Thermo SCIENTIFIC

Dionex ICS Series VWD Variable Wavelength Detector Operator's Manual

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For Research Use Only. Not for use in diagnostic procedures.

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1 • Introduction

1.1 Detector Overview

Figure 1-1. Thermo Scientific Dionex ICS Series Variable Wavelength Detector

The Thermo Scientific Dionex™ ICS Series Variable Wavelength Detector (Dionex VWD) is a high-quality instrument designed for IC analysis applications requiring a UV-Vis detector and for LC analysis applications requiring an inert (PEEK™) flow path. The Dionex VWD can be used with the following Thermo Scientific Dionex systems: the ICS-5000 (analytical systems only), ICS-2100, ICS-1600, ICS-1100, and ICS-900 (as well as some legacy systems). The Dionex VWD can be used in numerous laboratory environments for routine analysis, as well as for sophisticated research tasks.

Two versions of the Dionex VWD are available: a single-channel version (P/N 070220) and a four-channel version (P/N 070221).

- The detector is a dual-beam, variable-wavelength photometer with one measurement and one internal reference beam. See Section 2.3 for details about the optical system.

- Two light sources, a deuterium lamp for ultraviolet detection and a tungsten lamp for visible and near-infrared wavelength detection, provide a wavelength detection range from 190 to 900 nm. For details about the lamps and wavelength detection ranges, see Section 2.2.4.
- The four-channel detector measures at up to four wavelengths, by indexing between wavelengths several times per second.
- To suppress higher-order radiation, two optical filters are inserted (automatically) into the light path (see Section 2.3).
- The wavelength accuracy can be verified via the built-in holmium oxide filter (see Section 5.2).
- The detector is controlled with a PC (personal PC) running Microsoft® Windows Vista® or Windows® XP and either the Thermo Scientific Dionex Chromeleon® 7 Chromatography Data System or Chromeleon® 6.8 Chromatography Data System. Chromeleon 7 and Chromeleon 6.8 also provide data acquisition and data processing functions.

  NOTE Thermo Scientific Dionex Chromeleon® Xpress software can provide real-time control and monitoring of the detector, but does not include data management capabilities.

- Various monitoring, diagnostic, and calibration features are provided for system wellness and predictive performance (see Section 2.6.2).

1.2 Principles of Operation

Photometric detection is based upon the absorption of monochromatic light. The degree of absorption depends on the sample molecule, its concentration, the light's path length in the sample, and the measurement wavelength.

Absorbance is defined as:

$$A = \log\left(\frac{I_r}{I_s}\right) - \log\left(\frac{I_{ro}}{I_{so}}\right)$$

and is related to concentration by the empirical Lambert-Beer's Law:

$$A = \varepsilon c l$$

where:

I_r	Reference beam intensity
I_s	Sample beam intensity
I_{ro}	Reference beam intensity with autozero
I_{so}	Sample beam intensity with autozero
ε	Molar absorptivity coefficient of the analyte (L • mol^{-1} • cm^{-1})
c	Concentration (mol/L)
l	Cell path length (cm)

UV-Vis spectroscopy allows you to detect the chromophores of analyte molecules directly in the sample or to generate them indirectly by derivatization. Appendix D provides a list of wavelengths for the absorption maxima of various chromophores.

1.3 About This Manual

The electronic version (i.e., PDF file) of the Dionex VWD operator's manual contains numerous hypertext links that can take you to other locations within the file. These links include:

- Table of contents entries
- Index entries
- Cross-references (underlined in blue) to sections, figures, tables, etc.

If you are not familiar with how to navigate PDF files, refer to the Help system for Adobe® Acrobat® or Adobe Reader® for assistance.

Chapter 1 Introduction	An overview of the Dionex VWD, including a brief description of the detector, the principles of operation, and the chromatography software (Chromeleon) required for detector operation.
Chapter 2 Description	Detailed descriptions of Dionex VWD components and important operating features.
Chapter 3 Operation	Instructions for routine operation of the Dionex VWD. Includes routine preventive maintenance and shutdown procedures.
Chapter 4 Troubleshooting	Minor problems that may occur during operation of the Dionex VWD, with step-by-step procedures for how to isolate and eliminate the cause of each problem. Includes a list of Chromeleon Audit Trail error messages, with an explanation of the possible cause of each message and the corrective action to take.
Chapter 5 Service	Step-by-step instructions for routine service and parts replacement procedures the user can perform for the Dionex VWD.
Appendix A Specifications	Specifications and installation site requirements for the Dionex VWD.
Appendix B Installation	Step-by-step instructions for unpacking and installing the Dionex VWD.

Appendix C Reordering Information	Spare parts for the Dionex VWD.
Appendix D UV Absorbances	UV cutoff wavelengths of common mobile phases and wavelengths for the absorption maxima of various chromophores.

1.4 Safety and Regulatory Information

The Dionex VWD was manufactured by Thermo Fisher Scientific Corporation at the following location: 527 Lakeside Drive, Sunnyvale, CA 94088-3603 U.S.A. The Dionex VWD is designed for use with IC (ion chromatography) and HPLC (high-performance liquid chromatography) applications and should not be used for any other purpose. Operation of a Dionex VWD in a manner not specified by Dionex may result in personal injury.

If there is a question regarding appropriate usage, contact Technical Support for Dionex products. In the U.S. and Canada, call 1-800-346-6390. Outside the U.S. and Canada, call the nearest Thermo Fisher Scientific office.

1.4.1 Safety Messages and Notes

This manual contains warnings and precautionary statements that can prevent personal injury and/or damage to the Dionex VWD when properly followed. Safety messages appear in bold type and are accompanied by icons, as shown below.

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. Also used to identify a situation or practice that may seriously damage the instrument, but will not cause injury.

IMPORTANT **Indicates that the function or process of the instrument may be impaired. Operation does not constitute a hazard.**

Messages d'avertissement en français

Signale une situation de danger immédiat qui, si elle n'est pas évitée, entraînera des blessures graves à mortelles.

Signale une situation de danger potentiel qui, si elle n'est pas évitée, pourrait entraîner des blessures graves à mortelles.

Signale une situation de danger potentiel qui, si elle n'est pas évitée, pourrait entraîner des blessures mineures à modérées. Également utilisé pour signaler une situation ou une pratique qui pourrait gravement endommager l'instrument mais qui n'entraînera pas de blessures.

Warnhinweise in Deutsch

Bedeutet unmittelbare Gefahr. Mißachtung kann zum Tod oder schwerwiegenden Verletzungen führen.

Bedeutet eine mögliche Gefährdung. Mißachtung kann zum Tod oder schwerwiegenden Verletzungen führen.

Bedeutet eine mögliche Gefährdung. Mißachtung kann zu kleineren oder mittelschweren Verletzungen führen. Wird auch verwendet, wenn eine Situation zu schweren Schäden am Gerät führen kann, jedoch keine Verletzungsgefahr besteht.

Notes

Informational messages also appear throughout this manual. These are labeled NOTE and are in bold type:

NOTE NOTES call attention to certain information. They alert you to an unexpected result of an action, suggest how to optimize instrument performance, etc.

1.4.2 Safety Symbols

These symbols appear on the Dionex VWD or on labels affixed to the Dionex VWD:

Alternating current

Primary protective conductor terminal

Secondary protective conductor terminal

Power supply is on

Power supply is off

Indicates a potential hazard. Refer to this operator's manual for an explanation of the hazard and how to proceed.

1.4.3 Declaration of Conformity

The cTUVus Mark safety label and the CE Mark label on the Dionex VWD indicate that it is in compliance with the following standards: EN 61010-1:2001 (safety), CAN/CSA-C22.2 No. 1010.1-92 + A2:97 (safety), UL 61010C:2002 R8.02 (safety), and EN 61326:1997, including A1:1998 and A2:2001 (EMC susceptibility and immunity).

2.1 Front Features

Figure 2-1 illustrates the features on the front of the Thermo Scientific Dionex ICS Series Variable Wavelength Detector (Dionex VWD).

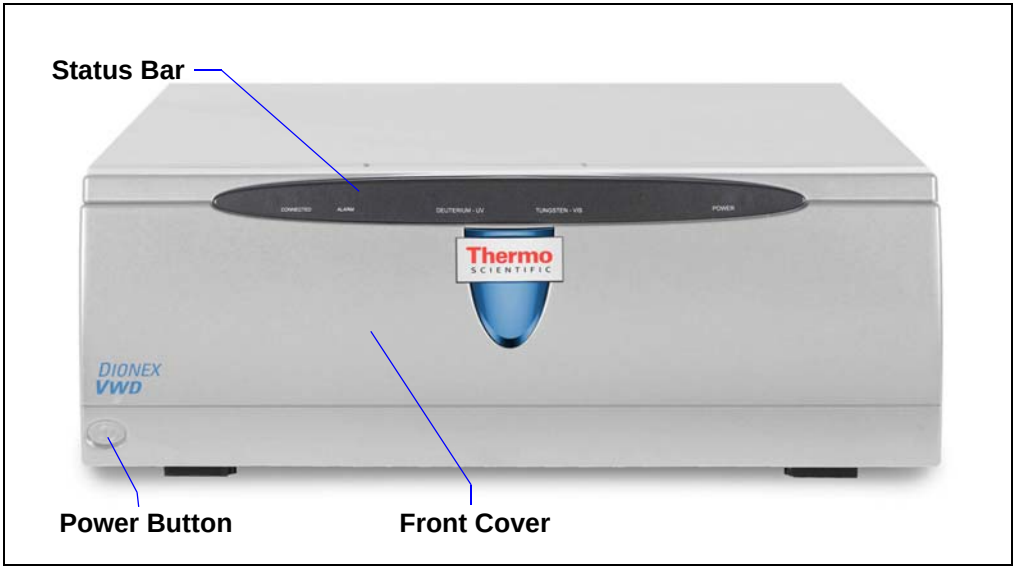


Figure 2-1. Thermo Scientific Dionex ICS Series Variable Wavelength Detector Front Features

- Use the power button in the lower left corner of the detector for routine on/off control of the Dionex VWD. To turn on the Dionex VWD, press the power button. To turn off the Dionex VWD, press and hold the power button for 2 seconds.

NOTE The main power switch is on the Dionex VWD rear panel (see Section 2.4.1).

- The front cover provides access to the interior components of the Dionex VWD. To remove the cover, grasp the cover by the sides and pull it straight off.
- The status bar provides LEDs (light emitting diodes) that indicate the status of several detector functions (see Figure 2-2).

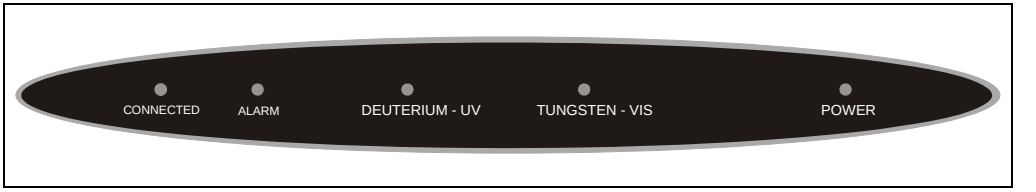
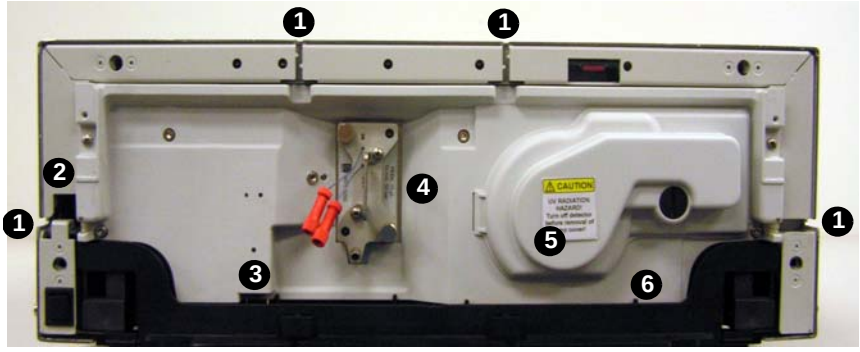


Figure 2-2. Dionex VWD Status Bar

Button/LED Label	If the LED is on ...
CONNECTED	The Dionex VWD is connected to a Chromeleon 7 instrument or a Chromeleon 6.8 timebase.
ALARM	A problem has occurred (for example, a leak). Check the Chromeleon Audit Trail for the cause.
DEUTERIUM – UV	The deuterium lamp is on.
TUNGSTEN – VIS	The tungsten lamp is on.
POWER	The Dionex VWD power is on.

2.2 Interior Components

To access the interior components of the Dionex VWD, grasp the front cover by the sides and pull it straight off.



1 Tubing Slots
2 Tubing Chase
3 Leak Sensor
4 Flow Cell
5 Lamp Housing Cover
6 Leak Drain

Figure 2-3. Dionex VWD Interior View (Front Cover Removed)

2.2.1 Tubing Slots and Tubing Chase

The tubing slots route tubing (for example, the flow cell inlet tubing) from the Dionex VWD interior to outside the detector.

The tubing chase routes tubing (for example, the waste line from the flow cell outlet) from the interior of the Dionex VWD, through the body of the module, and to the rear panel (see Figure 2-5).

2.2.2 Leak Sensor and Leak Drain

A leak sensor is installed inside the detector (see Figure 2-3). If the leak sensor detects a leak, the **ALARM** LED on the status bar lights, and an error message appears in the Chromeleon Audit Trail. The drip tray collects the fluid and the leak drain routes the fluid from the drip tray to the drain port on the Dionex VWD rear panel (see Figure 2-5). After

fixing the leak and drying the sensor, clear the **ALARM** LED (see Section 4.2).

2.2.3 Flow Cells

A flow cell is not included with the Dionex VWD and must be specifically ordered. Dionex offers two PEEK cells for use with the Dionex VWD:

- The standard (analytical) flow cell (P/N 066346), with a volume of 11 µL, is designed for standard bore applications with 3- to 4-mm ID separator columns and flow rates of 0.5 to 5.0 mL/min.
- The semi-micro flow cell (P/N 6074.0300), with a volume of 2.5 µL, is designed for microbore applications with 2-mm ID separator columns and flow rates up to 1.0 mL/min.

The flow cells are optimized for fast separations with no loss in chromatographic resolution. An identification chip is installed in each cell at the factory. The chip stores unique information about the cell, including the cell type and the serial number. When the cell is installed, a contact on the flow cell's rear panel connects the chip to the detector electronics. The detector downloads the information to Chromeleon, where it is used for System Wellness and Predictive Performance functions (see Section 2.6.2).

The flow cells are equipped with a built-in heat exchanger. The heat exchanger helps adapt the temperature of the solvent to the flow cell temperature before the solvent enters the flow cell. The total heat exchanger volume is 8.8 µL for the standard cell and 5 µL for the semi-micro cell.

IMPORTANT **Do not operate either the standard or semi-micro flow cell without flow for more than 5 minutes while a lamp is on. The heat from the lamp may damage the PEEK cell.**

The detector is shipped with a dummy cell. Before initial operation of the detector, replace the dummy cell with the flow cell. See Section B.4 for flow cell installation instructions.

IMPORTANT **Do not use the standard or semi-micro flow cell with normal phase or chlorinated solvents; these solvents will damage the PEEK cell.**

2.2.4 Lamps

The detector is shipped with a deuterium lamp (P/N 066347) for UV wavelength detection and a tungsten lamp (P/N 066348) for visible and near-infrared wavelength detection. The wavelength detection range is from 190 to 900 nm. The table below lists the lamp(s) to use for various wavelength detection ranges.

Wavelengths Detected	Lamp
<345.0 nm	UV
>670.0 nm	Vis
Between 345.0 and 670.0 nm	UV or Vis (or both)
<345.0 nm and >670.0 nm	UV and Vis

The lamps are installed behind the lamp housing cover (see Figure 2-3).

An identification chip is installed in each lamp at the factory. The chip stores unique identification and status information about the lamp, including the lamp type, serial number, number of lamp starts, lamp age, and lamp intensity. When the lamp is installed, a contact on the lamp connects the chip to the detector electronics. The detector downloads the information to Chromeleon, where it is used for System Wellness and Predictive Performance functions (see Section 2.6.2).

2.3 Optical System

Figure 2-4 is a schematic of the optical system. A concave mirror (2) focuses the light from the tungsten lamp (1) to the aperture of the deuterium lamp (3). Another mirror (4) receives the combined light from both light sources and focuses it into the entrance slit (6). A filter paddle (5) automatically places a cutoff filter in the light path for use in analyses: A 360 nm filter is placed in line for analytical wavelengths between 360 and 580 nm; a 580 nm filter is placed in line for analyses at wavelengths above 580 nm.

The light passes through the entrance slit to the mirror (7) and on to the optical grating (8), where the light beam is diffracted into the component wavelengths. The angular position of the grating determines which wavelength is directed to the reference mirror (10) and flow cell (12). The reference mirror (10) directs part of the light beam to the reference detector (11). The remaining light travels through

the flow cell (12) to the detector (13), where the absorbance of the analyte is measured and processed.

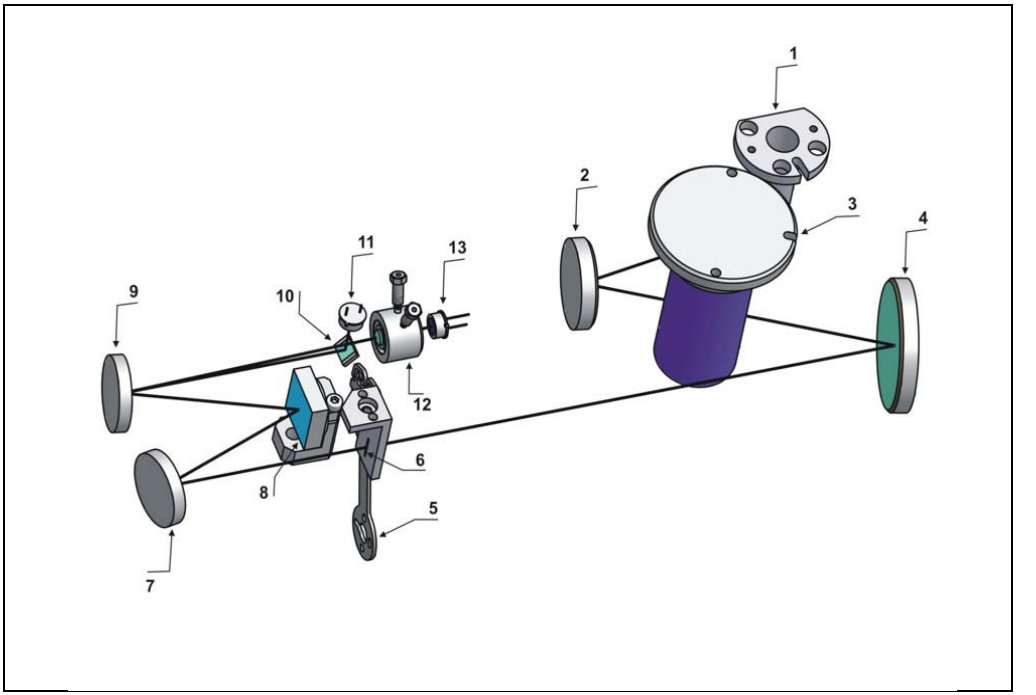


Figure 2-4. Dionex VWD Optical System

No.	Component	Description
1	Tungsten lamp	Light source for the visible and near-infrared wavelengths (345 to 900 nm).
2	Mirror (Vis)	Focuses the light from the tungsten lamp to the through hole (aperture) of the deuterium lamp.
3	Deuterium lamp	Light source for the UV wavelengths (190 to 670 nm).
4	Mirror	Focuses the combined light of both lamps to the entrance slit.
5	Filter paddle	Fitted with optical filters to suppress higher-order radiation and a holmium oxide filter for verification of wavelength accuracy.

