



# ICS-2000 ION CHROMATOGRAPHY SYSTEM OPERATOR'S MANUAL

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S C I E N T I F I C

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## **G • Glossary**

## 1.1 Introduction to Ion Chromatography (IC)

The Dionex ICS-2000 Ion Chromatography System (ICS-2000) performs ion analyses using suppressed or non-suppressed conductivity detection. An ion chromatography system typically consists of a liquid eluent, a high-pressure pump, a sample injector, a guard and separator column, a chemical suppressor, a conductivity cell, and a data collection system.

Before running a sample, the ion chromatography system is calibrated using a standard solution. By comparing the data obtained from a sample to that obtained from the known standard, sample ions can be identified and quantitated. The data collection system, typically a computer running chromatography software, produces a chromatogram (a plot of the detector output vs. time). The chromatography software converts each peak in the chromatogram to a sample concentration and produces a printout of the results.

A typical IC analysis consists of six stages (see [Figure 1-1](#)).

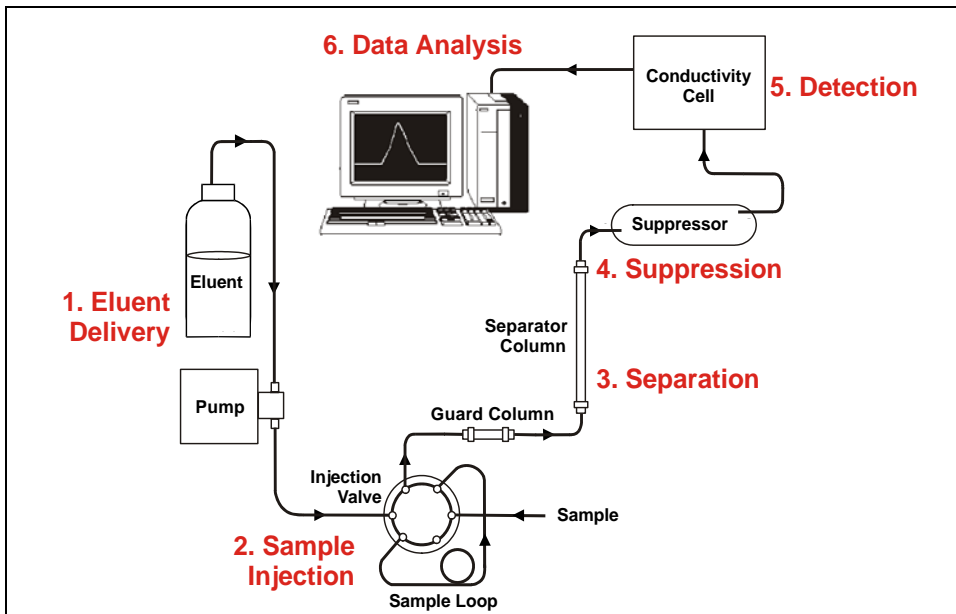


Figure 1-1. Ion Analysis Process

## 1. Eluent Delivery

- Eluent, a liquid that helps to separate the sample ions, carries the sample through the ion chromatography system. The ICS-2000 includes an eluent generator, which generates eluent online from deionized water.
- When the ICS-2000 is controlled from the front panel, only isocratic eluent delivery is possible. This means that the eluent composition and concentration remain constant throughout the run. Gradient delivery (a change in concentration over time) is possible when the ICS-2000 is controlled by Chromeleon® Chromatography Management System (the data collection system for the ICS-2000).

## 2. Sample Injection

- The liquid sample is loaded into a sample loop either manually or automatically (if an automated sampler is installed). When triggered, the ICS-2000 injects the sample into the eluent stream.

- The pump pushes the eluent and sample through the guard and separator columns (chemically-inert tubes packed with a polymeric resin). The guard column removes contaminants that might poison the separator column.

### **3. Separation**

- As the eluent and sample are pumped through the separator column, the sample ions are separated. In the ICS-2000, the mode of separation is called ion exchange. This 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.

### **4. Suppression**

- 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.

### **5. Detection**

- A conductivity cell 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.

### **6. Data Analysis**

- The conductivity cell transmits the signal to a data collection system.
- The data collection system (for the ICS-2000, this is Chromeleon) identifies the ions based on retention time, and quantifies each analyte by integrating the peak area or peak height. The data is quantitated by comparing the sample peaks in a chromatogram to those produced from a standard solution. The results are displayed as a chromatogram and the concentrations of ionic analytes can be automatically determined and tabulated.

### 1.2 Overview of the ICS-2000

The ICS-2000 is an integrated ion chromatography system containing an eluent generator, pump, injection valve, column heater, and conductivity detector. Other system components, including a guard column, separator column, and suppressor vary, depending on the analyses to be performed.

The ICS-2000 is also configured with a vacuum degas assembly, for online eluent degassing.

ICS-2000 operation can be controlled in one of two ways:

- Remotely, with a personal computer running Microsoft® Windows® XP or Windows 2000 and Chromeleon software (version 6.5 SP2 or later). Chromeleon also provides data acquisition and data processing functions.
- Locally, with the front panel LCD touch screen. The touch screen is used for instrument control only. It does not provide data acquisition or data processing functions. An analog output on the rear panel can be connected to a separate data acquisition device.

For communication between the ICS-2000 and Chromeleon, the ICS-2000 is connected to a USB (Universal Serial Bus) port on the computer or a USB hub. For installation instructions, see [Section B.5](#) and also refer to *Installing the Chromeleon Chromatography Management System with a Dionex Ion Chromatograph (IC)* (Document No. 031883).



## 1.3 About This Manual

The electronic version (i.e., PDF file) of the ICS-2000 operator's manual contains numerous hypertext links that can take you to other locations within the file.

These links include:

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

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

<b>Chapter 1 Introduction</b>	Introduces ion analysis and the ICS-2000; explains the conventions used in this manual, including safety-related information.
<b>Chapter 2 Features Overview</b>	Provides an overview of ICS-2000 operating features and system components; introduces the Chromeleon user interface.
<b>Chapter 3 Operation and Maintenance</b>	Provides operating instructions and describes routine preventive maintenance procedures.
<b>Chapter 4 Troubleshooting</b>	Lists problems and presents step-by-step procedures for how to isolate and eliminate the cause of each problem.
<b>Chapter 5 Service</b>	Provides step-by-step instructions for routine service and parts replacement procedures that the user can perform.
<b>Appendix A Specifications</b>	Lists the ICS-2000 specifications and installation site requirements.
<b>Appendix B Installation</b>	Describes how to install the ICS-2000.
<b>Chapter C Touch Screen Operation</b>	Describes the operating features available from the front panel touch screen.

<b>Appendix D TTL and Relay Control</b>	Describes the ICS-2000 TTL and relay control features.
<b>Appendix E Reordering Information</b>	Lists spare parts for the ICS-2000.
<b>Appendix F FAQ</b>	Provides answers to frequently asked questions about ICS-2000 operation.
<b>Appendix G Glossary</b>	Defines terms commonly used in ion analysis.

## 1.3.1 Safety Messages and Notes

The ICS-2000 is designed for IC (ion chromatography) 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 shown below.



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



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



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



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

### Messages d'avertissement en français



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



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



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

### Warnhinweise in Deutsch



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



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



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

### Notes

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

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

### 1.3.2 Safety Labels

The TUV GS and c TUVus Mark safety labels and the CE Mark label on the ICS-2000 indicate that the ICS-2000 is in compliance with the following standards: EN 61010-1:2001 (safety), CAN/CSA-C22.2 No. 1010.1-92 +A2:97 (safety), UL 3101-1/10.93 (safety), and EN 61326:1997, including A1:1998 and A2:2001 (EMC susceptibility and immunity).

The symbols below appear on the ICS-2000 or on labels affixed to the ICS-2000.



Alternating current



Protective conductor terminal (earth ground)



Power supply is on



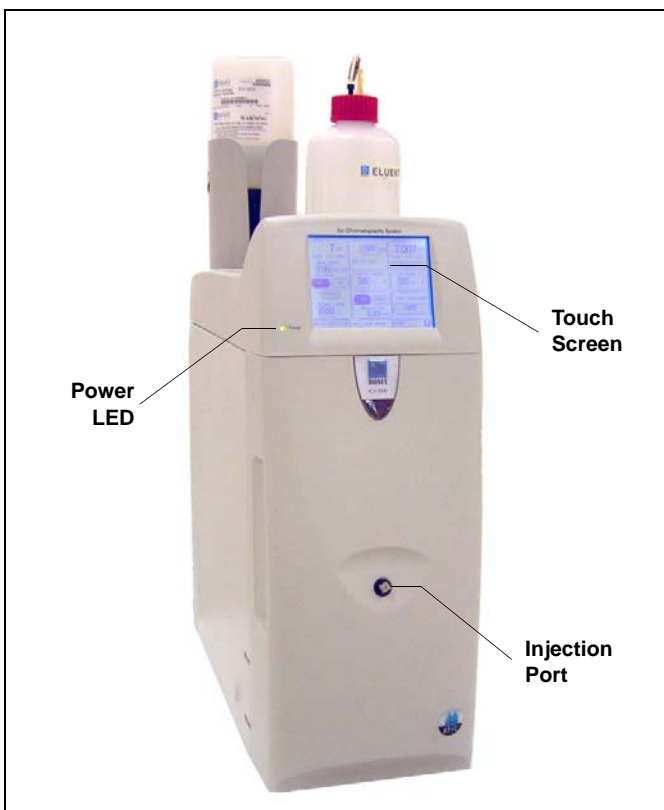
Power supply is off

This chapter describes key ICS-2000 features and introduces the Chromeleon user interface.

## 2.1 Operating Features

### 2.1.1 Front Panel

[Figure 2-1](#) illustrates the front panel of the ICS-2000.



#### Injection Port

The sample to be analyzed can be injected manually into the injection port, using a syringe. For automated sample injection, the ICS-2000 must be connected to an autosampler. For more information about sample injection, see [Section 3.10](#).

#### Touch Screen

The LCD touch screen provides local control of most ICS-2000 functions. You can control many of these functions directly on the touch screen's **HOME** page (see [Figure 2-2](#)). From the **HOME** page you can also go to a series of pages that provide access to all other locally controlled ICS-2000 operating functions.

*Figure 2-1. ICS-2000 Front Panel*

## Summary of Touch Screen Operation

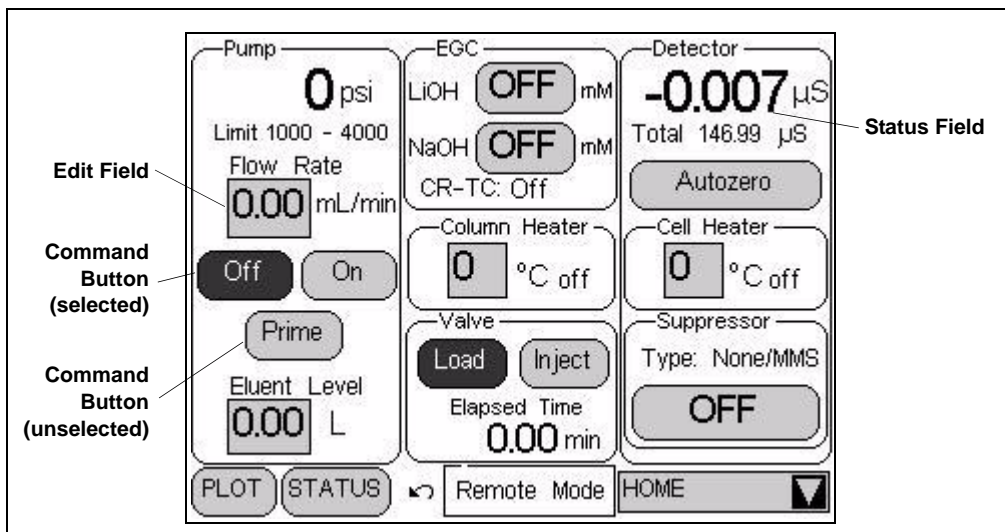



Figure 2-2. ICS-2000 Touch Screen Home  Page

**NOTE** To adjust the screen contrast, open the front door and adjust the knurled knob under the screen (see [Figure 2-8](#)).

- Edit fields and command buttons have blue text on a shaded background. Fields that display status information are not shaded.
- Edit fields have square corners, while command buttons are rounded.
- To select a command button or edit a field, touch and release the command button or edit field with your fingertip.

**NOTE** When you touch a button or edit field, the action is taken when you lift your finger. If you unintentionally touch a button or field, you can cancel the action by sliding your finger away from the button or field before lifting.

- Touching a command button (for example, ) executes the command immediately.

- Selecting a command button changes the button's appearance to white text on a dark background (for example, **Inject**).
- Touching an edit field (for example, **Flow Rate 0.00 mL/min**) opens a page with a number keypad (see [Figure 2-3](#)). Use the keypad to enter the desired numerical value for the field and then touch the **ENTER** button.

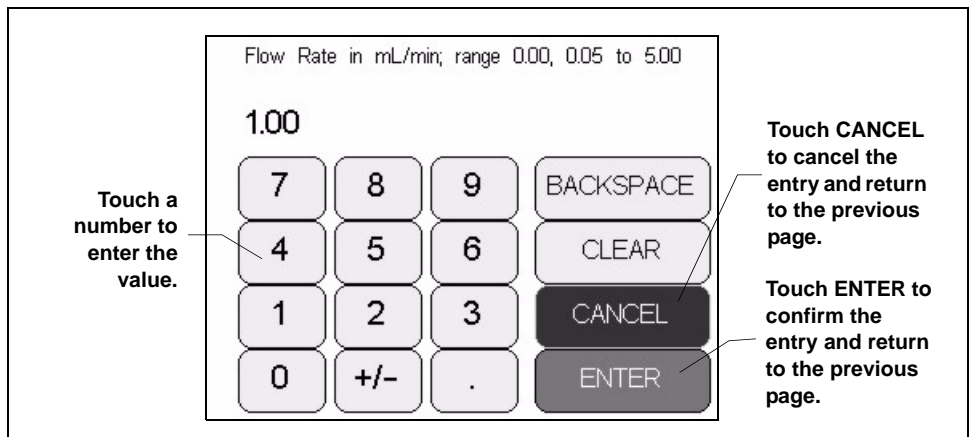

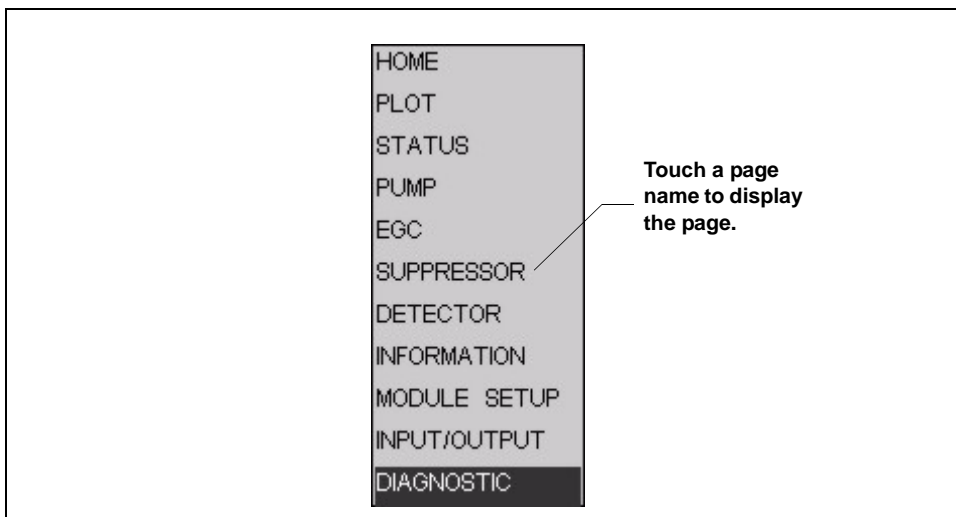


Figure 2-3. Number Keypad

- Touching the page name (for example, ) in the bottom right corner opens a menu of pages (see [Figure 2-4](#)).



*Figure 2-4. ICS-2000 Touch Screen Menu of Pages*

- Touching a page name on the menu of pages displays the selected page. For example, touching **SUPPRESSOR** displays the



**SUPPRESSOR** page (see [Figure 2-5](#)). See Appendix C for details about each touch screen page.

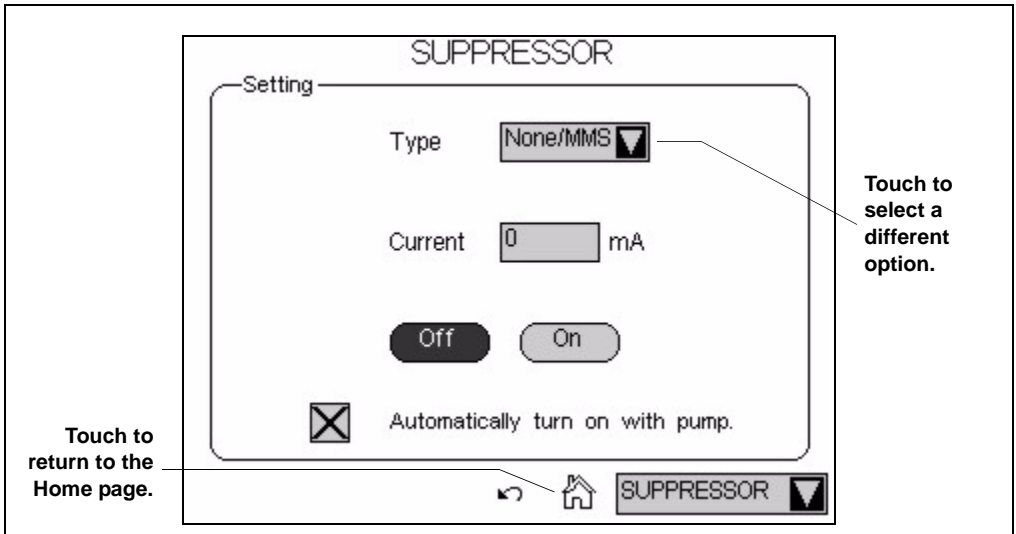




Figure 2-5. Suppressor Page

- Touching  returns you to the **HOME** page.
- Touching  opens a list of options (see [Figure 2-6](#)).

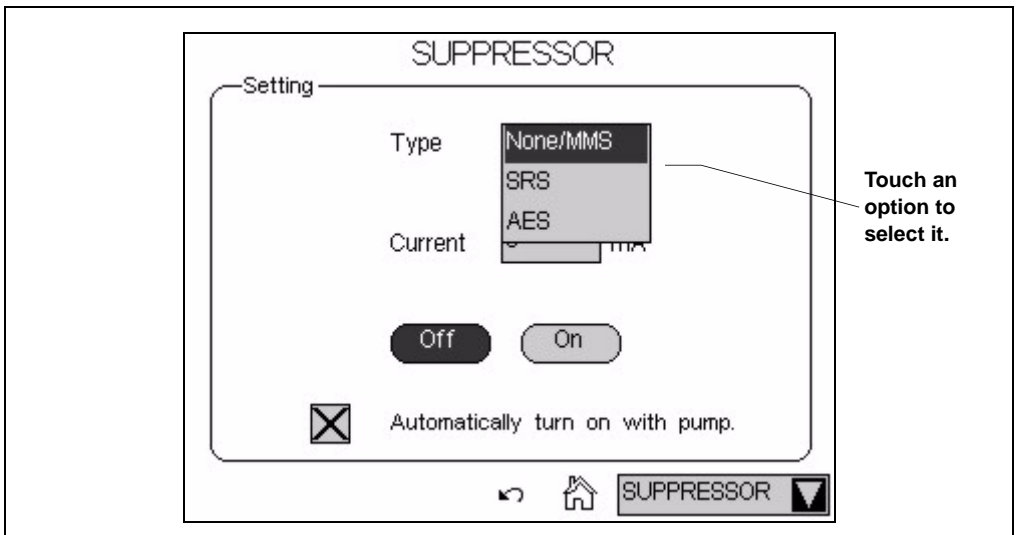
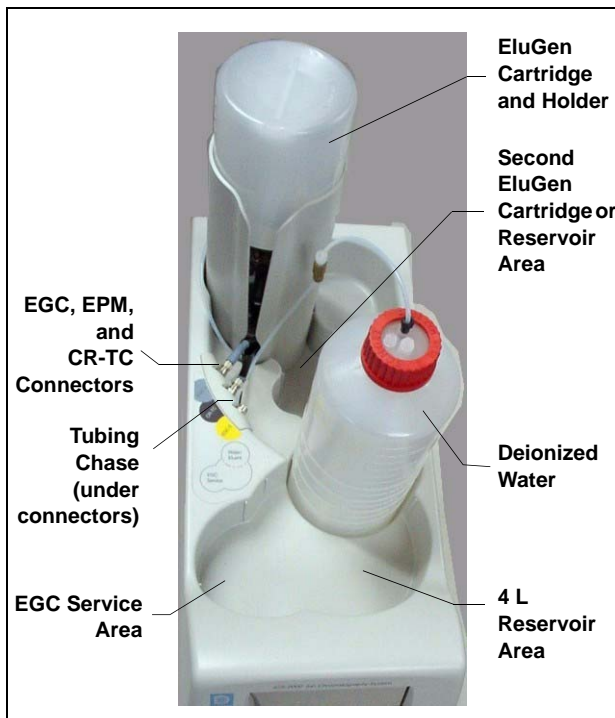


Figure 2-6. Suppressor Page: Selecting an Option

## 2.1.2 Top Cover

[Figure 2-7](#) illustrates the top cover of the ICS-2000.



### EluGen Cartridge and Reservoir Storage

The ICS-2000 top cover holds one or two EluGen® cartridges (see below) and up to two 2-L plastic reservoirs (P/N 044129).

### EluGen Cartridges

The EluGen cartridges are installed in holders that fit into the two back reservoir areas. See [Section 2.4.4](#) for details about the eluent generator.

### Tubing Chase

The tubing chase under the EGC and CR-TC connectors routes tubing from the eluent reservoir and EGC holder to the front of the ICS-2000.

*Figure 2-7. ICS-2000 (Top View)*

### EGC, EPM, and CR-TC Connectors

The cable from the EluGen cartridge (EGC) connects to the **EGC-1** connector. The cable from the Continuously Regenerated Trap Column (CR-TC) connects to the **CR-TC** connector. See [Section B.14](#) for installation instructions. If a second EluGen cartridge is installed, it connects to the **EGC-2** connector.

When operating with an EGC II  $K_2CO_3$  EluGen Cartridge and the EPM Electrolytic pH Modifier, the EluGen cartridge is typically connected to the **EGC-1** connector. The pH modifier, which mounts on the side of the EluGen cartridge holder, is connected to the **EGC-2** connector. However, the connections can be reversed, if desired.

### EGC Service Area

The EGC service area holds the cartridge during installation and replacement. See [Section B.14](#) for instructions.

### 2.1.3 Component Panel

[Figure 2-8](#) shows the user-accessible components installed on the component panel behind the ICS-2000 front door.

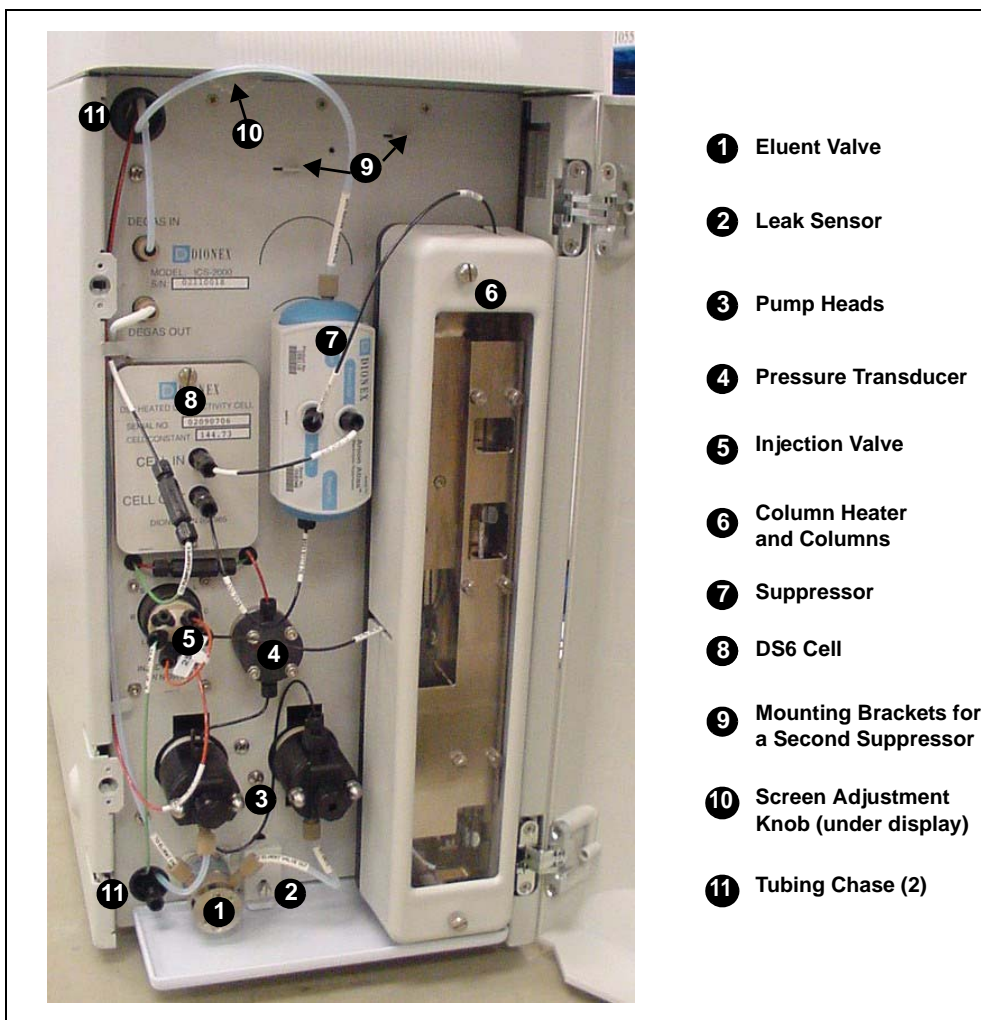


Figure 2-8. ICS-2000 Component Panel

### Eluent Valve

The eluent valve controls the flow from the eluent reservoir. The eluent valve opens automatically when the pump is started and closes when the pump is turned off.

### Leak Sensor

The leak sensor is installed in the drip tray at the bottom of the component panel. If liquid accumulates in the tray, an error message is logged in the Chromeleon Audit Trail and displayed on the LCD touch screen.

### Pump Heads

The ICS-2000 includes a dual-piston serial pump. The flow rate can be set to 0.00 mL/min or to between 0.05 and 5.00 mL/min. However, for optimum performance, set the flow rate to between 0.40 and 2.00 mL/min. Setting the flow rate to 0.00 mL/min turns off the pump. See [Section 2.4.3](#) for details about the pump.

### Pressure Transducer

The pressure transducer measures the system backpressure.

### Injection Valve

The injection valve is a six-port, electrically-activated valve. A 25- $\mu$ L sample loop (P/N 042857) is installed on the valve at the factory. See [Section 2.4.5](#) for details about valve operation.

### Separator and Guard Columns

Both the separator and guard columns are packed with resin and perform the separation of the sample ions. The main function of the guard column is to trap contaminants and remove particulates that might damage the separator column.

### Column Heater

The column heater controls the temperature of the separator and guard columns. The temperature can be set to between 30 and 60 °C, however it must be set at least 5 °C above the ambient temperature. See [Section 2.4.6](#) for details about the column heater.

**Suppressor**

The suppressor reduces the eluent conductivity and enhances the conductivity of the sample ions, thereby increasing detection sensitivity. Either an AES® Atlas Electrolytic Suppressor, SRS® Self-Regenerating Suppressor, or MMS™ MicroMembrane™ Suppressor can be used with the ICS-2000. See [Section 2.4.7](#) for details about the suppressor.

**DS6 Heated Conductivity Cell**

The flow-through conductivity cell measures the electrical conductance of analyte ions as they pass through the cell. A heat exchanger inside the cell regulates the temperature, which can be set to between 30 and 55 °C. For optimum performance, set the temperature to at least 7 °C above the ambient temperature. See [Section 2.4.8](#) for details about the cell.

**Screen Adjustment Knob**

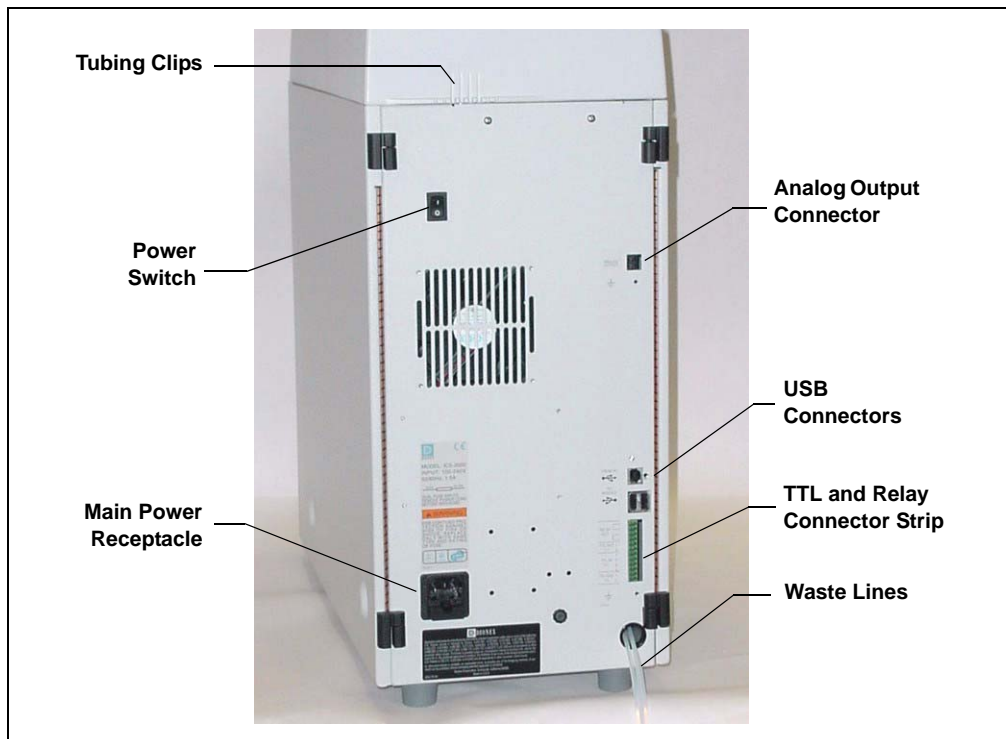
Use this knob to change the LCD touch screen contrast.

**Tubing Chases**

The upper tubing chase routes tubing from the top cover to the component panel. The lower tubing chase routes tubing from the component panel, through the ICS-2000 interior, to the rear panel.

## 2.1.4 Rear Panel

[Figure 2-9](#) illustrates the ICS-2000 rear panel.



*Figure 2-9. ICS-2000 Rear Panel*

### Analog Output Connector

The analog output connector outputs conductivity data (scaled to 1 volt) to an integrator or recording device. See [Section B.20](#) for connection and setup information.

### USB Connectors

A USB receptacle is provided to allow connection to the Chromeleon computer. Two USB ports are provided for connecting to other USB devices. See [Section B.5](#) for connection instructions.

### **TTL and Relay Connector**

The TTL and Relay connector strip provides two TTL outputs, two relay outputs, and four TTL inputs. The outputs can be used to control functions in other TTL- or relay-controllable devices. The inputs can be used to switch the injection valve position, turn on the pump, perform an autozero command, and send an event mark to the analog output. See [Section D.1](#) for connection instructions.

### **Tubing Clips**

The tubing clips hold tubing routed from the top cover in place.

### **Power Switch**

The power switch provides on/off control of power to the ICS-2000.

### **Main Power Receptacle**

The power supply cord plugs into the AC power receptacle.



**The power supply cord is used as the main disconnect device. Make sure the socket-outlet is located near the ICS-2000 and is easily accessible.**



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



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

## 2.2 The Chromeleon Interface

**NOTE** This section provides a brief overview of the Chromeleon interface. For details, refer to the Chromeleon Help or user's manual.

