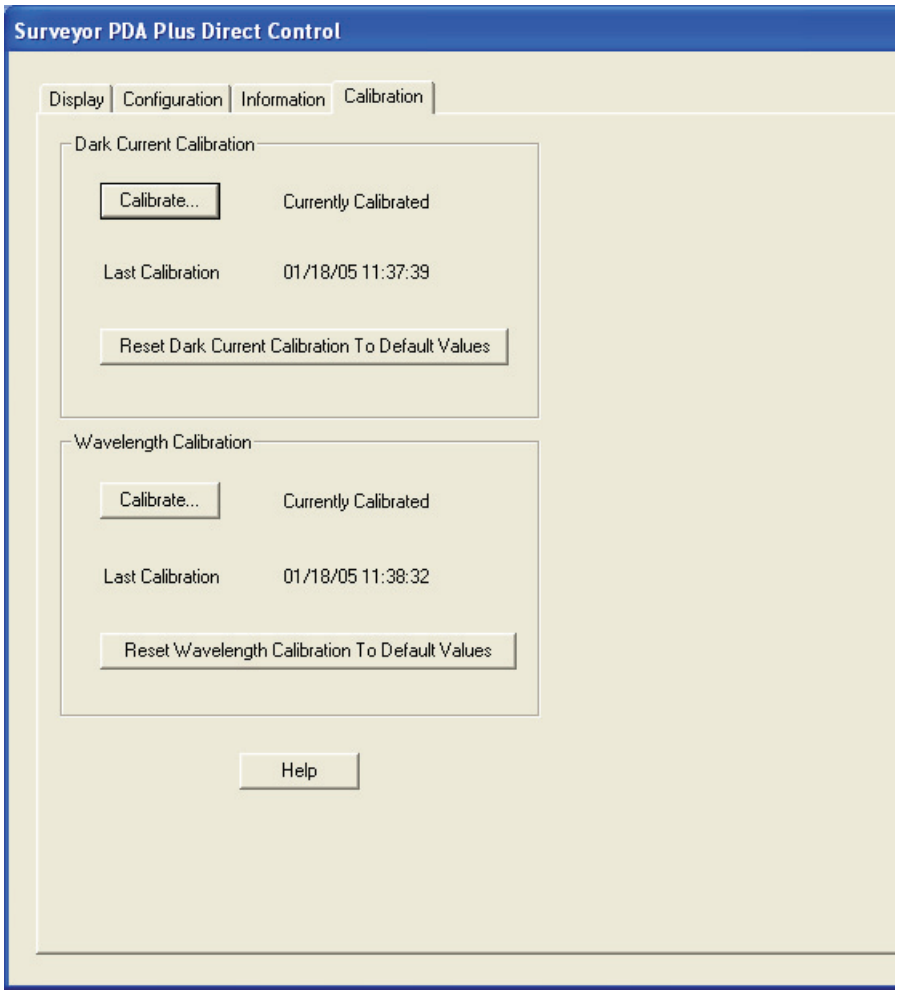

Figure 65. Surveyor PDA Plus Direct Control – Calibration page, showing the status as "Currently Calibrated"

Retrieving, Viewing, Printing, and Clearing the Event Log

Detector errors and major detector events, such as power-on self-tests (POSTs), are logged to a dedicated area in the memory of the detector. The log can hold 100 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 backup when the detector is turned Off. View, print and clear the log weekly as part of your regular maintenance routine. To view the error log, use the procedure in the appropriate topic below for ChromQuest or Xcalibur. A list of error messages that can be displayed in the event log along with suggested solutions is compiled in "Log Entries" on page 121.

Use the Information page in Xcalibur to retrieve, view, print, and clear the event log for the detector. The event log collects messages regarding major events and errors occurring in the detector. These messages are created as part of the normal operation of the detector and can be helpful when you are attempting to troubleshoot communications problems.

To open the Event log in Xcalibur

1. Open the Information page:

   a. In the **Xcalibur Home Page**, click the Instrument Setup button. The Instrument Setup view appears.

   b. In the view bar of the Instrument Setup window, click the Surveyor PDA Plus Detector icon. The Surveyor PDA Plus Instrument Setup view appears.

   c. On the menu bar in the Surveyor PDA Plus Instrument Setup view, choose **Surveyor PDA Plus > Direct Control** to open the Direct Control dialog box. See Figure 66.

   d. In the **Direct Control** dialog box, click the **Information** tab to open the Information page.

   Note When you first open the Information page, the event area might be blank.

2. In the **Information** page, click **Request Log** to retrieve the information from the detector and display it. Figure 66 shows a sample log.

3. Review the log and click **Export Log** to save the contents of the log as a text file. Print out and save a copy of the file for your maintenance records.

4. Click **Clear Log** to clear the log. For a list of some common error messages that might appear in the log, refer to "Log Entries" on page 121.

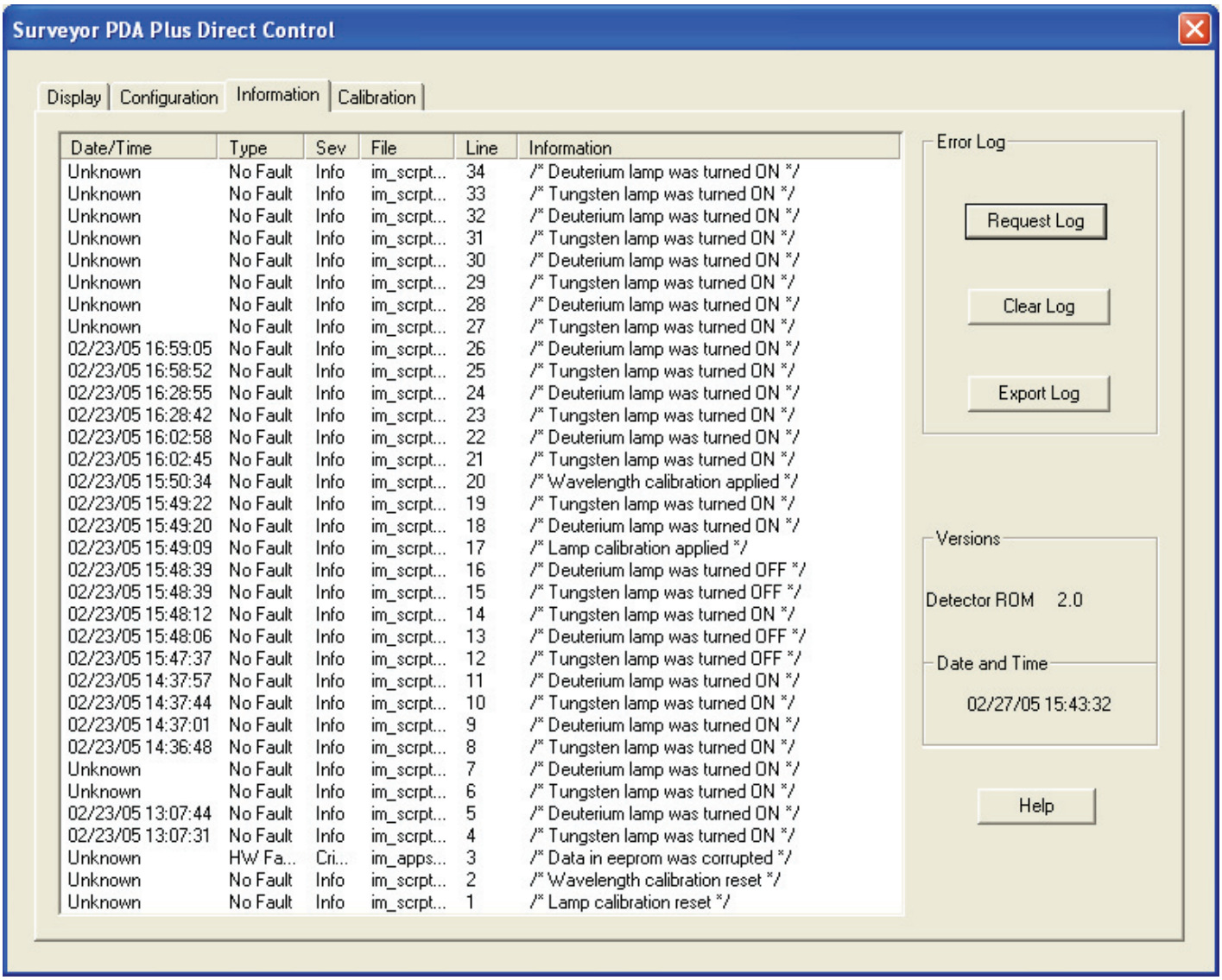

Figure 66. Surveyor PDA Plus Direct Control dialog box – Information Page, showing the event log

Creating a Display Method to View the Light Intensity

To adjust the attenuators and monitor the status of the lamps, you create a display method, and then view a spectrum of the light intensity in the **Surveyor PDA Plus Direct Control > Spectrum** page.

Display methods have an *.spda* file extension. These methods cannot be used in the Sequence Setup portion of Xcalibur. Files with the *.spda* extension can only be loaded and used in the Direct Control dialog box. The creation and modification of display methods is not tracked by the auditing feature in Xcalibur.

To create a display method

1. Open the Surveyor PDA Plus Method page:

   a. In the **Home Page – Roadmap** view, click the Instrument Setup button.

      The Instrument Setup view appears.

   b. In the view bar of the Instrument Setup window, click the Surveyor PDA Plus Detector icon.

      The Surveyor PDA Plus Instrument Setup view appears. See Figure 67.

2. In the Surveyor PDA Plus Detector Method page, enter the appropriate parameters:

   a. In the **Units** area, click the **Diode/Intensity** option to set the X-axis of the spectrum on the Display page to diode numbers.

   b. In the **Channels** area, click the **Three Channels** option to make all three Channels boxes available.

   c. In the **Channels** boxes, type the numbers for the diodes that you want to monitor.