No.	Component	Description
6	Entrance slit	Limits the bandwidth of the light that is directed to the flow cell.
7	Mirror	Directs the light to the optical grating.
8	Optical grating	Grating (1800 l/mm) selects the wavelength of light impinging on the sample.
9	Mirror	Directs the diffracted, monochromatic light from the grating to the flow cell.
10	Reference mirror	Directs part of the light beam to the reference detector. The reference mirror is installed in front of the flow cell.
11	Reference detector	Provides a reference signal that compensates for fluctuations in the intensity of the light source.
12	Flow cell	Provides the measurement site for sample absorbance. The mobile phase with the analyte travels through the flow cell. The measurement beam travels through the flow cell to the detector.
13	Detector	Measures the light intensity of the measurement beam after absorbance though the sample.

2.4 Rear Panel

Figure 2-5 illustrates the rear panel of the Dionex VWD.

1 Main Power Switch, Fuse Cartridge, Power Receptacle
2 Digital I/O Ports
3 USB Receptacle
4 Analog Outputs (optional)
5 Tubing Chase
6 Drain Port

Figure 2-5. Dionex VWD Rear Panel (Analog Output Connectors not Installed)

2.4.1 Main Power Switch, Fuse Cartridge, and Power Receptacle

The power switch on the rear panel is the main power switch for the Dionex VWD. Turn on the main power switch before initial operation and leave it on unless instructed to turn it off (for example, before performing a service procedure).

NOTE For routine on/off control, use the power button on the front of the Dionex VWD (see Figure 2-2). To turn off the detector, press and hold the power button for 2 seconds.

The fuse cartridge contains two IEC 60127-2 time lag fuses (P/N 954776) rated at 2 A, 250 VAC. For instructions on how to change the fuses, see Section 5.7.

The power cord plugs into the IEC 320 three-prong receptacle.

The power supply cord is used as the main disconnect device. Make sure the socket-outlet is located near the Dionex VWD and is easily accessible.

Le cordon d'alimentation principal est utilisé comme dispositif principal de débranchement. Veillez à ce que la prise de base soit située/installée près du module et facilement accessible.

Das Netzkabel ist das wichtigste Mittel zur Stromunterbrechung. Stellen Sie sicher, daß sich die Steckdose nahe am Gerät befindet und leicht zugänglich ist.

2.4.2 Digital I/O Ports

Two digital I/O ports (A and B) provide four TTL inputs and four relay outputs for communication with external devices.

To connect an external device to a digital I/O port, use the 6-pin mini-DIN cable (P/N 6074.0001) provided in the Dionex VWD Ship Kit (P/N 064787). See Section B.6 for connection instructions and for the functions assigned to the connector pins and cable.

2.4.3 USB Connector

One USB receptacle (“B” type connector) allows a connection between the PC on which Chromeleon is installed and the detector.

A 0.9-m (3-ft) USB cable (P/N 063246) is provided in the Dionex VWD Ship Kit (P/N 064787).

2.4.4 Analog Outputs (Optional)

If the optional DAC plug-in module (P/N 066349) is installed, two analog outputs with a resolution of 20 bits each are provided. The analog outputs supply a voltage signal proportional to the current measured by the flow cell. The outputs can be connected to an analog-to-digital (A/D) converter

such as an integrator or other recording device. Refer to Section B.7 and the documentation for the device for connection instructions.

You can select the output mode, offset, and range in the Chromeleon 7 Command window or the Chromeleon 6.8 Commands dialog box. Table 2-1 describes the available settings.

Analog Output Setting	Values	Description
Analog1_Mode Analog2_Mode	Ref_A, Ref_B, Ref_C, Ref_D Measm_A, Measm_B, Measm_C, Measm_D Abs_A, Abs_B, Abs_C, Abs_D Direct	Sets the signal type available at the analog output. For a single wavelength detector, only the Ref_A, Measm_A, Abs_A, and Direct signals are available.
Analog1_Offset Analog2_Offset	5% to 50%	Adjusts the zero position of the analog output when it is plotted. The value entered is a percentage of the full-scale analog output. An offset allows a recording device to plot the signal if it becomes negative. The offset level does not affect the magnitude of the output signal.
Range	1AU_per_1V 0.01AU_per_1V 5AU_per_1V 1AU_per_10V 0.01AU_per_10V 5AU_per_10V	Sets the resolution of the analog output signal. The range to use depends on the detector readings expected for the application and the recording device to which the analog output is connected.

Table 2-1. Analog Output Configuration Settings

2.4.5 Tubing Chase

The tubing chase routes tubing (for example, the waste line from the flow cell outlet) from the interior of the Dionex VWD, through the body of the module, and to the rear panel.

2.4.6 Drain Port and Drain Tube

Liquid (for example, from a leak) is routed from the drip tray inside the detector to the drain port on the rear panel. Connect the drain tube (P/N 055075), provided in the Dionex VWD Ship Kit (P/N 064787), to the port. See Section B.5 for installation instructions.

Place the free end of the drain tube into a waste container. To ensure proper drainage, position the waste container below the level of the detector.

IMPORTANT **The drain tube must remain below the drain port. If any part of the drain tube is above the drain port, the drip tray may overflow inside the detector.**

2.5 Operating Guidelines

2.5.1 Wavelength Selection

There are two key criteria for determining the wavelength for an analysis:

- Sample components should absorb strongly at the selected wavelength. For best results, select a wavelength on the absorption maximum. For a list of wavelengths for the absorption maxima of various chromophores, see Appendix D.
- The mobile phase should be "transparent," showing little or no absorption at the selected wavelength.

2.5.2 Mobile Phases

Mobile phase quality significantly affects detection limits and instrument performance. To ensure optimal performance of the detector, observe the following guidelines:

- Prepare all mobile phases and reagents with spectro-grade solvents, reagent-grade chemicals, and ASTM Type I (18 megohm-cm) filtered, deionized water that meets the specifications listed in Table B-1.
- Degas all mobile phases before use and maintain them in a degassed state.

- Strong bases can etch the silica windows of the flow cell. If the mobile phase is a base, make sure the mobile phase concentration does not exceed 0.1 M. If the concentration of the base is greater than 50 mM, disconnect the separator column and flush the system with ASTM Type I (18 megohm-cm) filtered, deionized water for 5 minutes at 1.0 mL/min immediately after the analysis.
- Mobile phase pH affects not only the retention time of the separation, but the sample absorbance and the background absorbance of the mobile phase.
- When changing from a buffer to a different operating mobile phase, be sure the solvents are miscible and will not induce precipitation of the buffers. Flush the cell with a buffer-compatible solvent (in most cases, ASTM Type I (18 megohm-cm) filtered, deionized water) immediately after the analysis. Do not allow buffers to remain in the cell for extended periods.

2.5.3 Mobile Phase Delivery System

The pumping system should deliver continuous flow while ensuring good mixing of the solvent (if gradient elution is used). Fluctuations in pump backpressure can cause baseline noise. If the signal noise is found to be regular and cyclical, monitor the pump for pressure fluctuations. Refer to the pump manual for troubleshooting information.

The plastics present in some solvent delivery systems are not fully compatible with the solvents commonly used in chromatography. Therefore, plastic components may dissolve and thus impair UV detection.

For UV operation, these guidelines are recommended:

- The solvent reservoir should be glass.
- All tubing connections should be made of materials suitable for IC or HPLC applications (e.g., PEEK, stain les steel, Tefzel®, or titanium), as required for the operating pressure and application.
- Some pump seals incorporate a band spring to preload the seal during the vacuum stroke of the piston. The band spring should be stainless steel, a fluoropolymer (Kalrez®or fluorosilicone), or other material of known quality.

2.6 Chromatography Software

2.6.1 Overview

The Dionex VWD is controlled by a PC configured with either the Chromeleon 7 Chromatography Data System or the Chromeleon 6.8 Chromatography Data System. Both software products provide extensive instrument control, data management, reporting, and compliance features.

In Chromeleon 7, an *ePanel Set* provides centralized system control. You can use the ePanel Set to view system status information and to issue commands for controlling each module. In Chromeleon 6.8, these functions are available on a *panel tabset*.

In both the ePanel Set and the panel tabset, a convenient **Home** panel shows the overall system status and provides basic module control functions. The **VWD** tab provides access to Dionex VWD functions, as well as detailed status and diagnostics information. Figure 2-6 shows the Dionex VWD ePanel in Chromeleon 7.

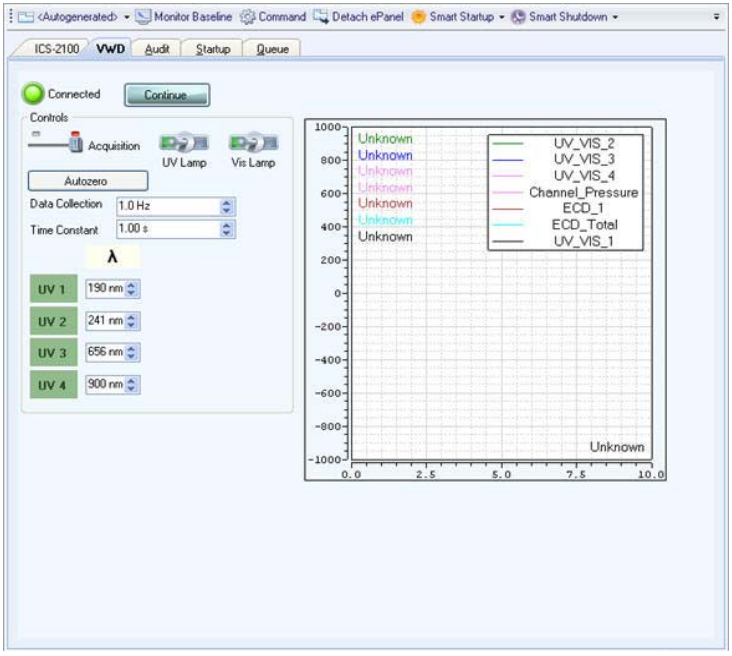


Figure 2-6. Example Dionex VWD ePanel in Chromeleon 7

Figure 2-7 shows the Dionex VWD Control panel in Chromeleon 6.8.

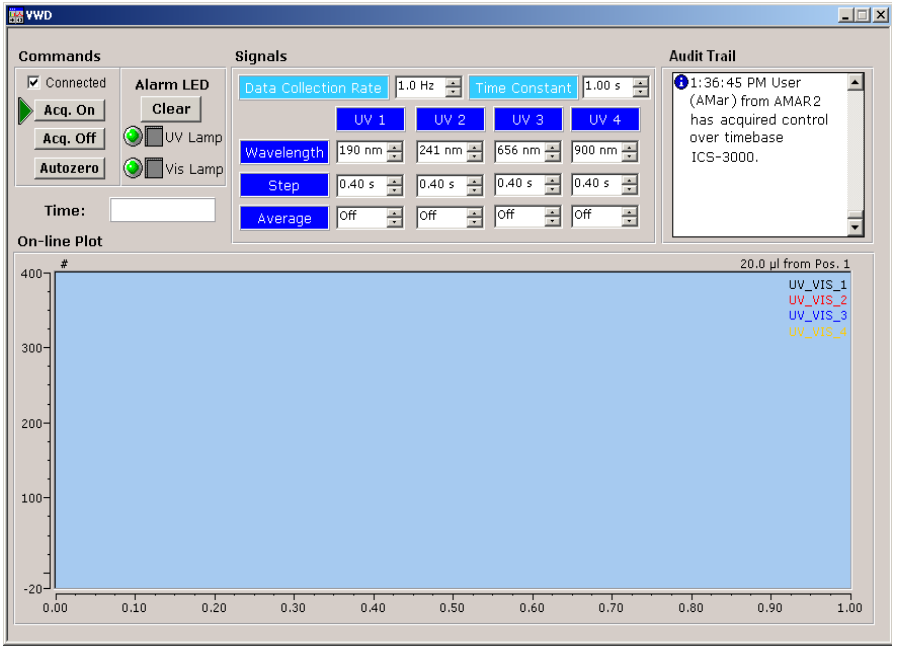


Figure 2-7. Example Dionex VWD Control Panel in Chromeleon 6.8

Two modes of software control are available: direct control and automated control.

- With *direct* control, you select operating parameters and commands from the Chromeleon 7 Command window and ePanel or the Chromeleon 6.8 Commands dialog box and Control panel. Direct control commands are executed as soon as they are entered. See Section 3.3 for details about direct control.

  NOTE **To open the Chromeleon 7 Command window, press F8 or click Command on the Instrument toolbar above the ePanel Set. To open the Chromeleon 6.8 Commands dialog box, press F8 or click Control > Command.**

- With *automated* control, you create a predefined list of commands and parameters (called an instrument method in Chromeleon 7 or a

program in Chromeleon 6.8). The commands are executed at specific times, allowed automated operation of the detector. Instrument methods and programs can be created automatically (with the help of a software wizard) or manually (by editing an existing instrument method or program). See Section 3.4 for details about automated control.

2.6.2 System Wellness and Predictive Performance

System Wellness monitors the overall "health" of a chromatographic system. It provides built-in diagnostic and calibration features that help prevent unscheduled system shutdowns and assure reliable operation of system devices. Predictive Performance provides various functions for estimating the lifetime of replaceable parts and for planning and recording service and qualification procedures.

A partial list of System Wellness and Predictive Performance features is provided below. For a complete list of available features, refer to the Chromeleon Help.

- Recording of detector properties, including the serial number, firmware version, and operating hours
- Recording of flow cell properties, including the serial number
- Recording of lamp properties, including the serial number and lamp type
- Monitoring of lamp properties, including lamp ignitions, lamp operation time, and lamp intensity
- Setting of limits for the lamp intensity and lamp operation time, including display of warning messages when limits are exceeded
- Reminders for service and qualification periods, including display of warning messages when limits are exceeded
- Leak detection
- Wavelength verification

System Wellness and Predictive Performance commands and parameters are available in the Chromeleon 7 Command window or the Chromeleon 6.8 Commands dialog box.

3 • Operation and Maintenance

3.1 Startup

3.1.1 Initial Startup

To start the Thermo Scientific Dionex ICS Series Variable Wavelength Detector (Dionex VWD) for the first time, turn on the main power switch on the rear panel of the detector (see Figure 2-5).

The following sequence of events occurs when the main power switch is turned on:

- The detector begins running a series of internal tests. During these self-diagnostics, all of the main components are checked and the LEDs on the front status bar light sequentially. During this time (about 30 seconds), the detector cannot be connected to Chromeleon. When testing is complete, three beeps sound.
- If an error is detected, the detector is not yet ready for analysis and the **ALARM** LED on the status bar lights. If the error is related to a lamp, the corresponding lamp LED flashes. After the detector is connected to Chromeleon, an error message is logged in the Audit Trail. If this occurs, see Section 4.1 for troubleshooting information.

After initial startup, leave the main power switch on unless instructed to turn it off (for example, before performing a service procedure).

For routine on/off control, use the power button on the front of the Dionex VWD (see Figure 2-1). To turn off the detector, press and hold the power button for 2 seconds.

3.1.2 Connect to the Chromeleon 7 Client

1. Start the Instrument Controller Service, if it is not already running. If the Chromeleon tray icon on the taskbar is crossed out in red  , the Instrument Controller Service is not running. To start it, right-click the icon and select **Start Chromeleon Instrument Controller**. The icon changes to gold  to indicate that the Instrument Controller Service is starting. When the Instrument Controller Service is running (idle), the icon changes to gray  .

   If the Chromeleon tray icon is not on the taskbar, click **Start > All Programs > Chromeleon 7 > Services Manager** to open the Services Manager and click **Start Instrument Controller**.

2. Start the Chromeleon 7 client:

   a. Click **Start** on the Windows taskbar and select **All Programs** > **Chromeleon 7 > Chromeleon 7**.

   b. Click the **Instruments** Category Bar on the Console.

   c. On the Navigation Pane, click the instrument that includes the detector. The ePanel Set for the instrument appears in the Console Work Area.

   d. To display the detector ePanel, click the **VWD** tab on the ePanel Set (see Figure 3-2).

   e. Verify that the **Connected** check box is selected. If it is not, click the box to connect the Dionex VWD to Chromeleon 7.

   NOTE **After starting Chromeleon 7 and connecting to the ePanel, the Connected LED on the detector's status bar is blue.**

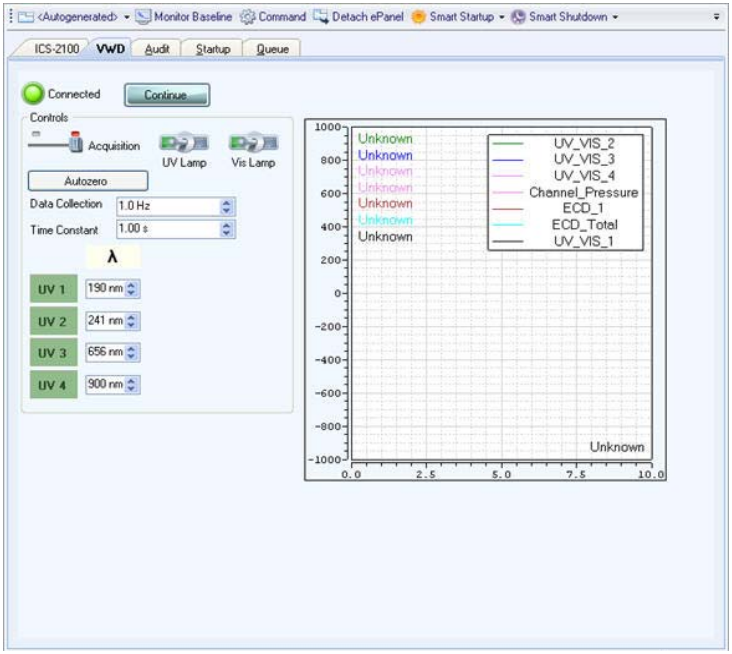


Figure 3-1. Example Dionex VWD ePanel in Chromeleon 7

3.1.3 Connect to the Chromeleon 6.8 Client

1. Start the Chromeleon Server, if it is not already running. If the Chromeleon Server icon on the taskbar is crossed out in red  , the Server is not running. To start the Server, right-click the icon and select **Start Server**. When the server is running (and data acquisition is not occurring), the icon is gray  .

   If the Server Monitor icon is not on the taskbar, click **Start** on the taskbar and select **All Programs > Chromeleon > Server Monitor**. Click **Start** to start the server.

2. Start the Chromeleon 6.8 client:

   a. Click **Start** on the Windows taskbar and select **All Programs** > > **Chromeleon > Chromeleon**.

b. Select **View > Default Panel Tabset** or click the corresponding toolbar button  to display the panel tabset.

c. To display the Dionex VWD Control panel, select the **VWD** tab on the panel tabset (see Figure 3-2).

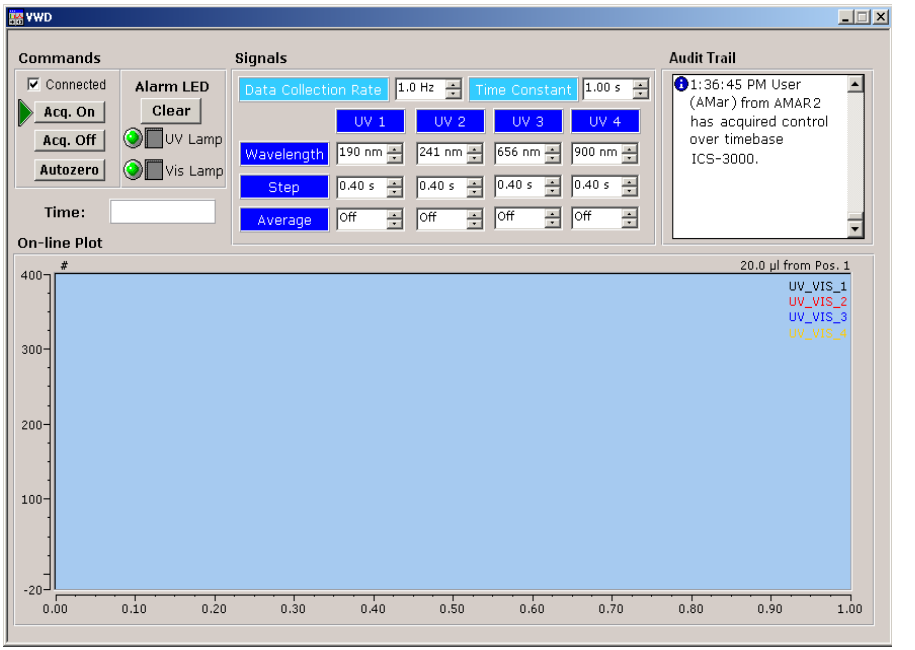


Figure 3-2. Example Dionex VWD Control Panel in Chromeleon 6.8

d. Verify that the **Connected** check box is selected. If it is not, click the box to connect the Dionex VWD to Chromeleon 6.8.