Chromeleon software is used for remote control of ICS-2000 operation. Two modes of software control are available: direct control and automated control.

- With direct control, you select operating parameters and commands from the Chromeleon menu bar, toolbars, and Control panels. Direct control commands are executed as soon as they are entered. [Section 2.2.2](#) describes the commands available from the ICS-2000 Control panels.
- With automated control, you create a list of samples (a sequence) to be processed automatically. The sequence includes programs with commands and parameters for controlling the ICS-2000, acquiring sample data, and producing reports. [Section 3.11.2](#) describes automatic sample processing.

### 2.2.1 The Chromeleon Main Window and Browser

When you start Chromeleon, the main window and the Chromeleon Browser appear (see [Figure 2-10](#)).

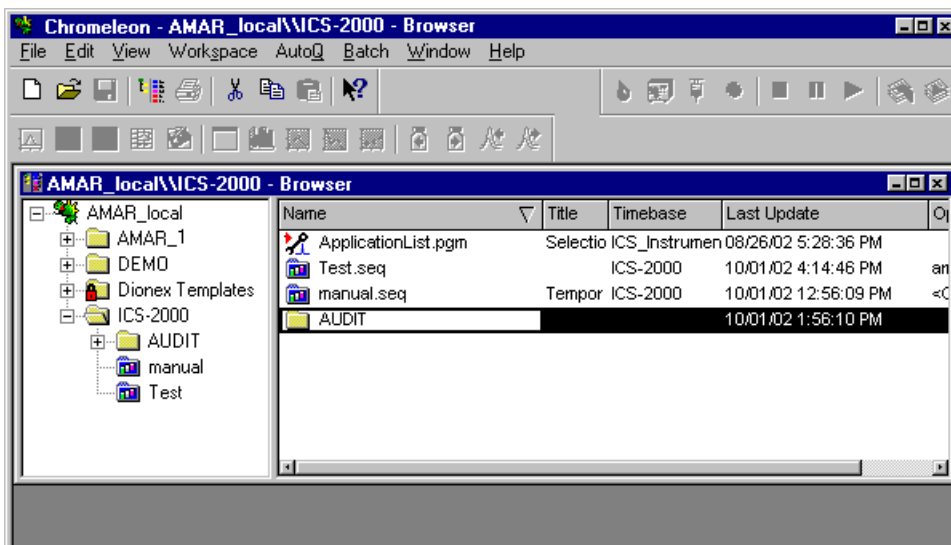


Figure 2-10. Chromeleon Main Window and Browser



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

The Browser displays the directories in which chromatographic data is located, and allows you to open, move, and delete data.

- 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 sequences, System Control panels, Wellness Panels, and reports.
- The right pane displays information about the item selected in the left pane.

### 2.2.2 The ICS-2000 Control Panels

Chromeleon provides two types of Control panels for the ICS-2000.

- System Control panels are used for controlling and monitoring ICS-2000 operation. System Control panels are described below.
- The Wellness Panel is used for performing calibration and diagnostic functions. The Wellness Panel is described in [Section 5.1](#).

#### System Control Panels

System Control panels for the ICS-2000 are located in the **Dionex Templates/Panels/Dionex\_IC\ICS-2000** folder. Chromeleon provides panels for each ICS-2000 system configuration. There are two styles of panels:

- Traditional system panels (see [Figure 2-11](#)) provide controls on a single window with minimal graphics.
- System panels (see [Figure 2-12](#)) provide a more graphical interface than the traditional style. On these panels, clicking a control often brings up another window in which you enter a value.

When you open a System Control panel, select a panel that matches your system configuration and choose the style that you prefer.

# ICS-2000 Ion Chromatography System

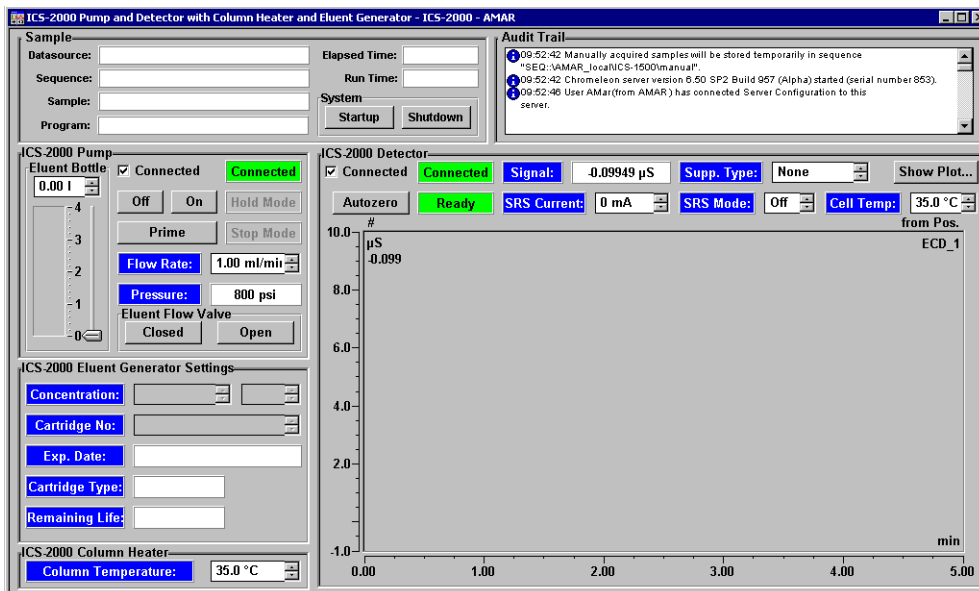


Figure 2-11. ICS-2000 System Control Panel (Traditional)

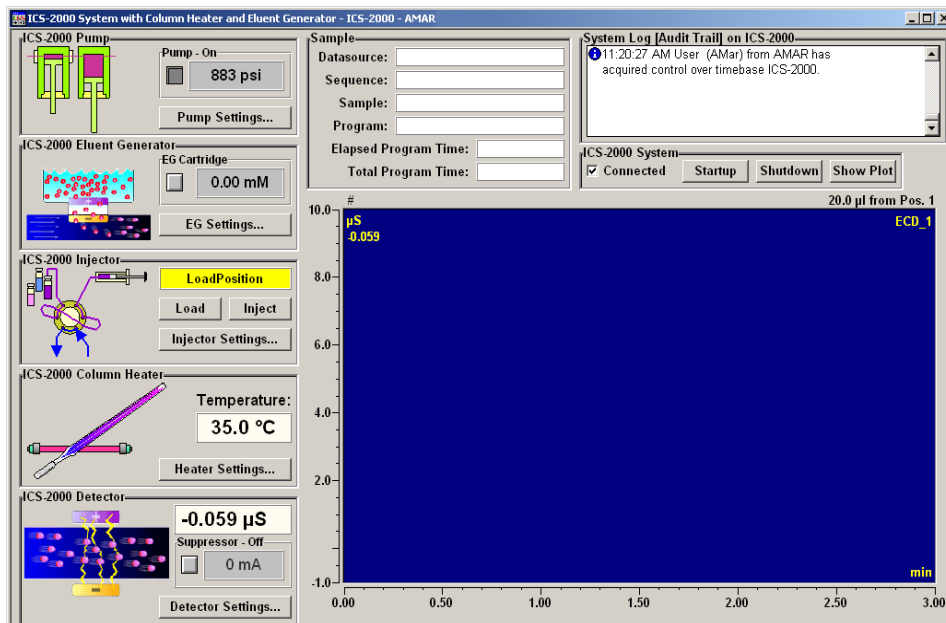
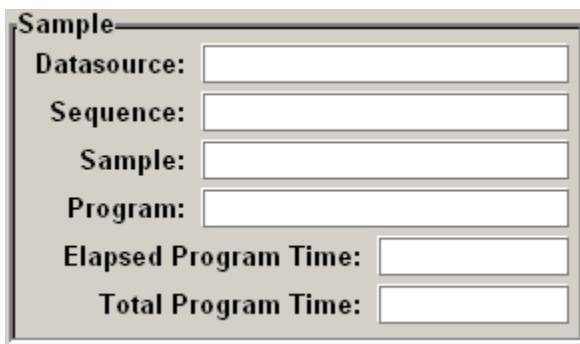


Figure 2-12. ICS-2000 System Control Panel (Graphical)

## System Controls Overview

This section provides brief descriptions of the various controls available on the ICS-2000 System Control panels.

### Sample Controls

A screenshot of a software control panel titled "Sample". It contains six input fields arranged vertically. The first four fields are labeled "Datasource:", "Sequence:", "Sample:", and "Program:". The last two fields are labeled "Elapsed Program Time:" and "Total Program Time:". Each label is followed by a rectangular text input box.

#### Datasource

Displays the database in which the chromatographic data for the sample is saved.

#### Sequence

Displays the sequence in which this sample is included.

#### Sample

Displays the name of the sample that is running.

#### Program

Displays the name of the program that is running.

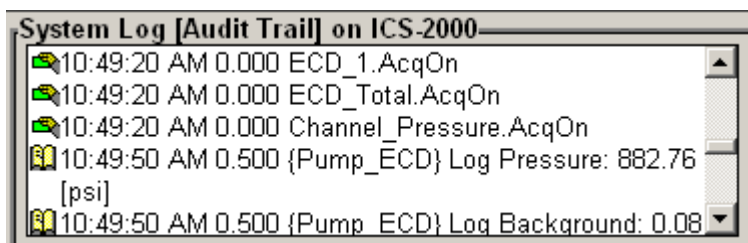
#### Elapsed Program Time

Displays the time that has elapsed since the sample analysis began.

#### Total Program Time

Displays the total run time specified in the program.

### Audit Trail



The Audit Trail displays an account of every event that occurs during ICS-2000 operation. This includes errors, status messages, operational events, etc.

### System Controls



#### Connected

Connects the ICS-2000 to the Chromeleon Control panel, enabling communication between the PC and the module. Clearing the check box disconnects the ICS-2000 from the PC.

#### Startup

Starts the pump, suppressor, and eluent generator. The flow rate, suppressor current, and eluent concentration settings that were in effect at system shutdown (see below) are restored.

#### Shutdown

Stops the pump, suppressor, and eluent generator. The flow rate, suppressor current, and eluent concentration settings currently in effect are remembered and will be restored at system startup (see above).

#### Show Plot...

Displays the ICS-2000 detector signal plot in a separate window.

## Pump Controls

**Pump Settings**

**Flow Rate:** 1.00 ml/min

**Eluent Bottle**  
3.73 l

Off On Prime

**Eluent Flow Valve**  
Closed Open

Max. Pressure: 3000 psi

Curr. Pressure: 883 psi

Min. Pressure: 200 psi

Eluent Level: 3.73 l

### Flow Rate

Sets the pump flow rate in mL/min.

### Eluent Bottle

The entry field and gauge indicate the level of liquid (in liters) in the eluent bottle. This is a user-controlled feature. The level must be entered by the user when the reservoir is filled. See [Section 3.4.2](#) for details.

### Off, On, Prime

Turn the pump on and off, or start the pump priming function.

### Eluent Flow Valve

Select the eluent flow valve position (**Closed** or **Open**).

### Max. Pressure

Displays the upper pressure limit. If this limit is exceeded, Chromeleon stops the flow, displays an error message, and stops the sample batch, as necessary.

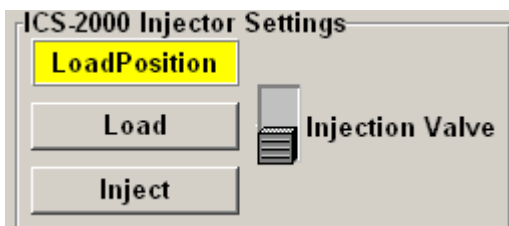
### Curr. Pressure

Displays the current pressure.

### Min. Pressure

Displays the lower pressure limit. If this limit is exceeded, Chromeleon stops the flow, displays an error message, and stops the sample batch, as necessary.

### Injection Valve Controls



#### **LoadPosition**

#### **InjectPosition**

Displays the current position of the injection valve.

#### **Load**

Switches the valve to the load position.

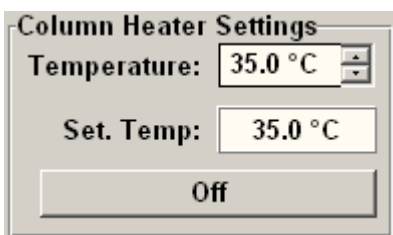
#### **Inject**

Switches the valve to the inject position.

#### **Injection Valve Switch**

Switches the valve from the current position to the other position.

### Column Heater Controls



#### **Temperature**

Displays the current heater temperature and lets you set a new temperature.

#### **Set Temp**

Displays the current set temperature.

#### **Off**

Turns the column heater off.

## Detector Controls

ICS-2000 Detector Settings			
Autozero	Acq. Ready	Total Cond:	-0.09107 $\mu$ S
Signal:	-0.02301 $\mu$ S	Supp. Type:	SRS
Data Rate:	5.0 Hz	Supp. Current:	50 mA
Cell Temp:	35.0 $^{\circ}$ C	Supp. Mode:	On

### Autozero

Sets the conductivity to zero.

### Acq. Ready

Indicates whether the detector is ready to begin data acquisition.

### Total Cond

Displays the total conductivity (the conductivity including the offset conductivity). To determine the offset, allow the system to equilibrate after startup. At equilibration, the total conductivity is the background conductivity (the eluent conductivity before sample injection). Touch **Autozero** to zero the conductivity and offset this background reading from the total reading.

### Signal

Displays the offset conductivity (the total conductivity with the background conductivity subtracted).

### Data Rate

Sets the rate at which data points are recorded.

### Cell Temp

Sets the temperature of the cell.

### Supp. Type

Selects the type of suppressor installed.

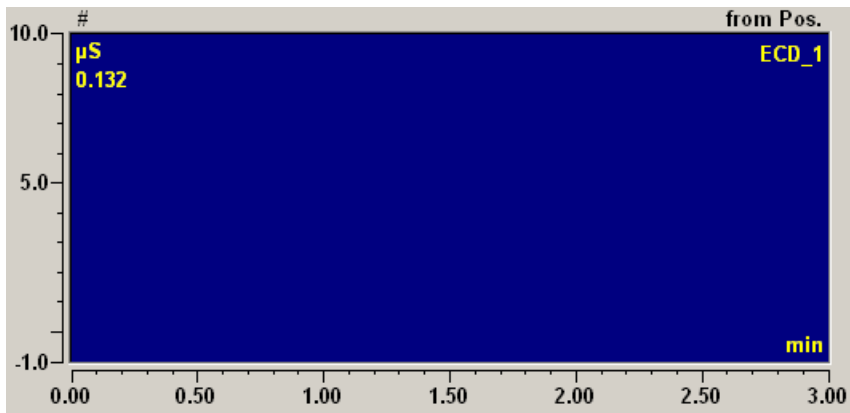
### Supp. Current

Sets the current supplied to the suppressor.

### Supp. Mode

Turns the suppressor on or off.

## Signal Plot



Displays a plot of the detector signal. Right-click to select plot options from a context menu. You can select autoscale commands, change the plot appearance, or select other signals to be displayed (for example, total conductivity or pump pressure).

## Eluent Generator Controls (Single Cartridge)

The figure shows a dialog box titled 'Eluent Generator Settings'. It contains several control elements:

- Concentration:** A text box containing '0.00 mM' and a dropdown menu set to 'On'.
- Cartridge No.:** A text box containing '\_123456789012'.
- Exp. Date:** An empty text box.
- Cartridge Type:** An empty text box.
- Remaining Life:** An empty text box.
- CR-TC:** A dropdown menu set to 'Off'.

### Concentration

Sets the concentration of eluent generated.

### On/Off

Turns the eluent generator on or off.

### Cartridge No.

Displays the serial number of the installed cartridge.



**Exp. Date**

Displays the expiration date of the installed cartridge. Although you can continue operation with the cartridge after the expiration date, performance may be impaired until a new cartridge is installed.

**Cartridge Type**

Displays the type of cartridge installed.

**Remaining Life**

Displays the percentage of ions remaining in the cartridge. The ion percentage is counted down in 1% increments. Warning messages are displayed in the Chromeleon Audit Trail when the percentage falls below 30%. At 0%, an error message informs you that the ion count is depleted and the cartridge must be replaced before continuing operation.

**Normalized Life** (displayed when an EPM is installed)

Indicates how much the EPM has been used. The value starts at 0 and counts up with use. A count of 1 means the EPM usage is approximately equal to the lifetime of one  $K_2CO_3$  cartridge.

**CR-TC**

Turns the CR-TC on or off.

**Eluent Generator Controls (Dual Cartridge)**

EGC-1 Settings		EGC-2 Settings	
<b>Target Conc:</b>	0.00 mM <input type="button" value="▲"/> <input type="button" value="▼"/>	<b>Target Conc:</b>	0.00 mM <input type="button" value="▲"/> <input type="button" value="▼"/>
	<input type="button" value="Off"/> <input type="button" value="▲"/> <input type="button" value="▼"/>		<input type="button" value="Off"/> <input type="button" value="▲"/> <input type="button" value="▼"/>
Applied Concentration	<input type="text" value="0.00"/>	Applied Concentration	<input type="text" value="0.00"/>
<b>Cartridge No:</b>	<input type="text" value="_123456789012"/>	<b>Cartridge No:</b>	<input type="text" value="_123456789012"/>
<b>Exp. Date:</b>	<input type="text"/>	<b>Exp. Date:</b>	<input type="text"/>
<b>Cartridge Type:</b>	<input type="text"/>	<b>Cartridge Type:</b>	<input type="text"/>
<b>Remaining Life:</b>	<input type="text"/>	<b>Remaining Life:</b>	<input type="text"/>
<b>CR-TC</b>	<input type="button" value="Off"/> <input type="button" value="▲"/> <input type="button" value="▼"/>		

Dual panels provide controls for either two EluGen cartridges or for one EluGen cartridge and one EPM. For carbonate/bicarbonate eluent generation, the  $K_2CO_3$  cartridge is typically connected to **EGC-1** and the EPM is connected to **EGC-2**. Except for the following two controls, the

controls for each cartridge in the dual panel are the same as described for the single cartridge panel controls (see [page 20](#)).

### **Target Concentration**

Sets the concentration of eluent generated. If a  $K_2CO_3$  EluGen cartridge and an EPM Electrolytic pH Modifier are installed (connected to **EGC-1** and **EGC-2**, respectively), set the **EGC-1 Target Concentration** to the concentration of  $K_2CO_3$  required for your application and set the **EGC-2 Target Concentration** to the concentration of  $KHCO_3$  required.

### **Applied Concentration**

Displays the concentration of eluent currently being generated. For carbonate/bicarbonate eluent, the **Applied Concentration** for the  $K_2CO_3$  cartridge is equal to the total of the target concentrations from both cartridges. This is the actual concentration of  $K_2CO_3$  that the cartridge must generate in order to achieve the desired  $K_2CO_3/KHCO_3$  eluent mixture:

*Applied Concentration  $K_2CO_3 = Target Concentration K_2CO_3 + Target Concentration EPM$*

## 2.3 Flow Schematics

The following figures illustrate the liquid flow path through an ICS-2000 when using suppression in autorecycle mode. Three configurations are shown:

- [Figure 2-13](#) illustrates the liquid flow path when the components required for producing KOH, LiOH, MSA, or NaOH eluent are installed. The required components include the corresponding type of EluGen cartridge and a CR-TC.
- [Figure 2-14](#) illustrates the liquid flow path when the components required for producing carbonate/bicarbonate eluent are installed. The required components include an EGC II K<sub>2</sub>CO<sub>3</sub> EluGen Cartridge, an EPM Electrolytic pH Modifier, and an EGC CO<sub>3</sub> Mixer.
- [Figure 2-15](#) illustrates the liquid flow path when the components required for producing carbonate eluent are installed. The required components include an EGC II K<sub>2</sub>CO<sub>3</sub> EluGen Cartridge and an EGC CO<sub>3</sub> Mixer.

# ICS-2000 Ion Chromatography System

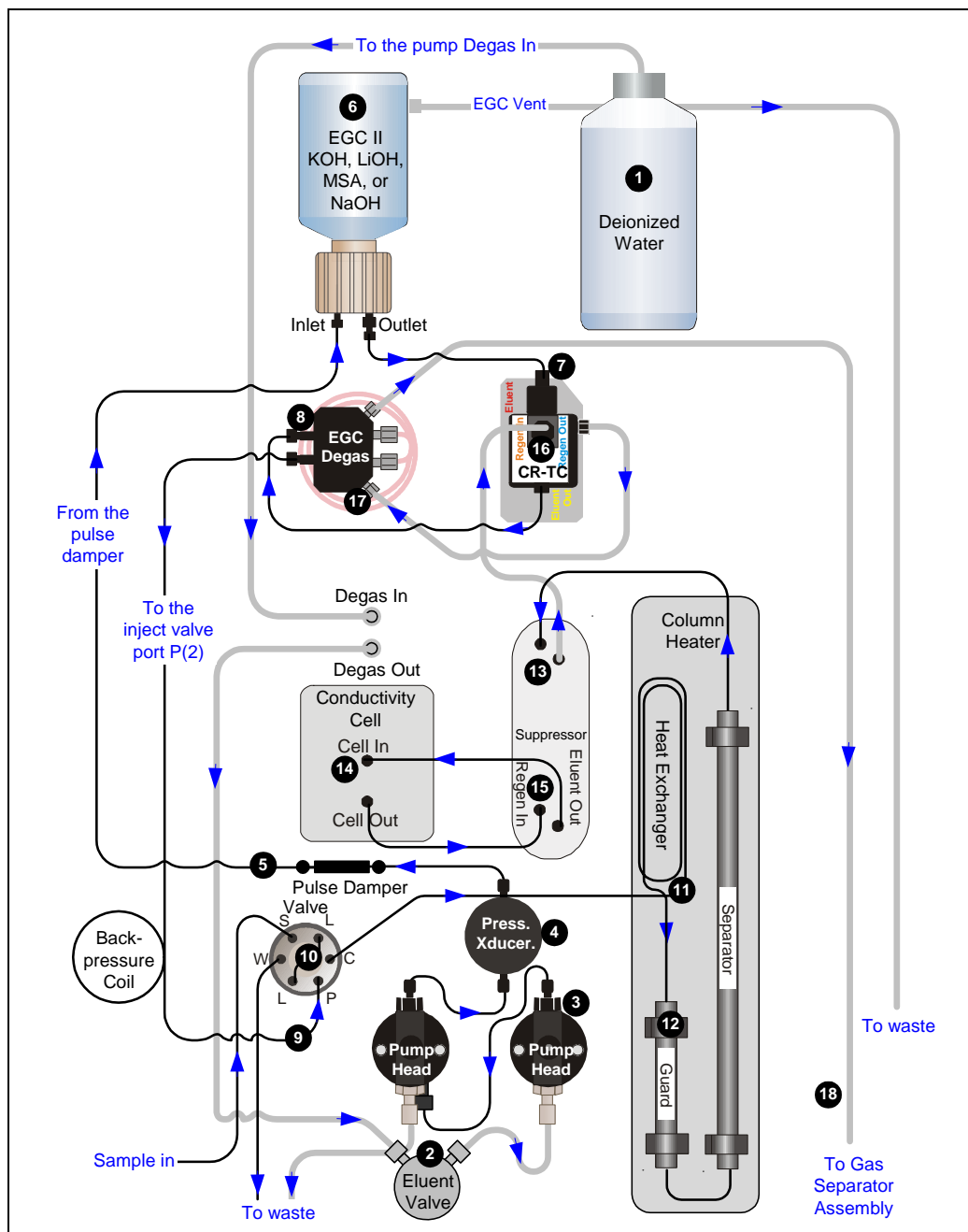


Figure 2-13. ICS-2000 Flow Schematic: KOH, LiOH, MSA, or NaOH Eluent Generation

### Flow Description for KOH, LiOH, MSA, or NaOH Eluent Generation

Refer to [Figure 2-13](#) for the flow path number locations.

- Deionized water from the reservoir **1** flows first through the pump degas assembly and then through the eluent valve **2** to the pump **3**. The water is then pushed through the pressure transducer **4**, which measures the system pressure. From there, the water flows through a pulse damper **5**, which smooths minor pressure variations from the pump to minimize baseline noise.
- Water then flows into the EluGen cartridge (EGC) **6**, which generates the programmed concentration of eluent. Eluent exits the cartridge and flows through the CR-TC **7** (which traps ionic contaminants), through the EGC degas tubing assembly **8**, and on to the injection valve **9**.
- After sample is loaded into the sample loop **10** and the injection valve is toggled to the Inject position, eluent passes through the sample loop.
- The eluent/sample mixture is pumped through the heat exchanger **11**, which heats the mixture to the column heater temperature. The mixture then goes to the guard and separator columns **12** and through the suppressor **13**.
- From the suppressor, the mixture flows through the cell **14**, where the analytes are detected. A digital signal is sent to Chromeleon software. Analog output can be collected simultaneously.
- The mixture flows out of the cell and is recycled back into the suppressor **15**, where it is the water source for the regenerant chamber.
- Regenerant waste from the suppressor is directed back to the CR-TC **16**, and then to the EGC degas tubing **17**, where any released hydrogen or oxygen gas is removed before it is sent to the gas separator assembly and then to waste **18**.

# ICS-2000 Ion Chromatography System

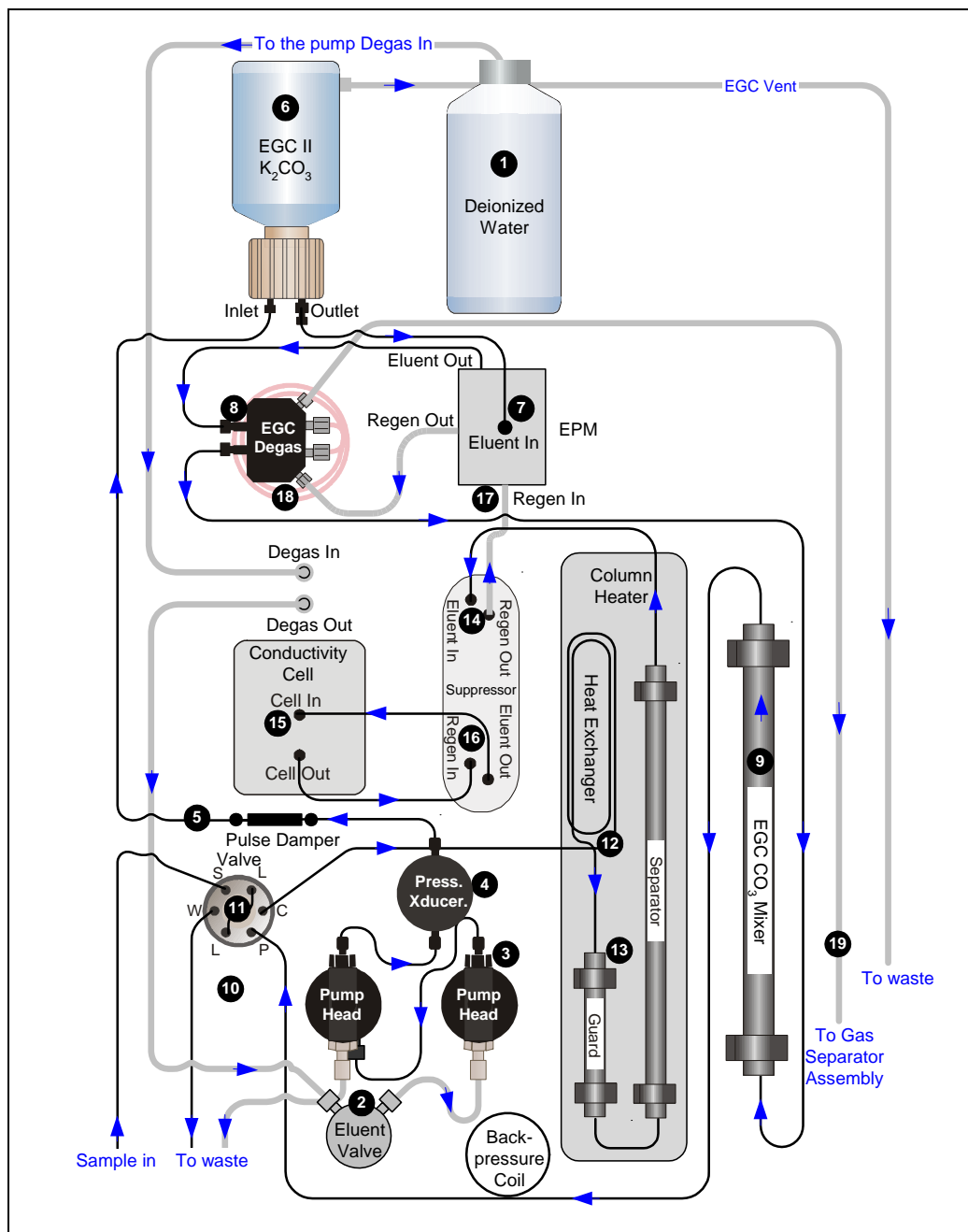


Figure 2-14. ICS-2000 Flow Schematic: Carbonate/Bicarbonate Eluent Generation

### Flow Description for Carbonate/Bicarbonate Eluent Generation

Refer to [Figure 2-14](#) for the flow path number locations.

- Deionized water from the reservoir **1** flows first through the pump degas assembly and then through the eluent valve **2** to the pump **3**. The water is then pushed through the pressure transducer **4**, which measures the system pressure. From there, the water flows through a pulse damper **5**, which smooths minor pressure variations from the pump to minimize baseline noise.
- Water then flows into the EluGen cartridge (EGC) **6**, which generates the programmed concentration of carbonate eluent. Eluent exits the cartridge and flows through the EPM **7**, which adjusts the eluent concentration to produce the carbonate/bicarbonate mixture. The mixture flows through the EGC degas tubing assembly **8** to the EGC CO<sub>3</sub> Mixer **9** (to ensure a homogenous carbonate/bicarbonate mixture), and then on to the injection valve **10**.
- After sample is loaded into the sample loop **11** and the injection valve is toggled to the Inject position, eluent passes through the sample loop.
- The eluent/sample mixture is pumped through the heat exchanger **12**, which heats the mixture to the column heater temperature. The mixture then goes to the guard and separator columns **13** and through the suppressor **14**.
- From the suppressor, the mixture flows through the cell **15**, where the analytes are detected. A digital signal is sent to Chromeleon software. Analog output can be collected simultaneously.
- The mixture flows out of the cell and is recycled back into the suppressor **16**, where it is the water source for the regenerant chamber.
- Regenerant waste from the suppressor is directed back to the EPM **17**, and then to the EGC degas tubing **18**, where any released hydrogen or oxygen gas is removed before it is sent to the gas separator assembly and then to waste **19**.