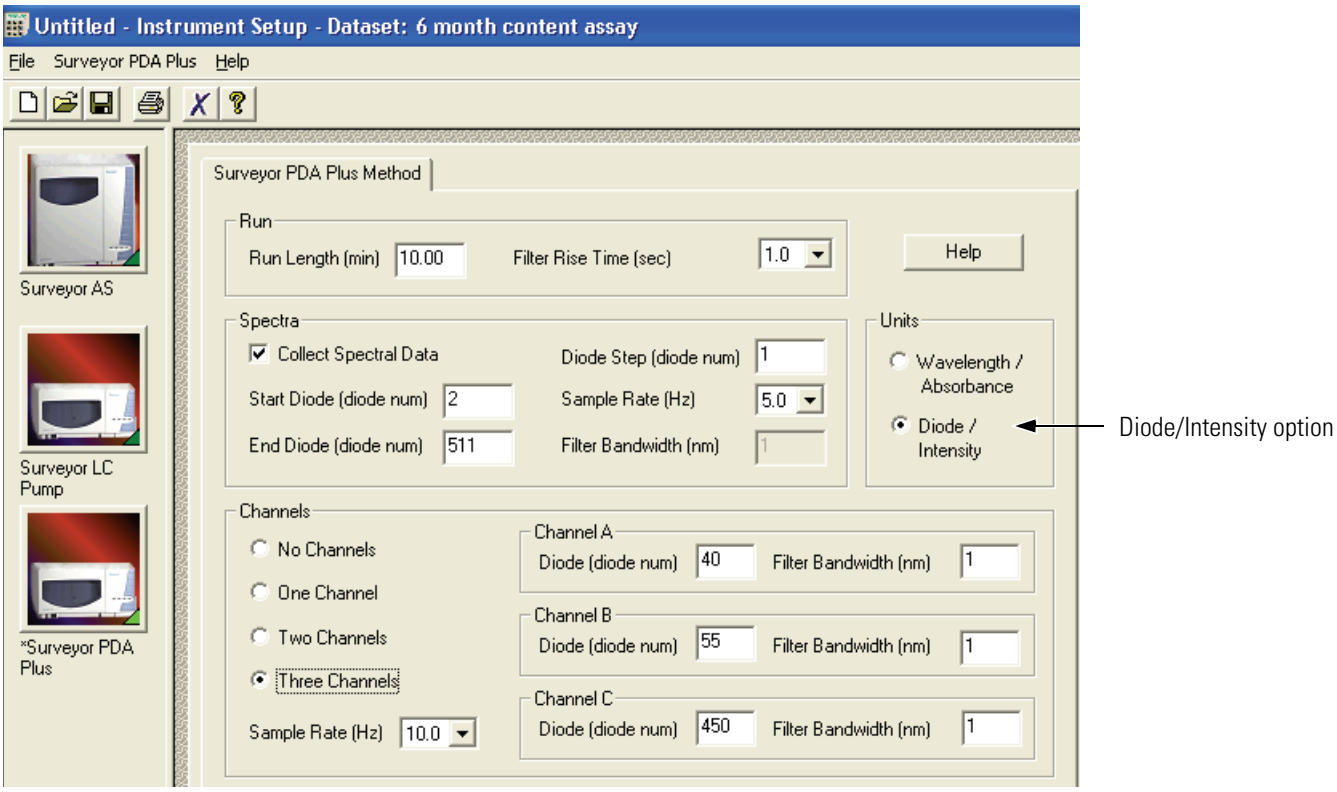

Figure 67. Surveyor PDA Plus Method page, showing the selection of the Diodes/Intensity option

3. Save the display method:

   a. In the menu bar, choose **Surveyor PDA Plus > Direct Control**. Figure 68 shows the warning that appears.

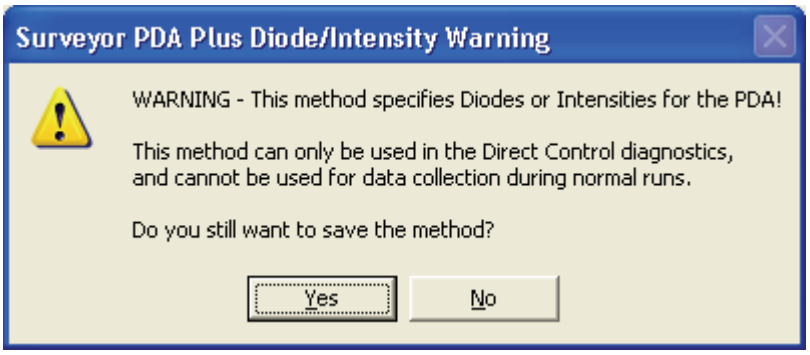

Figure 68. Surveyor PDA Plus Diode/Intensity Warning dialog box

b. In the **Surveyor PDA Plus Diode/Intensity Warning** dialog box, click **Yes**.

The Save Surveyor PDA Plus Display Method dialog box appears.

c. In the **Filename** box, type a filename.

d. Click **Save**.

Xcalibur saves the file with an *.spda* file extension.

Note The *.spda* file extension is a special file extension used for all method files based on Diode/Intensity units. These methods cannot be used in the Sequence Setup portion of Xcalibur. Files with the *.spda* extension can only be loaded and used in the Direct Control dialog box. They are not tracked by the auditing feature in Xcalibur.

Verifying Operational Performance

If you move your Surveyor PDA Plus Detector, replace lamps, or install a new flow cell, the system may change in performance. Verify that the detector is running as desired by performing the following operation verification procedure on your Surveyor PDA Plus Detector.

To verify the proper operation of the Surveyor PDA Plus Detector, perform the following procedures:

1. Preparing to Verify Lamp Performance
2. Viewing an Intensity Scan of the Deuterium Lamp
3. Viewing an Intensity Scan of Both Lamps
4. Viewing an Intensity Scan of the Tungsten Lamp

Preparing to Verify Lamp Performance

To prepare your instrument for lamp verification

1. Pump 100% HPLC-grade methanol through the cell at a constant flow rate of 1 mL/min.
2. Open the Direct Control dialog box for the Surveyor PDA Plus Detector:

   a. In the **Xcalibur Home Page – Roadmap view**, click the Instrument Setup button to display the Instrument Setup view.
   b. In the view bar of the Instrument Setup window, click the Surveyor PDA Plus Detector icon to open the Surveyor PDA Plus Instrument Setup view.
   c. In the **Surveyor PDA Plus Instrument Setup** view, choose **Surveyor PDA Plus > Direct Control** to display the Direct Control dialog box.
3. Make sure that the lamps are on and equilibrated:
   a. In the **Direct Control** dialog box, click the **Configuration** tab to open the Configuration page.
   b. In the **Configuration** page, note the status and usage of each lamp.
   c. If they are not already On, turn on both the deuterium (D_2) and tungsten (W) lamps.
   d. Wait for 1 hour for both lamps to equilibrate.

4. Perform a dark current calibration and then a wavelength calibration. Use the wavelength calibration file appropriate for your normal operation. Do not forget to apply the results by clicking **Apply**.

Viewing an Intensity Scan of the Deuterium Lamp

To view an intensity scan of the deuterium (D_2) lamp

1. Create a display method to view the intensity of the deuterium lamp. Set channels A,B, and C to monitor diodes 35, 52, and 77, respectively. See Figure 69.

   See "Creating a Display Method to View the Light Intensity" on page 84 for instructions on creating a display method.

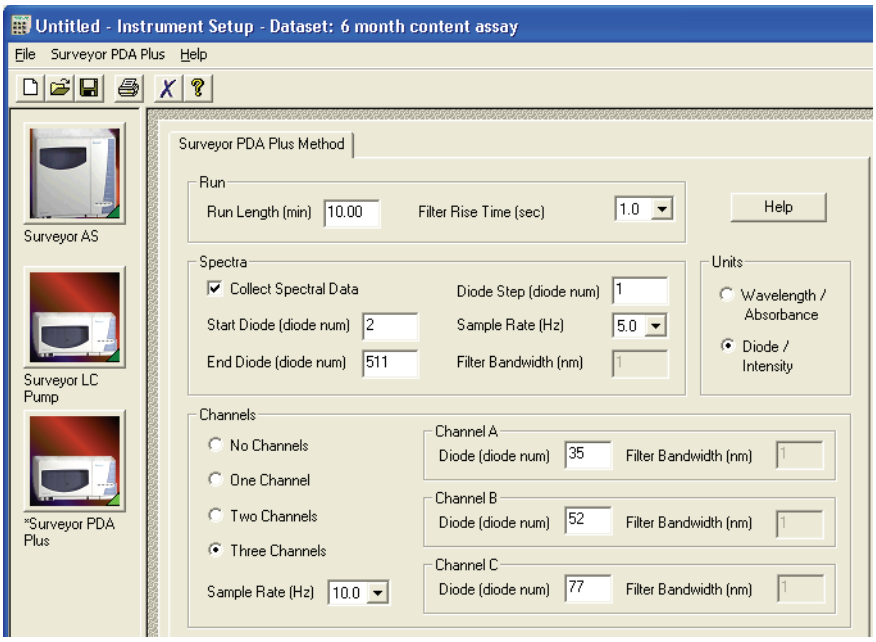

Figure 69. Surveyor PDA Plus Method page, showing the selection of the Diodes/Intensity option

2. Load the display method to the detector as follows:

   a. From the menu bar, choose **Surveyor PDA Plus > Direct Control** to open the Direct Control dialog box.

   b. In the **Surveyor PDA Plus Direct Control** dialog box, click the **Display** tab to open the Display page.

   c. In the **Control** area, click **Load Method** to display the Open Display Method dialog box. Browse to the display method that you

created to monitor the deuterium lamp. Then click **Open** to load the method.

The filename of the display method (.spda) appears in the box above the Spectrum plot.

3. Click the **Configuration** tab to open the Configuration page. Then turn off the tungsten lamp.

4. Click the **Display** tab to open the Display page. Then click **Start Data** to refresh the spectra. See Figure 70.

5. Press <**Alt**> + <**Print Screen**> to save a picture of the scan to the clipboard. Paste this picture into a text editor such as Microsoft Word. 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.

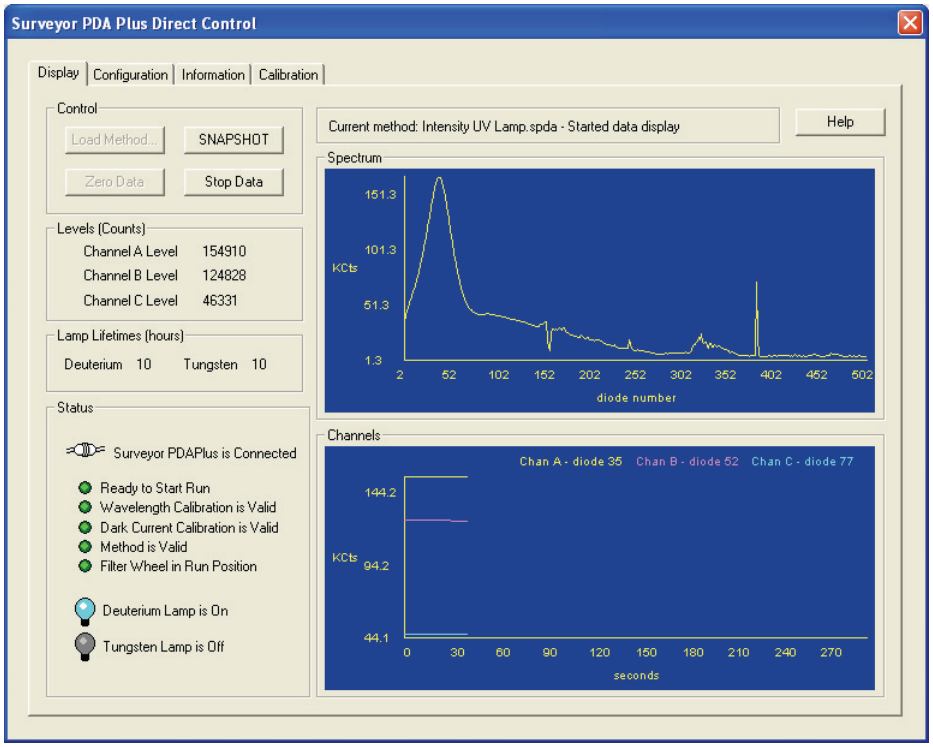

Figure 70. Viewing a scan of the deuterium lamp intensity

Viewing an Intensity Scan of Both Lamps

To view an intensity scan of the deuterium (D_2) and tungsten (W) lamps

1. Click the **Configuration** tab to open the Configuration page.
2. In the **Configuration** page, turn on the tungsten (W) lamp, if it is not already on.
3. Create a display method (.spda) to view the intensity of both lamps. Set channels A,B, and C to monitor diodes 94, 177, and 260, respectively.

   Refer to "Creating a Display Method to View the Light Intensity" on page 84 for instructions on creating a display method.
4. Load the display method (.spda) to the detector:
   a. Choose **Surveyor PDA Plus > Direct Control** to display the Surveyor PDA Plus Direct Control dialog box.
   b. Click the **Display** tab to open the Display page.
   c. In the **Control** area, click **Load Method** to open the Open Display Method dialog box. Browse to the method that you created to monitor both lamps. Then click **Open** to load the method. The method filename appears in the box above the Spectrum plot.
   d. Click **Start Data**. See Figure 71.
   e. Press **ALT**+ **PRINT SCREEN** to save a picture of the scan to the clipboard. Paste this picture into a text editor such as Microsoft Word. Keep this scan for future comparisons to see if there is degradation in light intensity. Date the printout and add it to your maintenance records.