NOTE **After starting Chromeleon 6.8 and connecting to the Control panel, the Connected LED on the detector's status bar is blue.**

3.1.4 Turn On the Lamps

To turn on the lamps, click **UV Lamp** and **VIS Lamp** on the Chromeleon 7 ePanel or the Chromeleon 6.8 Control panel.

When a detector lamp is turned on for the first time after the detector power is turned on, wavelength calibration is performed automatically. Calibration starts shortly after the lamp is ignited. The 0-order radiation is checked. The 0-order position is where all light is reflected off the grating and no diffraction occurs; this position is thus used as the “home” position for the grating.

NOTE If you want the lamps to be turned on automatically at startup, execute the AutoactivateUV_Lamp=On and AutoactivateVisible_Lamp=On commands in the Chromeleon 7 Command window or the Chromeleon 6.8 Commands dialog box.

3.2 System Equilibration

Before you can begin using the detector for sample analysis, the chromatography system must be equilibrated. To equilibrate the system, perform the following tasks:

- Pump the starting solvent through the entire system until the system is free of any other liquid composition.
- Heat or cool all temperature-controlled devices (for example, a column compartment) to the temperature required for the application.
- Set the detector wavelength(s) and turn on the lamp(s). (Wavelength calibration occurs automatically at this point.)

NOTE To achieve optimum results, allow 60 minutes for the lamp(s) to stabilize before beginning operation.

- Monitor the pump pressure and verify that the reading is correct for the application and is stable.
- Monitor the detector signal and verify that the baseline signal is at the expected reading for your application and is stable. This may not be the case if the solvent composition has been modified, or if air bubbles exist in the light

path. If necessary, see Section 4.5 and Section 4.6 for troubleshooting information.

Select one of the following methods to perform the equilibration tasks:

- Select operating commands and parameters directly from the Chromeleon 7 ePanel Set or the Chromeleon 6.8 Control panel. See Section 3.3 for details about direct control.
- Create and run an equilibration instrument method or program to automate the process. See Section 3.4 for details about automated control.
- If you are running Chromeleon, you can use the Smart Startup feature to automate system startup and equilibration. In Chromeleon 7, you first create an instrument method from which the Smart Startup settings are derived. In Chromeleon 6.8, you can use the Smart Startup Wizard to create a Smart Startup program. Refer to the Chromeleon Help for details.

3.3 Direct Control

With direct control, you select operating commands and parameters from the following locations:

- Chromeleon 7 ePanel Sets or the Command window

–or–

- Chromeleon 6.8 Control panels or the Commands dialog box

Direct control commands are executed as soon as they are entered. Most routine direct control functions can be performed from ePanels or Control panels.

For other functions, you can use the Command window or Commands dialog box. These provide access to all the available commands and properties for the Dionex VWD, as well as commands for other devices in the instrument or timebase, respectively.

To issue direct control commands to the Dionex VWD:

1. Open the ePanel Set (see Section 3.1.2) or panel tabset (see Section 3.1.3) and click the tab for the detector.
2. Use the controls (buttons, sliders, etc.) on the panel to issue commands.
3. If the function you want to perform is not available from the panel, open the Command window or Commands dialog box (see the instructions below).

The commands available in the Command window or Commands dialog box vary, depending on these variables:

- The version of Chromeleon installed
- The display filter level (**Normal**, **Advanced**, or **Expert**)
- The options selected for the detector in the Properties dialog box in the Chromeleon 7 Instrument Configuration program or the Chromeleon 6.8 Server Configuration program (see Section B.11.3)

To open the Chromeleon 7 Command window:

1. Open the ePanel Set for the instrument that includes the Dionex VWD.
2. Click **Command** on the **Instrument** toolbar above the ePanel Set (or press the **F8** key).

   The Command window appears (see Figure 3-3).

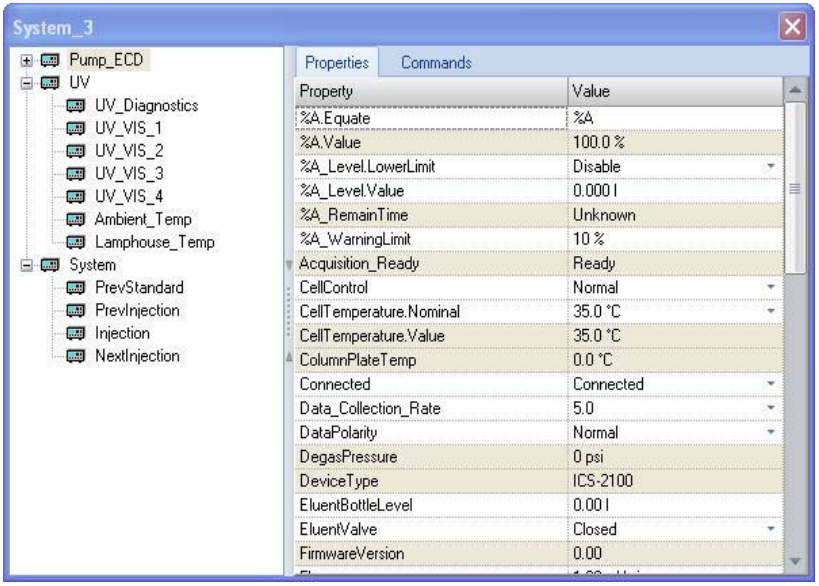


Figure 3-3. Command Window

3. Click **UV** and then click the **Properties** tab or **Commands** tab to view detector properties or commands, respectively. To execute a command, click the button next to the command.

NOTE To change the display filter level, right-click the list of commands and select the preferred filter on the context menu.

To open the Chromeleon 6.8 Commands dialog box:

1. Open the Dionex VWD Control panel.
2. Select **Control** > **Commands** (or press the **F8** key).

   The Commands dialog box appears (see Figure 3-4).

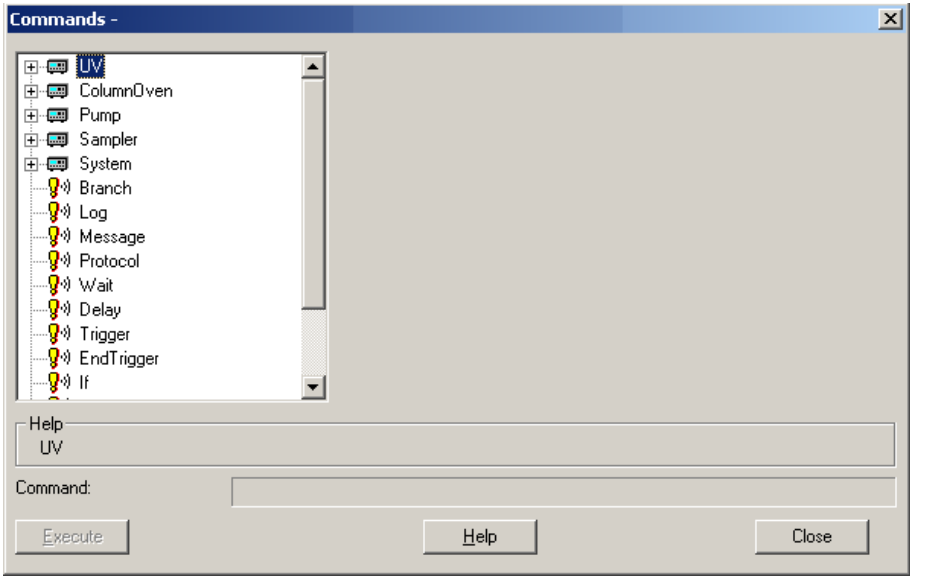


Figure 3-4. Commands Dialog Box

3. To see the commands available for the Dionex VWD, click the plus sign next to **UV**. To execute a command, click the **Execute** button.

NOTE To change the display filter level, right-click the list of commands and select the preferred filter on the context menu.

3.4 Automated Control

You can control the Dionex VWD automatically by running *instrument methods* (in Chromeleon 7) or *programs* (in Chromeleon 6.8) that specify the function the detector and other system instruments should perform at a specific time. Instrument methods and programs can be created automatically (with the help of a software wizard) or manually (by editing an existing instrument method or program).

To prepare for automated control, create a *sequence* (a list of injections) and specify the instrument method or program to run on each injection. The sequence also includes a processing method (in Chromeleon 7) or quantification method (in Chromeleon 6.8) for peak identification and area determination.

The following table lists the main steps required to set up and run the Dionex VWD automatically. Refer to the Chromeleon Help for details about these steps.

In Chromeleon 7	In Chromeleon 6.8
Create a sequence and specify the instrument method files to use for each injection	Create a sequence and specify the program files to use for each injection
Load the sequence into the queue	Load the sequence into the batch
Start the queue	Start the batch

3.5 Optimizing Detector Performance

The performance of the Dionex VWD can be optimized by careful selection of key operating parameters. This section defines these parameters, describes how they interact, and offers guidelines for selecting them. The following table summarizes the topics discussed here:

Operating Parameter	Performance Characteristics Affected
Time constant	Peak resolution, sensitivity, baseline noise
Data collection rate	Peak resolution, disk space
Wavelength	Sensitivity, linearity
Step*	Baseline noise, time constant, data collection rate, disk space
Average*	Time constant, data collection rate

* Set automatically by Chromeleon 6.8; not available in Chromeleon 7.

3.5.1 Time Constant

The time constant is a measure of how quickly the detector responds to a change in signal. The time constant can be set to any value between 0.00 and 4.55 seconds. The selected time constant applies to all UV-Vis data collected.

Select a time constant that is about 10% of the peak width at half-height for the narrowest peak of interest. A longer time constant allows more averaging of the signal and results in less short-term noise. However, a time constant that is too long may result in reduced peak heights and asymmetric peak shapes. When set correctly, the time constant significantly reduces baseline noise, but reduces peak height only slightly.

The Chromeleon 7 Instrument Method Wizard or Chromeleon 6.8 Program Wizard will automatically calculate the time constant (and data collection rate), based on the value you enter for peak width at half-height on the **Channels** page (in Chromeleon 7) or the **UV Options** page (in Chromeleon 6.8).

3.5.2 Data Collection Rate

The data collection rate is the number of data points per second (Hz) that Chromeleon collects from the detector and stores as raw data. The number of data points per second generated by the detector electronics depends on the detector version. The single-channel Dionex VWD generates data at 10.0 Hz; the four-channel Dionex VWD generates data at 100.0 Hz.

The Dionex VWD data collection rate can be set to between 0.2 and 10.0 Hz (for a single-channel Dionex VWD) or 0.2 and 100.0 Hz (for a four-channel Dionex VWD).

- In general, each peak should be defined by at least 20 data points. For chromatograms with co-eluting peaks or low signal-to-noise ratios, 40 data points per peak is recommended.
- If all peaks are relatively wide, select a slower data collection rate (1.0 Hz, for example).
- If any peaks of interest are less than a few seconds wide, select a faster data collection rate (10.0 Hz, for example).

- If the data collection rate is too slow, the start and end points of peaks are not accurately determined. If the collection rate is too fast, data files may occupy excessive disk space and post-run analyses may require more processing time.
- In multiple wavelength applications, baseline noise increases at higher data collection rates, especially if the data collection rate is at or near the recommended maximum rate. To reduce noise, select a lower data collection rate. For example, try selecting a rate that is 75% of the maximum recommended.
- The data collection rate and time constant settings are typically paired to optimize the amount of data collected and reduce short-term noise, while still maintaining peak height, symmetry, and resolution.

  The Chromeleon 7 Instrument Method Wizard or Chromeleon 6.8 Program Wizard will automatically calculate the data collection rate and corresponding time constant, based on the value you enter for peak width at half-height (see Section 3.5.1).
- The following table lists recommended settings for the data collection rate and time constant for various peak widths.

Width at Half-Height for the Narrowest Peak of Interest (Minutes)	Data Collection Rate (Hz)	Time Constant (Seconds)
0.75	0.5	4.50
0.50	0.5	3.00
0.25	1.0	1.50
0.10	2.5	0.60
0.05	5.0	0.30
0.01	25.0	0.06
0.005	50.0	0.03

3.5.3 Step (Chromeleon 6.8 only)

IMPORTANT **At the start of data acquisition, Chromeleon 6.8 automatically selects a step setting that is the inverse of the data collection rate. Therefore, it is not necessary for users to select a step setting.**

A step is the time interval between two successively stored data points. The shorter the step, the more data points recorded and, in general, the more precise the analytical results. At the start of data acquisition, Chromeleon 6.8 automatically selects the step value that is the inverse of the data collection rate selected by the user. For example, if the data collection rate is 5.0 Hz, Chromeleon 6.8 sets the step to 0.2 second at the start of data acquisition.

Step Override

IMPORTANT **This section explains how to override the step setting automatically selected by Chromeleon 6.8. This information is provided for reference for advanced users only. Be aware that selecting an inappropriate step setting may cause loss of sensitivity, skipped data points, and other problems.**

In almost all cases, the step setting selected by Chromeleon 6.8 is the preferred setting. However, it is possible to override this setting by manually changing the step in the program (on the Control panel). In contrast to the data collection rate, which applies to all enabled signals, the step setting is set separately for each signal. Ideally, the step is no smaller than the interval suggested for the data collection rate (see the table in Section 3.5.2). The advantage of a larger step size is that it reduces the amount of data stored.

If you select a larger step size when the Average parameter is on (see Section 3.5.4), the system response is a combination of the selected data collection rate and the average of the data points between steps. If you select a larger step size when the Average parameter is off, the selected data collection rate is valid, but some data points will be skipped.

3.5.4 Average (Chromeleon 6.8 only)

The Average parameter operates in conjunction with the Step parameter (see Section 3.5.3).

When Average is On, Chromeleon 6.8 averages the data points between Step intervals and reports that value. Noise is reduced. This setting is recommended for most applications.

When Average is Off, Chromeleon 6.8 reports the data points at the step interval. The data points between steps are skipped and noise is not reduced.

3.5.5 Sample Wavelength Selection

The Dionex VWD can measure absorbance in the wavelength range from 190 to 900 nm. Set the sample wavelength to the wavelength with the absorbance maxima for the analytes of interest. See Appendix D for a list of the UV absorbance wavelengths of common chromophores.

3.6 Shutdown

3.6.1 Short-term Shutdown

If the detector will be shut down for one week or less, make sure that any caustic eluent, with pH higher than 8, is removed from the flow cell by flushing with water. No other special shutdown procedure is required.

The Smart Shutdown feature in Chromeleon 7 or Chromeleon 6.8 can assist you in creating and running a shutdown or standby procedure. For shutdown, the detector lamps must be turned off (because the pump flow is off). For standby, you can choose whether to turn off the lamps or leave them on (because the pump flow remains on during standby). For details about Smart Shutdown, refer to the Chromeleon Help.

3.6.2 Long-term Shutdown

Observe the following precautions before shutting down the detector for more than one week or before shipping the detector:

- Flush out any solvents from the flow cell, using water followed by isopropanol (IPA).
- Always make sure a flow cell (or dummy flow cell) is installed, even during periods of inactivity. This prevents dust particles from damaging the detector optics.

IMPORTANT **Before moving or shipping the detector, tighten the two shipping locks on the detector bottom (see Section B.3) to secure the optics.**

3.7 Routine Maintenance

This section describes routine maintenance procedures for the Dionex VWD that users can perform. All other maintenance procedures must be performed by Thermo Scientific personnel.

3.7.1 Daily Maintenance

- Inspect the fluid connections for leaks or restrictions. Replace tubing and fittings as needed (see Section 5.1).
- When using buffer solutions, flush the system thoroughly after use with a solvent that does not contain buffers and/or salts.
- Check the volume of liquid in the waste container and empty as needed.

Neutralize acidic and caustic wastes before disposal. Dispose of all wastes in accordance with local regulations.

Neutralisez les déchets acides ou caustiques avant de les jeter. Jetez les déchets aux règlements locaux.

Neutralisieren Sie säurehaltige und ätzende Abfälle vor ihrer Entsorgung. Entsorgen Sie alle Abfälle entsprechend den lokalen Bestimmungen.

3.7.2 Periodic Maintenance

- Check the drain tube connected to the leak tray (see Figure 2-5). Verify that the tubing is unclogged and is routed below the drain port.
- Monitor the lamp intensity and the number of hours the lamp has been in operation. You can view this information in the Chromeleon 7 Command window or the Chromeleon 6.8 Commands dialog box.
- Replace the lamp if the intensity falls below the low limit. See Section 5.3 to replace a deuterium lamp or Section 5.4 to replace a tungsten lamp.

4 • Troubleshooting

This chapter is a guide to troubleshooting minor issues that may arise during operation of the Thermo Scientific Dionex ICS Series Variable Wavelength Detector (Dionex VWD).

- Section 4.1 describes error messages and how to troubleshoot them.
- Section 4.3 through Section 4.8 describe operating problems and how to resolve them.

If you are unable to resolve a problem by following the instructions here, contact Technical Support for Dionex products. In the U.S. and Canada, call 1-800-346-6390. Outside the U.S. and Canada, call the nearest Thermo Fisher Scientific office.

4.1 Audit Trail Error Messages

The Moduleware (the instrument control firmware installed in each Dionex VWD) periodically checks the status of certain parameters. If a problem is detected, it is reported to Chromeleon 7 or Chromeleon 6.8 and logged in the Audit Trail. Each error message is preceded by an icon that identifies the seriousness of the underlying problem (see the table below).

Icon	Severity Level	Description
	Warning	A message is displayed in the Audit Trail, but the current run is not interrupted.
	Error	A message is displayed in the Audit Trail, and the system attempts to correct the problem (sometimes by using an alternative parameter). An Error never interrupts the current analysis; however, if it occurs during the Ready Check, the analysis will not be started.
	Abort	A message is displayed in the Audit Trail, and the running batch is aborted.

The following table lists the most frequently observed Dionex VWD-related error messages and their default severity levels. For troubleshooting assistance, refer to the page indicated in the table.

