

# Surveyor PDA Plus Detector

## Hardware Manual

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DOCUMENTATION  
**SURVEY**

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Software versions: Xcalibur 2.0 and higher data system software or ChromQuest 4.2 and higher data system software

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## Regulatory Compliance

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

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

### Surveyor PDA Plus Detector

#### 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.

### 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 UNDESIRE OPERATION.



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

## Notice on Lifting and Handling of Thermo Scientific Instruments

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

## Notice on the Proper Use of Thermo Scientific Instruments

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

## Notice on the Susceptibility to Electromagnetic Transmissions

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

For manufacturing location, see the label on the instrument.

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## WEEE Konformität

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









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## Conformité DEEE

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



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

CAUTION Symbol	CAUTION	VORSICHT	ATTENTION	PRECAUCION	AVVERTENZA
	<b>Electric Shock:</b> This instrument uses high voltages that can cause personal injury. Before servicing, shut down the instrument and disconnect the instrument from line power. Keep the top cover on while operating the instrument. Do not remove protective covers from PCBs.	<b>Elektroschock:</b> 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.	<b>Choc électrique:</b> L'instrument utilise des tensions capables d'infliger des blessures corporelles. L'instrument doit être arrêté et débranché de la source de courant avant tout intervention. Ne pas utiliser l'instrument sans son couvercle. Ne pas enlever les étuis protecteurs des cartes de circuits imprimés.	<b>Descarga eléctrica:</b> Este instrumento utiliza altas tensiones, capaces de producir lesiones personales. Antes de dar servicio de mantenimiento al instrumento, éste deberá apagarse y desconectarse de la línea de alimentación eléctrica. No opere el instrumento sin sus cubiertas exteriores quitadas. No remueva las cubiertas protectoras de las tarjetas de circuito impreso.	<b>Shock da folgorazione.</b> L'apparecchio è alimentato da corrente ad alta tensione che può 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).
	<b>Chemical:</b> This instrument might contain hazardous chemicals. Wear gloves when handling toxic, carcinogenic, mutagenic, or corrosive or irritant chemicals. Use approved containers and proper procedures to dispose waste oil.	<b>Chemikalien:</b> 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.	<b>Chimique:</b> Des produits chimiques dangereux peuvent se trouver dans l'instrument. Portez des gants pour manipuler tous produits chimiques toxiques, cancérigènes, mutagènes, ou corrosifs/irritants. Utilisez des récipients et des procédures homologuées pour se débarrasser des déchets d'huile.	<b>Química:</b> El instrumento puede contener productos químicos peligrosos. Utilice guantes al manejar productos químicos tóxicos, carcinógenos, mutágenos o corrosivos/irritantes. Utilice recipientes y procedimientos aprobados para deshacerse del aceite usado.	<b>Prodotti chimici.</b> 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.
	<b>Heat:</b> Before servicing the instrument, allow any heated components to cool.	<b>Hitze:</b> Warten Sie erhitzte Komponenten erst nachdem diese sich abgekühlt haben.	<b>Haute Temperature:</b> Permettre aux composants chauffés de refroidir avant tout intervention.	<b>Altas temperaturas:</b> Permita que los componentes se enfríen, ante de efectuar servicio de mantenimiento.	<b>Calore.</b> Attendere che i componenti riscaldati si raffreddino prima di effettuare l'intervento di manutenzione.
	<b>Fire:</b> Use care when operating the system in the presence of flammable gases.	<b>Feuer:</b> Beachten Sie die einschlägigen Vorsichtsmaßnahmen, wenn Sie das System in Gegenwart von entzündbaren Gasen betreiben.	<b>Incendie:</b> Agir avec précaution lors de l'utilisation du système en présence de gaz inflammables.	<b>Fuego:</b> Tenga cuidado al operar el sistema en presencia de gases inflamables.	<b>Incendio.</b> Adottare le dovute precauzioni quando si usa il sistema in presenza di gas infiammabili.
	<b>Eye Hazard:</b> Eye damage could occur from splattered chemicals or flying particles. Wear safety glasses when handling chemicals or servicing the instrument.	<b>Verletzungsgefahr der Augen:</b> Verspritzte Chemikalien oder kleine Partikel können Augenverletzungen verursachen. Tragen Sie beim Umgang mit Chemikalien oder bei der Wartung des Gerätes eine Schutzbrille.	<b>Danger pour les yeux:</b> Des projections chimiques, liquides, ou solides peuvent être dangereuses pour les yeux. Porter des lunettes de protection lors de toute manipulation de produit chimique ou pour toute intervention sur l'instrument.	<b>Peligro par los ojos:</b> Las salicaduras de productos químicos o partículas que saltan bruscamente pueden causar lesiones en los ojos. Utilice anteojos protectores al manipular productos químicos o al darle servicio de mantenimiento al instrumento.	<b>Pericolo per la vista.</b> 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.
	<b>General Hazard:</b> A hazard is present that is not included in the above categories. Also, this symbol appears on the instrument to refer the user to instructions in this manual.  When the safety of a procedure is questionable, contact your local Technical Support organization for Thermo Fisher Scientific San Jose Products.	<b>Allgemeine Gefahr:</b> Es besteht eine weitere Gefahr, die nicht in den vorstehenden Kategorien beschrieben ist. Dieses Symbol wird im Handbuch außerdem dazu verwendet, um den Benutzer auf Anweisungen hinzuweisen.  Wenn Sie sich über die Sicherheit eines Verfahrens im unklaren sind, setzen Sie sich, bevor Sie fortfahren, mit Ihrer lokalen technischen Unterstützungsorganisation für Thermo Fisher Scientific San Jose Produkte in Verbindung.	<b>Danger général:</b> 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.  Si la sûreté d'un procédé est incertaine, avant de continuer, contacter le plus proche Service Clientèle pour les produits de Thermo Fisher Scientific San Jose.	<b>Peligro general:</b> Significa que existe un peligro no incluido en las categorías anteriores. Este símbolo también se utiliza en el instrumento para referir al usuario a las instrucciones contenidas en este manual.  Cuando la certidumbre acerca de un procedimiento sea dudosa, antes de proseguir, pongase en contacto con la Oficina de Asistencia Técnica local para los productos de Thermo Fisher Scientific San Jose.	<b>Pericolo generico.</b> 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.  Quando è in dubbio la misura di sicurezza per una procedura, prima di continuare, si prega di mettersi in contatto con il Servizio di Assistenza Tecnica locale per i prodotti di Thermo Fisher Scientific San Jose.

## CAUTION Symbol

## CAUTION

## 危険警告

## 危險警告



**Electric Shock:** This instrument uses high voltages that can cause personal injury. Before servicing, shut down the instrument and disconnect the instrument from line power. Keep the top cover on while operating the instrument. Do not remove protective covers from PCBs.

**電撃:** この計測器は高電圧を使用し、人体に危害を与える可能性があります。保守・修理は、必ず作業を停止し、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。

**電撃:** 儀器設備使用會造成人身傷害的高伏電壓。在維修之前，必須先關儀器設備並切除電源。務必要在頂蓋蓋上的情況下操作儀器。請勿拆除PCB保護蓋。



**Chemical:** This instrument might contain hazardous chemicals. Wear gloves when handling toxic, carcinogenic, mutagenic, or corrosive or irritant chemicals. Use approved containers and proper procedures to dispose waste oil.

**化学物質:** 危険な化学物質が計測器中に存在している可能性があります。毒性、発がん性、突然変異性、腐食・刺激性などのある薬品を取り扱う際は、手袋を着用して下さい。廃油の処分には、規定の容器と手順を使用して下さい。

**化学品:** 儀器設備中可能存在有危險性的化學物品。接觸毒性致癌、誘變或腐蝕/刺激性化學品時，請配帶手套。處置廢油時，請使用經過許可的容器和程序。



**Heat:** Before servicing the instrument, allow any heated components to cool.

**熱:** 熱くなった部品は冷えるのを待ってから保守・修理を行って下さい。

**高溫:** 請先等高溫零件冷卻之後再進行維修。



**Fire:** Use care when operating the system in the presence of flammable gases.

**火災:** 可燃性のガスが存在する場所でシステムを操作する場合は、充分な注意を払って下さい。

**火災:** 在有易燃氣體的場地操作該系統時，請務必小心謹慎。



**Eye Hazard:** Eye damage could occur from splattered chemicals or flying particles. Wear safety glasses when handling chemicals or servicing the instrument.

**眼に対する危険:** 化学物質や微粒子が飛散して眼を傷つける危険性があります。化学物質の取り扱い、あるいは計測器の保守・修理に際しては防護眼鏡を着用して下さい。

**眼睛傷害危険:** 飛濺の化学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 appears on the instrument to refer the user to instructions in this manual.

**一般的な危険:** この標識は上記以外のタイプの危険が存在することを示します。また、計測器にこの標識がついている場合は、本マニュアル中の指示を参照して下さい。

**一般性危険:** 説明未包括在上述類別中的其他危險。此外，儀器設備上使用這個標誌，以指示用戶本使用手冊中的說明。

When the safety of a procedure is questionable, contact your local Technical Support organization for Thermo Fisher Scientific San Jose Products.

**安全を確保する手順がよくわからない時は、作業を一時中止し、お近くのサーモエレクトロンサンローゼプロダクトのテクニカルサポートセンターにご連絡ください。**

**如對安全程序有疑問，請在操作之前與當地的菲尼根技術服務中心聯繫。**



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## Preface

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

## Related Documentation

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

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

## 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.

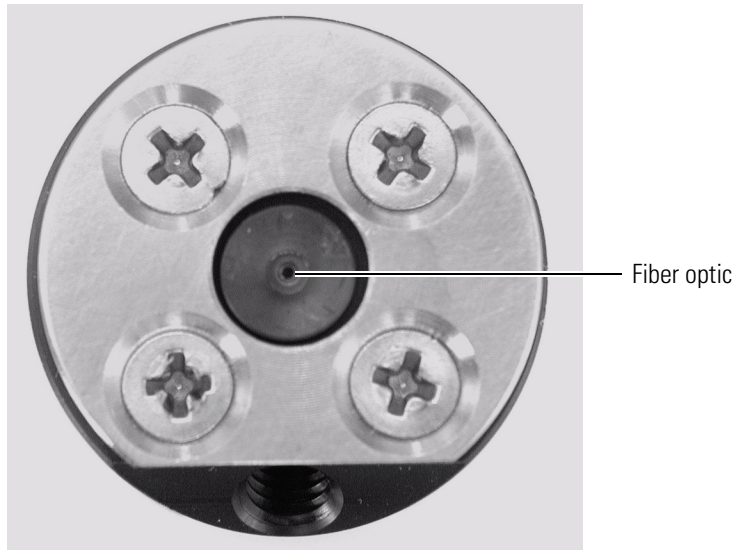
**IMPORTANT** Highlights information necessary to prevent damage to software, loss of data, or invalid test results; or might contain information that is critical for optimal performance of the system.

**Note** Highlights information of general interest.

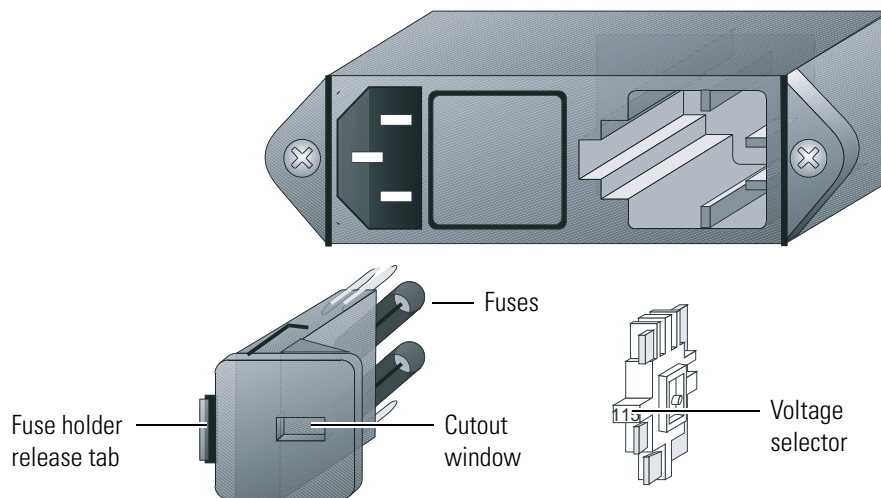
**Tip** Highlights helpful information that can make a task easier.

## Special Precautions for the PDA Detector

The PDA detector contains a LightPipe flowcell that you can easily damage if you handle it by its ends. Do **not** touch the fiber optics that are exposed at the ends of the flowcell. See the following figure.



The power entry module for the PDA detector contains a voltage selector as shown in the following figure. 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 12](#)).



Ensure that the outlet tubing from the PDA detector is inserted into the drainage system connected to a sealed waste bottle before you start the mobile phase flow.

## Good Laboratory Practices

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

- Keep good records.
- Read the manufacturers' Material Safety Data Sheets for the chemicals being used in your laboratory.
- Remove particulate matter from your samples before you inject them into the liquid chromatograph.
- Use HPLC-grade solvents.
- Connect the drainage tubes from the pump, autosampler, and detector to an appropriate waste receptacle. Dispose of solvents as specified by local regulations.

## Keep Good Records

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

## Chemical Toxicity

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

## Sample Preparation

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

## Solvent Requirements

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

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

## Solvent Disposal

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

## High-pressure Systems and Leaks

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



## Contacting Us

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

### ❖ To contact Technical Support

Phone	800-532-4752
Fax	561-688-8736
E-mail	<a href="mailto:us.techsupport.analyze@thermofisher.com">us.techsupport.analyze@thermofisher.com</a>
Knowledge base	<a href="http://www.thermokb.com">www.thermokb.com</a>

Find software updates and utilities to download at [mssupport.thermo.com](http://mssupport.thermo.com).

### ❖ To contact Customer Service for ordering information

Phone	800-532-4752
Fax	561-688-8731
E-mail	<a href="mailto:us.customer-support.analyze@thermofisher.com">us.customer-support.analyze@thermofisher.com</a>
Web site	<a href="http://www.thermo.com/ms">www.thermo.com/ms</a>

### ❖ To copy manuals from the Internet

Go to [mssupport.thermo.com](http://mssupport.thermo.com) and click **Customer Manuals** in the left margin of the window.

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

- To provide us with comments about this document, click the link below. Thank you in advance for your help.



- Send an e-mail message to the Technical Publications Editor at [techpubs-lcms@thermofisher.com](mailto:techpubs-lcms@thermofisher.com).



## Introduction

The Surveyor PDA Plus Detector is a member of the Surveyor Plus™ family of LC instruments (see [Figure 1](#)).

### Contents

- [Functional Description](#)
- [LightPipe Flowcell](#)
- [Status LEDs](#)
- [Specifications](#)

**Figure 1.** Surveyor PDA Plus Detector



## Functional Description

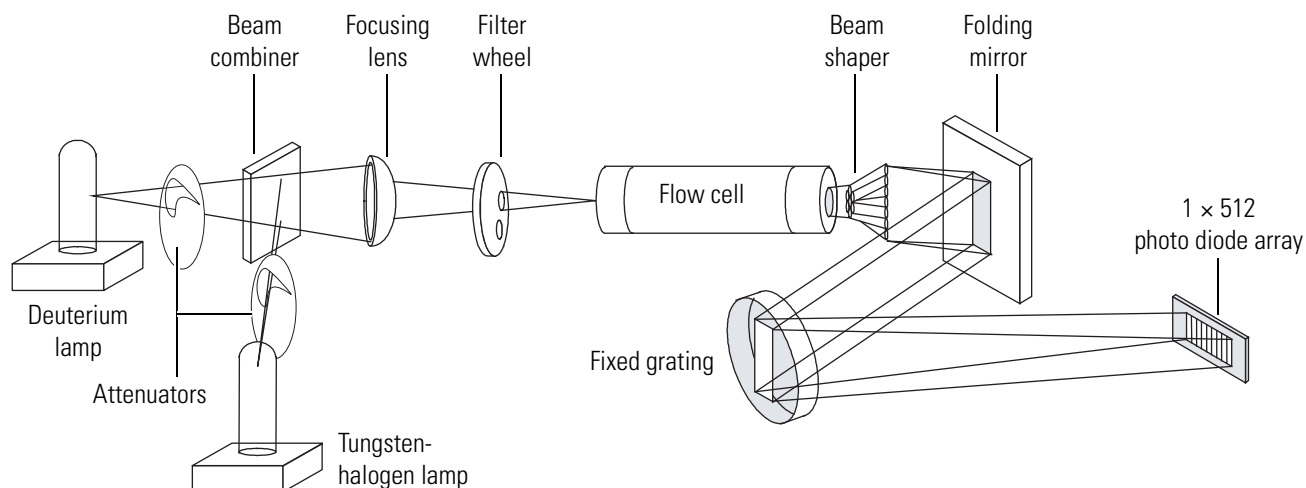
The detector is a full-featured, time-programmable, photodiode array (PDA) detector capable of scanning the ultraviolet-visible wavelength range from 190 to 800 nm. You can acquire data across the entire spectral range (with an effective resolution of 1.2 nm) at a rate of 0.5 to 20 Hz with 20-bit digital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

The PDA detector is a benchtop 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 the Xcalibur or ChromQuest data system 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).

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. Manually adjusting the two attenuators increases or decreases the light intensity reaching the photodiode array.

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

**Figure 2.** The PDA detector optical system



The light focused on the inlet window of the flowcell travels down the cell, is partially absorbed by the sample flowing through the cell, and exits into the beam shaper. The beam shaper is a fiber bundle. Its entrance aperture is circular to collect light from the flowcell. The

other end of the bundle is arranged to produce a narrow “slit” of light for the grating. The beam shaper transfers all 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  $611 \text{ nm} / 510 = 1.2 \text{ nm}$ . Firmware on the CPU PCB automatically interpolates diode intervals to arrive at integer wavelengths.

The photodiode array is mounted on the array acquisition PCB, which also contains all the analog detection circuitry. The 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.

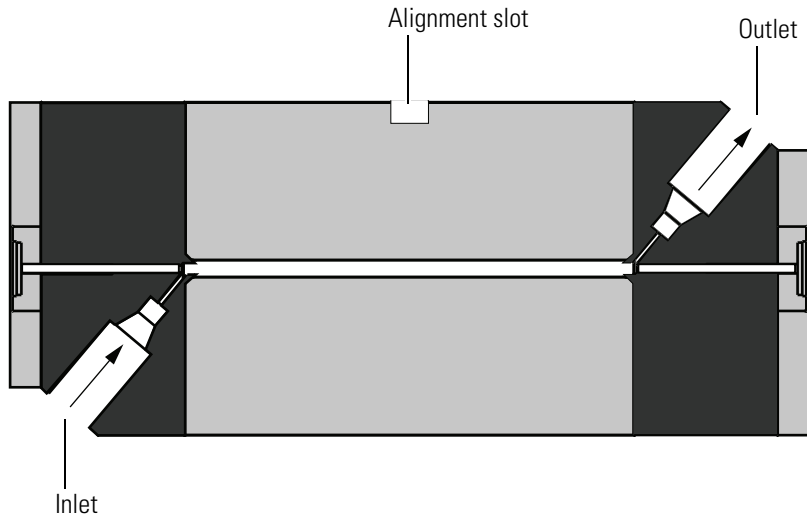
## LightPipe Flowcell

The Surveyor PDA Plus Detector ships with a 10-mm LightPipe flowcell. Thermo Fisher Scientific also offers an optional 50 mm LightPipe flowcell.

The internal bore of the 50-mm LightPipe flowcell is 50 mm long and has a volume of 10  $\mu\text{L}$ . The internal bore of the 10-mm LightPipe flowcell is 10 mm long and has a volume of 2  $\mu\text{L}$ . A special low refractive index coating of the internal bore ensures a high optical throughput and minimizes short-term noise.

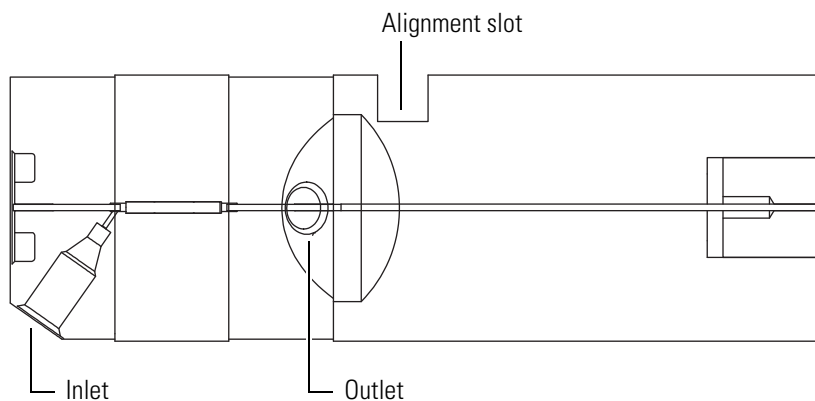
Mobile phase enters the 50 mm LightPipe flowcell through a port in the bottom of the flowcell and exits through a port in the top of the flowcell as shown in [Figure 3](#). Directing the flow from the bottom to the top of the flowcell helps prevent the entrapment of air bubbles.

**Figure 3.** Schematic of 50 mm LightPipe flowcell



Mobile phase enters the 10-mm LightPipe flowcell through a port in the bottom of the flowcell and exits through a port in the front of the flowcell as shown in [Figure 4](#). Directing the flow upward helps prevent the entrapment of air bubbles.

**Figure 4.** Schematic of 10-mm LightPipe flowcell

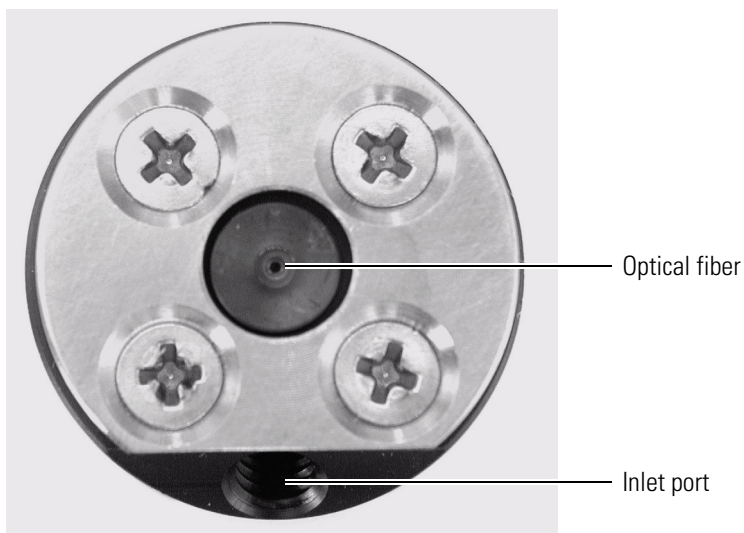


Sensitive optical fibers are exposed at both ends of the flowcell (see [Figure 5](#)). Thermo Fisher Scientific ships the LightPipe flowcell with end caps to protect these optical fibers (see [Figure 6](#)). Do not remove the protective end caps until you install the LightPipe flowcell. Replace the protective end caps for storage if you remove the LightPipe flowcell from the detector.

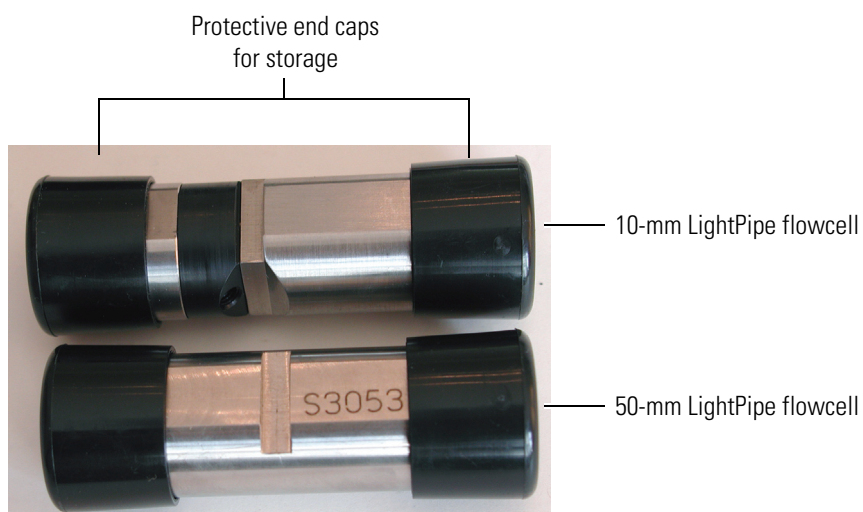


**CAUTION** Do **not** touch the ends of the LightPipe flowcell. Doing so could damage the sensitive optical fibers. If you must grasp the ends of the LightPipe flowcell, wear clean, talc-free gloves.

**Figure 5.** End of LightPipe flowcell with a view of the sensitive optical fiber and the inlet port



**Figure 6.** LightPipe flowcell with protective end caps



## Status LEDs

Four status LEDs (light-emitting diodes)—labeled Power, Communication, Run, and Lamps—are located on the left door of the detector (see Figure 7). Table 1 lists states of the status LEDs.

**Figure 7.** Surveyor PDA Plus Detector status LEDs



**Table 1.** Status LED states

LED	State	Amber
<b>Power</b>	Green	The detector is turned on and receiving power.
<b>Comm</b>	Amber	There is no communication with the data system.
	Flashing amber	The rotary switches are set to 00 and firmware is being downloaded to the CPU of the detector.
	Green	Communication to the data system PC has been established.
<b>Run</b>	Amber	The PDA detector is not ready to start a run for one of the following reasons: <ul style="list-style-type: none"> <li>• A valid method has not been downloaded (following power on).</li> <li>• Both lamps are off, or one of the lamps is failing to turn on.</li> <li>• The lamp or wavelength calibration is not valid.</li> </ul>
	Flashing amber	The PDA detector is in an error state while in the Run mode.
	Green	The detector is ready for a run.
	Flashing green	A run is in progress and the detector is sending data to the PC.
<b>Lamps</b>	Amber	The lamps are off or the D2 lamp is starting. It takes approximately 10 s for the D2 lamp to turn on.
	Green	One or both lamps are turned on.



## Specifications

The specifications for the Surveyor PDA Plus Detector are as follows:

Wavelength Range:	190 nm to 800 nm continuous
Wavelength Accuracy:	±1 nm at 254 nm and 656 nm
Digital Wavelength Resolution:	1.2 nm
Absorbance Range:	2.0 AU to +4.0 AU, 20-bit resolution
Short Term Noise* :	≤ 6 μAU/cm at 254 nm 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:	10-mm LightPipe flowcell, 50-mm LightPipe flowcell
Cell Pressure Rating:	1000 psi
Diodes:	512
Diode Spacing:	1.2 nm
Light Source:	Deuterium and tungsten-halogen lamps, pre-aligned
Filter Wheels:	<ul style="list-style-type: none"> <li>• Standard Filter Wheel: 2-position wheel, 1 open position and 1 Holmium oxide/perchloric acid filled cuvette, NIST traceable</li> <li>• 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</li> </ul>
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
Dimensions:	18 cm (7.1 in.) × 36 cm (14.2 in.) × 47 cm (18.5 in.) ( <i>h × w × d</i> )
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 flowcell, 5 nm bandwidth, 2 second rise time, and MeOH at 1 mL/min.).



# Installation

This chapter describes the initial installation of the PDA 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, fill it out when the installation is complete, and include it in your maintenance records.

## Contents

- [Installation Checklist](#)
- [Unpacking and Inspecting the Instrument](#)
- [Making the Initial Instrument Preparations](#)
- [Checking the Power Setting and Fuses](#)
- [Making the Back Panel Connections](#)
- [Installing the LightPipe Flowcell](#)
- [Turning On the Detector for the First Time](#)
- [Connecting Remote Outputs](#)
- [Completing the Installation](#)

## Installation Checklist

The following installation checklist is a brief summary of the steps that you need to complete in sequence for the proper installation of the PDA detector.

- Unpack and inspect your instrument (see [page 11](#)).
- Read the safety notices in the preface.
- Make the initial instrument preparations (see [page 11](#)).
- Check the power settings and fuses (see [page 12](#)).
- Make the initial back panel connections (see [page 13](#)).
- Connect and install the LightPipe flowcell (see [page 17](#)).
- Power on the detector for the first time (see [page 21](#)).
- Install software and connect remote communication outputs, as required (see [page 21](#)).
- Download the PDA detector firmware, if required. See [Appendix A, “Firmware.”](#)
- Configure the Surveyor PDA Plus Detector for control from your chromatography data system. See [Chapter 3, “Configuration.”](#)
- Calibrate the Surveyor PDA Plus Detector (see [“Calibrating the PDA Detector”](#) on [page 34](#)).

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, a LightPipe flowcell kit, a power cable, and an accessory kit containing the following items:

- Two signal cables
- RJ12 serial communications cable
- 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 Fisher Scientific representative immediately.

The part numbers of the accessory kit items are listed in [Table 9](#) on [page 107](#).

## Making the Initial Instrument Preparations

Place the PDA detector on a benchtop as close as possible to the chromatographic column outlet (minimizing the length of tubing necessary for connection to the LightPipe flowcell 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 back panel of the detector and any wall or obstruction. This clear space provides access to the back-panel connectors and a free flow of cooling air.