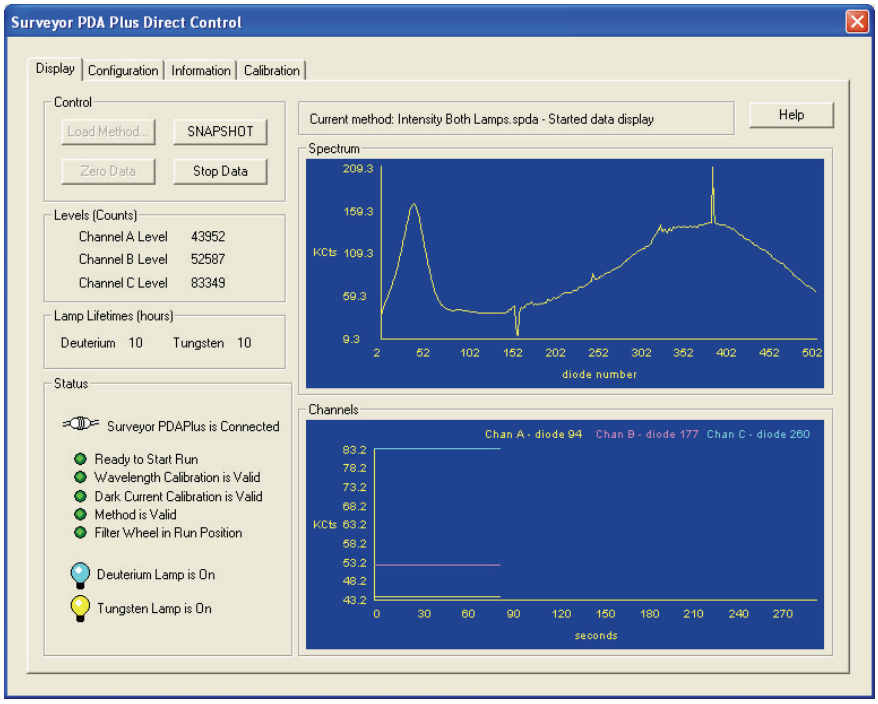

Figure 71. Viewing a scan of the lamp intensities

Viewing an Intensity Scan of the Tungsten Lamp

To view an intensity scan of the tungsten (W) lamp

1. Click the **Configuration** tab to display the Configuration page. Then turn off the deuterium lamp.

2. Create a display method to view the intensity of the tungsten lamp. Set the individual channels to monitor diodes 219, 302, and 427.

   See "Creating a Display Method to View the Light Intensity" on page 84 for instructions on creating a display method.

3. Load the display method to the detector as follows:

   a. Choose **Surveyor PDA Plus > Direct Control** to display the Surveyor PDA Plus Direct Control dialog box.

   b. Click the **Display** tab to open the Display page.

   c. In the **Control** area, click **Load Method** to open the Open Display Method dialog box. Browse to the method that you created to monitor the tungsten lamp. Then click **Open** to load the method. The method filename appears in the box above the Spectrum plot.

   d. Click **Start Data**. See Figure 72.

e. Press **ALT** + **PRINT SCREEN** to save a picture of the scan to the clipboard. Paste this picture into a text editor such as Microsoft Word. Keep this scan for future comparisons to see if there is degradation in light intensity. Date the printout and add it to your maintenance records.

4. Turn on the deuterium lamp, and allow sufficient warm-up time before you begin acquiring data.

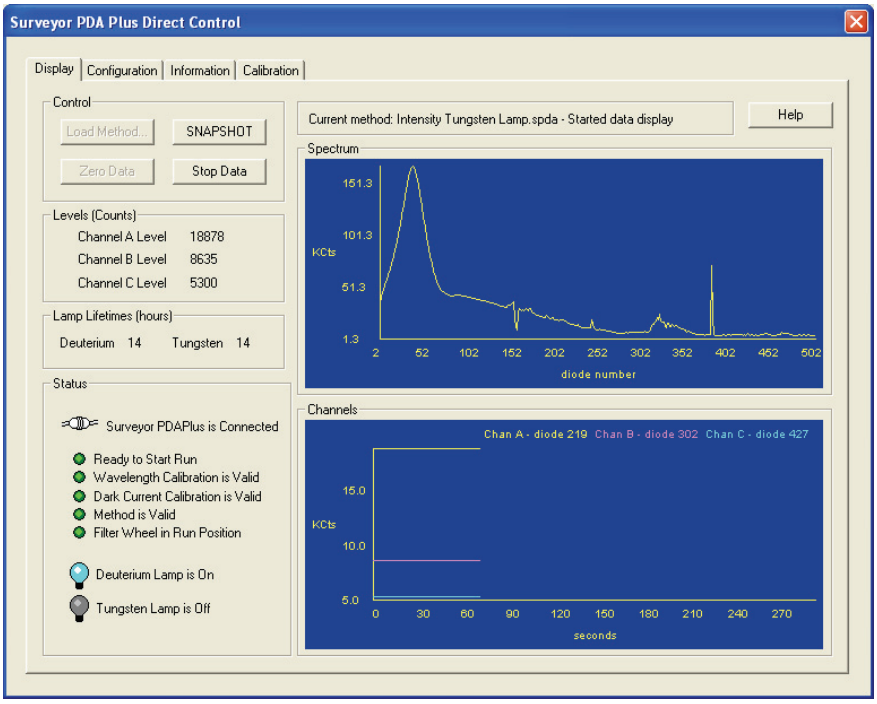

Figure 72. Direct Control dialog box – Display page, showing an intensity scan with the deuterium lamp

Controlling the Lamps with Xcalibur

As lamps age, they emit less light, which results in increased baseline noise. If the noise level on your detector signal is unacceptable, and cleaning the flow cell does not help, use the diagnostic features of the software to determine the cause of the problem. If light output becomes too low and adjusting the attenuators as described in "Adjusting the Attenuators " on page 96 does not help, replace the lamps.

The detector keeps track of the number of hours each lamp has been operating. The deuterium lamp has a lifetime of approximately 1000 h and the tungsten lamp has a lifetime of approximately 2500 h. Lamp lifetime varies depending upon the application.

You perform the following procedures in the **Surveyor PDA Plus Direct Control > Configuration** page (Figure 73):

- Turning On the Lamps
- Resetting the Lamp Lifetime
- Setting the Startup Time for the Lamps

Turning On the Lamps

To turn on the lamps

Click **Turn On** for the associated lamp.

When you turn on the deuterium lamp, its Status readback reads *Starting* during the 10-s ignition period, and then it changes to *On*. If there is a problem with either lamp, its Status readback reads *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 h for the lamp to stabilize after a cold start before collecting data in the spectral range of the deuterium lamp.

Resetting the Lamp Lifetime

To reset the displayed lamp lifetime

Click **Reset Lifetime** for the associated lamp.

The stored total run time for the associated lamp is reset to zero, and the Last Lifetime Reset readback is updated to the current date and time.

Note Avoid indiscriminately pressing the Reset buttons. They should be pressed only after their associated lamp has been replaced with a new one.

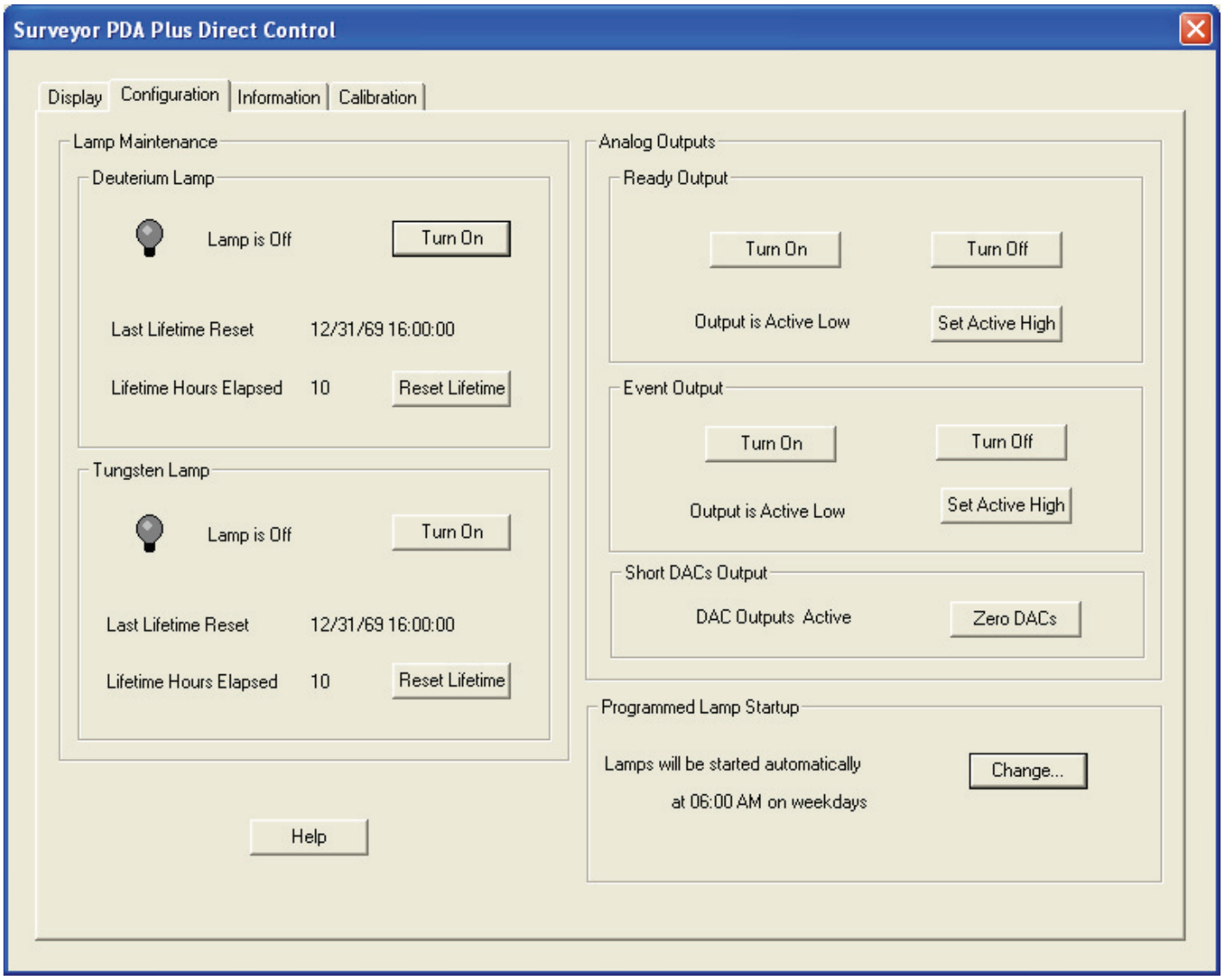

Figure 73. Surveyor PDA Plus Direct Control dialog box – Configuration page

Setting the Startup Time for the Lamps

To set the start-up time for the lamps

1. In the **Programmed Lamp Startup** area of the Configuration page, click **Change** to open the Lamp Start Up Time dialog box. See Figure 74.