Dionex VWD-Related Audit Trail Error Message	Default Severity Level	See
The counter UVRelIntensity (value: x%) has fallen below its limit (x%). Module should no longer be used. Replace the UV lamp.	**Error**	**page 44**
The counter VISRelIntensity (value: x%) has fallen below its limit (x%). Module should no longer be used. Replace the VIS lamp.	**Error**	**page 44**
The counter UVLampOperationTime (value: x hours) has exceeded its limit (x hours). Module should no longer be used. Replace the UV lamp.	**Error**	**page 45**
The counter VISLampOperationTime (value: x hours) has exceeded its limit (x hours). Module should no longer be used. Replace the VIS lamp.	**Error**	**page 45**
Critical module failure.	**Abort**	**page 45**
DAC 1 configured, but not present. Please check configuration using the Instrument Configuration program.	**Warning**	**page 45**
DAC 1 configured, but not present. Please check configuration using the Server Configuration program.	**Warning**	**page 45**
DAC 1 not configured, but present. Please check configuration using the Instrument Configuration program.	**Warning**	**page 46**
DAC 1 not configured, but present. Please check configuration using the Server Configuration program.	**Warning**	**page 46**
DAC 2 configured, but not present. Please check configuration using the Instrument Configuration program.	**Warning**	**page 45**
DAC 2 configured, but not present. Please check configuration using the Server Configuration program.	**Warning**	**page 46**
DAC 2 not configured, but present. Please check configuration using the Instrument Configuration program.	**Warning**	**page 46**
DAC 2 not configured, but present. Please check configuration using the Server Configuration program.	**Warning**	**page 46**

Dionex VWD-Related Audit Trail Error Message	Default Severity Level	See
Error opening VWD-xxx@USB-xxxx – The System cannot find the file specified.	Abort	page 47
Error reading from VWD-xxxx@USB-xxxx.	Abort	page 47
Error issuing control request to VWDxxx@USB-xxxxx.	Abort	page 47
Error reading from VWD-xxxx@USB-xxxxx Data error (cyclic redundancy check).	Abort	page 48
Filter calibration failed.	Abort	page 48
Lamp spectral range, wavelength mismatch.	Error	page 48
A leak has been detected.	Warning	page 49
Low lamp intensity.	Warning	page 49
Next qualification of this module is due in x day(s) (due date is [date]).	Warning	page 50
Next qualification of this module was due on [date]. Allowing x more grace day(s).	Warning	page 50
Next qualification of this module is overdue (due date was [date]).	Warning	page 50
Next qualification of this module is overdue (due date was [date]). Module may no longer be used.	Error	page 50
Next service of this module is due in x day(s) (due date is [date]).	Warning	page 50
Next service of this module is overdue (due date was [date]).	Error	page 50
Unsuitable flow cell position.	Warning	page 51
UV lamp ignition failed.	Abort	page 51
UV lamp intensity low.	Warning	page 51
VIS lamp ignition failed.	Abort	page 52
VIS lamp intensity low.	Warning	page 52
VWD configured but not present. Please check configuration using the Instrument Configuration program.	Warning	page 52
VWD configured but not present. Please check configuration using the Server Configuration program.	Warning	page 52

Dionex VWD-Related Audit Trail Error Message	Default Severity Level	See
VWD-xxxx@USB-xxxxx - Device not found on the USB.	**Abort**	**page 54**
The Warning threshold must be higher than the Limit threshold.	**Error**	**page 53**
The Warning threshold must be lower than the Limit threshold.	**Error**	**page 53**
Wavelength calibration failed.	**Abort**	**page 54**
You do not have the privilege to change the performance limits.	**Error**	**page 54**
You do not have the privilege to change the qualification intervals.	**Error**	**page 54**
You do not have the privilege to approve the module's qualification.	**Error**	**page 54**

The counter UVRelIntensity (value: x%) has fallen below its limit (x%). Module should no longer be used. Replace the UV lamp.

The counter VISRelIntensity (value: x%) has fallen below its limit (x%). Module should no longer be used. Replace the VIS lamp.

This error occurs if the relative intensity of the deuterium or tungsten lamp (as compared to the reference intensity) falls below the value set by the **UVRelIntensity.Limit** or **VISRelIntensity.Limit** parameter.

To troubleshoot:

1. If your application is not overly sensitive to noise, reduce the value of the lamp relative intensity limit (**UVRelIntensity.Limit** or **VISRelIntensity.Limit** command) in the Chromeleon 7 Command window or Chromeleon 6.8 Commands dialog box.

   The default limit is 50%. Some applications can be run when the lamp intensity is as low as 20%. However, other applications are extremely sensitive to noise and the limit may need to be set higher than the default.

2. Replace the deuterium lamp (P/N 066347) (see Section 5.3) or the tungsten lamp (P/N 066348) (see Section 5.4).

The counter UVLampOperationTime (value: x hours) has exceeded its limit (x hours). Module should no longer be used. Replace the UV lamp.

The counter VISLampOperationTime (value: x hours) has exceeded its limit (x hours). Module should no longer be used. Replace the VIS lamp.

This error occurs if the number of hours the deuterium or tungsten lamp has been in use exceeds the value set by the **UVLampOperationTime.Limit** or **VISLampOperationTime.Limit** parameter.

To troubleshoot:

1. If your application is not overly sensitive to noise, increase the value of the lamp operation time limit (**UVLampOperationTime.Limit** or **VISLampOperationTime.Limit** command) in the Chromeleon 7 Command window or Chromeleon 6.8 Commands dialog box.

   The default limit is 2500 hours. However, some applications are more sensitive to noise and the default limit should not be changed.

2. Replace the deuterium lamp (P/N 066347) (see Section 5.3) or the tungsten lamp (P/N 066348) (see Section 5.4).

Critical module failure.

To troubleshoot:

1. Turn the Dionex VWD power off and back on again.
2. If the message occurs again, contact Thermo Fisher Scientific for assistance.

DAC 1 configured, but not present. Please check configuration using the Instrument Configuration program.

DAC 1 configured, but not present. Please check configuration using the Server Configuration program.

DAC 2 configured, but not present. Please check configuration using the Instrument Configuration program.

DAC 2 configured, but not present. Please check configuration using the Server Configuration program.

This error occurs when a DAC plug-in module is configured in the Chromeleon 7 instrument or Chromeleon 6.8 timebase, but the software cannot establish communication with it.

To troubleshoot:

1. Verify that the DAC plug-in module is installed correctly (see Section B.7).
2. If a DAC plug-in module is not installed in the detector, remove it from the configuration:

   In the Chromeleon 7 Instrument Configuration program or Chromeleon 6.8 Server Configuration program, go to the **Detector** tab page of the Dionex VWD Properties dialog box. Clear the **DAC Board** check box and click **OK**.

DAC 1 not configured, but present. Please check configuration using the Instrument Configuration program.

DAC 1 not configured, but present. Please check configuration using the Server Configuration program.

DAC 2 not configured, but present. Please check configuration using the Instrument Configuration program.

DAC 2 not configured, but present. Please check configuration using the Server Configuration program.

This error occurs when a DAC plug-in module is installed in the detector, but it is not configured in the Chromeleon 7 instrument or Chromeleon 6.8 timebase.

To troubleshoot:

In the Chromeleon 7 Instrument Configuration program or Chromeleon 6.8 Server Configuration program, go to the **Detector** tab page of the Dionex VWD Properties dialog box. Select the **DAC Board** check box and click **OK**.

Error opening VWD-xxx@USB-xxxx – The System cannot find the file specified.

Error reading from VWD-xxxx@USB-xxxx.

These errors occur if the USB connection between the detector and the Chromeleon instrument controller or server is interrupted, or the power supply to the detector is interrupted.

To troubleshoot:

1. Check the USB connection (see Section B.8.2).
2. Check the power connection to the detector (see Section B.9).

Error issuing control request to VWDxxx@USB-xxxxx.

The Chromeleon instrument controller or server cannot connect to the specified detector.

To troubleshoot:

1. Check the USB connection (see Section B.8.2).
2. Check the power connection to the detector (see Section B.9).
3. Verify that the detector is correctly configured in the Chromeleon 7 instrument or Chromeleon 6.8 timebase:
   - In the Chromeleon 7 Instrument Configuration program or Chromeleon 6.8 Server Configuration program, go to the **General** tab page of the Dionex VWD Properties dialog box.
   - Turn off **Virtual Mode**, if it is on.
   - Click the **Browse** button and select the Dionex VWD from the **Device List**.

Error reading from VWD-xxxx@USB-xxxxx Data error (cyclic redundancy check).

There is a transmission error between the detector and the Chromeleon instrument controller or server.

To troubleshoot:

Check the USB connection (see Section B.8.2). The connection to the next hub must not exceed 5 m (5.5 yd). The overall connection length, including the hub connections, must not exceed 30 m (32 yd).

Filter calibration failed.

This error may be due to one of the following:

- The lamp(s) were not turned on when calibration was attempted.
- An error occurred during acquisition of the calibration data.

To troubleshoot:

1. Verify that the lamps are on.
2. Check the flow cell connections.

Lamp spectral range, wavelength mismatch.

This error occurs if the selected wavelength is not within the spectral range of the active lamp.

To troubleshoot:

Turn on the other lamp or select a different wavelength (see the table below).

Wavelengths	Lamp Required
<345.0 nm	UV
>670.0 nm	VIS
Between 345.0 and 670.0 nm	UV or VIS (or both)
<345.0 nm and >670.0 nm	UV and VIS

A leak has been detected.

The leak sensor is installed in the leak tray inside the detector compartment (see Figure 2-3). If liquid accumulates in the tray, the sensor signals the problem and this error message appears.

To troubleshoot:

1. Locate the source of the leak by visually inspecting the tubing, fittings, and flow cell.
2. Tighten fittings (or replace tubing and fittings) as required (see Section 5.1).
3. If the flow cell continues to leak after resuming operation, replace the cell (see Section 5.6).
4. After fixing the leak, use a cloth or tissue to wipe up all liquid from the drip tray and dry the leak sensor.

IMPORTANT **Make sure that you do not bend or damage the sensor.**

5. Clear the **ALARM** LED (see Section 4.2).

Low lamp intensity.

This error occurs when the intensity of the lamp is too low, compared to the reference intensity.

To troubleshoot:

1. If your application is not overly sensitive to noise, reduce the value of the lamp relative intensity limit (**UVRelIntensity.Limit** or **VISRelIntensity.Limit** command) in the Chromeleon 7 Command window or Chromeleon 6.8 Commands dialog box.

   The default limit is 50%. Some applications can be run when the lamp intensity is as low as 20%. However, other applications are extremely noise sensitive and the limit may need to be set higher than the default.
2. Replace the deuterium lamp (P/N 066347) (see Section 5.3) or tungsten lamp (P/N 066348) (see Section 5.4).
3. If the error appears again, contact Thermo Fisher Scientific for assistance. The detector optics may be defective.

Next qualification of this module is due in x day(s) (due date is [date]).

Next qualification of this module was due on [date]. Allowing x more grace day(s).

Next qualification of this module is overdue (due date was [date]).

Next qualification of this module is overdue (due date was [date]). Module may no longer be used.

Chromeleon monitors the date qualification was last performed and displays an appropriate message (shown above) at the following times: when the due date for the next qualification is approaching; when the due date is overdue, but the detector can still be used; and when the due date is overdue and the detector can no longer be used.

- The **Qualification.WarningPeriod** parameter determines how many days before the due date the first warning appears.
- The **Qualification.GracePeriod** parameter determines for how many days after the due date the detector can still be used without performing the qualification.

To troubleshoot:

Contact Technical Support for Dionex products to schedule an Operational Qualification and Performance Qualification.

Next service of this module is due in x day(s) (due date is [date]).

Next service of this module is overdue (due date was [date]).

Chromeleon monitors the date service was last performed on the detector and displays an appropriate message (shown above) at the following times: when the due date for the next service is approaching and when the due date is overdue. The **Service.WarningPeriod** parameter determines the number of days before the due date that the first warning appears.

To troubleshoot:

Contact Technical Support for Dionex products for information about performing preventive maintenance.

Unsuitable flow cell position.

This error may occur when the flow cell is incorrectly installed, thereby causing the deviation of the calibrated wavelength to be too high for the measurement and reference channels.

To troubleshoot:

Make sure the flow cell is installed correctly (see Section 5.6).

UV lamp ignition failed.

This message may appear if the deuterium lamp fails during operation.

To troubleshoot:

1. Turn the lamp off and on again.
2. Replace the deuterium lamp (P/N 066347) (see Section 5.3).

UV lamp intensity low.

This error occurs when the intensity of the deuterium lamp is too low, compared to the reference intensity.

To troubleshoot:

1. If your application is not overly sensitive to noise, reduce the value of the lamp relative intensity limit (**UVRelIntensity.Limit** command) in the Chromeleon 7 Command window or Chromeleon 6.8 Commands dialog box.

   The default limit is 50%. Some applications can be run when the lamp intensity is as low as 20%. However, other applications are extremely sensitive to noise and the limit may need to be set higher than the default.
2. Replace the deuterium lamp (P/N 066347) (see Section 5.3).
3. If the error appears again, contact Technical Support for Dionex products for assistance. The detector optics may be defective.

VIS lamp ignition failed.

This message may appear if the tungsten lamp fails during operation.

To troubleshoot:

1. Turn the lamp off and on again.
2. Replace the tungsten lamp (P/N 066348) (see Section 5.4).

VIS lamp intensity low.

This error occurs when the intensity of the tungsten lamp is too low, compared to the reference intensity.

To troubleshoot:

1. If your application is not overly sensitive to noise, reduce the value of the lamp relative intensity limit (**VISRelIntensity.Limit** command) in the Chromeleon 7 Command window or Chromeleon 6.8 Commands dialog box.

   The default limit is 50%. Some applications can be run when the lamp intensity is as low as 20%. However, other applications are extremely sensitive to noise and the limit may need to be set higher than the default.
2. Replace the tungsten lamp (P/N 066348) (see Section 5.4).
3. If the error appears again, contact Technical Support for Dionex products for assistance. The detector optics may be defective.

VWD configured but not present. Please check configuration using the Instrument Configuration program.

VWD configured but not present. Please check configuration using the Server Configuration program.

This error occurs if the Dionex VWD is configured in the Chromeleon 7 instrument or the Chromeleon 6.8 timebase, but the software cannot establish communication with the detector.

To troubleshoot:

1. Verify that the Dionex VWD power is on.

2. Verify that the detector is correctly configured:
   - In the Chromeleon 7 Instrument Configuration program or Chromeleon 6.8 Server Configuration program, go to the **General** tab page of the Dionex VWD Properties dialog box.
   - Turn off **Virtual Mode**, if it is on.
   - Click the **Browse** button and select the Dionex VWD from the **Device List**.

The Warning threshold must be higher than the Limit threshold.

This message appears if you attempt to set a Warning value for certain parameters (for example, **UVLampRelIntensity** or **VISLampRelIntensity)** that is lower than the Limit value. Chromeleon issues a warning message in the Audit Trail when the Warning value is reached and an error message when the Limit value is reached.

To troubleshoot:

Select a Warning value that is higher than the Limit value.

The Warning threshold must be lower than the Limit threshold.

This message appears if you attempt to set a Warning value for certain parameters (for example, **UVLampOperationTime** or **VISLampOperationTime)** that is higher than the Limit value. Chromeleon issues a warning message in the Audit Trail when the Warning value is reached, and an error message when the Limit value is reached.

To troubleshoot:

Select a Warning value that is lower than the Limit value.

Wavelength calibration failed.

This message may appear if the lamp(s) are not turned on when calibration is attempted.

To troubleshoot:

1. Verify that the lamps are on, and then retry the calibration.
2. Turn the Dionex VWD power off and on again.
3. If the message appears again, contact Technical Support for Dionex products for assistance.

VWD-xxxx@USB-xxxxx - Device not found on the USB.

This error can occur if the USB connection between the detector and the Chromeleon instrument controller or server is interrupted, or the power supply to the detector is interrupted.

To troubleshoot:

1. Check the USB connection (see Section B.8.2).
2. Check the power connection to the detector (see Section B.9).

You do not have the privilege to change the performance limits.

You do not have the privilege to change the qualification intervals.

You do not have the privilege to approve the module's qualification.

The Chromeleon administrator assigns various types of privileges to individual users or to user groups. Contact the administrator if you need one or more of the above privileges assigned to you.

4.2 ALARM LED Is Lighted

- **Leak sensor in drip tray may have been triggered**

  Check the Chromeleon Audit Trail for a leak-related error message. Find and eliminate the source of the leak.

  After fixing the leak and drying the sensor, clear the **ALARM** LED.

  In the Chromeleon 7 Command window: Click **UV**, click the **Commands** tab, and click the button next to **ClearAlarmLED**.

  On the Chromeleon 6.8 Control panel: Under **Alarm LED**, click the **Clear** button.

4.3 No Detector Response

- **Detector power not on**

  Check that the power cord is connected from the Dionex VWD rear panel to a power source.

  Check that the main power switch is turned on.

  Check the fuses and replace them, if necessary (see Section 5.7).

- **Lamp not turned on**

  Turn on the lamp from either Chromeleon or the TTL input. When a lamp is on, the corresponding front status bar LED (**Deuterium** or **Tungsten**) is lighted.

- **Detector not connected to the instrument or timebase**

  For Chromeleon 7: Add the Dionex VWD device driver to an instrument in the Instrument Configuration program (see Section B.11.1).

  For Chromeleon 6.8: Add the Dionex VWD device driver to a timebase in the Server Configuration program (see Section B.11.2).

- **Windows operating system does not recognize Dionex VWD**

  When the PC is turned on, Windows scans the network for unknown devices. If the Dionex VWD power is off, the detector cannot be identified. Also, if you connect the Dionex VWD to the PC before installing Chromeleon, the detector cannot be identified. Refer to Section 4.9 to solve the problem.

4.4 Lamp Does Not Light

- **Lamp is old or burned out**

  Replace the lamp. For deuterium lamp (P/N 066347) installation instructions, see Section 5.3. For tungsten lamp (P/N 066348) installation instructions, see Section 5.4.

4.5 Noisy Baseline

- **Mobile phase or post-column reagent is degraded**

  Prepare all mobile phases and reagents with spectro-grade solvents, reagent-grade chemicals, and ASTM Type I (18 megohm-cm) filtered, deionized water that meets the specifications listed in Table B-1.

- **Leaking fittings**

  Locate the source of the leak. Tighten (or replace) all liquid line connections (see Section 5.1).

- **Insufficient time for system equilibration after turning on lamp(s)**

  To achieve optimum results, allow 60 minutes for the lamp(s) to stabilize before beginning operation.

- **Strongly-retained components from previous analysis are slowly eluting**

  To elute strongly-retained species, use a stronger mobile phase. Re-equilibrate with the standard mobile phase before resuming routine operation.

  Clean the column as instructed in the column manual. Column manuals are shipped on the Thermo Scientific Reference Library DVD (P/N 053891). If the problem persists, refer to the column manual for troubleshooting guidance.

- **Plot scale exaggerates baseline noise**

  If autoscale is selected, even a plot with low noise may fill the screen. Check the Y-axis scale values.

- **Pump needs priming and/or maintenance**

  If the baseline noise is synchronized with the pump stroke, reprime the pump. The piston seals and/or check valves may also need to be cleaned. Refer to the pump or system operator's manual for instructions. Pump and system

operator's manuals are shipped on the Thermo Scientific Reference Library DVD (P/N 053891).

- **Air bubbles in flow cell**

  To prevent air from becoming trapped in the cell, follow these steps:

  - Degas mobile phases and post-column reagents by vacuum degassing or sparging with helium.
  - Connect a backpressure line to the cell (see Section B.4). This increases the backpressure on the cell, thereby shrinking bubbles and allowing them to pass more easily through the cell.

- **Contaminants in flow cell**

  Clean the cell (see Section 5.5).

- **Lamp needs replacement**

  The light output of the lamp decreases over time. The lower light output may increase noise above an acceptable level, especially if the lamp has been in service for more than 2000 hours. If this occurs, replace the lamp. For deuterium lamp (P/N 066347) installation instructions, see Section 5.3. For tungsten lamp (P/N 066348) installation instructions, see Section 5.4.

- **Lamp incorrectly installed**

  Make sure that both lamps are fully seated in the optical bench. For deuterium lamp (P/N 066347) installation instructions, see Section 5.3. For tungsten lamp (P/N 066348) installation instructions, see Section 5.4.

- **Front cover or lamp cover is missing**

  Optical components are sensitive to temperature and light. Do not operate the Dionex VWD unless the front cover and lamp cover are in place.

- **Crimped or plugged tubing**

  Over time, tubing may become pinched off and plugged. Periodically check all tubing and replace as needed (see Section 5.1).

- **Flow cell installed incorrectly**

  Check that the cell is inserted straight into the optical bench and is fully seated.

- **Detector exposed to high vibration**

  Optical detectors are sensitive to vibrations. Make sure the Dionex VWD installation site is vibration-free.

- **The data collection rate is too fast**

  Decrease the data collection rate (see Section 3.5.2).

