



DX-80 ION ANALYZER OPERATOR'S MANUAL

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1 • Introduction

1.1 Introduction to Ion Chromatography (IC)

The Dionex DX-80 Ion Analyzer (DX-80) performs isocratic ion analyses using suppressed conductivity detection.

An ion analyzer typically consists of a liquid eluent, a high-pressure pump, a sample injector, a separator column, a chemical suppressor, and a conductivity cell. Before running a sample, the ion analyzer is calibrated using a standard solution. By comparing the data obtained from a sample to that obtained from the standard, sample ions can be identified and quantitated. Chromatography software automatically converts each peak in a chromatogram to a sample concentration and produces a tabulated printout of the results. If you are not familiar with chromatography terminology, see the glossary in Appendix E.

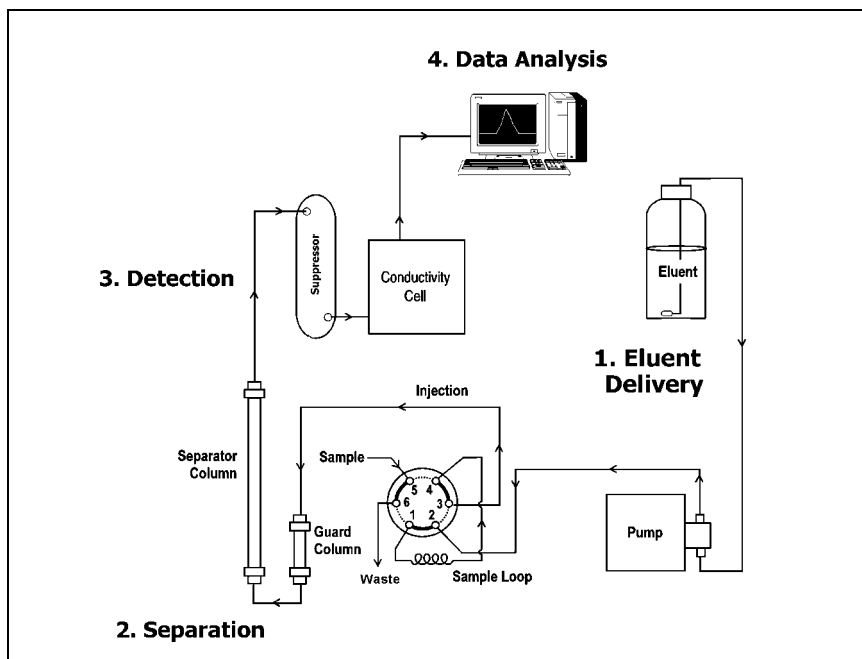


Figure 1-1. Ion Analysis Process

As illustrated in Figure 1-1, the IC analysis consists of four stages:

1. Eluent Delivery

- Eluent, a liquid that helps to separate the sample ions, carries the sample through the ion analyzer. The DX-80 is an isocratic delivery system. This means that the eluent composition and concentration remain constant throughout the run.
- Liquid sample is injected into the eluent stream either manually or automatically (if an automated sampler is installed).
- The pump forces the eluent and sample through a separator column.

2. Separation

- As the eluent and sample are pumped through the column (a chemically-inert tube packed with a polymeric resin), the sample ions are separated. In the DX-80, the mode of separation is called ion exchange. Ion exchange is based on the premise that different sample ions migrate through the IC column at different rates, depending upon their interactions with the ion exchange sites.

3. Detection

- After the eluent and sample ions leave the column, they flow through a suppressor that selectively enhances detection of the sample ions while suppressing the conductivity of the eluent.
- A conductivity cell monitors and measures the electrical conductance of the sample ions as they emerge from the suppressor and produces a signal based on a chemical or physical property of the analyte.

4. Data Analysis

- The conductivity cell transmits the signal to a computer running chromatography software.
- The chromatography software (for the DX-80, this is PeakNet® IA) analyzes the data by comparing the sample peaks in a chromatogram to those produced from a standard solution, identifying the ions based on retention time, and quantifying each analyte by integrating the peak area or peak height. The results are displayed as a chromatogram, with the concentrations of ionic analytes automatically determined and tabulated.

1.2 Overview of the DX-80

In all major respects, the DX-80 operating process is similar to the overview of ion analysis described in Section 1.1. The DX-80 is an integrated ion analyzer containing a pump, injection valve, conductivity cell, guard column, separator column, and suppressor. The DX-80 is preconfigured and factory-plumbed for immediate productivity. System components are described and illustrated in Section 2.1.3.

1.2.1 DX-80 Configurations

The DX-80 is available in the configurations listed below.

Configuration	110-120 VAC 60 Hz*	220-240 VAC 50 Hz*
Anion DX-80	P/N 057200	P/N 057204
Cation DX-80	P/N 057202	P/N 057206

*Must match the voltage of the installation site's power source.

Most of the descriptions and procedures discussed in this manual apply to both the anion and cation DX-80; where there are differences, they are noted in the text. The table below summarizes the two product versions.

DX-80 Version	Characteristics
Anion DX-80	- Measures negatively charged ions - AS14A column is designed to separate 7 common anions - Carbonate eluent - Dilute sulfuric acid regenerant - AMMS® III suppressor
Cation DX-80	- Measures positively charged ions - CS12A column is designed to separate 6 common cations - Methanesulfonic acid eluent - Tetrabutylammonium hydroxide (TBAOH) regenerant - CMMS® III suppressor

1.2.2 PeakNet IA Data System

DX-80 operation is controlled remotely by the PeakNet IA data system. The data system consists of a personal computer running PeakNet IA software (version 6.12 or later) and at least one DX-80. A single data system can control both an anion and a cation DX-80.

PeakNet IA automates instrument control, data acquisition, and data processing. Preconfigured chemistries and preloaded methods allow you to quickly produce results.

The DX-80 can be connected either to a private LAN (a network used only by PeakNet IA and Dionex instruments) or an office LAN. For complete installation instructions for the PeakNet IA data system, refer to *Installing the PeakNet IA System* (Document No. 031717).

1.3 About This Manual

Chapter 1 Introduction	Introduces ion analysis, gives an overview of the DX-80, and explains the conventions used in this manual, including safety-related information.
Chapter 2 Description	Describes DX-80 operating features and the chromatographic flow path.
Chapter 3 Operation and Maintenance	Provides operating instructions, introduces the PeakNet IA user interface, and describes routine preventive maintenance procedures.
Chapter 4 Troubleshooting	Lists problems and presents step-by-step procedures for how to isolate and eliminate the cause of each problem.
Chapter 5 Service	Provides step-by-step instructions for routine service and parts replacement procedures.
Appendix A Specifications	Lists the DX-80 specifications and installation site requirements.
Appendix B Installation	Describes how to install the DX-80.
Appendix C Reordering Information	Lists spare parts for the DX-80.
Appendix D FAQ	Provides answers to frequently asked questions about DX-80 operation.
Appendix E Glossary	Defines terms commonly used in ion analysis.

1.3.1 Safety Messages and Notes

The DX-80 is designed for ion analysis applications and should not be used for any other purpose. If there is a question regarding appropriate usage, contact Dionex at 1-800-346-6390 before proceeding. Outside the United States, call the nearest Dionex office.

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



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, may result in death or serious injury.



Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.



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.

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.

1.3.2 Safety Labels

The DX-80 meets EN 61010-1:1993 (safety), CAN/CSA-C22.2 No. 1010.1-92 (safety), UL 3101-1/10.93 (safety), EN 50082-1:1992 (susceptibility), and EN 55011:1991 (emissions). The TUV GS, C, US Mark safety labels and the CE Mark label on the DX-80 attest to compliance with these standards.

The symbols below appear on the DX-80, or on labels affixed to the DX-80.

Alternating current



Protective conductor terminal



Power supply is on



Power supply is off

2 • Description

The DX-80 Ion Analyzer is designed for simplicity and ease of use. It is configured for optimal performance at the factory. DX-80 operation is controlled by PeakNet IA software. This chapter presents a brief description of key DX-80 features and components and the PeakNet IA user interface.

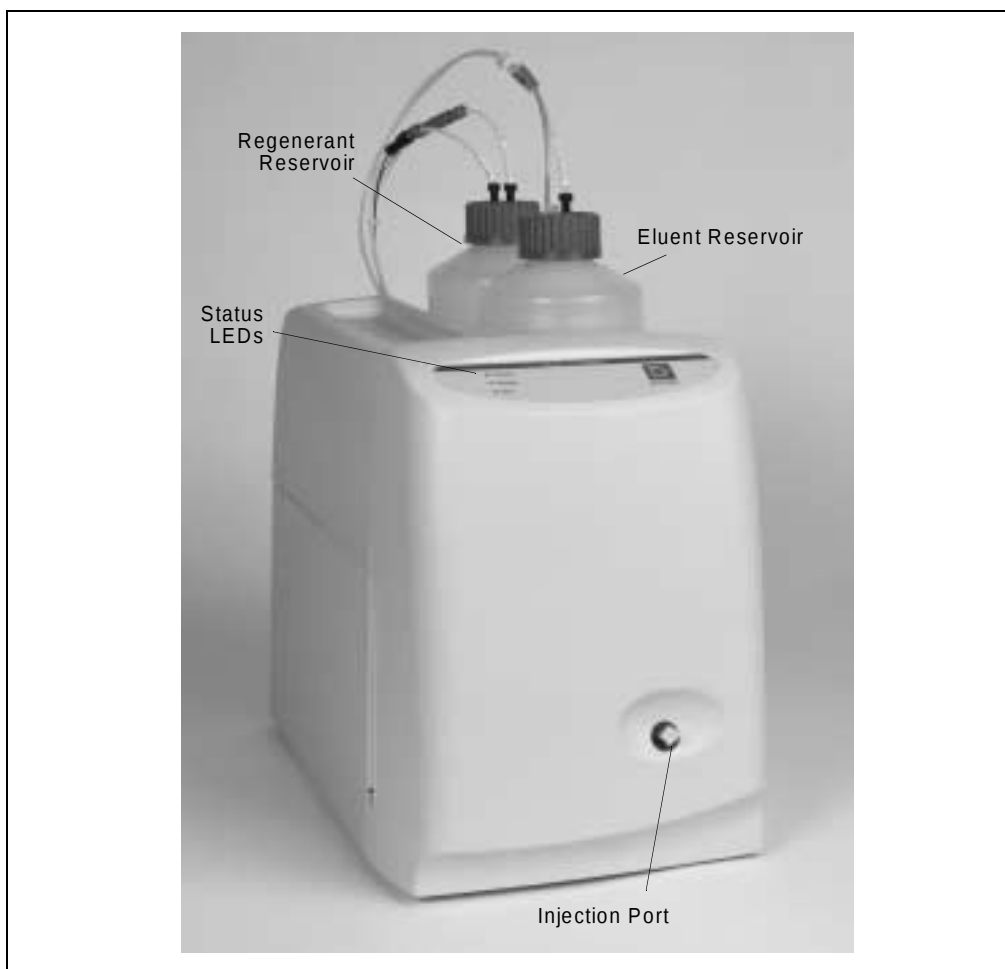


Figure 2-1. DX-80 Ion Analyzer

2.1 Operating Features

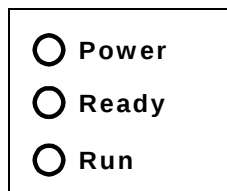
2.1.1 Front Door and Top Cover

Figure 2-1 illustrates the front door and top cover of the DX-80.

The front door contains a sample injection port and LEDs that indicate the DX-80 operating status. The top cover is molded to hold the eluent and regenerant reservoirs.

LEDs

There are three status LEDs on the DX-80 front panel. Other status information and alarm messages are available in PeakNet IA software. See Section 4.1 for an explanation of the software alarm messages.



LED Label	LED State	LED Interpretation
Power	Off	No power
	On	Power present
Ready	Off	Running or not trying to get ready
	On	System check passed, but sequence not yet started (LED remains on until run starts or sequence is aborted)
	Flashing	System check failed (occurs if system check executes for 10 minutes without success)
Run	Off	Not running
	On	Running/acquiring data
	Flashing	Error/alarm/fault (including injection valve position)

Injection Port

The sample to be analyzed is injected into the injection port, using either a syringe or the optional AS40 Automated Sampler. For more information about sample injection, see Section 3.4.4.

Eluent and Regenerant Reservoirs

The DX-80 top cover is molded to hold one eluent reservoir assembly (P/N 057711) and one regenerant reservoir assembly (anion, P/N 057712; cation, P/N 057713).

- Eluent carries the sample through the DX-80 and facilitates the ion separation process. The anion DX-80 uses carbonate eluent. The cation DX-80 uses methanesulfonic acid (MSA) eluent.
- Regenerant “regenerates” the suppressor’s ability to suppress eluent conductivity. The anion DX-80 uses dilute sulfuric acid regenerant. The cation DX-80 uses tetrabutylammonium hydroxide (TBAOH) regenerant.

Each DX-80 is shipped with a Start-Up Kit (Anion DX-80 Start-Up Kit, P/N 057068; Cation DX-80 Start-Up Kit, P/N 057070) containing the following items:

- One 100 mL bottle of eluent concentrate,
- One 100 mL bottle of regenerant concentrate, *and*
- One 100 mL bottle of anion or cation standard.

NOTE To replace the initial supply of eluent and regenerant, order the DX-80 Ion-I Reagent Refill Kit (Anion Refill Kit, P/N 057069; Cation Refill Kit, P/N 057071). Each refill kit contains four bottles of eluent concentrate and four bottles of regenerant concentrate.

2.1.2 Rear Panel

Figure 2-2 illustrates the DX-80 rear panel.

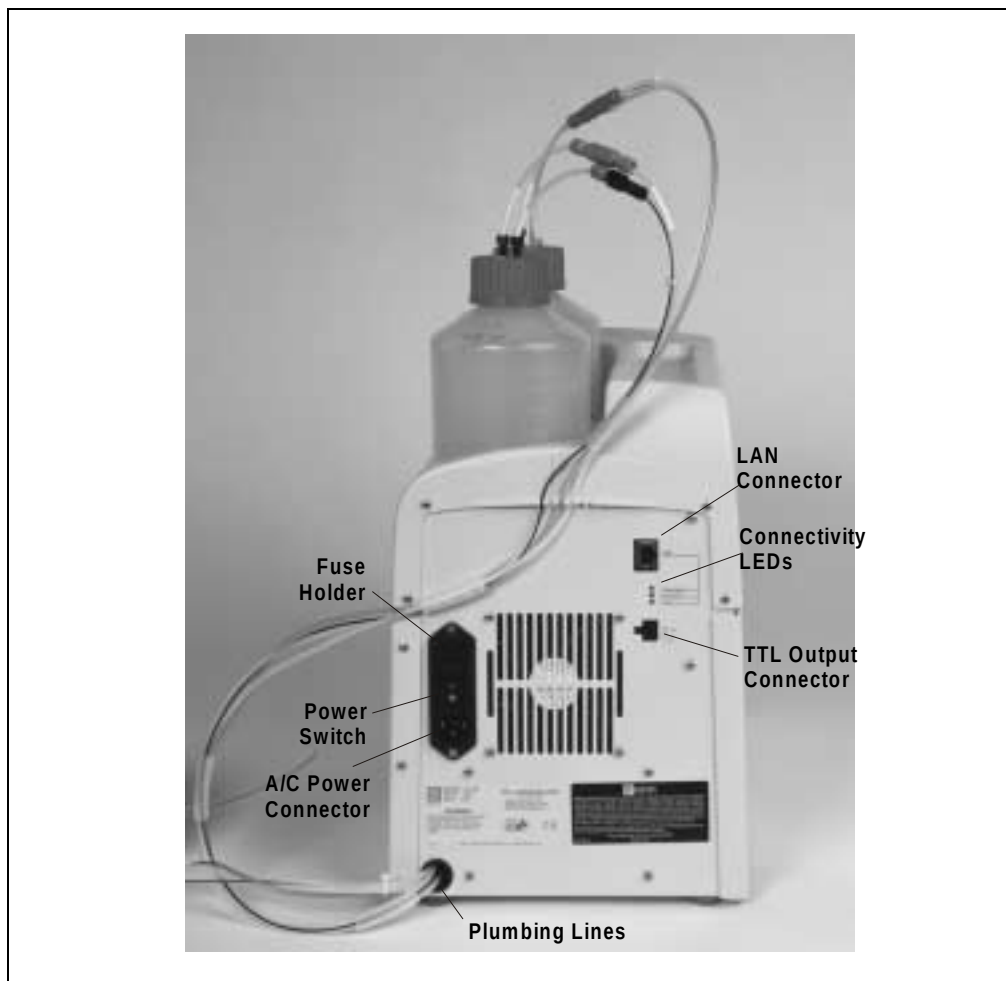


Figure 2-2. DX-80 Rear Panel

Power Switch

The power switch provides on/off control of power to the DX-80. This is the only operating feature that is controlled from the instrument.

Main Power Receptacle

The AC power outlet is located directly below the power switch.



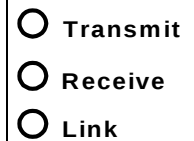
The power supply cord is used as the main disconnect device. Make sure the outlet is located near the DX-80 and is easily accessible.

LAN Connector

The 10BASE-T LAN connector provides a connection to the PeakNet IA data system. For the standard PeakNet IA system configuration of one DX-80 connected to a private LAN, connect a crossover 10BASE-T LAN cable (P/N 960280) here. For all other system configurations, connect a straight-through 10BASE-T LAN cable (P/N 960281).

Connectivity LEDs

The three connectivity LEDs indicate the communication status between the DX-80 and the PeakNet IA data system.



LED Name	Status	Description
Transmit	On	The DX-80 is transmitting information to the PeakNet IA data system
	Off	The DX-80 is not transmitting information to the PeakNet IA data system
Receive	On	The DX-80 is receiving information from the PeakNet IA data system
	Off	The DX-80 is not receiving information from the PeakNet IA data system
Link	On	A link has been established between the DX-80 and the PeakNet IA data system, but no data is currently being transmitted or received
	Off	No link between the DX-80 and the PeakNet IA data system has been established

TTL Output Connector

The TTL output connector provides a connection to an AS40 Automated Sampler. This allows the AS40 to receive TTL signals from the DX-80. See Section B.9 for installation instructions.