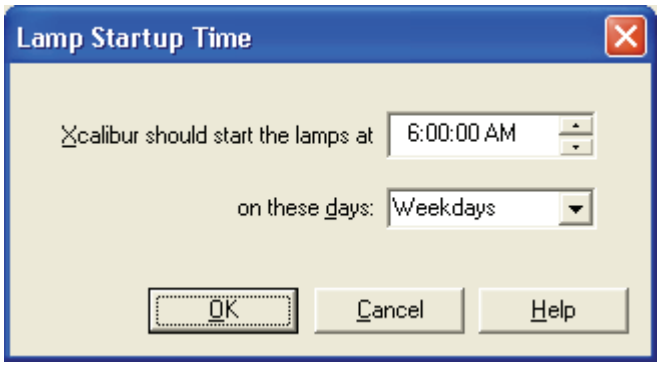

Figure 74. Lamp Startup Time dialog box

2. Click in the **Xcalibur should start the lamps at** box. Then use the keyboard arrow keys, the number keys, or both to change the time.

   Note If you inadvertently click the **Xcalibur should start the lamps at** box more than once to make a new entry, close the dialog box, and then reopen it. This time take care to use only the keyboard arrow keys and number keys to enter a time value.

3. Click **Ok** to apply the new lamp startup time.

Use the Programmed Start option to pre-warm the lamps before starting a sequence of sample analyses.

Adjusting the Attenuators

The Surveyor PDA Plus Detector has two attenuators that control the light output from the lamps. During the lifetime of the Surveyor PDA Plus Detector it might be necessary to adjust the attenuators to increase or decrease the amount of light falling onto the array.

Decreasing light output to the array increases baseline noise. Increasing light output to the array can cause saturation of the diode array. If the array is saturated the response from the Surveyor PDA Plus Detector will be a flat baseline.

The attenuators require adjustment when either lamp is replaced or when the flow cell is replaced. When any of these items are replaced, check the light intensity by following the Operational Verification procedure and adjust the attenuators to provide light intensities in the specified operating ranges.

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

To access the attenuators

1. Open the front doors of the detector.

2. Loosen the captive screw, and then remove the flow cell cover. See Figure 13 on page 21.

   The attenuators are located on the right side of the front panel. There are two black tabs attached to the attenuators for manual adjustments. See Figure 75.

   The left tab is the deuterium lamp attenuator and the right tab is the tungsten lamp attenuator. Pushing the attenuator tab up increases light output and pulling the tab down decreases light output.

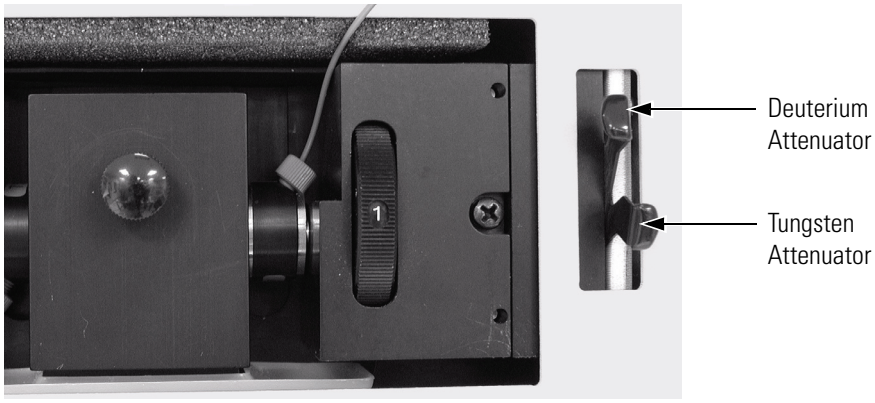

Figure 75. Front view of the detector, showing the attenuators

The first time that you adjust the attenuators, you need to create an .spda method. After you create the method for adjusting the attenuators, save it with a name that you will associate with adjusting the attenuators and store it for future use. Saving the method will simplify future adjustments of the attenuators.

To adjust the attenuators while viewing the light intensities from Xcalibur

1. Access the attenuators as instructed on page 96.

2. Open the Instrument Setup view as follows:

   a. From the Windows XP taskbar, choose **Start > All Programs > Xcalibur > Xcalibur** to open Xcalibur.

   b. In the **Xcalibur Home Page**, click the Instrument Setup icon to open the Instrument Setup window.

3. Set your chromatographic pump to deliver HPLC-grade water at a flow rate of 1 mL/min as follows:

   a. In the viewbar of the Instrument Setup view, click the Surveyor MS pump icon or the Surveyor LC pump icon to open the instrument setup view for your pump.

   b. Choose **Surveyor MS Pump > Direct Control** or **Surveyor LC Pump > Direct Control.** The Direct Control dialog box for your pump appears.

   c. Select a solvent bottle that contains HPLC-grade water and set the flow rate to 1 mL/min.

4. Create the display method for the Surveyor PDA Plus Detector as follows:

   a. In the viewbar of the Instrument Setup view, click the Surveyor PDA Plus icon to open the Surveyor PDA Plus Method page.

   b. In the **Units** area, click the **Diode/Intensity** option. This sets the Y- Axis of the spectra on the Direct Control dialog box – Display page to Intensity and the X-axis to Diode number.

   c. Verify that the following parameters are specified in the Spectra area of the Surveyor PDA Plus Method Page:

      Start Diode= 2

      End Diode= 511

      Diode Step = 1

      Sample rate = 1

   d. Save the display method.

      Refer to "Creating a Display Method to View the Light Intensity" on page 84 for instructions on creating and saving a display method.

5. Make sure that the lamps are On as follows:

   a. Choose **Surveyor PDA Plus > Direct Control.** The Surveyor PDA Direct Control dialog box appears.

   b. Click the **Configuration** tab to display the Configuration page.

   c. Verify that both lamps are On. If they are not On, click **Turn On** for both lamps.

6. Load the display method to the detector as follows:

   a. In the **Surveyor PDA Plus Direct Control** dialog box, click the **Display** tab to open the Display page.

   b. In the **Control** area, click **Load Method** and choose your attenuator method file from the list.

   c. Click **OK**.

7. Start the data stream and adjust the attenuators as follows:

   a. In the **Control** area, click **Start**. The spectrum of light intensities appears in the top window. See Figure 76.

For the UV region, the diode of maximum intensity will be between diode 30 and diode 50. For the Visible region, the diode of maximum intensity will be between diode 400 and diode 500. Ignore the spike at approximately diode number 380. This spike is an emission line of the deuterium lamp.

b. Adjust the attenuator with the left tab on the PDA (UV attenuation) to achieve a maximum value from 750000 to 775000 intensity counts in the region between diode number 30 and diode number 50.

c. Adjust the attenuator with the right tab (Visible attenuation) to achieve a maximum value from 750000 to 775000 intensity counts in the region between diode number 400 and diode number 500.

8. After you finish adjusting the attenuators, replace the flow cell access cover and close the front doors of the detector.

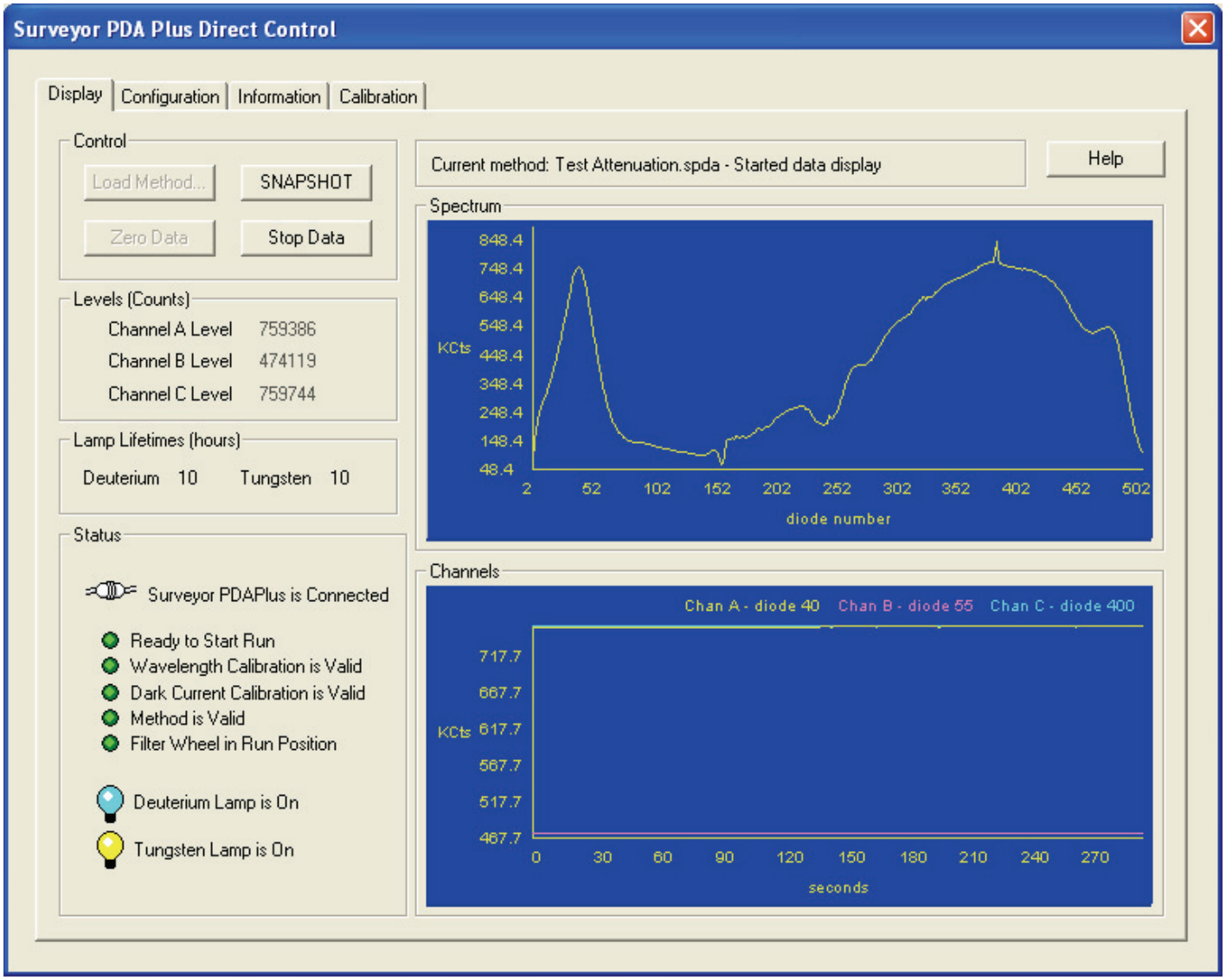

Figure 76. Display of intensity spectrum from diode number 2 to diode number 511

Checking the Firmware Version

In Xcalibur, the Information page of the Surveyor PDA Plus Direct Control dialog box displays the current firmware version of the detector.

To open the Information page in Xcalibur

1. On the menu bar of the Surveyor PDA Plus Instrument Setup view, choose **Surveyor PDA Plus > Direct Control**.

2. Click the **Information** tab to open the Information page.

   The Versions area displays firmware version numbers for several items. See Figure 77.