- **The Average parameter is turned off**

  The Average parameter operates with the Step parameter. A step is the time interval between two successively stored data points. When you select a Data Collection Rate, Chromeleon 6.8 automatically sets the step value to the reciprocal of the data collection rate at the start of data acquisition.

  When Average is on (the default setting), Chromeleon 6.8 averages the data points between step intervals and reports that value. This typically reduces noise.

  When Average is off, Chromeleon 6.8 reports only the last data point of the step interval. The data points between steps are skipped. Noise is not reduced in this case.

  To verify the Average parameter setting: In the Commands dialog box, scroll to the signal name (for example, **UV_VIS_1**). Click the plus sign to expand the list of commands and parameters for the signal.

4.6 Drifting Baseline

- **Fluctuations in ambient temperature**

  Make sure the Dionex VWD installation site temperature remains consistent. Allow at least 6 cm (2.4 in) of clearance behind the Dionex VWD for ventilation.

- **Mobile phase or post-column reagent is degraded**

  Prepare all mobile phases and reagents with spectro-grade solvents, reagent-grade chemicals, and ASTM Type I (18 megohm-cm) filtered, deionized water that meets the specifications listed in Table B-1.

- **Front cover or lamp cover is missing**

  Optical components are sensitive to temperature and light. Do not operate the Dionex VWD unless the front cover and lamp cover are in place.

- **Insufficient time for system equilibration after turning on lamp(s)**

  To achieve optimum results, allow 60 minutes for the lamp(s) to stabilize before beginning operation.

- **Leaking flow cell**

  Tighten fittings. Also, check that the backpressure on the cell does not exceed the specification (see Section A.5).

  If the cell continues to leak, replace it (see Section 5.6).

- **Lamp needs replacement**

  The light output of the lamp decreases over time. The lower light output may increase noise above an acceptable level or cause baseline drift, especially if the lamp has been in service for more than 2000 hours. If this occurs, replace the lamp. For deuterium lamp (P/N 066347) installation instructions, see Section 5.3. For tungsten lamp (P/N 066348) installation instructions, see Section 5.4.

4.7 Peak Broadening

- **Tubing inner diameter too large**

  Refer to Section 5.1 for tubing requirements for the cell inlet and outlet tubing. Replace tubing if needed.

- **Mobile phase or post-column reagent is degraded**

  Prepare all mobile phases and reagents with spectro-grade solvents, reagent-grade chemicals, and ASTM Type I (18 megohm-cm) filtered, deionized water that meets the specifications listed in Table B-1.

- **System-level problem**

  1. Check the system for blocked tubing.
  2. The column may be overloaded. Reduce the sample size or dilute the sample.
  3. The column may be contaminated. Clean or replace the column.
  4. The end-line filters on the mobile phase lines are clogged. Replace the filters.

- **Worn or damaged column**

  Replace the column.

4.8 Poor Reproducibility

Poor reproducibility is generally caused by a system-level problem and is not related to detector performance. Some examples of system-level problems that may cause poor reproducibility follow. Refer to the system manual or individual module manual (autosampler, pump, etc.) for additional causes and troubleshooting information. System and module manuals are shipped on the Thermo Scientific Reference Library DVD (P/N 053891).

- The autosampler is drawing air from the vial, or there are air bubbles in the syringe.
- Sample carryover is occurring.
- There is air in the flow path.
- Fitting connections to the tubing are not tightened properly.
- The pump piston seals need to be replaced.
- The mobile phase is not properly degassed.
- The sample is unstable.
- The gradient is not reproducible.
- The environmental conditions (temperature and/or humidity) are fluctuating.

4.9 Faulty USB Communication

- **Dionex VWD not recognized by Windows operating system**

  Dionex strongly recommends installing Chromeleon *before* connecting the Dionex VWD to the PC. When the chromatography software is installed first, USB driver information is loaded automatically. If Windows fails to detect the Dionex VWD, refer to the table below for corrective action.

Problem	Action
Windows Vista fails to detect the Dionex VWD and launches a wizard instead	This indicates that you connected the Dionex VWD to the PC and turned on the power for the first time before you installed Chromeleon. To resolve the problem: • Click **Cancel** to exit the wizard. • Turn off the detector and unplug the USB cable from the PC. • Install Chromeleon. • Reconnect the USB cable to the PC and turn on the power to the detector. • Windows Vista will now detect the Dionex VWD and automatically install the USB software for it.
Windows XP fails to detect the Dionex VWD and a message box asks for a USB configuration file (CmWdmUsb.inf)	This indicates that you connected the Dionex VWD to the PC and turned on the power for the first time before you installed Chromeleon. To resolve the problem: • Click **Cancel** in the Windows message box. • Turn off the detector power and unplug the USB cable from the PC. • Install Chromeleon. • Reconnect the USB cable to the PC and turn on the power to the detector. • Windows will now automatically detect the Dionex VWD and launch the Found New Hardware Wizard.

5 • Service

This chapter describes Thermo Scientific Dionex ICS Series Variable Wavelength Detector (Dionex VWD) service and repair procedures that users may perform. All procedures not included here, including electronics-related repair procedures, must be performed by Thermo Scientific personnel. For assistance, contact Technical Support for Dionex products. In the U.S. and Canada, call 1-800-346-6390. Outside the U.S. and Canada, call the nearest Thermo Fisher Scientific office.

Before replacing any part, refer to the troubleshooting information in Chapter 4 to correctly identify the cause of the problem.

IMPORTANT **Substituting non-Dionex/Thermo Fisher Scientific parts may impair a module's performance, thereby voiding the product warranty. Refer to the warranty statement in the Dionex Terms and Conditions for more information.**

5.1 Replacing Tubing and Fittings

Use the tubing and fittings listed below to plumb the Dionex VWD.

Tubing Size and Type	Color	P/N	Used For
0.125-mm (0.020-in) ID PEEK	Orange	052308 (20 ft)	Cell outlet (waste) line
0.25-mm (0.010-in) ID PEEK	Black	052306 (5 ft)	Backpressure line Cell inlet line from the column (standard bore systems)
0.125-mm (0.005-in) ID PEEK	Red	052311 (20 ft)	Cell inlet line from the column (microbore systems)

Double-cone 10-32 ferrule fittings (P/N 043276) and 10-32 bolts (P/N 043275) are used for all tubing connections.

WARNING **Keep in mind that the fluid components of the detector may be filled with toxic solvents. Therefore, purge the detector with an appropriate solvent and put on protective clothing before starting maintenance or repair work.**

Gardez à l'esprit que les circuits hydrauliques du détecteur peuvent être remplis de solvants toxiques. Par conséquent, purgez le détecteur avec un solvant approprié et portez des vêtements de protection avant de commencer les opérations de maintenance ou de réparation.

Bedenken Sie, dass die fluidischen Bauteile des Detektors eventuell mit giftigen Lösungsmitteln gefüllt sind. Spülen Sie daher vor Beginn der Wartungsarbeiten den Detektor mit einem geeigneten Lösungsmittel und tragen Sie Schutzkleidung

5.2 Wavelength Calibration and Verification

Wavelength calibration is performed automatically at the following times:

- When a detector lamp is turned on for the first time after the detector power is turned on.
- After the detector resumes operation from standby mode.

Calibration starts shortly after the lamp is ignited. The 0-order position of the grating is established; this is the point where the grating is positioned to reflect all light from the lamps without diffraction. It is used as the "home" position for the grating.

In addition, the wavelength accuracy can be verified via the holmium oxide filter installed in the beam path of the lamp. The maxima are determined from the resulting transmission spectrum and compared to the holmium oxide values stored in the detector firmware.

At a minimum, wavelength verification should be performed after changing the flow cell. Perform wavelength verification more often if your application is very sensitive to wavelength variations.

Before verifying wavelengths, observe the following precautions:

- Allow enough time (typically 15 minutes) to ensure that each lamp has reached the operating temperature. A lamp's spectrum changes significantly during the first few minutes after the lamp is turned on.
- Make sure the baseline is stable. The baseline may become unstable if the solvent composition has been modified, or if air bubbles exist in the light path.

- Verify that the solvent flowing through the cell is not strongly absorbing in the wavelength range to be verified. This will be the case, for example, if the cell is filled with a mixture of 96% hexane and 4% ethyl acetate.

To perform wavelength verification:

1. In the Chromeleon 7 Command window: Click **UV**, click the **Commands** tab, and click the button next to the **WavelengthVerTest** command.

   In the Chromeleon 6.8 Commands dialog box: Click the plus sign next to **UV**, click the **WavelengthVerTest** command, and click **Execute**.

   - The accuracy is verified for the following wavelengths: 360.9, 418.8, and 536.5. The results of the test (pass or fail) are logged in the Audit Trail.
   - Wavelength verification can take up to 2 minutes. During this time, data acquisition is not possible.

2. If verification fails, perform wavelength calibration:

   a. Open the Command window or Commands dialog box.

   b. Execute the **WavelengthCalibration** command.

5.3 Replacing a Deuterium Lamp

NOTE The typical lifetime of a deuterium lamp is 2000 hours.

1. Turn off the pump flow from the Chromeleon 7 ePanel Set or the Chromeleon 6.8 Control panel.
2. Stop the Chromeleon server.
3. Turn off the Dionex VWD power switch on the rear panel (see Figure 2-5).

The deuterium lamp emits UV radiation that is harmful to the eyes. Always turn off the detector power before removing the lamp cover.

La lampe deuterium emettet de rayons ultraviolets, qui sont dangeroux pour les yeux. Voulez vous etteindre le detecteur avant d'enlever le couvercle de la lampe.

Die Deuteriumlampe gibt UV-Strahlung ab; diese ist schädlich für die Augen. Schalten Sie den Detektor immer aus, ehe Sie die Abdeckung von der Lampe entfernen.

CAUTION

The lamp housing and base may be hot to the touch, especially after the lamp has been in operation for a long time. Wait until the lamp has cooled before continuing.

MISE EN GARDE

La lampe et la base de la lampe peuvent être chaudes au toucher, particulièrement après que la lampe a été allumée pendant longtemps. Attendez que la lampe ait refroidi avant de continuer.

VORSICHT

Das Lampengehäuse und die Lampenbefestigung können sehr heiß werden, besonders wenn die Lampe längere Zeit in Betrieb war. Warten Sie, bis die Lampe abgekühlt ist, bevor Sie diese berühren.

4. Grasp the detector front cover by the sides and pull straight off to remove it.
5. Loosen the screw holding the lamp housing cover in place (see Figure 5-1) by one-quarter turn. Remove the cover and set it aside.

Figure 5-1. Lamp Housing Cover

6. Squeeze the clip on the deuterium lamp connector (see Figure 5-2) and pull out the connector from its source.

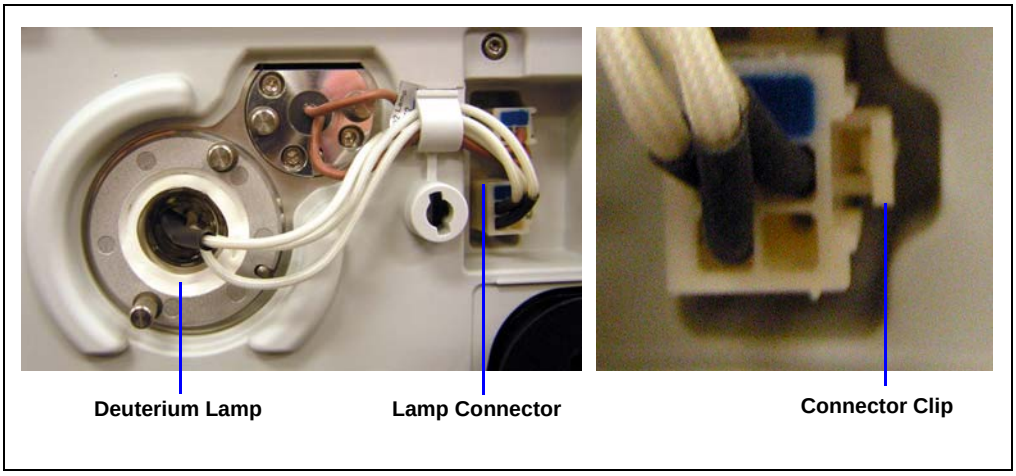


Figure 5-2. Deuterium Lamp, Connector, and Clip

7. Loosen the two screws in the lamp flange (see Figure 5-3) and pull out the lamp.

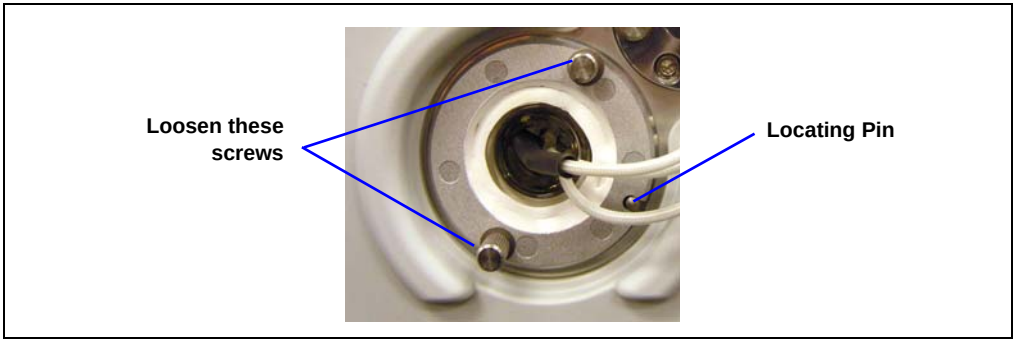


Figure 5-3. Deuterium Lamp Screws and Locating Pin

8. Inspect the new deuterium lamp (P/N 066347) for fingerprints and dust. If necessary, clean the lamp with isopropanol (IPA).

9. Align the flange of the new lamp with the locating pin (see Figure 5-3), and then gently push the lamp into the lamp housing. When the lamp is seated, tighten the screws in the flange.

IMPORTANT **To ensure proper performance, the lamp must be fully seated.**

10. Squeeze the clip on the deuterium lamp connector and reconnect it to its source.
11. Reinstall the lamp housing cover.
12. Replace the detector front cover.
13. Turn on the detector power.

    The lamp age counter (**UVLampOnTime**) is automatically reset to the value stored on the lamp's chip card.
14. Start the Chromeleon server.
15. Start the pump flow and turn on the lamp.

NOTE **Allow the new deuterium lamp to run for at least 24 hours before the first analysis. During this time, strong baseline fluctuations and increased noise may occur.**

You can use the Smart Startup feature in Chromeleon 7 or Chromeleon 6.8 to monitor the detector signal and notify you when the detector is ready for operation. For details, refer to the Chromeleon Help.

5.4 Replacing a Tungsten Lamp

NOTE The typical lifetime of a tungsten lamp is 2000 hours.

1. Turn off the pump flow from the Chromeleon 7 ePanel Set or the Chromeleon 6.8 Control panel.
2. Stop the Chromeleon server.
3. Turn off the Dionex VWD power switch on the rear panel (see Figure 2-5).

CAUTION

The lamp housing and base may be hot to the touch, especially if the lamp has been in operation for a long time. Wait until the lamp has cooled before continuing.

MISE EN GARDE

La lampe et la base de la lampe peuvent être chaudes au toucher, particulièrement après que la lampe a été allumée pendant longtemps. Attendez que la lampe ait refroidi avant de continuer.

VORSICHT

Das Lampengehäuse und die Lampenbefestigung können sehr heiß werden, besonders wenn die Lampe längere Zeit in Betrieb war. Warten Sie, bis die Lampe abgekühlt ist, bevor Sie diese berühren.

4. Grasp the detector front cover by the sides and pull straight off to remove it.
5. Loosen the screw holding the lamp housing cover in place (see Figure 5-4) by one-quarter turn. Remove the cover and set it aside.

Figure 5-4. Lamp Housing Cover

6. Squeeze the clip on the tungsten lamp connector (see Figure 5-5) and pull out the connector from its source.

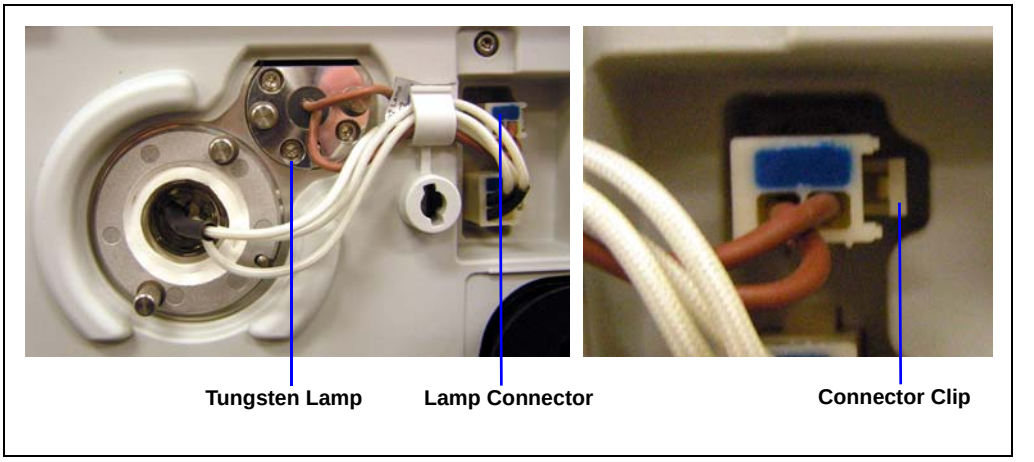


Figure 5-5. Tungsten Lamp, Connector, and Clip

7. Loosen the two screws in the lamp flange (see Figure 5-6) and pull out the lamp.

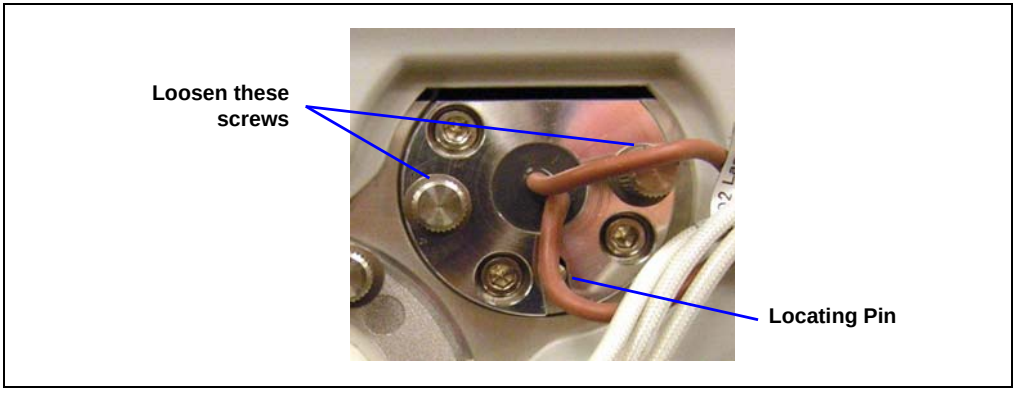


Figure 5-6. Tungsten Lamp Screws and Locating Pin

8. Align the new tungsten lamp (P/N 066348) with the locating pin (see Figure 5-6), and then gently push the lamp into the lamp housing. When the lamp is seated, tighten the screws in the flange.
9. Reinstall the lamp housing cover.

10. Replace the detector front cover.
11. Turn on the detector power.

    The lamp age counter (**VISLampOnTime**) is automatically reset to the value stored on the lamp's chip card.
12. Start the Chromeleon server.
13. Start the pump flow and turn on the lamp.

NOTE **After replacing the lamp, increased noise and strong baseline fluctuations may occur. Before beginning an analysis, allow the new lamp to run until the noise is reduced and the baseline is stable.**

You can use the Smart Startup feature in Chromeleon 7 or Chromeleon 6.8 to monitor the detector signal and notify you when the detector is ready for operation. For details, refer to the Chromeleon Help.

5.5 Cleaning the Flow Cell

Occasionally, eluted compounds may be deposited on the cell walls, thus increasing the detector noise level.