# ICS-2000 Ion Chromatography System

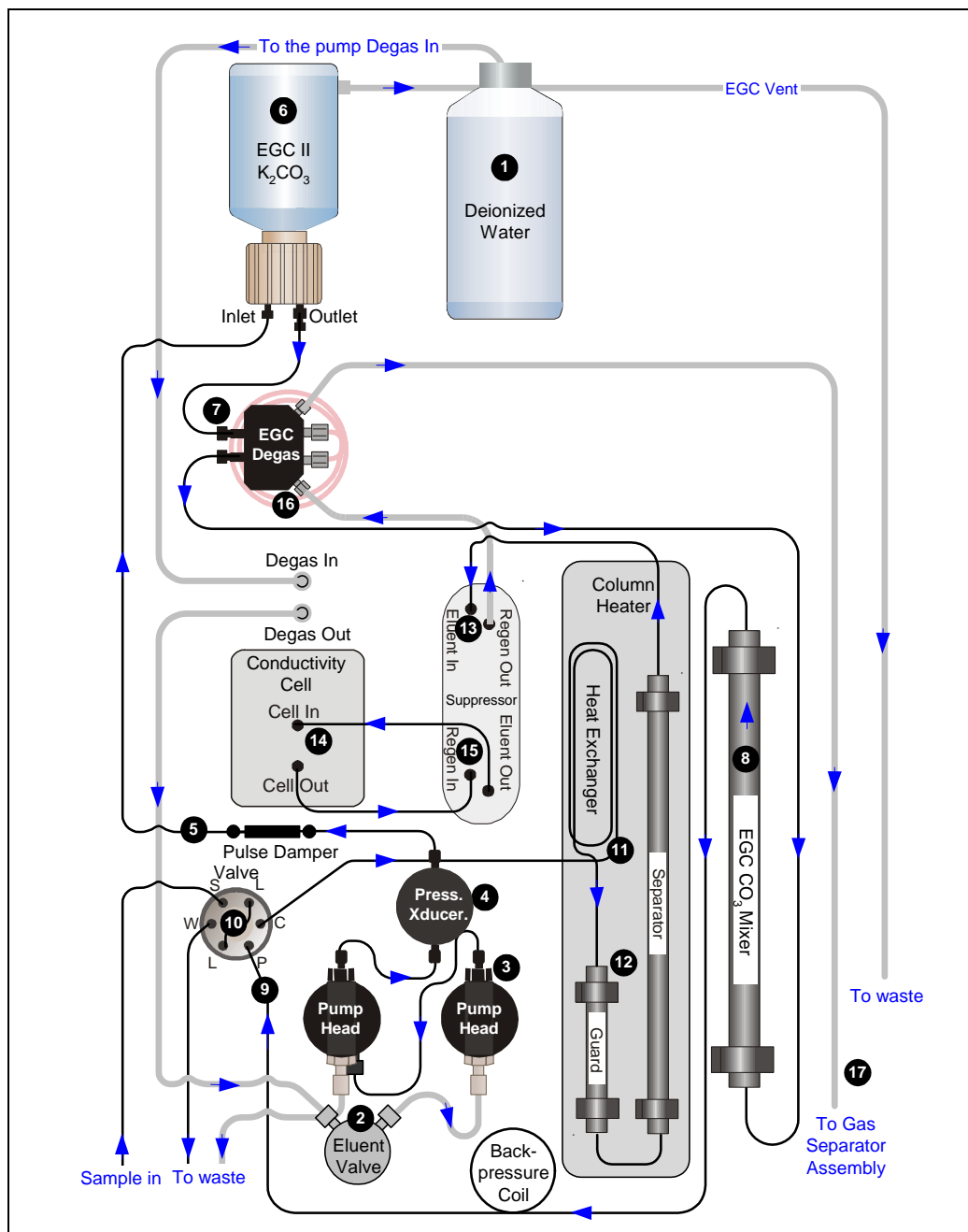


Figure 2-15. ICS-2000 Flow Schematic: Carbonate Eluent Generation



### Flow Description for Carbonate Eluent Generation

Refer to [Figure 2-15](#) for the flow path number locations.

- Deionized water from the reservoir **1** flows first through the pump degas assembly and then through the eluent valve **2** to the pump **3**. The water is then pushed through the pressure transducer **4**, which measures the system pressure. From there, the water flows through a pulse damper **5**, which smooths minor pressure variations from the pump to minimize baseline noise.
- Water then flows into the EluGen cartridge (EGC) **6**, which generates the programmed concentration of carbonate eluent. Eluent exits the cartridge and flows through the EGC degas tubing assembly **7**. Eluent then goes to the EGC CO<sub>3</sub> Mixer **8** (to ensure a homogenous eluent concentration), and then on to the injection valve **9**.
- After sample is loaded into the sample loop **10** and the injection valve is toggled to the Inject position, eluent passes through the sample loop.
- The eluent/sample mixture is pumped through the heat exchanger **11**, which heats the mixture to the column heater temperature. The mixture then goes to the guard and separator columns **12** and through the suppressor **13**.
- From the suppressor, the mixture flows through the cell **14**, where the analytes are detected. A digital signal is sent to Chromeleon software. Analog output can be collected simultaneously.
- The mixture flows out of the cell and is recycled back into the suppressor **15**, where it is the water source for the regenerant chamber.
- Regenerant waste from the suppressor is directed back to the EGC degas tubing **16**, where any released hydrogen or oxygen gas is removed before it is sent to the gas separator assembly and then to waste **17**.

### 2.4 System Component Details

This section provides details about ICS-2000 system components, including the vacuum degas assembly, pump, eluent generator, injection valve, column heater, suppressor, and conductivity cell.

#### 2.4.1 Vacuum Degas Assembly

The vacuum degas assembly provides online eluent degassing at the time and duration specified by the user. The assembly, which must be installed in the ICS-2000 at the factory, consists of:

- A single-channel degas chamber (with degas membranes) with internal capacity of 17 mL
- A dual-stage diaphragm vacuum pump
- A solenoid valve
- An on-board vacuum sensor
- The electronics required to operate the vacuum pump
- Tubing, fittings, and other accessories

By default, the ICS-2000 monitors the degas pressure reading and turns the degas pump on and off as needed. A different degas operating mode can be selected from the touch screen **PUMP** page (see [Section C.7](#)) or from Chromeleon. To select degas operating options from Chromeleon, open the Server Configuration program, select the ICS-2000 device icon

under the timebase, and select **Edit>Properties**. Select the **Options** tab (see [Figure 2-16](#)).

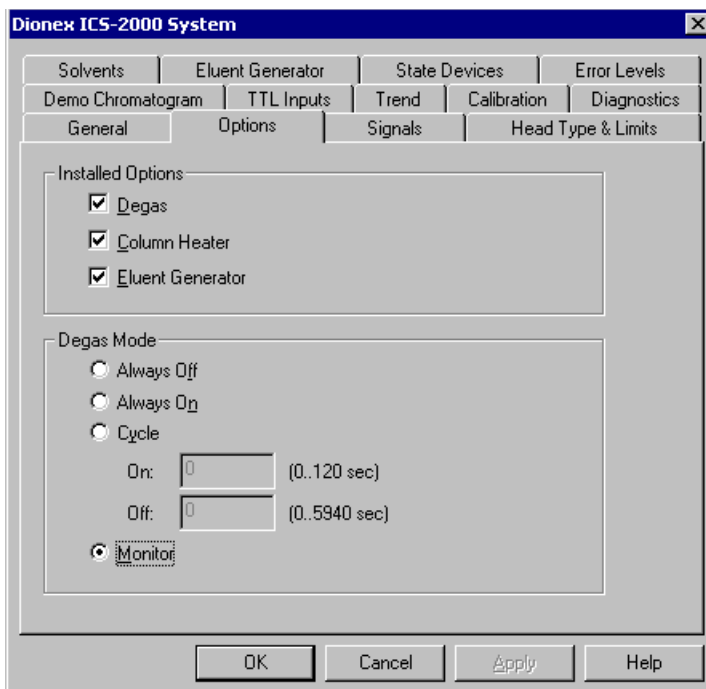


Figure 2-16. Server Configuration Properties: Degas Mode Options

### Degas Mode Options

- **Always Off:** The degas pump is always off.
- **Always On:** The degas pump is always on. This setting is for test purposes by a Dionex Service Representative. Do not use this setting for routine operation.
- **Cycle:** The degas pump cycles on and off according to the times specified in the **Cycle On** and **Off** fields. **Cycle On** specifies for how long the degas pump runs during a cycle. **Cycle Off** specifies the time between cycles.
- **Monitor:** (default mode) The ICS-2000 monitors the degas pressure reading and turns the degas pump on and off as required.

### 2.4.2 Eluent Valve

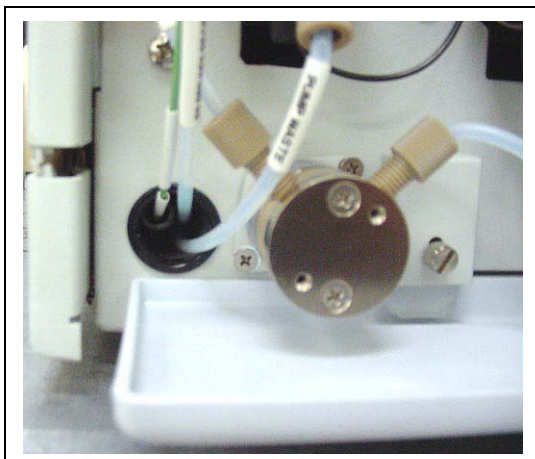


Figure 2-17. Eluent Valve

The eluent valve controls the flow from the eluent reservoir. The valve opens automatically when the pump is started and closes when the pump is turned off. The valve can also be opened and closed manually either from the Chromeleon Control panel (see [Section 2.2.2](#)), or the touch screen **PUMP** page (see [Section C.7](#)). This lets you perform service procedures on pump components without eluent leaks occurring.

### 2.4.3 Pump

The ICS-2000 pump is a microprocessor-based isocratic eluent delivery system. Its variable speed, dual-piston series design ensures pulse-free pumping for the most demanding applications.

#### Primary Pump Head

The primary pump head pumps eluent into the secondary head (see [Figure 2-18](#)). The check valves, which prevent reverse flow through the pump, are located on the bottom (inlet) and top (outlet) of the primary pump head. The priming valve is on the front of the pump head.

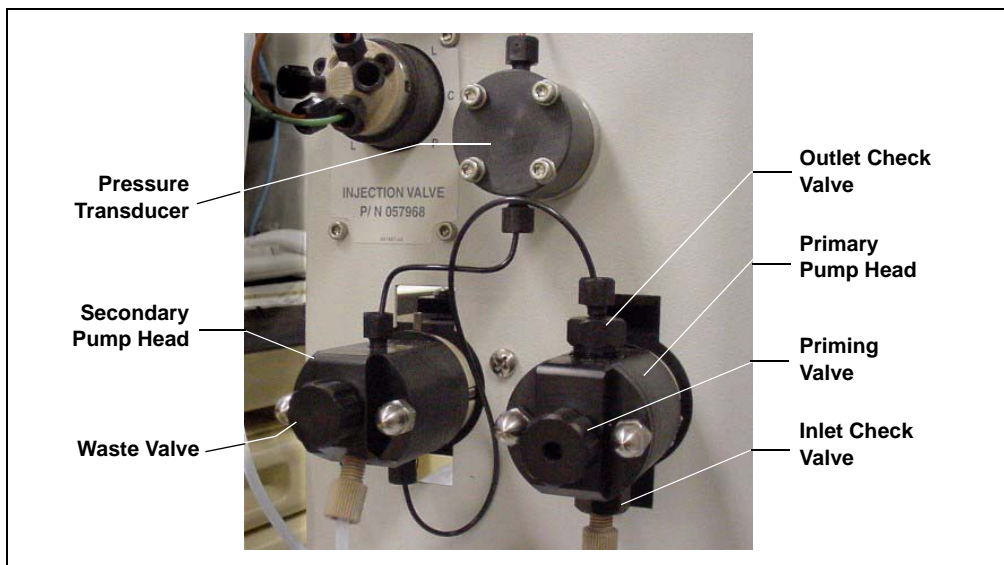


Figure 2-18. ICS-2000 Pump Components

To open the priming valve, turn the knob one-quarter to one-half turn counterclockwise. When the priming valve is open, liquid can flow into and out of the primary pump head via the port in the front of the valve.

**NOTE** The priming valve must be open when the pump is being primed with a syringe or with isopropyl alcohol. For detailed priming instructions, see [Section B.13](#).

### Secondary Pump Head

The secondary pump head delivers eluent to the remainder of the chromatography system (the injection valve, column, and detector). The waste valve is located on the front of the secondary pump head (see [Figure 2-18](#)).

To open the waste valve, turn the knob one-quarter to one-half turn counterclockwise. When the waste valve is in the open position, all output is directed to waste.

**NOTE** The waste valve must be open when the pump is being primed using the **Prime** button. For detailed priming instructions, see [Section B.13](#).

### Pressure Transducer

Flow exiting the secondary pump head is directed to the pressure transducer (see [Figure 2-18](#)), which measures the system pressure.

Pressure readings indicate that the pumping system is delivering smooth, accurate flow. Pressure readings can be monitored from the Chromeleon Control panel or the touch screen **HOME** page.

The system pressure should remain consistent (no more than a 3% difference from one pressure reading to the next). High and low pressure limits can be used to stop the pump flow if a limit is exceeded. The pressure limits can be set from Chromeleon (in the Server Configuration or in the control program) or from the touch screen **PUMP** page (see [Section C.7](#)). See [Section 4.1](#) for troubleshooting information if a pressure limit is exceeded.

### Pulse Damper

Flow output from the pressure transducer continues to the pulse damper, which smooths minor pressure variations. From there, flow is directed to the injection valve and then to the remainder of the chromatography system.

### Piston Seal Wash

The pump includes a piston seal wash assembly that can be set up to continuously rinse the back of the piston seals to remove salt crystals and prolong the life of the seals. To use this feature, an external water source must be connected. See [Section B.22](#) for connection instructions.

For continued protection of the pump, replace the piston rinse seals (see [Section 5.6](#)) and O-rings in the seal wash assembly every 6 months, or whenever you replace the main piston seals for the ICS-2000 pump.

## 2.4.4 Eluent Generator

The eluent generator produces high-purity eluents online, using only deionized water as the carrier. The eluent generator consists of an eluent generator cartridge (EGC) that generates the eluent, and a high-pressure degas tubing assembly that removes electrolysis gases created during eluent generation.

**NOTE** A gas separator waste tube (P/N 045460) should be connected to the system waste line during installation (see [Section B.10.1](#)).

Several types of EluGen cartridges are available for use with the ICS-2000 (see [Table 2-1](#)). Each cartridge contains 900 mL of the appropriate electrolyte concentrate solution for eluent generation.

EluGen Cartridge	Part Number	Function
EGC II K <sub>2</sub> CO <sub>3</sub> EluGen Cartridge	058904	Generates carbonate eluent for anion exchange separations. <b>Note:</b> Produces a carbonate/bicarbonate mixture when installed with the EPM Electrolytic pH Modifier (P/N 063175) and EGC CO <sub>3</sub> Mixer (P/N 061686).
EGC II KOH EluGen Cartridge	058900	Generates hydroxide eluent for anion exchange separations.
EGC II LiOH EluGen Cartridge	058906	Generates lithium hydroxide eluent for anion exchange separations.
EGC II MSA EluGen Cartridge	058902	Generates methanesulfonic acid eluent for cation exchange separations.
EGC II NaOH EluGen Cartridge	058908	Generates sodium hydroxide eluent for anion exchange separations.

*Table 2-1. EluGen Cartridge Types for the ICS-2000*

For more information, refer to the EluGen cartridge manual. The manual is included on the Dionex Reference Library CD-ROM (P/N 053891).

You can select the concentration of eluent to be generated from either the Chromeleon Control panel or from the touch screen **HOME** page (see [Section C.4](#)).

The allowable eluent concentration depends on several factors: the flow rate, suppressor type, EluGen cartridge type, and cartridge configuration. For details, refer to [Table 2-1](#) and [Table 2-2](#).

### Single-Cartridge Configuration

In the single-cartridge configuration, the ICS-2000 contains one EluGen cartridge.

EluGen Cartridge	Eluent Concentration Range
K <sub>2</sub> CO <sub>3</sub>	0.1 to 15 mM at 0.1 to 1.0 mL/min flow 0.1 to X mM at 1.0 to 2.0 mL/min flow where X = 15/flow in mL/min
KOH	0.1 to 100 mM at 0.1 to 1.0 mL/min flow 0.1 to X mM at 1.0 to 3.0 mL/min flow where X = 100/flow in mL/min
LiOH	0.1 to 80 mM at 0.1 to 1.0 mL/min flow 0.1 to X mM at 1.0 to 3.0 mL/min flow where X = 80/flow in mL/min
MSA	0.1 to 100 mM at 0.1 to 1.0 mL/min flow 0.1 to X mM at 1.0 to 3.0 mL/min flow where X = 100/flow in mL/min
NaOH	0.1 to 100 mM at 0.1 to 1.0 mL/min flow 0.1 to X mM at 1.0 to 3.0 mL/min flow where X = 100/flow mL/min

*Table 2-1. Eluent Concentration Ranges for Single-Cartridge Configurations*

### Linked Dual-Cartridge Configuration

In the linked dual-cartridge configuration, the ICS-2000 contains two EluGen cartridges (or one EluGen cartridge and an EPM) that perform as one cartridge. Note that the allowable eluent concentration for a linked cartridge is less than when the cartridge is defined as independent. For



details, refer to the EluGen cartridge manual. Cartridge manuals are included on the Dionex Reference Library CD-ROM (P/N 053891).

EluGen Cartridges	Eluent Concentration Range	Comment
K <sub>2</sub> CO <sub>3</sub> /EPM Electrolytic pH Modifier	0.1 to 15 mM at 0.1 to 1.0 mL/min flow 0.1 to X mM at 1.0 to 2.0 mL/min flow X = 15/flow	The total of the eluent concentrations from both the EluGen cartridge and the EPM must not exceed the specified range. The EPM concentration must not exceed 10 mM. See <a href="#">“Generating Carbonate/Bicarbonate Eluent” on page 2-39</a> for details.
KOH/KOH KOH/MSA KOH/NaOH MSA/MSA MSA/NaOH NaOH/NaOH	0.1 to 50 mM at 0.1 to 1.0 mL/min flow 0.1 to X mM at 1.0 to 3.0 mL/min flow X = 50/flow	The eluent concentration range for each cartridge is cut by 50%.
LiOH/LiOH	0.1 to 40 mM at 0.1 to 1.0 mL/min flow 0.1 to X mM at 1.0 to 3.0 mL/min flow X = 40/flow	The eluent concentration range for each cartridge is cut by 50%.

Table 2-2. Eluent Concentration Ranges for Linked Dual-Cartridge Configurations

### EluGen Cartridge Holder

The EluGen cartridge is installed in a cartridge holder, which mounts on the ICS-2000 top cover (see [Figure 2-7](#)). The cartridge holder also houses the high-pressure degas tubing assembly.

The ICS-2000 can control up to two EluGen cartridges. However, when operating with an EGC II K<sub>2</sub>CO<sub>3</sub> EluGen Cartridge and the pH Modifier,

only one cartridge can be installed, because the pH Modifier must be connected to the other EGC power supply (**EGC-1** or **EGC-2**).

Tubing and fittings for plumbing the cartridge, degas assembly, CR-TC, and EPM are included with the holder. See [Section B.14](#) for installation instructions.

### **Backpressure Coil (Optional)**

The EluGen cartridge requires at least 14 MPa (2000 psi) of system backpressure for removal of electrolysis gas from the eluent produced by the cartridge. A system backpressure of 16 MPa (2300 psi) is ideal.

If necessary, increase the system backpressure by installing a backpressure coil between the injection valve and the EluGen cartridge **OUTLET** port. For details, refer to [Section B.16.1](#).

### **Continuously Regenerated Trap Column (CR-TC)**

The CR-TC is a high pressure electrolytically-regenerated trap column. The CR-TC is designed to remove anionic or cationic contaminants in the eluent or deionized water and to reduce drift during gradient separations. Two versions of the CR-TC can be used with the ICS-2000:

- CR-ATC (Continuously Regenerated Anion Trap Column, P/N 060477)
- CR-CTC (Continuously Regenerated Cation Trap Column, P/N 060478)

For more information, refer to the CR-TC manual. The manual is included on the Dionex Reference Library CD-ROM (P/N 053891).

**NOTE** The IonPac® ATC-HC Trap Column (P/N 059604) or IonPac CTC-1 Trap Column (P/N 040192) can be used with the ICS-2000. However, both IonPac trap columns require off-line chemical regeneration. Contact Dionex for more information.

### EPM Electrolytic pH Modifier and EGC CO<sub>3</sub> Mixer

The EGC II K<sub>2</sub>CO<sub>3</sub> EluGen Cartridge can be used with an EPM Electrolytic pH Modifier (P/N 063175) (see [Figure 2-19](#)) and an EGC CO<sub>3</sub> Mixer (P/N 061686) to produce a carbonate/ bicarbonate mixture. The carbonate/bicarbonate mixture is used with carbonate-based IonPac columns for anion exchange separations.

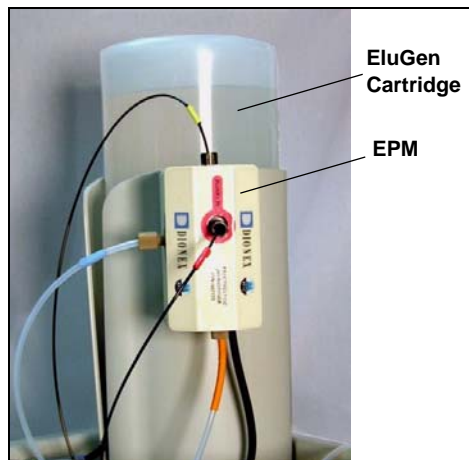


Figure 2-19. ICS-2000 with an EluGen Cartridge and EPM Installed

After the cartridge generates carbonate eluent, the pH Modifier adjusts the eluent concentration to produce the carbonate/bicarbonate mixture. The EGC CO<sub>3</sub> Mixer provides enough mixing to produce a homogenous solution of electrolytically-generated K<sub>2</sub>CO<sub>3</sub> and KHCO<sub>3</sub> eluent.

For more information about these products, refer to the EluGen cartridge manual. Cartridge manuals are included on the Dionex Reference Library CD-ROM (P/N 053891).

### Generating Carbonate/Bicarbonate Eluent

If a K<sub>2</sub>CO<sub>3</sub> EluGen cartridge and an EPM Electrolytic pH Modifier are installed (connected to EGC-1 and EGC-2, respectively), set EGC-1 to the concentration of K<sub>2</sub>CO<sub>3</sub> required for your application and set EGC-2 to the concentration of KHCO<sub>3</sub> required. In order to achieve the desired K<sub>2</sub>CO<sub>3</sub>/KHCO<sub>3</sub> eluent mixture, the K<sub>2</sub>CO<sub>3</sub> cartridge must generate the total of the two setpoint concentrations.

For example, for a 3.50 mM K<sub>2</sub>CO<sub>3</sub>/1.00 mM KHCO<sub>3</sub> eluent, set EGC-1 to 3.50 mM and EGC-2 to 1.00 mM. When the eluent is generated, the K<sub>2</sub>CO<sub>3</sub> cartridge generates 4.50 mM K<sub>2</sub>CO<sub>3</sub>, which is then modified by the EPM to achieve the desired 3.50 mM K<sub>2</sub>CO<sub>3</sub>/1.00 mM KHCO<sub>3</sub> mixture.

### 2.4.5 Injection Valve

The injection valve (P/N 057968) is a six-port, electrically-activated valve. A 25- $\mu$ 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 2-20](#)).

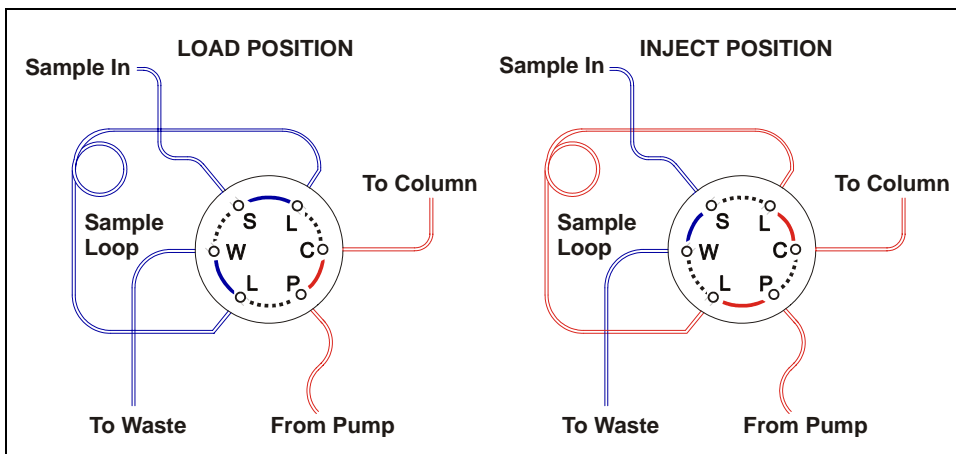


Figure 2-20. Injection Valve Flow Schematics

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. [Section 3.10](#) describes how to inject samples.

[Figure 2-21](#) shows the injection valve connections. The injection valve is plumbed at the factory with all tubing and fittings for connection to the pump, injection port, column, and waste. A 25- $\mu$ L PEEK sample loop (P/N 042857) is installed between ports L (1) and L (4). Dionex offers

sample loops in various sizes. If necessary, the pre-installed 25- $\mu$ L loop can be replaced with a loop that has a different sample injection volume.

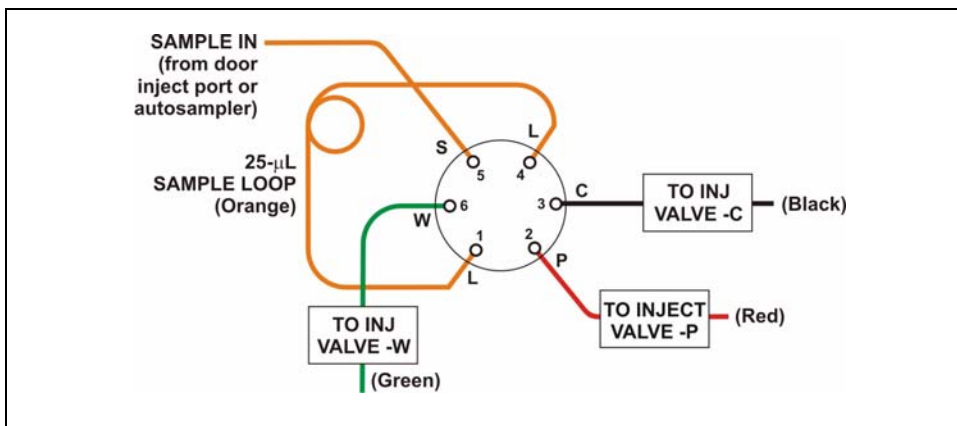


Figure 2-21. Injection Valve Plumbing

**NOTE** The EluGen cartridge requires at least 14 MPa (2000 psi) of system backpressure for removal of electrolysis gas from the eluent produced by the cartridge. A system backpressure of 16 MPa (2300 psi) is ideal.

If the system backpressure is too low, install a backpressure coil. Connect one end of the backpressure coil to Port P (2) on the injection valve; connect the other end to the TO INJ VALVE IN - P line. See [Section B.16.1](#) for details.

### 2.4.6 Column Heater



Figure 2-22. Column Heater

The column heater provides temperature control for the separator and guard column.

The heater temperature can be set to between 30 and 60 °C. However, the set temperature must be at least 5 °C above the ambient temperature. A thermistor mounted in the heater block monitors the temperature. Setting the temperature to 0 °C turns off the column heater.

If the temperature exceeds 65 °C, the column heater is shut off and the error message “Column heater exceeds safe temperature.” is displayed on the touch screen and in the Chromeleon Audit Trail. See [Section 4.1](#) for troubleshooting information.

### 2.4.7 Suppressor

The suppressor reduces the eluent conductivity and enhances the conductivity of the sample ions, thereby increasing detection sensitivity. Either an Atlas Electrolytic Suppressor, Self-Regenerating Suppressor, or MicroMembrane Suppressor can be used with the ICS-2000.

For details about any of the suppressors or for information about selecting a suppressor for your application, refer to the suppressor manuals. The manuals are on the Dionex Reference Library CD-ROM (P/N 053891).

### 2.4.8 DS6 Heated Conductivity Cell

The ICS-2000 flow-through conductivity cell measures the electrical conductance of analyte ions as they pass through the cell. Two passivated 316 stainless steel electrodes are permanently sealed into the PEEK cell body. The cell design provides efficient sweep-out, low volume (1  $\mu$ L), and low dispersion. Temperature control and compensation help ensure good peak reproducibility and baseline stability.

#### Temperature Control

Temperature directly affects the conductivity of a solution. 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, the effect of temperature variation is minimized by suppressing eluent conductivity. To further reduce the effect of temperature variation, a heater inside the cell regulates the temperature. The cell heater can be set to between 30 °C and 55 °C. The set temperature must be at least 7 °C above the ambient temperature. Setting the cell temperature to 0 °C turns off the cell heater.

#### Temperature Compensation

Built-in preset temperature compensation of 1.7% per °C helps minimize changes in the baseline or in peak heights when the operating temperature is different from the temperature at which the cell was calibrated.

#### DS6 Heated Conductivity Cell Components

The cell front cover provides **CELL IN** and **CELL OUT** fittings for connecting the cell to the suppressor (see [Figure 2-8](#)). The remaining cell components are mounted behind the component panel. To replace, the cell remove the screws on the cell front cover and pull the entire cell assembly out through the component panel. See [Section 5.9](#) for cell replacement instructions.





## 3 • Operation and Maintenance

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This chapter describes routine operating and maintenance procedures for the ICS-2000 Ion Chromatography System.

The ICS-2000 is designed for IC (ion chromatography) applications and should not be used for any other purpose. Operation of the ICS-2000 in a manner not specified by Dionex may result in personal injury.

### 3.1 Operation Overview

[Figure 3-1](#) illustrates the basic steps for routine operation of the ICS-2000.

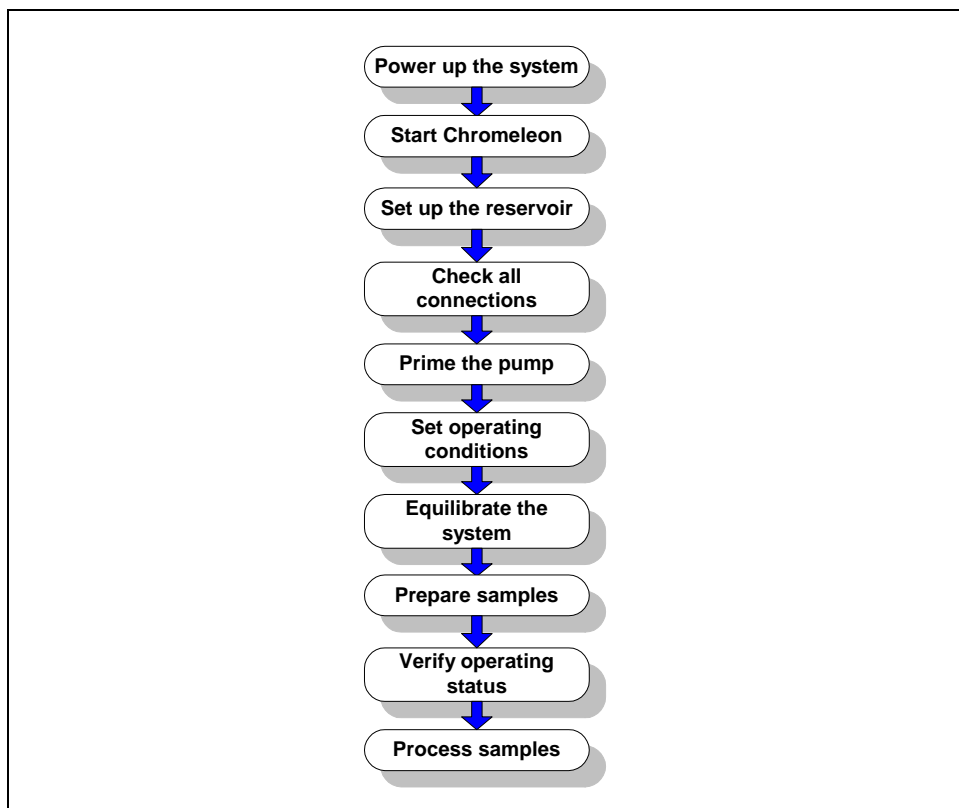


Figure 3-1. ICS-2000 Operation Flow Chart

## Sample Processing Overview

Samples can be run manually (one at a time), or they can be grouped and run automatically in batches. [Figure 3-2](#) shows the typical steps for manual and batch sample processing.