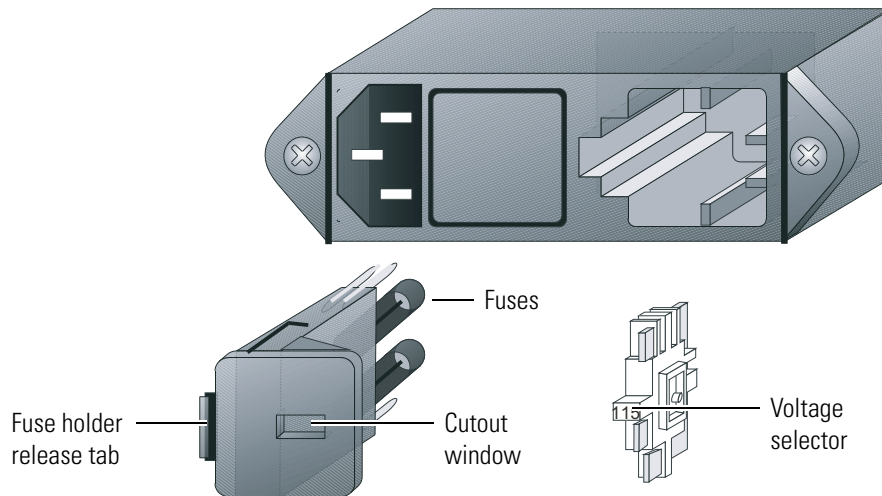
You must have the following tools for installation:

- Narrow-blade 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 of the back panel of the detector (see [Figure 8](#)).

**Figure 8.** Power entry module



**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 pops 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 Back Panel Connections

Use the cables provided in the Surveyor system accessory kit to make the connections to the back panel of the detector. The part numbers for these cables are listed in [Table 6](#) on [page 106](#).

See “[Turning On the Detector for the First Time](#)” on [page 21](#) for instructions on connecting to line power.

This section contains the following topics:

- [Connecting the Ethernet Cable](#)
- [Connecting the Interconnect Cable](#)
- [Connecting the Analog Outputs](#)
- [Setting the Analog Output Voltage](#)
- [Setting the Unit ID](#)

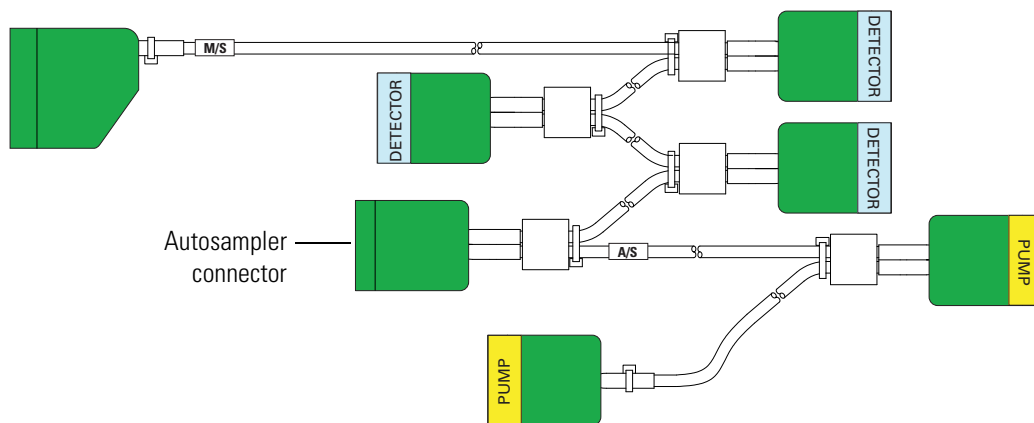
### Connecting the Ethernet Cable

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

### Connecting the Interconnect Cable

The interconnect cable coordinates the timing of the Surveyor Plus 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: three detector connectors labeled DETECTOR, two pump connectors labeled PUMP, an autosampler connector, and an MS detector connector.

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



## 2 Installation

### Making the Back Panel Connections

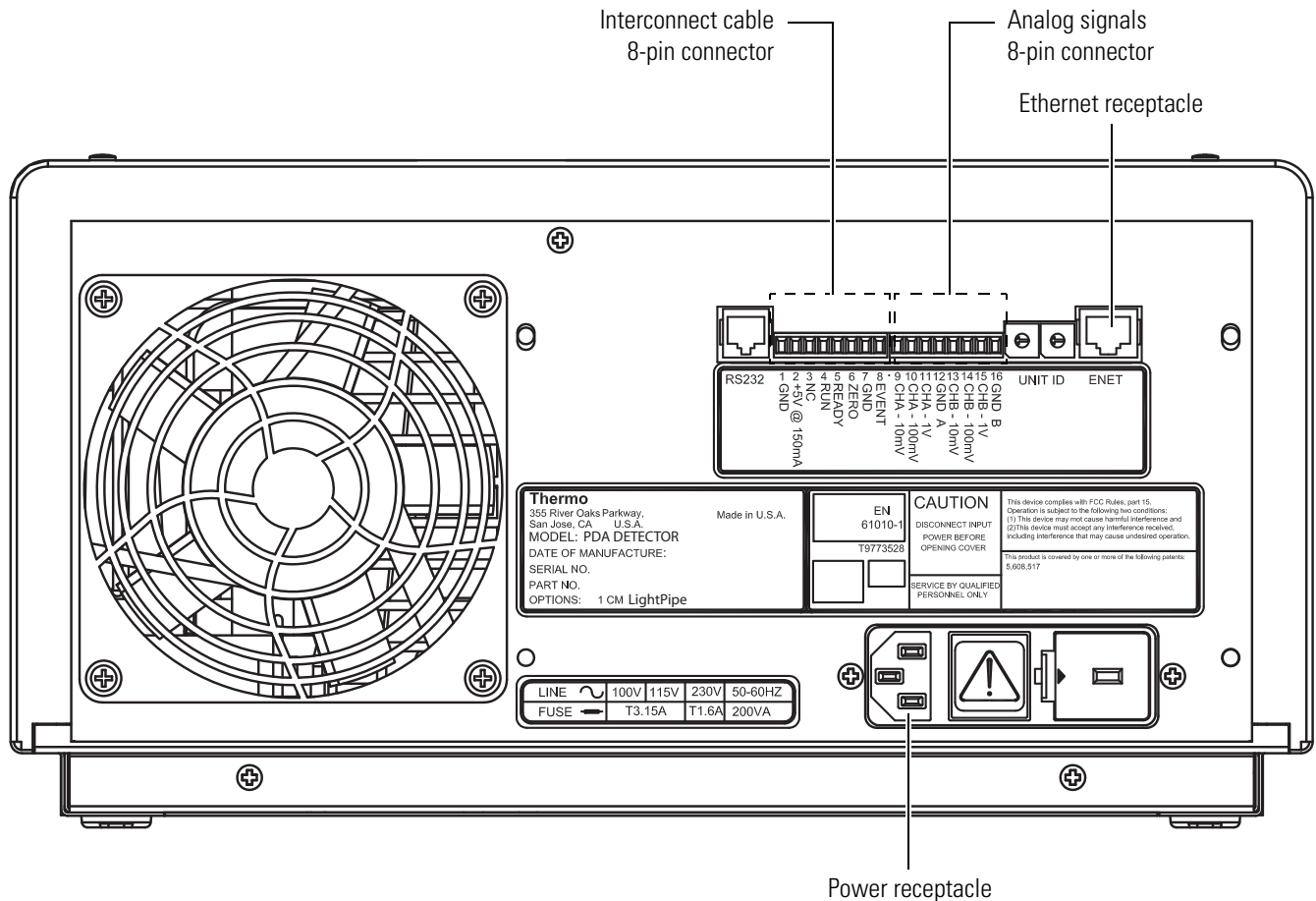
#### ❖ To connect the system interconnect cable

1. Plug one of the connectors labeled DETECTOR into the left, 8-pin receptacle labeled pins 1 to 8 on the back panel of the detector (see [Figure 10](#)).
2. Plug one of the connectors labeled PUMP into the 8-pin receptacle on the back panel of the Surveyor LC Pump Plus.
3. Plug the autosampler connector, which is identified by the tag on its adjacent cable, into the left, 8-pin receptacle on the back panel of the autosampler.

**IMPORTANT** Connecting the Surveyor MS Pump Plus requires an additional adaptor cable.

Refer to the *Surveyor Plus Getting Connected Guide* for information on connecting an MS detector.

**Figure 10.** Back panel of Surveyor PDA Plus Detector





## Connecting the Analog Outputs

Two analog signal cables (twin-axial computer cables) are provided in the installation kit to connect 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 carry an analog signal to data collection devices. Typically, the wire with the clear insulation is connected to the positive analog output, and the wire with the black insulation is connected to the signal ground (sometimes referred to as the negative signal). The third wire is not insulated and grounds the cable shielding. The cable shielding reduces signal noise caused by radio frequency interference and is most effective if the bare wire is grounded at just one end.

At the detector back 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.

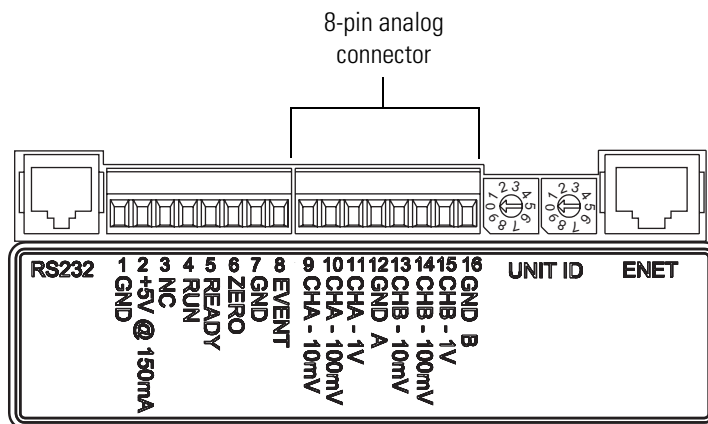
The ends (1/4-in.) of the analog signal wires are stripped and soldered to allow electrical contact and to prevent fraying.

### ❖ 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. Doing so leads to an increased noise level and a subsequent decrease in sensitivity.

**Figure 11.** View of the analog outputs



## Setting the Analog Output Voltage

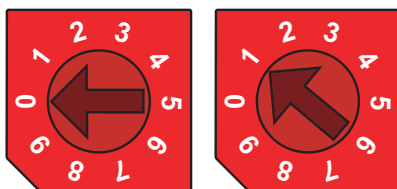
The analog outputs are controlled by the wavelength, bandwidth, rise time, and zero functions of the detector. These outputs are made compatible with data collection systems using any of the three different voltages (10 mV, 100 mV, or 1 V) by selecting the appropriate terminal of the analog output terminal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

## Setting the Unit ID

The Surveyor PDA Plus Detector arrives 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. Do not change the unit ID setting for your detector unless you are controlling more than one PDA detector from one computer. For details on configuring your detector, see Chapter 3, “Configuration.”

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

**Figure 12.** Unit ID rotary switches set to a value of 1



## Making Remote Communications Connections

The Surveyor PDA Plus Detector has the remote communications inputs RUN and ZERO, and the remote communications output EVENT.

### RUN

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

### ZERO

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

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

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

## EVENT

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

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 k $\Omega$ ) 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 Flowcell

The LightPipe flowcell is packed in a small, separate box within the detector shipping carton. This small box contains the LightPipe flowcell (with a protective cap on each end) and a plastic bag containing the inlet and outlet tubing and fingertight fittings. The part numbers for these items are listed in [Table 4](#) on [page 105](#).

You gain access to the LightPipe flowcell by opening the two front doors of the detector and removing the flowcell access cover (see [Figure 13](#)).

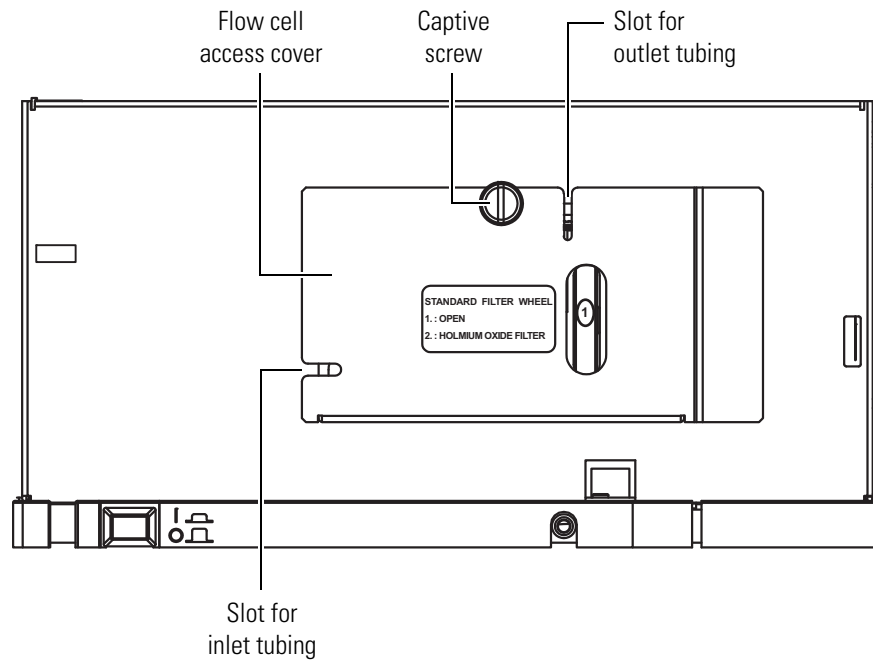
### ❖ To install the LightPipe flowcell

1. Open the front doors of the detector.
2. Unscrew the captive screw that secures the flowcell access cover to the front panel of the detector and pull the cover off (see [Figure 13](#)).

## 2 Installation

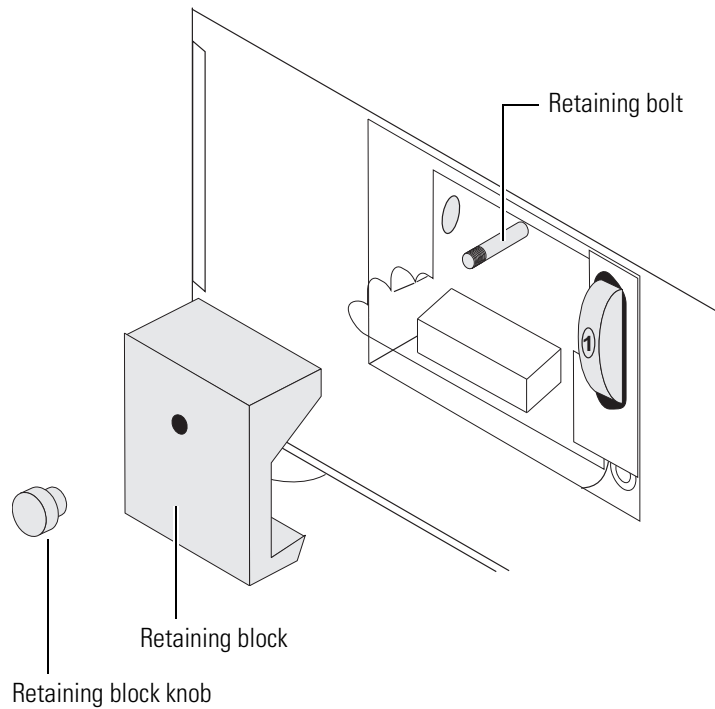
### Installing the LightPipe Flowcell

**Figure 13.** View of the flowcell access cover



3. Unscrew the retaining block knob and remove the retaining block (see [Figure 14](#)).

**Figure 14.** View of the retaining block and the retaining block knob



4. Remove the protective end caps from the ends of the LightPipe flowcell (see [Figure 16](#)).
5. Connect the inlet port of the LightPipe flowcell:
  - a. Use the PEEK fittings included with the LightPipe flowcell kit to connect one end of the 0.005-in. ID, red insulated inlet tubing to the flowcell inlet port. Slide the protective insulating sleeve of the tubing as close as possible to the inlet port of the LightPipe flowcell.

**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 flowcell:
  - 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 flowcell 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 105](#)), connect the outlet line to the low-pressure union and waste tubing.
  - If you are connecting the flowcell 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 flowcell 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 flowcell can withstand the greatest backpressure. A backpressure regulator is often recommended to prevent bubble formation in the detector flowcell.

7. Position the slot located on the top of the LightPipe flowcell under the retaining bolt in the detector, and then slide the LightPipe into place.

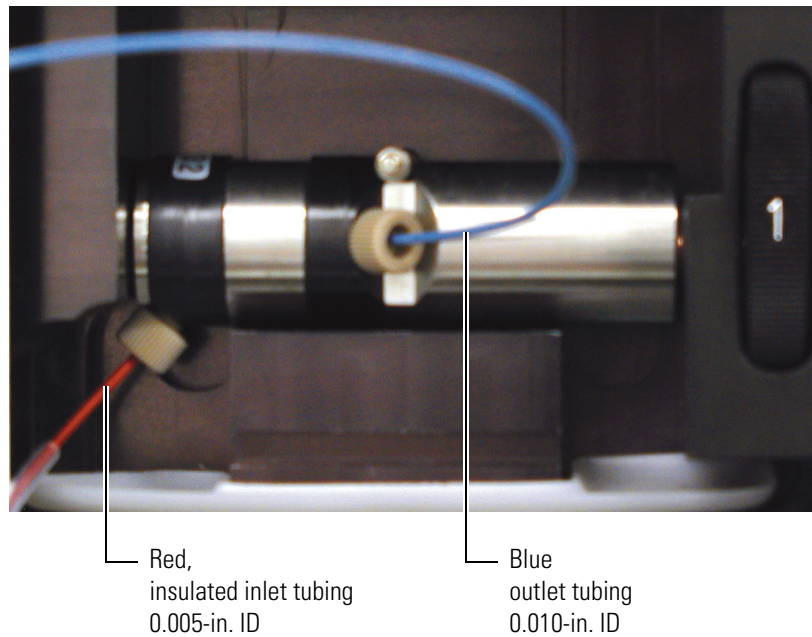
The location of the outlet fitting depends on the size of the flowcell:

- Place the 10-mm LightPipe flowcell so that the inlet fitting is on the bottom, left-side, and the outlet fitting is on the front-side (see [Figure 15](#)).
- Place the 50-mm LightPipe flowcell so that the inlet fitting is on the bottom, left-side and the outlet fitting on the top, right-side.

## 2 Installation

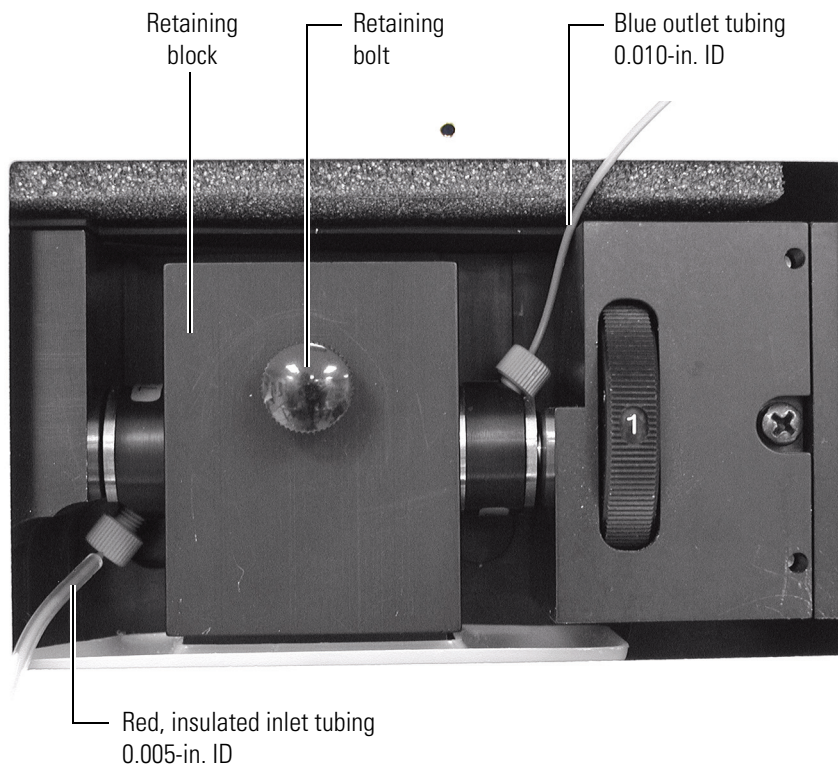
### Installing the LightPipe Flowcell

**Figure 15.** Location of the inlet and outlet tubing for the 10-mm flowcell



8. Replace the LightPipe flowcell retaining block and hand tighten the retaining knob (see [Figure 16](#)).

**Figure 16.** Inlet and outlet tubing connections for the 50-mm LightPipe flowcell



9. Replace the detector flowcell access cover, making sure that the inlet and outlet tubing pass through the slots (see [Figure 13](#) on [page 18](#)) without being pinched. Tighten the captive screw to secure the flowcell access cover to the detector.
10. Close the front doors of the detector.

## Turning On the Detector for the First Time

### ❖ To turn on the detector 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 back 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.

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 15](#)). 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 k $\Omega$ ) is required across the +5 V output and the open collector input connection if one is not built into the external device.

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

# Setting the Polarity of the Remote Outputs from Xcalibur

### ❖ To set the polarity of the remote outputs

1. Install the Xcalibur data system, if you have not already done so.
2. Add the Surveyor PDA Plus Detector to the configuration for your instrument. See [Chapter 3, “Configuration.”](#)
3. Start Xcalibur.
4. In the **Home Page – Roadmap** view, click the Instrument Setup icon to open the Instrument Setup view.



5. In the viewbar, click the **Surveyor PDA** button.

The Instrument Setup view for the PDA detector appears.

6. On the menu bar, choose **Surveyor PDA > Direct Control**.

The PDA Direct Control dialog box appears.

**Note** The Surveyor Autosampler Plus requires low active remote inputs.

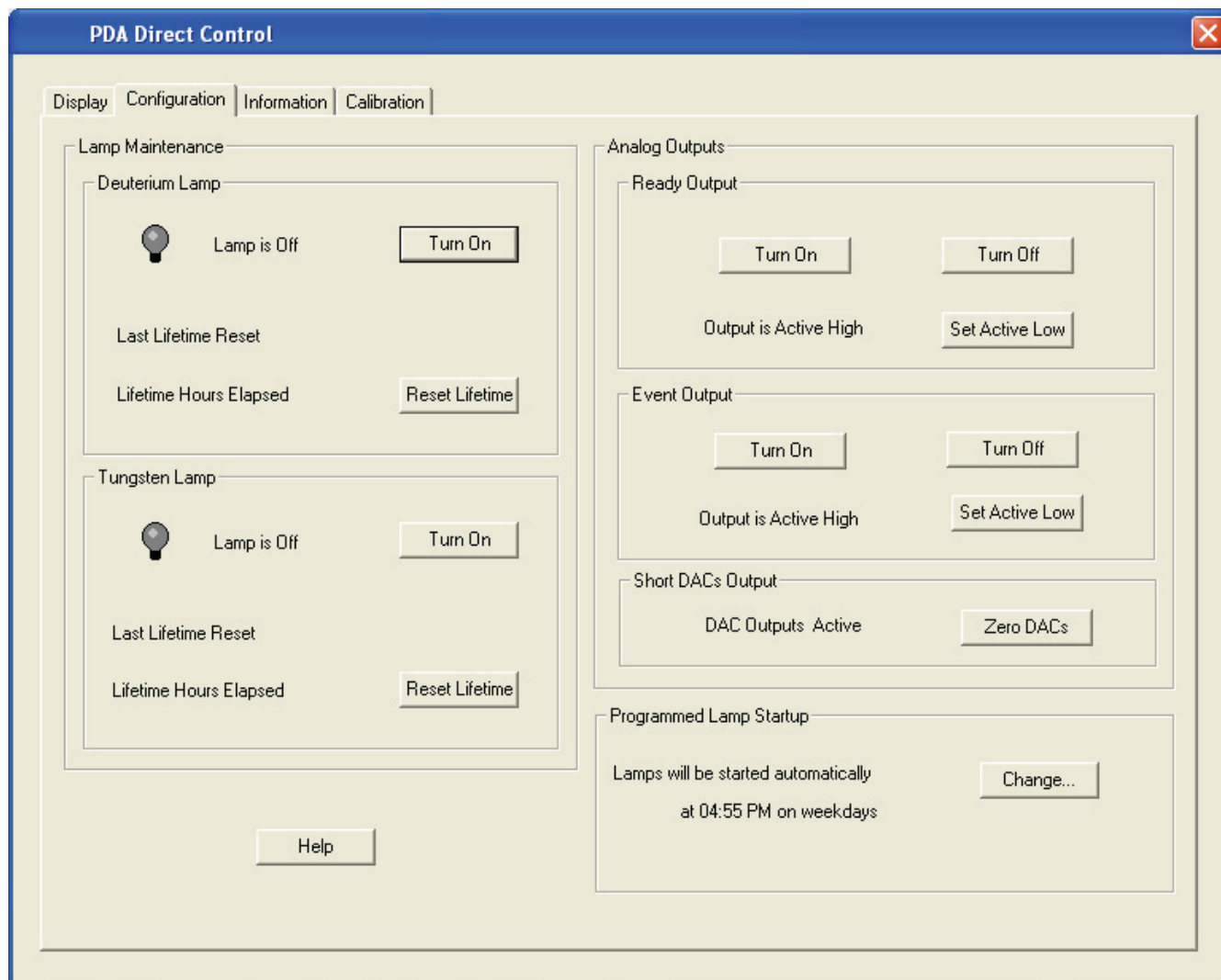
7. Click the **Configuration** tab.

The Configuration page shown in [Figure 17](#) appears.

8. In the Analog Outputs area of the Configuration page, check the current settings of the outputs.
9. Change the settings to match the connecting equipment, if necessary.
10. Close the software and turn off the detector to make any necessary remote communication connections.



**Figure 17.** Configuration page of the PDA Direct Control dialog box in Xcalibur



## Changing the Polarity of the Remote Outputs from ChromQuest

### ❖ To change the polarity of the remote outputs

1. Install the ChromQuest data system, if you have not already done so.
2. Add the Surveyor PDA Plus Detector to the instrument configuration (see [“Configuring the Surveyor PDA Plus Detector in ChromQuest”](#) on page 29).
3. Open the online Instrument window.
4. Choose **Control > Instrument Status**.
5. Click the **Surveyor PDA** tab.
6. Click the appropriate button in the Output States area on the PDA detector page.

# Completing the Installation

The Surveyor PDA Plus Detector is calibrated at the factory. However, it requires recalibration 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 [Chapter 3, “Configuration.”](#)

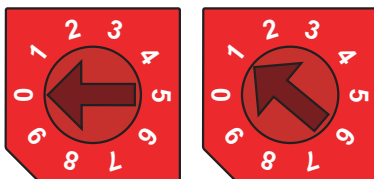
For details on calibrating your detector, see [Chapter 4, “Xcalibur Diagnostics for the PDA Detector.”](#)

## Configuration

The only manual control on the Surveyor PDA Plus Detector is the On/Off switch below the left door of the unit. All other instrument control functions are performed from the chromatography data system.

To control the detector, you must add it to the instrument configuration for your data system. The only configurable option for the PDA detector is its stack address, which must match its unit ID. The unit ID is set by adjusting the two rotary switches on the back panel of the detector. As [Figure 18](#) shows, the switches are set to 01 at the factory. Do not adjust the switches unless you are controlling more than one Surveyor PDA Plus Detector from the same data system computer.

**Figure 18.** Unit ID set to 01



### Contents

- [Configuring the Surveyor PDA Plus Detector in Xcalibur](#)
- [Configuring the Surveyor PDA Plus Detector in ChromQuest](#)

## Configuring the Surveyor PDA Plus Detector in Xcalibur

Before you can control the PDA detector from the Xcalibur data system, you must add it to the configured devices list and configure its stack number. The Instrument Configuration application lists the devices installed with the Xcalibur data system.