To clean the flow cell, pump methanol through the cell and observe the baseline.

If this procedure does not clean the cell, follow the steps below.

To avoid damage to the skin and eyes, wear appropriate protective clothing and goggles when using nitric acid.

Afin d'éviter des brûlures cutanées ou oculaires, portez des vêtements de protection appropriés et des lunettes de protection lorsque vous utilisez de l'acide nitrique.

Um Verletzungen an Augen und Haut zu vermeiden, sollten Sie beim Umgang mit Salpetersäure stets geeignete Schutzkleidung und eine Schutz-brille tragen.

1. Flush the flow cell with 0.1M nitric acid.

2. Flush the flow cell with deionized water until the solvent exiting the cell is neutral (pH 7).

5.6 Replacing the Flow Cell

5.6.1 Remove the Flow Cell

IMPORTANT **When the flow cell is removed, light (at the wavelength set for the detector) emits from the opening to the left of the flow cell. To avoid possible damage to the eyes, turn off the lamps, turn off the power to the detector, wear UV goggles, or set the wavelength to 600 nm or above.**

1. Unclip the cell inlet and outlet line unions (see Figure 5-7).

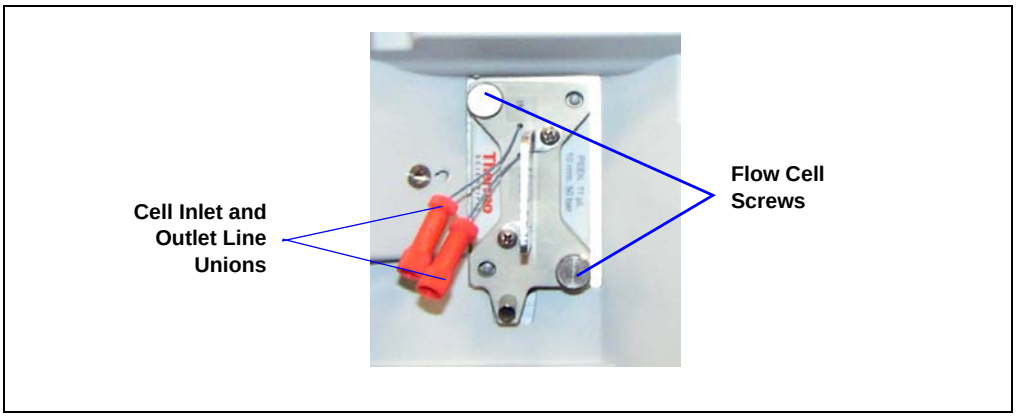


Figure 5-7. Removing the Flow Cell

2. While holding the inlet union in place, disconnect the cell inlet line from the union.

NOTE **Be careful not to twist, kink, or put other stress on the factory-installed lines and connectors to the flow cell IN and OUT ports.**

3. Repeat Step 2 to disconnect the cell outlet line.
4. Loosen the two flow cell screws.
5. Pull the flow cell out of the detector.

5.6.2 Install the Flow Cell

NOTE **Contacts for the flow cell identification chip are located on the rear of the flow cell (see Figure 5-8). To ensure optimum performance of the chip, be careful not to touch the contacts.**

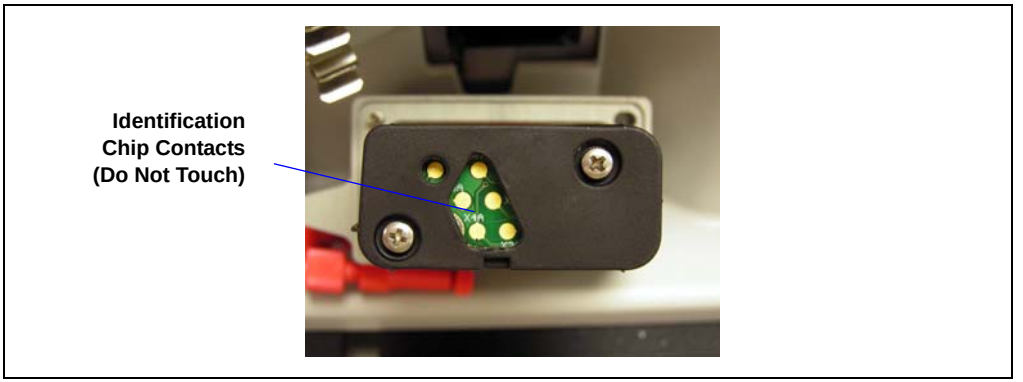


Figure 5-8. Rear of Flow Cell with Identification Chip Contacts

1. Orient the new flow cell (standard cell, P/N 066346; semi-micro cell, P/N 6074.0300) with the cell inlet and outlet unions on the left (see Figure 5-7) and push the flow cell into the opening in the detector.
2. Tighten the two screws.
3. Reconnect the cell inlet and outlet lines to their unions.
4. Push the cell inlet and outlet unions onto the clips to secure them.

NOTE **Tubing connections between the column and the flow cell should be as short as possible to avoid peak broadening effects due to excessive dead volume.**

5.6.3 Perform Wavelength Verification

After replacing a flow cell, perform wavelength verification (see Section 5.2).

5.7 Replacing the Fuses

1. Turn off the main power switch on the rear panel of the detector (see Figure 2-5).
2. Disconnect the main power cord from both its source and from the rear panel of the detector.

DANGER

HIGH VOLTAGE—Disconnect the main power cord from its source and also from the rear panel of the Dionex VWD.

DANGER

HAUTE TENSION—Débranchez le cordon d'alimentation principal de sa source et du panneau arrière du Dionex VWD.

ACHTUNG

HOCHSPANNUNG—Ziehen Sie das Netzkabel aus der Steckdose und der Netzbuchse auf der Rückseite des Dionex VWD.

3. The fuse cartridge is located next to the main power switch (see Figure 5-9). Use a small screwdriver to remove the fuse cartridge.

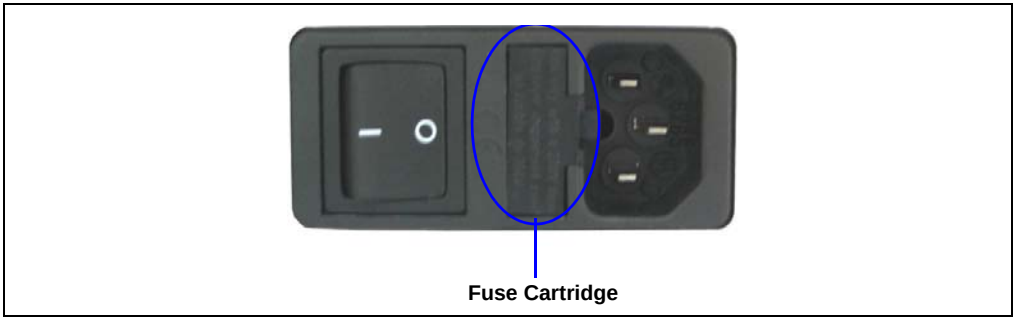


Figure 5-9. Main Power Switch, Fuse Cartridge, and Power Receptacle

4. Replace the two fuses with new IEC 60127-2 time lag fuses, rated at 2 A, 250 VAC (P/N 954776). Thermo Scientific recommends always replacing both fuses.
5. Reinstall the fuse cartridge.
6. Reconnect the main power cord to its source and to the detector. Turn on the main power switch.

A • Specifications

A.1 Electrical

Main Power Requirements	85 to 260 VAC, 47 to 63 Hz (auto-sensing power supply; no manual voltage or frequency adjustment required) Power limit: 150 W maximum
Fuse Requirements	Two IEC 60127-2 time lag fuses (P/N 954776) rated at 2 A, 250 VAC

A.2 Environmental

Operating Temperature (Ambient)	10 to 35 °C (50 to 95 °F)
Humidity (Ambient)	80% maximum relative humidity, noncondensing

A.3 Physical

Dimensions	Height: 15.2 cm (6.0 in) Width: 44.4 cm (17.5 in) Depth: 50.3 cm (19.8 in)
Weight	15.4 kg (34 lb)

A.4 Detector

Optical System	Double-beam forward optics design (monochromator) Dual-wavelength UV-Vis detector
Light Sources	Deuterium lamp (for ultraviolet wavelength detection) Tungsten lamp (for visible wavelength detection)
Wavelength Range	190 to 900 nm
Wavelength Accuracy	±1 nm (over detector lifetime)
Wavelength Repeatability	±0.1 nm
Noise (single wavelength)	<± 3.5 µAU (typical <± 2.5 µAU) under the following conditions: Dry (dummy) flow cell, 254 nm, 1 second time constant, deuterium lamp on only, 60 minutes or less of warm-up time <± 5.0 µAU (typical) under the following conditions: Dry (dummy) flow cell, 520 nm, 1 second time constant, tungsten lamp on only, 60 minutes or less of warm-up time <± 7.5 µAU (typical) under the following conditions: Wet standard cell, 520 nm, flowing methanol at 1.0 mL/min, 1 second time constant, tungsten lamp on only, 60 minutes or less of warm-up time
Noise (dual wavelength)	<± 25 µAU (typical <± 10 µAU) under the following conditions: Dry (dummy) flow cell, 254 and 280 nm, 2 second time constant, 2 Hz data collection rate, deuterium lamp on only, 60 minutes or less of warm-up time <± 30 µAU (typical <± 10 µAU) under the following conditions: Dry (dummy) flow cell, 450 and 520 nm, 2 second time constant, 2 Hz data collection rate, tungsten lamp on only, 60 minutes or less of warm-up time <± 50 µAU (typical <± 10 µAU) under the following conditions: Wet standard flow cell, 450 and 520 nm, flowing methanol at 1.0 mL/min, 2 second time constant, 2 Hz data collection rate, tungsten lamp on only, 60 minutes or less of warm-up time

Drift	$<1 \times 10^{-4}$ AU/hour under the following conditions: Dry (dummy) flow cell, 254 nm, deuterium lamp on only, 60 minutes or less of warm-up time, constant ambient conditions (temperature, humidity) $<1 \times 10^{-4}$ AU/hour under the following conditions: Dry (dummy) flow cell, 520 nm, tungsten lamp on only, 60 minutes or less of warm-up time, constant ambient conditions (temperature, humidity)
Linearity	Caffeine: <5% RSD at 2.5 AU at 272 nm based on ASTM Cobalt: <5% RSD at 2.5 AU at 520 nm based on ASTM
Wavelength Calibration	Internal calibration with zero order and D-alpha line of the deuterium lamp
Wavelength Verification	Internal verification with holmium oxide filter
Data Collection Rate (single wavelength)	Adjustable, up to 10 Hz (single-channel Dionex VWD) or 100 Hz (four-channel Dionex VWD)
Data Collection Rate (multiple wavelength)	Adjustable, up to 5 Hz, depending on the number of wavelengths (2 to 4) and the distance between the wavelengths (in nm)
Optical Bandwidth	6 nm at 254 nm
Identification System	Storage of identification and status information, including the lamp type, serial number, number of lamp starts, lamp age, and lamp intensity

A.5 Flow Cells

A.5.1 Standard Flow Cell

Cell Body	PEEK
Path Length	10 mm
Cell Volume	11 µL
Maximum Operating Pressure	5 MPa (725 psi)
Heat Exchanger	Volume of 8.8 µL
Identification System	Storage of identification information, including serial number

A.5.2 Semi-Micro Flow Cell

Cell Body	PEEK
Path Length	7 mm
Cell Volume	2.5 µL
Maximum Operating Pressure	5 MPa (725 psi)
Heat Exchanger	Volume of 5 µL
Identification System	Storage of identification information, including serial number

A.6 Digital I/O

Inputs	Four digital inputs
Outputs	Four digital outputs

A.7 Analog Outputs (Optional)

Output Mode and Resolution	Absorbance or ratio mode, 20-bit resolution
Full-Scale Voltage Range	1 V or 10 V
Full-Scale Response Range	0.1, 1, or 5 AU per full-scale voltage (1 V or 10 V)

B.1 Facilities Requirements

- Make sure the Thermo Scientific Dionex ICS Series Variable Wavelength Detector (Dionex VWD) installation site meets the power and environmental specifications listed in Appendix A.
- Optical detectors are sensitive to vibration. Provide a sturdy, vibration-free workbench of a height that ensures convenient access to the interior of the Dionex VWD.
- Make sure the workbench surface is resistant to solvents.
- Allow at least 6 cm (2.4 in) of clearance behind the Dionex VWD for power connections and ventilation.
- Optical detectors are sensitive to changes in temperature and light. Protect the detector, column, and all tubing from drafts and direct sunlight. Do not operate the detector unless the lamp housing cover and front cover are in place.
- For mobile phase generation, or when manually preparing mobile phase and regenerant, use ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Table B-1.

Contaminant	Specification
Ions–Resistivity	>18.0 (megohm-cm)
Organics–TOC	<10 ppb
Iron/Transition Metals*	<1 ppb
Pyrogens	<0.03 (Eu/mL)
Particulates >0.2 µm	<1 (units/mL)
Colloids–Silica	<10 ppb
Bacteria	<1 (cfu/mL)

* Iron/transition metal content not specified for ASTM Type I water

Table B-1. ASTM Filtered, Type I Deionized Water Specifications for IC

B.2 Positioning the Dionex VWD in the System

The detector can be positioned in various locations within a system, depending on the other modules included in the system and the application. For example, you can place the Dionex VWD in any of the following positions:

- Above or below a Thermo Scientific Dionex ICS-5000 Thermal Compartment or ICS-5000 Detector/Chromatography module
- Below a Thermo Scientific Dionex AS-AP Autosampler
- To the right or left of an integrated system module (for example, a Thermo Scientific Dionex ICS-1100 or ICS-1600)

B.3 Unpacking

1. Place the shipping container on the floor and open the container from the top.
2. Remove the foam spacer and the Dionex VWD Ship Kit (P/N 064787).
3. Using the handholds in the cardboard cradle, lift the detector out of the shipping container and place it on the bench.
4. Raise the front of the detector about 5 cm (2 in) and remove the cardboard cradle.
5. Remove the polyethylene bag.

NOTE **Keep the original shipping container and all packing material. These will be needed if the detector is ever shipped or is moved to a new location.**

6. Check that the main power switch on the rear panel is turned off.
7. Loosen the two shipping locks on the bottom of the detector (see Figure B-1). These locks secure the detector optics.

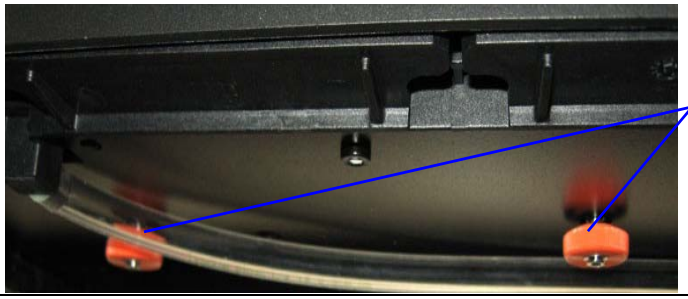


Figure B-1. Detector Shipping Locks

8. Before connecting the detector to the power supply, wait approximately 4 hours to allow the detector to come to room temperature and to allow any condensation to evaporate.

   After 4 hours, check the detector; if condensation still exists, allow the detector to continue to warm up (without connecting it to the power source) until the condensation is completely gone.

B.4 Installing the Flow Cell

A dummy flow cell is installed in the detector before shipping. Before initial operation of the detector, replace the dummy cell with a flow cell.

NOTE **Keep the dummy flow cell for reuse. The dummy cell protects the detector optics during long-term shutdown or if the detector must be shipped at a later time.**

Removing the Dummy Cell

1. Grasp the Dionex VWD front cover by the sides and pull it straight off to remove it.
2. Loosen the two screws that hold the dummy cell in position (see Figure B-2) and pull the cell out of the detector.

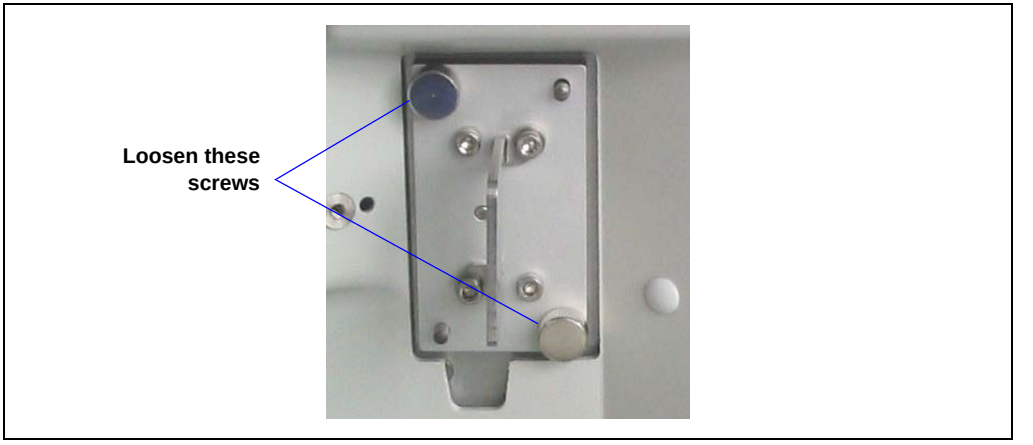


Figure B-2. Removing the Dummy Cell

Installing a Flow Cell

NOTE **Contacts for the flow cell identification chip are located on the rear of the flow cell (see Figure B-3). To ensure optimum performance of the chip, do not touch the contacts.**

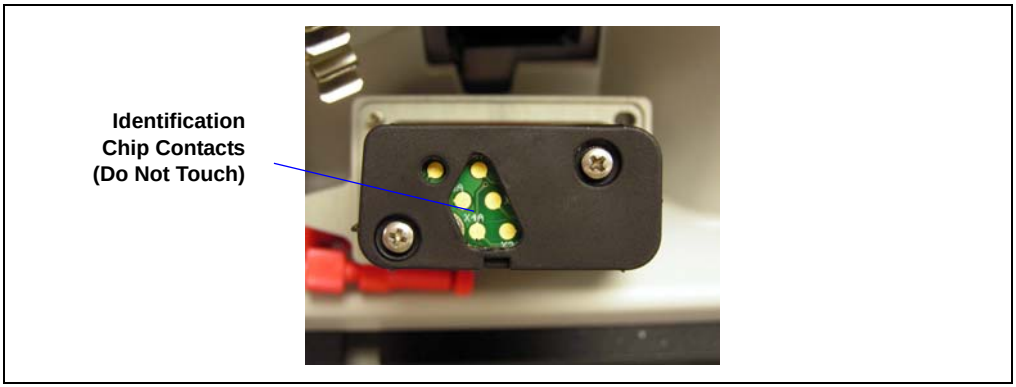


Figure B-3. Rear of Flow Cell with Identification Chip Contacts

Figure B-4 shows the flow cell after installation is complete.

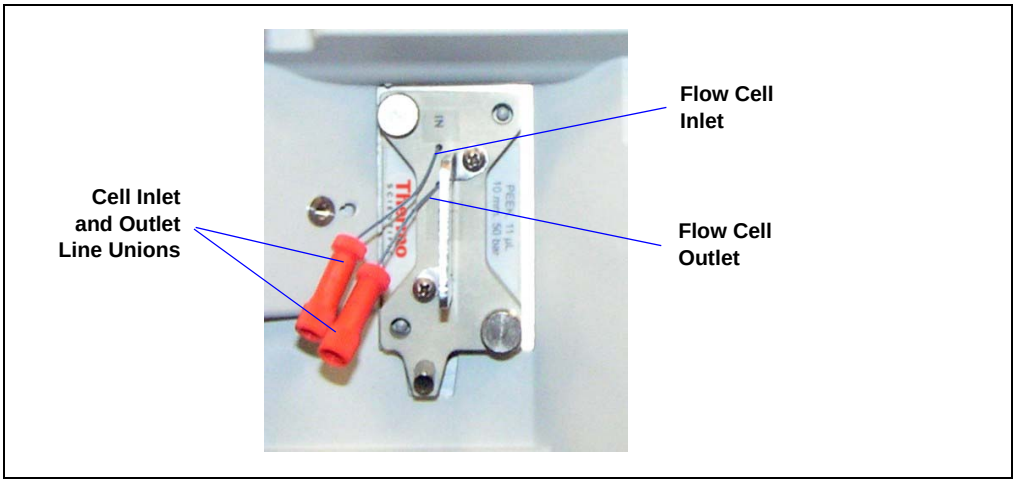


Figure B-4. Flow Cell Installed

Figure B-5 is a schematic of the flow cell tubing connections.