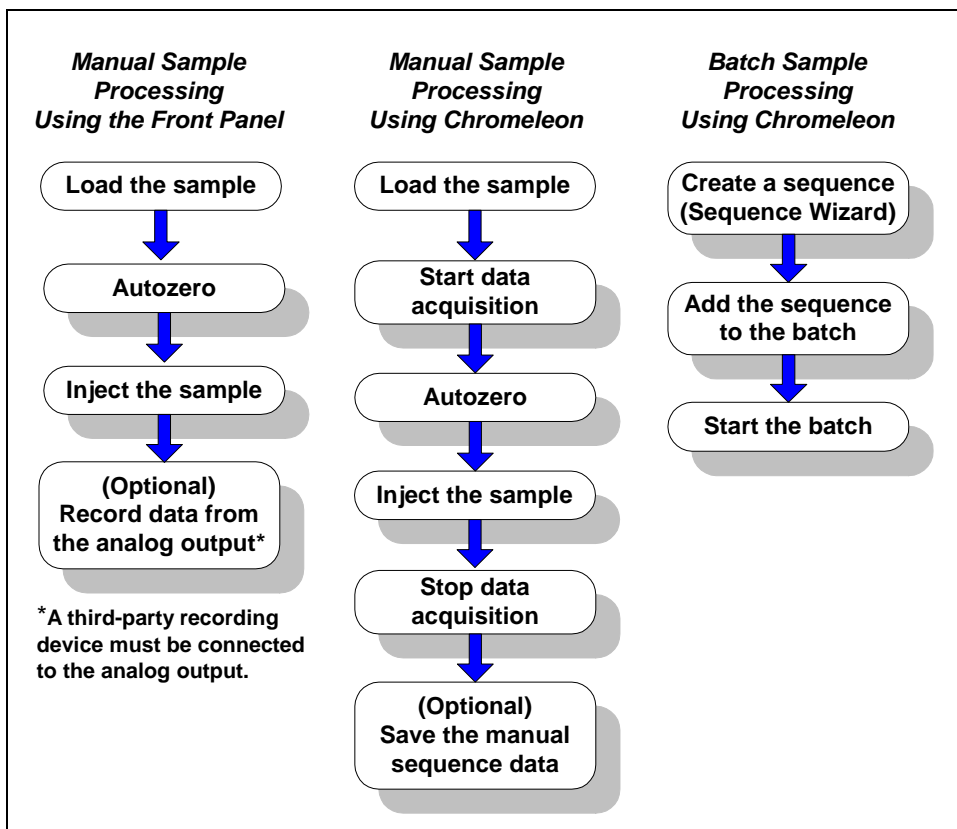


Figure 3-2. Sample Processing Overview

## 3.2 Power Up the System



Figure 3-3. ICS-2000 Rear Panel

Press the power switch on the ICS-2000 rear panel (see [Figure 3-3](#)) to turn on the system power. [Table 3-2](#) shows the ICS-2000 conditions at power up.

Also turn on the power to the computer and the autosampler (if used).



Feature	Power-Up Condition
Pump	Off
Injection valve	Load position
Cell	Reading current value
Suppressor	Off*
Cell heater	Set to the last value used. The default when the ICS-2000 is turned on for the first time is 35 °C.
Column oven temperature	Set to the last value used. The default when the ICS-2000 is turned on for the first time is 30 °C.
Eluent generator	Off*
CR-TC	Off
EPM	Off*

Table 3-2. ICS-2000 Power-Up Conditions

\* When you start the suppressor, eluent generator, or EPM, the value used last is restored.

## 3.3 Start Chromeleon

**NOTE** If you are beginning operation of an ICS-2000 that has not been configured in a timebase, see [Section B.8](#) for Chromeleon setup instructions.

1. If the Chromeleon Server is not running (the icon on the taskbar is crossed out in red ) , start the Server by right-clicking the icon and selecting **Start Server**. When the server starts, the icon changes to gray  .
2. Start Chromeleon by selecting **Start>Programs>Chromeleon>Chromeleon**. The Chromeleon main window and the Browser will open. Your screen display should resemble [Figure 3-4](#). If the Browser does not open, select **File>Browser** to open it.

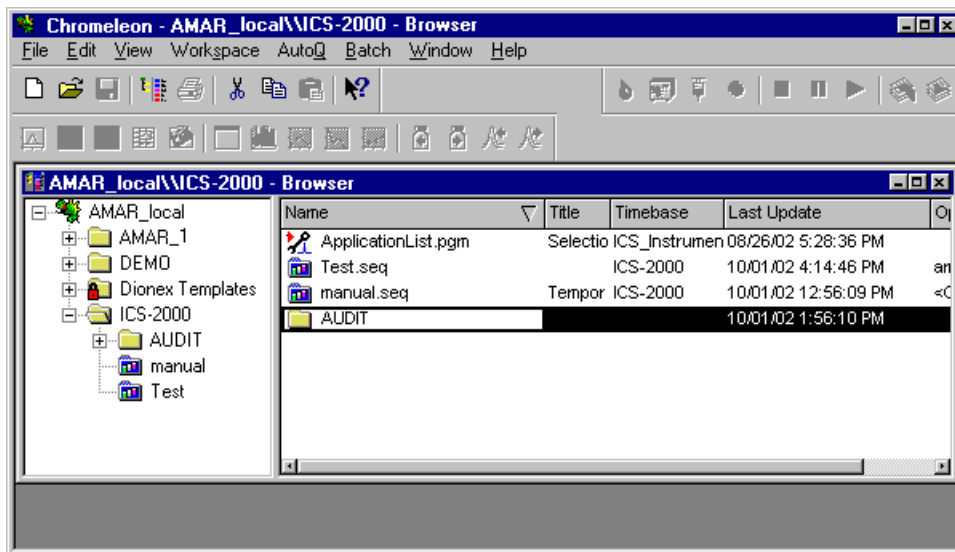


Figure 3-4. Chromeleon Main Window and Browser

- In the Browser, expand the **Dionex Templates\Panels\Dionex\_IC\ICS-2000 System Panels** folder. Several ICS-2000 Control panels (.PAN files), corresponding to various system configurations, are provided. Two styles of panels are available:
    - Traditional panels provide controls on a single window with minimal graphics.
    - System panels provide a more graphical interface than the traditional style and include more controls.
- You can choose either style of panel, depending on your personal preference.
- Open a panel for your system configuration by double-clicking its name in the list. For example, if your system includes an ICS-2000 and an AS50 autosampler, double-click either **ICS-2000\_Traditional\_System\_AS50.pan** or **ICS-2000\_System\_AS50.pan**.
  - The Control panel opens, unconnected (see [Figure 3-5](#)). To connect to the timebase, open the **Control** menu and click the name of the ICS-2000 timebase in the list at the bottom of the menu.

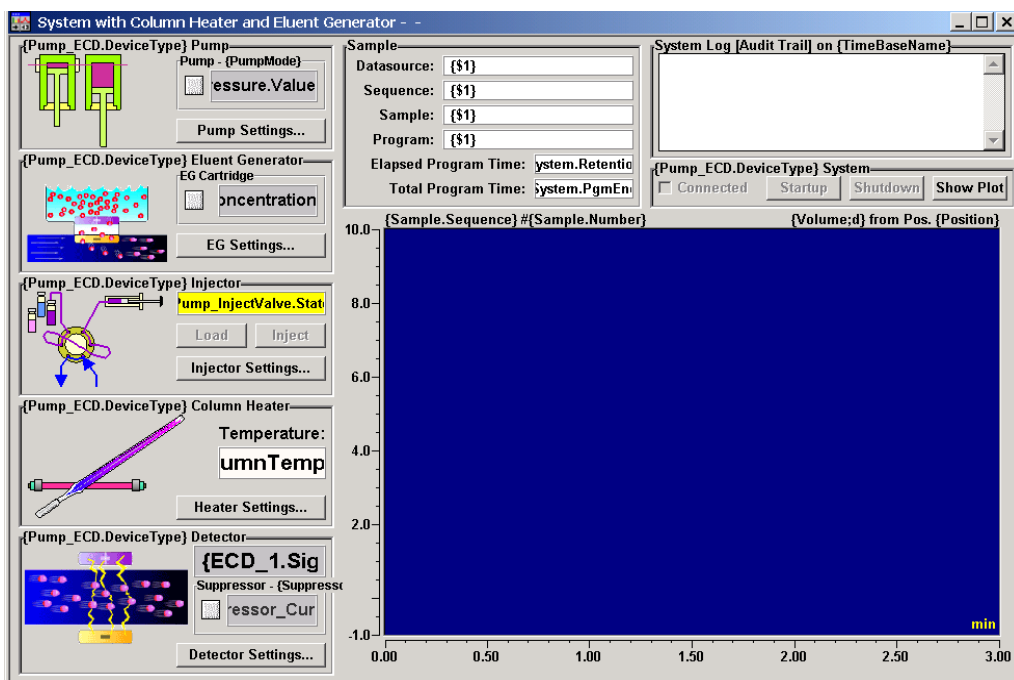


Figure 3-5. ICS-2000 System Control Panel (Unconnected)

Figure 3-6 shows a connected Control panel for an ICS-2000 system.

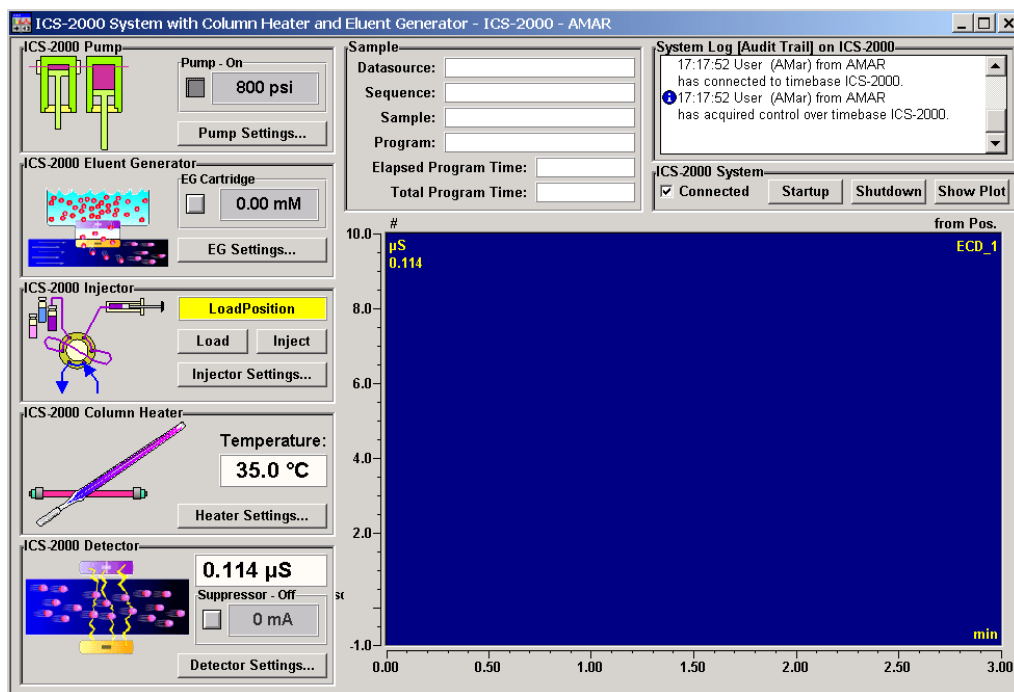


Figure 3-6. ICS-2000 System Control Panel (Connected)

## 3.4 Set Up the Eluent Reservoir

### 3.4.1 Filter the Deionized Water

Filtering removes small particulates in the deionized water that may contaminate the pump check valves and cause erratic flow rates or loss of prime. An end-line filter (P/N 045987) is provided in the ICS-2000 Ship Kit (P/N 064375) for this purpose.

Install the end-line filter on the end of the deionized water line, inside the reservoir. Verify that the end of the filter extends to the bottom of the reservoir and that the filter is submerged in deionized water. This prevents air from being drawn through the lines.

### 3.4.2 Fill the Reservoir

Fill the reservoir with ASTM filtered, Type I (18-megohm) deionized water.

### 3.4.3 Set the Eluent Level

After filling the reservoir, enter the volume of liquid in the reservoir in one of the following locations:

- On the **HOME** page in the **Eluent Level** field (see [Figure 3-7](#))
- In the **Eluent Bottle** field on the Chromeleon Control panel (see [Figure 3-8](#))

The ICS-2000 determines the eluent usage by monitoring the flow rate and the length of time the pump is on. The ICS-2000 updates the field as the eluent is used up. A warning first appears if the level falls below 200 mL. Warnings are repeated at 100 mL and 0 mL.

**IMPORTANT**

In order for the eluent level displayed on the screen to be accurate, the level must be entered by the user when the reservoir is filled. The ICS-2000 does not automatically detect when the reservoir is filled, nor when it is empty.

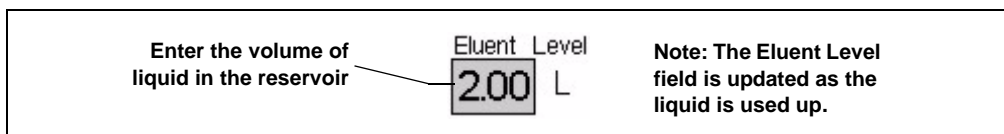


Figure 3-7. Home Page: Setting the Eluent Level

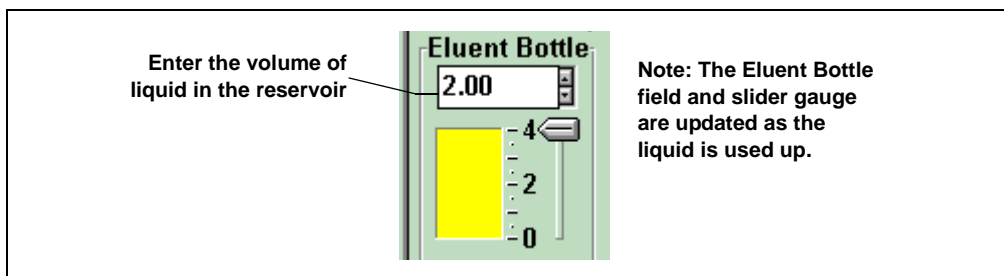


Figure 3-8. Chromeleon Control Panel: Setting the Eluent Level

The **STATUS** page (see [Figure 3-9](#)) also displays the amount of liquid remaining in the reservoir and an estimate of how many hours remain before the eluent reservoir is empty. See [Section C.6](#) for details about the **STATUS PAGE**.

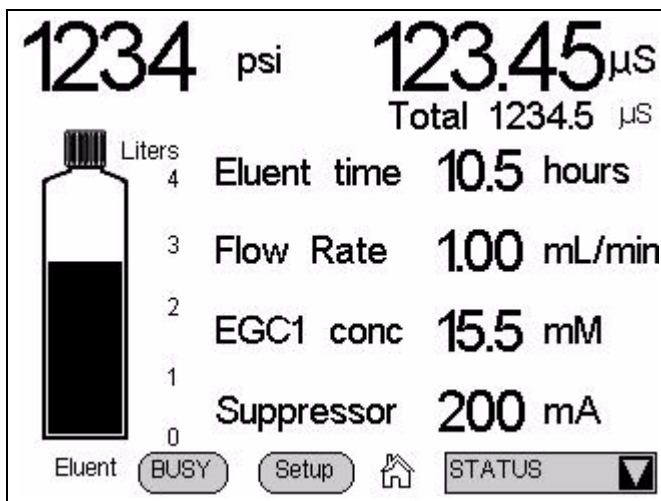


Figure 3-9. Status Page



### 3.4.4 Connect the Reservoir

If it is not already connected, connect the **ELUENT BOTTLE OUT** line from the reservoir cap to the **ELUENT IN** line, which extends from the plumbing and cable chase on the top of the ICS-2000 (see [Figure 3-10](#)).

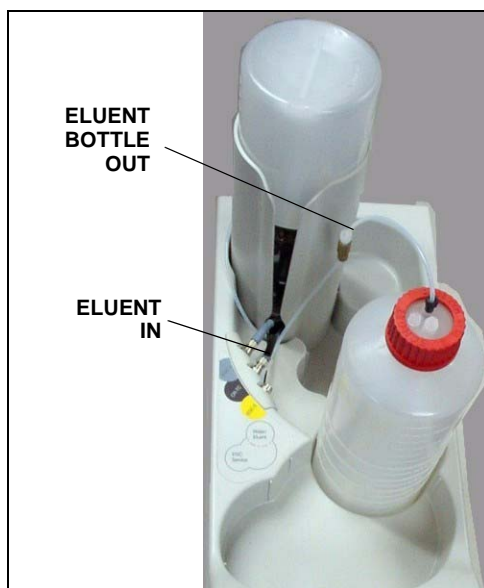


Figure 3-10. Reservoir Connections

## 3.5 Check All Connections

1. Make sure the eluent reservoir is filled and the tubing connecting the reservoir to the ICS-2000 tubing is securely connected (see [Figure 3-10](#)).
2. Make sure the blue eluent generator electrical cable is connected to the **EGC-1** (or **EGC-2**) connector.
3. If a CR-TC is installed, make sure the black CR-TC electrical cable is connected to the **CR-TC** connector.
4. If an EPM is installed, make sure the EPM electrical cable is connected to the **EGC-2** (or **EGC-1**) connector.
5. Make sure the USB cable from the computer is connected to the USB receptacle on the ICS-2000 rear panel.

### 3.6 Prime the Pump

**IMPORTANT**

If you changed eluent or if the eluent lines are dry, prime the lines first with a syringe before following the procedure below to prime the pump. See [Section B.13](#) for instructions on priming the lines with a syringe.

1. Verify that the priming valve on the primary pump head (see [Figure 3-11](#)) is closed (turned all the way clockwise).
2. Open the waste valve on the secondary pump head by turning the knob one-quarter to one-half turn counterclockwise. Opening the valve directs the eluent flow path to waste and eliminates backpressure.

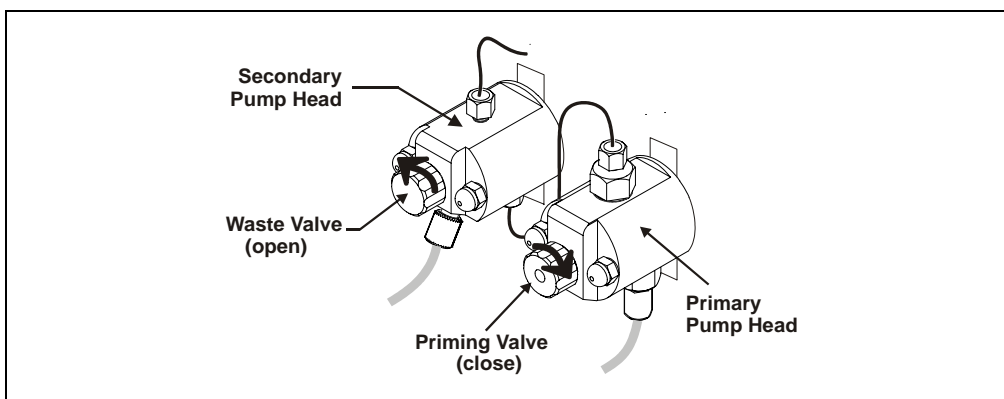


Figure 3-11. Priming the Pump

3. Press **Prime** on the Chromeleon Control panel or the ICS-2000 touch screen **HOME** page. Confirm that the waste valve is open by pressing **OK** when the reminder message appears. The pump will begin pumping at approximately 3 mL/min.
4. Continue priming the ICS-2000 until all air and previous eluent are purged and no air bubbles are exiting the waste line.
5. Press **Pump Off**.
6. Close the waste valve. **Do not overtighten**. The pump is now ready for operation.

## 3.7 Set System Operating Conditions

**NOTE** This section is an overview of the steps needed to start up the system and begin running samples. Actual operating parameters (flow rate, cell heater temperature, suppressor current, etc.) depend on the application to be run. Refer to the column manual for the required parameters for your application.

Set or verify system operating parameters from either the Chromeleon Control panel or from the touch screen **HOME** page. Operating parameters can also be set automatically by loading a Chromeleon sequence.

**NOTE** Clicking the System Startup button on the Chromeleon Control panel starts the pump, suppressor, eluent generator, and CR-TC. The flow rate, suppressor current, and eluent concentration settings that were in effect when the system was shut down are restored.

1. Verify that the pump is on and set to the correct flow rate.
2. Verify that the suppressor current is on and that the setting is correct.
3. Verify that the eluent generator is turned on and the correct concentration is set. Verify that the CR-TC (if installed) is turned on. Verify that the EPM (if installed) is on and the correct concentration is set.
4. Verify that the cell heater is set to the correct value.
5. Verify that the column heater is set to the correct value.

### Automatically Turning on the Suppressor and Eluent Generator

You can set up the ICS-2000 to turn on the suppressor, eluent generator, and CR-TC automatically when the pump is turned on. To do this:

- For the suppressor, select the **Automatically turn on with pump** option from the **SUPPRESSOR** page.
- For the eluent generator and CR-TC, select the option from the **ELUENT GENERATOR** page.

**NOTE** The suppressor, eluent generator, and CR-TC are always turned off automatically when the pump is turned off.

### 3.8 Equilibrate the System and Verify Operational Status

**NOTE** You can monitor system functions (conductivity, pressure, cell temperature, etc.) from the Chromeleon Control panel or from the touch screen HOME page.

1. Allow the system to equilibrate. During equilibration, the Chromeleon Control panel displays the background conductivity (the conductivity of the eluent before sample injection) and the system backpressure.
2. Monitor the background conductivity. Refer to the column manual for the appropriate background conductivity for your application.
3. Offset the background and zero the reading by clicking the **Autozero** button on the Chromeleon Control panel (see [Figure 3-4](#)).
4. Monitor the system pressure from the Control panel to make sure it is at the expected pressure for the installed column (refer to the column manual for details) and is stable.
  - If the pressure is less than the expected amount, gas may be trapped in the system. To release the gas, remove the pump fitting on the injection valve port, labeled **P (2)**. Allow the air to escape and then reconnect the fitting.
  - If the pressure fluctuates by more than about 0.13 MPa (20 psi), prime the pump. See [Section 4.3](#) for additional troubleshooting information.
  - If the pressure is too high, there may be a restriction in the system plumbing (see [Section 3.6](#)). See [Section 4.7](#) for troubleshooting information.
5. Verify that the baseline conductivity is at the expected reading for your application and is stable. In general, it should be <30  $\mu\text{S}$  for a system set up for anion analyses and <2  $\mu\text{S}$  for a system set up for cation analyses. See [Section 4.12](#) for troubleshooting information if the conductivity is too high. See [Section 4.13](#) if the baseline is drifting or has excessive “noise” (large fluctuations in readings).
6. Verify that the cell heater is at the set point and is stable. The temperature is at equilibrium when the **Set Temperature** and the **Current Temperature**

readings on the Control panel are the same, or when the “=” symbol is displayed next to the **Column Heater** temperature on the **HOME** page.

7. Verify that the column heater temperature is at the set point and stable. The temperature is at equilibrium when the **Set Temperature** and the **Current Temperature** readings on the Control panel are the same, or when the “=” symbol is displayed next to the **Column Heater** temperature on the **HOME** page.

The system is now ready for sample processing.

### 3.9 Prepare Samples

**NOTE** Sample preparation can be performed while the system is equilibrating.

#### 3.9.1 Collecting and Storing Samples

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 because these can leave traces of ions on the container walls. The ions may interfere with the analysis.

If samples will not be analyzed on the day they are collected, filter them through clean 0.45 µm filters immediately after collection; otherwise, bacteria in the samples may cause the ionic concentrations to change over time. Refrigerating the samples at 4° C (39° F) 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, thus increasing 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.

#### 3.9.2 Pretreating Samples

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

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. Refer to the *Installation and Troubleshooting Guide for OnGuard Cartridges* (Document No. 032943) for instructions.

### 3.9.3 Diluting Samples

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 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, also 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.

## 3.10 Loading and Injecting Samples

The two techniques for loading samples into the sample loop are: (1) with an autosampler or (2) with a syringe or vacuum syringe through the injection port on the ICS-2000 front door.

For autosampler injections, the injection port tubing is disconnected from the ICS-2000 injection valve and replaced by the autosampler outlet tubing. Other setup requirements depend upon the model of autosampler.

### Setup for an AS40 Autosampler

A relay or TTL connection is required for Chromeleon to control sample loading. See [Section B.19](#) for AS40 autosampler installation instructions.

### Setup for an AS or AS50 (USB) Autosampler

To use an AS or AS50 (USB) autosampler with the ICS-2000, the following requirements must met:

- The ICS-2000 injection valve must be linked to the AS or AS50 (USB) in the Chromeleon timebase (see [Section B.18.2](#))
- An injection valve should not be installed in the AS or AS50 (USB)

See [Section B.18](#) for AS or AS50 (USB) autosampler connection instructions.

**NOTE** The ICS-2000 and the AS or AS50 (USB) can be set up for stand-alone (front-panel) operation. This requires a TTL cable connection between the AS or AS50 (USB) and the ICS-2000. See [Section D.3](#) for stand-alone setup instructions.

## 3.10.1 Loading Samples with a Syringe

1. Make sure the injection port on the ICS-2000 front door (see [Figure 2-1](#)) is connected to the sample port **S** (5) on the injection valve (see [Figure 3-12](#)).

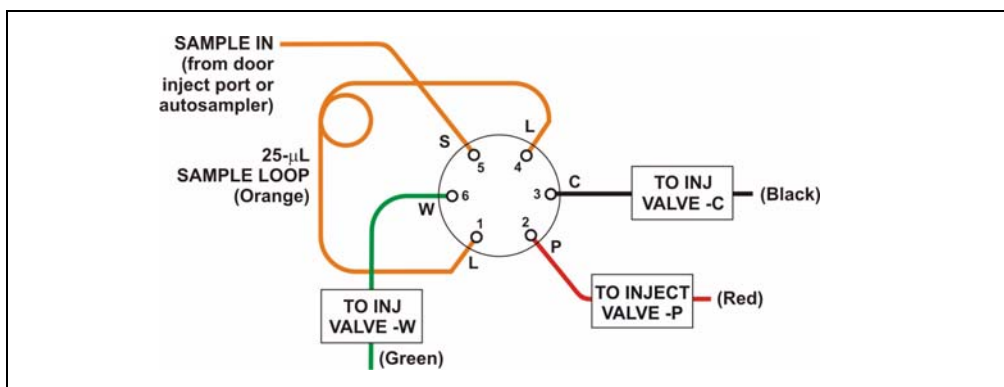


Figure 3-12. Injection Valve Connections

2. Fill the 1 cc syringe (P/N 016388) provided in the ICS-2000 Ship Kit (P/N 064375) with a calibration standard or sample.
3. Insert the syringe into the injection port on the ICS-2000 front door.
4. Verify that the injection valve is in the Load position.
5. Overfill the sample loop with several sample loop volumes. Excess sample will exit through the injection valve waste line.
6. Leave the syringe in the port.
7. Switch the injection valve to the Inject position (see [Section 3.10.4](#)).

### 3.10.2 Loading Samples with a Vacuum Syringe

1. Disconnect the waste line from port **W (6)** of the injection valve (see [Figure 3-12](#)) and attach a shorter line: 25 to 30 cm (10 to 12 inches) of PEEK or Teflon® tubing.
2. Place the free end of the line into the sample.
3. Verify that the injection valve is in the Load position.
4. Insert the 1 cc syringe (P/N 016388) provided in the ICS-2000 Ship Kit (P/N 064375) into the injection port on the ICS-2000 front door (see [Figure 2-1](#)) and pull out the plunger to draw the sample into the injection valve.
5. Switch the injection valve to the Inject position (see [Section 3.10.4](#)).

### 3.10.3 Loading Samples with an Autosampler

1. Verify that the autosampler output line is connected to port **S (5)** of the ICS-2000 injection valve.
2. Prepare and fill the sample vials and place them in the autosampler tray or cassette. Refer to the autosampler manual for detailed instructions.
3. The sample loading process depends on the autosampler. Refer to the autosampler manual for detailed instructions. In general, use one of the following methods:
  - Include the commands for controlling sample loading in a Chromeleon program. See the examples in [Section 3.10.5](#).



- Enter the commands for loading the sample on the autosampler front panel.
4. Switch the injection valve to the Inject position (see [Section 3.10.4](#)).

### 3.10.4 Injecting Samples

After loading the sample in the sample loop, use one of the following methods to switch the injection valve to the Inject position:

- Manually: Click the **Inject** button on the Chromeleon Control panel (see [Figure 3-6](#)) or touch the **Inject** button on the **HOME** page.
- Automatically: Include the Inject command in a Chromeleon program. See the examples in [Section 3.10.5](#).

### 3.10.5 Example Chromeleon Commands for Loading and Injecting Samples

The following examples show commands for loading and injecting samples using an AS or AS or AS50 (USB)40 autosampler.

#### Example AS or AS50 (USB) Program Commands

0.000	Pump_ECD.Autozero		;Zero the baseline.
	Load		;Switch the valve to Load.
	Wait	CycleTimeState	;Wait for cycle time (if any).
	Inject		;Switch the valve to Inject.
	Wait	InjectState	;Wait for injection to complete.
	ECD_1.AcqOn		;Start data acquisition.
14.000	ECD_1.AcqOff		;Stop data acquisition.

### Example AS40 Program Commands

-2.300	Pump_ECD_Relay_1.Closed	Duration=138.00	;Note 1
0.000	Pump_ECD.Autozero		;Note 2
	ECD_1.AcqOn		;Note 3
	Pump_InjectValve.InjectPosition	Duration=30.00	;Note 4
30.00	ECD_1.AcqOff		;Note 5

### AS40 Program Command Notes:

1. Close the ICS-2000 **RELAY OUT 1**, which is connected to the AS40 **LOAD** relay. This signals the AS40 to load the sample.
2. Zero the baseline.
3. Start data acquisition.
4. Switch the valve to Inject.
5. Stop data acquisition.

## 3.11 Process Samples

Samples can be run either manually (one at a time) or automatically (in groups or “batches”).

### 3.11.1 Manual Sample Processing

To process samples manually, select operating parameters and commands from the touch screen pages, or from the Chromeleon menu bar, toolbars, and Control panel. Commands are executed as soon as they are entered.

**NOTE** When you run samples manually from the front panel (without using Chromeleon), the data is saved only temporarily in the ICS-2000 memory. For a permanent record of the data, connect a recording device (chart recorder, integrator, etc.) to the analog output. See [Section B.20](#) for analog output connection instructions.

1. Complete the steps in Sections [3.2](#) through [3.8](#) to prepare for operation and to start up the ICS-2000.
2. Load the sample, using a syringe, vacuum syringe, or autosampler (see [Section 3.10](#)).
3. In Chromeleon, select **Control>Acquisition On**. Chromeleon records the signal supplied by the detector and displays the signal plot on the Control panel.
4. Click the **Autozero** button on the Control panel or the touch screen **HOME** page.
5. Inject the sample (see [Section 3.10.4](#)).
6. In Chromeleon, monitor the chromatogram on the Control panel and select **Control>Acquisition Off** when sample data is collected.

**NOTE** Data from Chromeleon manual processing is saved in the **MANUAL** sequence folder under the local datasource. This data is overwritten each time a new manual sample is processed. To save the data from a manual run, select the **MANUAL** folder, select **File>Save As**, and enter a new name for the sequence.

7. If you are controlling the ICS-2000 from the touch screens, select the **PLOT** button on the **HOME** page to view a plot of the conductivity data.

### 3.11.2 Automatic (Batch) Sample Processing

For batch processing, you use Chromeleon to create a list of samples (a sequence) to be processed automatically. For each sample, the sequence includes a program with commands and parameters for controlling the ICS-2000, controlling the autosampler (if used), and acquiring sample data. The sequence also includes a quantification method for peak identification and area determination. Additional sample processing parameters are included in the sequence (for example, the sample name, sample type, injection volume, etc.).

After defining the sequence, you can start batch processing.

1. Complete the steps in Sections [3.2](#) through [3.8](#) to prepare for operation and to start up the ICS-2000.
2. Create a new sequence or modify an existing one.  
To create a new sequence:
  - a. In the Browser, select **File>New**. Select **Sequence (using Wizard)** and click **OK**.
  - b. Complete the steps in the Sequence Wizard, adding the desired number of samples and standards to the list. For help with any of the steps, click the **Help** button on the Sequence Wizard page.

**NOTE** A simple way to get started is to select the “Use Application Template” option in Step 4 of the Sequence Wizard. This option lets you select a column and suppressor type from a list of applications. The Wizard then copies a program and quantification method, appropriate for the selected application, to the sequence folder and adds them to the sequence definition.

3. To start the sample processing, make sure the System Control panel is open (see [Section 3.3](#)) and is the active window. Then, select **Batch>Edit**. The Batch dialog box opens (see [Figure 3-13](#)).