Tubing Connections

Eight lines exit the DX-80 from the lower left corner of the rear panel. These lines include:

- 1 eluent line
- 1 regenerant line
- 1 cell outlet line
- 2 air lines
- 3 waste lines (sample, regenerant, and pump priming waste)

2.1.3 Component Mounting Panel

Figure 2-3 shows the user-accessible components installed inside the DX-80. The component panel is accessed by opening the front panel door. All of the components that the user can service are located on this panel.

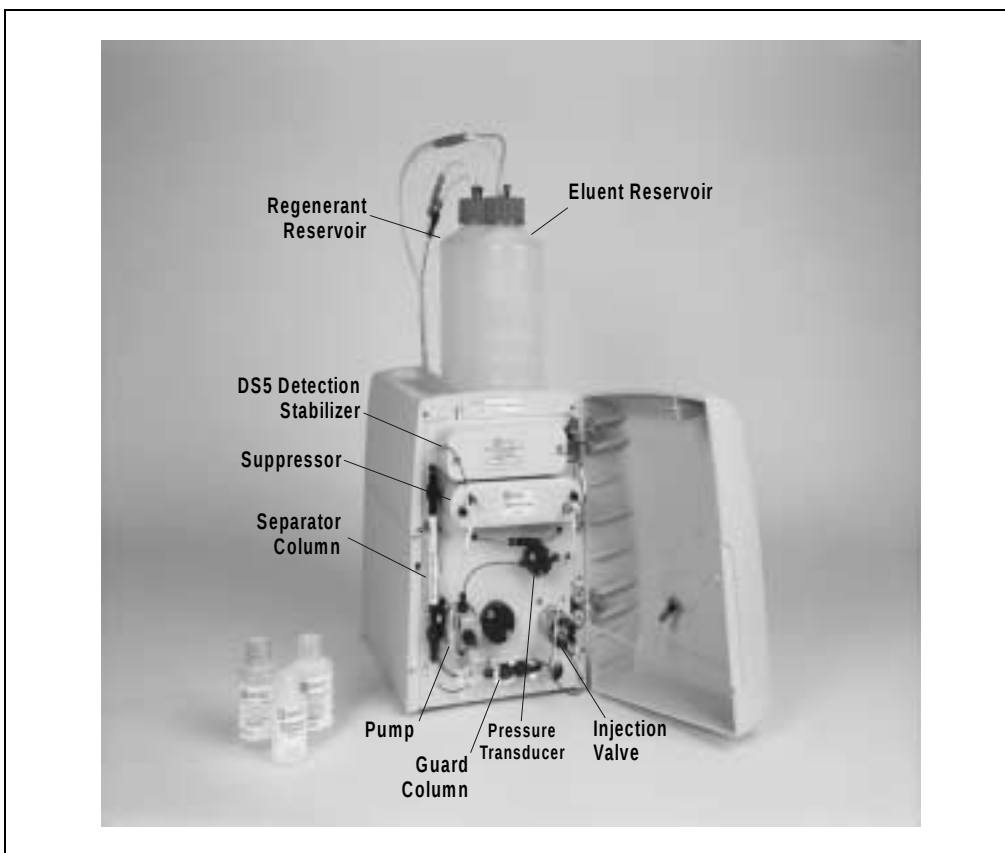


Figure 2-3. DX-80 Component Mounting Panel

DS5 Detection Stabilizer

The DS5 Detection Stabilizer (P/N 057290) houses a flow-through conductivity cell. Two 316 stainless steel electrodes are permanently sealed into the PEEK cell body. The cell measures the electrical conductance of analyte ions as they pass through the cell.

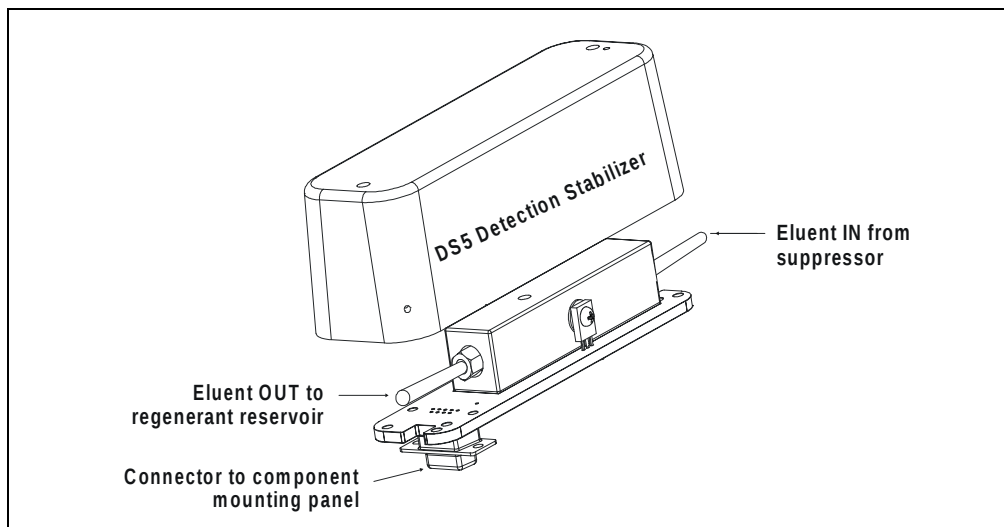


Figure 2-4. DS5 Detection Stabilizer

Because temperature directly affects the conductivity of a solution, direct conductive heating is used in the DX-80 to provide temperature control and compensation. For example, laboratory heating and air conditioning systems can cause a regular slow cycling in the baseline. This, in turn, can affect the reproducibility of an analysis. The higher the conductivity, the more pronounced the effect.

In ion analysis, temperature variation is minimized by suppressing eluent conductivity. Built-in preset temperature compensation also ensures that there is no major change in the baseline or in peak heights. Temperature compensation further improves baseline stability. A heat exchanger inside the DX-80 cell regulates the temperature. All data is collected at 40 °C.

MMS III Suppressor

The MMS III suppressor reduces the eluent conductivity and enhances the conductivity of the sample ions, thereby increasing detection sensitivity. As illustrated in Figure 2-5, a constant flow of regenerant over the membrane continually restores the suppression ability of the MMS III.

A process called Displaced Chemical Regeneration (DCR) pushes regenerant from the regenerant reservoir and through the suppressor. For more information, see Section 2.2.1.

There are two versions of the MMS III. The AMMS III (P/N 056750) is installed in the anion DX-80 and the CMMS III (P/N 056752) is installed in the cation DX-80. For more information, refer to the following:

Installation Instructions and Troubleshooting Guide for the Anion MicroMembrane Suppressor® III (Document No. 031727) or *Installation Instructions and Troubleshooting Guide for the Cation MicroMembrane Suppressor® III* (Document No. 031728).

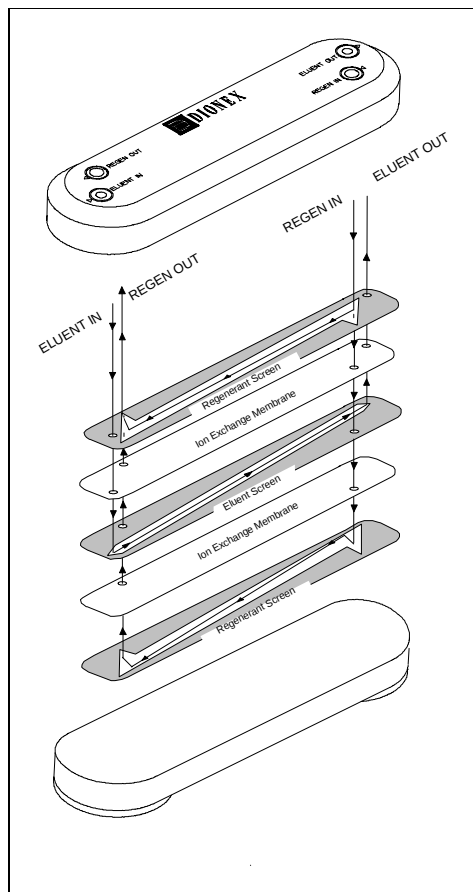


Figure 2-5. MMS III Suppressor Flow

NOTE A shipping screw to the left of the suppressor holds it in place during shipment. The screw does not need to be removed unless a new suppressor is installed. Dionex recommends leaving the screw in place in case you need to ship the DX-80.

Pressure Transducer

The pressure transducer measures the system pressure at the point where the eluent flows from the pump head outlet check valve into the pressure transducer. Pressure measurements (which can be monitored from PeakNet IA) indicate whether the pumping system is delivering smooth, accurate flow. Pressure limits are used to detect high or low pressure conditions that might require the pump to be shut down.

The system backpressure should remain consistent. A significant increase in backpressure indicates blockages in the liquid lines. A significant decrease in backpressure may indicate leaks or decreased pump flow due to an unprimed pump or insufficient eluent.

Injection Valve with Sample Loop

The injection valve is a six-port, electrically-activated Rheodyne valve. A 10 μ L sample loop (P/N 042857) is installed on the valve at the factory.

The valve has two operating positions: Load and Inject (see Figure 2-6). Eluent flows through either the Load or Inject path, depending on the valve position.

- In the Load position, sample is loaded into the sample loop, where it is held until injection. Eluent flows from the pump, through the valve, and to the column, bypassing the sample loop. Sample flows from the syringe or automated sampler line (if installed), through the valve, and into the sample loop. Excess sample flows out to waste.
- In the Inject position, sample is swept to the column for analysis. Eluent flows from the pump, through the sample loop, and on to the column, carrying the contents of the sample loop with it.

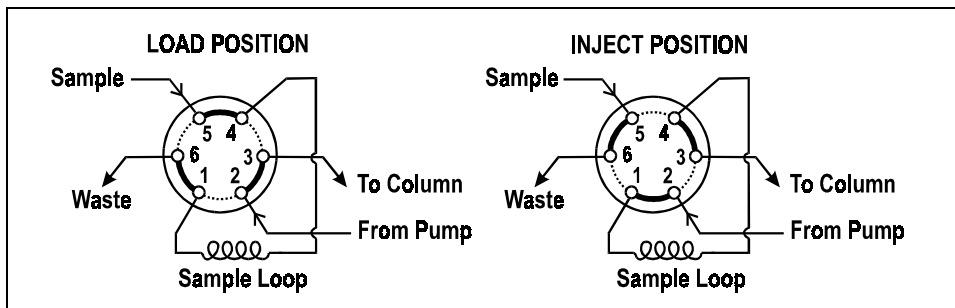


Figure 2-6. Rheodyne Injection Valve Flow Schematics

Pump

The DX-80 uses a high speed reciprocating pump with PEEK components. The flow rate is preset to 0.5 mL/min at the factory and cannot be adjusted.

Prime Valve

The prime valve is mounted on the pump head. The pump should be primed at installation and whenever the flow rate seems outside normal parameters. For priming instructions, see Section B.10.

Separator and Guard Columns

Both the separator and guard columns are packed with resin filling and perform the separation of the sample ions. However, the main function of the guard column is to absorb organic contaminants and remove particulates that might poison the separator column.

The separator and guard columns installed in the DX-80 vary, depending upon whether it is an anion or cation instrument.

Column Name	Part Number
AS14A Anion Separator Column	056902
AG14A Anion Guard Column	056900
CS12A Cation Separator Column	057187
CG12A Cation Guard Column	057188

The anion columns are designed to separate seven common anions, using carbonate eluent. The cation columns are designed to separate six common cations, using methanesulfonic acid (MSA) eluent. For a list of anions and cations analyzed by the DX-80, see Section 2.3.3.

2.2 Fluid Schematic

Figure 2-7 shows the flow path through the DX-80 Ion Analyzer.

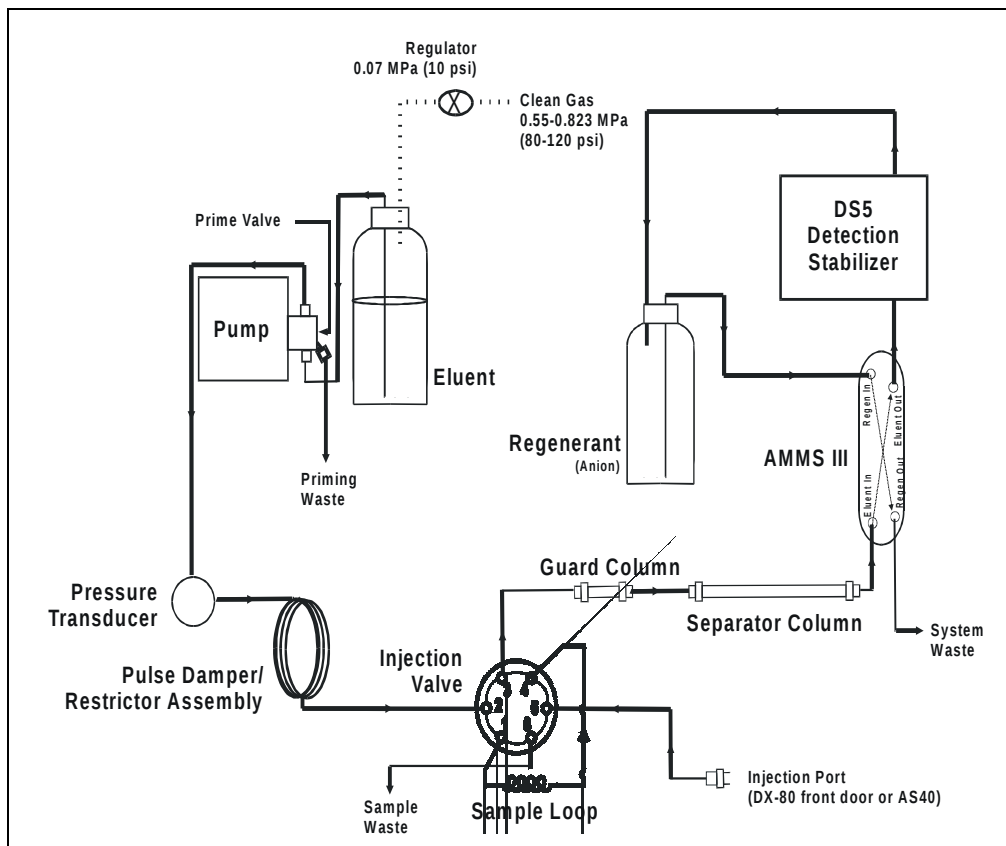


Figure 2-7. DX-80 Flow Schematic

Liquid flows through the DX-80 along the following flow path:

- Eluent from the eluent reservoir is pressurized by the gas, forced into the pump, and passes through the pressure transducer. From there, it is pushed through a pulse damper/restrictor assembly, which smooths minor pressure variations from the high speed pump to minimize baseline noise. The eluent then flows into the injection valve.

- When sample is loaded into the sample loop, the injection valve toggles to the Inject position. This combines the injected sample with the eluent and pushes it through the sample loop.
- The eluent/sample mixture is pumped through the guard and separator columns, where the ions are separated by the ion exchange process (that is, different sample ions migrate through the column at different rates, depending upon their interactions with the ion exchange sites).
- The eluent/sample mixture flows through the suppressor. There, detection sensitivity is enhanced by suppressing the conductivity of the eluent and enhancing the conductivity of the analyte. Regenerant flows continuously through the suppressor, restoring the ion exchange sites to their original state.
- The eluent/sample mixture then flows through the DS5, where the analytes are detected and a signal is produced and sent to PeakNet IA software.
- Finally, the eluent flows out of the cell and is directed into the regenerant reservoir, where it pressurizes the regenerant and forces it into the suppressor.

2.2.1 Displacement Chemical Regeneration (DCR)

Displacement Chemical Regeneration (DCR) is the process that regenerates the ability of the MMS III suppressor to suppress eluent. In DCR, the eluent/sample mixture that exits the cell is pumped into the regenerant reservoir. The eluent pressurizes the reservoir and pushes the regenerant into the suppressor. However, because the eluent is a different density than the regenerant, it remains separate.

In the anion DCR process (see Figure 2-8), the eluent/sample mixture is lighter than the regenerant and it remains on the top, forcing the regenerant to the bottom of the reservoir and out into the suppressor.

In the cation DCR process, the eluent/sample mixture is heavier than the regenerant and it flows to the bottom of the reservoir, displacing the regenerant and pushing regenerant out of the reservoir and into the suppressor.

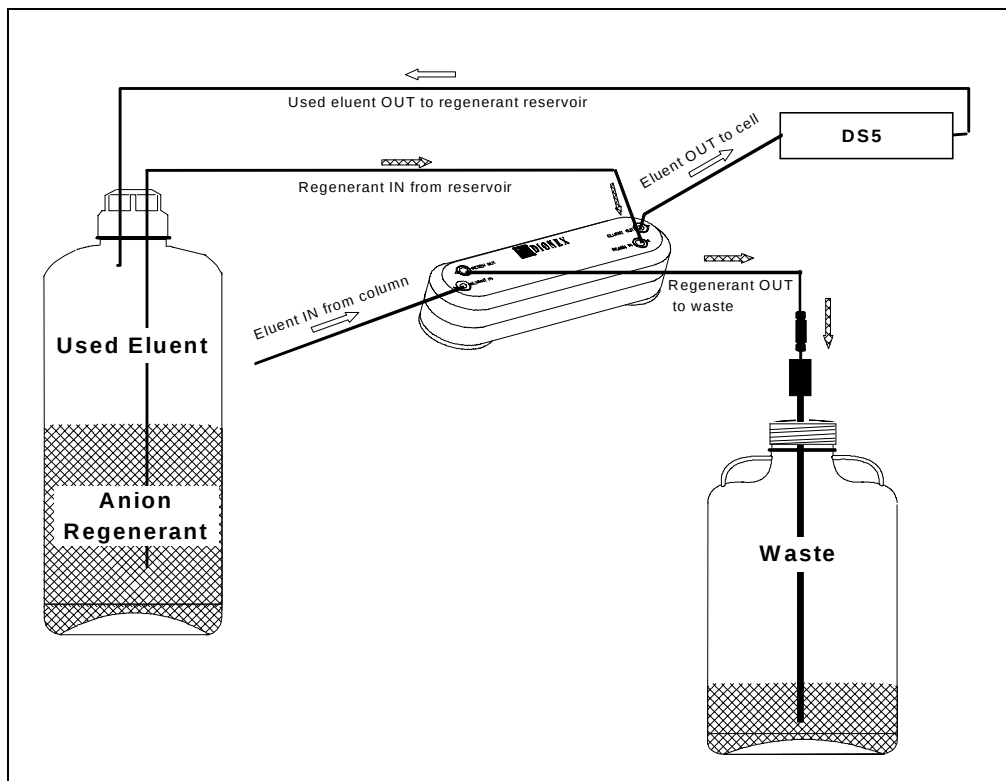


Figure 2-8. Anion Displacement Chemical Regeneration (DCR)

2.3 The PeakNet IA Interface

DX-80 operation is controlled remotely through PeakNet IA software. When PeakNet IA is started, a workspace similar to the one shown in Figure 2-9 will appear.