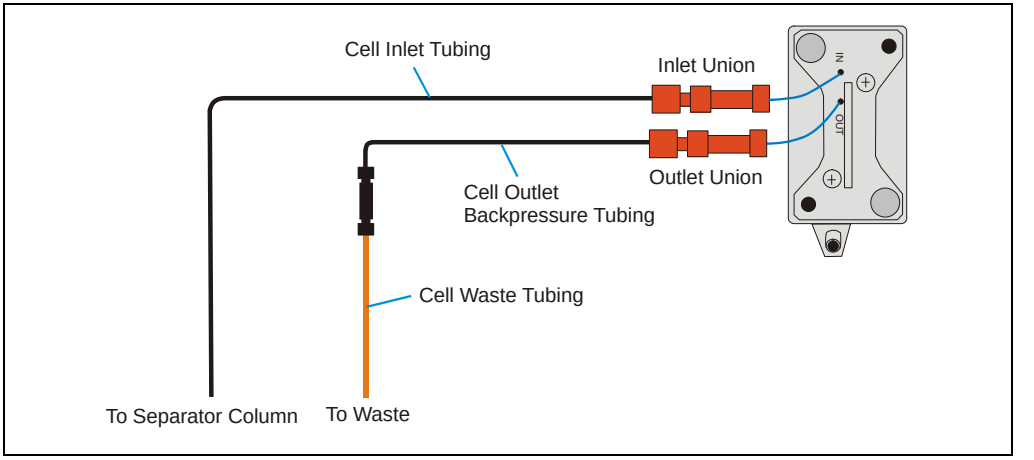


Figure B-5. Dionex VWD Flow Schematic

1. Push the flow cell into the opening in the detector and tighten the two screws.
2. While holding the inlet union in place (see Figure B-5), unscrew and remove the plug on the end of the union. Repeat to remove the plug from the outlet union.

   NOTE Be careful not to twist, kink, or otherwise put stress on the factory-installed lines and connectors to the flow cell IN and OUT ports.

3. Connect the flow cell inlet tubing:
   a. Locate the required tubing in the Dionex VWD Ship Kit (P/N 064787). For a standard bore system, locate the 0.25-mm (0.010-in) ID black PEEK tubing (P/N 052306). For a microbore system, locate the 0.125-mm (0.005-in) ID red PEEK tubing (P/N 052311).
   b. Cut a length of tubing long enough to connect the union on the flow cell inlet to the separator column outlet.

      NOTE Tubing connections between the column and the flow cell should be as short as possible to avoid

peak broadening effects due to excessive dead volume.

c. Locate the two red fittings supplied with the cell. Use one fitting to connect the inlet tubing to the inlet union. **Note:** These fittings do not use ferrules.

d. Install a double-cone 10-32 ferrule fitting (P/N 043276) and 10-32 bolt (P/N 043275) on the other end of the inlet tubing and connect it to the separator column outlet.

4. Connect a backpressure line to the cell outlet (recommended to prevent bubbles from forming in the cell):

   a. Cut a length of 0.25-mm (0.010-in) ID black PEEK tubing (P/N 052306) to the required length: 1 meter for a flow rate of 1.0 mL/min, 2 meters for a flow rate of 0.5 mL/min, and so on.

   b. Use the red fitting supplied with the cell to connect one end of the tubing to the outlet union.

5. Connect a waste line to the backpressure line:

   a. Locate the 0.125-mm (0.020-in) ID orange PEEK tubing in the Dionex VWD Ship Kit (P/N 064787). Cut a length long enough to connect the backpressure line to the waste container.

   b. Install a 10-32 ferrule fitting and bolt on one end of the tubing.

   c. Use a union (P/N 042627) to connect this line to the backpressure line.

6. Push the inlet and outlet line unions onto the clips.

7. Route the lines to the outside of the detector through the slot provided in the enclosure (see Figure 2-3). Direct the waste line to a waste container.

Notes for Cutting Tubing

- Use a tubing cutter to cut tubing to the required length. Make sure the cut is at a right angle to the length of the tubing and there are no nicks or burrs on the end.
- Tighten all fittings fingertight. After starting operation, check for leaks and tighten more only if a fitting is leaking. If you use a wrench,

tighten by small increments (about 1/16th of a turn), just until the leak stops. Severe overtightening of the bolt can damage the port.

B.5 Connecting the Drain Tube

Connect the drain tube (P/N 055075) to the drain port on the Dionex VWD rear panel (see Figure B-6). Place the free end of the tube in a waste container below the level of the workbench on which the Dionex VWD is installed.

IMPORTANT **The drain tube must remain below the drain port. If any part of the drain tube is above the drain port, the drip tray may overflow inside the detector.**

Figure B-6. Dionex VWD Rear Panel

B.6 Connecting the Digital I/O

Two digital I/O ports (A and B) on the Dionex VWD rear panel (see Figure B-6) provide four TTL inputs and four relay outputs for communication with external devices. The two ports are identical in function.

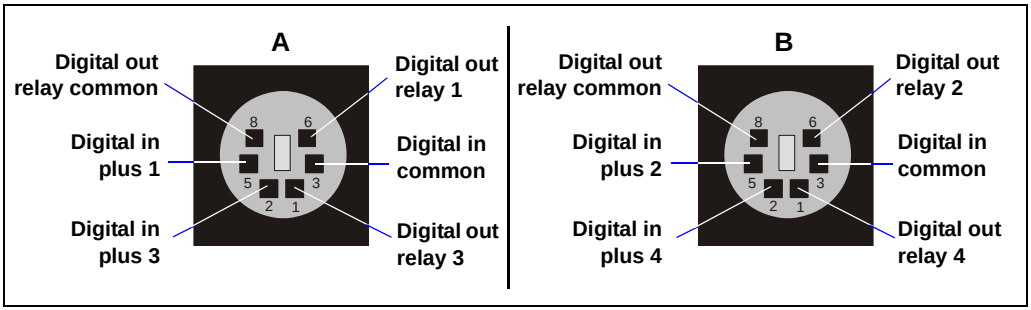


Figure B-7. 6-Pin Mini-DIN Digital I/O Ports

Table B-1 lists the functions assigned to the connector pins and the color of the cable wire connected to each pin.

Pin	Signal Name	Signal Level	Wire Color	Remark
1	Digital out relay 3 (port A) Digital out relay 4 (port B)	Potential free	Pink (or Red)	If the relay is activated, the connection is between the **Digital out relay** and the **Digital out relay common**.
2	Digital in plus 3 (port A) Digital in plus 4 (port B)	TTL	Gray	A voltage between 0 and +10V with respect to **Digital in common** can be applied to the input. A voltage of +4V is sufficient to switch the input.
3	Digital in common	Potential free	Green	Ground for the **Digital in plus** signals.
5	Digital in plus 1 (port A) Digital in plus 2 (port B)	TTL	Yellow	A voltage between 0 and +10V with respect to **Digital in common** can be applied to the input. A voltage of +4V is sufficient to switch the input.

Table B-1. Digital I/O Ports A and B Pin and Cable Wire Assignments

Pin	Signal Name	Signal Level	Wire Color	Remark
6	Digital out relay 1 (port A) Digital out relay 2 (port B)	Potential free	Brown	If the relay is activated, the connection is between the **Digital out relay** and the **Digital out relay common**.
8	Digital out relay common	Potential free	White	Common relay contact.

Table B-1. Digital I/O Ports A and B Pin and Cable Wire Assignments (Continued)

NOTE There is no connection between Digital out relay common and Digital in common. They have neither a conductive connection to protective ground nor to internal signals in the detector.

IMPORTANT **The maximum switching voltage of the relays is 24V. The switching current must not exceed 100 mA. The differential voltage between Digital in plus and Digital in common must not exceed 10V.**

1. Locate the 6-pin mini-DIN cable (P/N 6074.0001) provided in the Dionex VWD Ship Kit (P/N 064787).
2. Plug the cable's 6-pin connector into **Digital I/O** port **A** (or **B**).
3. For each relay output or TTL input to be used, connect the appropriate signal wire and ground wire to the corresponding connectors on the external device. Refer to the documentation provided with the external device for instructions.
4. When configuring the Dionex VWD in the Instrument Configuration program (Chromeleon 7) or Server Configuration program (Chromeleon 6.8) (see Section B.11.3), enable the corresponding relay output and/or TTL input on the **Relays** and/or **Inputs** tab page of the Properties dialog box.

B.7 Installing the Analog Outputs (Optional)

An optional DAC plug-in module (P/N 066349) (see Figure B-8) is available from Thermo Scientific. When the module is installed, two analog outputs with a resolution of 20 bits each are available on the Dionex VWD rear panel. The analog outputs supply a voltage signal proportional to the current measured by the detector cell. The outputs can be connected to an analog-to-digital (A/D)

converter such as an integrator or other recording device. Refer to Section B.7.2 and the documentation for the device for connection instructions.

The analog output voltages are updated with a data rate of 10 Hz (for the single-channel Dionex VWD) or 50 Hz (for the four-channel Dionex VWD).

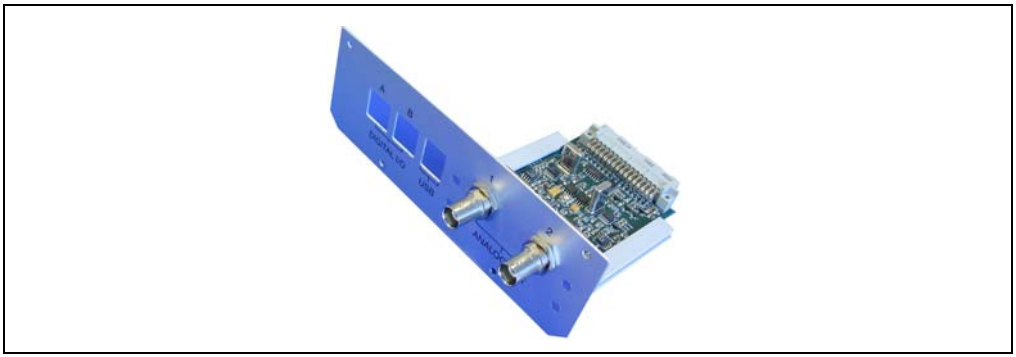


Figure B-8. DAC Plug-In Module

B.7.1 Installing the DAC Plug-In Module

1. Turn off the detector and disconnect the power cord from its source.
2. Use appropriate grounding protection to avoid electrostatic discharge, which may result in damage to electronics components.
3. Remove the four screws indicated in Figure B-9 and remove the access panel on the detector's rear panel. Save the screws.

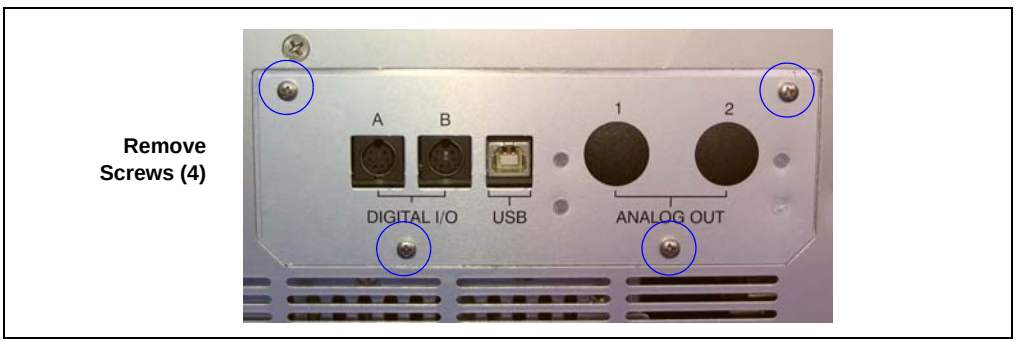


Figure B-9. Removing the DAC Access Panel

4. Slide the guide bar of the DAC plug-in module onto the green edge next to the USB port (see Figure B-10).

Figure B-10. Installing the DAC Plug-In Module

5. Push the DAC plug-in module partially into the enclosure. Apply slight pressure between the two analog outputs to push the module further into the enclosure until it locks into position.
6. Secure the DAC plug-in module with the four screws removed in Step 3.

B.7.2 Connecting the Analog Outputs to the External Device

1. Locate the analog output cable (P/N 6074.0002) provided with the DAC plug-in module.
2. Plug the cable connector into the analog output on the Dionex VWD rear panel.
3. Connect the other end of the cable to the analog input on the external device (integrator, recorder, etc.).

NOTE Several settings are available for configuring the analog output signal (output mode, full-scale range, and mAU range). Refer to Section 2.4.4 for details.

B.8 Connecting the Dionex VWD to the Chromeleon PC

B.8.1 Before You Begin

Before connecting the USB cable (see Section B.8.2) or the power cord (see Section B.9), verify that the following tasks have been completed:

- Chromeleon 7 or Chromeleon 6.8 is installed on the PC.
- The Chromeleon 7 or Chromeleon 6.8 license is installed.

NOTE **Dionex strongly recommends installing Chromeleon *before* connecting the Dionex VWD to the PC. When you install the software first, the USB driver for the detector is automatically loaded and the Windows operating system can detect the Dionex VWD when the power is turned on.**

If installation is required, follow the instructions in the appropriate installation guide. The guides are provided on the Thermo Scientific Reference Library DVD (P/N 053891).

- For Chromeleon 7, refer to *Chromeleon 7 Installation Guide*.
- For Chromeleon 6.8, refer to *Installing the Chromeleon Chromatography Management System with a Dionex Ion Chromatograph* (Document No. 031883).

B.8.2 Connecting the USB Cable

Select one of the following methods to connect the detector to the PC on which the Chromeleon instrument controller or server is installed:

- Connect the detector directly to the USB port on the PC.
- Connect the detector to an internal USB port on another module in the system that is connected to the PC.
- Connect the detector to an external USB hub.

To connect the Dionex VWD directly to the PC:

1. Plug the "A" connector of the USB cable (P/N 063246) into the USB port on the PC (see Figure B-11).
2. Plug the "B" connector of the USB cable into the USB receptacle on the Dionex VWD rear panel.

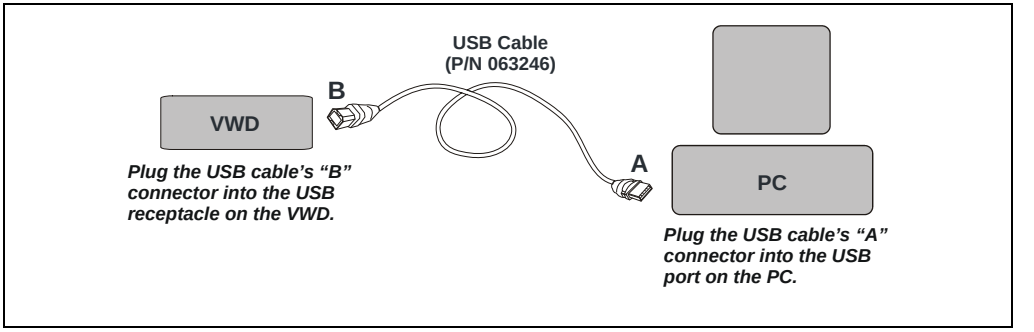


Figure B-11. Dionex VWD Connected Directly to the Chromeleon PC

To connect the Dionex VWD to an internal hub on another module:

NOTE If you are installing a Dionex VWD with a Dionex ICS-5000 Ion Chromatography System, refer to the system installation instructions for information about USB compatibility issues with Dionex ICS-5000 systems.

IMPORTANT **The USB standard limits the USB cable length to 5 meters (5.5 yards). Each USB device can be separated from the PC by no more than five hubs. Thus, if five hubs are installed, each USB device can be located no more than 30 meters (32 yards) from the PC.**

1. Plug the "A" connector of the USB cable (P/N 063246) into the USB port on the module with the internal hub.
2. Plug the "B" connector of the USB cable into the USB receptacle on the Dionex VWD rear panel (see Figure B-12).

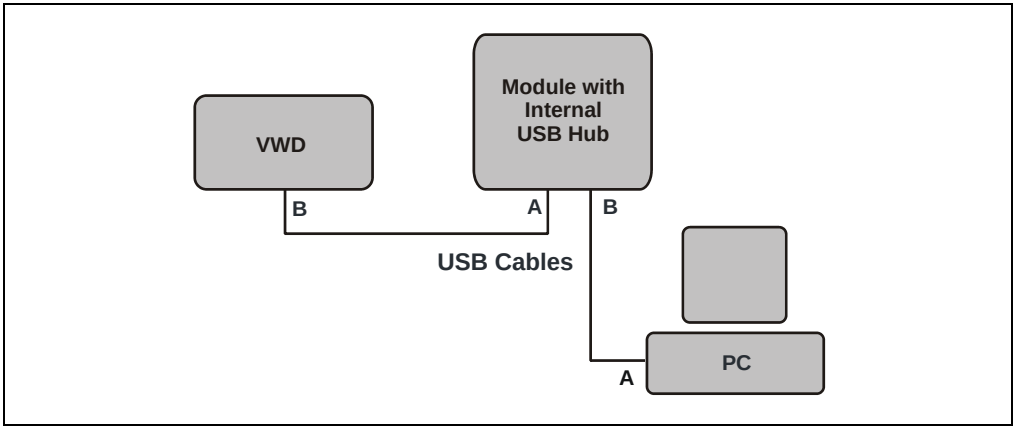


Figure B-12. Example USB Connection: Dionex VWD Connected to Another Module in the System

To connect the Dionex VWD to an external USB hub:

The Dionex VWD Ship Kit includes one USB cable (P/N 063246). You must order another USB cable for this configuration.

IMPORTANT **The USB standard limits the USB cable length to 5 meters (5.5 yards). Each USB device can be separated from the PC by no more than five hubs. Thus, if five hubs are installed, each USB device can be located no more than 30 meters (32 yards) from the PC.**

IMPORTANT **Carefully secure all USB cables, the USB hub, and the hub power cable so that they cannot be accidentally disconnected.**

1. Plug the "A" connector of a USB cable into a port on the external USB hub (see Figure B-13).
2. Plug the "B" connector of the cable into the USB receptacle on the Dionex VWD rear panel.
3. Plug the "A" connector of a USB cable into a USB port on the PC.
4. Plug the "B" connector of the cable into a receptacle on the USB hub.