### ❖ To configure your instrument in Xcalibur

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

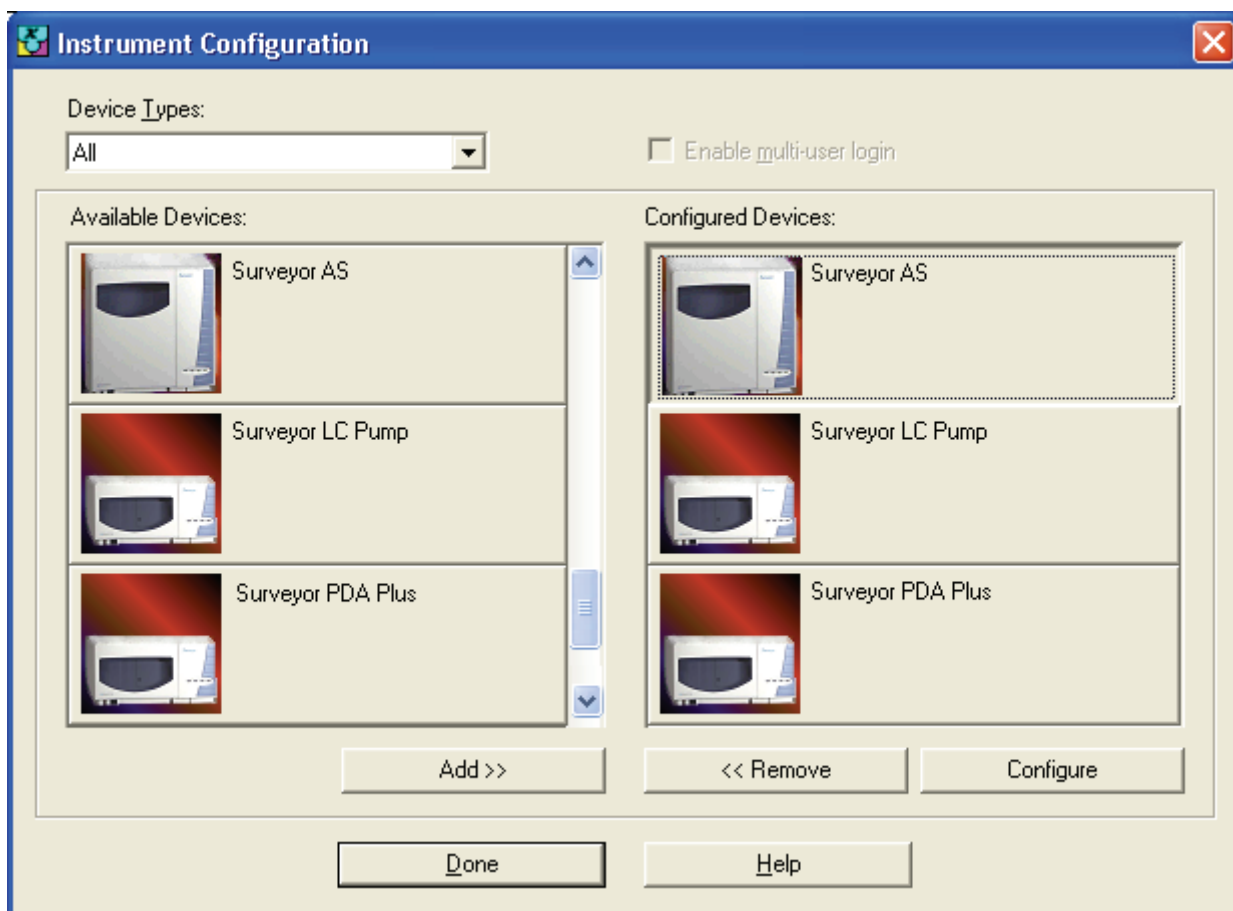
- For Xcalibur 2.0.x or lower, from the computer desktop, choose **Start > All Programs > Xcalibur > Instrument Configuration**, or double-click the **Instrument Configuration** icon.

The Instrument Configuration dialog box appears (see [Figure 19](#)).

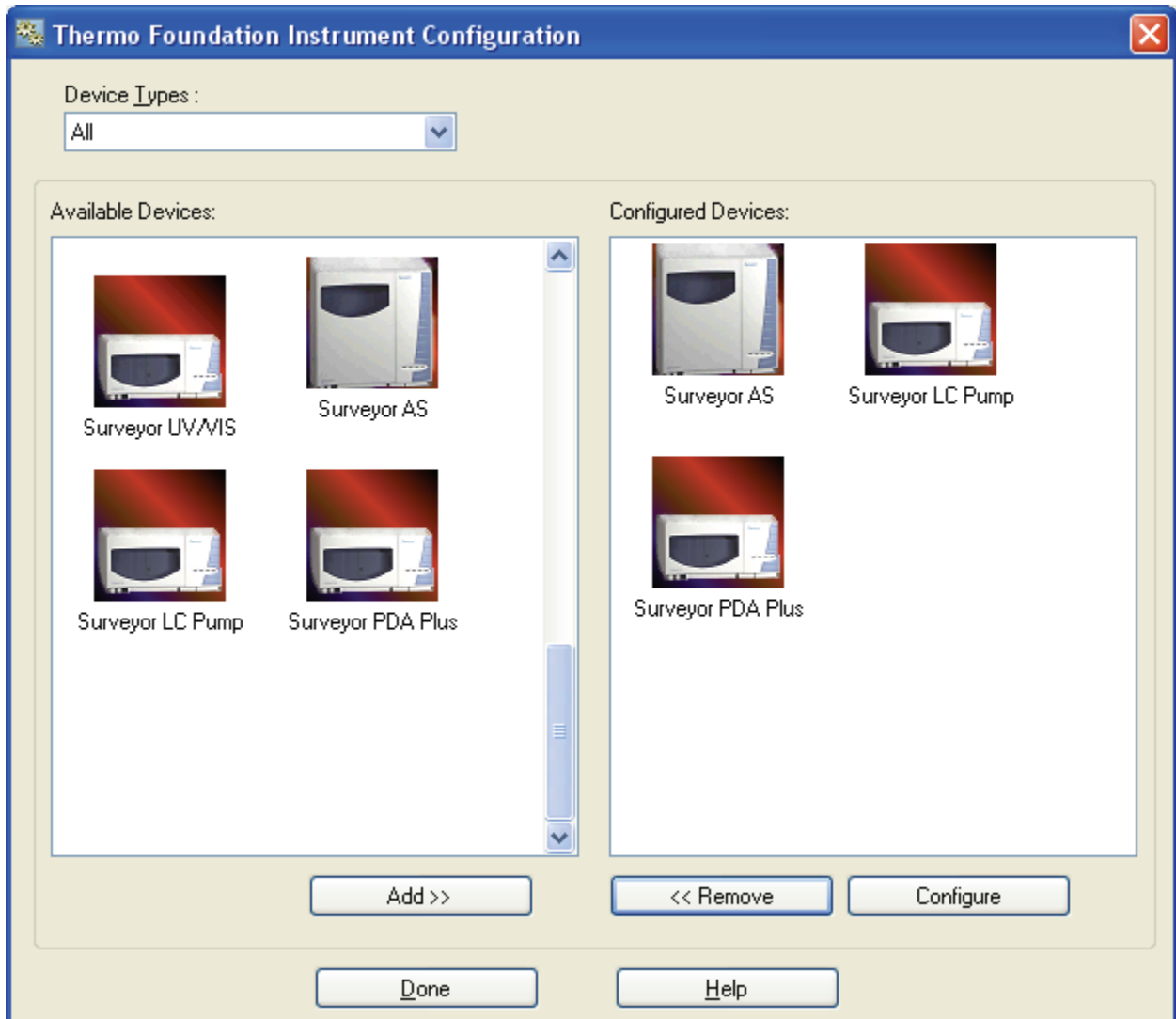
- For Xcalibur 2.1, from the computer desktop, choose **Start > All Programs > Thermo Foundation 1.0 > Instrument Configuration**.

The Thermo Foundation Instrument Configuration dialog box appears (see [Figure 20](#)).

**Figure 19.** Instrument Configuration dialog box with configured devices



**Figure 20.** Thermo Foundation Instrument Configuration dialog box with configured devices

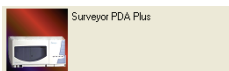


2. In the Available Devices list, double-click each of your Surveyor Plus devices.  
As you double-click a device in the Available Devices list, it appears in the list of configured devices.

### 3 Configuration

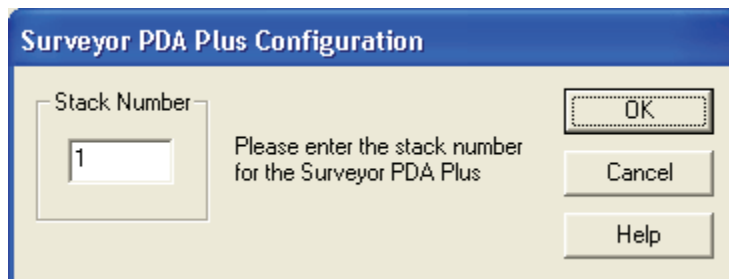
Configuring the Surveyor PDA Plus Detector in Xcalibur

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 21](#)).

**Figure 21.** Surveyor PDA Plus Configuration dialog box



- b. In the Stack Number box, type the number that the unit ID rotary switches on the back panel of the detector are set to.
  - c. Click on **OK** to close the Surveyor PDA Plus 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 LC system contains a Surveyor LC 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.

## Configuring the Surveyor PDA Plus Detector in ChromQuest

Before you can control the PDA detector from the ChromQuest data system, you must add it to the instrument configuration for the Surveyor Plus LC system.

### ❖ To configure the PDA detector

1. Depending on which version of ChromQuest you are using, do one of the following:

- For ChromQuest SI, choose **Start > All Programs > Chromatography > ChromQuest SI Config**. The ChromQuest SI Configuration dialog box appears. Click **Instrument Configuration**. The Instrument Configuration dialog box appears. Go to [step 5](#).
- For ChromQuest, go to [step 2](#).

2. If you have not already done so, create an instrument for your Surveyor LC stack:



- a. Start ChromQuest by double-clicking the ChromQuest icon on the Windows XP desktop. Alternatively, choose **Start > All Programs > Chromatography > ChromQuest**.

The Main Menu window appears.

- b. In the Main Menu window, right-click **The Enterprise**.

A shortcut menu appears.

- c. Choose **New > Instrument**.

A new instrument icon appears in the right pane of the Main Menu window.



3. In the Main Menu window, right-click the icon that represents your Surveyor Plus LC stack.

A shortcut menu appears.

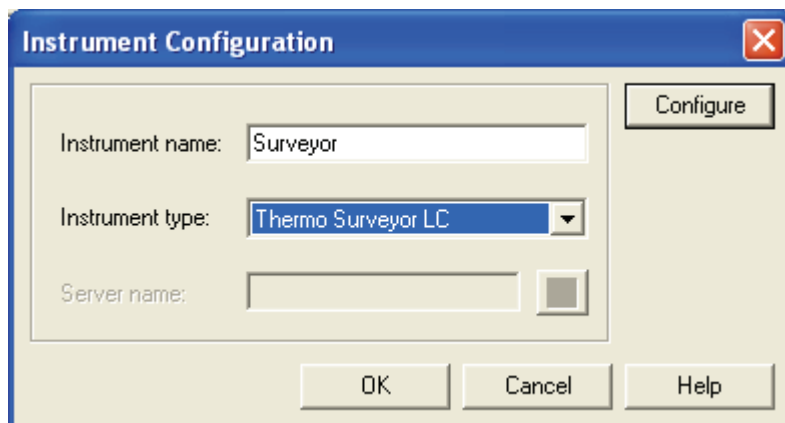
4. Choose **Configure > Instrument**.

The Instrument Configuration dialog box appears (see [Figure 22](#)).

### 3 Configuration

Configuring the Surveyor PDA Plus Detector in ChromQuest

**Figure 22.** Instrument Configuration dialog box



**Note** The instrument type selection for the Surveyor Plus LC system is Surveyor in ChromQuest versions less than 5.0.

5. If you have not already done so, type a name for your instrument in the **Instrument name** box (see [Figure 22](#)).
  6. Depending on the current configuration of the instrument, do one of the following:
    - If you are adding the Surveyor PDA Plus Detector to a current configuration for your Surveyor Plus LC stack, leave the selection in the **Instrument type** list as Thermo Surveyor LC (ChromQuest 5.0) or Surveyor (previous versions of ChromQuest).
    - If you want to erase the configuration for a previously configured Surveyor Plus LC stack or change the instrument type to Surveyor, select **Thermo Surveyor LC** (or **Surveyor**) in the **Instrument type** list and click **OK** in the message dialog box that appears.
  7. Click **Configure**.
- The Thermo Surveyor LC (or Surveyor) dialog box appears.
8. In the **Available** modules pane, double-click the **Detector** button.



Analog

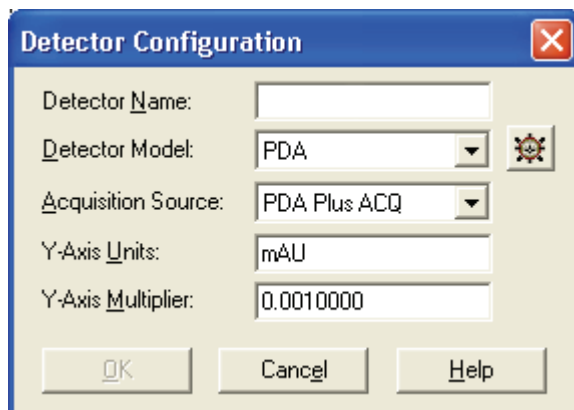
The Analog icon appears in the Configured modules pane.




9. To add the PDA detector to the instrument configuration:
  - a. Double-click the **Analog** button.

The Detector Configuration dialog box appears (see [Figure 23](#)).

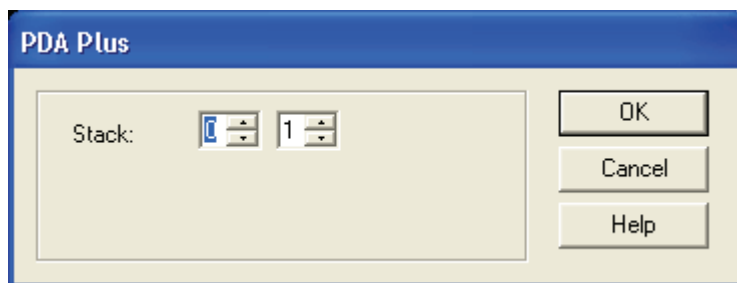
**Figure 23.** Detector Configuration dialog box



- b. In the Detector Name box, type a name to identify the Surveyor PDA Plus Detector. When you open the Instrument window, this name appears in the Analysis Channel list.
  - c. In the Detector Model list, select **PDA**.
  - d. In the Acquisition Source list, select **PDA Plus ACQ**.
  - e. Click .

The PDA Plus Configuration dialog box appears.

**Figure 24.** PDA Plus dialog box



- f. In the Stack boxes, type or select the appropriate stack address. Unless you are controlling more than one Surveyor PDA Plus Detector from the same data system computer, leave the value set to the default of 01.
 

The stack address must match the unit ID, which consists of two rotary switches, on the back panel of the PDA detector.
  - g. Click **OK** to close the PDA Plus Configuration dialog box.
  - h. In the Detector Configuration dialog box, leave the Y-Axis units set to the default of mAU and the Y-Axis Multiplier set to the default of 0.001.

### 3 Configuration

Configuring the Surveyor PDA Plus Detector in ChromQuest

- i. Click **OK** to close the Detector Configuration dialog box.
10. If you have not already done so, configure the remaining modules of your Surveyor Plus LC stack.
11. Click **OK** to close the the Thermo Surveyor LC (or Surveyor) dialog box.
12. Click **OK** to close the Instrument Configuration dialog box and return to the Main Menu window.

## Xcalibur Diagnostics for the PDA Detector

Use the diagnostics program to check the operation of the PDA detector, calibrate the detector, and view the event log. To perform diagnostics from the Xcalibur data system, your detector must be connected to the data system computer, configured as part of an instrument, and turned on. For information on configuring the PDA detector, see [Chapter 3](#), “Configuration.”

### Contents

- [Calibrating the PDA Detector](#)
- [Retrieving, Viewing, Printing, and Clearing the Event Log](#)
- [Creating a Display Method to View the Light Intensity](#)
- [Verifying Operational Performance](#)
- [Controlling the Lamps with Xcalibur](#)
- [Adjusting the Attenuators](#)
- [Checking the Firmware Version](#)

## Calibrating the PDA Detector

To calibrate your PDA detector, perform the following procedures:

- [Performing a Wavelength Calibration](#)
- [Performing a Dark Current Calibration](#)

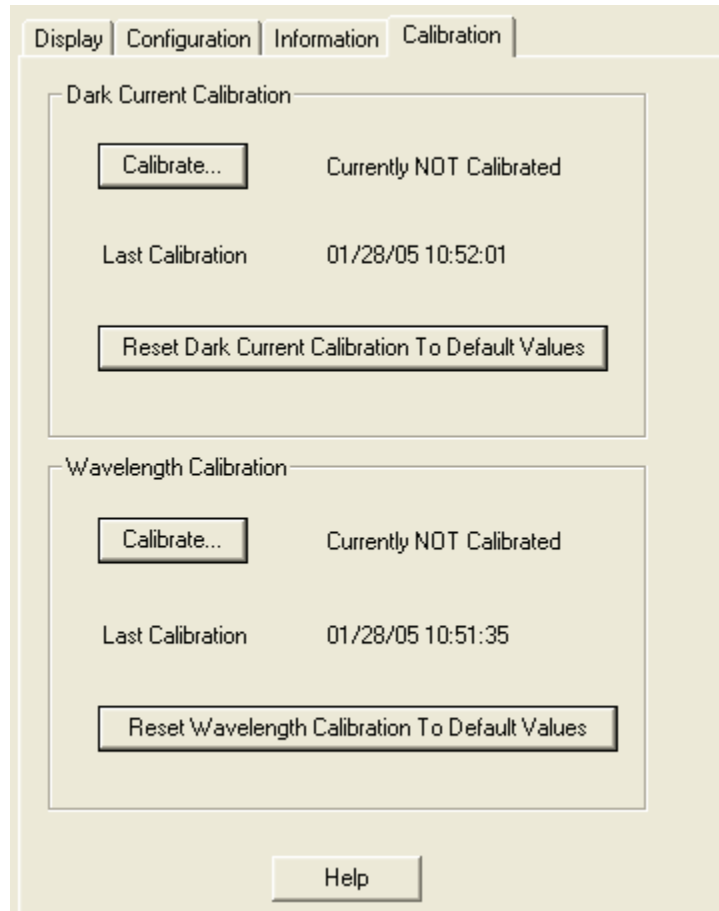
### Performing a Wavelength Calibration

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. Use the automated wavelength calibration to determine wavelength accuracy and to correct for any misalignment.

#### ❖ To perform a wavelength calibration with Xcalibur

1. Pump HPLC-grade methanol at 1 mL/min through the flowcell.
2. Turn on both lamps and wait one hour for the lamps to equilibrate:
  - a. In the view bar of the Instrument Setup window, click the **Surveyor PDA Plus** button. The Surveyor PDA Plus Instrument Setup window appears.
  - b. From the menu bar, choose **Surveyor PDA Plus > Direct Control**. The Surveyor PDA Plus Direct Control dialog box appears.
  - c. Click the **Configuration** tab. The Configuration page appears.
  - d. In the Deuterium Lamp area, turn on the deuterium lamp by clicking **Lamp On**.
  - e. In the Tungsten Lamp area, turn on the tungsten lamp by clicking **Lamp On**.
3. After the detector has reached a stable temperature (approximately 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. The Calibration page appears (see [Figure 25](#)).

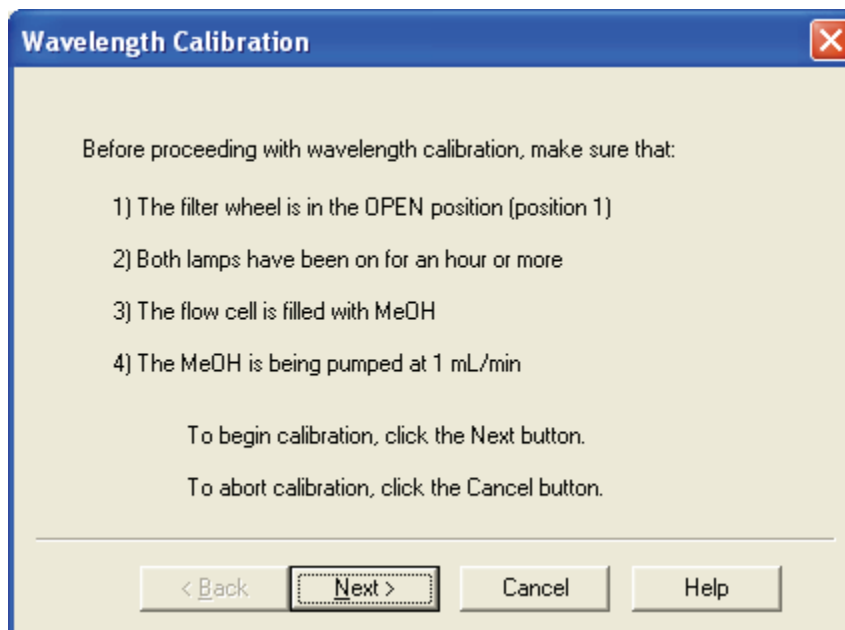
**Figure 25.** Calibration page



- b. In the **Wavelength Calibration** area, click **Calibrate** to start the Wavelength Calibration wizard.

The preconditions page appears (see [Figure 26](#)).

Figure 26. Preconditions page of the Wavelength Calibration wizard



- c. Read the preconditions and verify 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 and prepare the PDA detector for calibration.

**Note** You can press the Cancel buttons on the pages of the Wavelength Calibration Wizard at any time a calibration is in process to stop it.

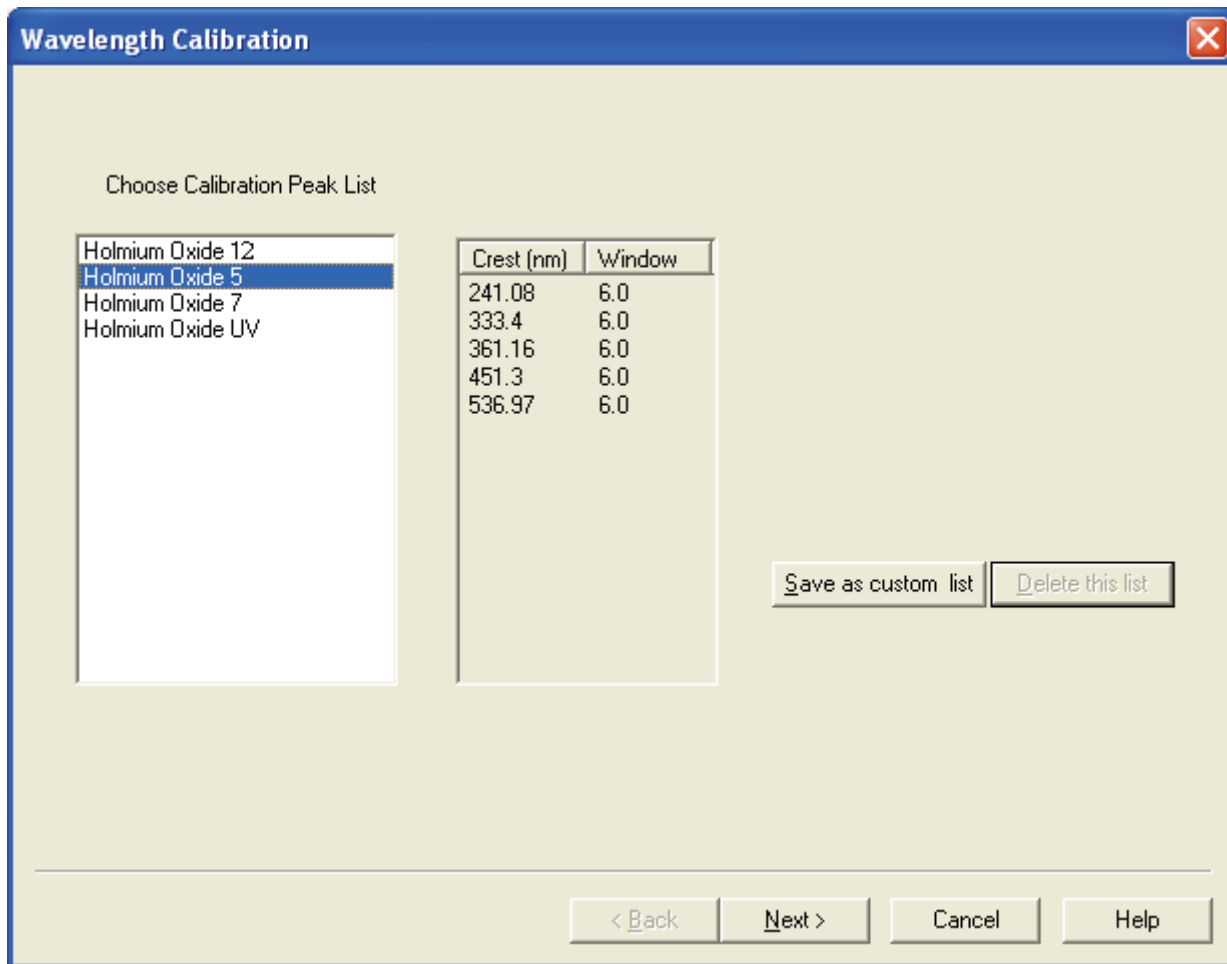
4. On page two of the Wavelength Calibration wizard (see [Figure 27](#)), do the following:
  - a. Choose a peak set from the list.

The peak set should span the wavelengths you use under normal operation conditions. In [Figure 27](#), the Holmium Oxide 5 peak set is selected. Using this wavelength list, Xcalibur calibrates the detector at each of the five wavelengths shown.

**Note** Xcalibur has four calibration files to choose from. For example, the HolmiumOxide UV 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)”.

- b. Click **Next**. The Calibration Status page appears.

Figure 27. Page two of the Wavelength Calibration wizard with a list of calibration files



5. On page three of the Wavelength Calibration wizard, do the following:
  - a. Observe the status screen that tells you the wavelength file is downloading (see [Figure 28](#)).
  - b. After the message **Click the Next button to proceed with calibration** appears, click **Next**. Page four of the Wavelength Calibration wizard appears (see [Figure 29](#)).

Figure 28. Page three of the Wavelength Calibration wizard

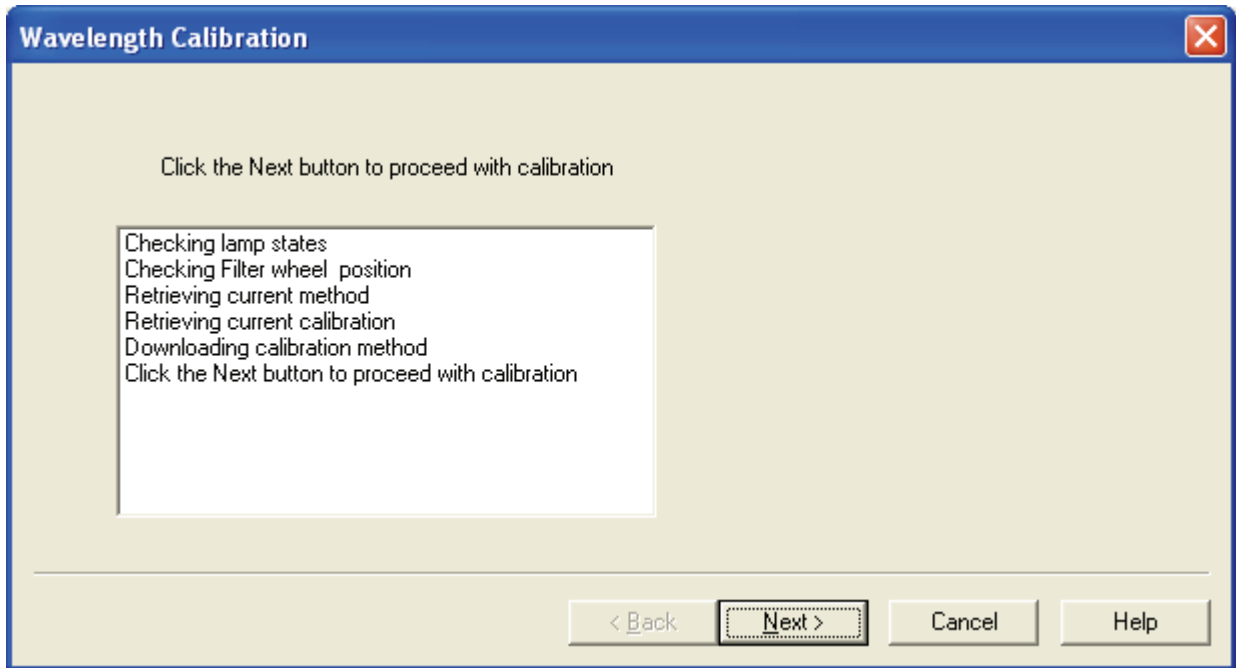
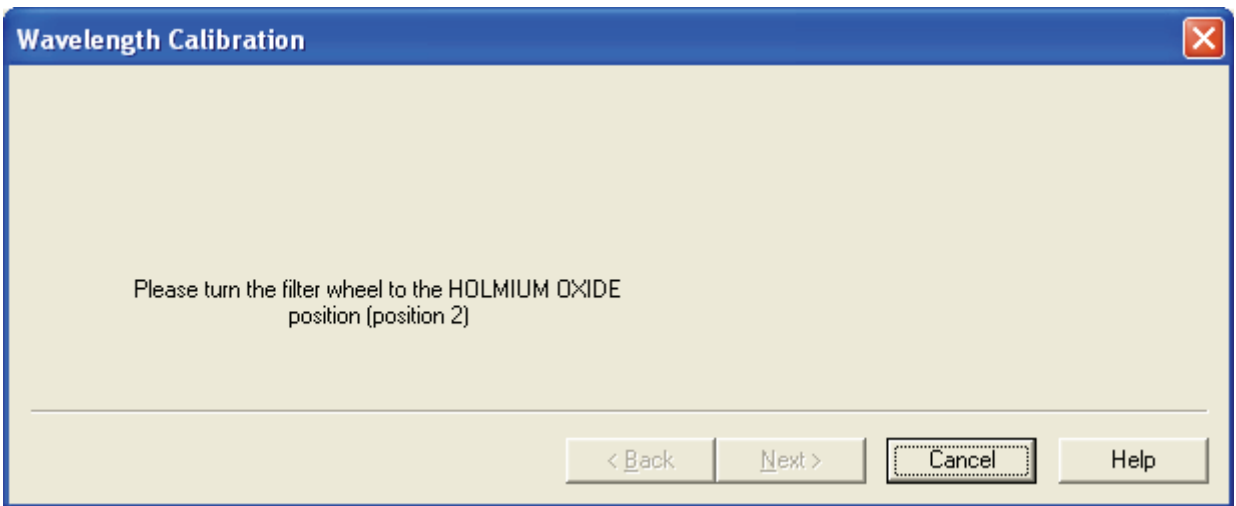


Figure 29. Page four of the Wavelength Calibration wizard



6. Rotate the Holmium Oxide filter wheel to position 2 as directed.

The Next button becomes active.