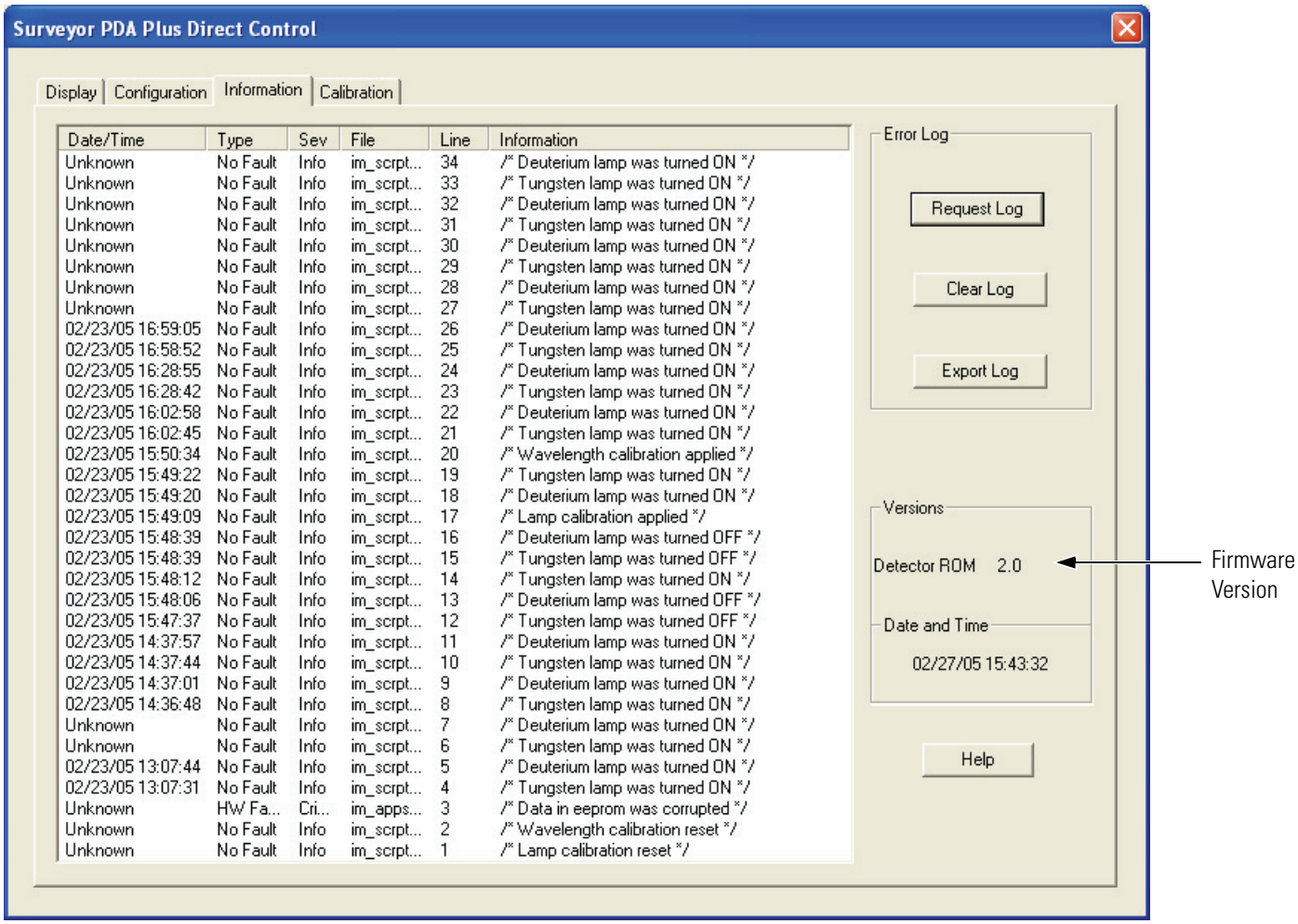

Figure 77. Direct Control dialog box - Information page, showing instrument firmware versions in the Versions area

Chapter 6 Routine Maintenance

The performance of the Surveyor PDA Plus Detector depends on the maintenance of all parts of the detector. It is your responsibility to maintain your PDA detector by properly performing the maintenance procedures on a regular basis. If you have any questions on proper maintenance, or would like to arrange for a preventive maintenance program, please contact your Thermo Electron Corporation Service Representative.

The maintenance procedures that require the use of your chromatography data system are described in Chapter 4, "Diagnostics for ChromQuest Users," or Chapter 5, "Diagnostics for Xcalibur Users."

This chapter contains the following sections:

Recommended Maintenance

Table 2 lists recommendations for routine maintenance of the Surveyor PDA Plus Detector. Use the table as a basis for developing your maintenance program in accordance with the practices of your company.

Table 2. Recommended Routine Maintenance

Procedure	Interval
Cleaning External Surfaces	As needed
LightPipe flow cell Cleaning	As needed*
Wavelength Calibration	After lamp replacement or as needed
Dark Current Calibration (Calibrating the dark current increases the linearity of the detector at the high end of its operating range. The dark current does not significantly affect absorbance values between 0.2 AU and 0.8 AU. The dark current is a function of temperature.)	After 100 hours of use or monthly, whichever comes first After significant changes (>4 °C) in ambient room temperature After lamp replacement
Event Log Printout	Weekly
Operation Verification	Semi-annually
Lamp Replacement	
Deuterium (D2)	Every 1000 hours or as required
Tungsten (W)	Every 2500 hours or as required
Adjust Attenuators	As needed
Update Firmware	As needed and as updates become available

* Good Laboratory Practice (GLP) dictates that the flow cell should be flushed with clean solvent after every use. This practice will reduce the frequency with which you will need to clean your flow cell.

Cleaning the External Surfaces of the Detector

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.

Cleaning the LightPipe Flow Cell

This section describes the general cleaning of the detector's LightPipe flow cell. For other LightPipe flow cell problems, such as leaks that occur in locations other than at the inlet/outlet fittings, contact your Thermo Electron Corporation Service Representative.

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

CAUTION Do **not** disassemble the LightPipe housing or tighten the screws on the housing. In addition, do not touch the optical fibers at the ends of the LightPipe. Doing so will damage the LightPipe flow cell. Thermo Electron cannot be held responsible for any damage done to the LightPipe by attempts to disassemble the housing or tighten the screws. Please contact your Thermo Electron Corporation Service Representative with any questions regarding LightPipe maintenance or service.

This section contains the following procedures:

- Removing the LightPipe Flow Cell
- Cleaning the Flow Cell with Organic Solvents
- Cleaning the Flow Cell with Nitric Acid

Removing the LightPipe Flow Cell

You need to remove the LightPipe flow cell from the Surveyor PDA Plus Detector to clean it.

To remove the LightPipe

1. Turn the detector power off, and disconnect the power cord from the rear panel of the detector.

2. Open the front doors of the detector.

3. Loosen the captive screw that secures the flow cell cover. Then remove the flow cell cover. See Figure 78.

   The LightPipe flow cell is located behind the flow cell cover. See Figure 79.

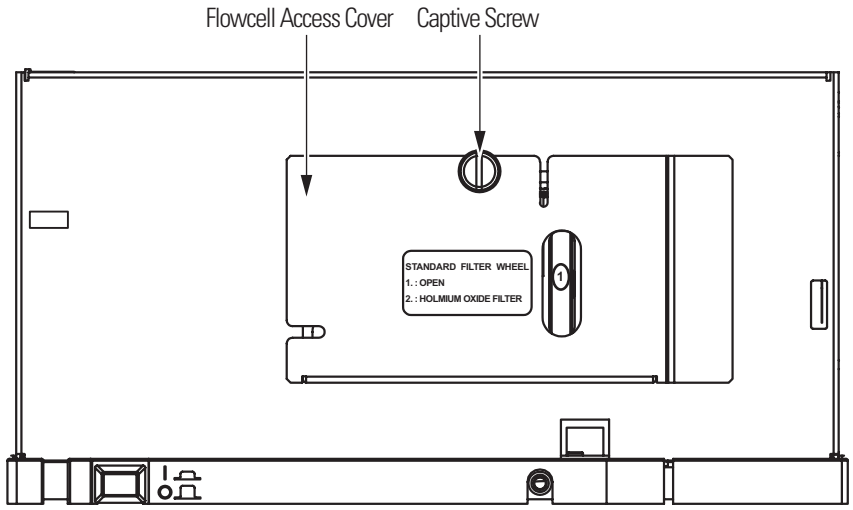

Figure 78. Front of Surveyor PDA Plus Detector, with the front doors open

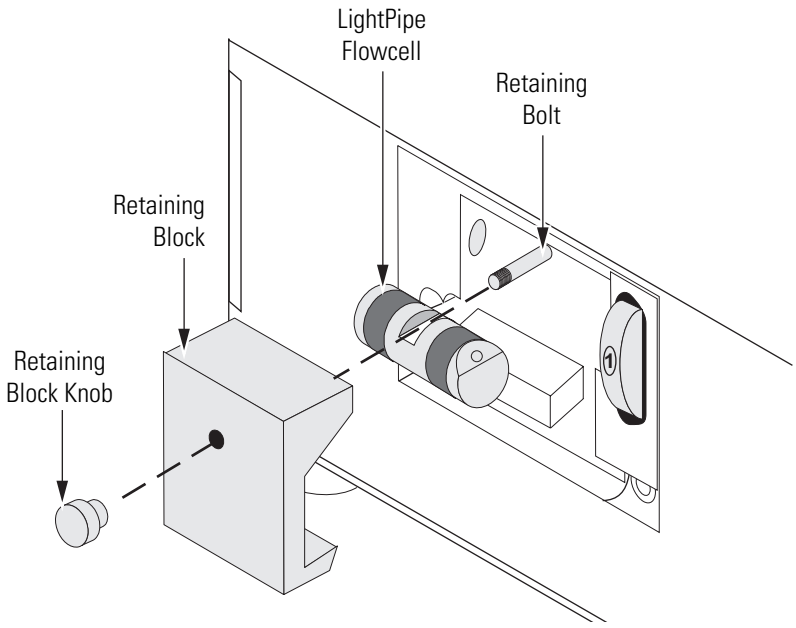

Figure 79. Surveyor PDA Plus Detector, showing the removal of the LightPipe flow cell

4. Unscrew and remove the retaining block knob that holds the LightPipe retaining block in place. Then remove the retaining block. See Figure 79.

CAUTION Do **not** touch the ends of the LightPipe flow cell as you remove it from the flow cell compartment.

5. Being careful not to touch the optical fibers at the ends of the LightPipe flow cell, pull the flow cell out of the flow cell compartment.

6. Depending on how you plan to clean the flow cell, do one of the following:

   - To store the flow cell, disconnect the liquid lines. Then place the protective end caps on the ends of the LightPipe flow cell.
   - To temporarily remove the flow cell from the system, disconnect the LightPipe inlet tube from the column.
   - To clean the LightPipe flow cell by pumping solvent through it, disconnect the flow cell inlet tube from the column and reconnect it directly to the pump. Leave the outlet tubing connected to the waste reservoir.

Cleaning the Flow Cell with Organic Solvents

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

CAUTION Do **not** disassemble the LightPipe housing or tighten the screws on the housing. In addition, do not touch the optical fibers at the ends of the LightPipe. Doing so will damage the LightPipe flow cell. Thermo Electron cannot be held responsible for any damage done to the LightPipe by attempts to disassemble the housing or tighten the screws. Please contact your Thermo Electron Corporation Service Representative with any questions regarding LightPipe maintenance or service.

To clean the LightPipe flow cell with organic solvent

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

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

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

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

3. Flush the flow cell with 40 to 50 mL of cleaning solvent (for example, isopropanol or methanol).

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

5. See "Installing the LightPipe Flow Cell" on page 21 for instructions on how to reinstall your LightPipe.

Cleaning the Flow Cell with Nitric Acid

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

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

To clean the LightPipe with nitric acid

1. Completely remove the LightPipe from the detector housing by following the procedure in "Removing the LightPipe Flow Cell" on page 106. (This prevents possible leaks from harming the mechanical and electronic components of the detector.)