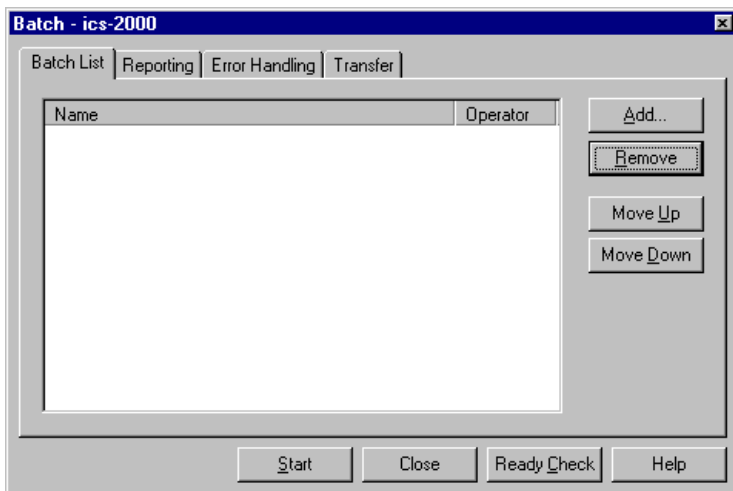


Figure 3-13. Batch Dialog Box

- Click the **Add** button on the **Batch List** tab and add the sequence you created in [Step 2](#). See [Figure 3-14](#) for an example.

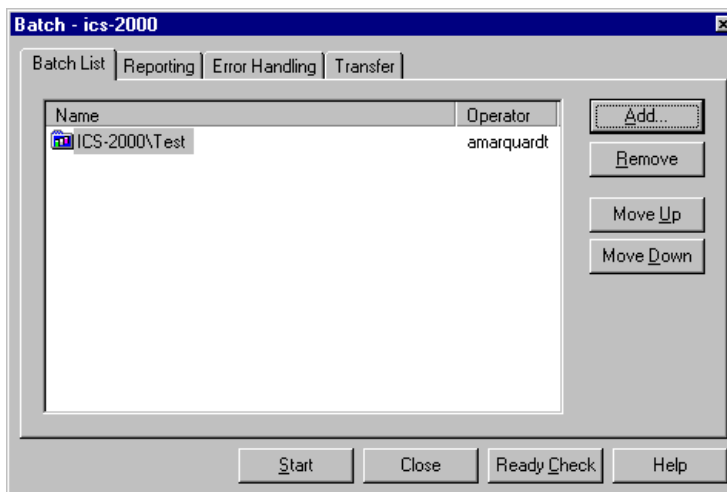


Figure 3-14. Batch Dialog Box with an Example Sequence Added to the Batch List

- To start the batch, click **Start**.

## 3.12 Maintenance

This section describes routine maintenance procedures that users may perform. All other maintenance procedures must be performed by Dionex personnel.

### As Needed

- Regularly check the eluent reservoir and refill when needed.

### Daily

- Check the ICS-2000 component mounting panel (see [Figure 2-8](#)) for leaks or spills. Wipe up spills. Isolate and repair leaks (see [Section 4.2](#)). Rinse off any dried eluent with deionized water.
- Check the waste container daily and empty when needed.

### Weekly

- Once a week, check fluid lines for crimping or discoloration. Relocate any pinched lines. Replace damaged lines.
- Check the junctions between the pump heads and the pump casting for evidence of liquid leaks. If the piston seal wash tubing is not connected, check the drain tubes at the rear of the pump heads for evidence of moisture. Normal friction and wear may gradually result in small liquid leaks around the piston seal. If unchecked, these leaks can gradually contaminate the piston housing, causing the pump to operate poorly. If leaks occur, replace the piston seals (see [Section 5.6](#)).
- Check the end-line filter (P/N 045987) and change if needed. When new, end-line filters are pure white. If the system is in continuous operation, change the end-line filter weekly, or whenever it becomes discolored. Replace the filter more often if bacterial buildup is visible or if the eluent does not contain solvent.

**NOTE** It is especially important to regularly replace end-line filters when using aqueous eluents, which may contaminate the filter with bacteria or algae. The bacterial buildup may not be visible.

### Every Six Months

- Calibrate the cell (see [Section 5.1.3](#)).
- Calibrate the vacuum degas assembly (see [Section 5.1.5](#)).
- Replace the pump piston rinse seals and piston seals (see [Section 5.6](#)).

### Yearly

- Rebuild the injection valve (see [Section 5.4](#)).
- Replace the AS40 Automated Sampler tip and tubing. The AS40/ASM Maintenance Kit (P/N 055647) contains all of the components required to replace the sampling tip and the tubing between the tip and the injection valve. Instructions are included with the kit.
- Perform the AS or AS50 (USB) preventive maintenance procedure. The AS or AS50 (USB) Maintenance Kit (P/N 060581) contains all of the required components and instructions for performing the procedure.

## 4 • Troubleshooting

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This chapter is a guide to troubleshooting minor issues that may arise during operation of the ICS-2000. Turn to the section of this chapter that best describes the operating problem or symptom that has been observed. Each section lists possible causes of the problem or symptom in order of probability. A systematic troubleshooting approach is the most effective way to determine the root cause.

If you are unable to resolve a problem by following the instructions here, contact Dionex Technical Support. In the U.S., call 1-800-346-6390. Outside the U.S., call the nearest Dionex office. Please have this chapter at hand when talking with Technical Support personnel.

### 4.3 Error Messages

The Moduleware (the instrument control firmware installed in each ICS-2000 module) periodically checks the status of certain parameters. If a problem is detected, it is displayed on the touch screen.

Error messages are also reported to Chromeleon and logged in the Audit Trail. Each error message is preceded by an icon that identifies the seriousness of the underlying problem (see the table below). You can change the severity level assigned to a problem whenever appropriate.

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

## ICS-2000 Ion Chromatography System

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The table below lists the most frequently observed ICS-2000 error messages. For troubleshooting assistance, refer to the page indicated in the table.

<b>Alarms and Error Conditions</b>	<b>See</b>
Column heater exceeds safe temperature	<a href="#">page 3</a>
Column heater open circuit	<a href="#">page 3</a>
Column heater short circuit	<a href="#">page 4</a>
CR-TC over current error	<a href="#">page 4</a>
CR-TC stopped for zero flow rate	<a href="#">page 4</a>
Degas calibration failed	<a href="#">page 4</a>
EGC board not present	<a href="#">page 5</a>
EGC-1 calibration error	<a href="#">page 5</a>
EGC-1 disconnected error	<a href="#">page 5</a>
EGC-1 invalid concentration vs flow rate error	<a href="#">page 6</a>
EGC-1 invalid flow rate error	<a href="#">page 6</a>
EGC-1 over current	<a href="#">page 7</a>
EGC-1 over voltage	<a href="#">page 7</a>
EGC-2 calibration error	<a href="#">page 5</a>
EGC-2 disconnected error	<a href="#">page 5</a>
EGC-2 invalid concentration vs. flow rate error	<a href="#">page 6</a>
EGC-2 invalid flow rate error	<a href="#">page 6</a>
EGC-2 over current	<a href="#">page 7</a>
EGC-2 over voltage	<a href="#">page 7</a>
Hardware not present	<a href="#">page 7</a>
Leak sensor wet	<a href="#">page 7</a>
Load/inject valve error	<a href="#">page 8</a>
Option not installed	<a href="#">page 8</a>
Pressure slope calibration error	<a href="#">page 9</a>
Pump motor lost control	<a href="#">page 9</a>
Pump pressure hardware error	<a href="#">page 9</a>
Pump over pressure	<a href="#">page 9</a>
Pump under pressure	<a href="#">page 10</a>

*Table 4-4. ICS-2000 Alarms and Error Messages Summary*



Alarms and Error Conditions	See
Suppressor over current	<a href="#">page 10</a>
Suppressor over voltage	<a href="#">page 11</a>
Suppressor over power	<a href="#">page 11</a>
Suppressor not connected	<a href="#">page 11</a>
Suppressor stopped for flow rate	<a href="#">page 12</a>

Table 4-4. ICS-2000 Alarms and Error Messages Summary (Continued)

## 4.1 Troubleshooting Error Messages



### COLUMN HEATER EXCEEDS SAFE TEMPERATURE

This error occurs when the column heater temperature is higher than the maximum allowed. This error may occur if the ICS-2000 is operating in an extreme environment (greater than 40 °C (104 °F)).

**To troubleshoot:**

Refer to [Section A.3](#) for environmental specifications.



### COLUMN HEATER OPEN CIRCUIT

This error occurs when the column heater is unplugged from the component panel.

**To troubleshoot:**

1. Check that the column heater is plugged into the component panel.
2. If the error persists, the column heater may be faulty. Replace the column heater (see [Section 5.11](#)).



### **COLUMN HEATER SHORT CIRCUIT**

This error occurs when there is a short circuit on the thermistor input used to measure the column heater temperature. This error indicates a faulty column heater.

**To troubleshoot:**

Replace the column heater (see [Section 5.11](#)).



### **CR-TC OVER CURRENT ERROR**

This error occurs when the current applied to the CR-TC exceeds the maximum current allowed.

**To troubleshoot:**

1. Check the CR-TC cable connection.
2. If the error persists, contact Dionex for assistance. There may be a malfunction in the CR-TC control electronics.



### **CR-TC STOPPED FOR ZERO FLOW RATE**

This message appears when you click the **Shutdown** button on the Chromeleon Control panel. The message also appears when you turn off the pump flow while the EGC current (and CR-TC) is on. The CR-TC is automatically turned off.

**To troubleshoot:**

If the pump stopped unexpectedly, see [Section 4.5](#) for pump troubleshooting information.



### **DEGAS CALIBRATION FAILED**

This error occurs when the degas vacuum does not reach the expected level during calibration.

### To troubleshoot:

1. Retry the calibration.
2. If calibration still fails, the vacuum degas assembly may need to be replaced. Contact Dionex for assistance.



### **EGC BOARD NOT PRESENT**

This error occurs if Chromeleon sends a command to the ICS-2000 related to the eluent generator, but the eluent generator controller board is either not installed or the ICS-2000 does not recognize the installed board.

### To troubleshoot:

Contact Dionex for assistance. The ICS-2000 electronics components cannot be serviced by the user.



### **EGC-1 CALIBRATION ERROR EGC-2 CALIBRATION ERROR**

This error occurs if the measured current is outside the expected range when running the eluent generator calibration procedure.

### To troubleshoot:

- Review the procedure to verify that you set up the ICS-2000 correctly and then rerun the calibration.
- If the error message reappears, contact Dionex for assistance.



### **EGC-1 DISCONNECTED ERROR EGC-2 DISCONNECTED ERROR**

This error occurs if Chromeleon sends a command to set an eluent generator parameter when the EGC is disconnected. The error also can occur if you attempt to run the EGC verification test when the EGC is disconnected.

### To troubleshoot:

1. Verify that the eluent generator cartridge is connected to the EGC-1 connector on top of the ICS-2000 (see [Figure 2-7](#)).
2. If the error persists, contact Dionex for assistance. There may be a malfunction in the EGC control electronics.



### **EGC-1 INVALID CONCENTRATION VS. FLOW RATE ERROR EGC-2 INVALID CONCENTRATION VS. FLOW RATE ERROR**

The maximum eluent concentration that can be set for a particular application depends on the suppressor type, the EGC type, and the flow rate. This error occurs if the selected concentration is too high for the current flow rate.

### To troubleshoot:

Refer to the column manual, which is included on the Dionex Reference Library CD-ROM (P/N 053891), for the concentration of eluent to use with your application. Reset the eluent concentration and/or the flow rate to the recommended values.



### **EGC-1 INVALID FLOW RATE ERROR EGC-2 INVALID FLOW RATE ERROR**

This error occurs if the flow rate is set to a value not supported by the eluent generator. The ICS-2000 allows a flow rate range of 0.00 to 5.00 mL/min without an eluent generator. With an eluent generator, the allowed range is 0.10 to 3.00 mL/min. The recommended operating range is 0.40 to 2.00 mL/min.

### To troubleshoot:

Set the flow rate to a value within the allowed range.



### **EGC-1 OVER-CURRENT EGC-2 OVER-CURRENT**

This error occurs when the current applied to the eluent generator cartridge exceeds the maximum current allowed. Under these conditions, the EGC current is turned off to prevent damage to the EGC. This error may occur if the liquid flow to the cartridge is interrupted.

**To troubleshoot:**

- See [Section 4.5](#) for troubleshooting when there is no flow from the pump.



### **EGC-1 OVER-VOLTAGE EGC-2 OVER-VOLTAGE**

This error occurs when the current applied to the eluent generator cartridge exceeds the maximum current allowed. The EGC current is turned off to prevent damage to the EGC. This error may occur if the liquid flow to the cartridge is interrupted.

**To troubleshoot:**

- See [Section 4.5](#) for troubleshooting when there is no flow from the pump.



### **HARDWARE NOT PRESENT**

This error indicates a problem in the ICS-2000 electronics.

**To troubleshoot:**

- Contact Dionex for assistance. The ICS-2000 electronics components cannot be serviced by the user.



### **LEAK SENSOR WET**

The leak sensor is installed in the drip tray at the bottom of the component panel (see [Figure 2-8](#)). If liquid accumulates in the tray, the sensor signals the problem and the “Leak sensor wet” error message appears.

### To troubleshoot:

1. Locate the source of the leak by visually inspecting the tubing, fittings, and components on the component panel.
2. Tighten fittings or replace tubing and fittings as required. Refer to [Section 4.2](#) for detailed troubleshooting of various types of leaks.
3. After fixing the leak, dry the drip tray thoroughly to prevent the leak sensor from triggering additional error messages.



### LOAD/INJECT VALVE ERROR

If the injection valve fails to switch position within 1 second of being toggled, the ICS-2000 Moduleware reports an error to Chromeleon and the “Load/Inject valve error” message appears.

### To troubleshoot:

1. If a sequence is being executed, terminate the sequence by selecting **Batch>Stop** on the Chromeleon menu.
2. Turn off the ICS-2000 power briefly and then restart.
3. Try to toggle the valve from Load to Inject by clicking the **Load** and **Inject** buttons on the ICS-2000 Control panel in Chromeleon or on the touch screen **HOME** page.
4. If the problem persists, contact Dionex for assistance.



### OPTION NOT INSTALLED

This error occurs if a command is issued to control an option that is not installed.

### To troubleshoot:

- Check the Chromeleon Server Configuration program to verify that the option is enabled.



### **PRESSURE SLOPE CALIBRATION ERROR**

This error occurs if you try to calibrate the pressure slope when the pressure is less than 3 MPa (500 psi).

**To troubleshoot:**

- Contact Dionex for assistance.



### **PUMP MOTOR LOST CONTROL**

This error indicates a problem in the pump controller electronics.

**To troubleshoot:**

- Contact Dionex for assistance. The ICS-2000 electronics components cannot be serviced by the user.



### **PUMP PRESSURE HARDWARE ERROR**

This error indicates a problem in the pump controller electronics.

**To troubleshoot:**

- Contact Dionex for assistance. The ICS-2000 electronics components cannot be serviced by the user.



### **PUMP OVER PRESSURE**

If the system pressure exceeds the set limit for at least 0.5 seconds, this error message appears and the pump stops. Pressure limits can be set in the Chromeleon Server Configuration or in the control program. The limits can also be set on the touch screen **PUMP** page (see [Section C.7.1](#)).

**To troubleshoot:**

1. Check for blockages in the liquid lines by working your way backward from the cell to the pump. See [Figure 2-13](#) for the system flow schematic.
2. Check that the flow rate is set to the correct value.

3. Check that the high pressure limit is set to the correct value.
4. Restart the pump.



### **PUMP UNDER PRESSURE**

If the system pressure falls below the low pressure limit, the pump stops and this error message appears. Pressure limits can be set in the Chromeleon Server Configuration or in the control program. The limits can also be set on the touch screen **PUMP** page (see [Section C.7.1](#)).

#### **To troubleshoot:**

1. Make sure the eluent reservoir is full.
2. Check for liquid leaks (see [Section 4.2](#)).
3. Check that the waste valve is closed.
4. Prime the pump (see [Section B.13](#)).
5. Restart the pump.



### **SUPPRESSOR OVER CURRENT**

This error may be caused by an expended or dirty suppressor or by a malfunction in the suppressor controller electronics.

#### **To troubleshoot:**

1. Follow the instructions in the suppressor manual to regenerate the suppressor. Suppressor manuals are included on the Dionex Reference Library CD-ROM (P/N 053891).
2. Follow the instructions in the suppressor manual to clean the suppressor.
3. If a malfunction in the suppressor controller is suspected, contact Dionex for assistance. The ICS-2000 electronics components cannot be serviced by the user.





### **SUPPRESSOR OVER VOLTAGE**

This error occurs if you turn on the suppressor but the ICS-2000 cannot establish a connection with the suppressor.

**To troubleshoot:**

1. Check the suppressor cable connection (see [Section 5.10](#)).
2. If the error persists, replace the suppressor (see [Section 5.10](#)).



### **SUPPRESSOR OVER POWER**

This error occurs when, in order to maintain the selected current, the ICS-2000 is required to apply a higher voltage than the suppressor can support.

**To troubleshoot:**

- Reduce the flow rate.
- Rehydrate the suppressor. Refer to the suppressor manual for instructions. Suppressor manuals are included on the Dionex Reference Library CD-ROM (P/N 053891).
- If the error persists, replace the suppressor (see [Section 5.10](#)).



### **SUPPRESSOR NOT CONNECTED**

This error occurs if you turn on the suppressor and the ICS-2000 cannot establish a connection with the suppressor.

**To troubleshoot:**

1. Check the suppressor cable connection (see [Section 5.10](#)).
2. If the error persists, contact Dionex for assistance. There may be a problem in the suppressor controller electronics. The ICS-2000 electronics components cannot be serviced by the user.



### **SUPPRESSOR STOPPED FOR ZERO FLOW RATE**

This error message appears when you click the **Shutdown** button on the Chromeleon Control panel. The message also appears anytime you turn off the pump flow while the suppressor is on. The suppressor is automatically turned off to prevent damage to the suppressor.

#### **To troubleshoot:**

- If the pump stopped unexpectedly, see [Section 4.5](#) for pump troubleshooting information.

## **4.2 Liquid Leaks**

- **Leaking fitting**

Locate the source of the leak. Tighten or, if necessary, replace the liquid line connection (see [Section 5.3](#)). Refer to *Installation of Dionex Liquid Line Fittings* (Document No. 031432) for tightening requirements. The manual is on the Dionex Reference Library CD-ROM (P/N 053891).

- **Broken liquid line**

Replace the line and fittings with the same length and internal diameter tubing (see [Section 5.3](#)).

- **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 ICS-2000. If a line is blocked, replace it (see [Section 5.3](#)).

- **Loose pump check valve**

1. 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.
2. If the leak persists, replace the check valve (see [Section 5.5](#)).

- **Leaking seal wash port**

Leaking from the seal wash port indicates a leaking piston seal. Replace the seal (see [Section 5.6](#)).

- **Damaged pump piston seal**
  1. Replace the piston seal (see [Section 5.6](#)).
  2. If the leak persists, replace the piston (see [Section 5.7](#)).
- **Pump head not tight against casting**

Carefully tighten the pump head mounting nuts just until the leak stops. **DO NOT OVERTIGHTEN!**
- **Leaking pressure transducer**
  1. Make sure the liquid line connections into the pressure transducer are tight. Refer to *Installation of Dionex Liquid Line Fittings* (Document No. 031432) for tightening requirements. The manual is on the Dionex Reference Library CD-ROM (P/N 053891). Replace any damaged fittings.
  2. If the pressure transducer continues to leak, contact Dionex for assistance. The pressure transducer cannot be serviced by the user.
- **Leaking pump head waste valve**

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

If the leak persists, replace the waste valve O-ring (see [Section 5.8](#)).
- **Leaking suppressor**

Refer to the suppressor manual for troubleshooting procedures. Suppressor manuals are included on the Dionex Reference Library CD-ROM (P/N 053891).
- **Leaking injection valve**
  1. Make sure the liquid line connections to the transducer are tight. Refer to *Installation of Dionex Liquid Line Fittings* (Document No. 031432) for tightening requirements. The manual is on the Dionex Reference Library CD-ROM (P/N 053891). Replace any damaged fittings.
  2. Liquid leaks from behind the valve stator may indicate a scratched rotor seal. Rebuild the injection valve (see [Section 5.4](#)).

- **Leaking cell**
  1. 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.
  2. 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.

### 4.3 Pump Difficult to Prime or Loses Prime

Excessive pressure fluctuations (more than 3% difference from one pressure reading to the next) indicate that the pump is out of prime.

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

Fill the reservoir. Make sure all connections are secure.

- **Eluent improperly or insufficiently degassed**

Check the vacuum degas settings:

1. Open the Chromeleon Server Configuration program, select the ICS-2000 device icon under the timebase, and select **Edit>Properties** (or double-click the ICS-2000 device icon).

2. Select the **Options** tab (see [Figure 4-1](#)).

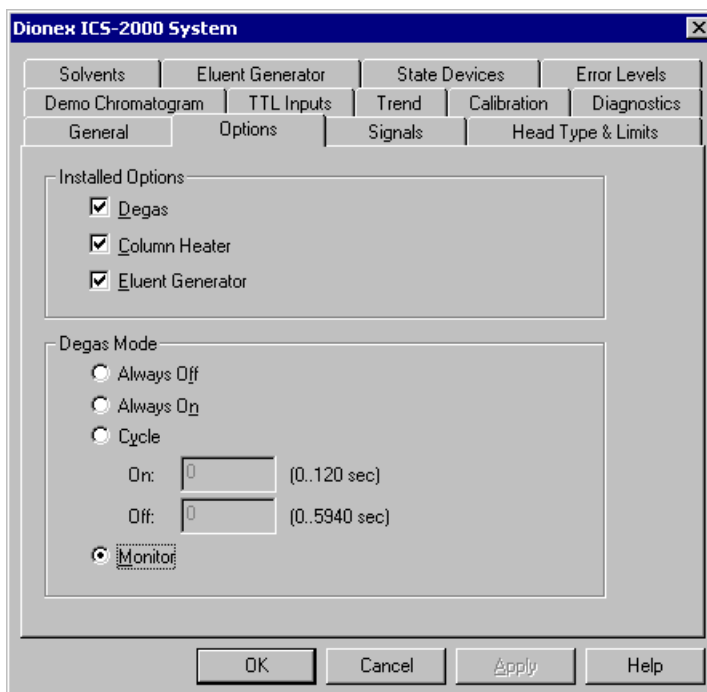


Figure 4-1. ICS-2000 Server Configuration Properties: Options

3. Under **Installed Options**, verify that the **Degas** check box is selected.
4. Check the **Degas Mode** settings. Select either the **Monitor** option or the **Cycle** option. If you select **Cycle**, set the time **On** to 30 seconds and the time **Off** to 10 minutes. If **Cycle** is already selected, try increasing the time on or decreasing the time off.

**NOTE** Degas Mode options can also be selected from the touch screen **PUMP** page (see [Section C.7](#)).

- **End-line filter is dirty or clogged**

When new, end-line filters (P/N 045987) are pure white. If the system is in continuous operation, change the end-line filter weekly, or whenever it becomes discolored. Replace the filter more often if bacterial buildup is visible or if the eluent does not contain solvent.

**NOTE** It is especially important to regularly replace end-line filters when using aqueous eluents, which may contaminate the filter with bacteria or algae. The bacterial buildup may not be visible.

- **Blockages in inlet tubing**

Kinked or clogged tubing causes the pump to be “starved” for eluent. Replace the tubing and fittings (see [Section 5.3](#)).

- **Dirty check valve**

Clean or replace the pump check valve (see [Section 5.5](#)).

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

Use the open-end wrench (P/N 014605) provided in the ICS-2000 Ship Kit (P/N 057905) to tighten the two acorn nuts that attach the pump head to the pump housing (see [Figure 5-11](#)). Tighten the nuts evenly (12 in-lb torque).

If the leak persists, replace the piston seal (see [Section 5.6](#)).

- **Liquid leaks from the seal wash port**

Replace the piston seal (see [Section 5.6](#)).

- **Scratched pump piston**

Check the pump pistons for scratches and replace if necessary (see [Section 5.7](#)).

## 4.4 Pump Does Not Start

- **No power (front 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 5.16](#)).

- **No communication between ICS-2000 and Chromeleon**

Verify that the USB cable is connected correctly. See [Section B.5](#) for installation instructions.

- **Pump is turned off**

Turn on the pump from either the Chromeleon Control panel or the ICS-2000 touch screen **HOME** page.

- **Flow rate is set to 0**

Set the flow rate from either the Chromeleon Control panel or the ICS-2000 touch screen **HOME** page.

## 4.5 No Flow

- **Pump waste or priming valve open (see [Figure 4-2](#)).**

Close the valves by turning the knobs clockwise until fingertight. **DO NOT OVERTIGHTEN! Overtightening may damage the valve and the pump head.**



Figure 4-2. Waste and Priming Valves

- **Flow rate is set to 0**

Set the flow rate from the Chromeleon Control panel or from the touch screen **HOME** page.

- **Eluent valve is closed**

Open the eluent valve from the Chromeleon Control panel or from the touch screen **PUMP** page.

- **Pump not primed**

Prime the pump (see [Section B.13](#)).

- **Broken pump piston**

Replace the piston (see [Section 5.7](#)).

- **Eluent generator degas tubing assembly ruptured**  
Replace the EluGen cartridge holder (see [Section 5.17](#)).

### 4.6 Erratic Flow/Pressure Reading

- **Pump needs priming**  
Prime the pump (see [Section B.13](#)).
- **Damaged piston seal**  
Replace the piston seal (see [Section 5.6](#)).
- **Dirty pump check valve**  
Clean or replace the check valve (see [Section 5.5](#)).
- **Leaking liquid lines or fittings**  
Check the liquid lines and fittings for small leaks. Tighten or, if necessary, replace the liquid line connection (see [Section 5.3](#)). Refer to *Installation of Dionex Liquid Line Fittings* (Document No. 031432) for tightening requirements. The manual is on the Dionex Reference Library CD-ROM (P/N 053891).

### 4.7 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 Liquid Line Fittings* (Document No. 031432) for details. The manual is on the Dionex Reference Library CD-ROM (P/N 053891). If you have trouble isolating the restriction, refer to [Section 5.2](#).
- **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 5.3](#)).
- **Flow rate through the columns too high**  
Set the correct rate for your application. If an incorrect flow rate calibration is suspected, calibrate the flow (see [Section 5.1.4](#)).



- **Clogged column bed supports**

Refer to the instructions in the column manual for troubleshooting guidance. Column manuals are included on the Dionex Reference Library CD-ROM (P/N 053891).
- **Contaminated columns**

Clean the columns as instructed in the column manual.
- **Plugged injection valve passages**

Rebuild the injection valve (see [Section 5.4](#)).

## 4.8 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 be the result of a contaminated standard or eluent, or a malfunctioning injection valve. These peaks may co-elute with peaks of interest, resulting in nonreproducible peak heights/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.
- **Incorrect or contaminated eluent**

Verify that the correct eluent concentration is selected.

Install or replace the end-line filter on the end of the deionized water line (see [Section 3.4.1](#)).
- **Malfunctioning injection valve**
  1. Rebuild the injection valve (see [Section 5.4](#)).
  2. If the valve leak persists, contact Dionex for assistance.

### 4.9 Nonreproducible Peak Height or Retention Time

- **Column overloading**  
Dilute the sample (see [Section 3.9](#)).
- **Liquid leaks**  
Locate and eliminate the leaks (see [Section 4.2](#)).
- **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.13](#)).

### 4.10 Abnormal Retention Time or Selectivity

- **Incorrect eluent**  
Check the EGC concentration setting.
- **Contaminated or degraded sample**  
Take appropriate precautions when preparing and storing samples to prevent contamination and degradation (see [Section 3.9](#)).
- **Contaminated column**
  1. Clean the column as instructed in the column manual. Column manuals are included on the Dionex Reference Library CD-ROM (P/N 053891).
  2. If cleaning is unsuccessful, replace the column.

### 4.11 No Cell Response

- **Cell not properly installed**  
Verify that the cell front cover is flush against the component panel. If necessary, tighten the two mounting screws. When the cell is correctly installed and the screws tightened, an electronics connector on the cell plugs into a receptacle inside the ICS-2000.

- **No flow from pump**

This condition has several possible causes. See [Section 4.4](#) and [Section 4.5](#) for details.

- **Cell electronics malfunctioning**

Use the Chromeleon Wellness Panel diagnostics to test the electronics (see [Section 5.1](#) and the Chromeleon online Help for instructions). If the variance reading is outside the tolerance range (less than 1  $\mu$ S), the electronics are malfunctioning. Contact Dionex for assistance. The ICS-2000 electronics cannot be serviced by the user.

### 4.12 High Cell Output

- **Background not suppressed by suppressor**

Verify that the suppressor is turned on and the current is set to the correct value. Refer to the suppressor manual for additional troubleshooting guidance. Suppressor manuals are included on the Dionex Reference Library CD-ROM (P/N 053891).

- **Sample concentration too high**

Dilute the sample [Section 3.9.3](#).

- **Wrong eluent**

Check that you are using the correct eluent for your application.

- **Background conductivity not offset from conductivity reading**

Before making an injection, allow the background conductivity to equilibrate, and then press **Autozero** on the Chromeleon Control panel or the ICS-2000 touch screen **HOME** page.

- **Cell out of calibration**

Recalibrate the cell (see [Section 5.1.3](#)).

### 4.13 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 Liquid Line Fittings* (Document No. 031432) for tightening requirements. The manual is on the Dionex Reference Library CD-ROM (P/N 053891).

- **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 suppressor eluent ports.

- **Pump not properly primed**

Prime the pump (see [Section B.13](#)).

- **Incorrect eluent**

Check the EGC concentration setting.

- **Inadequate system backpressure**

Add backpressure tubing between the injection valve and the **ELUENT OUT** port on the EGC to maintain a pressure of  $16 \pm 0.7$  MPa ( $2300 \pm 100$  psi). See [Section B.16.1](#) for details.

- **Rapid changes in ambient temperature**

Make sure the ambient temperature is between 4 and 40 °C (40 and 104 °F).

Make sure air conditioning and heating vents are directed away from the ICS-2000 and the ICS-2000 front door is closed.

- **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. Suppressor manuals are included on the Dionex Reference Library CD-ROM (P/N 053891).

- **Cell above or below temperature**  
Contact Dionex for assistance.
- **Damaged piston seal**  
Replace the piston seal (see [Section 5.6](#)).

## 4.14 Vacuum Degas Assembly Does Not Run

- **Degas option not enabled in Chromeleon**
  1. Open the Chromeleon Server Configuration program. Select the ICS-2000 device icon under the timebase and select **Edit>Properties** (or double-click the ICS-2000 device icon).

Select the **Options** tab (see [Figure 4-3](#)).

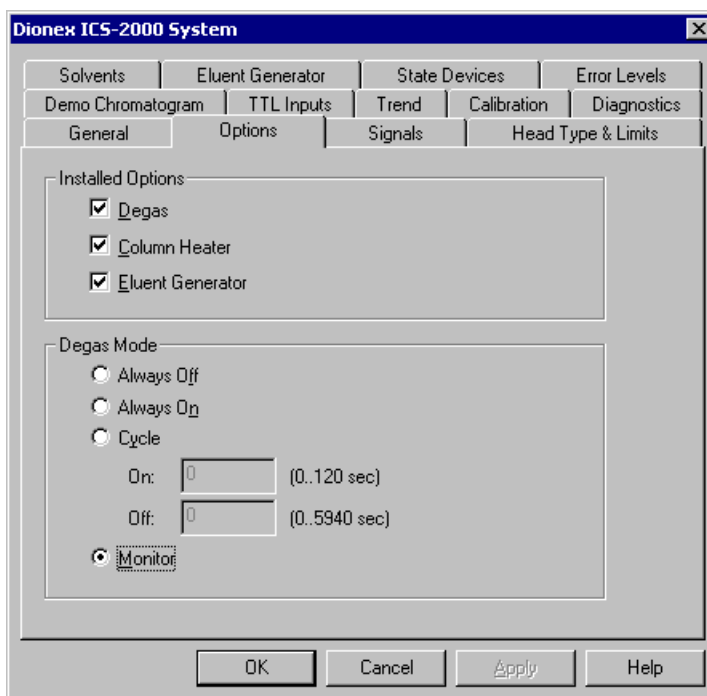


Figure 4-3. ICS-2000 Server Configuration Properties: Options.