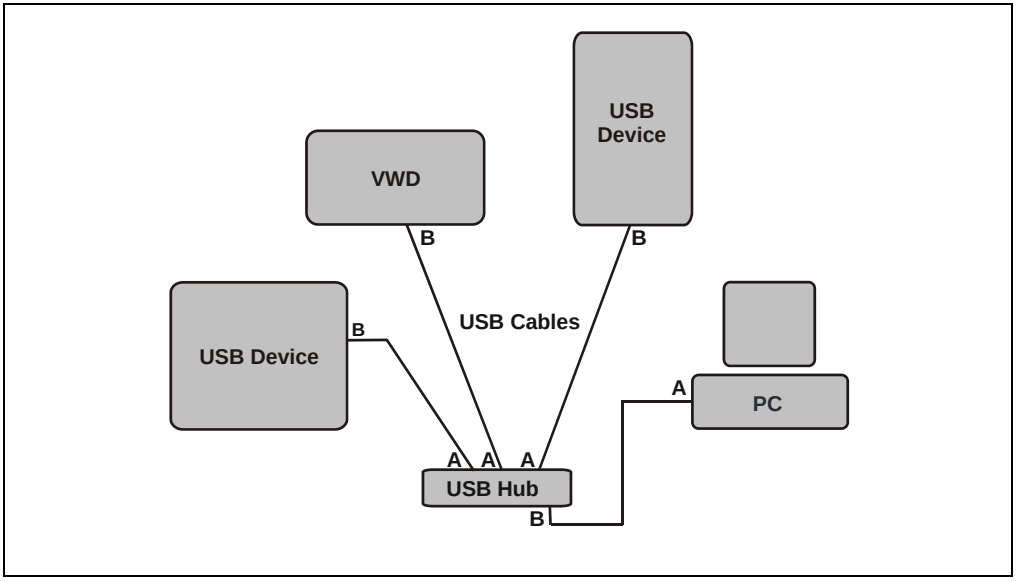


Figure B-13. Example Connections: Multiple Modules Connected via an External USB Hub

B.9 Connecting the Power Cord

1. Verify that the main power switch on the rear panel of the Dionex VWD is turned off. (The main power switch may be turned on accidentally when the detector is unpacked.)
2. Connect a modular power cord (IEC 320 C13) from the Dionex VWD main power receptacle (see Figure B-6) to a grounded, single-phase power source. The power supply is auto-sensing: No adjustment is needed to select the line voltage.

SHOCK HAZARD—To avoid electrical shock, use a grounded receptacle. Do not operate the Dionex VWD or connect it to the AC power source without an earthed ground connection.

The power supply cord is used as the main disconnect device. Make sure the socket-outlet is located near the Dionex VWD and is easily accessible.

Operation at AC input levels outside of the specified operating voltage range may damage the Dionex VWD.

DANGER D'ÉLECTROCUTION—Pour éviter toute électrocution, il faut utiliser une prise de courant avec prise de terre. Ne l'utilisez pas et ne le branchez pas au secteur C.A. sans utiliser de branchement mis à la terre.

Le cordon d'alimentation principal est utilisé comme dispositif principal de débranchement. Veillez à ce que la prise de base soit située/installée près du module et facilement accessible.

STROMSCHLAGGEFAHR—Zur Vermeidung von elektrischen Schlägen ist eine geerdete Steckdose zu verwenden. Das Gerät darf nicht ohne Erdung betrieben bzw. an Wechselstrom angeschlossen werden.

Das Netzkabel ist das wichtigste Mittel zur Stromunterbrechung. Stellen Sie sicher, daß sich die Steckdose nahe am Gerät befindet und leicht zugänglich ist.

B.10 Turning On the Dionex VWD Power

IMPORTANT **Before turning on the Dionex VWD power, verify that Chromeleon 7 or Chromeleon 6.8 was installed on the PC and the license code was entered. If the chromatography software is not installed first, Windows will be unable to identify the detector.**

1. Turn on the PC power, if it is not already on.
2. If this is a local PC, log onto Windows Vista or Windows XP as an **administrator**.

   If this is a network PC, log on as a user with local PC administrator privileges.
3. To start the Chromeleon 7 Instrument Configuration program:

   Right-click the Chromeleon tray icon  (which is crossed out in red) and click **Start Chromeleon Instrument Controller**. The icon changes to gold  to indicate that the Instrument Controller Service is starting. When the Instrument Controller Service is running (idle), the icon changes to gray  .

   If the Chromeleon tray icon is not on the taskbar, click **Start > All Programs > Chromeleon 7 > Services Manager** to open the Services Manager and click **Start Instrument Controller**.
4. To start the Chromeleon 6.8 Server Monitor program:

   Right-click the Chromeleon Server Monitor tray icon  (which is crossed out in red) on the Windows taskbar and click **Start Server**. The icon changes to gold  to indicate that the Chromeleon Server is starting. When the Chromeleon Server is running (idle), the icon changes to gray  .

   If the Server Monitor icon is not on the taskbar, click **Start** > **All Programs > Chromeleon >Server Monitor** to open the Server Monitor and click **Start**.
5. Turn on the main power switch on the rear panel of the Dionex VWD.

NOTE **Always leave the main power switch on unless instructed to turn it off. Use the power button on the front of the detector for on/off control. To turn off the detector, press and hold the power button for 2 seconds.**

6. Microsoft Windows will automatically detect the new detector and launch the Found New Hardware Wizard. Use the wizard to install the detector as described below.
   a. If asked whether Windows can connect to Windows Update to search for software, select **No, not this time**.
   b. Accept the default option (**Install the software automatically**) and click **Next >**.
   c. When the hardware wizard reports that the software for the detector has been installed, click **Finish**.

NOTE If Windows fails to detect the Dionex VWD, refer to Section 4.9 for troubleshooting help.

B.11 Setting Up the Chromatography Software

This section provides brief instructions for setting up Chromeleon 7 or Chromeleon 6.8 software. For details about any of these steps, refer to the Chromeleon Help.

B.11.1 Chromeleon 7: Assigning the Dionex VWD to an Instrument

After the Windows Found New Hardware Wizard is finished (see Section B.10), follow the steps below to add the Dionex VWD to a Chromeleon 7 instrument.

1. Click **Start** on the taskbar and select **All Programs > Chromeleon 7 > Services Manager** to open the Services Manager. Click **Start Instrument Controller**.
2. Click **Configure Instruments** to start the Instrument Configuration program.
3. If necessary, click the plus sign beside the instrument controller name to display the items underneath.
4. Select the instrument to which the Dionex VWD will be assigned, or create a new instrument (select **Edit > Add Instrument**).

5. Select **Edit > Add Module** or right-click and select the command on the context menu.

   The Add module to instrument dialog box appears.

6. Under **Manufacturers**, select **IC: ICS-5000 Systems** or **IC: Modules**.

7. Under **Modules**, select **VWD Variable Wavelength Detector (ICS)** (see Figure B-14) and click **OK**.

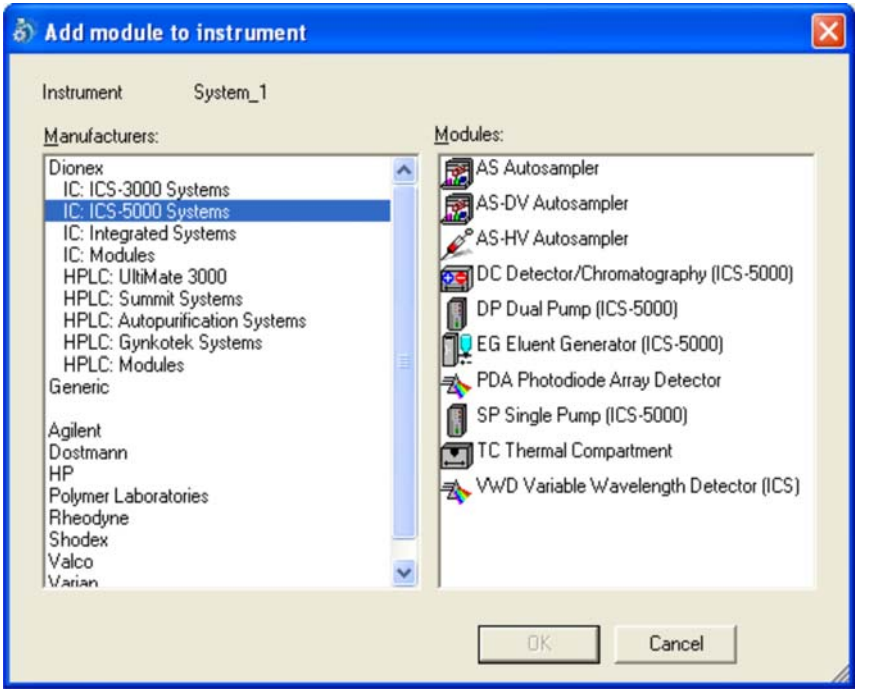


Figure B-14. Adding the Dionex VWD to an Instrument

8. The Properties dialog box for the Dionex VWD appears. Check that the default settings are correct for your system and select other settings, if needed (see Section B.11.3). Click **OK** to close the dialog box.

9. Save the configuration (select **File > Save Installation**).

B.11.2 Chromeleon 6.8: Assigning the Dionex VWD to a Timebase

After the Windows Found New Hardware Wizard is finished (see Section B.10), follow the steps below to add the Dionex VWD to a Chromeleon 6.8 timebase.

1. Start the Server Configuration program by clicking **Start** on the taskbar and selecting **All Programs > Chromeleon 6.8 > Server Configuration**.
2. If necessary, click the plus sign beside the server name to display the items underneath.
3. Select the timebase to which the Dionex VWD will be assigned, or create a new timebase (select **Edit > Add Timebase**).
4. Select **Edit > Add Device** or right-click and select the command on the context menu.

   The Add device to timebase dialog box appears.
5. Under **Manufacturers**, select **IC: ICS-5000 Systems** or **IC: Modules**.

6. Under **Devices**, select **VWD Variable Wavelength Detector (ICS)** (see Figure B-15) and click **OK**.

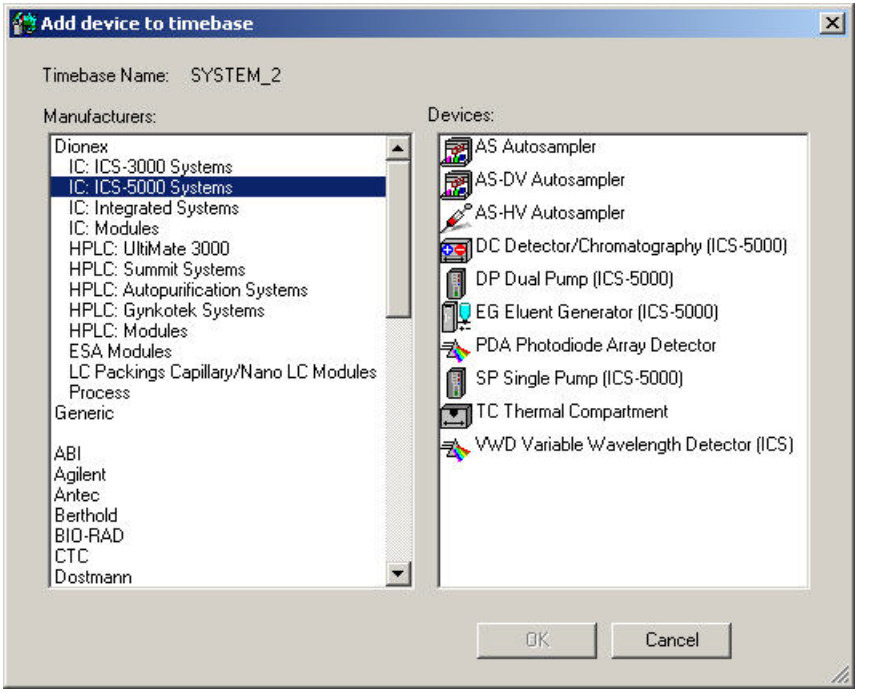


Figure B-15. Adding the Dionex VWD to a Timebase

7. The Properties dialog box for the Dionex VWD appears. Check that the default settings are correct for your system and select other settings, if needed (see Section B.11.3). Click **OK** to close the dialog box.

8. Save the configuration (select **File > Save Installation**).

B.11.3 Selecting Configuration Properties

When the Dionex VWD is added to an instrument or a timebase, default configuration properties are selected. You can verify that the default settings are correct for your system and select other settings, if needed.

1. To open the Properties dialog box if it is not already open, right-click the Dionex VWD in the instrument or timebase and click **Properties**.
2. On each tab page in the Properties dialog box, select the preferred settings. (See the following sections for descriptions of the various tab pages.)
3. When you finish, click **OK** to close the dialog box.
4. Select **File > Save Installation** and then close the Instrument Configuration program or Server Configuration program.

For more information about how to configure the detector, refer to the Chromeleon 7 or Chromeleon 6.8 Help.

General Tab Page

The **General** tab page displays the module address of the detector and the name of the firmware file currently installed in the detector. If an update is ever required, click the **Download** button to download new firmware.

Detector Tab Page

The **Detector** tab page (see Figure B-16) displays the type of Dionex VWD installed (**1 Channel** or **4 Channels**) and the device name (**UV**) used to identify the detector in the configuration and in the Chromeleon client. Thermo Scientific recommends retaining the default device name because the name is linked to various controls in the Chromeleon client. If you change the name, the controls will no longer function.

Select the corresponding check box for each option currently installed in the detector: **UV Lamp**, **VIS Lamp**, and **DAC Board**.

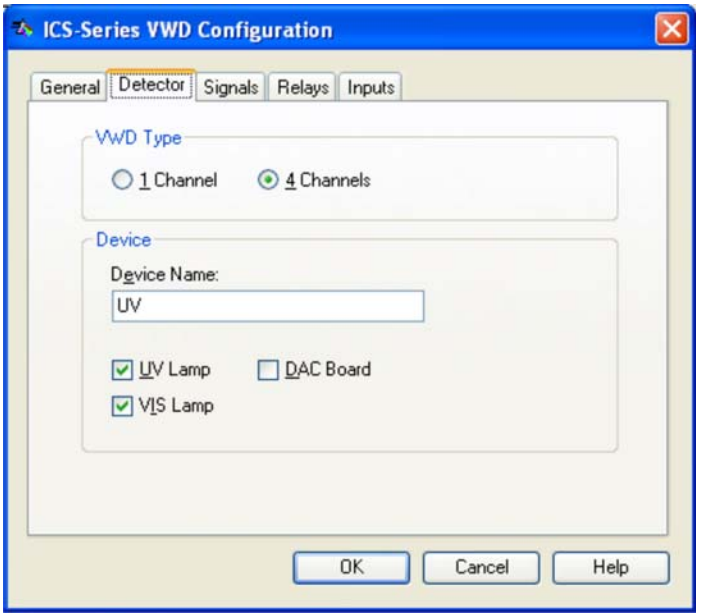


Figure B-16. Dionex VWD Configuration Properties: Detector Tab Page

Signals Tab Page

The **Signals** tab page lists the signals that the detector can record. The signal type and name of each signal is displayed. To allow raw data collection for a signal, select the **Enabled** check box next to its name. If the check box is cleared, the detector cannot collect raw data for the signal.

Relays Tab Page

The **Relays** tab page lists all available relays. Select a check box to enable the corresponding relay. If a check box is cleared, the relay will not be available in Chromeleon. To change a relay name, overwrite the existing name directly in the **Name** field.

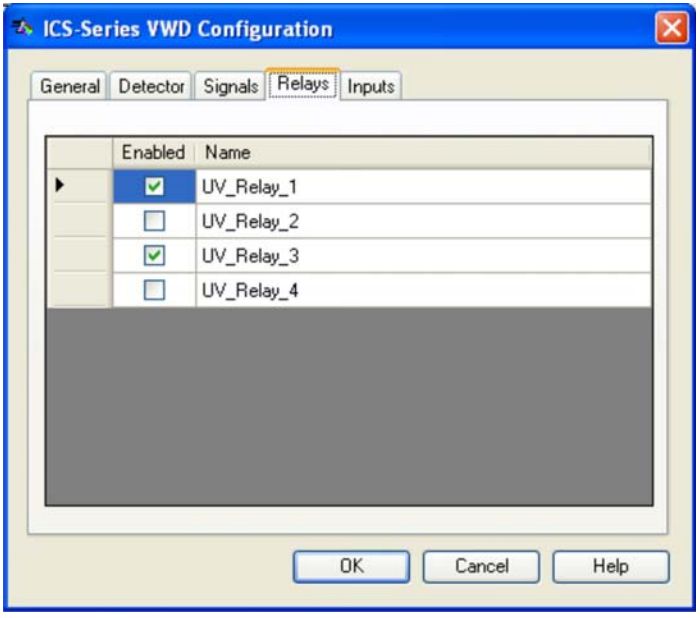


Figure B-17. Dionex VWD Configuration Properties: Relays Tab Page

Inputs Tab Page

The **Inputs** tab page lists all available remote inputs. Select a check box to enable the corresponding input. If a check box is cleared, the input will not be available in Chromeleon. To change an input name, overwrite the existing name directly in the **Name** field.

C • Reordering Information

Part Number	Item
066347	Deuterium lamp
066348	Tungsten lamp
066346	Standard flow cell, 11 µL volume, 10 mm path length, PEEK
6074.0300	Semi-micro flow cell, 2.5 µL volume, 7 mm path length, PEEK
066349	DAC plug-in module (analog output)
6074.0002	DAC cable (analog output)
6074.0001	6-pin mini-DIN cable, 5 m (16 ft)
063246	USB cable, 0.9 m (3 ft)
055075	Drain tube
052308	Tubing, 0.51-mm (0.020-in) ID PEEK (6 m [20 ft])
052306	Tubing, 0.25-mm (0.010-in) ID PEEK (1.5 m [5 ft])
052311	Tubing, 0.125-mm (0.005-in) ID PEEK (6 m [20 ft])
043276	Ferrule fitting, 10-32 double-cone
043275	Fitting bolt, 10-32 (for 10-32 double-cone ferrule fitting)
954776	Fuse, IEC 60127-2 time lag rated at 2 A, 250 VAC

D.1 UV Cutoff Wavelengths of Common Mobile Phases

The mobile phase composition affects its *UV cutoff* (the minimum effective wavelength for the measurement). In general, mobile phases are solvents such as water, acetonitrile, or methanol. They may also contain salts, such as sodium hydroxide.

The UV cutoff wavelengths of these solvents may differ from the predicted values listed in Table D-1. Among other factors, the degassing quality and purity grade of the solvent affect the UV cutoff. Therefore, the values listed in Table D-1 are approximate values only. The cutoffs listed in the table apply to spectro-quality grade solvents.

Solvent	UV Cutoff (nm)	Refractive Index	Selectivity Group
Acetic acid	208	1.370	IV
Acetone	330	1.356	VIa
Acetonitrile	190	1.341	VIb
Dioxane	215	1.420	VIa
Ethanol	210	1.359	II
Ethyl acetate	256	1.370	VIa
Hexane sulfonic acid (0.005 M)	230		
Isopropanol	205	1.384	II
Methanol	205	1.326	II
Methylene chloride	233	1.421	V
n-Hexane	190	1.372	VII
Octane sulfonic acid	230		
Sodium carbonate (0.01 M)	210		
Sodium hydroxide (0.1 M)	217		
Tetrabutylammonium hydroxide (0.005 M)	215		

Table D-1. Properties of Common Mobile Phases

Solvent	UV Cutoff (nm)	Refractive Index	Selectivity Group
Tetrahydrofuran	212	1.405	III
Tetrapropylammonium hydroxide	195		
Toluene	285	1.494	VII
Triethylamine		1.398	I
Water		1.333	VIII

Table D-1. Properties of Common Mobile Phases (Continued)

D.2 UV Absorbance Wavelengths of Chromophores

Table D-2 lists the wavelengths for the absorption maxima of various chromophores.

Functional Group	Chromophore	Wavelength (nm)
Aldehyde	–CHO	280–300
Amine	–NH2	195
Anthracene		252
		375
Azido	>C=N–	190
Azo	–N=N–	285–400
Benzene		202
		255
Bromide	–Br	208
Carboxyl	–COOH	200–210
Diphenyl		246
Disulfide	–S–S–	194
		255
Esters	–COOR	205
Ether	–O–	185
Iodide	–I	260
Isoquinoline		218

Table D-2. UV Absorbance Wavelengths of Various Chromophores

Functional Group	Chromophore	Wavelength (nm)
		266
		317
Ketone	>C=O	270–280
Naphthalene		220
		275
		312
Nitrate	–ONO2	270 (shoulder)
Nitroso	–N=O	302
Olefins	C=C–	185
Oxalic acid	HOOC–COOH	250
Pyridine		195
		251
Quinoline		227
		270
		314
Thioether	–S–	194
		215
Thioketone	>C=S	205
Thiol	–SH	195

Table D-2. UV Absorbance Wavelengths of Various Chromophores (Continued)

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