2. Ensure that the column is removed from the chromatographic system to avoid column degradation. Connect the LightPipe inlet directly to the chromatographic pump.

3. This step is very important! Flush the LightPipe with water to prevent a reaction between the last solvent used in the chromatographic system and the nitric acid solution that is going to be used to clean the cell.

4. Prepare a 20% (v/v) solution of nitric acid in HPLC-grade water.

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

CAUTION Ensure that the column has been removed from the chromatographic system and that water was the last solvent in the pump and solvent reservoir before you pump nitric acid solution through the LightPipe flow cell.

5. Pump the nitric acid solution through the LightPipe using the chromatographic pump.

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

7. See "Installing the LightPipe Flow Cell" on page 21 for instructions on how to reinstall your flow cell.

Replacing the Lamps

As lamps age, there is a reduction in light output, which results in increased baseline noise. If the noise level on your detector output signal is unacceptable, and cleaning the flow cell does not help, use the diagnostic features of the software to determine the cause of the problem. If light output becomes too low and adjusting the attenuators does not help, replace the lamps.

The detector keeps track of the number of hours each lamp has been operating. The deuterium lamp has a lifetime of approximately 1000 h and the tungsten lamp has a lifetime of approximately 2500 h. Lamp lifetime varies depending upon the application.

If the light output becomes too low and adjusting the attenuators does not help, replace the lamps. The lamps are pre-aligned on small mounting blocks to facilitate replacement.

The deuterium (D2) and tungsten (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 80).

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

You must have the following tools to replace the lamps:

- narrow-tip screwdriver (2 mm wide)
- #2 Phillips head screwdriver
- 1/4-in. open end wrench

To replace the deuterium and tungsten 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. Open the front doors by swinging each door outwards.
3. Remove the flow cell as described in "Removing the LightPipe Flow Cell" on page 106.

CAUTION Always allow sufficient time for the lamp to cool before removing it. The lamp gets very hot when it is illuminated.

4. Remove the ribbon cable from the status LED pins by depressing the plastic retaining clip while pulling out the connector.

5. Remove the four Phillips head screws that secure the chassis to the housing. These screws are located on either side of the detector. See Figure 80.

6. Slide the chassis out of the housing until the metal lamp compartment cover is accessible from the right side of the instrument.

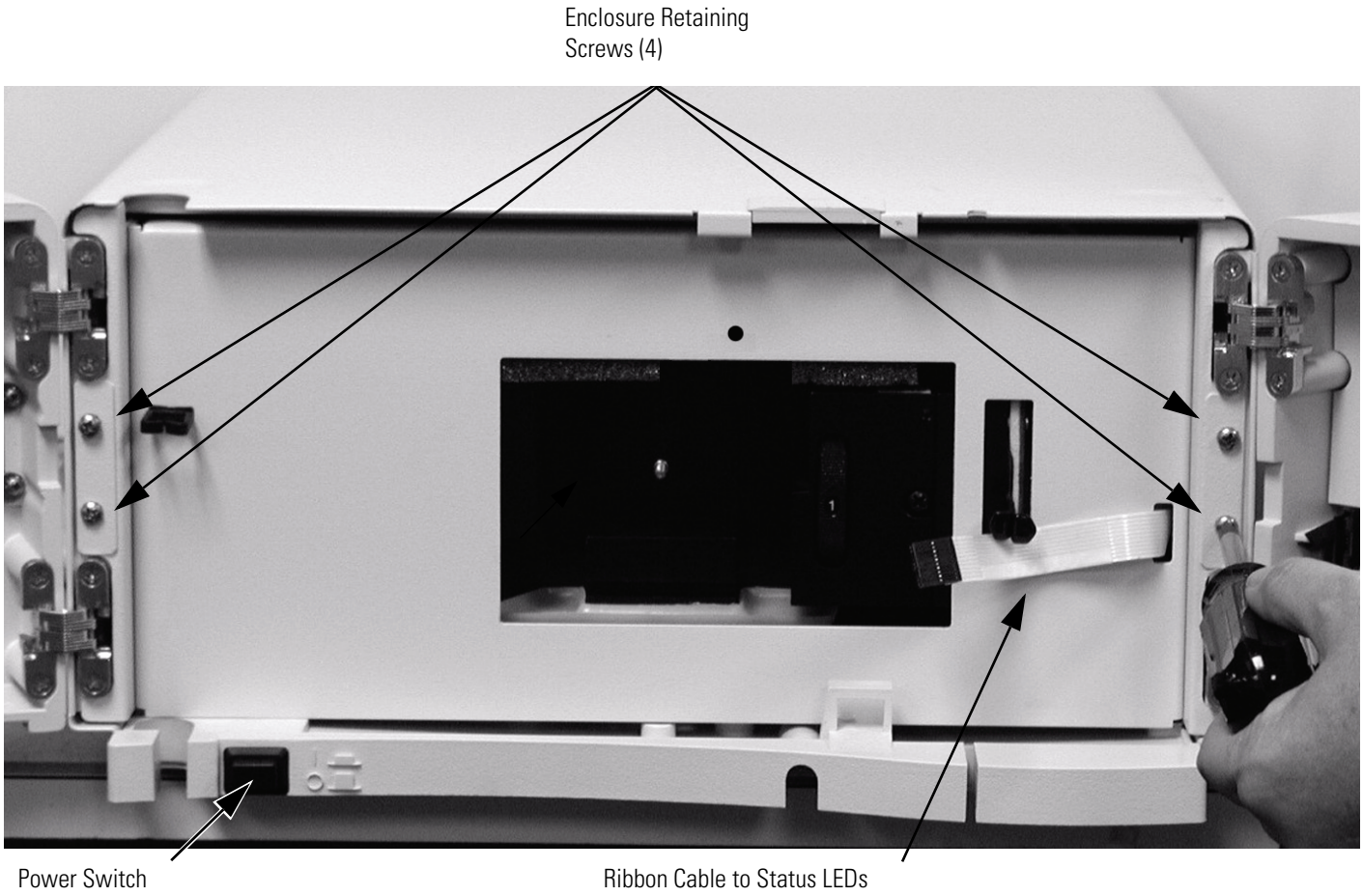

Figure 80. Detector with front doors open, showing the enclosure retaining screws and LED ribbon cable

CAUTION The lamps generate a significant amount of heat. Allow sufficient time for the lamps to cool before removing the lamp cover.

7. Make sure that you have allowed sufficient time for the lamps to cool. Then remove the lamp cover by loosening the large, captive Phillips head screw enough to free the lamp cover from the lamp tray. See Figure 81. Carefully lift the lamp cover out of the detector.

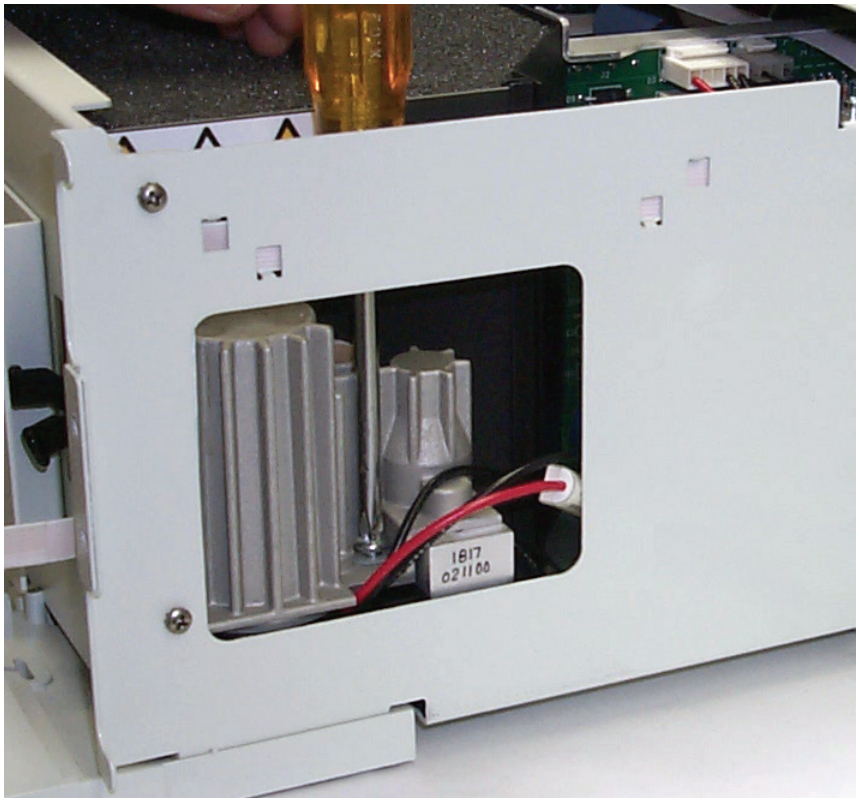

Figure 81. Removing the Phillips head screw

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.

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

8. To remove the deuterium lamp assembly:

   a. Gently pull its connector free from the contact pins on the lamp power supply board. As Figure 82 shows, the connector for the deuterium lamp has three leads.

   b. Loosen (but do not remove) the two Phillips head screws by approximately four turns, lift and gently twist the mounting flange to free the lamp. See Figure 83.

   c. Lift out the wiring between the connector and lamp socket from the compartment.