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

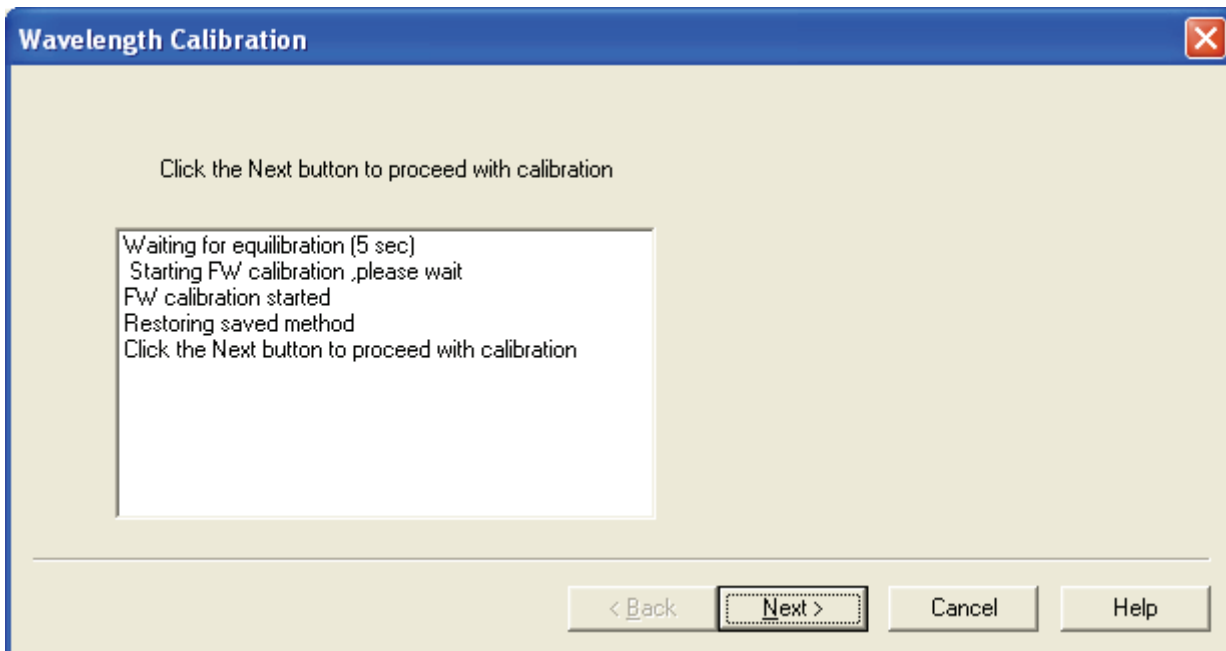
7. Click **Next** to proceed.



8. On page five of the Wavelength Calibration wizard, do the following:
  - a. Observe the status screen (see [Figure 30](#)).

The diagnostics program waits for a few seconds for the rise time filter to equilibrate and takes a holmium oxide scan.
  - b. When the message **Click the Next button to proceed with calibration** appears, click **Next** to proceed.

**Figure 30.** Page 5 of the Wavelength Calibration wizard



9. Rotate the wheel back to position 1 (Open) as instructed on page six of the Wavelength Calibration wizard (see [Figure 31](#)).

The next button becomes active (see [Figure 32](#)).

**Figure 31.** Page six of the Wavelength Calibration wizard

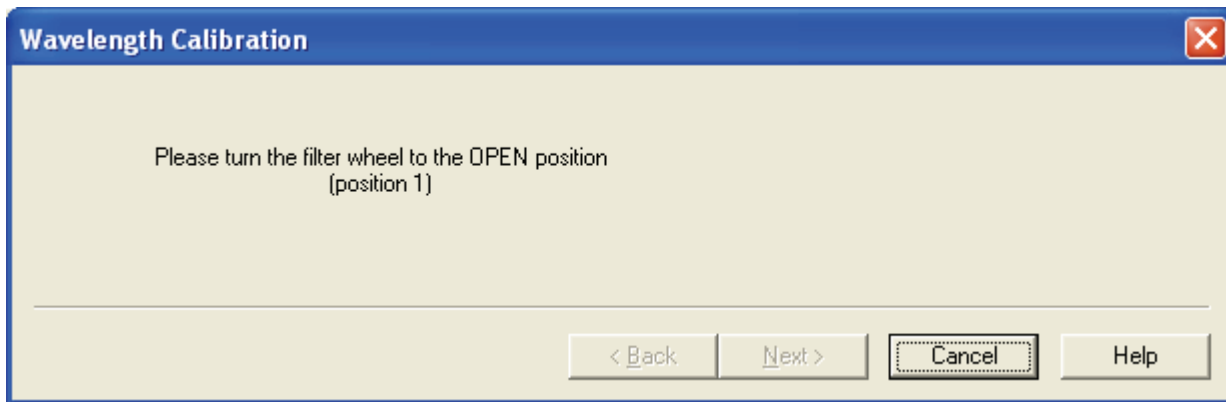
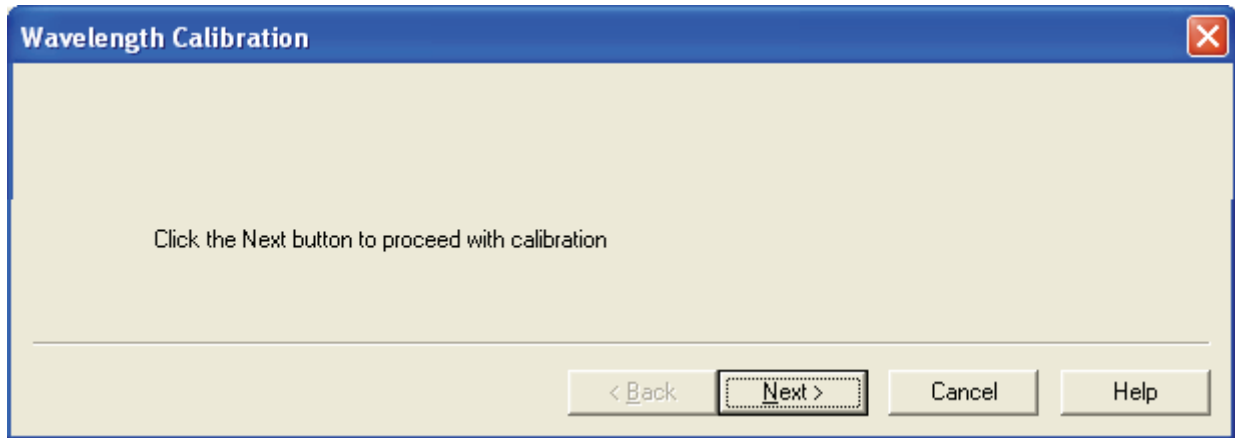


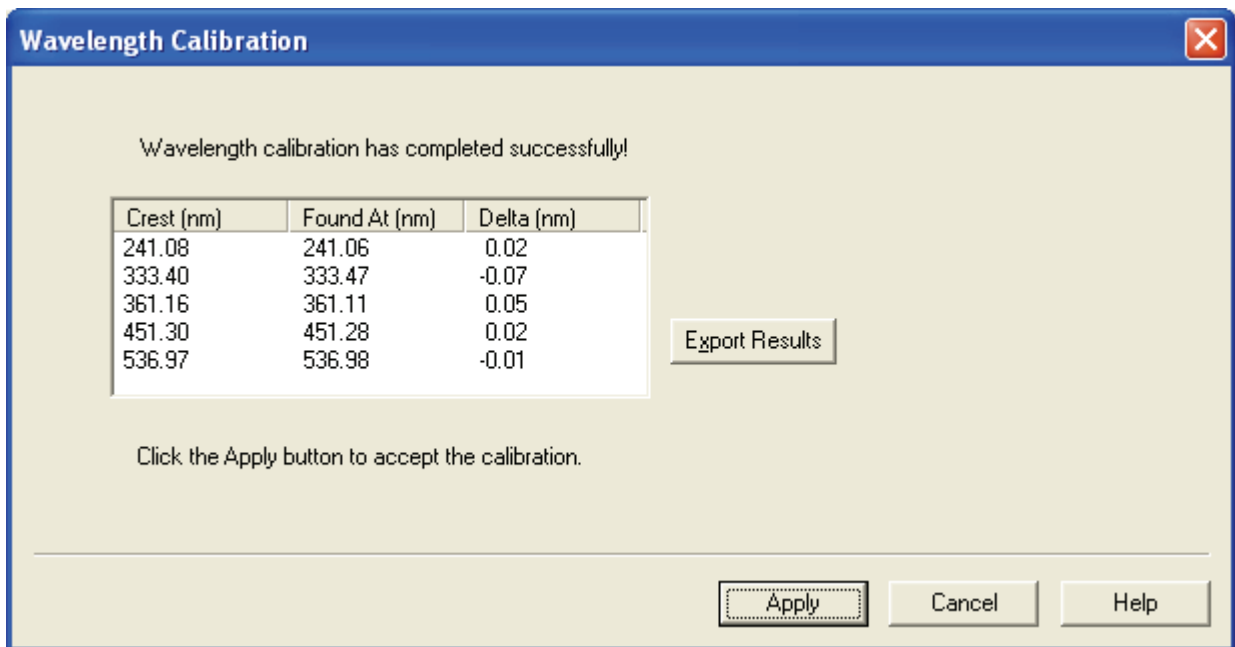
Figure 32. Page seven of the Wavelength Calibration wizard with an active Next button



10. Click **Next** to proceed.

Page eight of the Wavelength Calibration wizard appears (see Figure 33).

Figure 33. Page eight of the Wavelength Calibration wizard



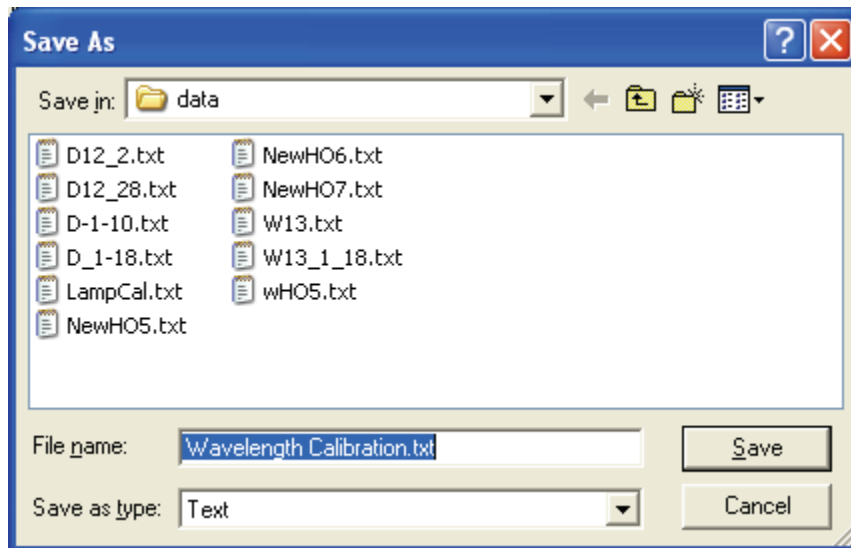
11. Check that the delta values are within  $\pm 1$  nm, and then do one of the following:

- If the Delta values are acceptable, proceed to [step 12](#).
- If the delta values are not within the range of  $\pm 1$  nm, do not export the results, and proceed to [step 14](#). 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  $\pm 1$  nm, call your Thermo Fisher Scientific service representative for assistance.

12. (Optional) Print a report of the calibration results:
  - a. Click **Export Results** to print the results to a file.

The Save As dialog box appears (see [Figure 34](#)).

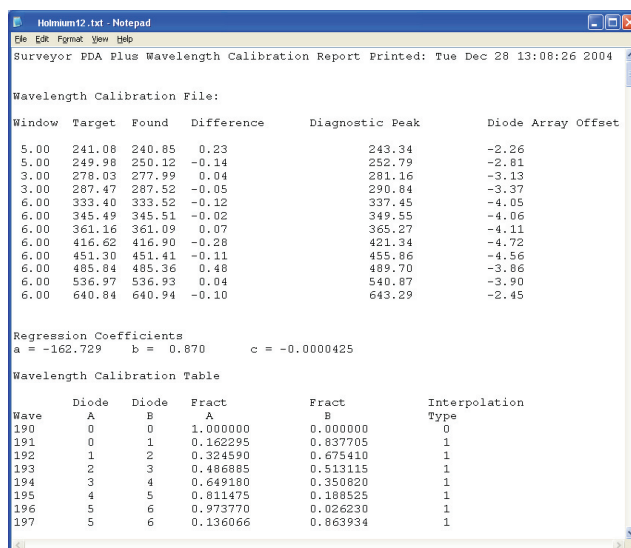
**Figure 34.** Save As dialog box



- 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 35](#)).

**Figure 35.** Wavelength calibration report opened in Notepad



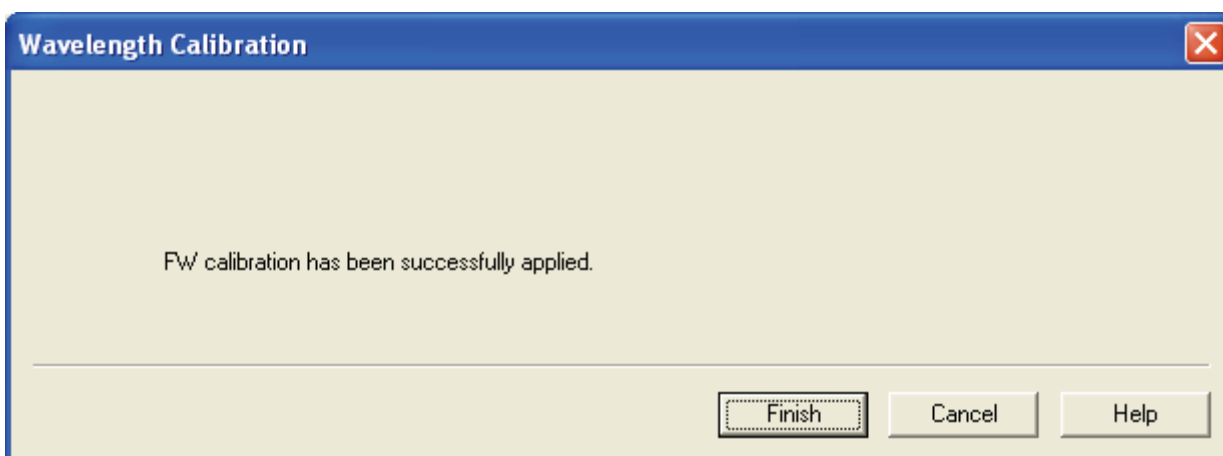
13. On page eight (see [Figure 33](#)), click **Apply**.

The final page of the Wavelength Calibration wizard appears (see [Figure 36](#)).

14. Click **Finish** to complete the calibration.

The detector saves the calibration information. The date and time of the calibration appear in the Wavelength Calibration area of the Calibration page (see [Figure 25](#) on page 35).

**Figure 36.** Final page of the Wavelength Calibration wizard



## Performing a Dark Current Calibration

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

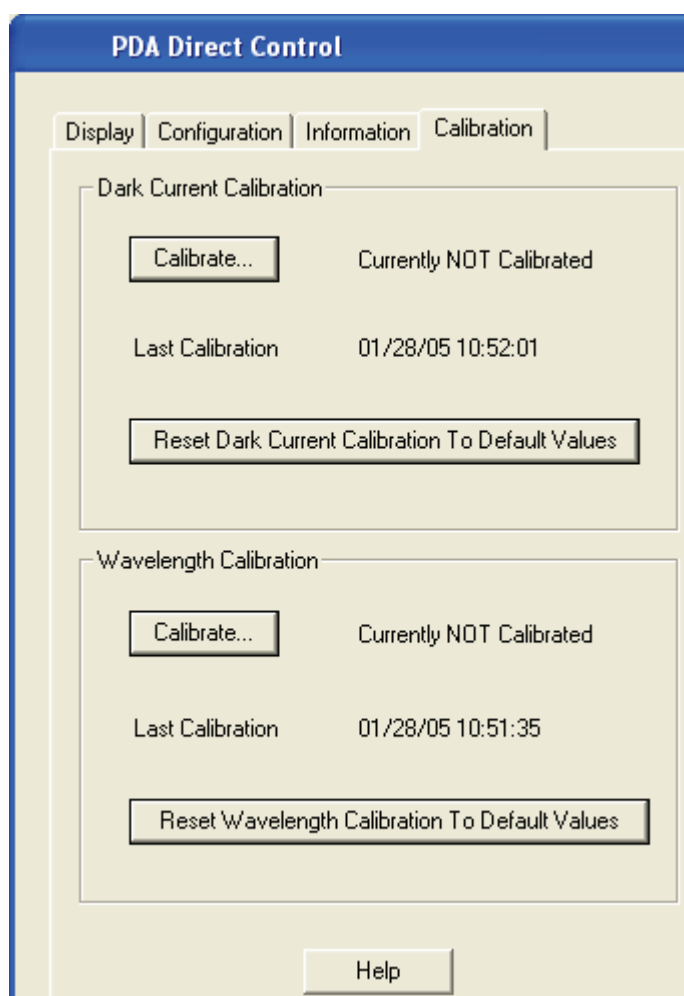
Because the dark current produced by the diodes rises as the temperature within the detector rises, it is important to warm up the lamps for 1 hour before performing a dark current calibration. Warming up the lamps for 1 hour equilibrates the detector to its normal operating temperature.

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 flowcell at 1 mL/min.
2. Turn on both lamps and wait 1 hour for the lamps to equilibrate.
3. On the menu bar of the Surveyor PDA Plus Detector Instrument Setup window, choose **Surveyor PDA > Direct Control**. Then click the **Calibration** tab to open the Calibration page. [Figure 37](#) shows the readback display for an uncalibrated detector.

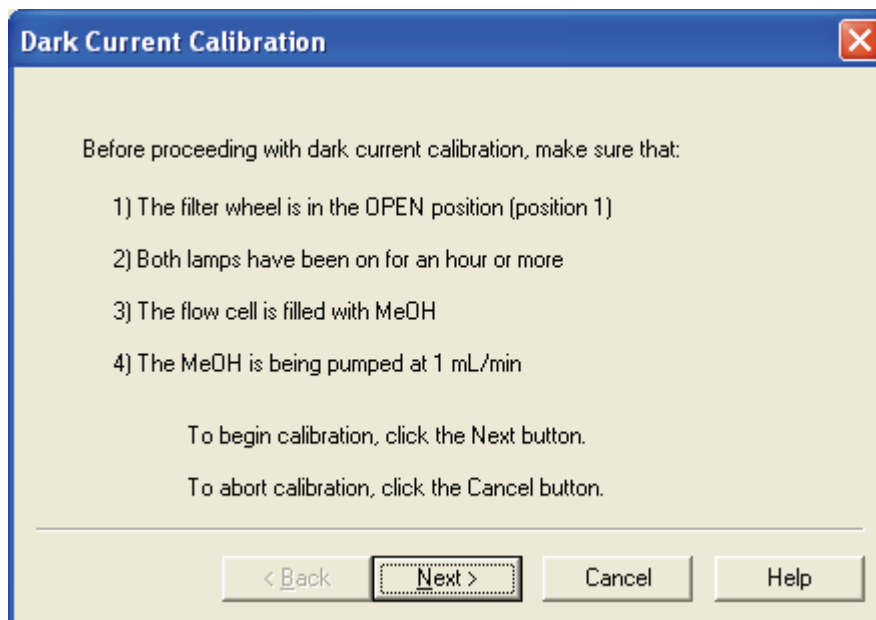
**Figure 37.** Calibration page



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

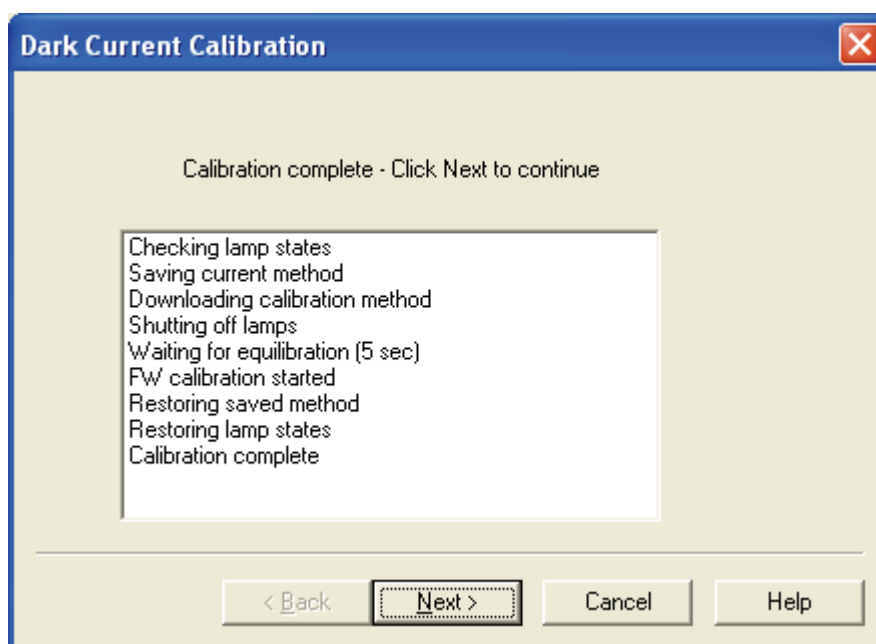
The Preconditions page appears (see [Figure 38](#)).

**Figure 38.** Preconditions page of the Dark Current Calibration wizard



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. Page two of the Dark Current Calibration wizard appears (see [Figure 39](#)).
  - 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.

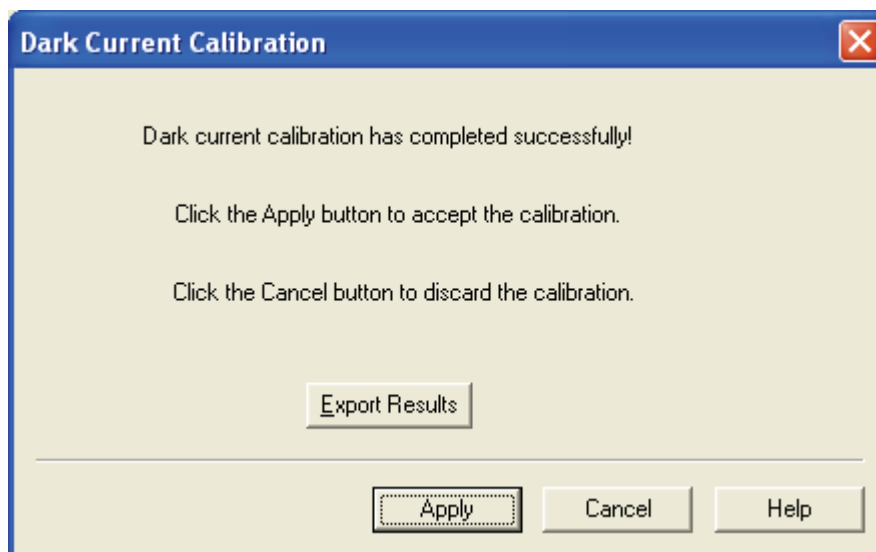
**Figure 39.** Page two of the Dark Current Calibration wizard



6. On page two (see [Figure 39](#)) of the Dark Current Calibration wizard, observe the status readback as the calibration proceeds. When the calibration is complete, click **Next**.

Page three of the Dark Current Calibration wizard appears (see [Figure 40](#)). You can export the results of the calibration from this page.

**Figure 40.** Page three of the Dark Current Calibration wizard



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

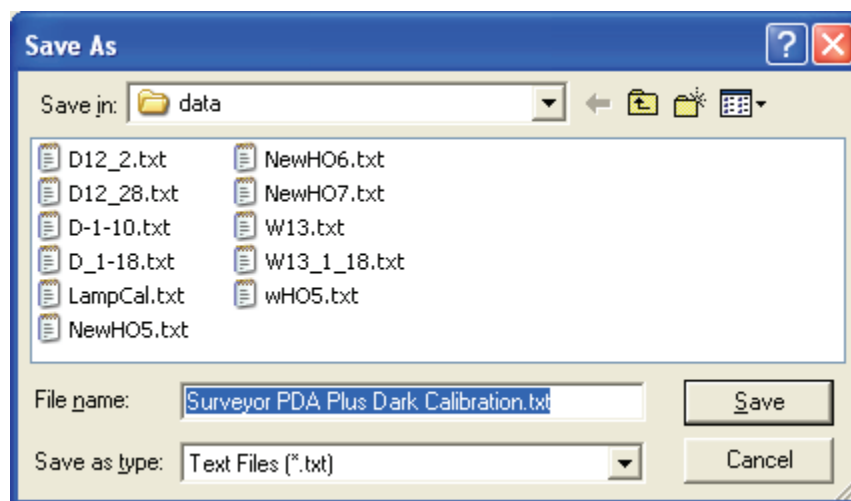
- a. Click **Export Results**.

The Save As dialog box appears (see [Figure 41](#)).

- b. In the File name box, type a name. 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 42](#)).

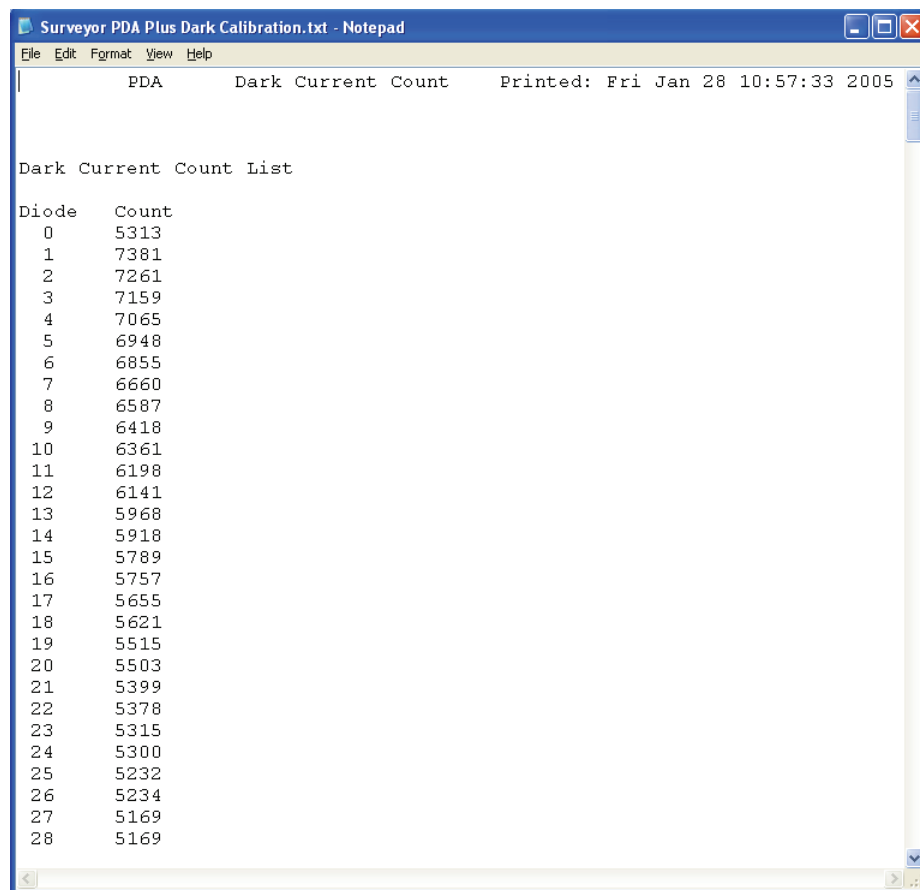
**Figure 41.** Save As dialog box



## 4 Xcalibur Diagnostics for the PDA Detector

Calibrating the PDA Detector

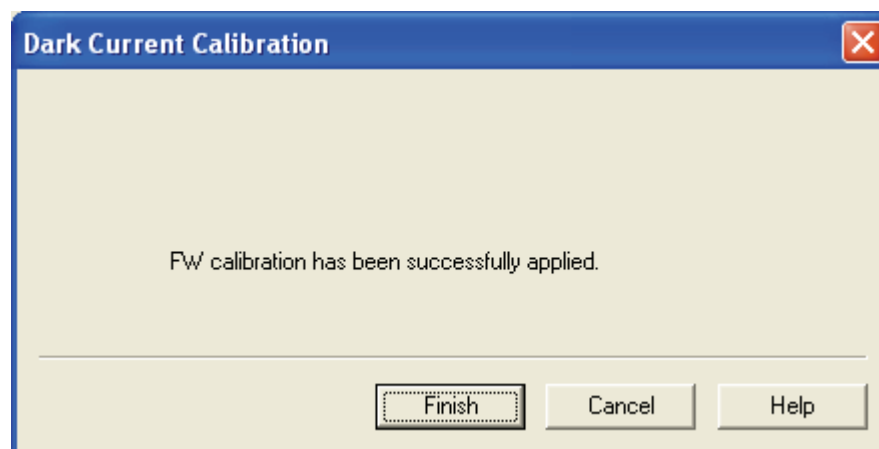
**Figure 42.** PDA Dark Calibration text file



8. On page three of the Dark Current Calibration wizard, click **Apply**.

The fourth and final page of the Dark Current Calibration dialog box appears (see [Figure 43](#)).