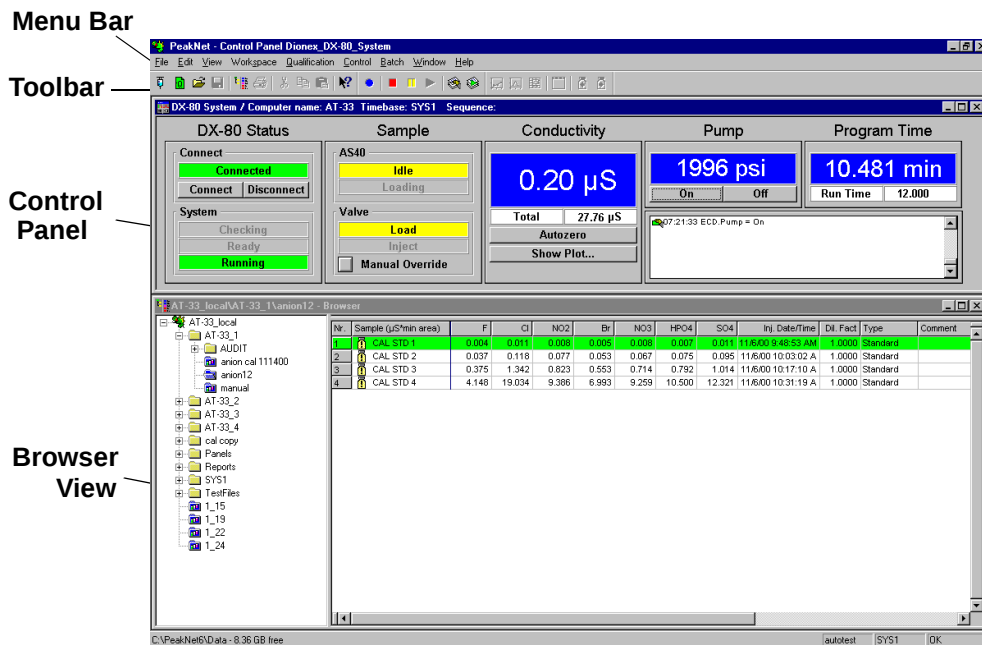


Figure 2-9. PeakNet IA Workspace

If your PeakNet IA configuration does not look like the window in Figure 2-9, open the Control Panel and the Browser, adjust the positions of the windows until they resemble the figure, and then save the workspace (using the Save Workspace command on the Workspace menu). For more information about workspaces, see the PeakNet IA online Help.

NOTE If a PeakNet IA data system is being used to control both an anion and a cation DX-80, you can configure the interface to toggle between the two Control Panels. See the online Help for more information.

2.3.1 PeakNet IA Menu Bar and Toolbars

Most DX-80 functions are accessed by selecting menu commands or by clicking buttons on the four toolbars shown in Figure 2-10.



Figure 2-10. PeakNet IA Menu Bar and Toolbars

Not all menu commands and toolbar buttons are available at all times. If a function is not available, the corresponding menu command and toolbar buttons are gray (or are not present). The following table describes all PeakNet IA toolbar functions.

Toolbar	Button	Name	Function
Standard Toolbar		New Sequence	Click to open the Sequence Wizard and create a new sequence.
		New Query	Click to open the Query Wizard and create a new query.
		Open	Click to open an existing file.
		Save	Click to save the open file.
		Browser	Click to open the Browser view.
		Print	Click to print the open file.
		Cut	Click to cut selected material.

Toolbar	Button	Name	Function
Standard Toolbar (contd.)		Copy	Click to copy selected material.
		Paste	Click to paste selected material.
		Help	Click and position cursor on an item to display context-sensitive Help.
Online Toolbar		Acquisition On/Off	Click to start and stop data acquisition.
		Stop Flow	Click to pause data acquisition.
		Hold	Click to pause data acquisition without stopping flow.
		Continue	Click to continue data acquisition.
		Edit Batch	Click to edit sample sequences and control their execution.
		Start/Stop Batch	Click to start and stop a sample batch.
Method Toolbar		Calibration Plot	Click to view a calibration plot.

Toolbar	Button	Name	Function
Method Toolbar (contd.)		Integration Plot	Click to view an integration plot (chromatogram).
		Printer Layout	Click to see the printer layout.
		Show Report	Click to show a report.
		Previous Chromatogram	Click to display the previous chromatogram.
		Next Chromatogram	Click to display the next chromatogram.
Integration Toolbar		Automatic Tool	Click to autoselect appropriate tools, depending upon the cursor position.
		Zoom	Click to zoom in on an area.
		Full Size	Click to scale the plot axes for optimal data display.
		Autoscale	Click to scale the axes to fit the window.

Toolbar	Button	Name	Function
Integration Toolbar (contd.)		Unzoom	Click to restore the previous zoom scale.
		Decoration	Click to set display options.

2.3.2 The DX-80 Control Panel

The DX-80 Control Panel (see Figure 2-11) is used to control and monitor DX-80 operation.

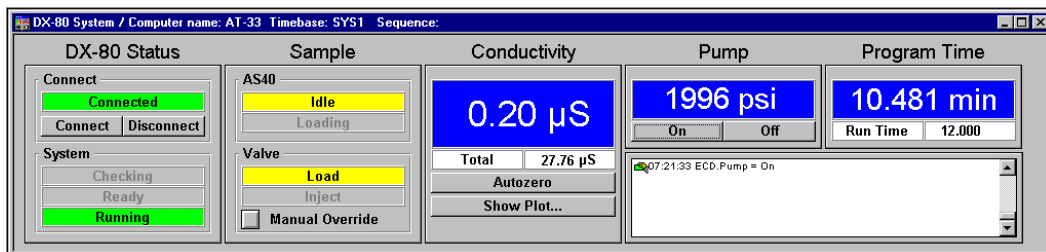


Figure 2-11. DX-80 Control Panel

From left to right, the Control Panel contains the following information and controls.

DX-80 Status

Connect:

- **Connect** and **Disconnect** buttons control the DX-80 connection to the PeakNet IA data system and determine whether there is communication between the DX-80 and the data system.
- Connection status is displayed above the buttons.

System:

- The current system status is highlighted (**Checking**, **Ready**, or **Running**).

Sample

AS40:

- AS40 Automated Sampler status is highlighted (**Idle** or **Loading**).

Valve:

- The position of the injection valve is highlighted (**Load** or **Inject**).
- The **Manual Override** button manually toggles the injection valve between load and inject.

Conductivity

- The offset conductivity and total conductivity are displayed.
- The **Autozero** button sets the conductivity to zero.
- The **Show Plot** button accesses the chromatogram view.

Pump

- The current pump pressure is displayed.
- **On** and **Off** buttons turn the pump on and off.

Program Time

- The total elapsed time when running a method is displayed.
- The total run time is displayed.

Audit Trail

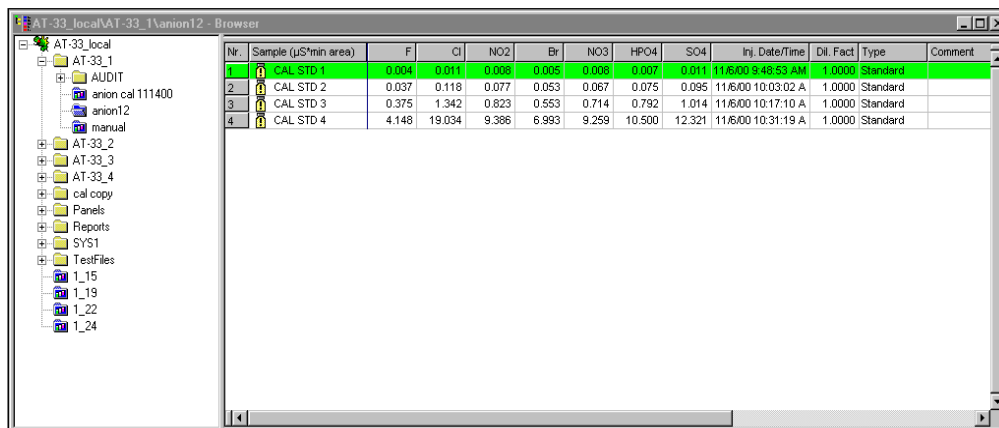
- The Audit Trail displays an account of every event that occurs during DX-80 operation: errors, status messages, operational events, etc.

2.3.3 The Browser

NOTE The PeakNet IA Browser looks and functions like Windows Explorer, but do not confuse the two. If you copy files from the PeakNet IA Browser into Explorer, the files will be corrupted.

The PeakNet IA Browser (see Figure 2-12) displays information about the samples that have been analyzed.

- The left pane of the Browser shows the directory tree structure. By clicking the '+' signs next to the folders and expanding the directory tree, you can access the anion or cation sample list, the Control Panel, Wellness Panel, and reports.
- The right pane displays information about the samples and calibrations that have been run.



The screenshot shows the PeakNet IA Browser window. The left pane displays a directory tree structure with folders like AT-33_local, AT-33_1, AUDIT, anion cal 111400, anion12, manual, AT-33_2, AT-33_3, AT-33_4, cal copy, Panels, Reports, SYS1, and TestFiles. The right pane displays a table with the following data:

Nr.	Sample (μS*min area)	F	Cl	NO2	Br	NO3	HPO4	SO4	Inj. Date/Time	Dil. Fact	Type	Comment
1	CAL STD 1	0.004	0.011	0.008	0.005	0.006	0.007	0.011	11/6/00 9:48:53 AM	1.0000	Standard	
2	CAL STD 2	0.037	0.118	0.077	0.053	0.067	0.075	0.095	11/6/00 10:03:02 A	1.0000	Standard	
3	CAL STD 3	0.375	1.342	0.823	0.553	0.714	0.792	1.014	11/6/00 10:17:10 A	1.0000	Standard	
4	CAL STD 4	4.148	19.034	9.386	6.993	9.259	10.500	12.321	11/6/00 10:31:19 A	1.0000	Standard	

Figure 2-12. PeakNet IA Browser View

NOTE If a PeakNet IA data system is being used to control both an anion and a cation DX-80, you can configure the interface to toggle between the two Browser views. See the PeakNet IA online Help for more information.

The table below lists the default column headings for the sample list (for both anion and cation sequences).

Column Heading	Description
Nr.	Sample number for a particular sample row
Sample	Sample name
Ions	Anions or cations (see table below)
Inj. Date/Time	Date and time of sample injection
Dil. Factor	Dilution factor for unknowns
Type	Type of sample (standard or unknown)
Comment	Any desired comments

The **Ions** column of the sample list includes the anion or cation compounds listed below. The amount of the ion present in the sample is indicated in mg/L (ppm).

Anion Compounds		Cation Compounds	
F	Fluoride	Li	Lithium
Cl	Chloride	Na	Sodium
NO ₂	Nitrite	NH ₄	Ammonium
Br	Bromide	K	Potassium
NO ₃	Nitrate	Mg	Magnesium
HPO ₄	Phosphate	Ca	Calcium
SO ₄	Sulfate		

3 • Operation and Maintenance

DX-80 Ion Analyzer operation is controlled through PeakNet IA software. However, three functions take place at the instrument:

- Eluent and regenerant preparation and/or reservoir installation
- On/off power control
- Sample or standard injection

3.1 Preparing Eluent and Regenerant

Your DX-80 is shipped with the appropriate Start-Up Kit (Anion DX-80 Start-Up Kit, P/N 057068; Cation DX-80 Start-Up Kit, P/N 057070). Each kit includes a 100 mL bottle of eluent and a 100 mL bottle of regenerant concentrate.

NOTE To replace the initial supply of eluent and regenerant, order a DX-80 Ion-I Reagent Refill Kit (Anion Refill Kit, P/N 057069; Cation Refill Kit, P/N 057071). The refill kit contains four bottles each of eluent and regenerant concentrate.

3.1.1 Mixing the Eluent

NOTE Make fresh eluent every two or three weeks, or as needed.

The anion DX-80 uses carbonate eluent. The cation DX-80 uses methanesulfonic acid (MSA) eluent. Follow the instructions below to prepare either anion or cation eluent.

1. Fill a 2-liter glass or polymeric volumetric flask about halfway with ASTM filtered, Type I (18-megohm) deionized (DI) water.



For acid concentrates (such as the cation eluent), always pour the concentrate into deionized water, not into the empty reservoir.



Pour les concentrés acides (comme l'éluant cationique), versez toujours le concentré dans de l'eau désionisée et non dans le réservoir vide.



Gießen Sie bei säurehaltigen Konzentraten (beispielsweise dem Kationenelutionsmittel) das Konzentrat immer in entionisiertes Wasser und nicht in den leeren Behälter.

2. Empty one bottle (100 mL) of eluent concentrate into the flask.

NOTE Eluent concentrate is provided in the Anion DX-80 Start-Up Kit (P/N 057068), Cation DX-80 Start-Up Kit (P/N 057070), Anion Refill Kit (P/N 057069), and Cation Refill Kit (P/N 057071).

3. Fill the concentrate bottle with DI water and empty the contents into the flask.
4. Continue to pour DI water into the flask until it reaches the 2-liter mark.
5. Mix the eluent concentrate with the DI water, and then transfer the contents to the eluent reservoir (P/N 057711).
6. Insert the stopper assembly tubing into the reservoir and tighten the stopper.

3.1.2 Mixing the Regenerant

The anion DX-80 uses a dilute sulfuric acid regenerant. The cation DX-80 uses tetrabutylammonium hydroxide (TBAOH) regenerant. Follow the instructions below to prepare either anion or cation regenerant.

1. Fill the regenerant reservoir (anion, P/N 057712; cation, P/N 057713) about halfway with ASTM filtered, Type I (18-megohm) deionized (DI) water.



For acid concentrates (such as the anion regenerant), always pour the concentrate into deionized water, not into the empty reservoir.



Pour les concentrés acides (comme le régénérant anionique), versez toujours le concentré dans de l'eau désionisée et non dans le réservoir vide.



Gießen Sie bei säurehaltigen Konzentraten (beispielsweise dem Anionen-Regeneriermittel) das Konzentrat immer in entionisiertes Wasser und nicht in den leeren Behälter.

2. Empty the entire bottle of concentrate into the reservoir.
3. Fill the concentrate bottle with DI water and empty the contents into the reservoir.
4. Continue to pour DI water into the reservoir until it is filled all the way to the top. If a few drops spill over, then it is full enough.



The regenerant reservoir must be filled all the way to the top at all times.

5. Insert the stopper assembly tubing into the reservoir and tighten the stopper.



Do not shake the regenerant reservoir to mix the contents. The DX-80 will stratify the contents.

3.1.3 Pressurizing the Eluent Reservoir

Two of the lines extending from the DX-80 rear panel must be connected to the lines extending from the eluent reservoir cap:

- The eluent inlet line carries eluent to the pump.
- The gas line delivers the gas that pressurizes the reservoir and forces eluent to the pump. A regulator inside the DX-80 regulates the gas to 0.07 MPa (10 psi).

Before beginning operation, verify that the clean gas supply is regulated to between 0.55 and 0.83 MPa (80 to 120 psi) and is connected to the gas line exiting the DX-80 rear panel. The DX-80 Ship Kit (P/N 057217) includes a fitting (P/N 039167) to connect the gas supply to the DX-80 gas line (see Section B.7).

3.2 Preparing Calibration Standards

PeakNet IA software supports two types of calibrations: four-level and six-level. A four-level calibration is appropriate for routine analyses with the DX-80. A six-level calibration is recommended if an analysis requires a more selective quantitation range.

3.2.1 Anion Standards for a Four-Level Calibration

The table below lists the standard concentrations for a four-level anion calibration.

Analyte	STD I (mg/L)	STD II (mg/L)	STD III (mg/L)	STD IV (mg/L)
F	0.02	0.20	2.00	20
Cl	0.10	1.00	10.0	100
NO ₂	0.10	1.00	10.0	100
Br	0.10	1.00	10.0	100
NO ₃	0.10	1.00	10.0	100
PO ₄	0.20	2.00	20.0	200
SO ₄	0.10	1.00	10.0	100

To prepare 100 mL of each of the four anion standards, follow the serial dilution instructions below. Use ASTM filtered, Type I (18-megohm) DI water.

Standard	Preparation
STD IV	Use the anion concentrate for STD IV.
STD III	Pipette 10 mL of STD IV into a 100 mL volumetric flask. Fill the flask with DI water to the mark and mix.
STD II	Pipette 10 mL of STD III into a 100 mL volumetric flask. Fill the flask with DI water to the mark and mix.
STD I	Pipette 10 mL of STD II into a 100 mL volumetric flask. Fill the flask with DI water to the mark and mix.

3.2.2 Cation Standards for a Four-Level Calibration

The table below lists the standard concentrations for a four-level cation calibration.

Analyte	STD I (mg/L)	STD II (mg/L)	STD III (mg/L)	STD IV (mg/L)
Li	0.01	0.05	0.50	5.00
Na	0.04	0.20	2.00	20.0
NH ₄	0.05	0.25	2.50	25.0
K	0.10	0.50	5.00	50.0
Ca	0.05	0.25	2.50	25.0
Mg	0.10	0.50	5.00	50.0

To prepare 100 mL of each of the four cation standards, follow the serial dilution instructions below. Use ASTM filtered, Type I (18-megohm) DI water.