2. Under **Installed Options**, verify that the **Degas** check box is selected.

3. Under **Degas Mode**, verify that the **Always Off** option is *not* selected. If it is, select one of the following settings:
  - **Cycle**, and select **On**: 30 seconds and **Off**: 10 minutes
  - **Monitor**
4. If the **Degas Mode** settings are correct, but the degas assembly still does not run, test the assembly by selecting the **Always On** option. The pump should turn on immediately. If it does not, the vacuum degas assembly may need to be replaced. Contact Dionex for assistance.

**NOTE** Degas Mode options can also be selected from the touch screen **PUMP** page (see [Section C.7](#)).

**IMPORTANT**

Select the **Degas Mode, Always On** option only when testing the vacuum degas assembly. Do not select the **Always On** option for routine use.

5. If the degas pump runs when you select **Always On**, but does not run when **Monitor** mode is selected, recalibrate the degas assembly (see [Section 5.1.5](#)).

This chapter describes ICS-2000 service and repair procedures that the user can perform. All procedures not included here, including electronics-related repair procedures, must be performed by Dionex personnel. For assistance, contact Dionex Technical Support. In the U.S., call 1-800-346-6390. Outside the U.S., call the nearest Dionex office.

Before replacing any part, refer to the troubleshooting information in [Chapter 4](#) to isolate the cause of the problem.

**IMPORTANT**

**Substituting non-Dionex parts may impair performance, thereby voiding the product warranty. Refer to the warranty statement in the Dionex Terms and Conditions for more information.**

### 5.1 Diagnostic and Calibration Procedures

Diagnostic and calibration procedures can be performed either from the touch screen or from the Chromeleon Wellness Panel (see [Figure 5-1](#)).

For an overview of the Wellness Panel features, see [Section 5.1.1](#). For an overview of the diagnostic and calibration touch screen, see [Section 5.1.2](#). For instructions on performing calibration and diagnostic procedures, see the following sections:

- Calibrating the Conductivity Cell ([Section 5.1.3](#))
- Calibrating the Flow Rate ([Section 5.1.4](#))
- Calibrating the Vacuum Degas Assembly ([Section 5.1.5](#))

## 5.1.1 Chromeleon Wellness Panel Overview

**NOTE** Do not open a System Wellness Control panel if the name includes “Service.pan.” These Wellness panels are reserved for use by Dionex Service Representatives.

### To Open the Wellness Panel

1. Open the Chromeleon Browser and expand the **Dionex Templates** folder.
2. Expand the **Panels** folder and then the **Wellness** folder.
3. In the right pane of the Browser window, double-click **ICS-1000\_1500\_2000\_Wellness\_user.pan**. The Wellness Panel appears.
4. Open the **Control** menu and click the name of the ICS-2000 timebase at the bottom of the menu. This connects the Wellness Panel to the ICS-2000 and enables the controls on the panel.

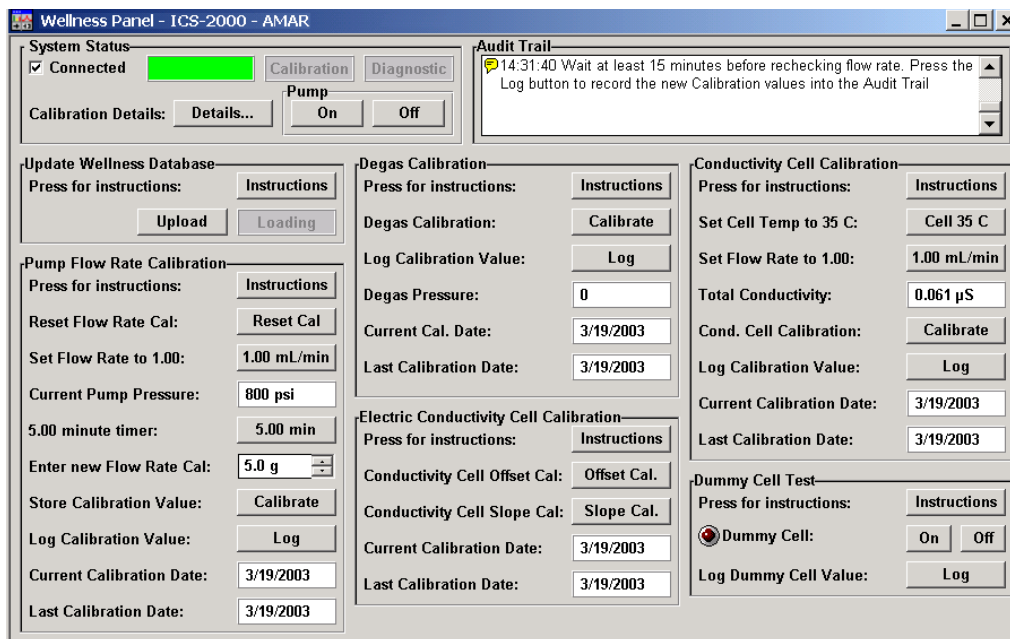


Figure 5-1. Chromeleon Wellness Panel



Use the Wellness Panel to perform the following functions:

- Calibrate the pump flow rate
- Calibrate the vacuum degas assembly
- Calibrate the conductivity cell
- Test the conductivity cell electronics, using a dummy cell
- Upload calibration values from the ICS-2000 to the Chromeleon Wellness database

**IMPORTANT**

**After completing a calibration procedure from the touch screen, always update the Chromeleon Wellness database by clicking the Upload button on the Chromeleon Wellness Panel (see [Figure 5-1](#)). This action ensures that the current calibration information is stored in Chromeleon as well as in the ICS-2000.**

## 5.1.2 Diagnostic and Calibration Touch Screen Overview

Select **DIAGNOSTIC** from the touch screen menu of pages. The **DIAGNOSTIC** page opens (see [Figure 5-2](#)). From there, you can access individual diagnostic and calibration pages.

**NOTE** The **Service** button provides access to service functions that are performed only by Dionex personnel. An access code is required to go to the service pages.

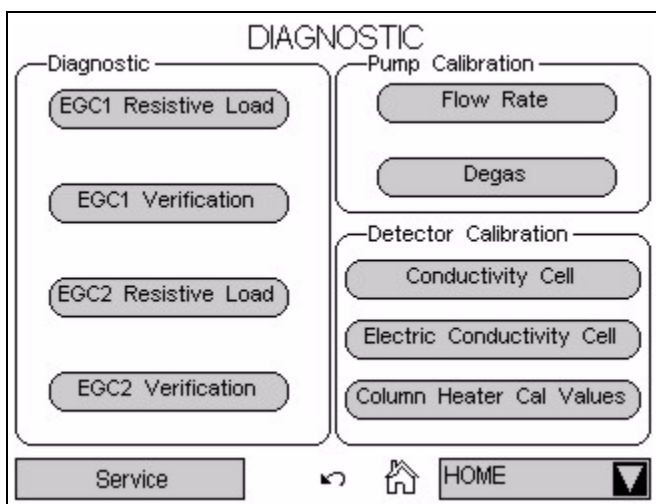


Figure 5-2. System Diagnostic Menu Page

**NOTE** The **Diagnostic** touch pages, **EGC1** and **EGC2 RESISTIVE LOAD** and **EGC1** and **EGC2 VERIFICATION**, display the results of the EluGen cartridge validation procedure, which is normally performed by Dionex personnel. Contact Dionex for more information.

### 5.1.3 Calibrating the Conductivity Cell

#### When to Calibrate

- After every 6 months of use

**NOTE** Do not use this procedure to calibrate a new cell. If you are replacing a cell, see the instructions in [Section 5.9](#) to install the new cell and calibrate it.

Items Needed	Description
1.0 mM KCl solution	Prepare by dissolving 0.07456 g of reagent-grade KCl in 1 liter of 18-megohm DI water.
Backpressure tubing to provide at least 7 MPa (1000 psi)	Use 0.076-mm (0.003-in) ID yellow PEEK tubing (P/N 049715).

1. Open the ICS-2000 Wellness Panel in Chromeleon (see [Section 5.1.1](#)), or open the touch screen **ELECTRIC CONDUCTIVITY CALIBRATION** page (see [Figure 5-3](#)).

**ELECTRIC CONDUCTIVITY CALIBRATION**

Total Conductivity 0.000 μS

Cell Constant

Wait until this calibration is done before doing slope cal.

WARNING: THIS WILL ERASE THE  
PRIOR SLOPE CALIBRATION AND STORE A NEW VALUE

Fine	Offset 0.00000000	Slope	0.02483527 X 10 <sup>-6</sup>
Medium	Offset 0.00000000	Slope	0.39736432 X 10 <sup>-6</sup>
Coarse	Offset 0.00000000	Slope	1.86264525 X 10 <sup>-6</sup>

Figure 5-3. Electric Conductivity Calibration Page

2. On the Wellness Panel under **Electric Conductivity Cell Calibration**, click **Offset Cal**, or touch **Run Offset Cal** on the ICS-2000 touch screen.
3. When the offset calibration is complete, click **Slope Cal** on the Wellness Panel, or touch **Run Slope Cal** on the ICS-2000 touch screen.
4. If you are using the Wellness Panel, click **Log** to record the new calibration values in the Audit Trail.
5. Disconnect the pump output line from the injection valve.
6. Disconnect the line from the suppressor **ELUENT OUT** port to the cell inlet and connect the pump output line directly to the cell inlet.
7. Verify that the backpressure is at least 7 MPa (1000 psi).
8. If you are using the touch screens to perform the calibration, open the **CONDUCTIVITY CELL** page (see [Figure 5-4](#)).

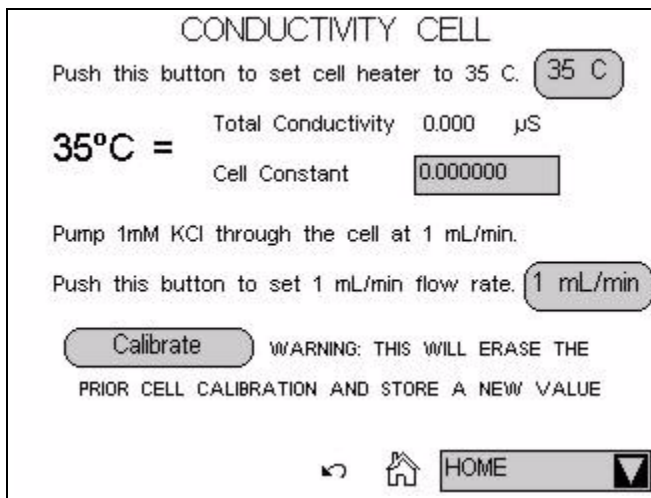


Figure 5-4. Conductivity Cell Page

9. On the Wellness Panel under **Conductivity Cell Calibration**, click **Cell 35 C**, or touch **35 C** on the ICS-2000 touch screen. Allow the cell to reach this temperature and then wait an additional 5 minutes to let it stabilize. When the temperature has stabilized, “=” is displayed to the right of the temperature reading on the **CONDUCTIVITY CELL** page.

10. Select **1.00 mL/min** to begin pumping 1.00 mM KCl through the cell at 1.0 mL/min.
11. Wait until the total conductivity reading stabilizes (in about 15 minutes) and then select **Calibrate** on the Wellness Panel or the touch screen **CONDUCTIVITY CELL** page.

After calibration, the conductivity reading should be  $147.00 \pm 2 \mu\text{S}$  and the cell constant should be between 120 and 180. If this is not the case, contact Dionex for help.
12. If you are using the Wellness Panel, click **Log** to record the new calibration values in the Audit Trail.
13. If you are using the ICS-2000 touch screen, record the new calibration values in the Chromeleon Wellness database. To do this, open the Wellness Panel (see [Section 5.1.1](#)) and click **Upload** under **Update Wellness Database**.
14. Flush the KCl solution from the system by pumping deionized water through the cell. When the conductivity drops to less than  $1 \mu\text{S/cm}$ , stop the pump.
15. Reconnect the pump to the injection valve and reconnect the line from the suppressor to the cell inlet.

## 5.1.4 Calibrating the Flow Rate

### When to Calibrate

If you run the ICS-2000 Operational Qualification or Performance Qualification and it fails.

### Items Needed

- 0.076-mm (0.003-in) ID yellow PEEK tubing (P/N 049715) to create  $14 \pm 2 \text{ MPa}$  ( $2000 \pm 300 \text{ psi}$ ) of backpressure (if needed)
- High purity ASTM filtered, Type I (18 megohm-cm) deionized water
- Balance capable of weighing more than 10 g with 0.001 g readability
- Tared beaker

### To Calibrate

1. Open the ICS-2000 Wellness Panel in Chromeleon (see [Section 5.1.1](#)), or open the ICS-2000 touch screen **FLOW RATE** page (see [Figure 5-5](#)).

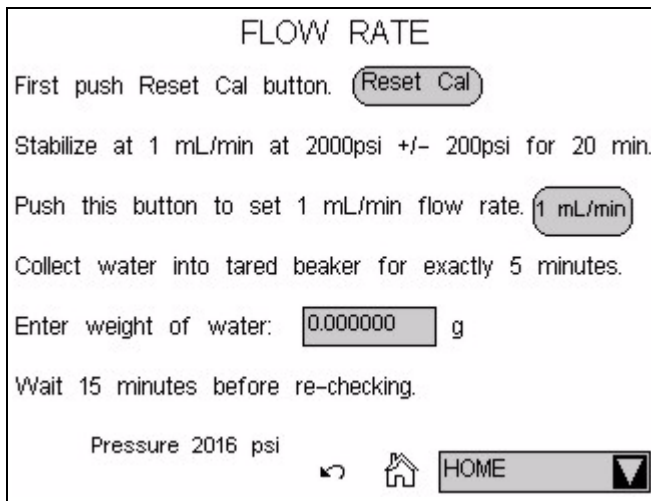


Figure 5-5. Flow Rate Page

2. Verify that there is  $14 \pm 1.4$  MPa ( $2000 \pm 200$  psi) of backpressure.
3. On the Chromeleon Wellness Panel under **Pump Flow Rate Calibration**, select **Reset Cal**, or touch **Reset Cal** on the ICS-2000 touch screen.
4. Select **1 mL/min** to set the flow rate and begin pumping deionized water.
5. Allow the pump to stabilize for 20 minutes.
6. If you are using the Wellness Panel, click **5.00 min** to start the timer. If you are using the touch screen, start an external timer. Immediately start collecting water into the tared beaker.
7. Collect the water for exactly 5.00 minutes.
8. Enter the weight of the water (in grams).
9. If you are using the Wellness Panel, click **Calibrate** to download the value to the ICS-2000.

10. To recheck the value, wait at least 15 minutes, and then repeat the calibration.
11. If you are using the Wellness panel, click **Log** to record the new calibration value in the Audit Trail.
12. If you performed the calibration from the ICS-2000 touch screen, record the new calibration values in the Chromeleon Wellness database. To do this, open the Wellness Panel (see [Section 5.1.1](#)) and click **Upload**.

### 5.1.5 Calibrating the Vacuum Degas Assembly

#### When to Calibrate

- After every 6 months of use
1. Open the ICS-2000 Wellness Panel in Chromeleon (see [Section 5.1.1](#)), or open the ICS-2000 touch screen **PUMP DEGAS** page (see [Figure 5-6](#)).

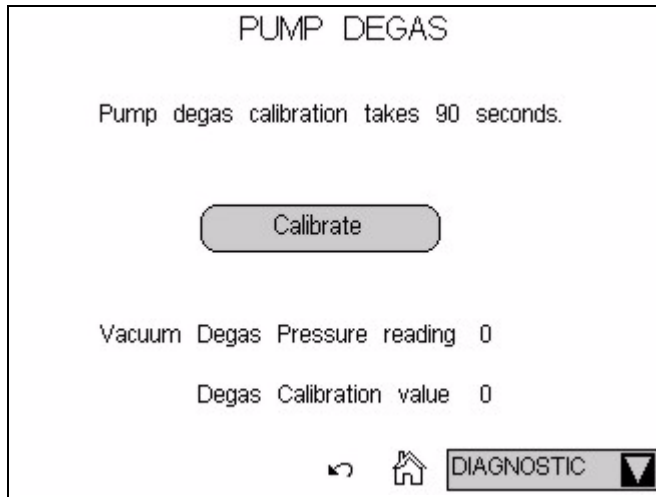


Figure 5-6. Pump Degas Page

2. On the Wellness Panel under **Degas Calibration**, select **Calibrate**, or touch **Calibrate** on the ICS-2000 touch screen. The degas pump runs for 90 seconds to allow a vacuum to be created. After 90 seconds, the

vacuum degas pressure reading is recorded. When the vacuum degas assembly is running in monitor mode, this calibration value is used to determine when to turn on the degas pump.

3. If you are using the Wellness panel, click **Log** to record the new calibration value in the Audit Trail.
4. If you performed the calibration from the ICS-2000 touch screen, record the new calibration values in the Chromeleon Wellness database. To do this, open the Wellness Panel (see [Section 5.1.1](#)) and click **Upload** under **Update Wellness Database**.

## 5.2 Isolating a Restriction in the Liquid Lines

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

1. Begin pumping eluent through the system (including the columns).
2. Follow the ICS-2000 flow schematics in [Figure 5-7](#), [Figure 5-8](#), or [Figure 5-9](#) and work backward through the system, beginning at the suppressor **Regen Out** port. One at a time, loosen each fitting and observe the pressure. The connection at which the pressure drops abnormally indicates the point of restriction.

**NOTE** The numbers on the ICS-2000 flow schematic indicate the order in which liquid flows through the system components.

If the restriction has caused such high pressure that the system cannot be operated, you must work forward through the flow schematics, 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 (see [Section 5.3](#)).



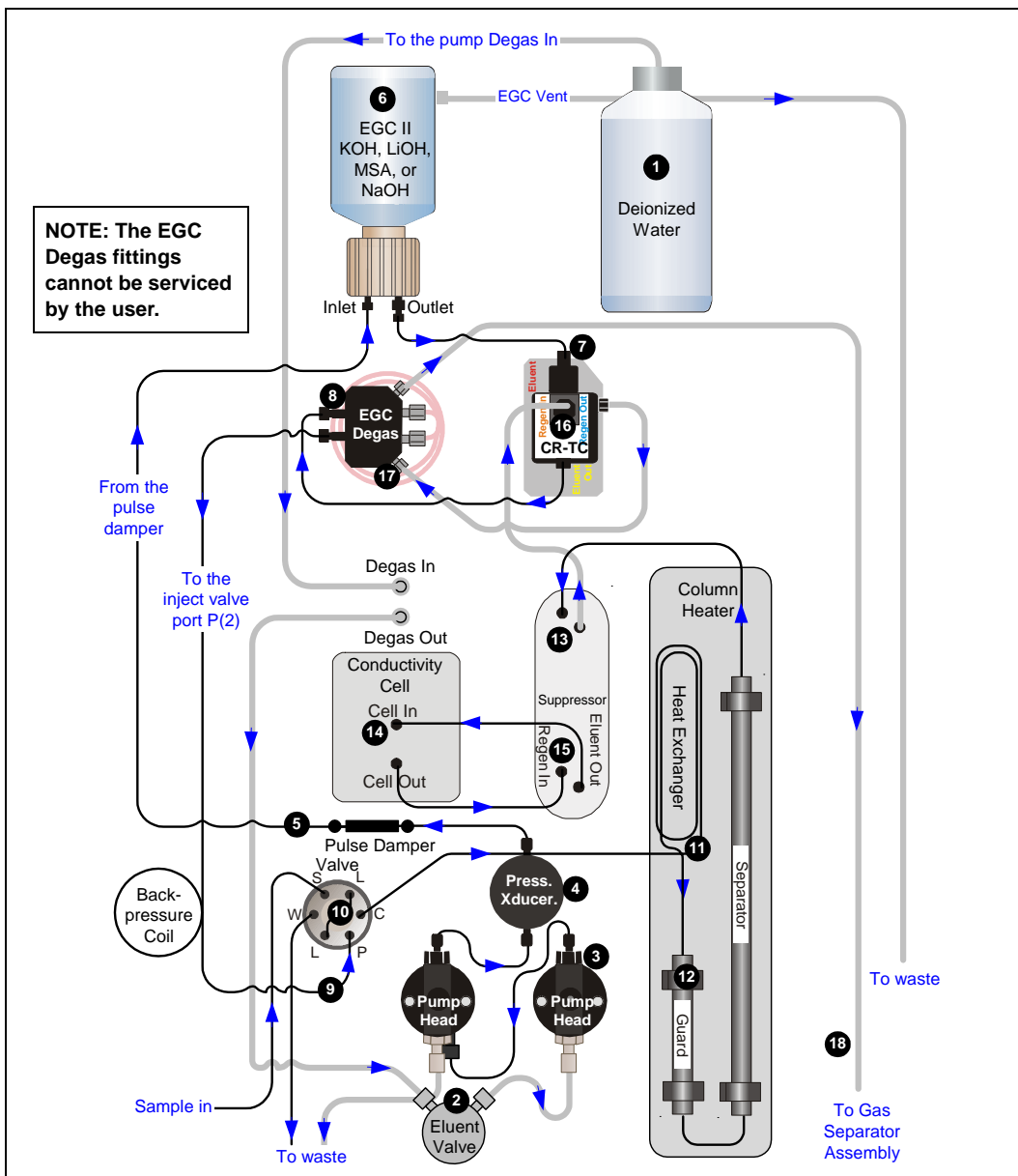


Figure 5-7. ICS-2000 Flow Schematic: KOH, LiOH, MSA, or NaOH Eluent Generation

**NOTE** The numbers on the flow schematic indicate the order in which liquid flows through the system components.

# ICS-2000 Ion Chromatography System

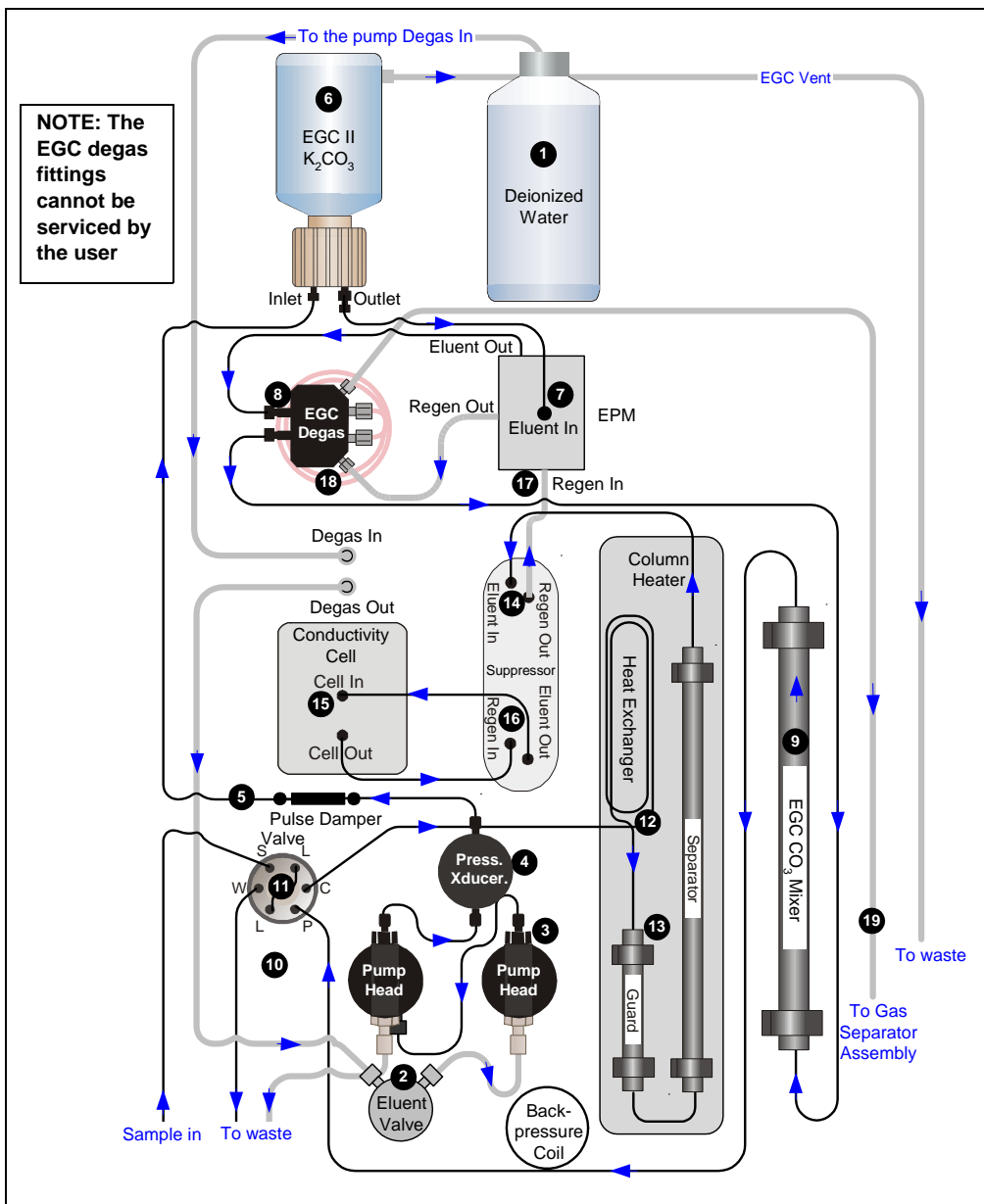


Figure 5-8. ICS-2000 Flow Schematic: Carbonate/Bicarbonate Eluent Generation

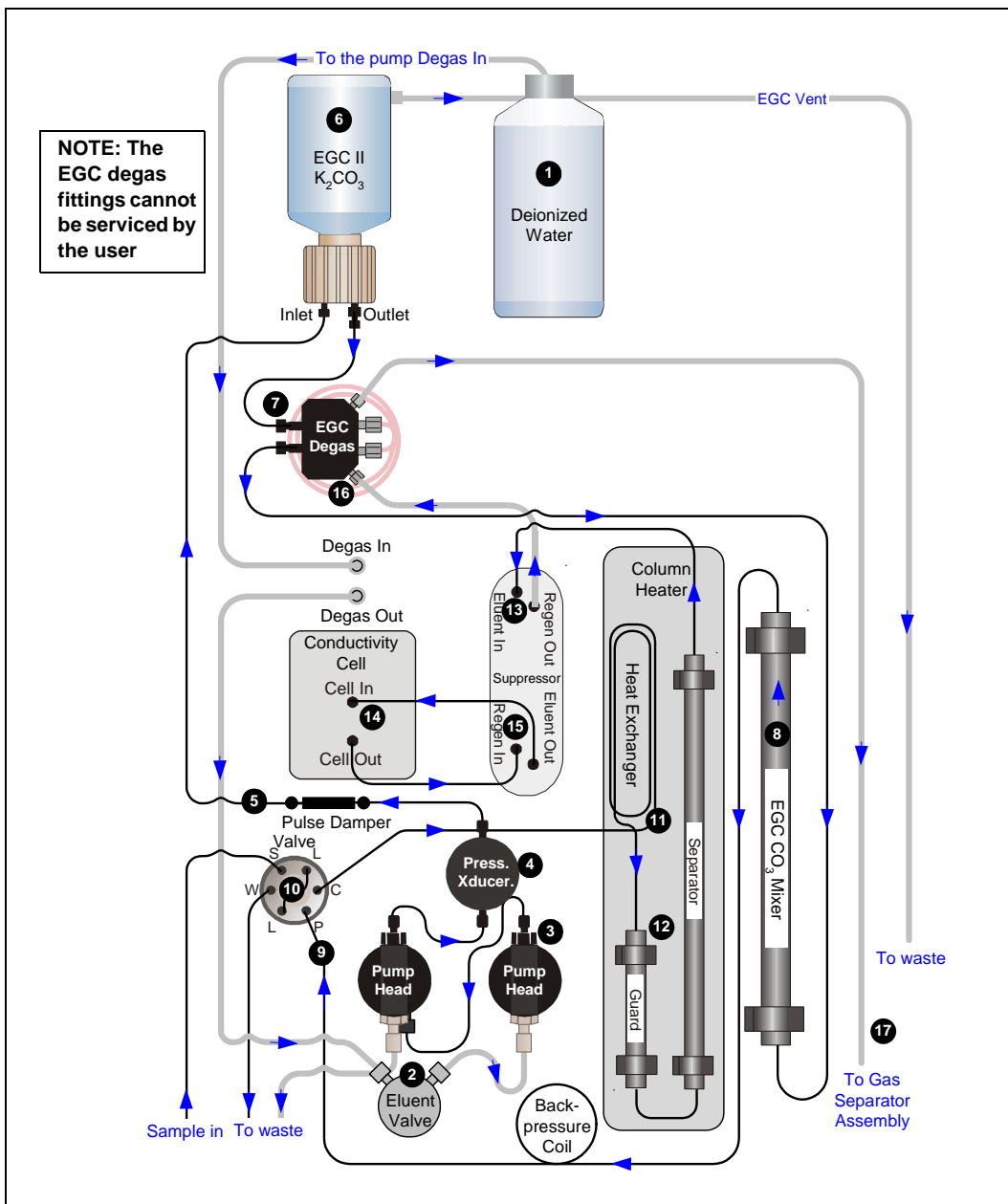


Figure 5-9. ICS-2000 Flow Schematic: Carbonate Eluent Generation

### 5.3 Replacing Tubing and Fittings

The ICS-2000 is plumbed with the tubing and tubing assemblies listed below.

Tubing Size and Type	Color	Used For
0.125-mm (0.005-in) ID PEEK (P/N 044221)	Red	Connection from pump pulse damper to pressure transducer
0.25-mm (0.010-in) ID PEEK (P/N 042690)	Black	Connections between other system components
0.50-mm (0.020-in) ID PEEK (P/N 042855)	Orange	Connection from injection port to injection valve
0.75-mm (0.030-in) ID PEEK (P/N 044777)	Green	Connection from injection valve to waste
1.58-mm (0.062-in) ID Teflon (P/N 014157)	Clear	Connection from pump to degas or eluent reservoir; pump waste
25 $\mu$ L sample loop (P/N 042857)	Orange	Connection between ports <b>L (1)</b> and <b>L (4)</b> on the injection valve

- 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 Liquid Line Fittings* (Document No. 031432). The manual is on the Dionex Reference Library CD-ROM (P/N 053891).
- 1/8-in fittings (P/N 052267) and ferrules (P/N 048949) are used for connections to the suppressor **REGEN OUT** port and the eluent reservoir.

## 5.4 Rebuilding the Injection Valve

Dionex recommends rebuilding the injection valve annually. The Injection Valve Rebuild Kit (P/N 057896) 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 ICS-2000 Control panel in Chromeleon or from the touch screen **HOME** page.
2. Open the ICS-2000 front door.
3. Disconnect each liquid line connected to the injection valve.
4. Follow the instructions provided in the Rebuild Kit to replace the rotor seal, isolation seal, and stator face.
5. Reconnect all liquid lines to the injection valve (see [Figure 5-10](#)).
6. Close the door.
7. Turn on the pump.