**Figure 43.** Final page of the Dark Current Calibration wizard

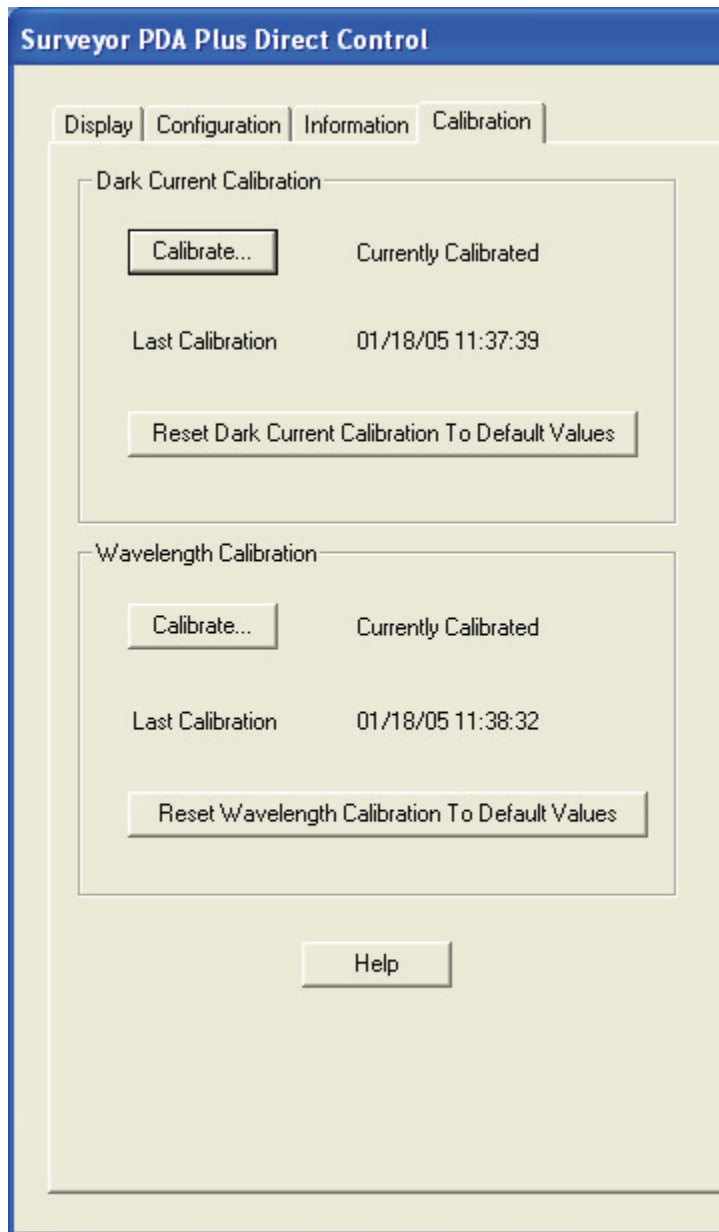




9. Click **Finish** to complete the calibration.

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 44](#)).

**Figure 44.** Calibration page of the Surveyor PDA Plus Direct Control dialog box



# 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 up to 100 events. When the log is full, the next entry replaces the first entry. For best results, 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 appear in the event log along with suggested solutions is compiled in “[Log Entries](#)” on [page 103](#).

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

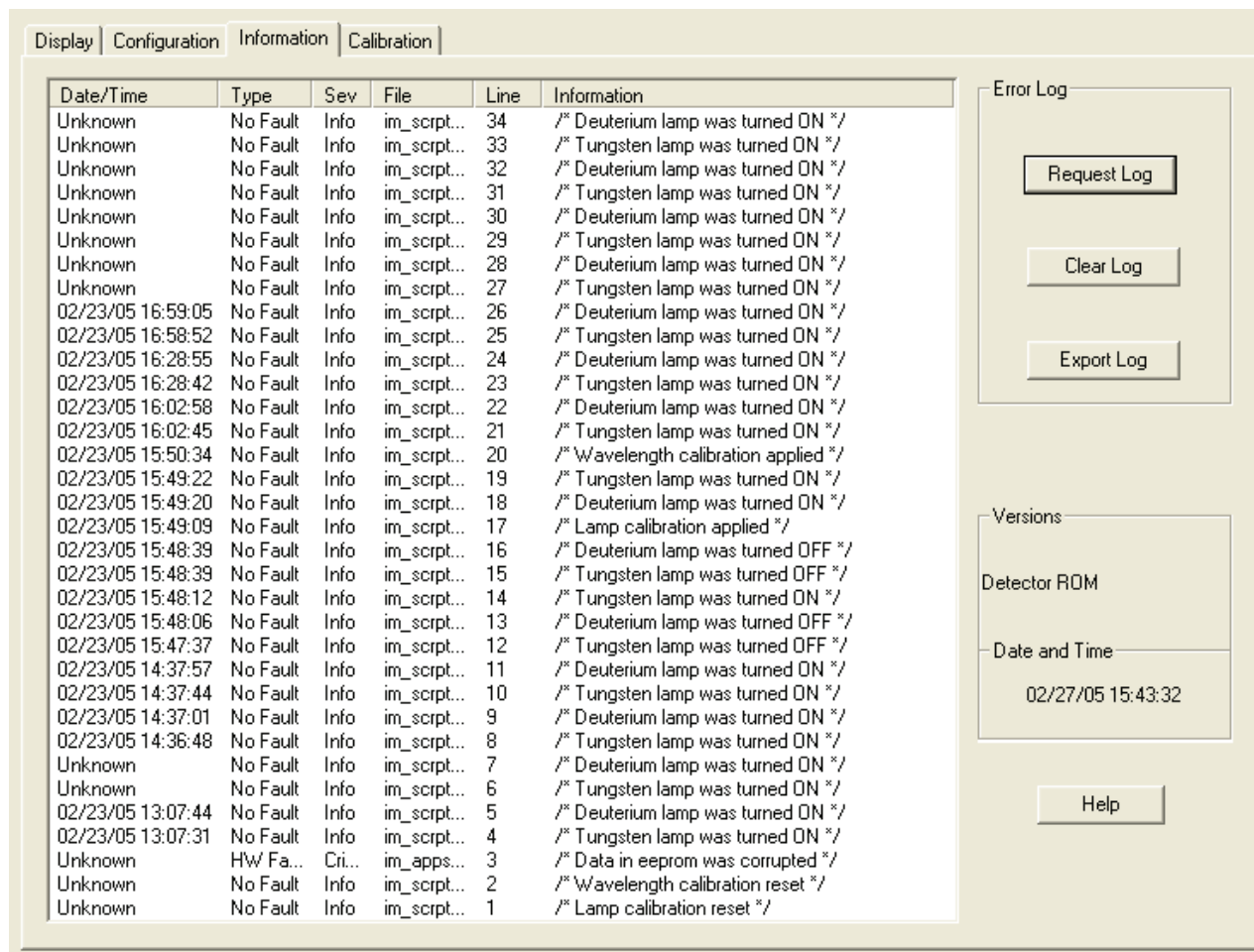
1. Open the Information page:
  - a. In the Xcalibur Home Page, click the **Instrument Setup** button to open the Instrument Setup view.
  - b. In the view bar, click the **Surveyor PDA Plus Detector** button to open the Surveyor PDA Plus Detector Instrument Setup view.
  - c. On the menu bar, choose **Surveyor PDA > Direct Control** to open the Direct Control dialog box (see [Figure 45](#)).
  - d. Click the **Information** tab to open the Information page.



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

2. Click **Request Log** to retrieve the information from the detector and display it. [Figure 45](#) 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 103](#).

Figure 45. Information Page with 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 auditing feature in Xcalibur does not track the creation and modification of display methods.

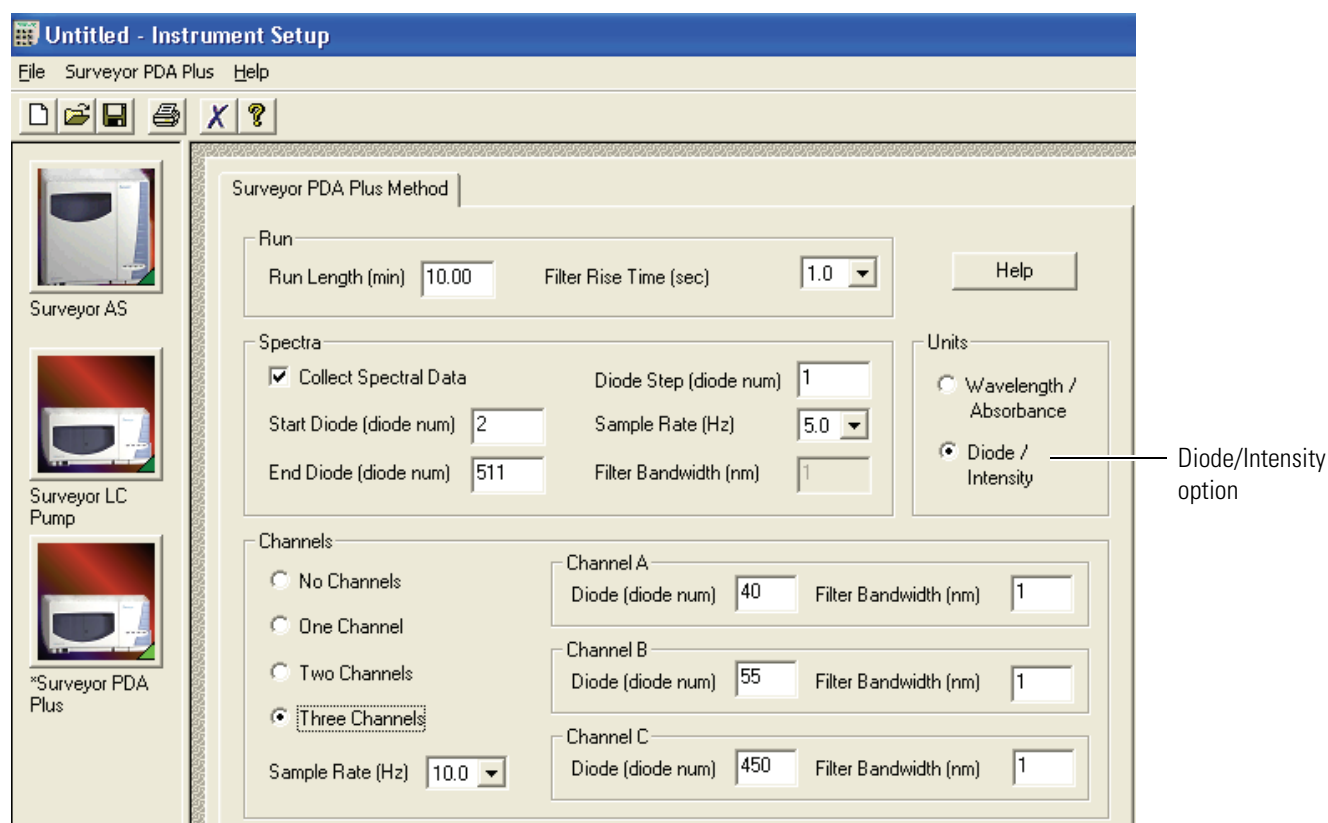
### ❖ To create a display method

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.



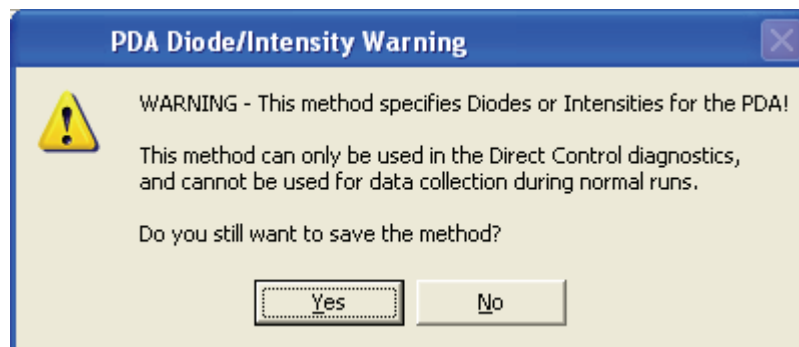
- b. In the view bar, click the **Surveyor PDA Plus** button.  
The Surveyor PDA Plus Instrument Setup view appears (see [Figure 46](#)).
2. In the **Surveyor PDA Plus Method** page, enter the appropriate parameters:
  - a. In the Units area, select the **Diode/Intensity** option to set the X-axis of the spectrum on the Display page to diode numbers.
  - b. In the Channels area, select 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 46.** Surveyor PDA Plus Method page with the selection of the Diodes/Intensity option



3. Save the display method:
  - a. In the menu bar, choose **Surveyor PDA Plus > Direct Control**.  
[Figure 47](#) shows the warning message that appears.

**Figure 47.** PDA Diode/Intensity Warning dialog box



- b. In the PDA Diode/Intensity Warning dialog box, click **Yes**.  
The Save PDA Display Method dialog box appears.
- c. In the File name box, type a file name.
- 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 performance can change. 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. On the Xcalibur Roadmap view, click the **Instrument Setup** button to display the Instrument Setup view.
  - b. In the view bar, click the **Surveyor PDA Plus** button to open the Surveyor PDA Plus Instrument Setup view.
  - c. From the menu bar, choose **Surveyor PDA Plus > Direct Control** to open 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. On the Configuration page, note the status and usage of each lamp.
  - c. If they are not already on, turn on both the deuterium (D<sub>2</sub>) 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. Make sure that you click **Apply**.



## Viewing an Intensity Scan of the Deuterium Lamp

### ❖ To view an intensity scan of the deuterium (D<sub>2</sub>) 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 48).

See “Creating a Display Method to View the Light Intensity” on page 49 for instructions on creating a display method.

**Figure 48.** Surveyor PDA Plus Method page with the selection of the Diodes/Intensity option

The screenshot shows the 'Surveyor PDA Plus Method' configuration window. It is divided into several sections:

- Run:** Run Length (min) is 10.00, Filter Rise Time (sec) is 1.0, and a Help button is present.
- Spectra:** 'Collect Spectral Data' is checked. Start Diode (diode num) is 2, End Diode (diode num) is 511. Diode Step (diode num) is 1, Sample Rate (Hz) is 5.0, and Filter Bandwidth (nm) is 1.
- Units:** 'Diode / Intensity' is selected with a radio button.
- Channels:** 'Three Channels' is selected. Channel A is set to Diode 35, Channel B to Diode 52, and Channel C to Diode 77. Each channel has a Filter Bandwidth (nm) of 1.

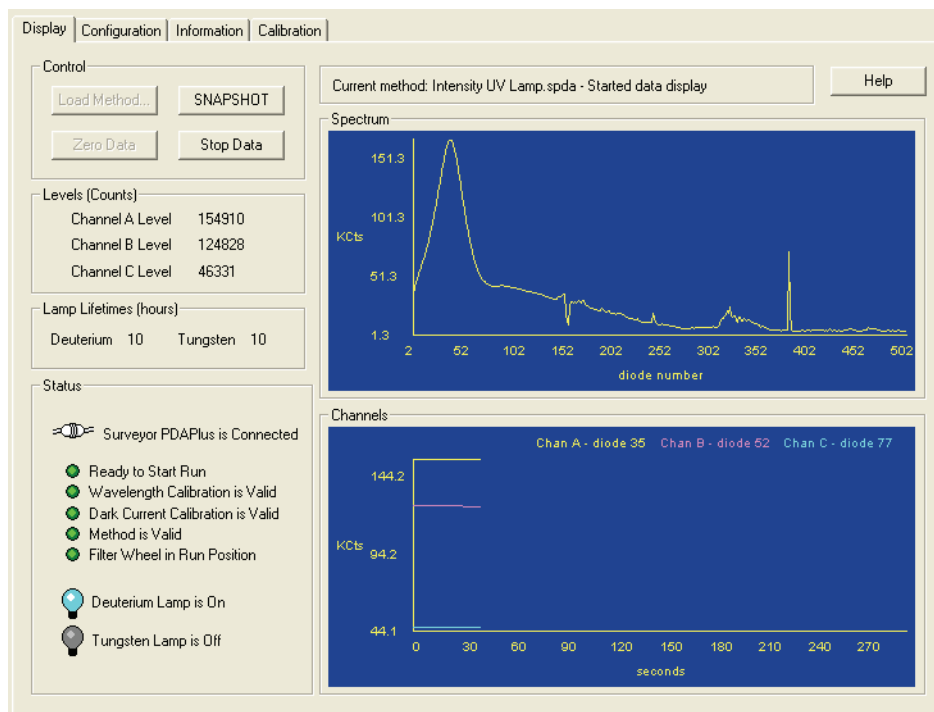
2. Load the display method to the detector as follows:
  - a. From the menu bar, choose **Surveyor PDA Plus > Direct Control** to open the Direct Control dialog box.
  - b. Click the **Display** tab to open the Display page.
  - c. In the Control area, click **Load Method** to open the Open Display Method dialog box.
  - d. 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 49](#)).
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. To track any degradation in intensity, keep this scan to compare with future scans. Date the printout and add it to your maintenance records.

**Figure 49.** Viewing a scan of the deuterium lamp intensity (diodes 35, 52, 77)



## Viewing an Intensity Scan of Both Lamps

### ❖ To view an intensity scan of the deuterium (D<sub>2</sub>) 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.

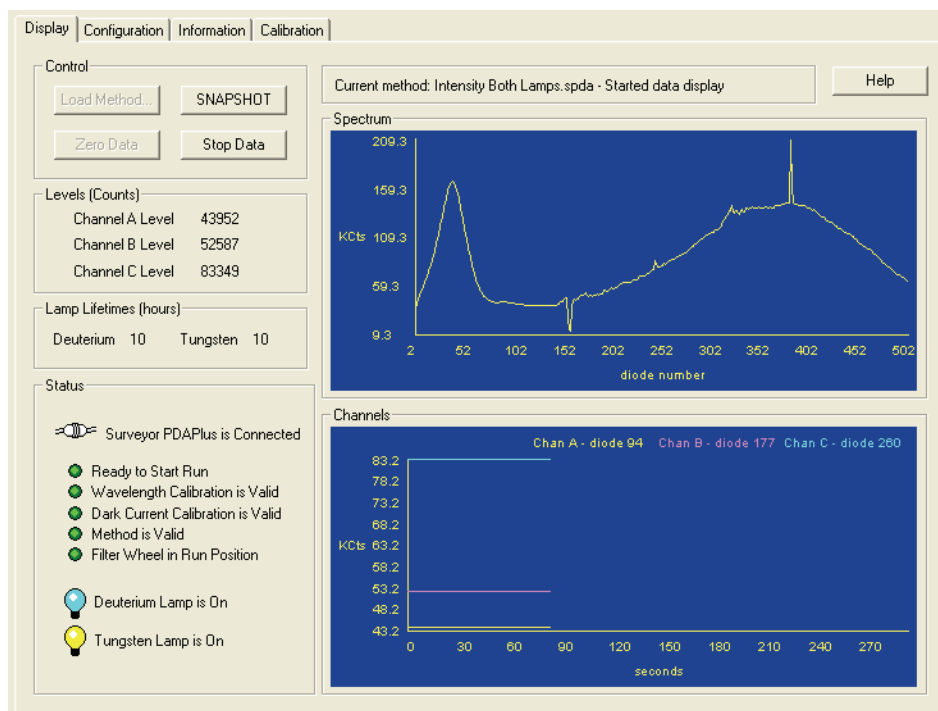
See “[Creating a Display Method to View the Light Intensity](#)” on [page 49](#) for instructions on creating a display method.

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 (see Figure 50).
- d. Click **Start Data**.
- 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 50.** Viewing a scan of the lamp intensities (diodes 94, 177, 260)



## Viewing an Intensity Scan of the Tungsten Lamp

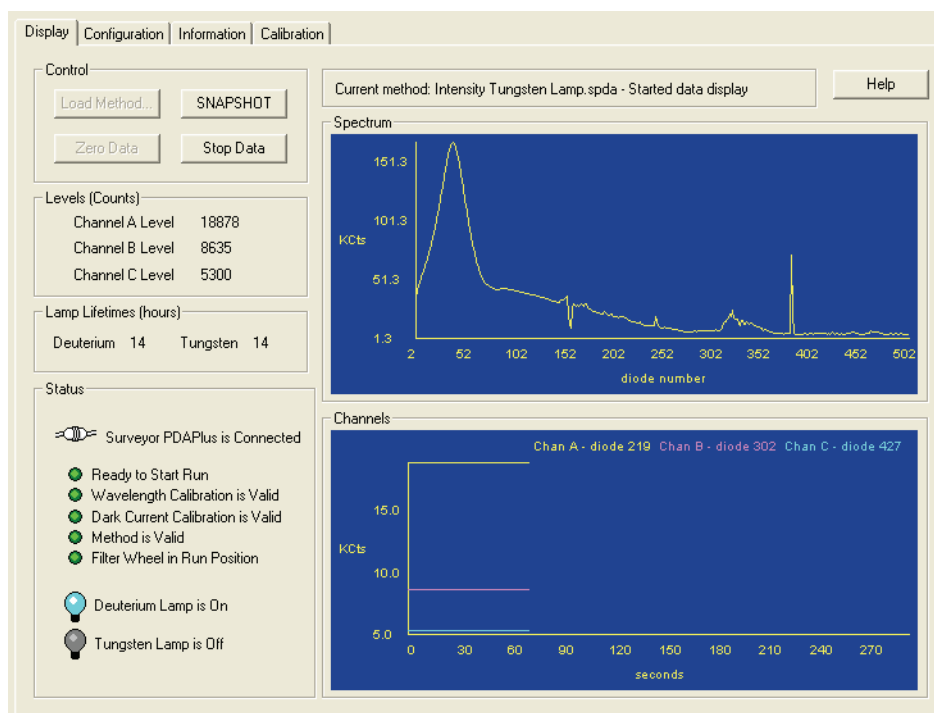
### ❖ To view an intensity scan of the tungsten (W) lamp

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 49 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 file name appears in the box above the Spectrum plot (see [Figure 51](#)).
  - d. Click **Start Data**.
  - 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 warmup time before you begin acquiring data.

**Figure 51.** Display page with an intensity scan of the light output from the Tungsten lamp (diodes 219, 302, 427)



## 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 flowcell does not help, use the diagnostic features of the software to determine the cause of the problem. If light output becomes too low and adjusting the attenuators as described in “[Adjusting the Attenuators](#)” on [page 59](#) 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 hours and the tungsten lamp has a lifetime of approximately 2500 hours. Lamp lifetime varies depending upon the application.

Perform the following procedures in the Configuration page of the Direct Control dialog box for the Surveyor PDA Plus Detector ([Figure 52](#)):

- [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-second 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 hour 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.

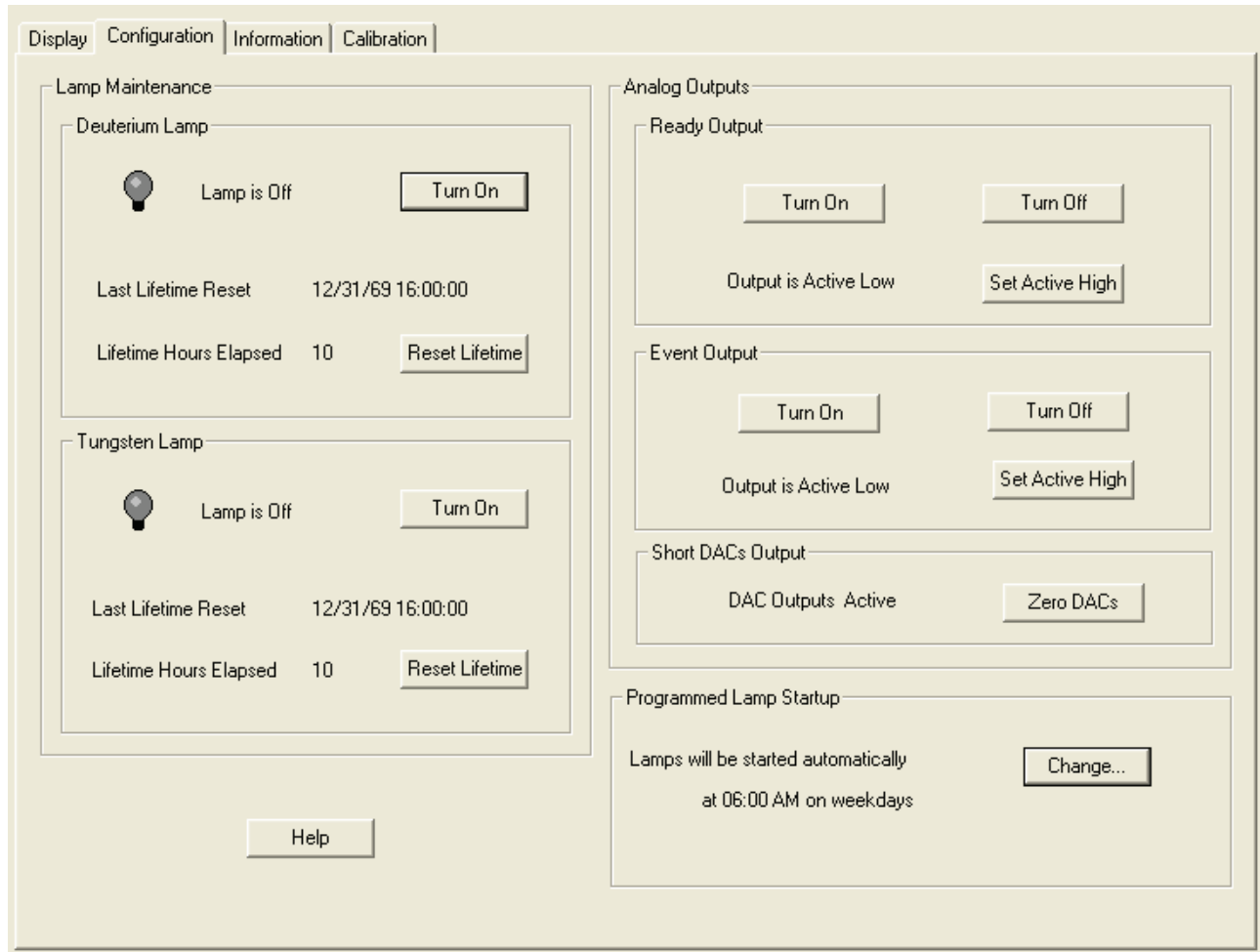
The stored total run time for the associated lamp is reset to zero, and the Last Lifetime Reset readback is updated to the current date and time.

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

## 4 Xcalibur Diagnostics for the PDA Detector

Controlling the Lamps with Xcalibur

**Figure 52.** Surveyor PDA Plus Direct Control dialog box – Configuration page

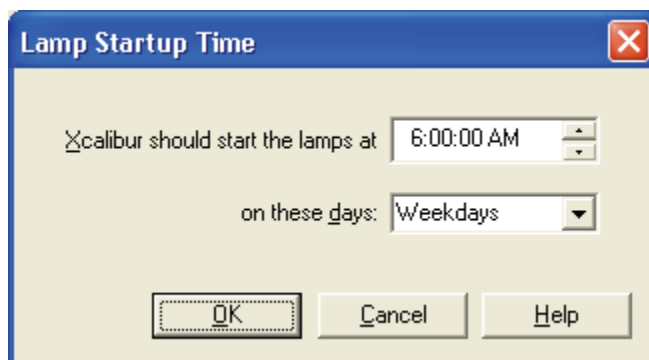


## Setting the Startup Time for the Lamps

### ❖ 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 53](#)).

**Figure 53.** 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 is a flat baseline.

The attenuators require adjustment when either lamp is replaced or when the flowcell 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.