Standard	Preparation
STD IV	Pipette 10 mL of cation concentrate into a 100 mL volumetric flask. Fill the flask with DI water to the mark and mix.
STD III	Pipette 10 mL of STD IV into a 100 mL volumetric flask. Fill the flask with DI water to the mark and mix.
STD II	Pipette 10 mL of STD III into a 100 mL volumetric flask. Fill the flask with DI water to the mark and mix.
STD I	Pipette 20 mL of STD II into a 100 mL volumetric flask. Fill the flask with DI water to the mark and mix.

3.2.3 Anion Standards for a Six-Level Calibration

The table below lists the standard concentrations for a six-level anion calibration.

Analyte	STD I (mg/L)	STD II (mg/L)	STD III (mg/L)	STD IV (mg/L)	STD V (mg/L)	STD VI (mg/L)
F	0.02	0.20	2.00	4.0	8.0	12.0
Cl	0.10	1.00	10.0	20.0	40.0	60.0
NO ₂	0.10	1.00	10.0	20.0	40.0	60.0
Br	0.10	1.00	10.0	20.0	40.0	60.0
NO ₃	0.10	1.00	10.0	20.0	40.0	60.0
PO ₄	0.20	2.00	20.0	40.0	80.0	120.0
SO ₄	0.10	1.00	10.0	20.0	40.0	60.0

To prepare 100 mL of each of the six anion standards, follow the serial dilution instructions below. Use ASTM filtered, Type I (18-megohm) DI water.

Standard	Preparation
STD VI	Pipette 30 mL of anion concentrate into a 50 mL volumetric flask. Fill the flask with DI water to the mark and mix.
STD V	Pipette 20 mL of anion concentrate into a 50 mL volumetric flask. Fill the flask with DI water to the mark and mix.
STD IV	Pipette 10 mL of anion concentrate into a 50 mL volumetric flask. Fill the flask with DI water to the mark and mix.
STD III	Pipette 5 mL of STD VI into a 50 mL volumetric flask. Fill the flask with DI water to the mark and mix.
STD II	Pipette 5 mL of STD III into a 50 mL volumetric flask. Fill the flask with DI water to the mark and mix.
STD I	Pipette 5 mL of STD II into a 50 mL volumetric flask. Fill the flask with DI water to the mark and mix.

3.2.4 Cation Standards for a Six-Level Calibration

The table below lists the standard concentrations for a six-level cation calibration.

Analyte	STD I (mg/L)	STD II (mg/L)	STD III (mg/L)	STD IV (mg/L)	STD V (mg/L)	STD VI (mg/L)
Li	0.01	0.05	0.5	1.5	3.0	5.0
Na	0.04	0.20	2.0	6.0	12.0	20.0
NH ₄	0.05	0.25	2.5	7.5	15.0	25.0
K	0.10	0.50	5.0	15.0	30.0	50.0
Ca	0.05	0.25	2.5	7.5	15.0	25.0
Mg	0.10	0.50	5.0	15.0	30.0	50.0

To prepare 100 mL of each of the six cation standards, follow the serial dilution instructions below. Use ASTM filtered, Type I (18-megohm) DI water.

Standard	Preparation
STD VI	Pipette 10 mL of cation concentrate into a 100 mL volumetric flask. Fill the flask with DI water to the mark and mix.
STD V	Pipette 30 mL of STD VI into a 50 mL volumetric flask. Fill the flask with DI water to the mark and mix.
STD IV	Pipette 25 mL of STD V into a 50 mL volumetric flask. Fill the flask with DI water to the mark and mix.
STD III	Pipette 5 mL of STD VI into a 50 mL volumetric flask. Fill the flask with DI water to the mark and mix.
STD II	Pipette 5 mL of STD III into a 50 mL volumetric flask. Fill the flask with DI water to the mark and mix.
STD I	Pipette 10 mL of STD II into a 50 mL volumetric flask. Fill the flask with DI water to the mark and mix.

3.3 Preparing Samples

3.3.1 Collecting and Storing

Collect samples in high density polyethylene containers that have been thoroughly cleaned with deionized (DI) water. Do not clean containers with strong acids or detergents; these will leave traces of ions on the container walls and the ions may interfere with analysis.

If you do not plan to analyze samples on the day they are collected, filter them through clean 0.45 µm filters immediately after collection. If you do not filter samples promptly, bacteria in the samples may cause changes in the ionic concentrations over time. Refrigerating the samples at 4° C will reduce, but not eliminate, bacterial growth.

Analyze samples containing nitrite or sulfite as soon as possible. Nitrite oxidizes to nitrate, and sulfite to sulfate, which increases the measured concentrations of these ions in the sample. In general, samples that do not contain nitrite or sulfite can be refrigerated for at least one week with no significant changes in anion concentrations.

3.3.2 Pretreating

Analyze rain water, drinking water, and air particulate leach solutions directly with no sample preparation (other than filtering and perhaps diluting them).

Filter groundwater and wastewater samples through 0.45 µm filters before injection, unless samples were filtered after collection.

Before injection, pretreat samples that may contain high concentrations of interfering substances by putting them through Dionex OnGuard™ cartridges. For instructions, refer to the *Installation and Troubleshooting Guide for OnGuard Cartridges* (Document No. 032943).

3.3.3 Diluting

Because the concentrations of ionic species in different samples can vary widely from sample to sample, no single dilution factor can be recommended for all samples of one type. In some cases (for example, many water samples), concentrations are so low that dilution is not necessary.

Use eluent or ASTM filtered, Type I (18-megohm) deionized water or eluent to dilute the sample. When using carbonate eluents, diluting with eluent minimizes the effect of the water dip at the beginning of the chromatogram. If you dilute the sample with eluent, use eluent from the same lot to prepare the calibration standards. This is most important for fluoride and chloride, which elute near the water dip.

To improve the accuracy of early eluting peak determinations (such as fluoride) at concentrations below 50 ppb, dilute standards in eluent or spike the samples with concentrated eluent to minimize the water dip. For example, spike a 100 mL sample with 1.0 mL of a 100 X eluent concentrate.

3.4 DX-80 Operation

3.4.1 Starting Up the DX-80

1. Make sure the eluent and regenerant reservoirs are filled, the caps are tightly screwed onto the reservoirs, and the lines connecting the eluent and regenerant reservoirs to the DX-80 lines are securely connected (see Figure B-5).
2. Make sure the clean gas line is regulated to 0.63 to 0.77 MPa (90 to 110 psi), and is connected to the gas line exiting the DX-80 rear panel.
3. Make sure the appropriate LAN cable is connected to the LAN connector on the DX-80 rear panel. See Section B.3 for installation instructions.
4. Press the power switch on the DX-80 rear panel (see Figure 2-2) to turn on the system power.

3.4.2 Starting Up the PeakNet IA Data System

1. Turn on the computer, if it is not already on. From the **Start** menu, select **Programs > PeakNet > PeakNet** to open PeakNet IA. A window similar to Figure 3-1 will open.

NOTE If the Calibration Test Results dialog box opens, click OK.

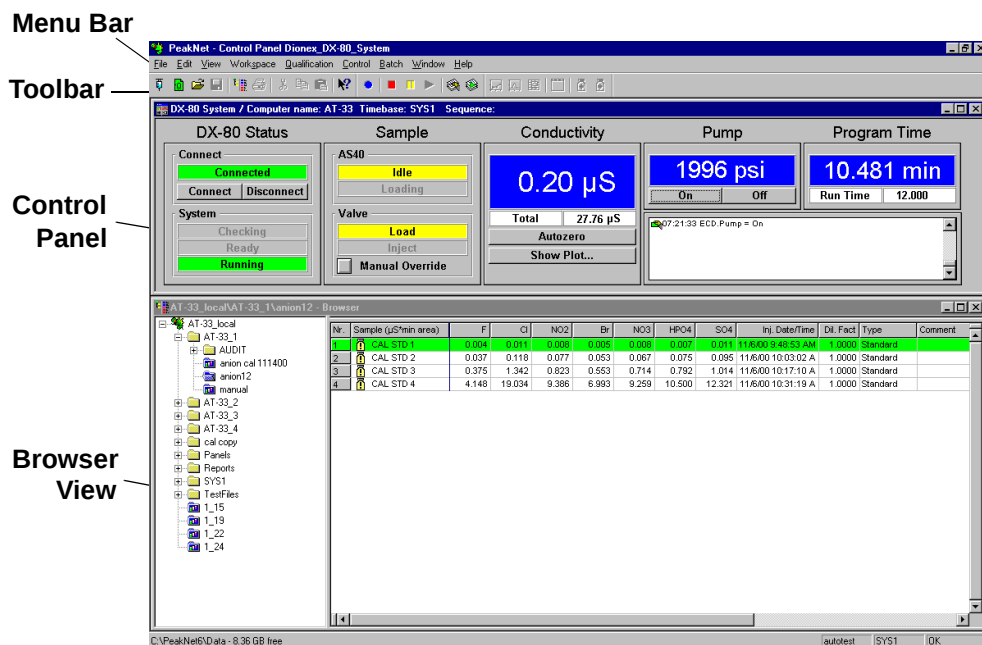


Figure 3-1. PeakNet IA

NOTE If your PeakNet IA workspace does not look like Figure 3-1, you can easily modify it. First, open both the Control Panel and the Browser. Adjust the positions of the panels until they resemble the view shown here, and then select **Workspace > Save Workspace**. For more information about workspaces, see the PeakNet IA online Help.

2. These are the conditions at power-up:
 - The pump is off.
 - The injection valve is in the Load position.
 - The DS5 is reading its current value.
3. When the system is on, check the Control Panel for the following:
 - The operating pressure should be 14 ± 2 MPa (2000 ± 300 psi).
 - The operating total conductivity background should be $<35 \mu\text{S}$ for an anion system or $<3 \mu\text{S}$ for a cation system.

3.4.3 Preparing the DX-80 for Operation

1. Turn on the pump by clicking the **On** button on the DX-80 Control Panel (see Figure 3-1).
2. Prime the pump (see Section B.10).
3. Allow the system to equilibrate for 30 minutes. During equilibration, the Control Panel displays the background conductivity (the conductivity of the eluent before sample injection). Offset the background and zero the reading by clicking the **Autozero** button on the Control Panel (see Figure 3-1).

NOTE If the DX-80 pump is running but no data is being collected, the flow rate will remain constant indefinitely. However, if the DX-80 receives no input from PeakNet IA (for example, you do not toggle the injection valve position or run a sequence) for 6 hours after data collection, the module enters standby mode.

In standby mode, the pump flow is reduced to 1/20th of the normal flow rate. To return to the normal flow rate (0.5 mL/min), either begin a new sequence or turn on the pump from the DX-80 Control Panel.

3.4.4 Sample Injection

This section describes three ways to inject sample into the DX-80.

Injection via a Syringe

1. Fill the 1 cc syringe (P/N 016388) provided in the DX-80 Ship Kit (P/N 057217) with a calibration standard or sample.
2. Insert the syringe into the injection port on the DX-80 front door (see Figure 2-1).
3. Overfill the sample loop with several sample loop volumes. Excess sample will exit through the injection valve waste line.
4. Leave the syringe in the port.
5. PeakNet IA will prompt you to start the injection process when a batch is started.

Injection via a Vacuum Syringe

1. Disconnect the waste line from port 6 of the injection valve (see Figure 5-1) and attach a shorter line (10 to 12 inches of PEEK or Teflon® tubing).
2. Place the free end of the line into the sample.
3. Insert the 1 cc syringe (P/N 016388) provided in the DX-80 Ship Kit (P/N 057217) into the injection port on the DX-80 front door (see Figure 2-1) and pull the plunger out to “suck” the sample into the injection valve.
4. PeakNet IA will prompt you to start the injection process when a batch is started.

Injection via the AS40 Automated Sampler

1. Open the DX-80 front door to access the component panel (see Figure 2-3). Connect the AS40 output line to port 5 of the injection valve (see Figure 5-1).
2. Load the injection valve sample loop. For instructions, see the *AS40 Automated Sampler Operator's Manual* (Document No. 034970).

3. PeakNet IA will automatically start the injection process when the AS40 injection method option is selected in the Sequence Wizard.

Post-Injection Events

By default, the following events occur after sample injection:

- The background conductivity is offset from the total, thereby zeroing the baseline conductivity value.
- If the AS40 Automated Sampler is connected, the TTL output sends out a pulse indicating that injection occurred.
- After 1 minute, the injection valve returns to the Load position.

3.5 Maintenance

This section describes routine maintenance procedures for the DX-80 that users can perform. All other maintenance procedures must be performed by Dionex personnel.

Daily

- Check the DX-80 component mounting panel (see Figure 2-3) for leaks or spills. Wipe up spills. Isolate and repair leaks (see Section 4.3). Rinse off any dried eluent or regenerant with deionized water.
- Check the waste container and empty when needed.

Weekly

- Check gas and fluid lines for crimping or discoloration. Relocate any pinched lines. Replace damaged lines.
- Check the junction between the pump head and the pump casting for evidence of liquid leaks. Normal friction and wear may gradually result in small liquid leaks around the piston seal. If unchecked, leaks can gradually contaminate the piston housing, causing the pump to operate poorly. If leaks occur, replace the piston seals (see Section 5.5).
- Make fresh eluent as needed.

Yearly

- Change the pump seals (see Section 5.5).
- Rebuild the injection valve (see Section 5.9).
- Replace the AS40 Automated Sampler tip and tubing. The ASM/AS40 Sample Tip Replacement Kit (P/N 040835) contains all of the components required to replace the sampling tip and the tubing between the tip and the injection valve. For instructions, see the *AS40 Automated Sampler Operator's Manual* (Document No. 034970).

As Needed

- Regularly check the eluent reservoir and refill it when needed.
- After refilling the eluent reservoir, the regenerant reservoir should also be emptied and refilled with regenerant.

4 • Troubleshooting

This chapter is a guide to troubleshooting problems that may occur while operating the DX-80 Ion Analyzer.

- Section 4.1 describes the error messages displayed in the PeakNet IA Audit Trail.
- Section 4.2 describes how to use the PeakNet IA Wellness Panel to monitor system functions and perform calibrations and diagnostics.
- The remaining sections in this chapter describe other operating problems and how to resolve them.

If you are unable to eliminate a problem, contact Dionex for help. In the U.S., call Dionex Technical Support at 1-800-346-6390. Outside the U.S., call the nearest Dionex office.

4.1 Alarms and Error Conditions

If any of the alarm conditions described here occurs, PeakNet IA displays a message in the Audit Trail.

- **PUMP OVER PRESSURE ALARM**

The DX-80 has a maximum system pressure limit of 21 MPa (3000 psi). If the system pressure exceeds the limit for at least 0.5 second, PeakNet IA will stop the pump and the following error message will appear in the Audit Trail:



The system pressure has exceeded the limit.

To troubleshoot:

1. Check for blockages in the liquid lines by working your way backward from the cell to the pump (see Figure 2-7 for the flow schematic).
2. Restart the pump from the DX-80 Control Panel.

- **PUMP UNDER PRESSURE ALARM**

The system pressure has fallen below the low pressure limit of 4.2 MPa (500 psi). PeakNet IA will stop the pump and display the following error message in the Audit Trail:



The pump has lost prime.

To troubleshoot:

1. Make sure the eluent reservoir is full.
2. Check for liquid leaks (see Section 4.3).
3. Prime the pump (see Section B.10).
4. Restart the pump from the DX-80 Control Panel.

- **OVER CONDUCTIVITY**

This message usually appears for the first few minutes after the DX-80 is started. If the message appears at other times, it indicates a problem.



Conductivity exceeds limit.

To troubleshoot:

1. Perform the suppressor quickstart procedure:
 - a. Disconnect the separator column outlet line and connect it to the DS5 cell inlet line.
 - b. Turn on the pump from the DX-80 Control Panel and allow the suppressor to regenerate for 5 minutes.
 - c. Turn off the pump and allow the suppressor to hydrate for 5 minutes.
 - d. Reconnect the separator column outlet line and cell inlet line.
2. If the high background persists:
 - Prepare fresh eluent (see Section 3.1.1).
 - Prepare fresh regenerant (see Section 3.1.2).

- Verify the cell calibration by pumping DI water through the cell (bypassing the consumables). The total background should be less than 1.0 μ S.
 - Perform the suppressor off-line regeneration procedure. For instructions, refer to the suppressor manual.
 - If the problem persists, replace the suppressor (see Section 5.13).
- **LOAD/INJECT VALVE ERROR**

If the injection valve fails to switch positions within 1 second of being toggled, the DX-80 Moduleware will report an error to PeakNet IA and the following error message will be displayed in the Audit Trail:



Load/inject valve error.

To troubleshoot:

1. If a sequence is being executed, terminate the sequence by selecting **Stop** from the **Batch** menu.
2. Turn off the DX-80 power briefly and then restart.
3. Try to toggle the valve from Load to Inject by clicking the **Manual Override** button on the Control Panel.
4. If the problem persists, call Dionex for assistance.

- **SYSTEM CHECK ALARM**

The system has been unable to reach the ready state after 10 minutes because the conductivity is too high. The conductivity should be below 35 μS for anion systems or below 3 μS for cation systems. PeakNet IA will stop the pump and display the following error message in the Audit Trail:



The system ready state could not be reached.

To troubleshoot:

1. Make sure the regenerant flow is on.
2. If the problem still continues, make fresh eluent (see Section 3.1.1).
3. If the problem continues, make fresh regenerant (see Section 3.1.2).
4. If the problem continues, replace the suppressor.
5. Contact Dionex if none of these solutions eliminates the problem.

- **DRIFT ALARM**

If the baseline shows drift, PeakNet IA will display the following error message in the Audit Trail:



The drift during this injection was outside the recommended limit.

To troubleshoot:

1. Follow the instructions in Section 4.14.

- **NOISE ALARM**

If there is baseline noise, PeakNet IA will display one of the following error messages in the Audit Trail:



The noise during this injection was outside the recommended limit.



The noise during this injection approached the recommended limit.

To troubleshoot:

1. Follow the instructions in Section 4.14.

4.2 Diagnostics and Calibrations

PeakNet IA allows you to perform online calibration and diagnostic procedures and to monitor DX-80 functions from the Wellness Panel (see Figure 4-1).