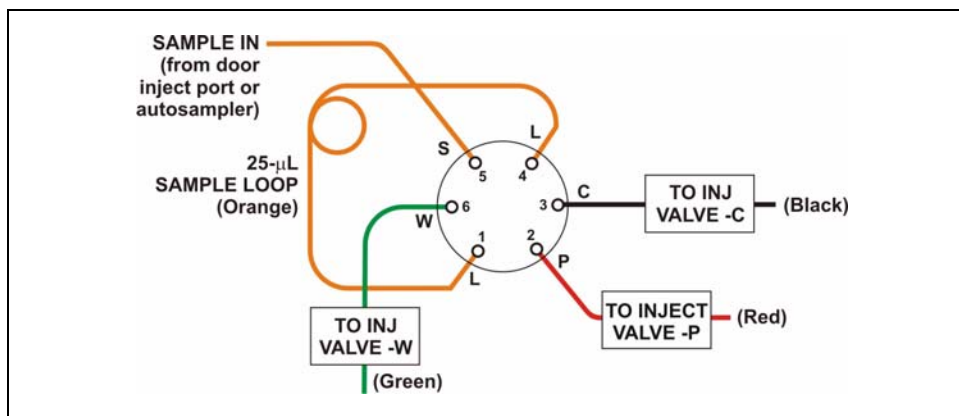


Figure 5-10. Injection Valve Plumbing

**NOTE A backpressure coil may be installed between Port P and the line labeled TO INJECT VALVE - P.**

### 5.5 Cleaning and Replacing the Pump Check Valves

A dirty check valve causes erratic flow rates and pressures. In addition, it may cause the pump to lose prime and/or be difficult to reprime. If possible, replace dirty check valves. If new check valves are not available, follow the instructions for cleaning.

#### Replacing Check Valves

1. Close the eluent valve from the ICS-2000 Control panel in Chromeleon or select **Eluent Valve Closed** on the touch screen **PUMP** page.
2. Turn off the main power switch, to ensure that you do not unintentionally start the ICS-2000.
3. To prevent contamination of pump parts, put on a pair of rubber gloves before disassembling the pump head.
4. Disconnect the tube fittings from the inlet and outlet check valve assemblies on the primary pump head (see [Figure 5-11](#)).
5. Use a 1/2-inch wrench to loosen both check valve assemblies. Remove the check valve assemblies from the pump head.

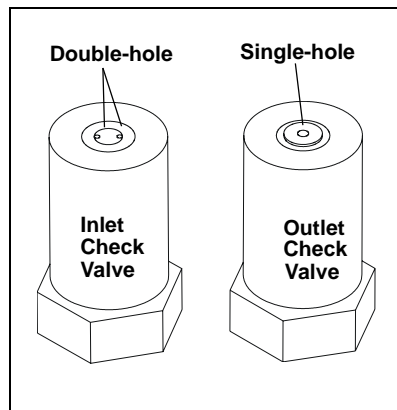


Figure 5-11. Pump Heads

**NOTE** The *inlet* check valve assembly housing has a 1/4-28 port.  
The *outlet* check valve assembly housing has a 10-32 port.

6. If you are installing new cartridges (P/N 045994) in the existing check valve housings, place the cartridge in the *inlet* check valve housing with the double-hole end of the cartridge visible and place the cartridge in the *outlet* housing with the single-hole end visible.

**NOTE** The pump will not operate properly unless the cartridge is installed in the housing in the correct orientation. Liquid flows through the check valve in the large single hole and out the small double holes.



7. Install the inlet check valve assembly (P/N 045722) on the bottom of the primary pump head. Install the outlet check valve assembly (P/N 045721) on the top of the head. Tighten the check valves fingertight, and then use a wrench to tighten an additional one-quarter to one-half turn.



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

8. Reconnect the liquid lines. Turn on the ICS-2000 main power.
9. Open the eluent valve from the ICS-2000 Control panel in Chromeleon or select **Eluent Valve Closed** on the touch screen **PUMP** page.
10. Prime the pump (see [Section B.13](#)).
11. When the ICS-2000 is at operating pressure, check for leaks from the check valves. Tighten a check valve a *little more* only if it leaks.

### Cleaning Check Valves

1. Carefully remove the check valve cartridges from the valve housings.
2. Place the check valve housings and cartridges in a beaker with methanol. Sonicate or agitate the parts for several minutes.
3. Rinse each check valve housing and cartridge thoroughly with filtered deionized water.
4. See [Step 6](#) through [Step 11](#) above to reinstall the check valves and complete the procedure.

## 5.6 Replacing a Pump Piston Seal and Piston Rinse Seal

A damaged seal allows leakage past the piston, as well as leakage from the piston seal wash housing. The pump may be difficult to prime, flow rates may be unstable, and there may be baseline noise.

### Preparation

1. Rinse the pump flow path with deionized water. Direct the flow to waste by opening the waste valve on the secondary pump head (see [Figure 5-14](#)). To open the valve, turn the knob one-quarter to one-half turn counterclockwise.
2. After rinsing, close the waste valve.
3. Close the eluent valve from the ICS-2000 Control panel in Chromeleon or select **Eluent Valve Closed** on the touch screen **PUMP** page.
4. To prevent contamination of pump parts, put on a pair of rubber gloves before disassembling the pump head.

### Removing the Head and Piston

1. Turn off the main power switch, to ensure that you do not unintentionally start the ICS-2000.
2. Disconnect all tubing connections to the pump head.
3. Locate the open-end wrench (P/N 014605) provided in the ICS-2000 Ship Kit (P/N 057905). Use the wrench to remove the two acorn nuts (see [Figure 5-11](#)) from the pump head.
4. Slowly pull the head and allow it to separate from the housing. Carefully disengage the head from the piston by pulling the head straight off and away from its mounting studs.



**Lateral motion while disengaging the pump head from the piston may break the piston.**



**Un mouvement latéral pendant la séparation de la tête et du piston peut casser le piston.**



**Vermeiden Sie Seitwärtsbewegungen, wenn Sie den Kopf vom Kolben lösen. Andernfalls kann der Kolben brechen.**



- Place the head (front end down) on a clean work surface and lift off the spacer to expose the piston seal (see [Figure 5-12](#) or [Figure 5-13](#)).

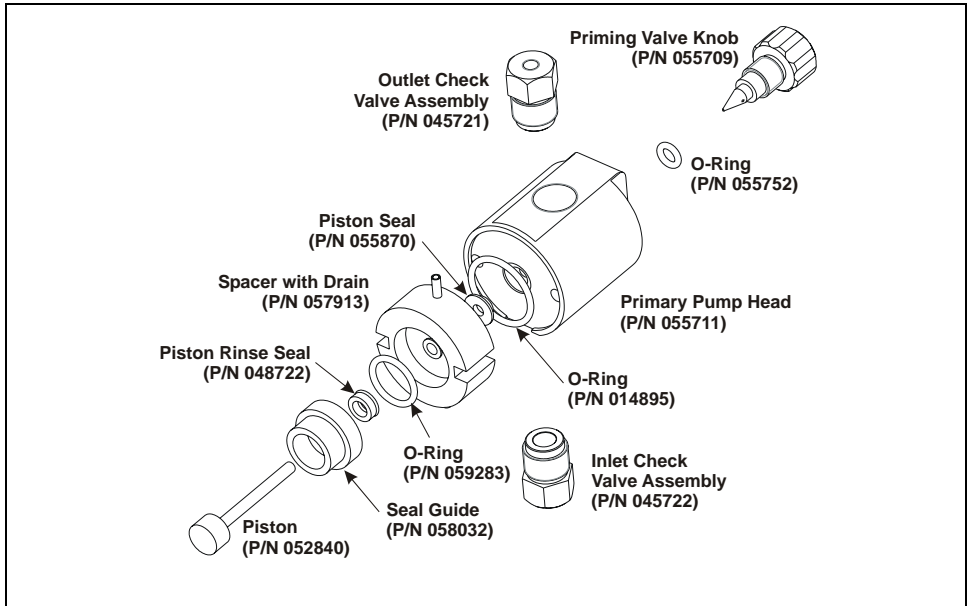


Figure 5-12. Primary Pump Head

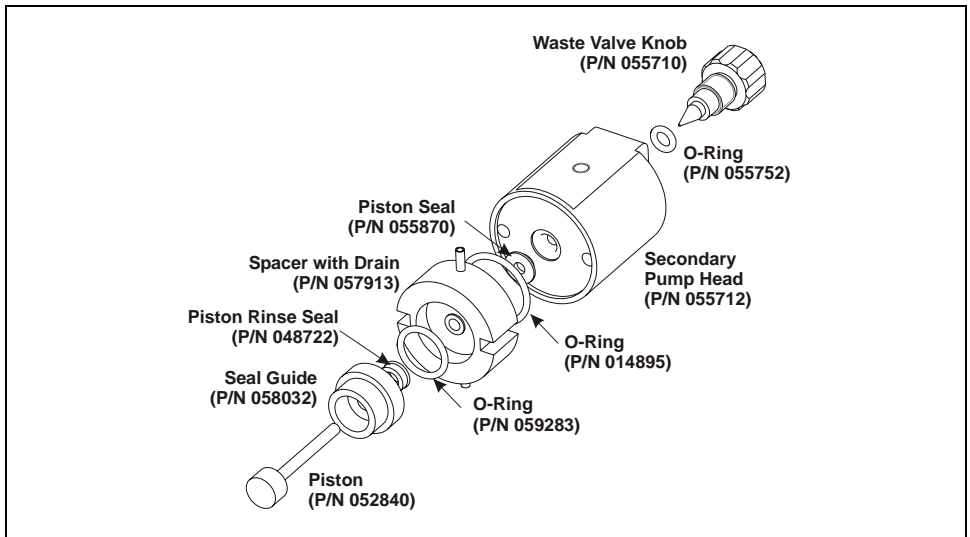
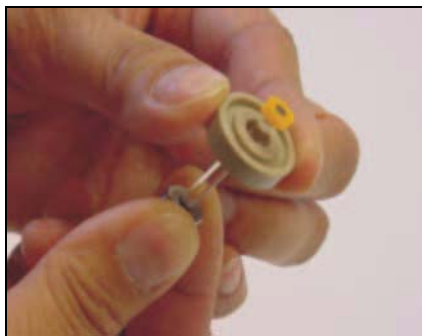


Figure 5-13. Secondary Pump Head

6. The piston does not come off as part of the pump head assembly because it is captured by a magnetic retention system. After removing the pump head, hold the shaft of the piston (near the base), tilt the piston slightly, and pull the piston away from the pump.

### Installing the New Piston Rinse Seal

1. Remove the guide from the spacer to expose the piston rinse seal and O-ring. Remove the O-ring.
2. Remove the old piston rinse seal from the guide as follows:
  - a. Hold the guide with the flat side facing up.
  - b. To dislodge the piston rinse seal, gently insert the shaft of the piston through the small hole in the center of the guide (see photo).
  - c. Pull the seal off the end of the piston shaft and remove the piston from the guide.
3. Hold the new piston rinse seal (P/N 048722) with the grooved side facing up.
4. Using your fingertip, gently press the piston rinse seal into the guide until the edge of the seal is below the surface of the guide.

**IMPORTANT**

**The piston rinse seal is made of soft plastic. Do not press on the seal with anything hard or sharp, including your fingernail. If the seal is nicked or gouged, it will not seal properly and may result in leaks.**

5. Place the new O-ring (P/N 059283) into the groove in the guide.
6. Remove the O-ring from the groove in the flat side of the spacer and replace it with the new O-ring (P/N 014895).
7. In one hand, hold the guide with the O-ring and piston rinse seal facing up (this prevents the O-ring from falling out). In the other hand, hold the spacer with the cavity facing down.
8. Gently press the guide into the cavity in the spacer until it is fully seated.

### Removing the Piston Seal from the Head

1. Fill the head cavity with deionized water by injecting the liquid through either the piston opening or the inlet check valve.
2. Reinsert the piston approximately 3 mm (0.125) inch into the seal.
3. If this is the *primary* pump head, install a 10-32 fitting plug (P/N 042772) on the outlet check valve. Tighten the plug.
4. If this is the *secondary* pump head, install a 10-32 fitting plug (P/N 042772) in both the inlet and outlet ports. Tighten the plugs.
5. Push the piston into the head. (This should hydraulically unseat the seal from the head.) Remove the piston and pull off the seal.

**NOTE** If the piston seal is not removed, make sure the 10-32 fitting plug(s) are tight and add more water. Make sure the head contains no air bubbles, and then repeat Steps 2 and 5.

6. Remove the 10-32 fitting plug(s).

### Installing the New Piston Seal

1. Open the priming valve knob (primary pump head) or waste valve knob (secondary pump head) by turning the knob one-quarter to one-half turn counterclockwise.
2. Push the piston through the spacer and then through the new seal. Insert the piston and seal into the pump head until the seal makes contact with the bottom of the counterbore.

**NOTE** If necessary, lubricate the seal with a small amount of isopropyl alcohol to facilitate insertion.

3. To seat the seal, push down on the spacer until it is flush with the head. A clicking sound indicates that the seal is correctly seated.
4. Close the priming valve knob or waste valve knob.

### Reinstalling the Head and Piston

Dionex recommends reinstalling the head and piston as a single assembly, so that the piston centers itself onto the magnetic follower.

1. Hold the assembled spacer and guide with the drain tubes aligned vertically and press the spacer into the head until it is flush with the indented surface of the head.
2. Insert the piston so that 1/4 inch of the shaft is exposed. This ensures that the magnet in the follower picks up the piston. (The follower is the cylinder that holds the piston in place as it moves in and out of the pump head assembly.)
3. Reinstall the head and piston assembly; use a wrench to tighten the nuts evenly (12 in-lb torque).

### Completing the Procedure

1. Reconnect all liquid lines to the pump head.
2. Turn on the main power switch.
3. Open the eluent valve.
4. Prime the pump (see [Section B.13](#)).

## 5.7 Replacing a Pump Piston

**Continued leaking of the piston seal after installation of a new seal (assuming the pump head is tight) indicates a dirty, scratched, or broken piston.**

Follow the instructions in [Section 5.6](#) to install a new piston (P/N 052840) and piston seal (P/N 055870).

## 5.8 Replacing the Waste Valve or Priming Valve O-Ring

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

1. Close the eluent valve from the Control panel in Chromeleon or select **Eluent Valve Closed** on the touch screen **PUMP** page.
2. Turn off the main power switch, to ensure that you do not unintentionally start the ICS-2000.
3. To remove the waste valve or priming valve from the pump head (see [Figure 5-14](#)), turn the knob counterclockwise until it is loose, and then pull the knob straight out of the cavity in the pump head.



Figure 5-14. Waste and Priming Valves

4. If the O-ring is removed with the valve knob in [Step 3](#), pull the O-ring off the end of the knob (see [Figure 5-15](#)). If the O-ring is not removed with the valve knob, insert a thin object (for example, the bent end of a paper clip) into the cavity in the pump head and carefully pull out the O-ring. **Do not scratch the cavity.**

**IMPORTANT**

Scratches in the cavity will cause leaks around the base of the knob while the pump is being primed.

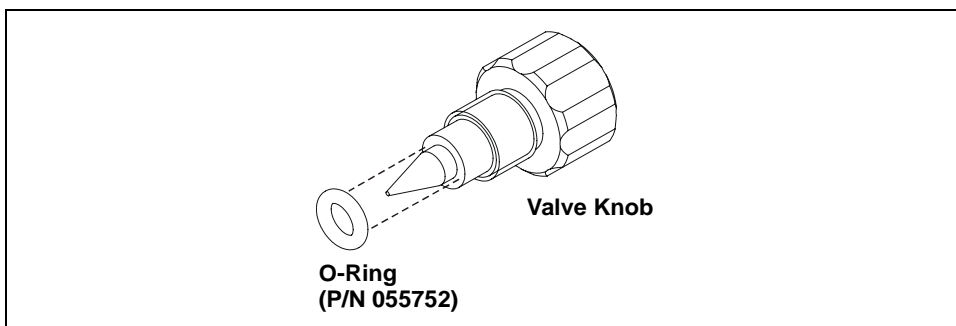


Figure 5-15. Waste Valve or Priming Valve O-Ring Replacement

5. Slide a new O-ring (P/N 055752) over the end of the valve.
6. To reinstall the valve containing the new O-ring, turn the knob clockwise and then tighten fingertight.

**NOTE** It is normal to encounter resistance after several rotations of the knob; the O-ring is being pushed into the cavity of the pump head.

7. Turn on the main power switch.
8. Open the eluent valve.
9. Prime the pump (see [Section B.13](#)).

## 5.9 Replacing the Conductivity Cell

1. Turn off the ICS-2000 power.
2. Open the front door and disconnect the tubing from the **CELL IN** and **CELL OUT** fittings (see [Figure 5-16](#), View A). Loosen the two screws on the cell front cover. The screws remain attached (see [Figure 5-16](#), View B).

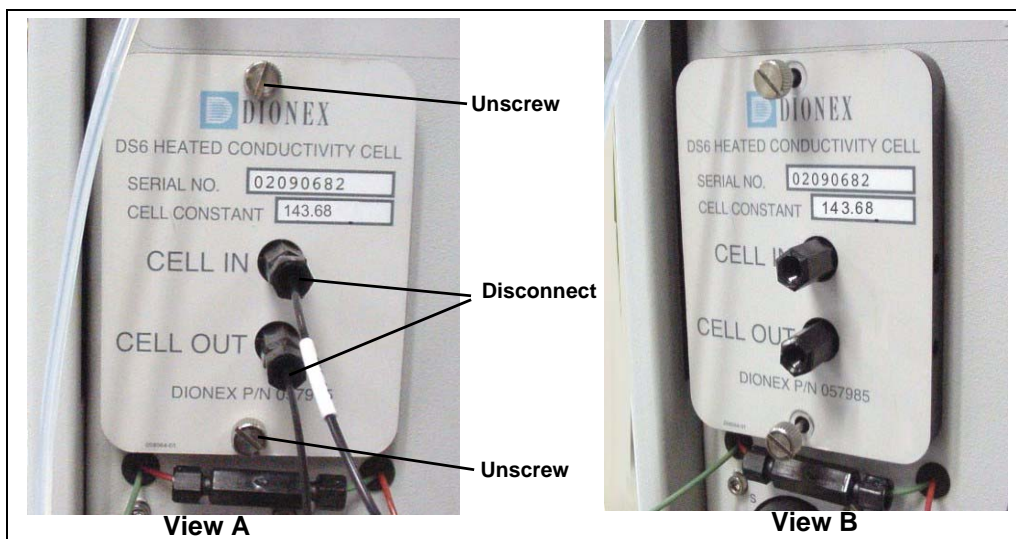


Figure 5-16. Removing the Cell Front Cover

3. Grip the two loosened screws and pull the cell cover toward you to remove it from the component panel. **Do not pull from the CELL IN and CELL OUT fittings.**
4. Continue pulling on the cover until the attached cell assembly slides out the front of the ICS-2000 (see [Figure 5-17](#)).



Figure 5-17. Removing the Cell Assembly

5. Slide the new cell assembly into the opening in the component panel until it stops and the cell cover is flush against the component panel. The cell's electronic connector automatically plugs into a connector inside the ICS-2000 when you push the assembly into the opening.
6. Tighten the screws on the cell front cover fingertight.
7. Reconnect the inlet and outlet lines.
8. Turn on the ICS-2000 power.
9. Calibrate the new cell in Chromeleon or on the ICS-2000 touch screen **DIAGNOSTIC** page. Cell calibration of a new cell consists of three parts:
  - Running the offset calibration, which measures the output of the cell electronics alone and determines an offset value to be applied to raw conductivity readings.
  - Running the slope calibration, which measures the output of the cell electronics when a built-in dummy cell, which provides a constant conductivity reading of 21  $\mu\text{S}$ , is automatically enabled. The slope value is applied to raw conductivity readings.
  - Entering the cell constant measured at the factory. The ICS-2000 uses the cell constant to determine the measured conductivity.

**To calibrate the cell in Chromeleon:**

- a. Open the Wellness Panel (see [Section 5.1.1](#))
- b. Under **Electric Conductivity Cell Calibration**, click **Offset Cal.**
- c. When the offset calibration is complete, click **Slope Cal.**
- d. Click **Calibration Details**. Under **Conductivity Cell Cal Details**, enter the **Cell Constant** value printed on the front of the cell.
- e. In the field next to the **Download** button, verify that **Current** is selected and then click **Download** to download the new value to the ICS-2000.
- f. To ensure that the new values are recorded in the ICS-2000 memory, do not turn off the ICS-2000 power for at least 1 minute after downloading.



To calibrate the cell on the ICS-2000 touch screen **DIAGNOSTIC** page:

- a. Go to the **DIAGNOSTIC** page and touch **Electric Conductivity Cell**.
- b. On the **ELECTRIC CONDUCTIVITY CALIBRATION** page (see [Figure 5-18](#)), touch **Run Offset Cal**.

ELECTRIC CONDUCTIVITY CALIBRATION

Total Conductivity 0.000  $\mu\text{S}$

Cell Constant 0.000000

Run Offset Cal

Wait until this calibration is done before doing slope cal.

Run Slope Cal

WARNING: THIS WILL ERASE THE  
PRIOR SLOPE CALIBRATION AND STORE A NEW VALUE

Fine	Offset 0.00000000	Slope 0.02483527 X 10 <sup>-6</sup>
Medium	Offset 0.00000000	Slope 0.39736432 X 10 <sup>-6</sup>
Coarse	Offset 0.00000000	Slope 1.86264525 X 10 <sup>-6</sup>

⏪ 🏠 HOME ▾

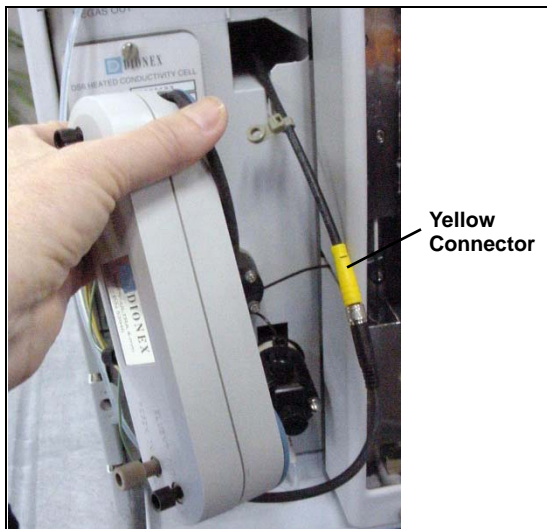
Figure 5-18. Electric Conductivity Calibration Page

- c. When the offset calibration is complete, touch **Run Slope Cal**.
- d. Touch the **Cell Constant** field and enter the value printed on the front of the cell.
- e. To ensure that the new calibration values are recorded in the ICS-2000 memory, do not turn off the ICS-2000 power for at least 1 minute.
- f. Record the new calibration values in the Chromeleon Wellness database. To do this, open the Wellness Panel (see [Section 5.1.1](#)) and click **Upload** under **Update Wellness Database**.

### 5.10 Replacing the Suppressor

Refer to the suppressor manual for guidance about when to replace a suppressor. Suppressor manuals are included on the Dionex Reference Library CD-ROM (P/N 053891).

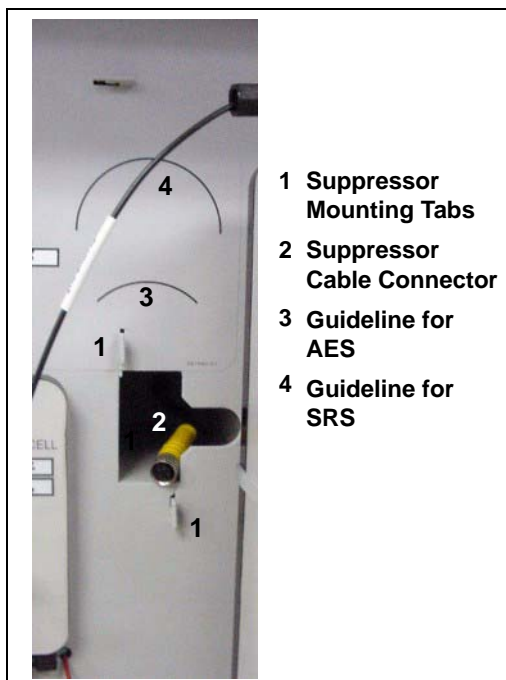
1. Refer to the suppressor quick start guide (shipped with the suppressor) for instructions on preparing the suppressor before initial use and for additional installation details.
2. Turn off the pump from the ICS-2000 Control panel in Chromeleon or from the touch screen **HOME** page.
3. Open the front door of the ICS-2000.
4. Disconnect the two eluent and the two regenerant lines from the suppressor.
5. To remove the suppressor from the component mounting panel, slide it up to detach it from the mounting tabs on the panel and then pull it toward you.
6. Continue pulling the suppressor out until the yellow connector on the cable inside the ICS-2000 is outside the panel (see [Figure 5-19](#)).
7. Disconnect the suppressor cable (twist the ring on the yellow connector and pull the two connectors apart).



*Figure 5-19. Removing the Suppressor*

8. Connect the cable from the new suppressor to the ICS-2000 cable (align the pins on the two connectors and push them together).
9. Orient the suppressor with the **REGEN OUT** fitting on top and the cables to the right.

10. Push the cables into the opening in the component panel.
11. Align the top of the suppressor with the guide line printed on the component panel (see [Figure 5-20](#)) and align the slots on the rear of the suppressor with the tabs on the panel.
12. Press the suppressor onto the tabs and then slide it down until it locks into place. Pull slightly on the center of the suppressor to verify that it is securely fastened. **Note:** Some suppressors require more force to secure them onto the tabs.
13. Connect the two eluent and two regenerant lines to the new suppressor.
14. Close the ICS-2000 front door.

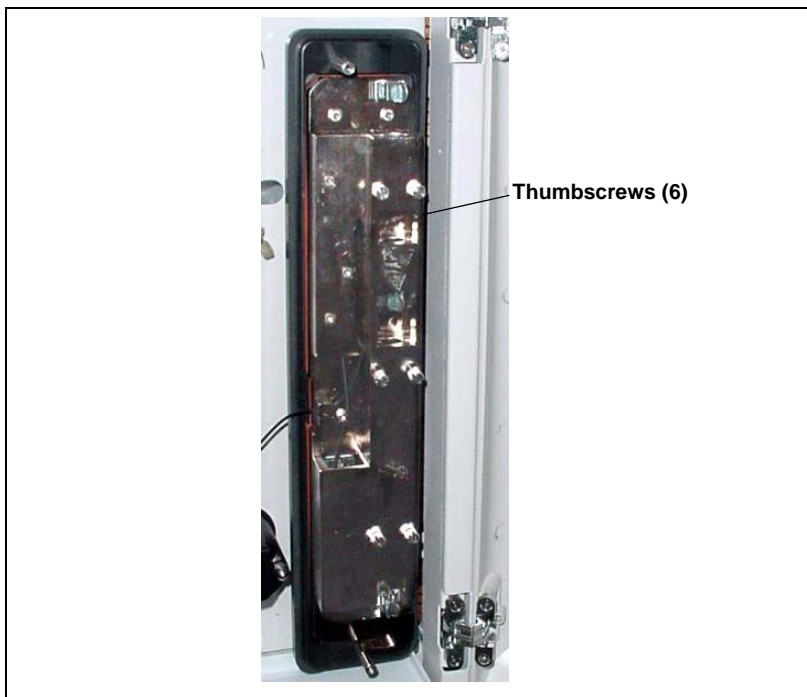


*Figure 5-20. Suppressor Guidelines and Mounting Tabs on Component Panel*

## 5.11 Replacing the Column Heater

1. Turn off the ICS-2000 power.
2. Open the front door of the ICS-2000.
3. Follow the steps below to remove the existing column heater:
  - a. Unscrew the two thumbscrews on the heater cover (they remain attached to the cover).
  - b. Pull the heater cover straight out to remove it.

- c. Unscrew the six thumbscrews on the top metal plate (see [Figure 5-21](#)) and remove the plate.



*Figure 5-21. ICS-2000 Column Heater Cover Removed*

- d. Remove the columns from the column heater.
  - e. Pull the column heater straight toward you to remove it from the component panel.
4. Before installing the new column heater, write down the two calibration values (offset and slope) recorded on the back of the heater.
  5. Align the connector on the back of the new column heater (P/N 058060) with the connector on the component panel and push the column heater onto the component panel.
  6. Remove the heater cover and the metal plate on the new heater.
  7. Install the columns in the new heater and replace the top metal plate and heater cover.
  8. Turn on the ICS-2000 power.

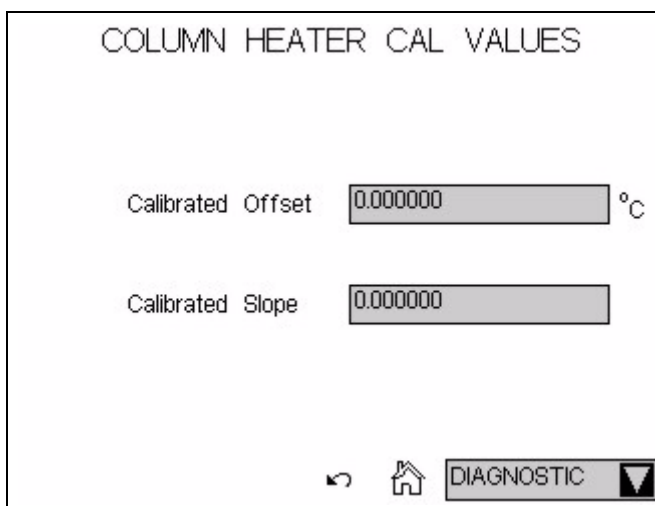
9. Enter the column heater calibration values in Chromeleon or on the ICS-2000 touch screen **DIAGNOSTIC** page as follows.

To enter the calibration values in Chromeleon:

- a. Open the Wellness Panel (see [Section 5.1.1](#)) and click **Calibration Details**.
- b. Under **Column Heater Calibration Values**, enter the **Column Heater Offset** and **Column Heater Slope** values recorded in [Step 4](#).
- c. In the field next to the **Download** button, verify that **Current** is selected and then click **Download** to download the new calibration values to the ICS-2000.
- d. To ensure the new calibration values are recorded in the ICS-2000 memory, do not turn off the ICS-2000 power for at least 1 minute after downloading the values.

To enter the calibration values on the ICS-2000 touch screen **DIAGNOSTIC** page:

- a. Go to the **DIAGNOSTIC** page and touch **Column Heater Cal Values**.
- b. On the **COLUMN HEATER CAL VALUES** page (see [Figure 5-22](#)), enter the **Calibrated Offset** and **Calibrated Slope** values recorded in [Step 4](#).



COLUMN HEATER CAL VALUES

Calibrated Offset  °C

Calibrated Slope

⏪ 🏠 DIAGNOSTIC ▼

Figure 5-22. Column Heater Cal Values Page

- c. To ensure the calibration values are recorded in the ICS-2000 memory, do not turn off the ICS-2000 power for at least 1 minute after entering the values.
- d. Record the calibration values in the Chromeleon Wellness database. To do this, open the Wellness Panel (see [Section 5.1.1](#)) and click **Upload** under **Update Wellness Database**.

### 5.12 Replacing the Column Heater Heat Exchanger

1. Turn off the ICS-2000 power.
2. Open the front door of the ICS-2000.
3. Unscrew the two thumbscrews on the column heater cover (they remain attached to the cover).
4. Pull the heater cover straight out to remove it.
5. Unscrew the six thumbscrews on the top metal plate (see [Figure 5-23](#)) and remove the plate.
6. Disconnect the heat exchanger inlet line from Port C on the injection valve.

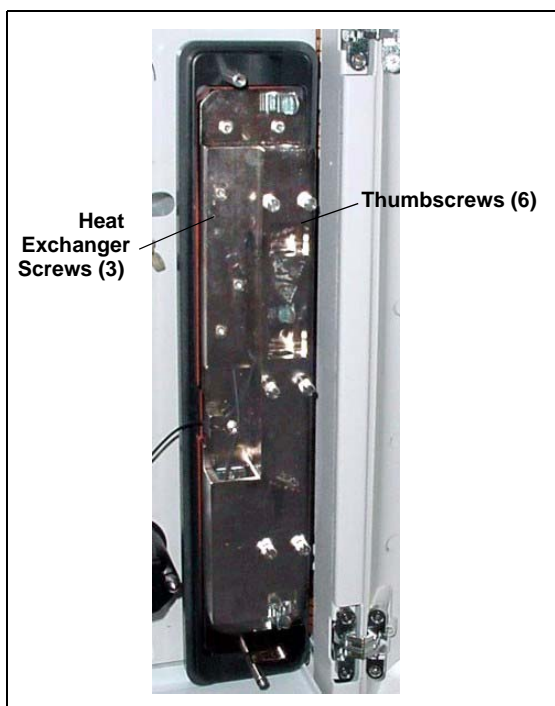


Figure 5-23. ICS-2000 Column Heater Cover Removed

7. Disconnect the heat exchanger outlet line from the guard column inlet.
8. Use an Allen wrench to remove the three screws from the heat exchanger metal plate and remove the plate (with the tubing) from the heater.
9. Remove the plastic backing from the new heat exchanger (P/N 059979, with 0.25-mm (0.010-in) ID tubing; P/N 060943, with 0.125-mm (0.005-in) ID

tubing) and press the heat exchanger onto the heater. Replace the screws removed in [Step 8](#).