## 4 Xcalibur Diagnostics for the PDA Detector

### Adjusting the Attenuators

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

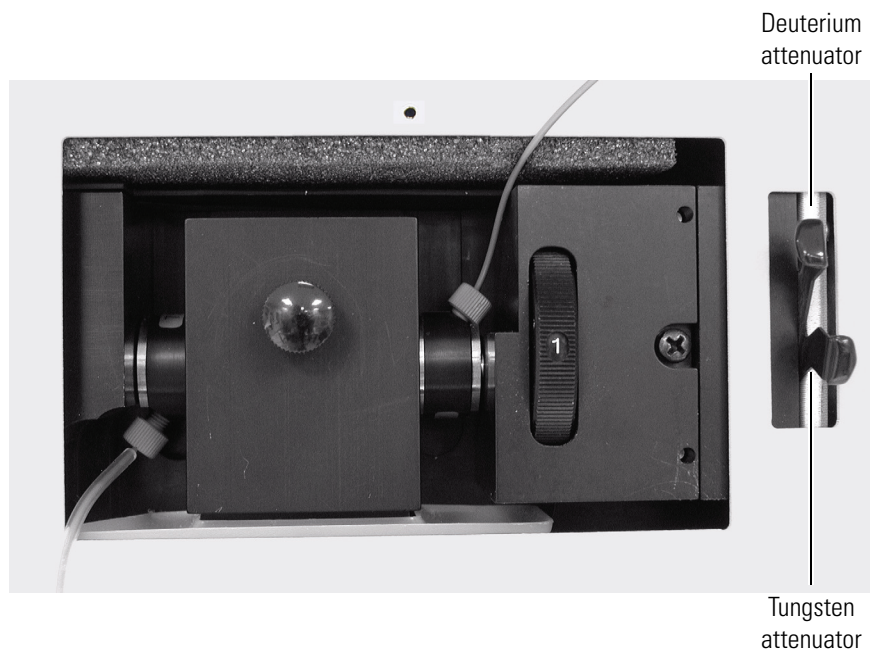
#### ❖ To access the attenuators

1. Open the front doors of the detector.
2. Loosen the captive screw, and then remove the flowcell cover (see [Figure 13](#) on [page 18](#)).

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 54](#)).

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 54.** View of 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**

1. Access the attenuators as instructed on [page 60](#).
2. Open the Instrument Setup view as follows:
  - a. Open Xcalibur:
    - For Xcalibur 2.0 or lower, from the computer desktop, choose **Start > All Programs > Xcalibur > Xcalibur**.
    - For Xcalibur 2.1 or higher, from the computer desktop, choose **Start > All Programs > Thermo Xcalibur > Xcalibur**.
  - b. In the Xcalibur Home Page, click the **Instrument Setup** button 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 view bar of the Instrument Setup view, click the **Surveyor LC Pump** or **Surveyor MS Pump** button to open the instrument setup view for the pump.
  - b. Choose **Surveyor LC Pump > Direct Control** or **Surveyor MS Pump > Direct Control**. The Direct Control dialog box for the 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 view bar of the Instrument Setup view, click the **Surveyor PDA Plus Detector** icon to open the Surveyor PDA Plus Method page.
  - b. In the Units area, select 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.  
  
See “[Creating a Display Method to View the Light Intensity](#)” on [page 49](#) 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 Plus Direct Control dialog box appears.



## 4 Xcalibur Diagnostics for the PDA Detector

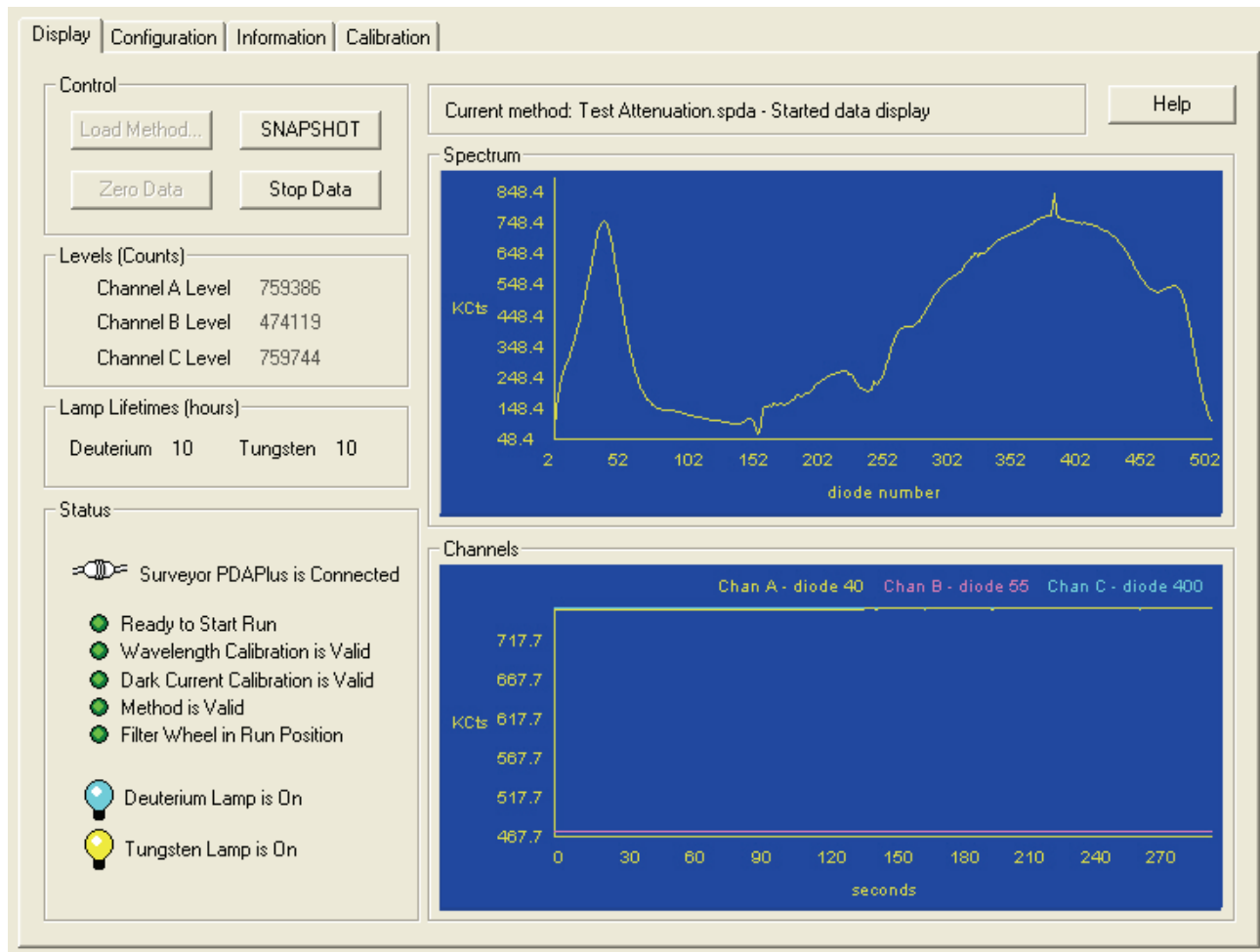
### Adjusting the Attenuators

- 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 55](#)).

For the UV region, the diode of maximum intensity is between diode 30 and diode 50. For the Visible region, the diode of maximum intensity is 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 750 000 to 775 000 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 750 000 to 775 000 intensity counts in the region between diode number 400 and diode number 500.
  8. After you finish adjusting the attenuators, replace the flowcell access cover and close the front doors of the detector.



Figure 55. Display of intensity spectrum from diode number 2 to diode number 511



## Checking the Firmware Version

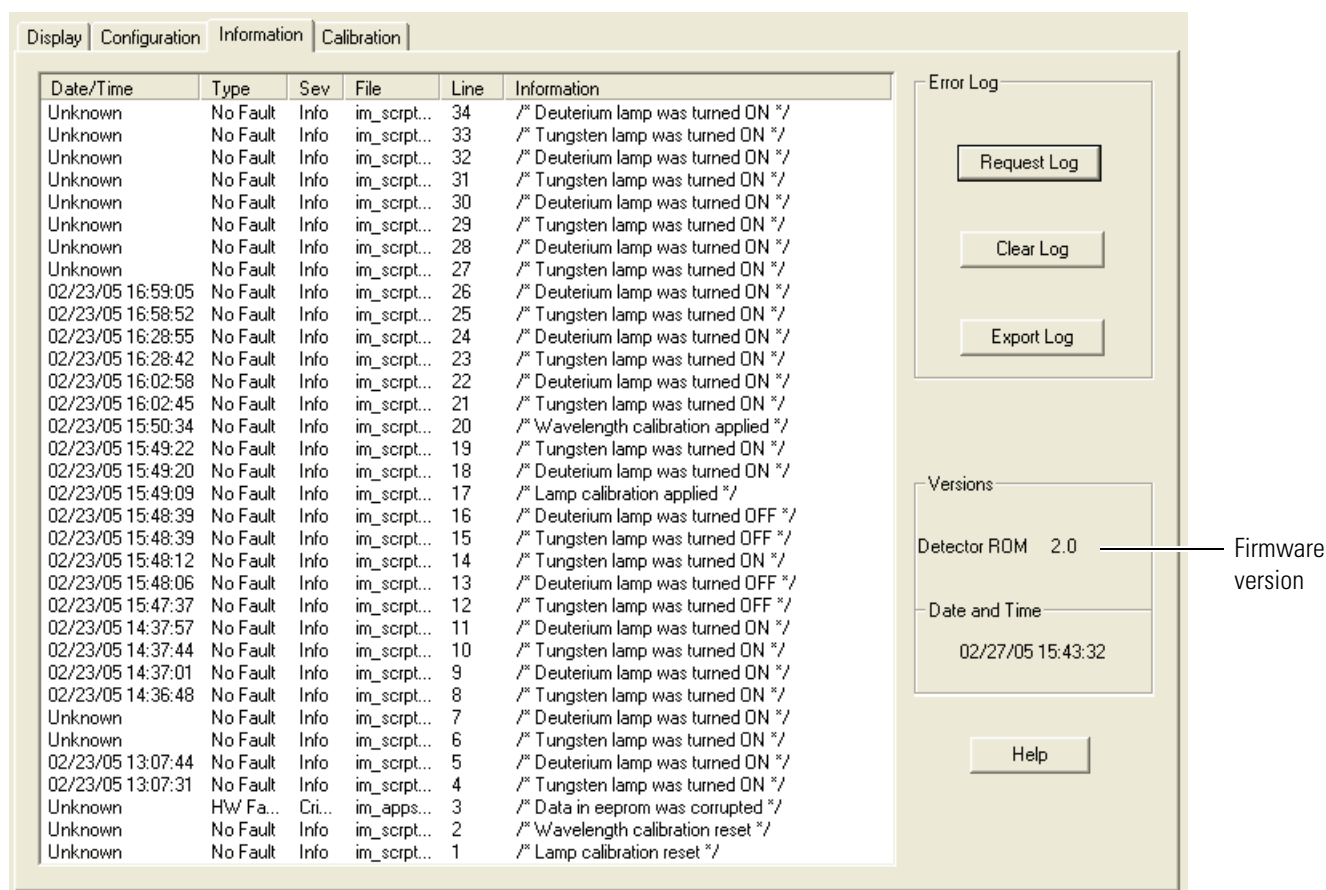
The current firmware version of the PDA detector is displayed in the Information page of the Surveyor PDA Plus Direct Control dialog box.

❖ **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 56).

**Figure 56.** Direct Control dialog box – Information page with the firmware versions displayed in the Versions area



## ChromQuest Diagnostics for the PDA Detector

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 the Surveyor PDA Plus Detector in ChromQuest” on page 29.

### Contents

- [Calibrating the Detector with ChromQuest](#)
- [Displaying, Printing, and Clearing the Error Log](#)
- [Verifying Operational Performance](#)
- [Controlling the Lamps with ChromQuest](#)
- [Adjusting the Light Output from the Lamps](#)
- [Checking the Firmware Version](#)

## 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.

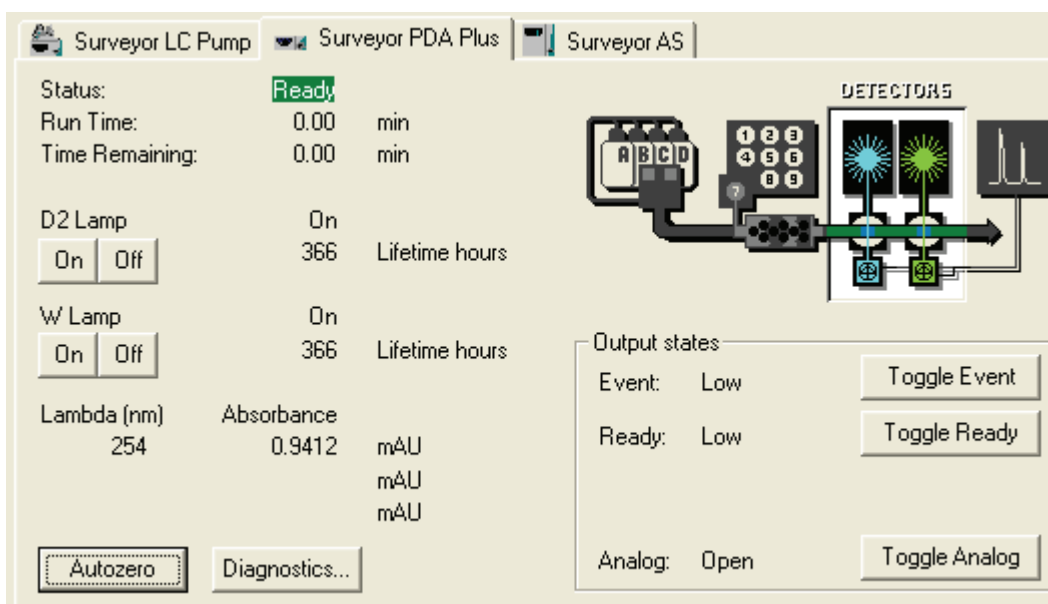
- [Preparing the Detector for Calibration](#)
- [Performing a Wavelength Calibration](#)
- [Performing an Array Calibration](#)

## 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 flowcell 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 Plus** tab to open the Surveyor PDA Plus page (see [Figure 57](#)).
  - c. Under D2 Lamp, click **On**.
  - d. Under W Lamp, click **On**.

**Figure 57.** Surveyor PDA Plus page of the ChromQuest Instrument Status window



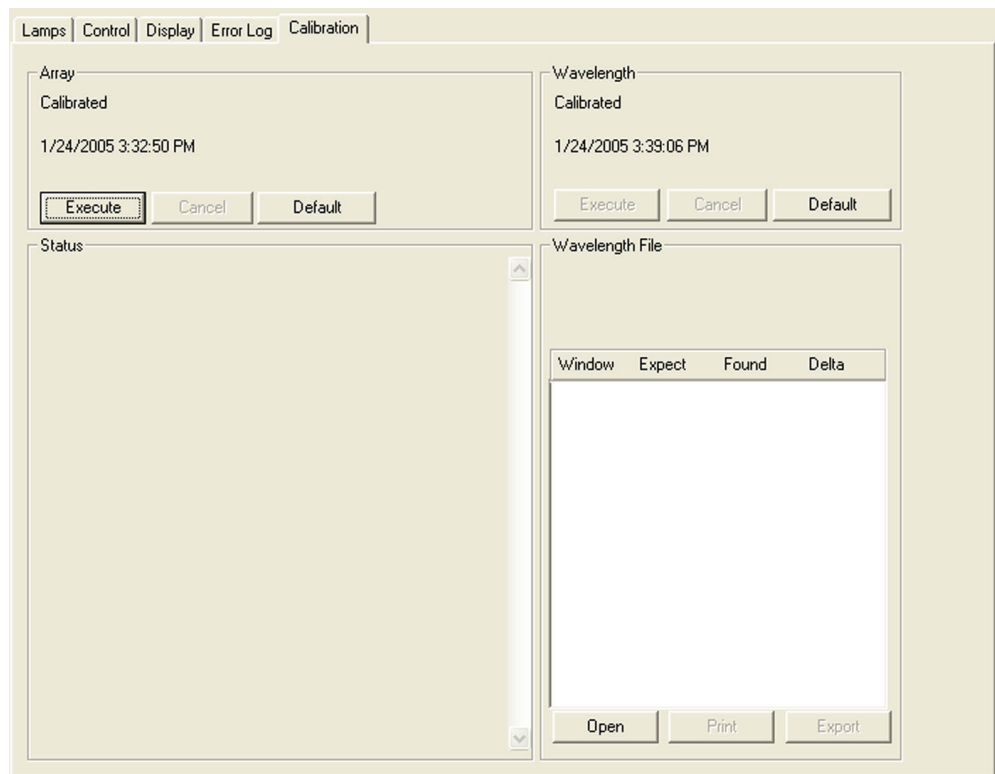
## Performing a Wavelength Calibration

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. On the Instrument Status page for the PDA detector, click **Diagnostics** to open the PDA Plus Diagnostics dialog box.
2. Click the **Calibration** tab to display the Calibration page (see [Figure 58](#)).

**Figure 58.** Calibration page of the PDA Plus Diagnostics dialog box



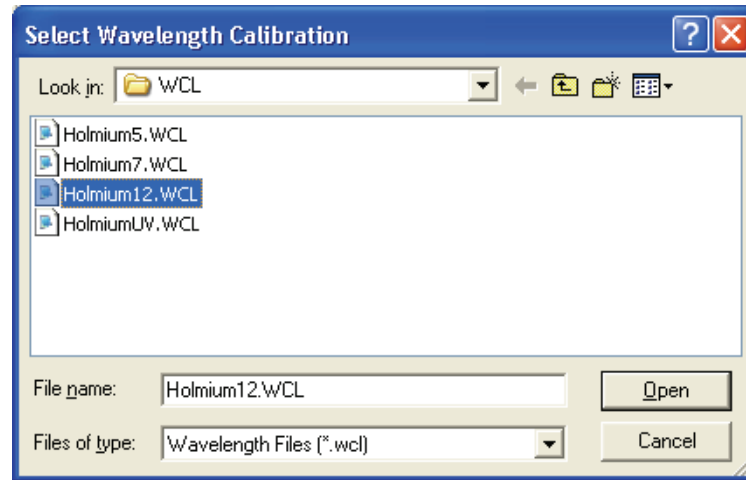
3. Open a Wavelength Calibration file as follows:
  - a. In the Wavelength File area, click **Open** to display the Select Wavelength Calibration dialog box.
  - b. In the Select Wavelength Calibration dialog box shown in [Figure 59](#), select an appropriate wavelength calibration file from the list.

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

## 5 ChromQuest Diagnostics for the PDA Detector

Calibrating the Detector with ChromQuest

**Figure 59.** Select Wavelength Calibration dialog box

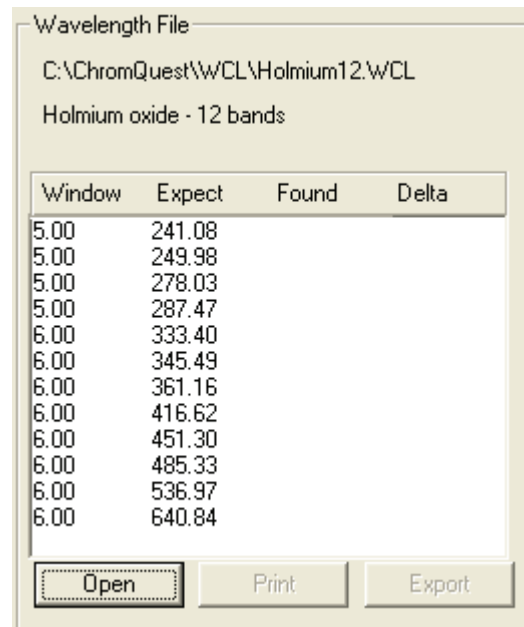


- c. Click **Open**.

**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 60](#).

**Figure 60.** Diagnostics dialog box – Calibration page with the Holmium12 Wavelength Calibration File selected

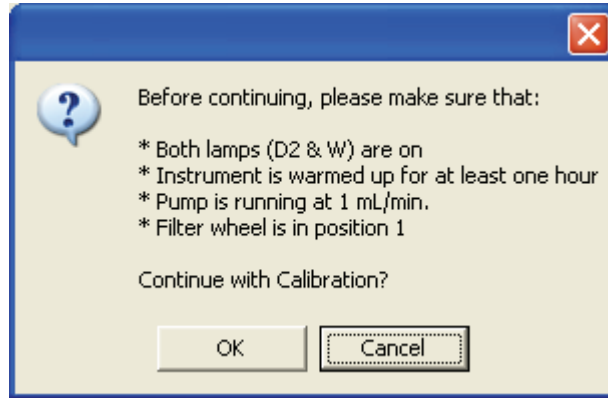


Window	Expect	Found	Delta
5.00	241.08		
5.00	249.98		
5.00	278.03		
5.00	287.47		
6.00	333.40		
6.00	345.49		
6.00	361.16		
6.00	416.62		
6.00	451.30		
6.00	485.33		
6.00	536.97		
6.00	640.84		

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

The dialog box shown in [Figure 61](#) appears.

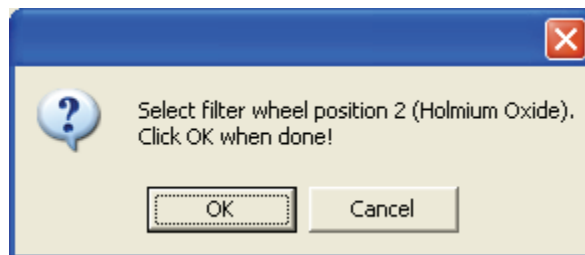
**Figure 61.** Calibration Preconditions



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 following dialog box appears (see [Figure 62](#)).

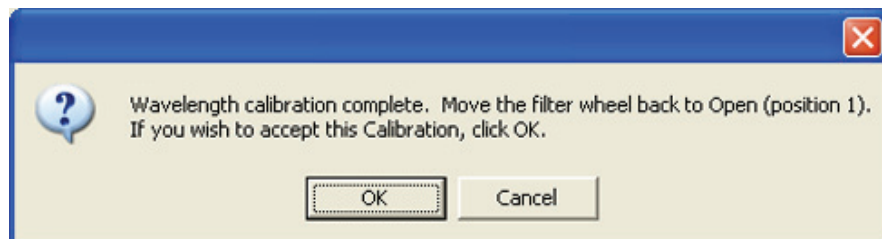
**Figure 62.** Message reminding you to move the filter wheel to position 2



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 63](#)).

**Figure 63.** Calibration message reminding you to return the filter wheel to position 1

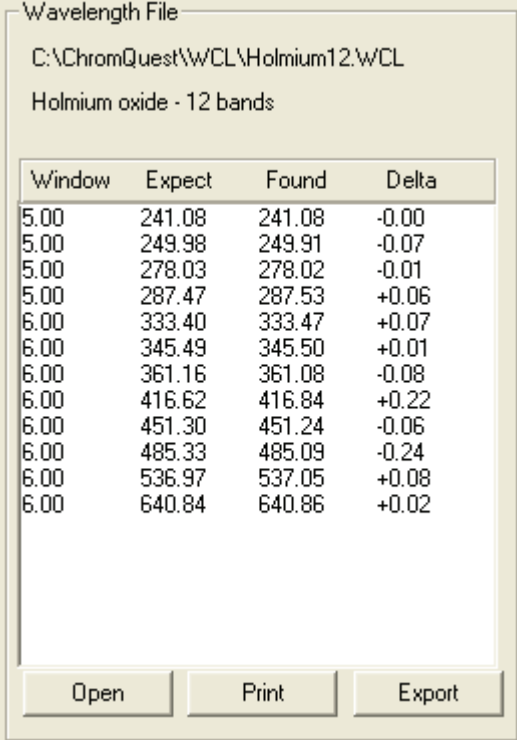


## 5 ChromQuest Diagnostics for the PDA Detector

Calibrating the Detector with ChromQuest

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 64](#)).
  - a. If the delta values are not within the range of  $\pm 1$  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  $\pm 1$  nm, call your Thermo Fisher Scientific service representative for assistance.

**Figure 64.** Diagnostics dialog box – Calibration page with a list of acceptable Delta values



Wavelength File  
C:\ChromQuest\WCL\Holmium12.WCL  
Holmium oxide - 12 bands

Window	Expect	Found	Delta
5.00	241.08	241.08	-0.00
5.00	249.98	249.91	-0.07
5.00	278.03	278.02	-0.01
5.00	287.47	287.53	+0.06
6.00	333.40	333.47	+0.07
6.00	345.49	345.50	+0.01
6.00	361.16	361.08	-0.08
6.00	416.62	416.84	+0.22
6.00	451.30	451.24	-0.06
6.00	485.33	485.09	-0.24
6.00	536.97	537.05	+0.08
6.00	640.84	640.86	+0.02

Open Print Export

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 1 500 to 3 000 counts.

Because the environmental conditions of your laboratory can cause the dark current of the diode array to increase over time, Thermo Fisher Scientific 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 does 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 flowcell 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<sub>2</sub> 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 57](#)).
  - c. Under D2 Lamp, click **On**. Under W Lamp, click **On**.

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

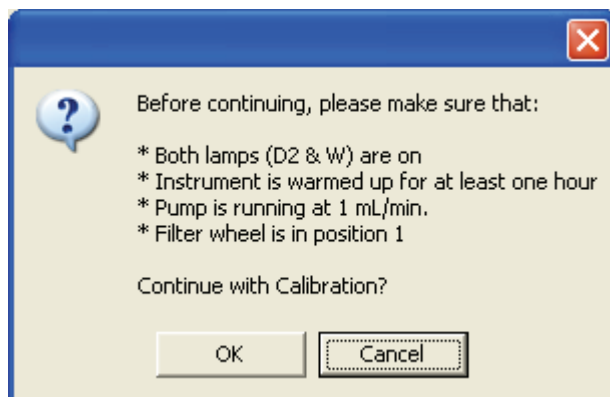
4. Click **Diagnostics**.

The PDA Plus Diagnostics dialog box appears.

5. Click the **Calibration** tab to display the Calibration page (see [Figure 60](#) on [page 68](#)).
6. In the Array area, click **Execute**.

A message box appears (see [Figure 65](#)).

**Figure 65.** Calibration preconditions dialog box



7. 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.

8. 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 Fisher Scientific 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 103](#).

Use the Error Log page in ChromQuest, shown in [Figure 66](#), 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. Open the online Instrument window for your instrument.
  - b. Choose **Control > Instrument Status**.

The Instrument Status window appears.

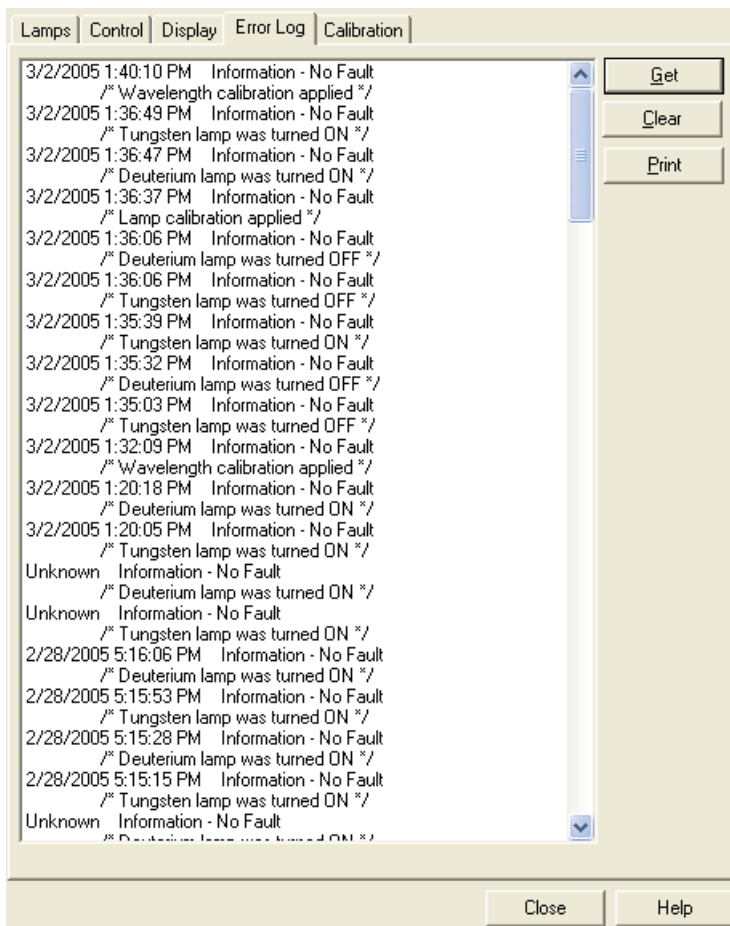
- c. Click the **Surveyor PDA Plus** tab to open the Surveyor PDA Plus Instrument Status page.
- d. Click **Diagnostics** to open the PDA Plus Diagnostics dialog box.
- e. Click the **Error Log** tab to display the Error Log page.

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

2. Use the buttons in the Error log page to do the following:
  - Click **Get** to retrieve and display the error log information from the detector. [Figure 66](#) shows a sample Error Log.
  - Click **Print** to print a copy of the displayed log.
  - 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 103](#).