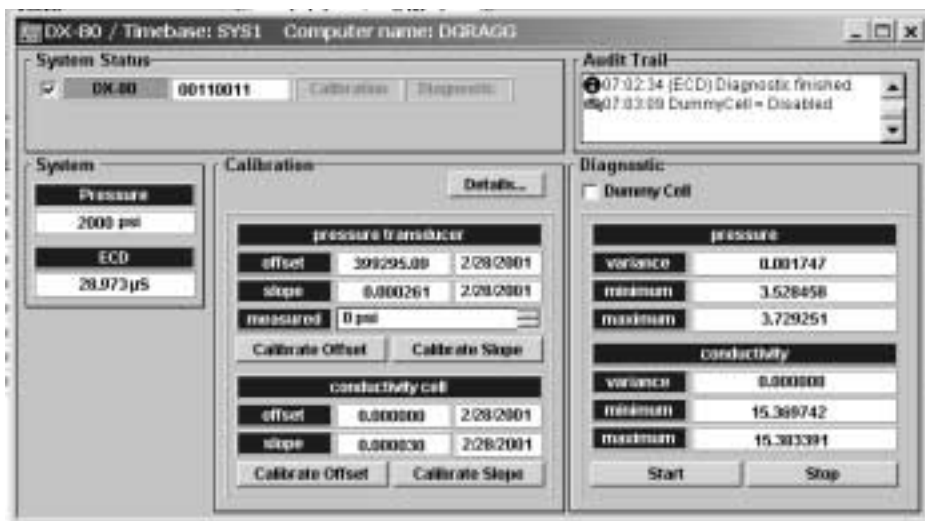


Figure 4-1. PeakNet IA Wellness Panel

Use the Wellness Panel to monitor and/or perform the following:

- | | |
|----------------------|---|
| System Status | <ul style="list-style-type: none">• The check box to the left of the DX-80 LED indicates connectivity status. When the check box is gray, there is no connectivity between the DX-80 and the PeakNet IA data system.• The DX-80 serial number is displayed to the right of the DX-80 LED.• While a calibration or diagnostic procedure is running, the Calibration or Diagnostic LED is lighted. |
| Audit Trail | <ul style="list-style-type: none">• The Audit Trail displays an account of every event that occurs during DX-80 operation: errors, status messages, operational events, etc. |
| System | <ul style="list-style-type: none">• The current total system Pressure is displayed.• The current electrochemical detector (ECD) conductivity is displayed. |
| Calibration | <ul style="list-style-type: none">• Pressure Transducer<ul style="list-style-type: none">• The offset, slope, and date of the last calibration are displayed.• Enter the measurement against which you want to calibrate the pressure transducer in the Measured field.• Click the Calibrate Offset or Calibrate Slope button to calibrate the pressure transducer (see Section 5.8).• Conductivity Cell<ul style="list-style-type: none">• The offset, slope, and date of the last DS5 calibration are displayed.• Click the Calibrate Offset or Calibrate Slope button to calibrate the cell (see Section 5.11).• Click the Details button to open a window that displays the factory-set calibration values, the current values, and the last prior set of calibration values. The factory and last set of calibration values can be downloaded from this window. |

Diagnostic

- The last calibrated **pressure** and **conductivity variance, minimum**, and **maximum** readings for the DS5 are displayed.
- Click the **Start** button to calibrate the DS5. Click the **Stop** button to stop the calibration.
- To determine the conductivity variance of the electronics alone, select the **Dummy Cell** box and then click **Start** to run a calibration on the dummy cell.

4.3 Liquid Leaks

- **Leaking fitting**

Locate the source of the leak. Tighten or, if necessary, replace the liquid line connection (see Section 5.1). Refer to *Installation of Dionex Ferrule Fittings* for tightening requirements.

- **Broken liquid line**

Replace the line and fittings (see Section 5.1).

- **Blocked or improperly installed line**

Make sure the lines are not crimped or otherwise blocked. Also, if the blocked line is a waste line, make sure it is not elevated at any point after it exits the DX-80. If a line is blocked, replace it (see Section 5.1).

- **Loose pump check valve housing**

Make sure the check valves are firmly seated in the pump head. If they are not, tighten them carefully with an open end wrench just until the leak stops.

- **Damaged pump piston seal**

1. Replace the piston seal (see Section 5.5).
2. If the problem persists, replace the piston (see Section 5.6).

- **Pump head not tight against casting**

Carefully tighten the pump head mounting nuts just until the leak stops. **DO NOT OVERTIGHTEN!**

- **Leaking pressure transducer**

Make sure the liquid line connections into the pressure transducer are tight. (Refer to *Installation of Dionex Ferrule Fittings* for tightening requirements.) Replace any damaged fittings.

- **Leaking pump head waste valve**

Make sure the waste valve is closed. To close the valve, turn the knob clockwise, just until tight. **DO NOT OVERTIGHTEN! Overtightening may damage the valve and the pump head.**

Inspect the pump head. If the waste valve is the source of the leak, replace the waste valve O-ring (see Section 5.7).

- **Leaking MMS III**

Refer to the suppressor manual for troubleshooting procedures.

- **Leaking injection valve**

Make sure the liquid line connections to the transducer are tight. (Refer to *Installation of Dionex Ferrule Fittings* for tightening requirements.) Replace any damaged fittings.

Liquid leaks from behind the valve stator may indicate a scratched rotor seal. Contact Dionex for assistance.

- **Leaking DS5**

Check the waste lines for blockage; trapped particles can plug the lines and cause a restriction and/or leak. If necessary, clear the waste lines by reversing the direction of flow.

Make sure the plumbing downstream from the cell is clear; a blockage may overpressurize the cell, causing it to leak. If the problem continues, contact Dionex for assistance.

4.4 Pump Difficult to Prime or Loses Prime

- **Empty reservoir and/or no eluent connected**

Fill the reservoir. Make sure all connections are secure.

- **Eluent reservoir not pressurized**

Make sure the gas line is properly connected to the reservoir and the inlet gas supply is regulated to 0.63 to 0.77 MPa (90 to 110 psi). Make sure the eluent reservoir cap is screwed on tightly.

- **Dirty check valve**

Clean and/or replace the pump check valve (see Section 5.4).

- **Liquid leaks at junction between pump head and pump casting**

Replace the piston seal (see Section 5.5).

4.5 Pump Does Not Start

- **No power (front door Power LED indicator is not lit)**

Check that the power cord is plugged in.

Check the main power fuses and replace if needed (see Section 5.13).

- **No communication between DX-80 and PeakNet IA (Link LED on rear panel is not lit)**

- A LAN cable(s) is the wrong type.

Use a crossover 10BASE-T LAN cable (P/N 960280) to connect one DX-80 to a computer on a private LAN (see Section B.3.1).

Use straight-through 10BASE-T LAN cables (P/N 960281) to connect two DX-80s to a private LAN (see Section B.3.1) or an office LAN (see Section B.3.3).

IMPORTANT

Dionex 10BASE-T LAN cables are Category 5 unshielded twisted-pair cables. Do not substitute cables of an inferior grade. Failure to use the correct cable will cause the DX-80 to lose communication with other devices.

- Ethernet hub connections are incorrect.

Make sure the power to the hub is turned on.

Check that all connections to the hub are made with straight-through 10BASE-T LAN cables (P/N 960281) and that the connections are not loose.

IMPORTANT

Dionex 10BASE-T LAN cables are Category 5 unshielded twisted-pair cables. Do not substitute cables of an inferior grade. Failure to use the correct cable will cause the DX-80 to lose communication with other devices.

If the DX-80 system is connected to an office LAN, check the following:

- Make sure the cable from the office LAN 10BASE-T port is connected to the Uplink (or MDI) port on the hub.
- Make sure the Normal/Uplink push button on the hub is set to Uplink. (If the push button is labeled MDI/MDI-X, set it to the MDI position.)

4.6 No Flow

- **Pump not primed**

Prime the pump (see Section B.10).

- **Broken pump piston**

Replace the piston (see Section 5.6).

4.7 Erratic Flow

- **Pump needs priming**

Prime the pump (see Section B.10).

- **Damaged piston seal**

Replace the piston seal (see Section 5.5).

- **Dirty pump check valve**

Clean or replace the check valve (see Section 5.4).

4.8 Excessive System Backpressure

- **Restriction in the system plumbing**

Check all liquid lines for crimping or blockage. Make sure the ferrule fittings are not overtightened onto tubing. Refer to *Installation of Dionex Ferrule Fittings* for tightening requirements.

- **Plugged or damaged fitting**

Isolate the faulty fitting by loosening fittings, one-by-one, until the pressure returns to normal. Repair or replace the fitting (see Section 5.1).

- **Flow rate through the columns too high**

Measure the pump flow rate, using a 10 mL graduated cylinder and stopwatch. If the flow rate is not 0.5 mL/min, contact Dionex for assistance.

- **Clogged column bed supports**

Refer to the instructions in the column manual for troubleshooting guidance.

- **Contaminated columns**

Clean the columns as instructed in the column manual.

- **Plugged Rheodyne valve passages**

Contact Dionex for assistance.

4.9 Peak “Ghosting”

Ghosting is the appearance of extraneous peaks in a chromatogram. These may be late-eluting peaks from a previous injection or they may result from a contaminated, malfunctioning, or incorrectly installed injection valve. These peaks may co-elute with peaks of interest, resulting in nonreproducible peak heights and areas.

- **Insufficient time between sample injections**

Wait until the previous sample has been completely eluted before making another injection.

- **Insufficient flush between samples**

Flush the sample loop with at least 10 loop volumes of deionized water or sample between sample injections.

- **Incorrect or contaminated standards**

Remake standards (see Section 3.2).

- **Incorrect or contaminated eluent**

Remake the eluent (see Section 3.1.1).

- **Malfunctioning injection valve**

Contact Dionex for assistance.

4.10 Nonreproducible Peak Height or Retention Time

- **Column overloading**

Dilute the sample (see Section 3.3.3).

- **Liquid leaks**

Locate and eliminate leaks (see Section 4.3).

- **Incomplete or imprecise filling of the sample loop**

1. Fill the sample loop until excess sample exits the waste line.
2. Inspect the 1 cc syringe (P/N 016388) and replace if damaged.

- **Pump not primed properly**

Prime the pump (see Section B.10).

4.11 Abnormal Retention Time or Selectivity

- **Contaminated or incorrect eluent**

Remake the eluent, using concentrated eluent and ASTM filtered, Type I (18-megohm) deionized water (see Section 3.1.1).

- **Contaminated or degraded sample**

Take appropriate precautions when preparing and storing samples to prevent contamination and degradation (see Section 3.3).

- **Contaminated column**

1. Clean the column as instructed in the column manual.
2. If cleaning is unsuccessful, replace the column.

4.12 No DS5 Response

- **DS5 not properly installed**

Make sure the DS5 is plugged into the component mounting panel and screwed down until the bottom of the DS5 is flush against the sheet metal panel (see Figure 2-3 and Figure 2-4).

- **No flow from pump**

Several conditions may cause this condition; see Section 4.5 and Section 4.6 for details.

- **Cell electronics malfunctioning**

Use the PeakNet IA Wellness Panel diagnostics to switch to the dummy cell (see Section 4.2 and the PeakNet IA online Help for instructions). You should see a flat line that is very quiet. If the line is outside the tolerance range (less than 1 μ S), the electronics are malfunctioning. Call Dionex for assistance.

4.13 High DS5 Output

- **Background not suppressed by suppressor**

If **Conductivity exceeds limit** is displayed in the PeakNet IA Audit Trail, follow the instructions in Section 4.1. Refer to the suppressor manual for additional troubleshooting guidance.

- **Sample concentration too high**

Dilute the sample (see Section 3.3.3).

- **Wrong eluent or regenerant**

Check that you are using the correct eluent and regenerant for your system (see Section 3.1).

- **Cell out of calibration**

Recalibrate the cell from the PeakNet IA Wellness Panel (see Section 5.11).

4.14 Baseline Noise or Drift

- **Flow system leak; erratic baseline**

Check all fittings and liquid lines for leaks. Tighten or, if necessary, replace all liquid line connections. Refer to *Installation of Dionex Ferrule Fittings* for tightening requirements.

- **Trapped gases**

Release any trapped gases in the cell by loosening the lines to and from the cell and then retightening them. Also loosen and retighten the fittings to and from the MMS eluent ports.

- **Pump not properly primed**

Prime the pump (see Section B.10).

- **Contaminated or incorrect eluent and/or regenerant**

Remake the eluent and regenerant (see Section 3.1).

- **Rapid changes in ambient temperature**

If the ambient temperature does not meet specification (10 to 35 °C), make sure air conditioning and heating vents are directed away from the DX-80.

- **Insufficient system equilibration following changes to operating parameters; especially apparent when operating at high sensitivities**

Allow a longer system equilibration time (up to 2 hours) before starting operation.

- **Incorrect suppressor operating conditions**

Refer to the suppressor manual for troubleshooting information.

- **Cell above or below set point**

Call Dionex for assistance.

- **Damaged piston seal**

Replace the piston seal (see Section 5.5).

- **DCR waste backpressure tubing not installed**

Check that the tubing is connected to the end of the suppressor waste line (see Section B.5).

This chapter describes routine service procedures that users can perform. Other service procedures must be performed by Dionex personnel.

NOTE The DX-80 Ion Analyzer electronics components cannot be serviced by the user. Repair of electronics components must be performed by Dionex.

Before replacing any part, refer to the troubleshooting information in Chapter 4 to isolate the cause of the problem. When ordering replacement parts, please include the DX-80 model number and serial number. To contact Dionex in the U.S., call 1-800-346-6390. Outside the U.S., call the nearest Dionex office.

Substituting non-Dionex parts may impair DX-80 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

The DX-80 is plumbed with the tubing and tubing assemblies listed below.

Tubing Size and Type	Used For
0.125-mm (0.005-in) ID PEEK (P/N 044221)	Connection from pump pulse damper to injection valve
0.25-mm (0.010-in) ID PEEK (P/N 042690)	Connections between other system components
0.30-mm (0.012-in) ID Tefzel® (P/N 048904)	Connection from injection port to injection valve
0.75-mm (0.030-in) ID PEEK (P/N 044777)	Connection from injection valve to waste

- 10-32 fittings (P/N 043275) and ferrules (P/N 043276) are used for most tubing connections. For tightening requirements, refer to *Installation of Dionex Ferrule Fittings*.
- 1/8-in fittings (P/N 052267) and ferrules (P/N 048949) are used for connections to the MMS III **REGEN OUT** port and the eluent and regenerant reservoirs.
- 1/16-in fittings (P/N 052230) and ferrules (P/N 052231) are used for connections from the injection port to the injection valve.

5.2 Changing the Sample Loop

Figure 5-1 shows the injection valve connections. The injection valve is plumbed at the factory with all tubing and fittings required for connections to the pump, injection port, and column. A 10 μ L PEEK sample loop (P/N 042857) is installed between ports 1 and 4. Always replace the pre-installed 10 μ L loop with another of the same size.

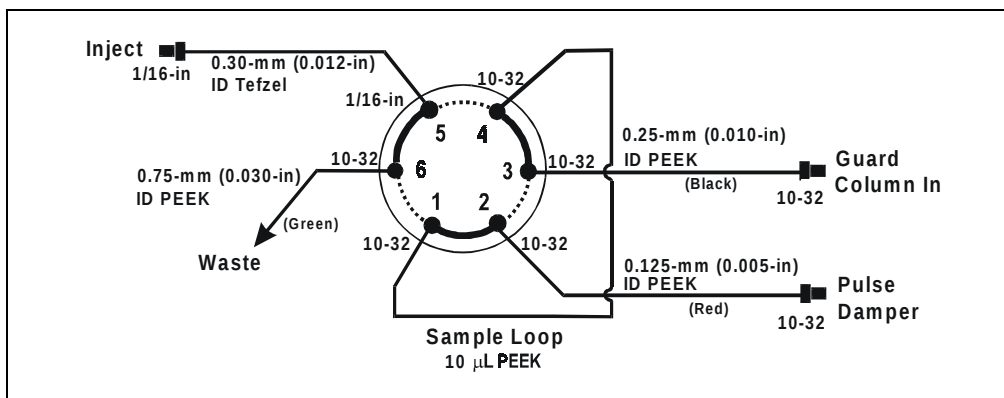


Figure 5-1. Injection Valve Plumbing

1. Turn off the pump from the DX-80 Control Panel.
2. Open the DX-80 front door.
3. Disconnect the sample loop from ports 1 and 4 on the injection valve (see Figure 5-1).
4. Install the new sample loop between ports 1 and 4 on the injection valve.
5. Make sure the loop is tightly coiled, allowing the door to close securely.
6. Close the front door.
7. Turn on the pump from the DX-80 Control Panel.

5.3 Isolating a Restriction in the Liquid Plumbing

A restriction in the liquid plumbing will cause excessive system backpressure.

1. Begin pumping eluent through the system (including the columns).
2. Follow the DX-80 flow schematic (see Figure 2-7) and work backward through the system, beginning at the cell exit. One at a time, loosen each fitting and observe the pressure. The connection at which the pressure drops abnormally indicates the point of restriction.

If the restriction has caused such high pressure that the system cannot be operated, you must work forward through the flow schematic, adding parts one at a time until an abnormal pressure increase (and hence, the restriction) is found.

3. If the restriction is in the tubing or fitting, remove the restriction by back flushing or by replacing the tubing or fitting.

5.4 Cleaning and Replacing Pump Check Valves

A dirty check valve causes an erratic flow rate. It may also cause the pump to lose prime and/or be difficult to reprime.

1. Prime the pump (see Section B.10). If the pump does not stay primed, go to the next step.
2. Turn off the power switch on the DX-80 rear panel and disconnect the power cord.
3. Open the front door of the DX-80.
4. Disconnect the tube fittings from both the inlet and outlet pump check valve housings (see Figure 5-2).
5. Using a 1/2-in box wrench or an adjustable wrench, carefully remove both check valve housings from the pump head.
6. Place the check valves in a beaker of methanol and sonicate or agitate for several minutes.
7. Rinse each check valve thoroughly with filtered, deionized water.