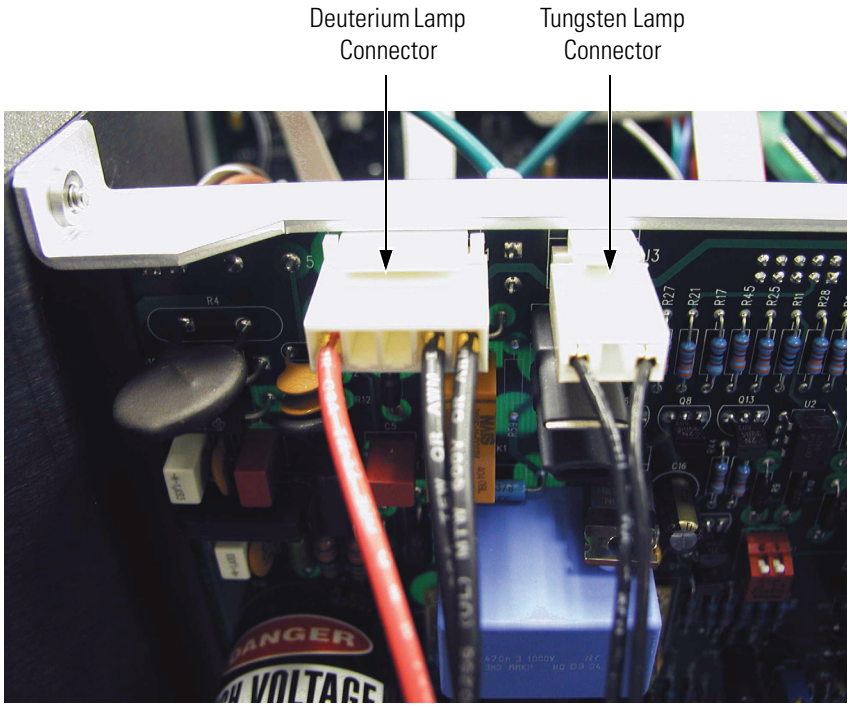

Figure 82. Lamp connections

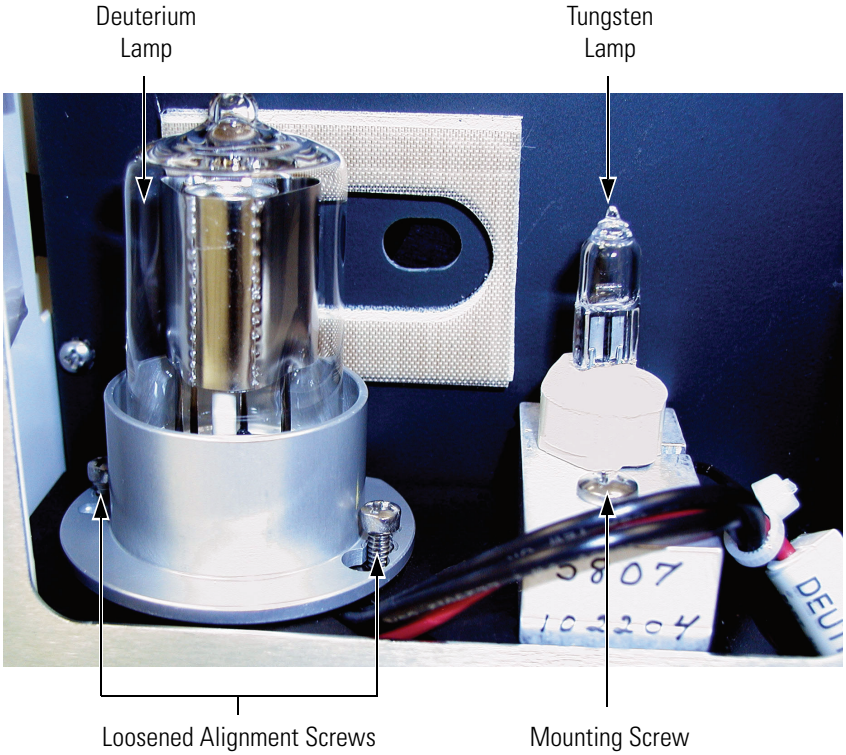

Figure 83. View of the deuterium lamp, showing the alignment screws loosened by four turns

9. To remove the tungsten (W) lamp:

   a. Gently pull its connector free from the contact pins on the lamp power supply board. As Figure 82 shows, the connector for the deuterium lamp has two leads.

   b. Loosen and remove the single Phillips head screw that secures the lamp-mounting block. See Figure 83.

   c. Lift out the wiring between the connector and lamp socket from the compartment.

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

IMPORTANT Remember to reset the elapsed lamp hours after replacing a lamp. See "Controlling the Lamps with ChromQuest" on page 56, or "Controlling the Lamps with Xcalibur" on page 93.

Chapter 7 Troubleshooting

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 might actually be due to other components in the chromatographic system, references and potential solutions to these types of problems have also been included.

This chapter contains the following sections:

Detector-Related Problems

Table 3 lists detector-related problems along with suggestions for corrective action.

Table 3. Troubleshooting detector-related problems

Symptom	Cause	Remedy
1. Spikes on baseline.	a. Continuous gas bubbles in the flow cell.	a. Degas mobile phase. Connect backpressure device to flow cell (check backpressure rating).
	b. Immiscible solvent bubbles following mobile phase changeover.	b. Flush flow cell 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 POWER line.	d. Remove systems (for example, ovens) that cause voltage fluctuations, isolate the detector to a "quiet" circuit, or use UPS (Uninterruptable Power Supply).
2. Random noisy baseline.	a. Contaminated flow cell.	a. Flush flow cell with cleaning solvents as described in "Cleaning the LightPipe Flow Cell" on page 106. Check for leaks.
	b. Leak in sample inlet line.	b. Check all fittings from column outlet to flow cell inlet for leaks.
	c. Bubble trapped in flow cell.	c. Increase flow rate until bubble is removed. Supply backpressure device to flow cell (check pressure rating to avoid rupturing flow cell).
	d. Leaking flow cell.	d. Replace flow cell.
	e. Insufficient lamp warm-up.	e. Allow a 30 min warm-up for normal operation and a 1½ h warm-up 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. Flow Cell or lamps dirty.	h. Clean dirty component.
	i. Integrator input voltage does not match detector output voltage.	i. Verify integrator connected to appropriate Analog Output connections on detector. (Refer to Chapter 2, "Installation.") Check attenuation setting on integrator.

Table 3. Troubleshooting detector-related problems, continued

Symptom	Cause	Remedy
3. Excessive baseline drift.	a. Flow cell contaminated.	a. Flush flow cell with cleaning solvents as described in "Cleaning the LightPipe Flow Cell" on page 106. 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 flow cell.	d. Check all fittings for leaks. Replace flow cell.
	e. Tiny bubble trapped in flow cell.	e. Increase flow rate until bubble is removed. Connect backpressure device to flow cell outlet (check backpressure rating to avoid rupturing flow cell).
	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. Verify integrator connected to appropriate Analog Output connections on detector. (See Chapter 2, "Installation.") 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 flow cell 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 power outlet.	a. Resolve problem, reset circuit breaker.
	b. Blown detector fuse.	b. Resolve problem, replace fuse.
	c. Incorrect voltage selected.	c. Verify Voltage Selector installed for correct incoming line-voltage. (See Chapter 2, "Installation.")
	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.
8. Flat baseline, portion of spectrum missing.	a. Saturation of photodiode array.	a. Adjust attenuators.
9. LED1 - Power	a. Green - power on.	a. No action required.

Table 3. Troubleshooting detector-related problems, continued

Symptom	Cause	Remedy
10. LED2 - Comm	a. Green - communications normal.	a. Power-on Self Test.
	b. Amber - no communications with PC system.	b. Check Ethernet connections and module configuration in the software, reload firmware.
	c. Blinking Amber - firmware download in process.	c. Complete download and reestablish communications with PC.
11. LED3 - Run	a. Flashing Green - run in progress.	a. No action required.
	b. Green - Ethernet communications have not been established or PDA is connected and ready to accept commands.	b. Establish Ethernet communications or begin a run if unit is ready.
	c. Amber - an error has occurred while performing a run.	c. See software to determine the nature of the error, or begin the run again.
12. LED4 - Lamps	a. Green - one or both lamps are on.	a. No action required.
	b. Amber - both lamps are off.	b. Turn on lamps in software and allow 1.5 hours for warm-up.

Log Entries

This section describes the various log entries that are possible when operating the Surveyor PDA Plus Detector from ChromQuest or Xcalibur.

To access the error log from your data system

1. For ChromQuest, choose **Control > Instrument Status** from the Instrument window. Click the Surveyor PDA Plus tab. Click **Diagnostics**. Click the Error Log tab. Click **Get** to retrieve and display the error log information from the detector.

2. For Xcalibur, choose **Surveyor PDA Plus > Direct Control** from the Surveyor PDA Instrument Setup view. Click the Information tab. Click **Request Log** to retrieve the information from the detector and display it

Note For further information, document the log entry and contact Thermo Electron technical support. For contact information, see "Contacting Us" on page xvi.

The diagnostics Event Log chronologically records messages relating to detector/system problems. There are three categories of messages:

- Warning Messages
- Critical Failure Messages
- Information Messages

Warning Messages

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

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

Critical Failure Messages

Critical failure messages indicate that the PDA cannot 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:

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

Information Messages

Information messages include:

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

Chapter 8 Accessories and Replaceable Parts

This chapter contains the lists of accessories and replaceable parts that you can order from Thermo Electron Corporation.

The LightPipe flow cell assembly consists of the parts listed in Table 4.

Table 4. LightPipe flow cell assembly parts

Part Number	Description
803237	Flow cell assembly, with inlet/outlet tubing and fittings (5 cm LightPipe)
2522-0285	FingerTight PEEK Ferrule Nuts
803260	Inlet tubing, with insulation, PEEK 1/16 x 0.005-in. ID (RED)
703950	Outlet tubing, PEEK 1/16 x 0.01-in. ID (Blue)

Table 5 contains a list of optional accessories. Table 6 contains a list of parts required to make the rear panel connections. Table 7 contains a list of maintenance parts. Table 8 contains a list of repair and service parts.

Table 5. Optional Accessories

P/N	Description
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)
803265S	10 mm flow cell assembly (1 cm LightPipe)
A5514-010	PDA Stand
802259	Backpressure regulator

Table 6. Cables and connectors for rear panel connections

P/N	Description
70111-63302	Ethernet cable
60053-63034	Interconnect cable (seven-connector cable)
F5049-010	Interconnect cable (legacy, five-connector cable)
60053-63034	Surveyor MS Pump Plus adaptor cable (connects to the PUMP connector of the system interconnect cable)

Table 7. Maintenance Parts

P/N	Description
108052	Deuterium Lamp Assembly (pre-aligned)
803247	Tungsten-halogen (W) Lamp Assembly (pre-aligned)
2522-0285	Finger tightening PEEK Ferrule Nuts
803260	Inlet tubing, with insulation, PEEK 1/16 × 0.005 in. ID (Red)
703950	Outlet tubing, PEEK 1/16 × 0.010 in. ID (Blue)
803237	Flow cell assembly, with inlet/outlet tubing and fittings (5 cm LightPipe)
126078	Fuse, T3.15 A (5 × 20 mm) (for 100/115 V operation)
126079	Fuse, T1.6 A (5 × 20 mm) (for 230 V operation)

Table 8. Repair and Service Parts

P/N	Description
60053-61020	Assy, PCB, 860T PDA
60053-61030	Assy, PCB, PDA transition
60053-61035	Assy, PCB, lamp power supply board
00012-01-00008	Low Voltage Power Supply PCB
104092	Lamp Power Supply Transformer
138018	Cooling Fan
803219	Power Entry Module Assembly
112210	Power Switch
F9030-010	LED Assembly
803246	Standard Filter Wheel
803229	Cable, ribbon, CPU to Array Acquisition PCB
60053-63000	Cable Assy, CPU/Transition PDA Plus
803226	Cable, ribbon, CPU to Lamp Power Supply PCB
00302-02-00023	Cable, CAT5E, 1 ft, shielded

Appendix A Firmware

Periodically, upgrades to the Surveyor PDA Plus converter board firmware become available. In anticipation of future upgrades, both the ChromQuest and the Xcalibur data systems are supplied with the Surveyor Firmware Upgrade Utility. Use this utility to download new firmware to the converter board in your detector. Firmware upgrade files for the convertor board have a .bin extension.

For Xcalibur, the firmware files and the Surveyor Firmware Upgrade utility are automatically installed to your personal computer during the installation of the data system. These files can be found in the following folder: *[drive]:\Xcalibur\system\Surveyor Firmware\PDA Plus*.

For ChromQuest, the firmware files and the Surveyor Firmware Upgrade utility reside on the ChromQuest CD. Because they are not automatically installed during the installation of the data system, you must copy them to an appropriate folder on your PC. For instructions on installing the update files to your PC, see the topic "Installing the Update Files for ChromQuest" on page 126.

This appendix contains the following sections:

Installing the Update Files for ChromQuest

The update files for the Surveyor modules can be found on the ChromQuest 4.2 CD. The files are not automatically loaded to your computer when you install ChromQuest.

To install these files

1. Insert the ChromQuest CD into your CD-ROM drive.
2. From the Windows desktop, double-click My Computer.
3. Right-click the CQ42 icon to open the shortcut menu.
4. Choose **Explore** from the shortcut menu to access the contents of the ChromQuest CD.
5. Copy the contents of the Firmware folder to your ChromQuest directory.

Updating the Firmware

To update the firmware for the Surveyor PDA Plus Detector, perform the following procedures in the order listed:

1. Setting Up the Detector for a Firmware Download
2. Downloading the Firmware File

Setting Up the Detector for a Firmware Download

Before you download firmware to the detector, you must set the rotary switches on its rear panel to the maintenance position.