**Figure 66.** Error Log page of the PDA Plus Diagnostics dialog box



## Verifying Operational Performance

If you move your PDA detector, replace lamps, or install a new flowcell, 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](#)

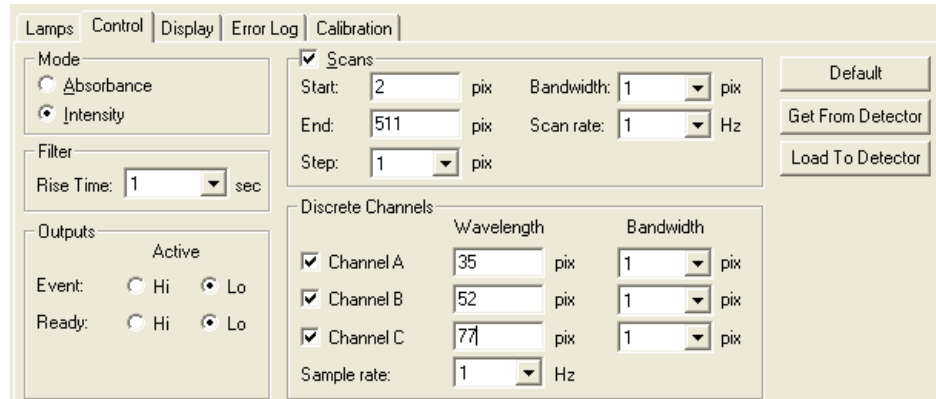
### Verifying the Performance of the Detector

❖ **To verify the proper operation of the detector from ChromQuest**

1. Open the online Instrument window for your instrument.
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. Click the **Surveyor PDA Plus** tab to display the Surveyor PDA Plus Instrument Status page.
  - c. Click **Diagnostics** to open the PDA Plus Diagnostics dialog box.
  - d. 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<sub>2</sub>) 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<sub>2</sub>) 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. In the Mode area, select the **Intensity** option 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 67](#)).

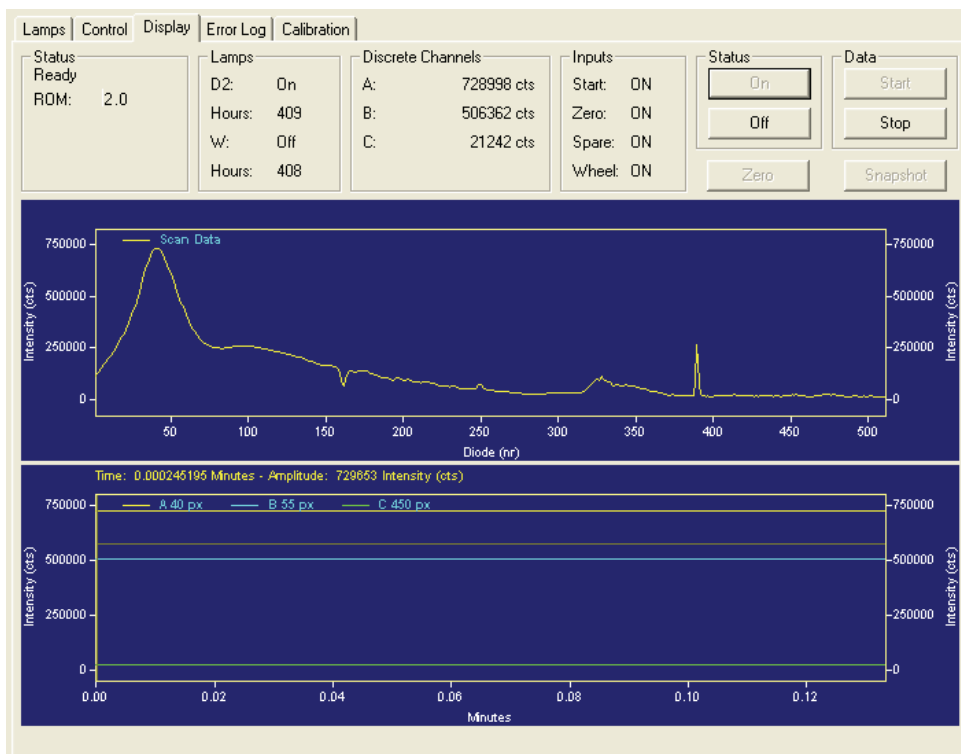
**Note** These diodes roughly correspond to the wavelengths of 230 nm, 250 nm, and 280 nm, respectively. The Discrete Channels area on the Display page contains a digital readout for the selected diodes (see [Figure 68](#)). Record these readout values to track the performance of the deuterium lamp. You can also use other diode values to track the performance of the deuterium lamp.

**Figure 67.** Control page of the PDA Plus Diagnostics dialog box with 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.
- i. In the Data area, click **Start** to refresh the display (see [Figure 68](#)).
- j. 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 78).

**Figure 68.** Display page with an intensity scan of the light output from the deuterium lamp

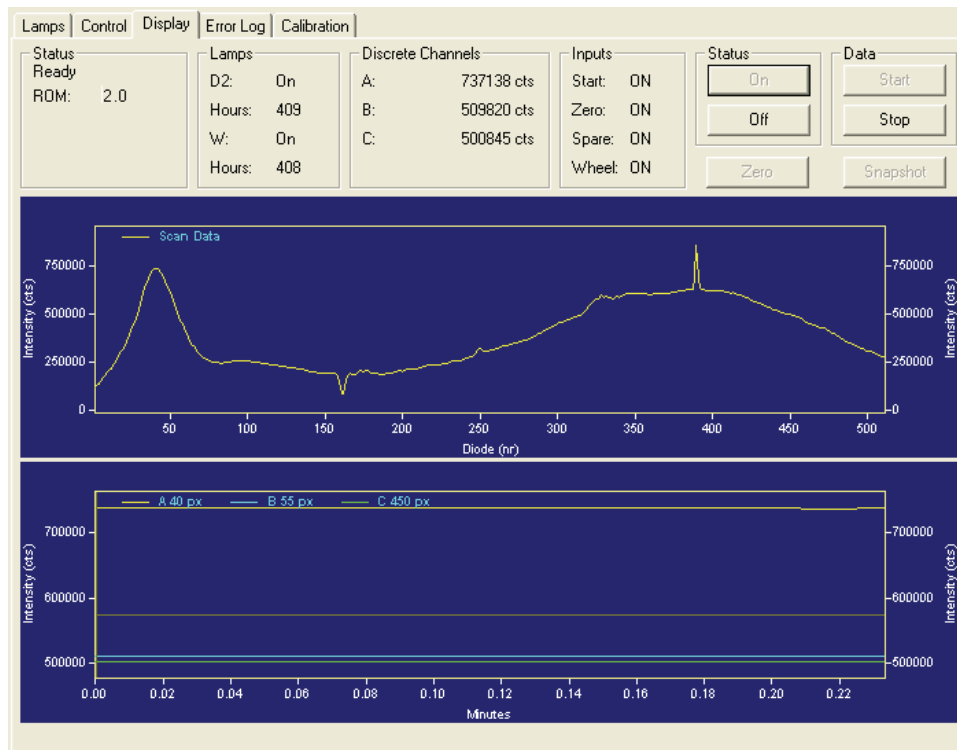


6. View an intensity scan of the deuterium (D<sub>2</sub>) and tungsten (W) lamps together:
  - a. Open the Lamps page and turn on the tungsten (W) lamp. Leave the deuterium (D<sub>2</sub>) lamp on.
  - b. Return to the Control page and change the Discrete Channels settings to monitor diodes 94, 177, 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 68). 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 69).
- 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 78).

**Figure 69.** Display page with an intensity scan of the light output from both lamps



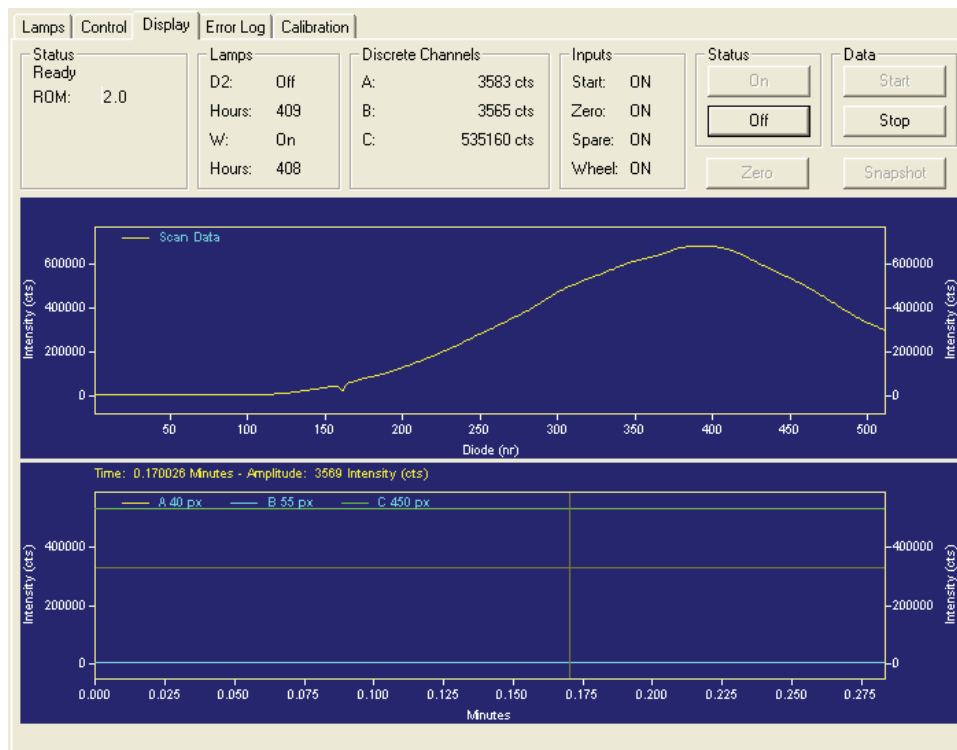
7. View an intensity scan of the tungsten (W) lamp:
  - a. In the Lamps page, turn Off the deuterium (D<sub>2</sub>) lamp.
  - b. Return to the Control page and change the Discrete Channels settings to monitor diodes 219, 302, and 427.
  - c. Click **Load To Detector**. A dialog box containing the following 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 68). 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<sub>2</sub> and combined lamp spectra, save a copy of the scan for your maintenance records (see Figure 70).

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

**Figure 70.** Display page with an intensity scan of the light output from 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

- As you are collecting the data stream in the Display page, press SHIFT+PRINT SCREEN.
- 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 flowcell does not help, use the diagnostic features of the software to determine the cause of the problem. If light output becomes too low and adjusting the attenuators as described in [“Adjusting the Light Output from the Lamps”](#) on page 81 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 on the Lamps page of the PDA Diagnostics.

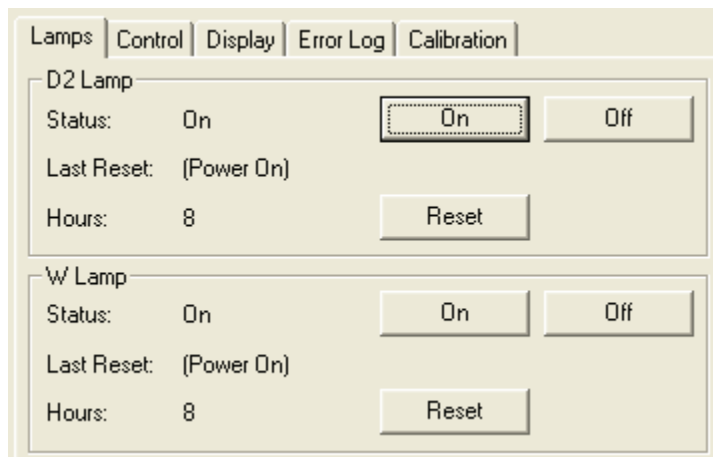
### ❖ To open the Lamps page in ChromQuest

1. Open the online Instrument window in ChromQuest.
2. In the menu bar of the Instrument window, choose **Control > Instrument Status** to open the Instrument status window.
3. In the Instrument Status window, click the **Surveyor PDA Plus** tab to open the Surveyor PDA Plus Instrument Status page.
4. Click **Diagnostics** to open the PDA Plus Diagnostics dialog box.
5. Click the **Lamps** tab to open the Lamps page, and then note the status and usage of each lamp (see [Figure 71](#)).

**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 71.** 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

Do one of the following:

- Click **On** to ignite the deuterium lamp. The Status readback displays *Starting* during the 10-second ignition period, and then it changes to *On*. If there is a problem with the lamp, the Status readback displays *Failed*.
- Click **On** to turn on the tungsten lamp. The tungsten lamp turns on immediately. If there is a problem with the lamp, the Status readback displays *Failed*.

- 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 is a flat baseline.

The attenuators require adjustment when either lamp is replaced or when the flowcell 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 flowcell.

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

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.

## 5 ChromQuest Diagnostics for the PDA Detector

### Adjusting the Light Output from the Lamps

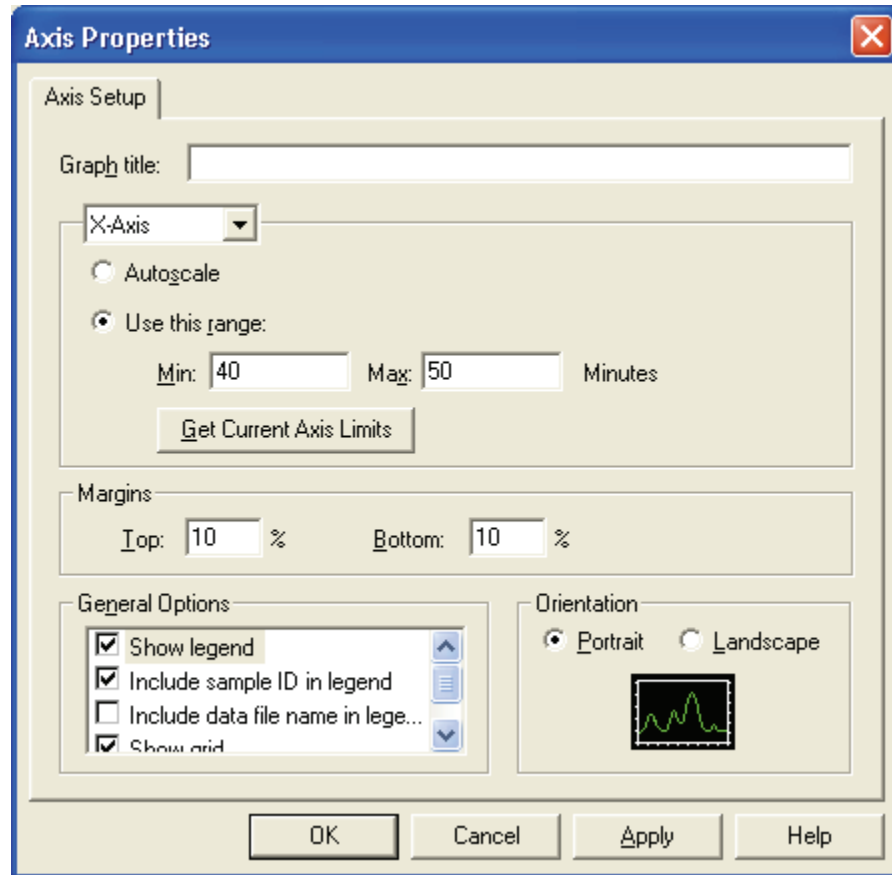
- d. In the Instrument Status window, click the **Surveyor PDA Plus** tab to open the Surveyor PDA Plus Instrument Status page.
  - e. Click **Diagnostics** to open the PDA Plus Diagnostics dialog box.
2. To turn both lamps on:
    - a. In the Diagnostics dialog box, click the **Lamps** tab to open the 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 67](#) on [page 75](#)).
    - b. In the Mode area, select the **Intensity** option.
    - c. Click **Default**, and then verify that the following parameters are specified:
      - Start = 2
      - End = 511
      - Step = 1
      - 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 72](#)).

Figure 72. Axis Properties dialog box



5. In the Axis Properties dialog box, do the following:
  - a. Select **X-axis** from the list
  - b. Select 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. Do the following:

## 5 ChromQuest Diagnostics for the PDA Detector

### Adjusting the Light Output from the Lamps

- 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 flowcell cover.

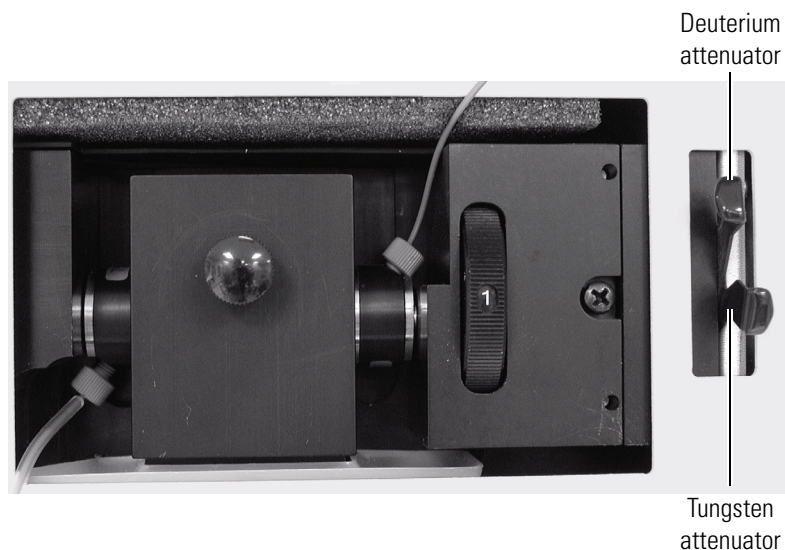
### ❖ To access the attenuators

1. Open the front doors of the detector.
2. Unscrew the captive screw and remove the flowcell cover (see [Figure 13](#) on [page 18](#)).

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 73](#)).

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 73.** View of 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 750 000 and 775,000 intensity counts.
3. Adjust the attenuator with the right tab (Visible attenuation) to achieve a Channel C value of between 750 000 and 775 000 intensity counts.
4. After you finish adjusting the attenuators, replace the flowcell 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 Fisher Scientific 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 PDA Plus Diagnostics – Display page.

### ❖ To open the Display page

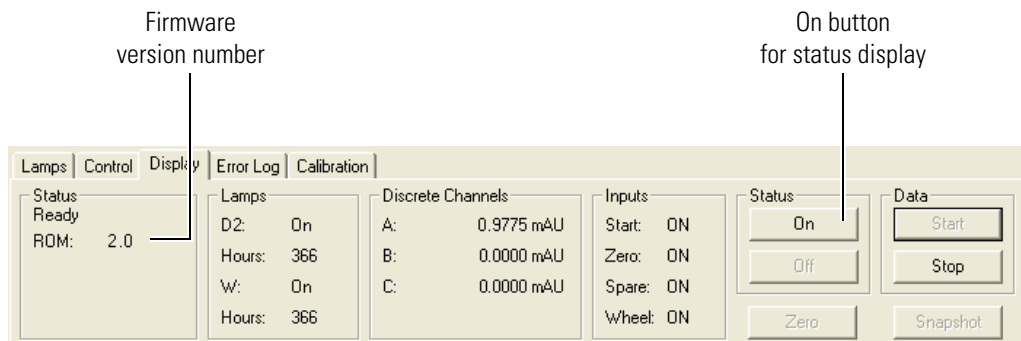
1. On the menu bar in the Main Menu window, choose **Control > Instrument Status**.
2. Click the **Surveyor PDA Plus** tab to open the Surveyor PDA Plus Instrument Status window.

## 5 ChromQuest Diagnostics for the PDA Detector

### Checking the Firmware Version

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 74).
5. On the Display page, click **On** to display the firmware version in the Status area.

**Figure 74.** PDA Diagnostics dialog box – Display page with the firmware version numbers displayed





## Routine Maintenance

The optimum performance of the Surveyor PDA Plus Detector depends on proper maintenance. 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, contact your Thermo Fisher Scientific Service Representative.

The maintenance procedures that require the use of the Xcalibur data system are described in Chapter 4, “Xcalibur Diagnostics for the PDA Detector.”

### Contents

- [Recommended Maintenance](#)
- [Cleaning the External Surfaces of the Detector](#)
- [Cleaning the LightPipe Flowcell](#)
- [Replacing the Lamps](#)

## Recommended Maintenance

Table 2 lists recommendations for routine maintenance of the Surveyor PDA 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 flowcell 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 flowcell should be flushed with clean solvent after every use. This practice reduces the frequency with which you need to clean your flowcell.

## 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 Flowcell

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

The exterior and interior surfaces of the LightPipe flowcell 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, 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 damages the LightPipe flowcell. Thermo Fisher Scientific cannot be held responsible for any damage done to the LightPipe by attempts to disassemble the housing or tighten the screws. Contact your Thermo Fisher Scientific Service Representative with any questions regarding LightPipe maintenance or service.

This section contains the following procedures:

- [Removing the LightPipe Flowcell](#)
- [Cleaning the Flowcell with Organic Solvents](#)
- [Cleaning the Flowcell with Nitric Acid](#)

## Removing the LightPipe Flowcell

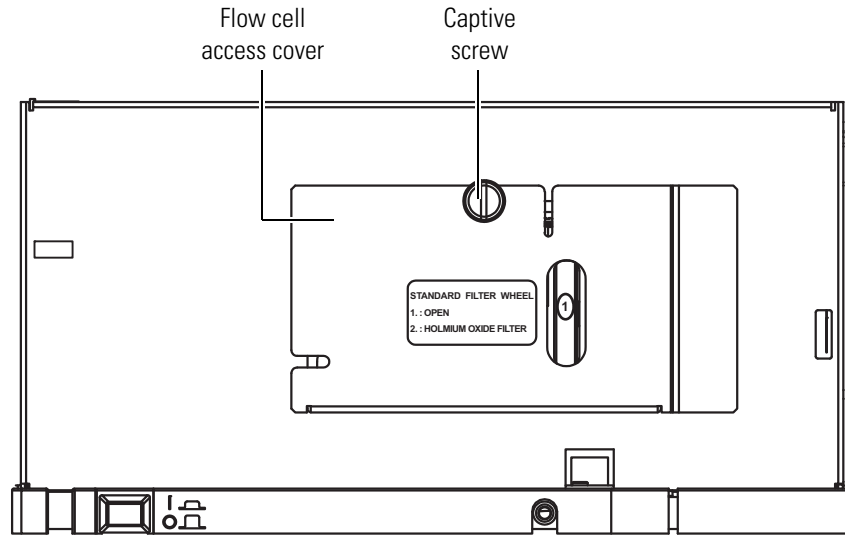
You need to remove the LightPipe flowcell from the Surveyor PDA Plus Detector to clean it.

### ❖ To remove the LightPipe

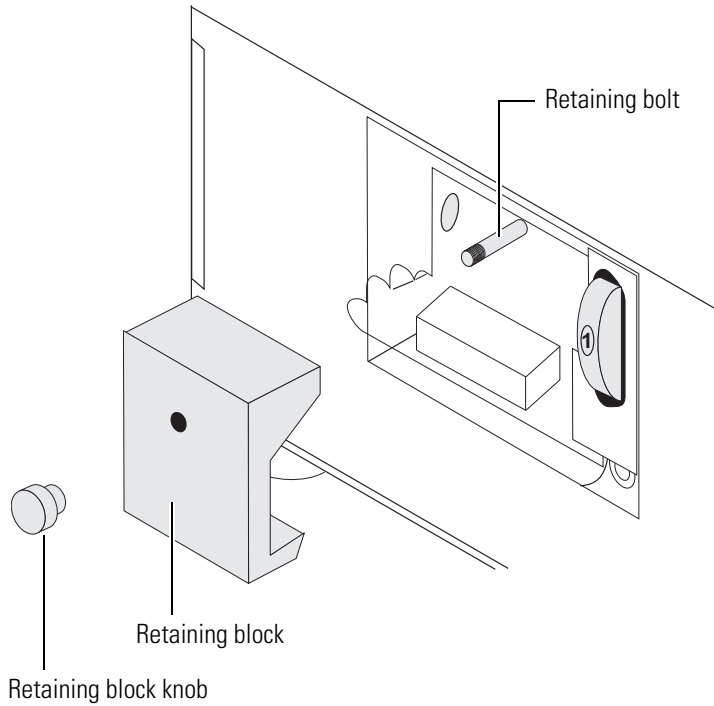
1. Turn the detector power off, and disconnect the power cord from the back panel of the detector.
2. Open the front doors of the detector.
3. Loosen the captive screw that secures the flowcell cover. Then remove the flowcell cover (see [Figure 75](#)).

The LightPipe flowcell is located behind the flowcell cover (see [Figure 76](#)).

**Figure 75.** View of the Surveyor PDA Plus Detector with the front doors open



**Figure 76.** View of the retaining block and retaining block knob



4. Unscrew and remove the retaining block knob that holds the LightPipe retaining block in place. Then remove the retaining block (see [Figure 76](#)).



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

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

## Cleaning the Flowcell with Organic Solvents

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



**CAUTION** Do **not** disassemble the LightPipe housing or tighten the screws on the housing. In addition, do not touch the optical fibers at the ends of the LightPipe. Doing so damages the LightPipe flowcell. Thermo Fisher Scientific cannot be held responsible for any damage done to the LightPipe by attempts to disassemble the housing or tighten the screws. Contact your Thermo Fisher Scientific Service Representative with any questions regarding LightPipe maintenance or service.

### ❖ To clean the LightPipe flowcell 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 solvents you plan to use are miscible with the solvent already present in the LightPipe and pump. Isopropanol is a good choice as a cleaning solvent for most applications. If the last solvent in the pump was an aqueous buffer solution, be sure to pump 25 to 40 mL of HPLC-grade water (or equivalent) through the system to remove any salts before you flush it with the cleaning solvents. This wash helps 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 Fisher Scientific does not recommend using a syringe to force solvent through the flowcell. Pressurizing the syringe could cause a leak or rupture, resulting in a dangerous and uncontrolled spraying of solvent.

3. Flush the flowcell with 40 to 50 mL of cleaning solvent (for example, isopropanol or methanol).
4. Flush the 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 Flowcell](#)” on [page 17](#) for instructions on how to reinstall your LightPipe.

## Cleaning the Flowcell 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 flowcell 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 Flowcell](#)” on [page 89](#). (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 Fisher Scientific does **not** recommend using a syringe to force acid solutions through the flowcell. Pressurizing the syringe could cause a leak or rupture, resulting in a dangerous and uncontrolled spraying of acid.



**CAUTION** 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 flowcell.

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 flowcell 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 Flowcell](#)” on [page 17](#) for instructions on how to reinstall your flowcell.

## 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 flowcell does not help, use the diagnostic features of the software to determine the cause of the problem. If light output becomes too low and adjusting the attenuators 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 1 000 h and the tungsten lamp has a lifetime of approximately 2 500 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](#) on [page 96](#)).



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

### ❖ To replace the deuterium and tungsten lamps

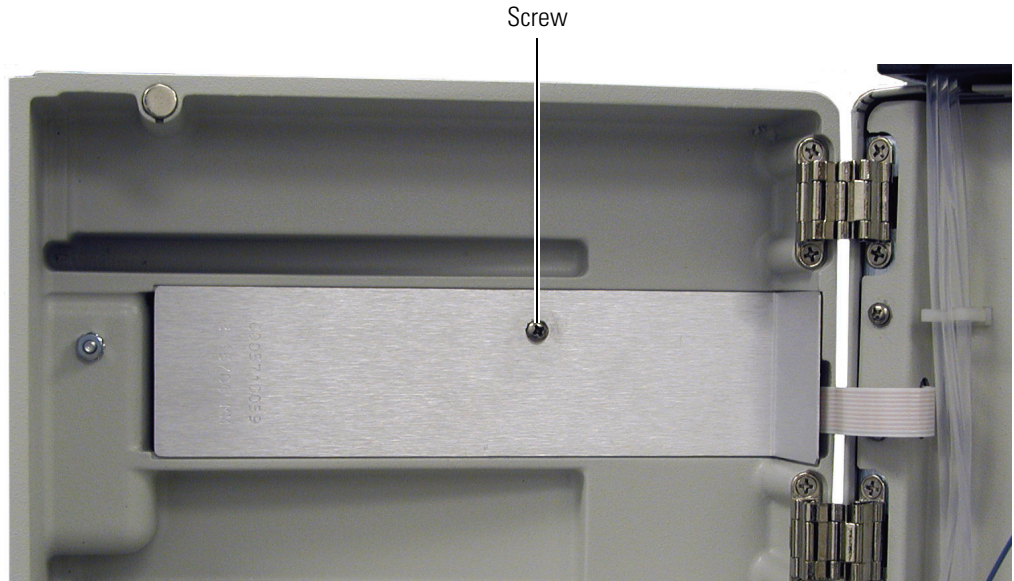
1. Turn the power switch at the front of the detector to Off (released position) and disconnect the power cord from the back panel.
2. Open the front doors by swinging each door outwards.
3. Remove the flowcell as described in “[Removing the LightPipe Flowcell](#)” on [page 89](#).