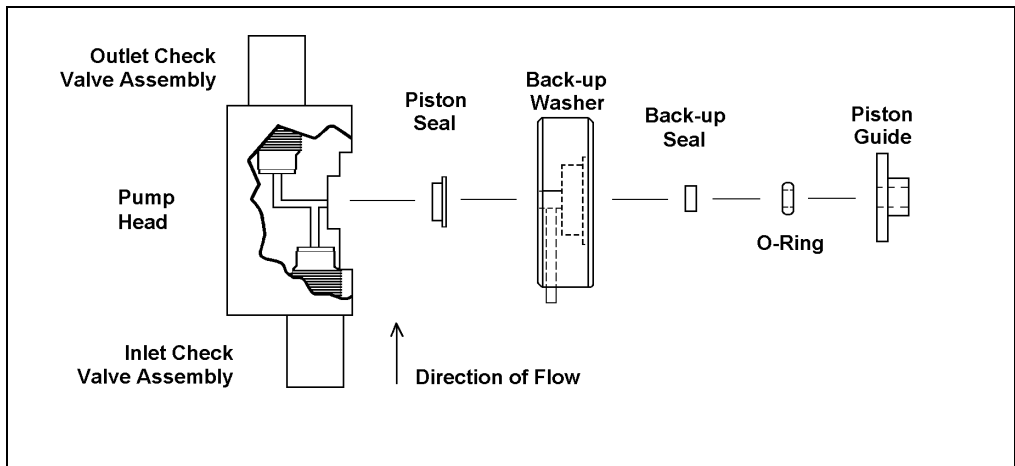


Figure 5-2. Pump Head Assembly (P/N 057853)

8. Reinstall the check valves in the pump head and tighten just enough to seat. (Be sure to install the inlet check valve on the bottom of the head and the outlet check valve on the top.)



Overtightening may damage the pump head or the check valve housing and crush the check valve seats.

9. Reconnect the liquid lines. Close the front door.
10. Reconnect the power cord and turn on the power switch.
11. Prime the pump (see Section B.10). If the pump will not prime, and you have eliminated all other possible causes of the problem, replace both check valves (inlet check valve, P/N 047660; outlet check valve, P/N 047661).

5.5 Replacing a Pump Piston Seal

A damaged piston seal allows leakage around the piston at the head mounting plate or around the base of the pump head. Flow rates will be unstable and there may be baseline noise.

1. Turn off the power switch on the DX-80 rear panel. Disconnect the power cord.
2. Open the DX-80 front door.
3. Disconnect the tube fittings from the inlet and outlet check valves (see Figure 5-2).
4. Hold the head firmly against the pump housing, to compensate for the spring loading, and remove the two nuts.



Lateral motion when disengaging the head from the piston can break the piston.

5. Slowly release the head, allowing it to separate from the housing.
CAREFULLY disengage the head from the sapphire piston by pulling the head straight off and away from the mounting guides. Be especially careful not to snap the piston if the internal spring is stuck to the piston guide.
6. Place the head, front end down, on a clean work area. Lift off the piston guide and back-up washer to expose the seal (see Figure 5-2 and Figure 5-3).
7. Remove the piston seal from the head. Discard the seal.
8. Remove the O-ring and back-up seal from the back-up washer.

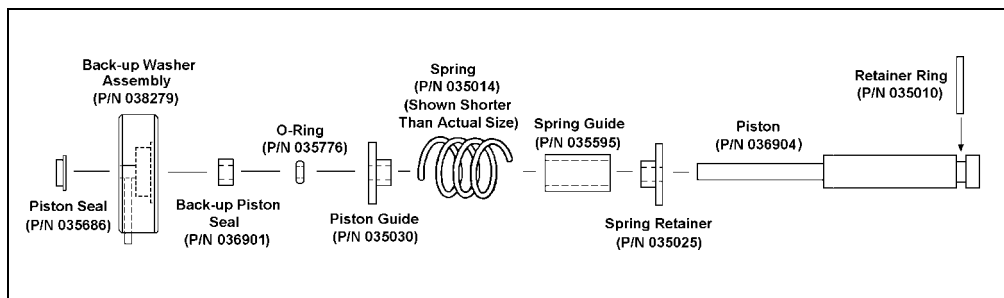


Figure 5-3. Piston Assembly

9. Carefully push the new piston seal (P/N 055870) into the head. When properly installed, the piston seal is almost flush with the indented surface of the head.
10. Press a new back-up seal (P/N 036901) into the O-ring (P/N 035776). If necessary, also replace the O-ring. Then press the O-ring and back-up seal into the back-up washer (P/N 057233).
11. Press the back-up washer into the head, followed by the piston guide (P/N 035030).
12. Remove the spring, spring guide, spring retainer, and piston from the pump housing (see Figure 5-3). Inspect the interior of the housing for liquid and corrosion. Clean up any spills and carefully clean any signs of corrosion from the interior of the housing.
13. Clean and inspect the piston. If it is scored or scratched, replace it (see Section 5.6).
14. Reinstall the piston, spring retainer, spring guide, and spring in the pump housing.
15. Carefully slide the pump head straight onto the mounting guides. Guide the spring onto the piston guide. Apply gentle pressure to push the piston through the seal.



Avoid all lateral motion when sliding the head onto the piston. Failure to slide the head straight on will break the piston and also damage the piston seal and back-up seal.

16. Hold the head firmly against the pump housing and replace the two nuts. Use a wrench to tighten them evenly.
17. Reconnect the liquid lines to the inlet and outlet check valves on the pump head assembly (see Figure 5-2).
18. Reconnect the power cord and turn on the power switch.
19. Prime the pump (see Section B.10).

5.6 Replacing a Pump Piston

Continued leaking from around the pump head after replacing the piston seal indicates a scratched or broken piston.

1. Turn off the power switch on the DX-80 rear panel. Disconnect the power cord.
2. Open the DX-80 front door.
3. Disconnect the tube fittings from the inlet and outlet check valves (see Figure 5-2).
4. While holding the head firmly against the pump housing to compensate for the spring loading, remove the two nuts.



Lateral motion when disengaging the head from the piston can break the piston.

5. Slowly release the head and allow it to separate from the housing. **CAREFULLY** disengage the head from the sapphire piston by pulling the head straight off and away from the mounting guides. Be especially careful not to snap the piston if the spring is stuck to the piston guide.
6. Remove the piston guide, spring, spring guide, spring retainer, and piston by pulling them straight out, away from the pump housing (see Figure 5-3).
7. If the piston is broken, replace the piston seal and the back-up seal (see Section 5.5). This will prevent pieces of broken piston from scratching the new piston assembly.
8. Remove the retainer ring (P/N 035010) from the old piston assembly and install it on the new piston assembly (P/N 036904).
9. Carefully slide the spring retainer onto the piston assembly.
10. Slide the assembled piston back into the piston housing.
11. Slide the spring over the piston, positioning it flush against the spring retainer.

12. Carefully slide the pump head straight onto the alignment rods. Guide the spring over the piston guide. Gently push the piston through the seal.



Avoid all lateral motion when sliding the head onto the piston. Failure to slide the head straight on will break the piston, as well as damage the piston seal and back-up seal.

13. Hold the head firmly against the pump housing and replace the two nuts. Use a wrench to tighten them evenly.
14. Reconnect the liquid lines to the check valve housings.
15. Reconnect the power cord and turn on the power switch.
16. Prime the pump (see Section B.10).

5.7 Replacing the Waste Valve O-Ring

A damaged O-ring causes leakage around the base of the waste valve knob.

1. Turn off the pump from the DX-80 Control Panel.
2. Open the front door of the DX-80.
3. Turn off the gas pressure to the eluent reservoir.
4. Remove the valve from the pump head housing by turning the knob counterclockwise until it comes loose from the housing (see Figure 5-4).
5. Remove the O-ring.

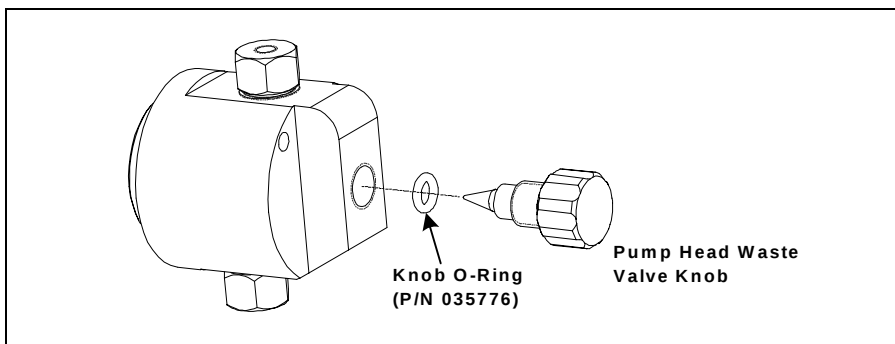


Figure 5-4. Pump Head Assembly

6. Carefully slide a new O-ring (P/N 035776) over the end of the valve and push it into the groove.
7. Reinstall the valve in the pump head housing, turning the knob clockwise until the valve is firmly seated. **Do not overtighten the valve knob.**
8. Turn on the gas pressure to the eluent reservoir.
9. Close the DX-80 front door.
10. Prime the pump (see Section B.10).

NOTE If the pump head leaks after replacing the waste valve O-ring, the valve knob may not have been seated firmly enough. Tighten the knob further, but only by hand. Never use a tool.

5.8 Calibrating the Pressure Transducer

NOTE About 10 minutes before starting this calibration procedure, click the **Manual Override** button on the DX-80 Control Panel in PeakNet IA a few times. This removes any air or contaminant buildup in the injection valve loop.

1. Turn off the pump flow.
2. Open the waste valve on the front of the pump head.
3. Open the DX-80 Wellness Panel in PeakNet IA (see Figure 4-1).
4. Click the **Calibrate Offset** command button under **pressure transducer**. The pump calibrates the transducer and uploads the new value to the PeakNet IA Data System. The new offset is stored as the current value.
5. Close the waste valve.
6. Connect a pressure gauge between the pump outlet and the pressure transducer. Turn on the pump and let the system stabilize. Note the average pressure reading on the gauge, and enter this reading in the **measured** field.
7. Click the **Calibrate Slope** command button under **pressure transducer**. The pump calibrates the slope and uploads the new value to the Dionex Data System. The new slope is stored as the current value.

8. Turn off the pump.
9. Disconnect the pressure gauge. Reconnect the pressure transducer to the pump.

5.9 Rebuilding the Injection Valve

Dionex recommends rebuilding the injection valve annually. The LC25 Injection Valve Maintenance Kit (P/N 055676) contains all required replacement parts.

NOTE Substitution of non-Dionex parts may impair valve performance and void the product warranty.

1. Turn off the pump from the DX-80 Control Panel.
2. Open the front door of the DX-80.
3. Disconnect each liquid line connected to the injection valve.
4. Follow the instructions provided in the LC25 Injection Valve Maintenance Kit (P/N 055676) to replace the rotor seal, isolation seal, and stator face.
5. Reconnect all liquid lines to the injection valve.
6. Close the DX-80 front door.
7. Turn on the pump from the Control Panel.

5.10 Installing a New DS5 Detection Stabilizer

1. Turn off the power on the DX-80 rear panel. Disconnect the power cord.
2. Open the DX-80 front door.
3. Disconnect the **Eluent In** line connecting the DS5 and the suppressor.
4. Disconnect the **Eluent Out** line connecting the DS5 to the regenerant reservoir (see Figure 5-5). Do not misplace the ferrule fittings at the end of the tubing.
5. Loosen the two screws on the top of the DS5.
6. Remove the DS5 by unplugging it from the component mounting panel.
7. Plug the new DS5 (P/N 057290) into its mounting location.

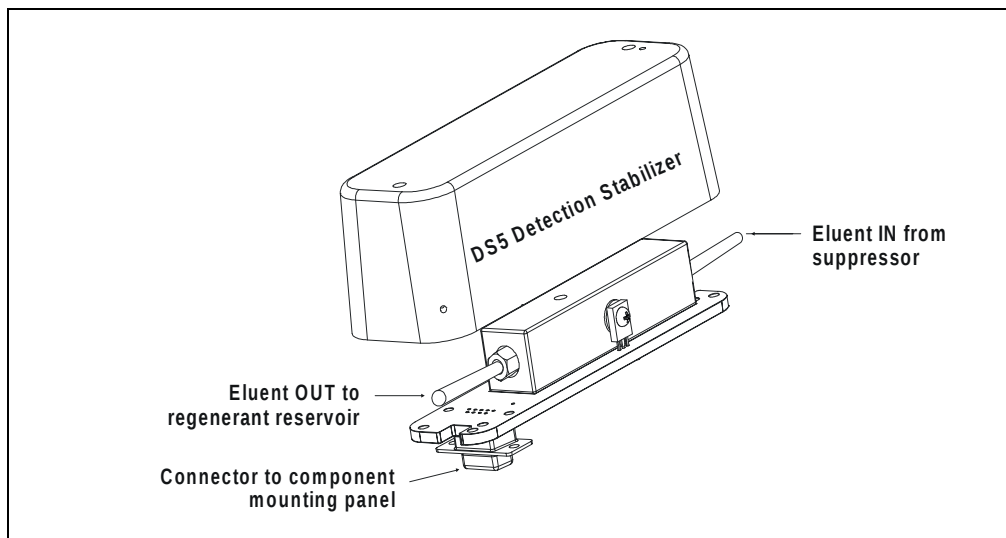


Figure 5-5. DS5 Detection Stabilizer Assembly

8. Retighten the screws on the top of the DS5.
9. Attach the inlet and outlet lines to the new DS5.
10. Close the front door.
11. Reconnect the power cord and turn on the DX-80 power.
12. Calibrate the cell (see Section 5.11).

5.11 Calibrating the Cell

Calibrate the cell every 6 months or after installing a new DS5 Detection Stabilizer.

Items Needed

1.0 mM KCl solution	To prepare: Dissolve 0.07456 g of reagent-grade KCl in one liter of 18-megohm DI water.
Backpressure tubing; must provide at least 7 MPa (1000 psi)	Use 0.076-mm (0.003-in) ID yellow PEEK tubing (P/N 049715).

1. Open the DX-80 Wellness Panel in PeakNet IA (see Figure 4-1).
 2. Remove the two screws securing the cell to the DX-80 component mounting panel. Let the cell hang by the tubing.
 3. Allow the conductivity to stabilize for 5 to 10 minutes.
 4. Click the **Calibrate Offset** command button under **conductivity cell**.
 5. Reconnect the cell to the DX-80 component mounting panel.
 6. Disconnect the pump outlet line from the injection valve; connect the line directly to the cell inlet.
 7. Verify that there is a minimum of 7 MPa (1000 psi) of backpressure.
 8. Pump 1.0 mM KCl through the cell.
 9. Allow the conductivity to stabilize for 5 to 10 minutes.
 10. Click the **Calibrate Slope** command button under **conductivity cell**. The cell is calibrated and a new cell calibration constant is uploaded to the PeakNet IA Data System. The new value is stored as the current cell calibration constant.
- After calibration, the conductivity reading should be $147.00 \pm 2 \text{ } \mu\text{S/cm}$ and the cell calibration constant should be between 130 and 190. If this is not the case, follow the steps below to download the factory calibration values to the DX-80.
- a. Click the **Details** button on the Wellness Panel. This opens the Calibration Details dialog box.

- b. Select **Factory** from the list to the right of the **Download** button and then click **Download**.
 - c. On the Wellness Panel, verify that the conductivity reading is now $147.00 \pm 2 \mu\text{S/cm}$ and the cell calibration constant is between 130 and 190.
 - d. Pump 1.0 mM KCl through the cell. If the correct values are still displayed, go on to Step 11. If one of the values is wrong, repeat the entire cell calibration procedure.
11. Flush the KCl solution from the system by pumping DI water through the cell. When the conductivity drops to near zero, stop the pump flow.
12. Reconnect the pump to the injection valve and reconnect the line from the suppressor to the cell inlet.

5.12 Installing a New Suppressor

Refer to the suppressor manual for guidance about when to replace a suppressor.

1. Turn off the pump from the DX-80 Control Panel.
2. Open the front door of the DX-80.
3. Disconnect the four eluent and regenerant lines from the suppressor.
4. Use a Phillips screwdriver to unscrew the shipping screw to the left of the suppressor. Save the screw.

IMPORTANT

Failure to remove the shipping screw before removing the suppressor will cause serious damage to the suppressor.

5. Slide the suppressor to the left to detach it from the component mounting panel.
 6. Slide the new suppressor to the right until it locks into place on the mounting panel.
 7. Reinstall the shipping screw.
 8. Connect the four eluent and regenerant lines to the new suppressor.
 9. Close the DX-80 front door.
10. Prime the pump (see Section B.10).

5.13 Changing the Main Power Fuses



HIGH VOLTAGE—Disconnect the main power cord from its source and also from the rear panel of the DX-80.



HAUTE TENSION—Débranchez le cordon d'alimentation principal de sa source et du panneau arrière du DX-80.



HOCHSPANNUNG—Ziehen Sie das Netzkabel aus der Steckdose und der Netzbuchse auf der Rückseite des DX-80.

1. Turn off the main power and disconnect the power cord.
2. The fuse holder is part of the main power receptacle on the DX-80 rear panel. Note the recessed lock located on each side of the fuse holder (see Figure 5-6).

Using a small screwdriver, push each lock toward the center to release it. When both locks are released and the fuse holder pops out slightly, pull the fuse holder straight out of its compartment.

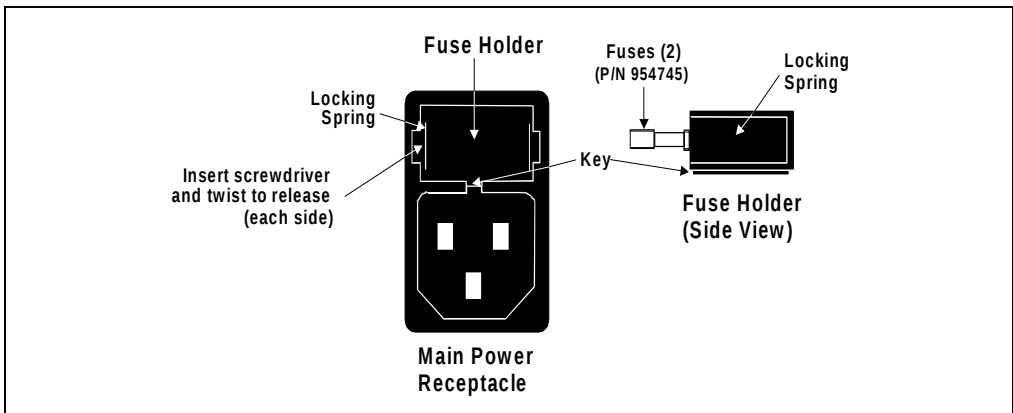


Figure 5-6. Main Power Fuse Holder

3. Reinsert the fuse holder into its compartment. The fuse holder is keyed to fit only in its proper orientation. Apply sufficient pressure evenly against the holder to engage the two locks. The holder is flush against the panel when both locks are engaged.
4. Reconnect the main power cord and turn on the power.