To set up your detector for a firmware download

1. Make sure you have the firmware file that you intend to download and the Surveyor Firmware Upgrade Utility on your computer.
   - For the Xcalibur data system, these files reside in the following folder: *[drive]:\Xcalibur\system\Surveyor Firmware\PDA_Plus*.
   - For the ChromQuest data system, these files are not installed on your computer when you install the data system. To install these files, see "Installing the Update Files for ChromQuest" on page 126.
2. Make a note of the current settings of the rotary switches on the rear panel of the Surveyor PDA Plus Detector. You will return the switches to these settings after you download the firmware files.
3. Make sure that your detector is connected to your computer with the standard Ethernet connection.
4. Turn the power to the Surveyor PDA Plus Detector Off.
5. Use a small flat-head screwdriver to set the rotary switches on the rear panel of the PDA to 00.
6. Turn the detector power On. The Comm LED blinks amber to confirm that the Surveyor PDA Plus Detector is configured for downloading the firmware.

Downloading the Firmware File

Now that the detector is set up for a firmware download, you can download the firmware files.

To download the firmware file to the detector

1. Double-click the icon for the Surveyor Firmware Upgrade Utility application program. See Figure 84.

   The Surveyor Firmware Upgrade Utility window appears. See Figure 85.

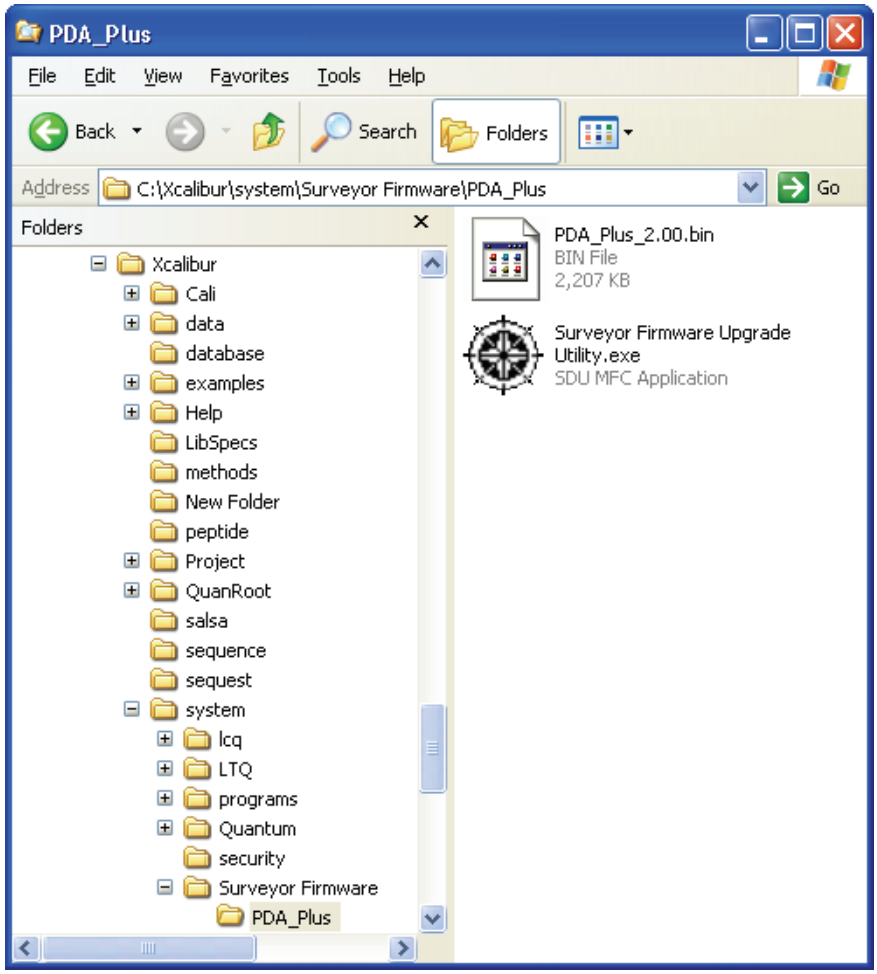

Figure 84. Location of Surveyor Firmware Upgrade Utility application for Xcalibur

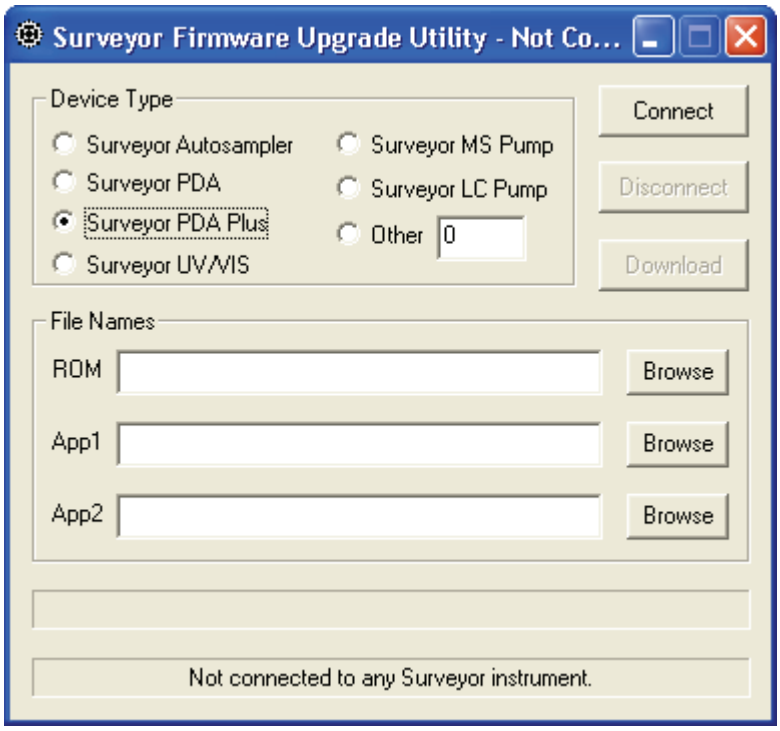

Figure 85. Surveyor Firmware Upgrade Utility, showing the Surveyor PDA Plus option selected

CAUTION Do **not** interrupt the firmware download process. Do **not** turn off the power to the Surveyor PDA Plus Detector or close the Surveyor Firmware Upgrade Utility while the detector is connected to the Surveyor Firmware Upgrade Utility. If you lose power to the detector during the firmware download process, contact your local Thermo Electron representative. The firmware board will need to be reprogrammed.

2. Start the communication between the detector and the utility:

   a. Under **Device Type**, click the **Surveyor PDA Plus** option. See Figure 85.

   b. Click **Connect** to initiate communication between the utility and the Surveyor PDA Plus Detector.

      The status display at the bottom of the Surveyor Firmware Upgrade Utility window indicates that a connection has been made. See Figure 86.

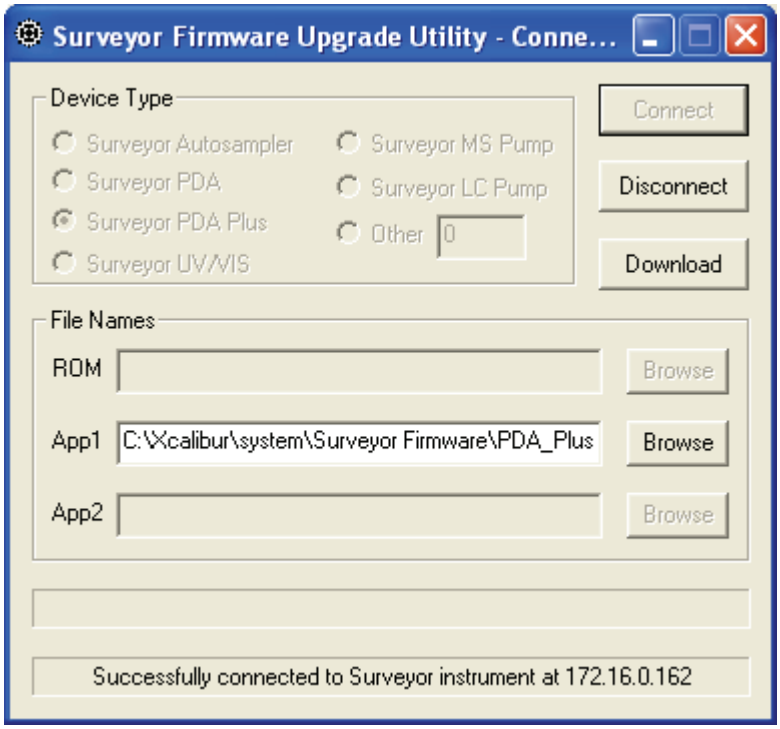

Figure 86. Surveyor Firmware Upgrade Utility, showing a successful connection to the Surveyor PDA Plus Detector

c. Under **File Names**, click **Browse** to the right of App1, and then select the APP1 file ("PDA_Plus_*.bin").

   The filename appears in the App1 box. See Figure 87 on page 131.

d. Click **Download**, and then wait for the download to finish.

   The utility notifies you when the download is complete.

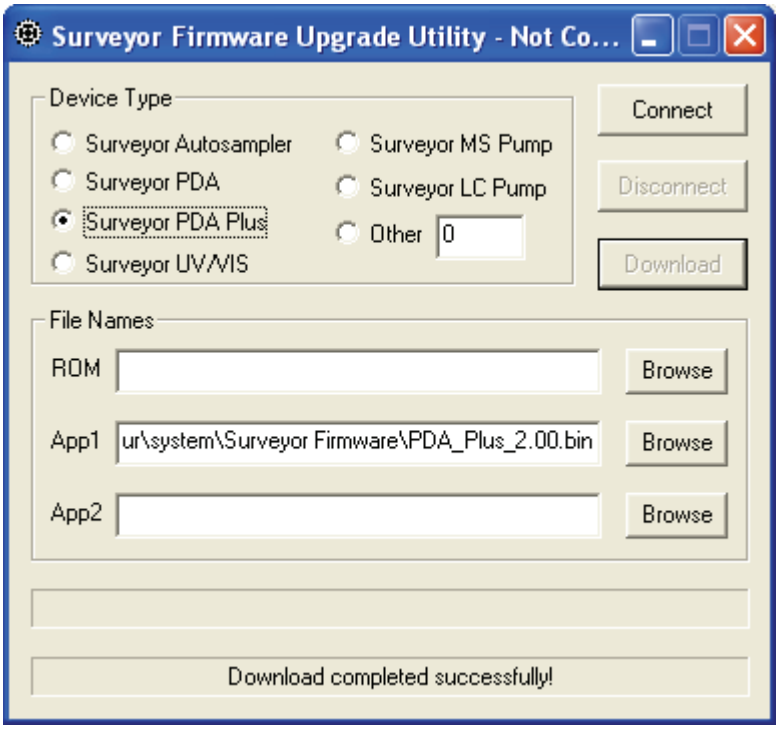

Figure 87. Surveyor Firmware Upgrade Utility, showing the PDA_Plus_*.bin file selected

3. After you finish upgrading your firmware:

   a. Close the Surveyor Firmware Upgrade Utility.

      After you close the Surveyor Firmware Upgrade Utility, the connection with the Surveyor PDA will be terminated automatically.

      Note You can now safely turn off the power to the detector.

   b. Depress the On/Off switch on the front of the Surveyor PDA Plus Detector to turn off the power.

      IMPORTANT It is important to turn the PDA power Off before adjusting the rotary switches

   c. Set the rotary switches back to their original settings.

   d. Turn the PDA power On to resume normal operation.

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