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

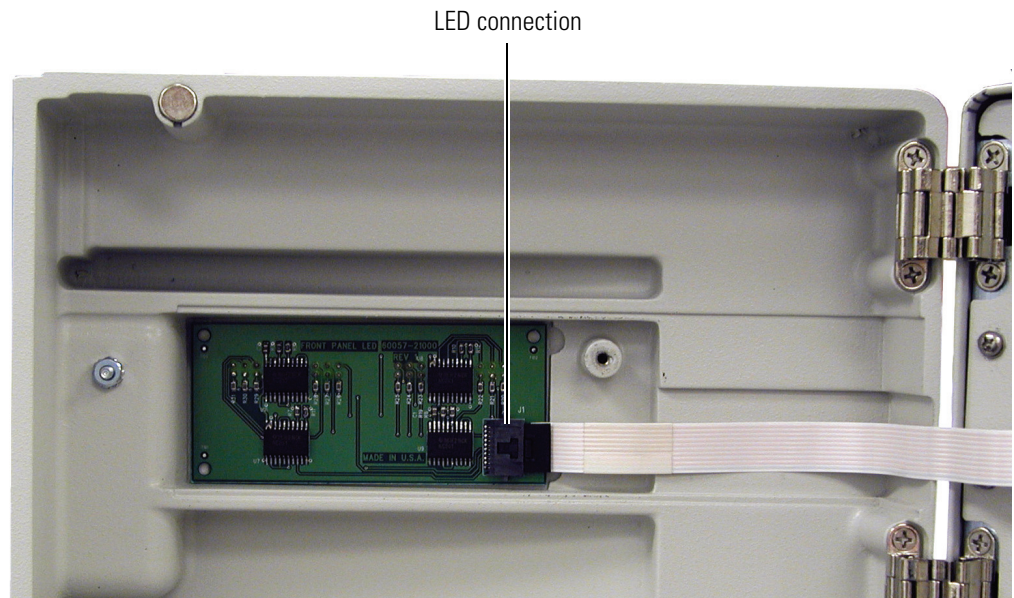
- Using a #2 Phillips head screw driver, remove the screw that secures the metal plate covering the LED cable connection to the inside of the left door.

**Figure 77.** View of the screw that secures the metal plate covering the LED cable



- Detach the LED cable from the door.

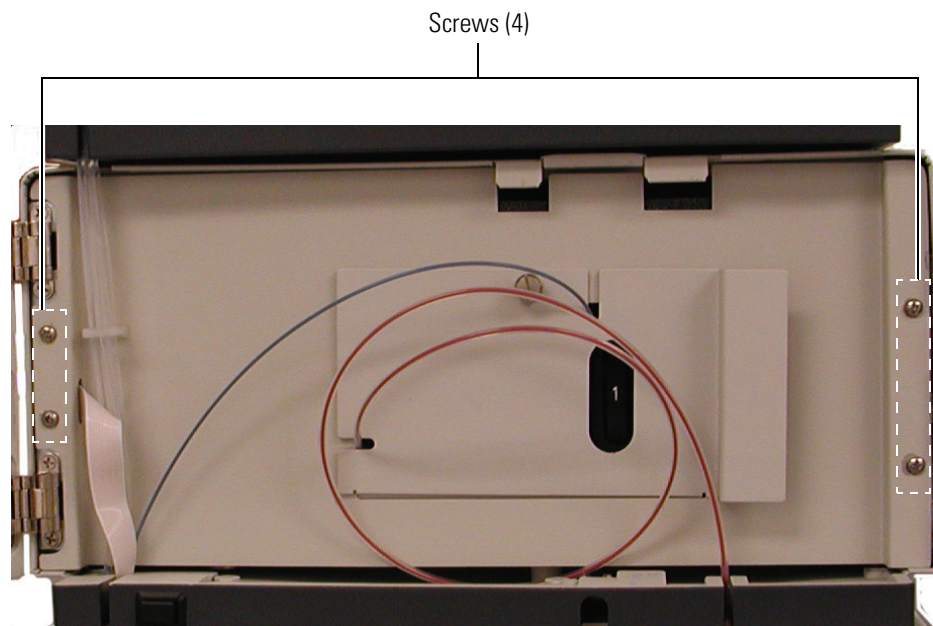
**Figure 78.** View of the LED cable connection to the inside of the left door





- Using a #2 Phillips head screw driver, remove the four screws that secure the chassis to the housing. These screws are located on either side of the front panel (see [Figure 79](#)).

**Figure 79.** View of the four screws that secure the chassis to the housing



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



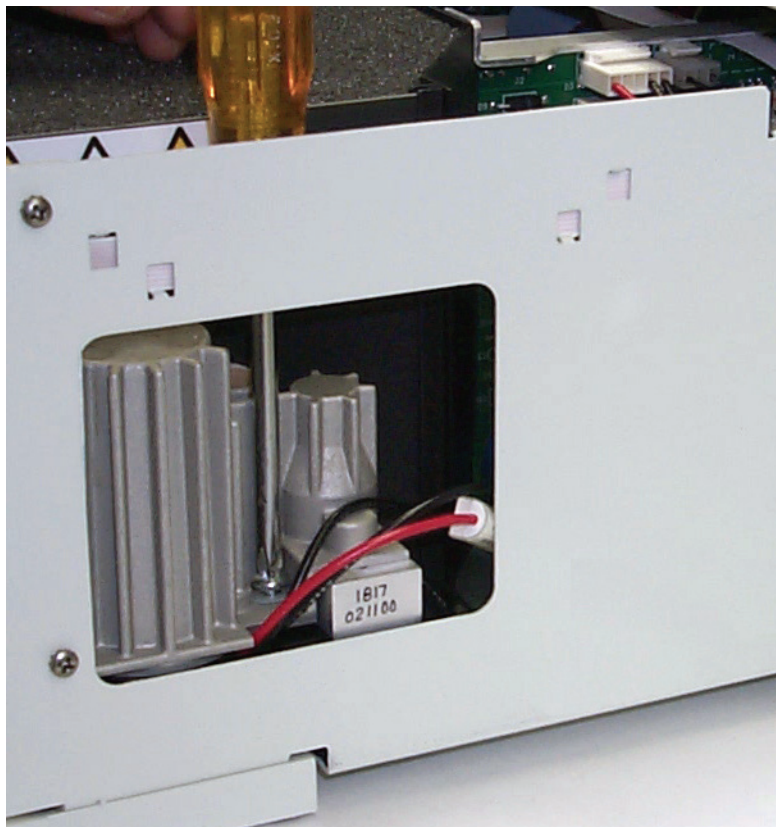
**CAUTION** The lamps generate a significant amount of heat. Allow sufficient time for the lamps to cool before removing the lamp cover.

- 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 80](#)). Carefully lift the lamp cover out of the detector.

## 6 Routine Maintenance

### Replacing the Lamps

**Figure 80.** Removing the Phillips head screw

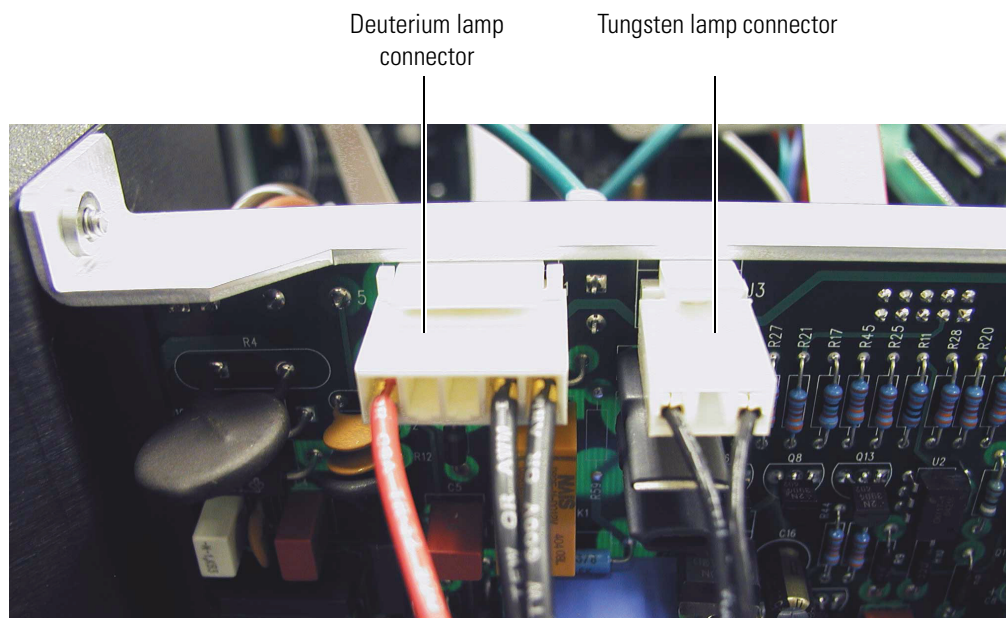


**Note** Do **not** try to remove the lamps from their mounting assemblies. Remove and replace a lamp, its mount, cable, and connector as an assembly as described in the following steps.

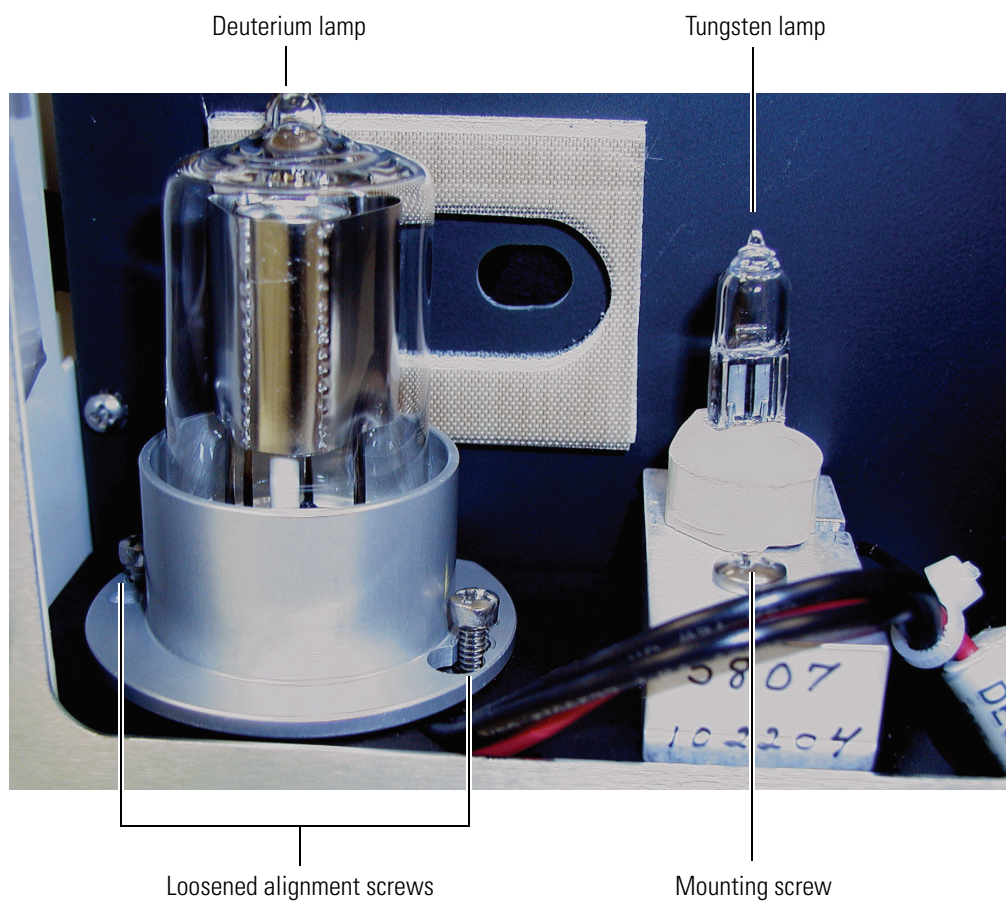
**IMPORTANT** The surfaces of both lamps must be free of fingerprints and smudges, which cause performance problems. For this reason, wear clean, talc-free gloves when you handle the lamps. If either lamp requires cleaning, clean with a lint-free lens paper moistened with methanol or isopropanol before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

9. To remove the deuterium lamp assembly:
  - a. Gently pull its connector free from the contact pins on the lamp power supply board. As [Figure 81](#) 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 82](#)).

**Figure 81.** Lamp connections



**Figure 82.** View of the deuterium lamp with its alignment screws loosened by four turns



## 6 Routine Maintenance

### Replacing the Lamps

10. To remove the tungsten (W) lamp:
  - a. Gently pull its connector free from the contact pins on the lamp power supply board. The connector for the tungsten lamp has two leads (see [Figure 81](#)).
  - b. Loosen and remove the single Phillips head screw that secures the lamp-mounting block (see [Figure 82](#)).

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 Xcalibur](#)” on [page 57](#)).

## Troubleshooting

This chapter contains 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.

### Contents

- [Detector-Related Problems](#)
- [Log Entries](#)

## Detector-Related Problems

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

**Table 3.** Troubleshooting detector-related problems (Sheet 1 of 4)

Symptom	Cause	Remedy
1. Spikes on baseline.	a. Continuous gas bubbles in the flowcell.	a. Degas the mobile phase. Connect a backpressure device to the flowcell (check backpressure rating).
	b. Immiscible solvent bubbles following mobile phase changeover.	b. Flush the flowcell with 2-propanol followed by mobile phase.
	c. Electrical interference.	c. Check the 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 an uninterruptible power supply.

**Table 3.** Troubleshooting detector-related problems (Sheet 2 of 4)

Symptom	Cause	Remedy
2. Random noisy baseline.	a. Contaminated flowcell.	a. Flush the flowcell with cleaning solvents as described in “Cleaning the LightPipe Flowcell” on page 89. Check for leaks.
	b. Leak in sample inlet line.	b. Check all of the fittings from the column outlet to the flowcell inlet for leaks.
	c. Bubble trapped in flowcell.	c. Increase the flow rate until the bubble is removed. Supply a backpressure device to the flowcell (check pressure rating to avoid rupturing flowcell).
	d. Leaking flowcell.	d. Replace the flowcell.
	e. Insufficient lamp warm-up.	e. Allow a 30 minute warm-up for normal operation and a 1½ hour warm-up for maximum sensitivity.
	f. Lamp aging or defective.	f. Replace the lamp.
	g. Ground loop problem between integrator and detector.	g. Check for proper cable connections for detector output; do not ground at both ends of cable.
	h. Flowcell or lamps dirty.	h. Clean the dirty component.
	i. Integrator input voltage does not match detector output voltage.	i. Verify that the integrator is connected to the appropriate Analog Output connections on detector. (See Chapter 2, “Installation.”) Check the attenuation setting on integrator.

**Table 3.** Troubleshooting detector-related problems (Sheet 3 of 4)

Symptom	Cause	Remedy
3. Excessive baseline drift.	a. Flow cell contaminated.	a. Flush the flowcell with cleaning solvents as described in “Cleaning the LightPipe Flowcell” on page 89. 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 the column.
	d. Leaks in system, or flowcell.	d. Check all of the fittings for leaks. Replace the flowcell.
	e. Tiny bubble trapped in flowcell.	e. Increase the flow rate until the bubble is removed. Connect a backpressure device to the flowcell outlet (check the backpressure rating to avoid rupturing flowcell).
	f. Large temperature fluctuations.	f. Remove the system from drafts. Thermostatically control the column temperature.
4. No peaks, or peaks much smaller than expected.	a. Incorrect wavelength setting.	a. Check the wavelength setting. Make sure the correct file is selected.
	b. Lamp not on, or defective.	b. Make sure the lamp is lit. Run detector’s diagnostic tests to check the lamps. Replace the lamps if necessary.
	c. Integrator input voltage does not match detector output voltage.	c. Verify that the integrator is connected to the appropriate Analog Output connections on the detector. (See Chapter 2, “Installation.”) Check the attenuation setting on integrator.
	d. Insufficient sample reaching the detector.	d. Check the entire chromatographic system for leaks. Verify the sample injection volume.
5. Broad, tailing peaks.	a. Rise time is too large (too slow).	a. Lower the rise time selection.
	b. Poor connection at flowcell inlet.	b. Check the end of inlet tubing for a clean, flat surface free of obstructions.

**Table 3.** Troubleshooting detector-related problems (Sheet 4 of 4)

Symptom	Cause	Remedy
6. Detector does not power up.	a. Tripped circuit breaker at power outlet.	a. Resolve the problem and reset the circuit breaker.
	b. Blown detector fuse.	b. Resolve the problem and replace the fuse.
	c. Incorrect voltage selected.	c. Verify that the voltage selector is set for the correct incoming line-voltage. (See <a href="#">Chapter 2, "Installation."</a> )
	d. Power cord not connected.	d. Connect the power cord.
7. Detector does not go into run upon injection.	a. Detector not receiving Start signal.	a. Check the connection to the Run contacts on the back panel.
8. Flat baseline, portion of spectrum missing.	a. Saturation of photodiode array.	a. Adjust the attenuators.
9. LED1 - Power	a. Green - power on.	a. No action is required.
10. LED2 - Comm	a. Green - communications normal.	a. No action is required.
	b. Amber - no communications with PC system.	b. Check the Ethernet connections and module configuration in the software, and then reload the firmware.
	c. Blinking Amber - firmware download in process.	c. Complete the download and reestablish communications with the PC.
11. LED3 - Run	a. Flashing Green - run in progress.	a. No action is 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 the 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 is required.
	b. Amber - both lamps are off.	b. Turn on the lamps and allow 1.5 hours for warmup.



## Log Entries

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

### ❖ To access the error log from your data system

Choose **Surveyor PDA Plus > Direct Control** from the Surveyor PDA Plus 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 Fisher Scientific technical support.

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

- [Critical Failure Messages](#)
- [Warning Messages](#)
- [Information Messages](#)

## 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 might be corrupted or lost, and the run terminates. Possible Critical Error messages include:

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

## 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

## 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

## Accessories and Replaceable Parts

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

The LightPipe flowcell assembly consists of the parts listed in [Table 4](#).

**Table 4.** LightPipe flowcell assembly parts

Part Number	Description
803265-01	Flowcell assembly, with inlet/outlet tubing and fittings (1 cm LightPipe)
803237-01	Flowcell assembly, with inlet/outlet tubing and fittings (5 cm LightPipe)
2522-0285	FingerTight PEEK Ferrule Nuts
803260	Inlet tubing, with insulation, PEEK 1/16 × 0.005-in. ID (RED)
703950	Outlet tubing, PEEK 1/16 × 0.01-in. ID (Blue)

[Table 5](#) contains a list of optional accessories. [Table 6](#) contains a list of parts required to make the back panel connections. [Table 7](#) contains a list of maintenance parts. [Table 8](#) contains a list of repair and service parts. [Table 9](#) contains a list of the items in the accessory kit.

**Table 5.** Optional Accessories

Part Number	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 flowcell assembly (1 cm LightPipe)
A5514-010	PDA Stand
802259	Backpressure regulator

**Table 6.** Cables and connectors for back panel connections

Part Number	Description
70111-63302	Ethernet cable
60053-63034	Interconnect cable (seven-connector cable)

**Table 7.** Maintenance Parts

Part Number	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	Flowcell 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

**Table 9.** Surveyor PDA Plus Detector accessory kit

Part Number	Description
A3538-010	Cable adapter, RJ45/14-D89FM
A3638-110	Cable, 4-pin, RJ45
6040-0103	Analog cable, SS, detector
00004-02511	Connector, plug, 8-pin, 3.81 mm pitch, minicombicon
F3012-010	Funnel, drainage
F5034-010	Tubing, convoluted, detector drainage
70111-63302	Cable, Ethernet, straight patch w/ferrite, 7 ft



## Firmware

Periodically, upgrades to the Surveyor PDA Plus converter board firmware become available. In anticipation of future upgrades, both the ChromQuest and 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 converter 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 109](#).

### Contents

- [Installing the Update Files for ChromQuest](#)
- [Updating the Firmware](#)

## Installing the Update Files for ChromQuest

The update files for the Surveyor modules can be found on the ChromQuest 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 **CQ** 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 back 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 109.
2. Make a note of the current settings of the rotary switches on the back 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 back 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.



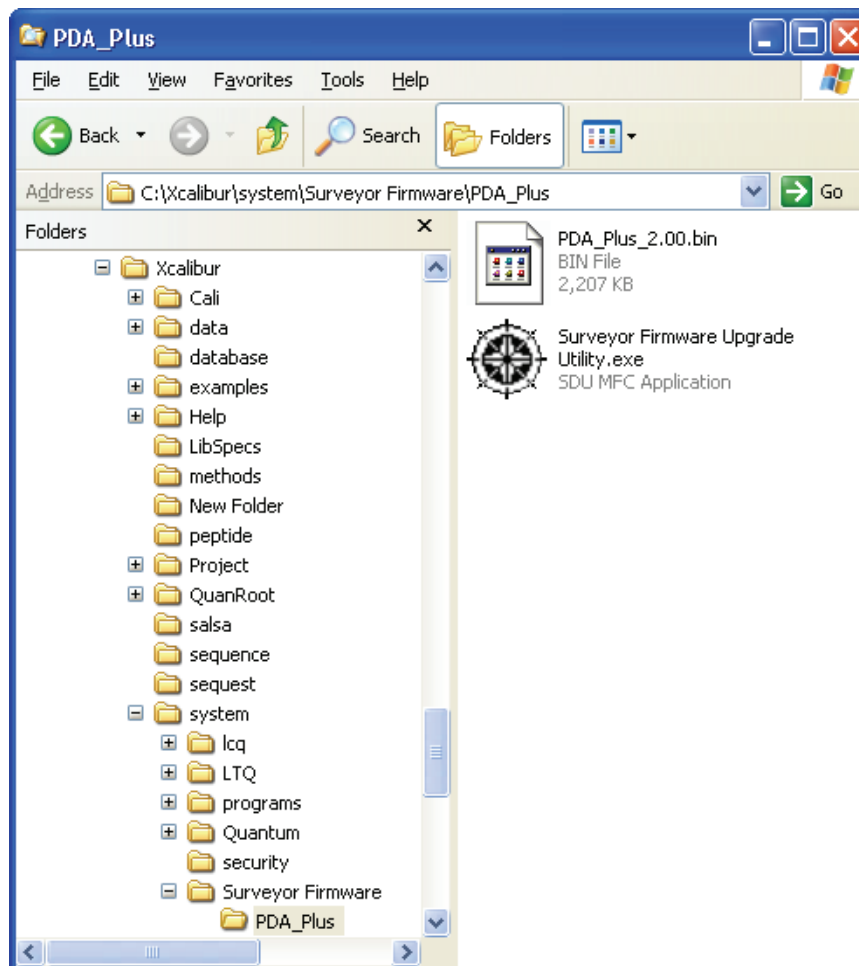
## Downloading the Firmware File

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

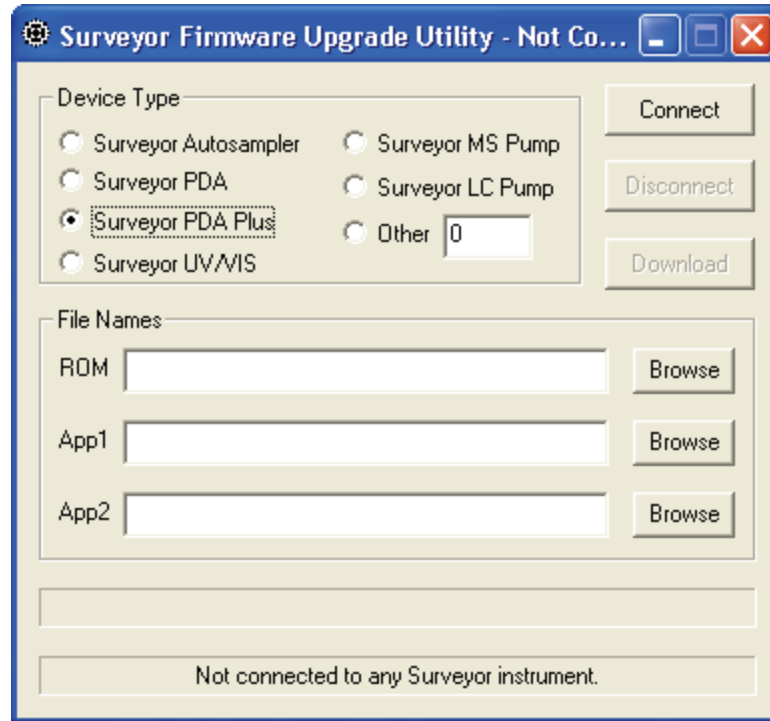
1. Double-click the icon for the Surveyor Firmware Upgrade Utility application program (see [Figure 83](#)).

**Figure 83.** Location of Surveyor Firmware Upgrade Utility application for Xcalibur



The Surveyor Firmware Upgrade Utility window appears (see [Figure 84](#)).

**Figure 84.** Surveyor Firmware Upgrade Utility, showing the Surveyor PDA Plus option selected

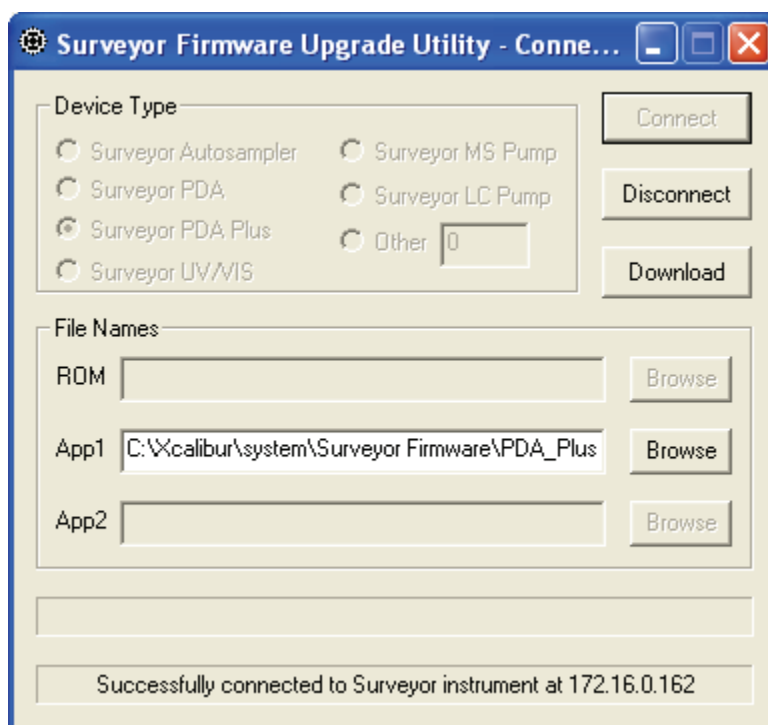


**CAUTION** Do **not** interrupt the firmware download process. Do **not** turn off the power to the Surveyor PDA Plus Detector or close the Surveyor Firmware Upgrade Utility while the detector is connected to the Surveyor Firmware Upgrade Utility. If you lose power to the detector during the firmware download process, contact your local Thermo Fisher Scientific 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.
  - 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 85](#)).

**Figure 85.** Surveyor Firmware Upgrade Utility, showing a successful connection to the Surveyor PDA Plus Detector



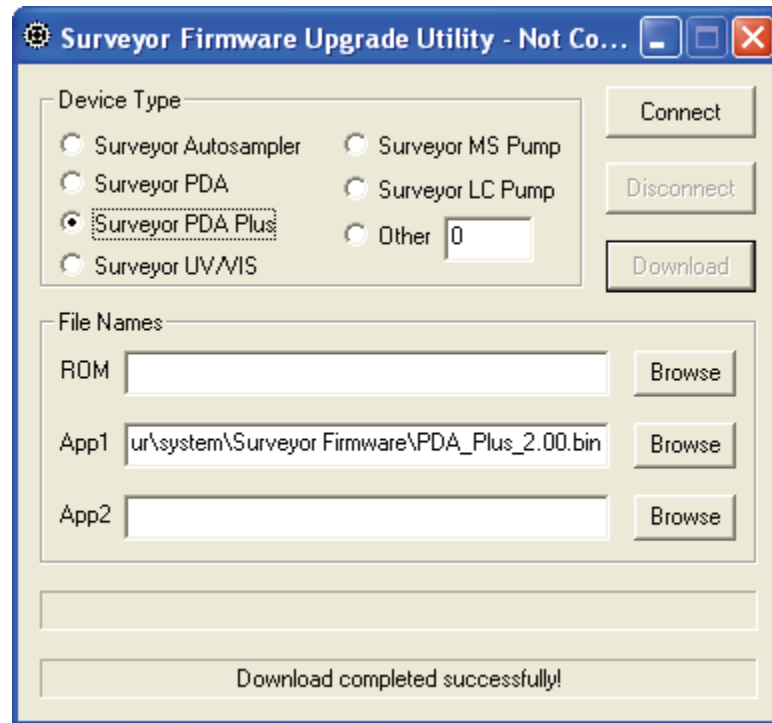
- c. Under File Names, click **Browse** to the right of App1, and then select the APP1 file ("PDA\_Plus\_\*.bin").

The filename appears in the App1 box.

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

The utility notifies you when the download is complete (see [Figure 86](#)).

**Figure 86.** 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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