A • Specifications

A.1 Electrical

Main Power Two voltage/frequency configurations (not user-selectable):
110 to 120 Vac/60Hz
220 to 240 Vac/50Hz

Fuses Two fast-blow IEC127 fuses rated 3.15 amps (P/N 954745)

A.2 Physical

**Dimensions
(with reservoirs
and tubing)** Height without reservoirs: 32.125 cm (12.85 in)
Height with reservoirs and cap tubing: 59.625 cm (23.85 in)
Width: 23.225 cm (9.29 in)
Depth: 39.725 cm (15.89 in)

Weight 14 kg (30 lb)

Decibel Level < 53 db (at “A WEIGHING” setting)

A.3 Environmental

Operating Temperature	10 to 35 °C (50 to 95 °F)
Humidity	5% to 95% relative humidity, noncondensing
Gas Pressure	Laboratory-quality clean gas regulated to 0.55 to 0.83 MPa (80 to 120 psi)
Operating Pressure	21 MPa (3000 psi) maximum liquid path (tubing, valve, column, etc.)

A.4 Front Panel

Operation LED Indicators	LEDs indicate the DX-80 operational status. • Power • Off: No power • On: Power present • Ready • Off: Running or not trying to get ready • On: System check passed but sequence not started (stays on until run starts or sequence is aborted) • Flashing: System check failed (occurs if system check executes for 10 minutes without success) • Run • Off: Not running • On: Running/acquiring data • Flashing: Error/alarm/fault (including injection valve position fault)
---------------------------------	---

A.5 Rear Panel

Connectivity LED Indicators

LEDs indicate the communication status between the DX-80 and the PeakNet IA data system.

- **Transmit**

- On: The DX-80 is sending data to the PeakNet IA data system.
- Off: No data is being sent to the PeakNet IA data system.

- **Receive**

- On: The DX-80 is receiving data from the PeakNet IA data system.
- Off: No data is being received from the PeakNet IA data system.

- **Link**

- On: The communication link between the DX-80 and the PeakNet IA data system is activated, although no communications are being transmitted or received.
- Off: There is no communication link between the DX-80 and the PeakNet IA data system.

A.6 Pump

Type	Single-reciprocating piston with metal-free flow path with PEEK components
Operation Mode	Constant volume
Flow Rate	0.5 mL/min, preset at factory; cannot be changed by the user
Maximum Operating Pressure	21 MPa (3000 psi)

A.7 Pulse Damper

Type	0.8-mm (0.030-in) ID tubing
Maximum Pressure	21 MPa (3000 psi)

A.8 Detector

Range	Digital signal range of 0 to 500 μ S
Temperature Compensation	Preset for accurate reading at 40 °C
Cell Drive	8 kHz square wave
Auto Offset	-999 to 999 μ S
Control and Data Evaluation	Provided by PeakNet IA software; communication with the DX-80 is via the LAN interface.
Linearity	1%

A.9 DS5 Detection Stabilizer

Cell Body	PEEK
Electrodes	Passivated 316 stainless steel
Active Volume	1 μ L
Maximum Pressure	2.0 MPa (300 psi)

A.10 Injection Valve

Injection Valve	Two-position, six-port, electrically-activated Rheodyne valve with PEEK wetted components
------------------------	---

A.11 Delay Volume

System Total	<5 mL
---------------------	-------

B • Installation

This chapter provides instructions for the initial installation of the DX-80 Ion Analyzer.

B.1 Facility Requirements

- Make sure the DX-80 installation site meets the power and environmental specifications listed in Appendix A.
- Install the DX-80 on a sturdy workbench at a height that ensures convenient access to the interior.



Lift the DX-80 only from each side of the cabinet bottom. Lifting from the front door will damage the door hinges.



Ne soulevez le DX-80 que par le fond ou les côtés. Son soulèvement par la porte du panneau avant endommagera les charnières de la porte.



Wenn Sie den DX-80 anheben oder bewegen möchten, greifen Sie bitte unter den Boden oder heben Sie das Gerät an den Seiten an. Heben Sie das Gerät nicht an der Vordertür an. Dadurch können die Türangeln beschädigt werden.

- Allow at least 15 cm (6 in) behind the DX-80 for power connections and ventilation. For optimal performance, install the DX-80 in a draft-free location, out of the path of air conditioning and heating vents.
- A clean gas source regulated to 0.55 to 0.83 MPa (80 to 120 psi) is required for pressurization of the eluent reservoir.
- Use ASTM filtered, Type I (18-megohm) deionized water when preparing eluent and regenerant.

B.2 Unpacking the DX-80 System

B.2.1 Unpacking the DX-80

1. Open the shipping box.
2. Remove the eluent and regenerant reservoir assemblies, the DX-80 Ship Kit, and the Start-Up Kit.
3. Remove the foam cover.
4. Using the cardboard side handles, carefully remove the DX-80 from the box. You may need to remove the foam at the sides of the DX-80 before you can lift the instrument from the box.
5. Set the DX-80 on a workbench and cut the tape to remove the plastic surrounding the instrument.
6. Inspect the DX-80 for any shipping damage.

B.2.2 Removing the Pump Shipping Screw

1. Carefully lay the DX-80 on its back.
2. Locate the middle screw on the bottom of the DX-80 (see Figure B-1). This screw secures the pump in place during shipment.
3. Use a Phillips screwdriver to remove the shipping screw.
4. A screw holder is located to the right of the screw (see Figure B-1). Place the screw in the holder for safekeeping. You will need to reinstall the screw if the DX-80 is shipped to another location.
5. Return the DX-80 to an upright position.

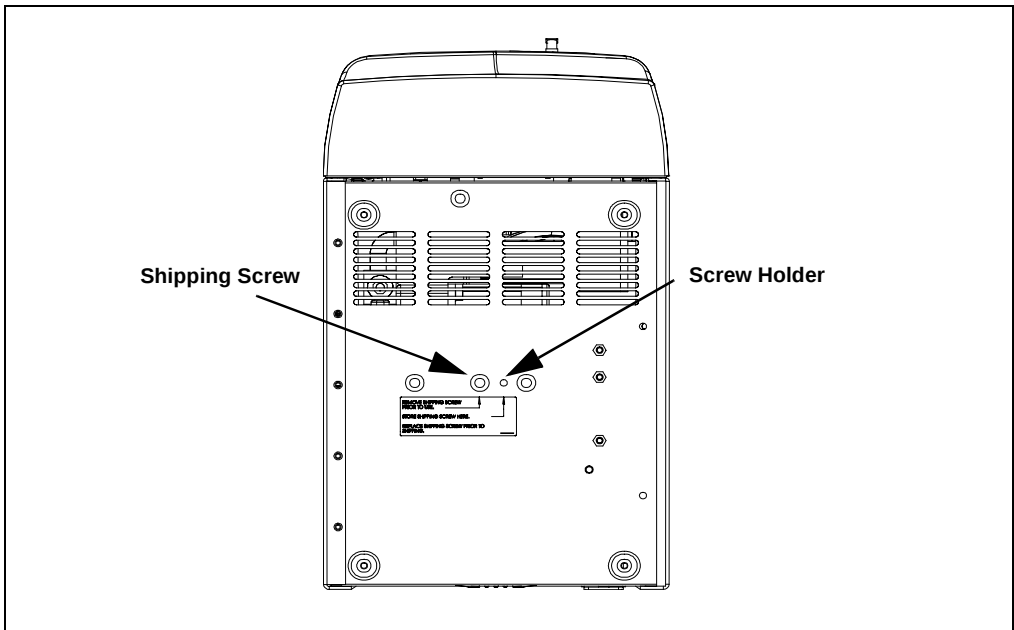


Figure B-1. Pump Shipping Screw Removal (Bottom view of DX-80)

B.2.3 Unpacking the Computer (North America only)

1. Remove the central processing unit (CPU), keyboard, mouse, and all documentation from the computer box and place them on a workbench.
2. Remove the monitor from its box and place it on the workbench.
3. Follow the instructions in the computer installation guide to hook up the monitor, mouse, keyboard, and CPU.
4. Go on to Section B.3.

B.2.4 Unpacking the Computer (outside North America)

1. Refer to *Installing the PeakNet IA System* (Document No. 031717) to verify that the computer being used meets PeakNet IA specifications.
2. Remove the central processing unit (CPU), keyboard, mouse, and all documentation from the computer box and place them on a workbench.
3. Remove the monitor from its box and place it on the workbench.
4. Follow the instructions in the computer installation guide to hook up the monitor, mouse, keyboard, and CPU.
5. Follow the instructions in *Installing the PeakNet IA System* to install PeakNet IA software and assign IP properties.

B.3 Connecting the DX-80

B.3.1 Connecting One DX-80 to a Private LAN

Follow these instructions to install the standard DX-80 Ion Analyzer system configuration: one DX-80 connected to a computer on a private LAN (see Figure B-2). The DX-80 Ship Kit (P/N 057217) includes all required parts.

1. Connect one end of a crossover 10BASE-T LAN cable (P/N 960280) to the **LAN** connector on the DX-80 rear panel.

IMPORTANT

The 10BASE-T LAN cable is a Category 5 unshielded twisted-pair cable. Do not substitute a cable of an inferior grade. Failure to use the correct cable will cause the DX-80 to lose communication with the computer.

2. Connect the other end of the crossover 10BASE-T LAN cable to the network port on the computer.
3. You can now install PeakNet IA software, configure the LAN card, and assign IP properties. For instructions, refer to *Installing the PeakNet IA System* (Document No. 031717). When you finish, go on to Section B.4 of the DX-80 manual.

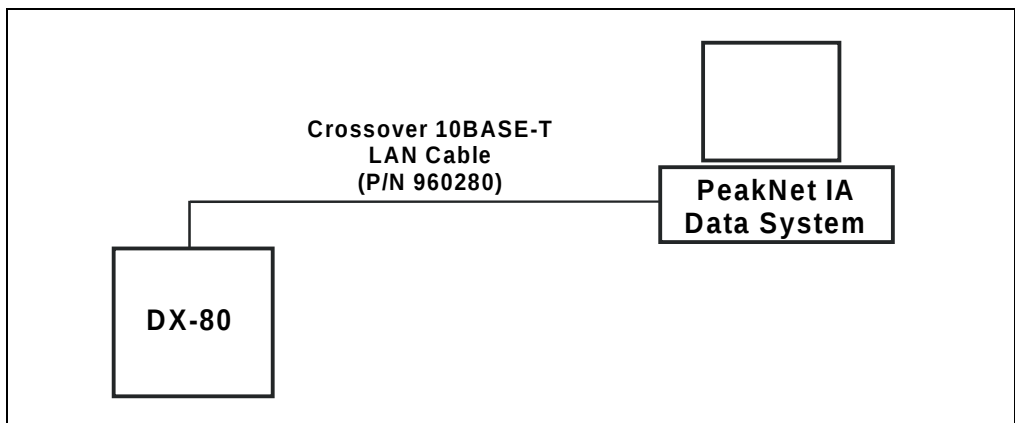


Figure B-2. Standard Configuration: One DX-80 on a Private LAN

B.3.2 Connecting Two DX-80s to a Private LAN

Follow these instructions to install two DX-80s on a private LAN (see Figure B-3).

Optional Parts Required

1 Ethernet hub (P/N 057398)

3 straight-through 10BASE-T LAN cables (P/N 960281)

Installation Instructions

1. Connect a straight-through 10BASE-T LAN cable to the **LAN** connector on the DX-80 rear panel.

IMPORTANT

The 10BASE-T LAN cable is a Category 5 unshielded twisted-pair cable. Do not substitute a cable of an inferior grade. Failure to use the correct cable will cause the DX-80 to lose communication with the computer.

2. Connect the other end of the straight-through 10BASE-T LAN cable to a 10BASE-T port on the front panel of the Ethernet hub. Do **not** connect the DX-80 to the Uplink (or MDI) port.
3. Repeat Steps 1-2 for the second DX-80.

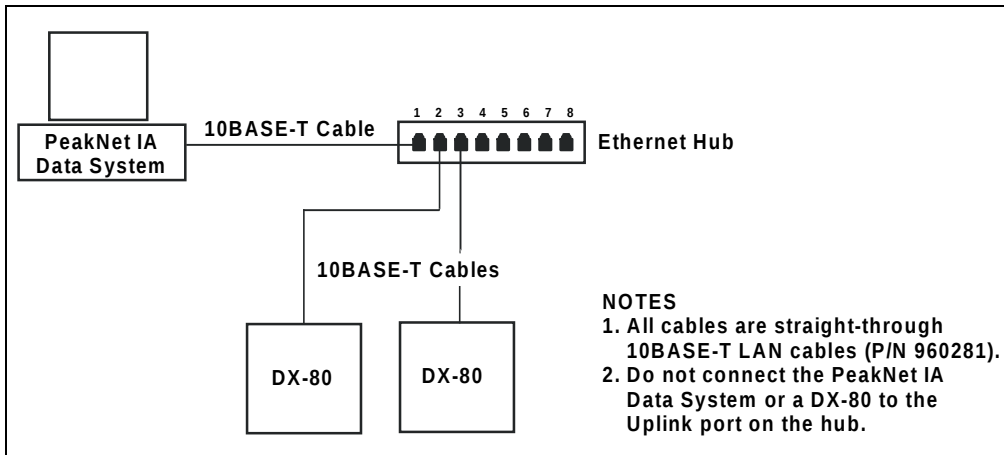


Figure B-3. Example Connections: Two DX-80s on a Private LAN

4. Connect a straight-through 10BASE-T LAN cable from the network port on the computer to a 10BASE-T port on the hub. Do **not** connect the computer to the hub's Uplink (or MDI) port.
5. You can now install PeakNet IA software, configure the LAN card, and assign IP properties. For instructions, refer to *Installing the PeakNet IA System* (Document No. 031717). When you finish, go on to Section B.4 of the DX-80 manual.

B.3.3 Connecting One or Two DX-80s to an Office LAN

Follow these instructions to install one or two DX-80s on an office LAN (see Figure B-4).

Optional Parts Required

1 Ethernet hub (P/N 057398)

3 or 4 straight-through 10BASE-T LAN cables (P/N 960281)

Installation Instructions

1. Connect a straight-through 10BASE-T LAN cable to the **LAN** connector on the DX-80 rear panel.

IMPORTANT

The 10BASE-T LAN cable is a Category 5 unshielded twisted-pair cable. Do not substitute a cable of an inferior grade. Failure to use the correct cable will cause the DX-80 to lose communication with the computer.

2. Connect the other end of the straight-through 10BASE-T LAN cable to a 10BASE-T port on the front panel of the Ethernet hub. Do **not** connect the computer to the hub's Uplink (or MDI) port.
3. Repeat Steps 1-2 for the second DX-80, if present.
4. Connect a straight-through 10BASE-T LAN cable from the network port on the computer to a 10BASE-T port on the hub. Do **not** connect the computer to the hub's Uplink (or MDI) port.

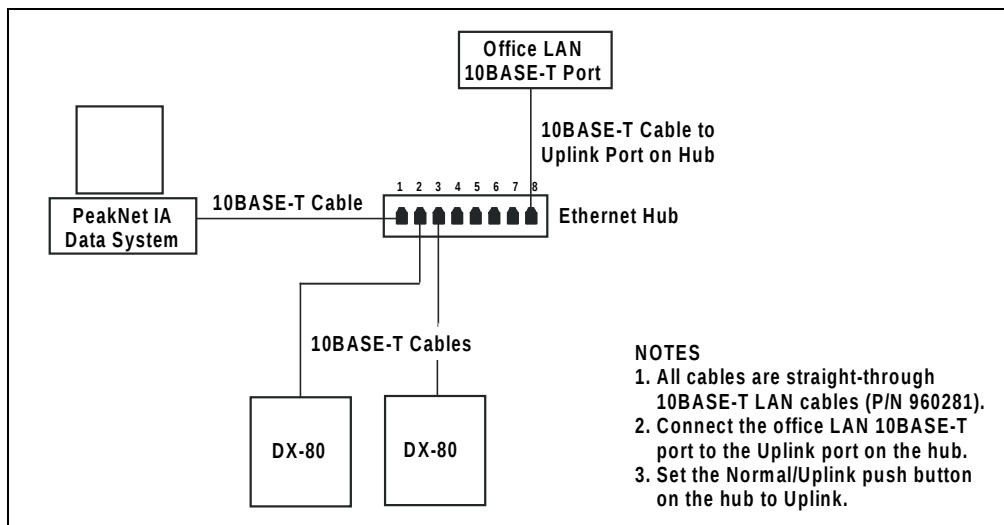


Figure B-4. Example Connections: Two DX-80s on an Office LAN

5. Connect a straight-through 10BASE-T LAN cable from the office LAN 10BASE-T port to the Uplink (or MDI) port on the front panel of the hub.
6. Set the Normal/Uplink push button on the hub to Uplink.

NOTE If the push button is labeled MDI/MDI-X (instead of Normal/Uplink), set the button to the MDI position.

7. You can now install PeakNet IA software, configure the LAN card, and assign IP properties. For instructions, refer to *Installing the PeakNet IA System* (Document No. 031717). When you finish, go on to Section B.4 of the DX-80 manual.

B.4 Connecting the Power Cord

NOTE Before connecting the power cord, install PeakNet IA software, configure the LAN card, and assign IP properties. For instructions, see *Installing the PeakNet IA System* (Document No. 031717).

1. A label on the DX-80 rear panel (see Figure 2-2) indicates the line frequency (60 Hz or 50 Hz) and voltage (110 to 120 VAC or 220 to 240 VAC) for which the system is designed. Make sure the frequency and voltage are appropriate for your location. If you are not sure, consult an electrician.
2. Connect the power cord (IEC 320 C13) from the main power receptacle on the rear panel to a grounded power source.



SHOCK HAZARD—To avoid electrical shock, use a grounded receptacle. Do not operate the DX-80 or connect it to AC power mains 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 DX-80 and is easily accessible.



Operation at AC input levels outside of the specified operating voltage range may damage the DX-80.



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.5 Connecting the Waste Lines

Untape the three coiled waste lines from the rear panel (see Figure 2-2) and place the ends into a waste container. These waste lines siphon off prime waste from the pump head, sample overflow from the injection valve, and system waste from the suppressor.

A DCR waste backpressure tubing assembly (P/N 060214) is connected to the suppressor waste line. The tubing assembly, which includes a coupler and a short length of 0.25-mm (0.010-in) ID black tubing, provides just enough backpressure to compress any air bubbles formed in the regenerant chamber of the suppressor.

IMPORTANT

If you shorten or replace the suppressor waste line, remember to reinstall the DCR waste backpressure tubing assembly. Failure to do so will result in high baseline drift.

NOTE To prevent waste from siphoning back into the system, check the waste lines periodically to be sure they are not bent, pinched, or elevated at any point.

B.6 Turning On the DX-80 Power

Turn on the power from the DX-80 rear panel (see Figure 2-2).

B.7 Connecting the Gas Source

1. Locate the barbed fitting (P/N 030071) and pipe thread reducer (P/N 030087) supplied in the DX-80 Ship Kit (P/N 057217).
2. Use the barbed fitting and pipe thread reducer to connect the green 1/8-in ID tubing exiting the DX-80 rear panel (see Figure 2-2) to a clean gas source regulated to 0.55 to 0.83 MPa (80 to 120 psi).

NOTE Do not turn on the gas source. Do not pressurize until the eluent is prepared.

B.8 Setting Up the Eluent and Regenerant Reservoirs

NOTE For instructions on how to prepare eluent and regenerant, see Section 3.1.

1. Make sure the regenerant reservoir is filled almost to overflowing.
2. Connect the gas and liquid lines from the DX-80 to the lines exiting the eluent and regenerant reservoir caps (see Figure B-5) as follows:
 - a. Connect the yellow gas lines from the eluent reservoir and the DX-80.
 - b. Connect the two lines labeled **Eluent Bottle Out**.
 - c. Connect the two lines labeled **Regen Bottle Out**.
 - d. Connect the line labeled **Regen In** to the black line from the DX-80.
3. Plumb the MMS III suppressor as follows (the suppressor tubing is labeled):
 - a. Disconnect the **Column Out** from the **Cell In** and remove the union.
 - b. Connect the **Column Out** to the MMS **Eluent In**.
 - c. Connect the **Cell In** to the MMS **Eluent Out**.

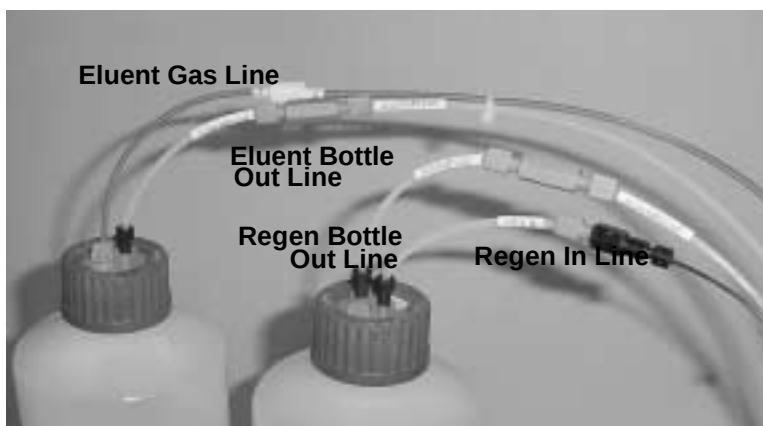


Figure B-5. Reservoir Connections

4. Insert the lines into the appropriate reservoirs and screw on the caps. Place the reservoirs in the holders on the top cover of the DX-80.
5. Turn on the gas source to pressurize the eluent reservoir.

B.9 Connecting the AS40 Automated Sampler (Optional)

B.9.1 Connecting the Autosampler Outlet Line

Open the front door of the DX-80 and connect the outlet line from the AS40 Automated Sampler to port 5 of the injection valve (see Figure 2-6).

B.9.2 Connecting the TTL Output

Follow the steps below to connect the TTL output connector on the DX-80 rear panel to an AS40 Relay Control cable (see Figure B-6).

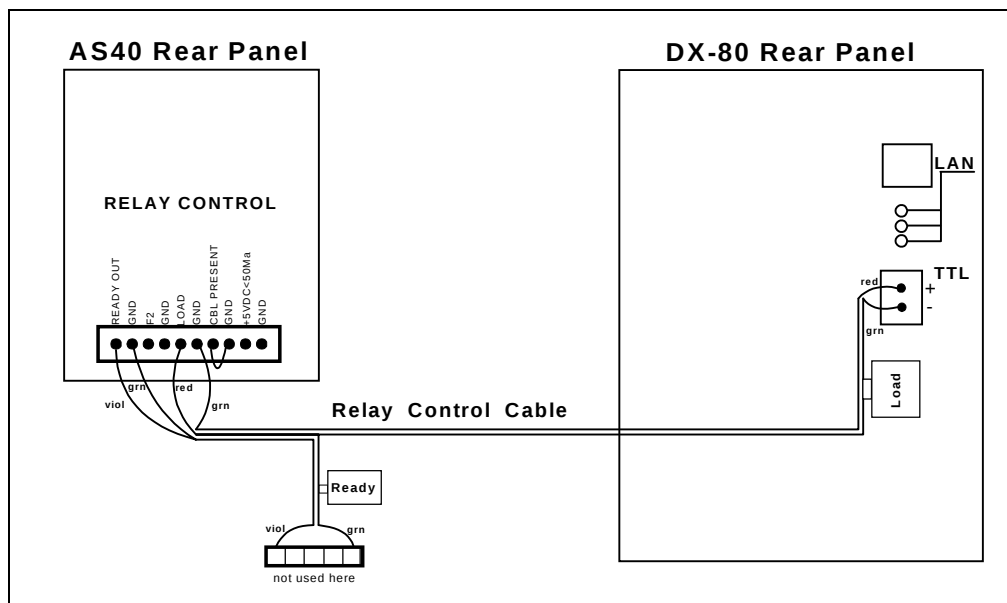


Figure B-6. AS40 Autosampler Connection

1. Locate the Relay Control cable (P/N 047946) supplied with the AS40 Automated Sampler. Connect this cable's 10-pin connector to the **RELAY CONTROL** connector on the AS40 rear panel.

2. Plug the 2-pin connector from the pair of wires labeled **LOAD** on the Relay Control cable into the **TTL Output** connector on the DX-80 rear panel (see Figure B-6).

B.10 Priming the Pump

1. Verify that the eluent reservoir is filled with the prepared eluent (see Section 3.1.1 for instructions on mixing eluent).
2. Lower the outlet lines of the reservoir cap assembly into the eluent reservoir. Hand tighten the cap.
3. Make sure the line from the gas supply is connected to the gas connector on the green gas tubing exiting the DX-80 rear panel (see Section B.7).
4. Open the pump head waste valve (see Figure 5-4) by turning the knob counterclockwise two turns. When the valve is open, eluent flows directly from the pump to waste.
5. Turn on the pump from the DX-80 Control Panel in PeakNet IA.
6. Let the pump prime for at least 2 to 3 minutes to ensure that there are no trapped gas bubbles in the line from the eluent bottle to the pump head.
7. Verify that the column outlet is connected to waste. Close the pump head waste valve and flush the system for about 5 minutes to equilibrate it and to ensure that eluent flows out of the column to waste.
8. Monitor the system pressure from the Control Panel to make sure the pressure is 107 to 153 MPa (1600 to 2300 psi). If the pressure is less than 107 MPa (1600 psi), gas may be trapped in the system. Dislodge the gas by opening one fitting at a time from the pump head and along the plumbing to the column; pay close attention to the line from the pulse damper.
9. Check that there are no leaks in the regenerant reservoir.
10. Check that liquid is coming out of the suppressor **Regen Out** port and that the pressure is stable.
11. Monitor baseline conductivity.

B.11 Verifying Operational Status

After the system has equilibrated, verify the actual pump pressure and stability by monitoring the pump pressure. Start PeakNet IA, if it is not already running (see Section 3.4.2). From the Control Panel, verify the following:

- The operating pressure is 14 ± 2 MPa (2000 ± 300 psi). Record the short-term pressure fluctuations; they should be less than 0.13 MPa (20 psi).
- The total conductivity is <35 μ S for anion systems and <3 μ S for cation systems.

B.12 Preparing Calibration Standards

Follow the instructions in Section 3.2 to prepare calibration standards. Use the PeakNet IA Sequence Wizard to set up the calibration. See the PeakNet IA online Help for instructions.

B.13 Starting Up the DX-80

Proceed to Section 3.4 to operate the DX-80.

C • Reordering Information

Part Number	Item
<i>Pump</i>	
057853	Pump head assembly
055870	Main piston seal
036901	Backup piston seal
047661	Output check valve assembly, 10-32
047660	Input check valve assembly, 1/4-28
057223	Backup washer assembly
035030	Piston guide
036904	Piston
035014	Piston return spring
035595	Piston spring guide
035885	Washer (installed under acorn nut on pump head assembly)
036884	Acorn nut (secures the pump head to the pump housing)
<i>Sample Loop and Injection Valve</i>	
042949	10 μ L sample loop assembly
052278	Injection valve rebuild kit (stator face and rotor seal only)
054463	Stator for Rheodyne 9750 injection valve
024305	1/4-28 luer adapter fitting (for manual injections)

Part Number	Item
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Reagent Reservoir Assemblies

057711	Eluent reservoir assembly (includes stopper and cap)
057712	Anion regenerant reservoir assembly (includes stopper and cap)
057713	Cation regenerant reservoir assembly (includes stopper and cap)
059068	O-ring for eluent or regenerant reservoir stopper

Reagents

057068	Anion Start-Up Kit Contains 1 bottle each of eluent, regenerant (7 anions), and standard concentrate
057070	Cation Start-Up Kit Contains 1 bottle each of eluent, regenerant (6 cations), and standard concentrate
057069	Anion Refill Kit Contains 4 bottles each of AS14A eluent and anion regenerant concentrate
057071	Cation Refill Kit Contains 4 bottles each of CS12A eluent and cation regenerant concentrate
057590	7-anion standard, 50 mL
046070	6-cation standard, 50 mL

Columns

056901	AS14A anion separator column, 3 mm
056899	AS14G anion guard column, 3 mm
057185	CS12A cation separator column, 3 mm
057184	CS12G cation guard column, 3 mm
056664	Column mounting clip

Part Number	Item
<i>Suppressors and Cell</i>	
056751	AMMS III suppressor
056753	CMMS III suppressor
057290T	DS5 Detection Stabilizer

D.1 How do I hook up an AS40 Automated Sampler?

For instructions on how to connect an AS40 to the DX-80, see Section B.9 of the DX-80 manual. Also see the *AS40 Automated Sampler Operator's Manual* (Document No. 034970).

D.2 How do I print?

Click the **Print** toolbar button in PeakNet IA (see Section 2.3.1).

D.3 How often should I perform calibrations?

Recalibrate every six months or after changing a major component (separator column, DS5, suppressor, etc.).

D.4 How do I adjust retention times?

Retention times are calculated at the time of calibration and cannot be adjusted by the user.

D.5 Why are the retention times moving?

Retention times can shift if the pump flow is erratic or the column is contaminated.

D.6 When should I remake standards?

Standards are used only for calibration and should always be made fresh (they have a lifetime of only one week).

D.7 When should I remake eluents?

Eluents should be remade every two or three weeks.

D.8 How do I start PeakNet IA?

Click **Start** on the Windows taskbar, and then select **Programs > PeakNet > PeakNet**.

D.9 How do I delete data?

In PeakNet IA, highlight the sequence you want to delete and then select **File > Delete**.

D.10 How do I back up data?

In PeakNet IA, select **File > Export/Backup**. Back up the data and indicate the backup source.

D.11 How do I shut off the system?

In PeakNet IA, turn off the pump from the DX-80 Control Panel. On the DX-80, turn off the power switch on the rear panel.

D.12 How do I store columns?

Columns should be stored in eluent. See the column manual for complete instructions.

D.13 How do I know when a column is dirty?

See the troubleshooting section of the column manual.

D.14 How do I clean a column?

See the troubleshooting section of the column manual.

D.15 Why is the conductivity high?

Possible reasons for high conductivity include:

- The suppressor needs regeneration.
- The regenerant is exhausted and should be remade.
- The DS5 may be out of calibration.

For troubleshooting help, see the discussion of the **OVER CONDUCTIVITY** message in Section 4.1.

Analytical Column

Synonymous with **Separator Column**.

Band Spreading

The broadening of the sample band as it travels through the column. Band spreading can also occur in the injection valve, detector cell, and interconnecting tubing.

Calibration Curve

A graph showing detector response in peak height or area versus analyte concentration.

Capacity Factor (k')

The number of column volumes of eluent, pumped through the column, required to elute an analyte. Capacity factor is a dimensionless measure of retention which is independent of column length or eluent flow rate. It is calculated as follows:

$$k' = \frac{t_r - t_o}{t_o}$$

Where: t_r = retention time

t_o = retention time of unretained solute (column void volume)

Cell Constant (k)

A factor determined experimentally by measuring the conductance (G) of a standard solution of known equivalent conductivity (k).

$$k = \kappa / G$$

The value of k depends upon the surface area of, and distance between, the electrode faces in the conductivity detector cell.

$$k = l / A$$

Where: l = length

A = area of one electrode (the other electrode is equal to the first)

Channeling

The preferential flow of liquid along more open, less resistant paths through the column packing. This causes **Band Spreading**.

Column Efficiency (N)

A measure of the *narrowness* of analyte bands as they elute from the column. High efficiency is desirable because resolution between closely spaced bands improves with greater efficiency. For a symmetrical (Gaussian) peak, column efficiency can be determined by the following:

$$N = 5.54(t_1/W_{1/2})^2$$

Where: t_1 = the peak retention time, in seconds

$W_{1/2}$ = the peak width at 1/2 height, in seconds

Column efficiency is proportional to column length: for a given resin and column diameter, increasing the column length increases the column efficiency.

Synonymous with **Theoretical Plates**.

Column Selectivity (a)

Describes the relative separation of the band maxima between two adjacent peaks. Selectivity can be determined by the following:

$$a = (t_2 - t_0)/(t_1 - t_0)$$

Where: t_1 and t_2 = retention time of components 1 and 2, respectively

t_0 = retention time of unretained components (void volume)

Concentrator Column

A short column used to retain and concentrate analytes from a measured volume of relatively clean sample. This allows large volumes of sample to be injected, lowering concentration detection limits.

Conductivity

A measure of the ease with which electrical current flows through a liquid contained between two opposite charged electrodes. Conductivity is a characteristic of ions in solution. Units are siemens.

Counterion

Ions carrying a charge opposite that of the sample ions (e.g., Na^+) may be the counterion of a Cl^- analyte. These ions preserve electrical neutrality in solution.

% Crosslink

Divinylbenzene content in a polystyrene/divinylbenzene (PS-DVB) resin; this contributes to the mechanical strength of the resin and determines chromatographic properties.

Electrical Conductance**Equivalent Conductivity (λ)**

The contribution of an ionic species to the total conductivity of a solution as measured in a standard cell having electrodes 1 cm² in area and exactly 1 cm apart.

Guard Column

A small column which prevents poisoning of the separator column by sorbing organic contaminants and removing particulates. It is filled with the same packing as the separator column. Synonymous with **Pre-Column**.

HETP (H)

Height Equivalent to a Theoretical Plate. A measure of column efficiency which allows comparison between columns of different lengths.

$$\text{HETP} = H = L/N$$

Where: L = the column length (mm)

N = the number of theoretical plates

Ion-Exchange Capacity

The number of active ion exchange sites in a given weight or volume of resin, most often expressed in meq/g or meq/mL.

Ion-Exchange Resin

An insoluble polymer matrix containing fixed-charge exchange sites (anionic or cationic). IC resins are formed into small spherical particles (beads).

Packing

The material which fills a chromatographic column; usually a resin or silica-based material.

Pellicular Resin

A resin with a solid, nonporous core coated with a thin layer of more porous material. The exchange sites of pellicular ion exchange resins are located only on the surface layer of the bead. These resins have a low ion-exchange capacity.

Pre-Column

Synonymous with **Guard Column**.

Regenerant

A dilute acid or base which converts ion exchange sites in the suppressor back to the form which will suppress the eluent conductivity.

Resin

See **Ion-Exchange Resin**.

Resolution (R)

A measure of the separation between two sample components. It is expressed as the ratio of the distance between the two peak maxima to the mean value of the peak width at the baseline.

$$R = 2(t_2 - t_1)/(W_2 + W_1)$$

Where: t_1 and t_2 = the retention times of components 1 and 2, respectively

W_1 and W_2 = the baseline width of peaks 1 and 2, respectively (measured in the same units as the retention time)

R is proportional to the square root of efficiency (N). A value of $R = 1.5$ represents “baseline separation” of the two peaks.

Retention Time

The time from injection to peak maximum; the basis for identification of a species in chromatographic analysis.

Separator Column

The column used to perform a chromatographic separations; also called analytical column.

Siemens (S)

Unit measure of conductance; the reciprocal of the electrical resistance of a solution.

Suppressor

A device used to minimize eluent conductivity and convert sample species to a common form, thus increasing detection sensitivity.

Temperature Coefficient

The percent of change in the conductivity of a solution with a 1 °C change in temperature. Every solution has a characteristic temperature coefficient which is determined experimentally.

Theoretical Plates (N)

See **Column Efficiency**.

Void Volume (V_0)

The volume occupied by the eluent in a packed column. This volume includes the volume between the injection valve and the column, as well as between the column and the detector cell. Unretained components are eluted in the void volume.

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TBAOH

*See Tetrabutylammonium hydroxide
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