10. Connect the new heat exchanger inlet line to Port C on the injection valve and connect the outlet line to the guard column inlet.
11. Reinstall the top metal plate and the heater cover.

### 5.13 Replacing the Eluent Valve

1. Turn off the power to the ICS-2000.
2. Open the ICS-2000 front door.
3. To prevent an eluent leak during the valve replacement procedure, disconnect the eluent line from the reservoir cap. Or, plug the line on the left side of the valve with a coupler (P/N 039056 and a plug (P/N 037268) after disconnecting the liquid line from the valve ([see Step 4](#)).
4. Disconnect the two liquid lines connected to the eluent valve (see [Figure 5-24](#)).
5. Unscrew and remove the two screws that attach the valve to the component panel (see [Figure 5-24](#)). Save the screws.

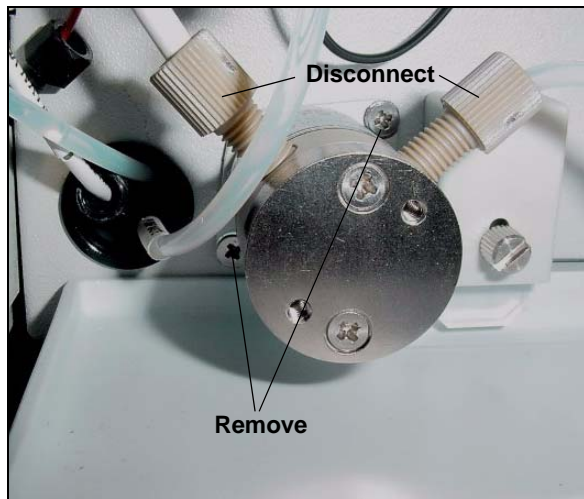


Figure 5-24. Eluent Valve

- Pull the valve straight out from the component panel and begin pulling the attached cable out of the opening in the panel.
- The cable is connected to a matching cable inside the ICS-2000. Continue pulling until the connectors for the two cables are outside the panel (see [Figure 5-25](#)). Disconnect the cables.

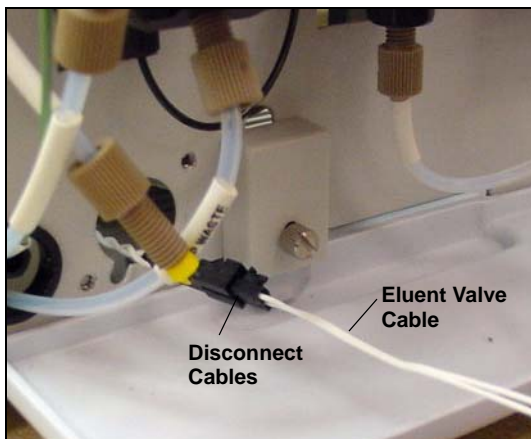


Figure 5-25. Eluent Valve Cable

- Remove the mounting plate on the old valve by unscrewing and removing the two screws. Save the screws.
- Thread the cable from the new eluent valve through the mounting plate.
- Attach the mounting plate to the new valve using the screws removed in [Step 8](#).



Figure 5-26. Removing the Valve Mounting Plate

- Connect the cable from the new valve (P/N 057945) to the ICS-2000 cable. Feed the cables back inside the ICS-2000.
- Align the new valve on the component panel with the liquid ports facing up and attach it with the two screws removed in [Step 5](#). Reconnect the liquid lines.
- Turn on the power to the ICS-2000.
- Prime the pump (see [Section B.13](#)).



## 5.14 Replacing the Leak Sensor

1. Turn off the power to the ICS-2000.
2. Open the ICS-2000 front door.
3. Loosen the screw on the front of the leak sensor (see [Figure 5-27](#)). **Note:** The screw remains attached to the sensor.

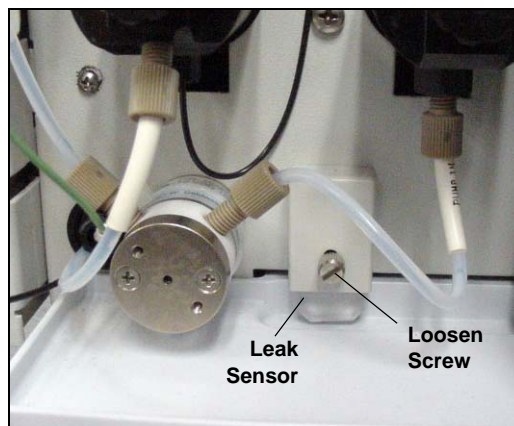


Figure 5-27. Leak Sensor

4. Remove the leak sensor from the component panel and pull the cable out of the opening in the panel.
5. The cable attached to the leak sensor is connected to a matching cable inside the ICS-2000. Continue pulling the cable until the connectors for the two cables are outside of the panel (see [Figure 5-28](#)).
6. Disconnect the two cables.

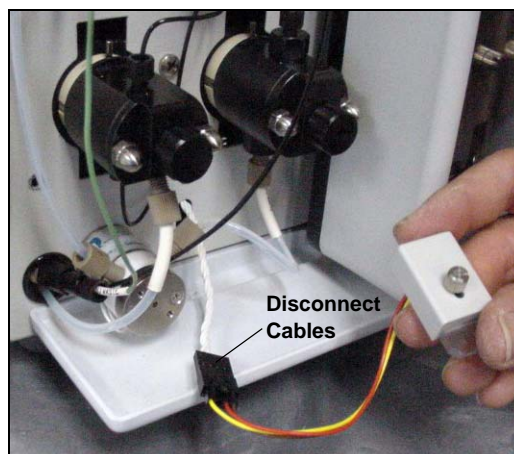


Figure 5-28. Leak Sensor Cable

7. Connect the cable from the new leak sensor (P/N 058053) to the ICS-2000 cable.
8. Feed the cables back inside the ICS-2000. Align the leak sensor with the component panel opening and fingertighten the screw.
9. Make sure the leak sensor does not touch the bottom of the drip tray.

### 5.15 Priming the Pump with Isopropyl Alcohol

**NOTE** Prime the pump heads with isopropyl alcohol only if the two standard priming procedures described in [Section B.13](#) are unsuccessful.

1. Connect a 10-mL syringe (P/N 054578) filled with isopropyl alcohol (IPA) to the port in the primary pump head (see [Figure 5-29](#)).
2. Open the waste valve on the secondary pump head (see [Figure 5-29](#)) by turning the knob one-quarter to one-half turn counterclockwise.

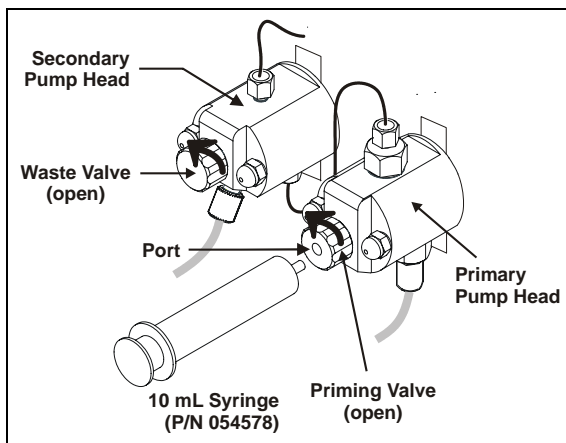


Figure 5-29. Priming the Pump Heads with IPA

3. Click **Pump On** on the Chromeleon Control panel to turn on the pump motor.
4. Open the priming valve on the primary pump head by turning it one-quarter to one-half turn counterclockwise.
5. Use the syringe to slowly push alcohol through the pump.

**NOTE** Be careful not to push any air trapped in the syringe through the pump. Check the waste line from the secondary pump head to verify that there are no air bubbles.

6. Close the priming valve. **Do not overtighten.** Disconnect the syringe from the priming valve.
7. Let the pump run for several minutes, to purge alcohol from the pump heads, and then click **Prime** and flush the heads with the desired eluent.



Isopropyl alcohol may damage some columns. Be sure to thoroughly rinse the alcohol from the pump, using the process described in [Step 7](#).

8. Close the waste valve. **Do not overtighten.**
9. Select the flow rate required for the analysis.
10. Click **Pump Off** to turn off the pump motor. The pump is now ready for operation.

## 5.16 Changing Main Power Fuses

1. Turn off the main power switch.



**HIGH VOLTAGE**—Disconnect the main power cord from its source and also from the rear panel of the ICS-2000.



**HAUTE TENSION**—Débranchez le cordon d'alimentation principal de sa source et du panneau arrière du ICS-2000.



**HOCHSPANNUNG**—Ziehen Sie das Netzkabel aus der Steckdose und der Netzbuchse auf der Rückseite des ICS-2000.

2. The fuse holder is part of the main power receptacle (see [Figure 5-30](#)) on the ICS-2000 rear panel. To remove the fuse holder, squeeze the tab on the top of the holder to release it and pull the holder straight out of its compartment.

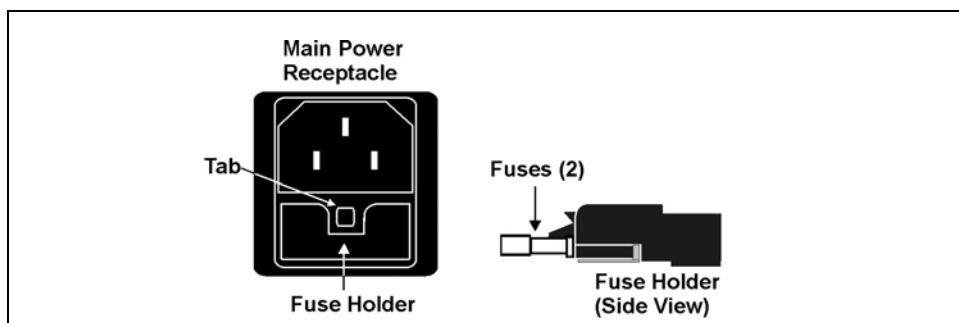


Figure 5-30. Main Power Fuse Holder

3. Replace the two fuses in the holder with new IEC 127 fast-blow fuses rated 3.15 amps (P/N 954745). Dionex recommends always replacing both fuses.
4. Reinsert the fuse holder into its compartment and push in until the tab clicks in place.
5. Reconnect the main power cord and turn on the power.

### 5.17 Replacing an EluGen Cartridge



The EluGen cartridge contains one of the following: a corrosive base (KOH, LiOH, or NaOH), or a corrosive acid (MSA). Wear protective eyewear and gloves when handling the cartridge.



La cartouche d'EluGen contient un de ce qui suit: une base corrosive (KOH, LiOH, ou NaOH), ou un acide corrosif (MSA). Porter des lunettes et des gants protectives en manipulant la cartouche.



Die EluGen-Kassette enthält eine korrodierende Base (KOH, LiOH oder NaOH), oder eine korrodierende Säure (MSA). Tragen Sie daher beim Umgang mit Kassette eine Schutzbrille und Handschuhe.

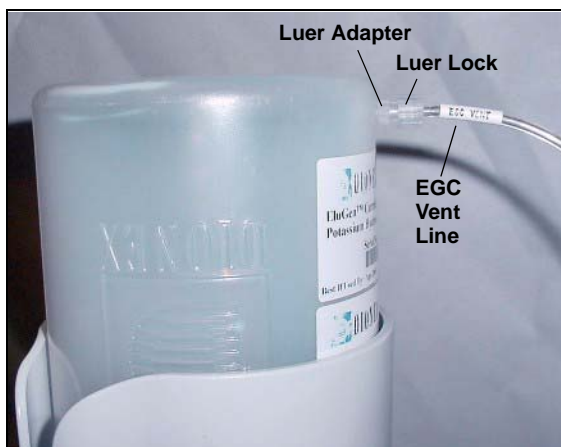
The procedure for replacing an EluGen cartridge differs, depending on the type of cartridge:

- To replace a KOH, LiOH, MSA, or NaOH EluGen cartridge, go to [Section 5.17.1](#).
- To replace a  $K_2CO_3$  cartridge, go to [Section 5.17.2](#)

### 5.17.1 Replacing a KOH, LiOH, MSA, or NaOH EluGen Cartridge

1. Turn off the pump from the ICS-2000 Control panel in Chromeleon or from the ICS-2000 touch screen **HOME** page.
2. Disconnect the EluGen cartridge cable from the **EGC-1** connector on the ICS-2000 top cover.
3. Disconnect the CR-TC cable from the **CR-TC** connector.
4. Remove the EluGen cartridge **VENT** line (see [Figure 5-31](#)) from the EluGen cartridge by unscrewing the luer lock from the luer adapter.

If necessary, use a wrench to hold the luer adapter in place while unscrewing the vent line.



*Figure 5-31. EluGen Cartridge Vent Line and Luer Fitting*

5. Install the luer cap (P/N 053981), provided with the EluGen cartridge, onto the luer adapter. This prevents leaks from the vent opening when you turn over the EluGen cartridge (see Step 7).
6. Lift the EluGen cartridge straight up and out of the cartridge holder.

## ICS-2000 Ion Chromatography System

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7. Turn the cartridge upside down and set it in the EluGen cartridge service area on top of the ICS-2000 (see [Figure 5-32](#) and [Figure 5-33](#)).

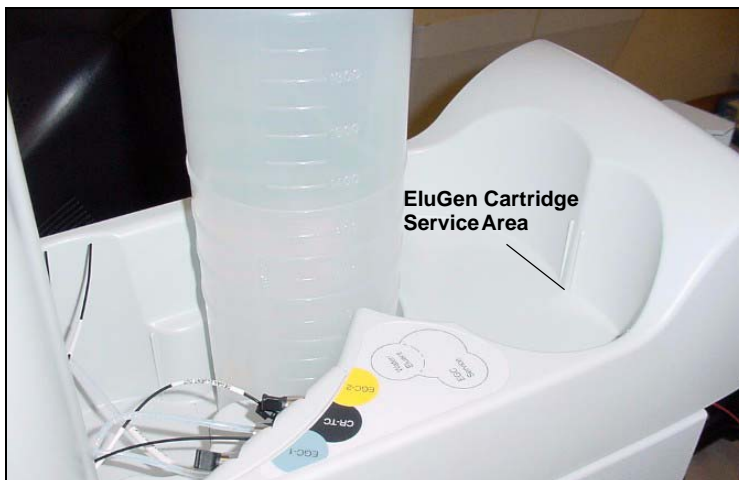


Figure 5-32. EluGen Cartridge Service Area

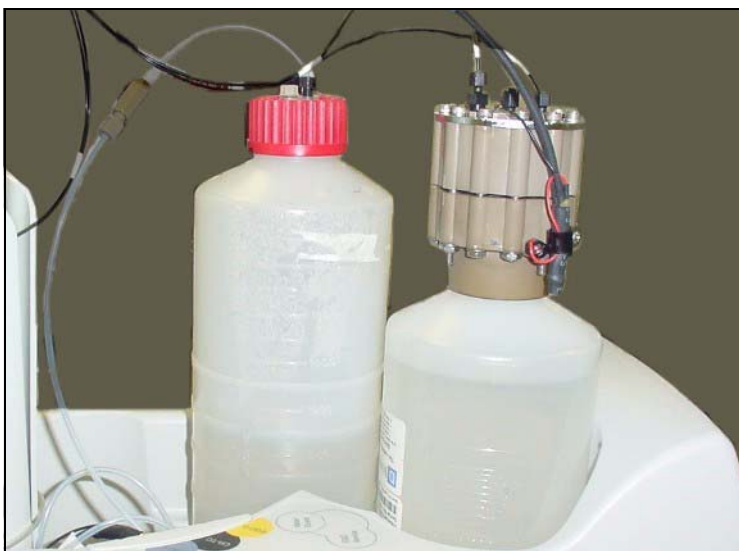
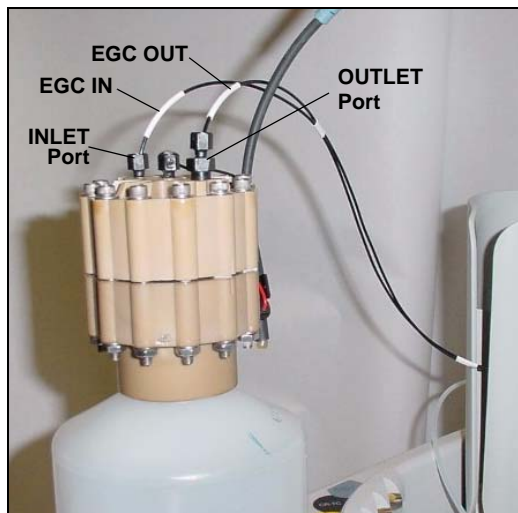


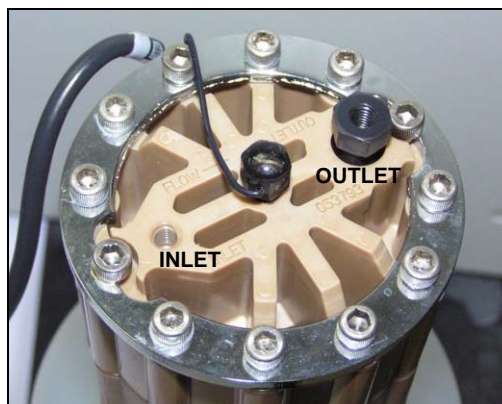
Figure 5-33. EluGen Cartridge in the Service Area

8. Disconnect the **EGC IN** and **EGC OUT** lines from the **INLET** and **OUTLET** ports on the EluGen cartridge (see [Figure 5-34](#)).



*Figure 5-34. Disconnect the EluGen Cartridge Inlet and Outlet Port Lines*

9. Follow the instructions in the EluGen cartridge manual, provided on the Dionex Reference Library CD-ROM (P/N 053891), to prepare an expended EluGen cartridge for disposal or to store a partially used EluGen cartridge for later use.
10. Remove the new EluGen cartridge from the shipping box.
11. Orient the EluGen cartridge with the fittings facing up and remove the plugs from the EluGen cartridge **INLET** and **OUTLET** ports (see [Figure 5-35](#)).



*Figure 5-35. EluGen Cartridge Inlet and Outlet Ports*

- Set the EluGen cartridge in the service area on top of the ICS-2000 and orient it with the cable toward the EGC holder (see [Figure 5-36](#)).

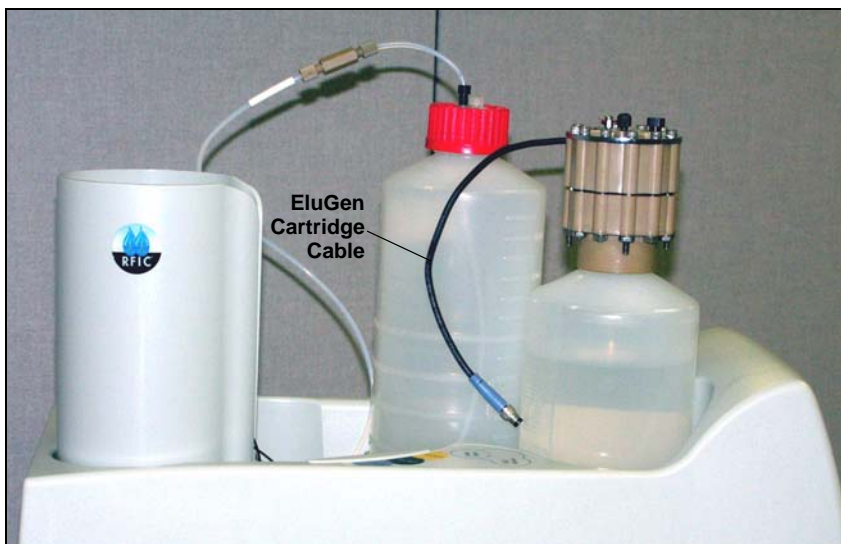


Figure 5-36. EluGen Cartridge in Service Area

- Connect **EGC IN** to the EluGen cartridge **INLET** port.
- Locate the yellow 0.5 mL/min, 7 MPa (1000 psi) backpressure coil (P/N 053765) in the ICS-2000 Ship Kit (P/N 064375).
- Connect one end of this coil to the EluGen cartridge **OUTLET** port (see [Figure 5-37](#)). Leave the other end of the coil unconnected.

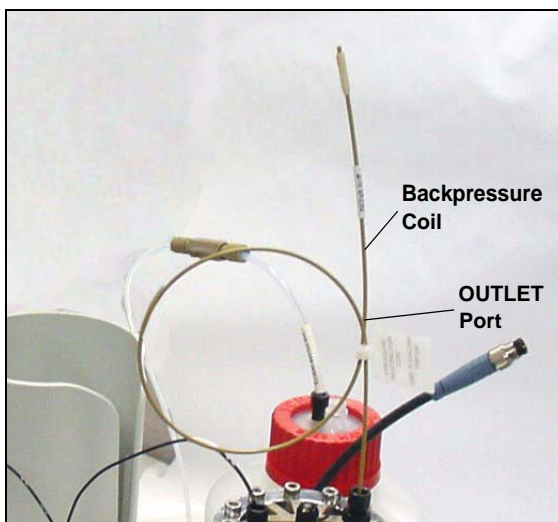


Figure 5-37. EluGen Cartridge Outlet Connection for Conditioning the Cartridge



**NOTE** The backpressure coil connection is temporary; it is used only during the EluGen cartridge conditioning procedure described in [“Conditioning the EluGen Cartridge” on page 5-46.](#)

16. Turn the EluGen cartridge over, with the fittings facing down. **Shake the EluGen cartridge vigorously and tap it with the palm of your hand 10 to 15 times. Check that all bubbles trapped in the eluent generation chamber are dislodged.**



The EluGen cartridge contains one of the following: a corrosive base (KOH, LiOH, or NaOH), or a corrosive acid (MSA). Wear protective eyewear and gloves when handling the cartridge.

La cartouche d'EluGen contient un de ce qui suit: une base corrosive (KOH, LiOH, ou NaOH), ou un acide corrosif (MSA). Porter des lunettes et des gants protectives en manipulant la cartouche.

Die EluGen-Kassette enthält eine korrodierende Base (KOH, LiOH oder NaOH), oder eine korrodierende Säure (MSA). Tragen Sie daher beim Umgang mit Kassette eine Schutzbrille und Handschuhe.

17. Slide the EluGen cartridge down into the holder until it stops. Make sure the cable and backpressure coil remain out of the holder (see [Figure 5-38](#)).

**NOTE** To avoid crimping the lines inside the holder, do not twist the cartridge before you slide it into the holder. The lines are designed to coil inside the holder.



*Figure 5-38. Installing the EluGen Cartridge in the Holder*

18. Orient the cartridge's blue 4-pin electrical cable connector as shown in [Figure 5-39](#). Push it onto the **EGC-1** connector on the ICS-2000. Twist the ring on the cable connector fingertight to secure it.



*Figure 5-39. Connecting the EluGen Cartridge Cable*

19. Remove the plug from the EluGen cartridge vent opening and connect the EluGen cartridge **VENT** line.

## Recording the EluGen Cartridge Serial Number in Chromeleon

The serial number is printed on the EluGen cartridge label.

1. Open the Chromeleon Server Configuration program (select **Start > Programs** (or **All Programs**) > **Chromeleon > Server Configuration**).
2. Double-click the ICS-2000 system icon. The properties dialog box for the ICS-2000 appears.
3. Click the **Eluent Generator** tab (see [Figure 5-40](#)).
4. Select the **EGC-1** check box.
5. Enter the EluGen cartridge serial number and click **OK**.

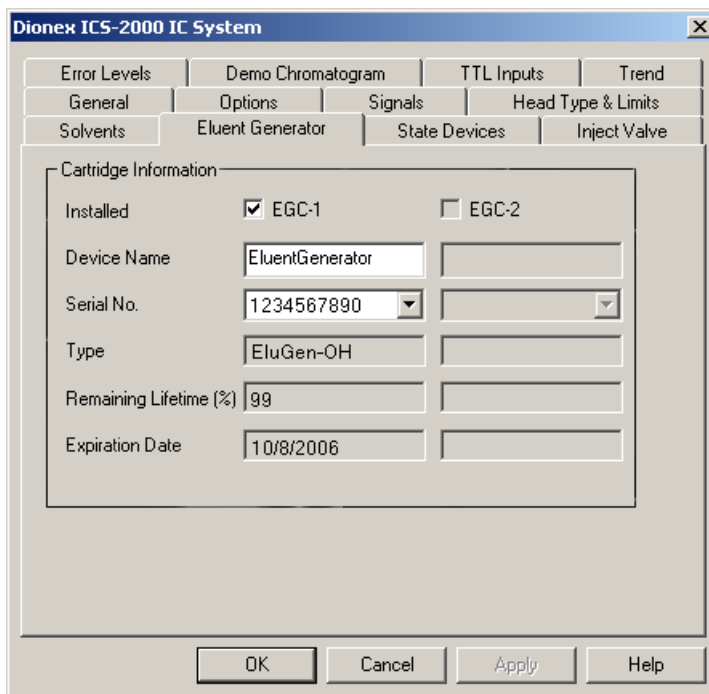


Figure 5-40. Eluent Generator Configuration Properties Example

### Conditioning the EluGen Cartridge

Always condition the EluGen cartridge before initial use. This requires directing the backpressure coil connected to the EluGen cartridge outlet to waste, and then generating 50 mM of eluent at 1.00 mL/min for 30 minutes. Follow the steps below:

1. Set a temporary waste container, such as a beaker, on top of the ICS-2000 and direct the yellow backpressure coil from the EluGen cartridge **OUTLET** port to the container.
2. From the Chromeleon Control panel or the ICS-2000 touch screen **HOME** page, set the pump flow rate to **1.00 mL/min** and set the EluGen cartridge concentration to **50 mM**.
3. Verify that the suppressor and CR-TC are off.

**IMPORTANT**

**To avoid damaging the suppressor and CR-TC, always turn off the suppressor and CR-TC before conditioning the EluGen cartridge. The pump flow is on during conditioning, however, no flow reaches the suppressor or CR-TC.**

4. Verify that the **Automatically turn on with pump** options are not selected on the ICS-2000 touch screen **SUPPRESSOR** page (see [Section C.9](#)) and **ELUENT GENERATOR** page (see [Section C.8](#)). Disabling these options lets you turn on the pump, without automatically turning on the suppressor and CR-TC.
5. Verify that the eluent reservoir is filled with ASTM filtered, Type 1 (18 megohm-cm) deionized water.
6. Turn on the pump.
7. Run at the selected settings (1.00 mL/min at 50 mM) for 30 minutes.
8. Turn off the pump.
9. Disconnect the EluGen cartridge cable.
10. Remove the backpressure tubing from the waste container and remove the waste container.

11. Lift the EluGen cartridge out of the holder, turn it over, and set it in the service area.
12. Disconnect the backpressure coil from the EluGen cartridge **OUTLET** port.
13. Connect the **EGC OUT** line from the holder to the **OUTLET** port (see [Figure 5-41](#)).

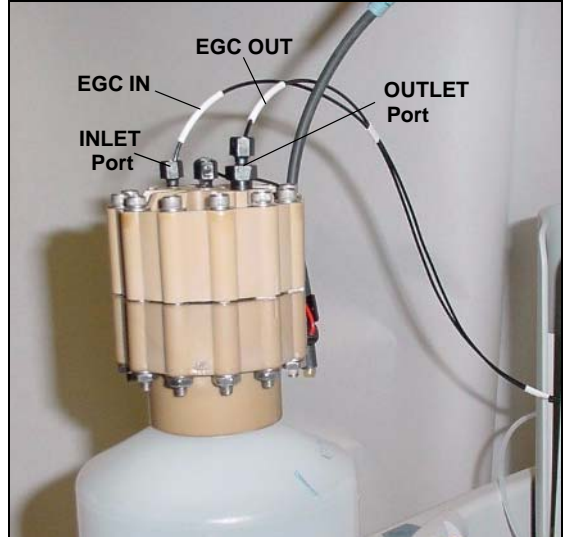


Figure 5-41. EluGen Cartridge Inlet and Outlet Connections

14. Turn over the EluGen cartridge (fittings facing down). Check for bubbles. If necessary, shake and tap the EluGen cartridge to remove bubbles.
15. Reinstall the EluGen cartridge in the holder.
16. Reconnect the EluGen cartridge cable.
17. Reconnect the CR-TC cable.
18. If you disabled the **Automatically turn on with pump** option in [Step 3](#), select the option.

## 5.17.2 Replacing a K<sub>2</sub>CO<sub>3</sub> Cartridge

1. Turn off the pump from the ICS-2000 Control panel in Chromeleon or from the ICS-2000 touch screen **HOME** page.
2. Disconnect the EluGen cartridge cable from the **EGC-1** connector on the ICS-2000 top cover.
3. If an EPM is installed, disconnect the EPM cable from the **EGC-2** connector.

4. Remove the EluGen cartridge **VENT** line (see [Figure 5-31](#)) from the EluGen cartridge by unscrewing the luer lock from the luer adapter.

If necessary, use a wrench to hold the luer adapter in place while unscrewing the vent line.

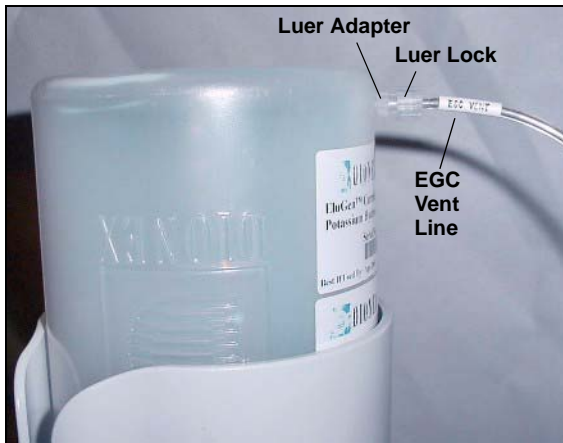


Figure 5-42. EluGen Cartridge Vent Line and Luer Fitting

5. Install the luer cap (P/N 053981), provided with the EluGen cartridge, onto the luer adapter. This prevents leaks from the vent opening when you turn over the EluGen cartridge (see Step 7).
6. Lift the EluGen cartridge straight up and out of the cartridge holder.

7. Turn the cartridge upside down and set it in the EluGen cartridge service area on top of the ICS-2000 (see [Figure 5-32](#) and [Figure 5-33](#)).

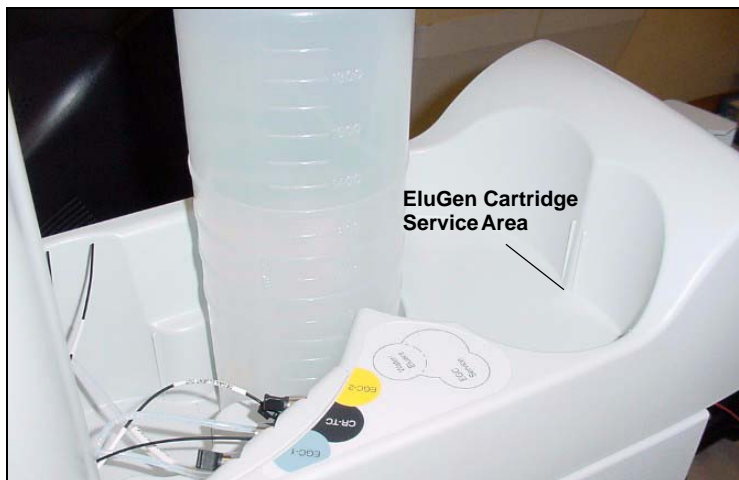


Figure 5-43. EluGen Cartridge Service Area



Figure 5-44. EluGen Cartridge In the Service Area

8. Disconnect the **EGC IN** and **EGC OUT** lines from the **INLET** and **OUTLET** fittings on the EluGen cartridge (see [Figure 5-34](#)).

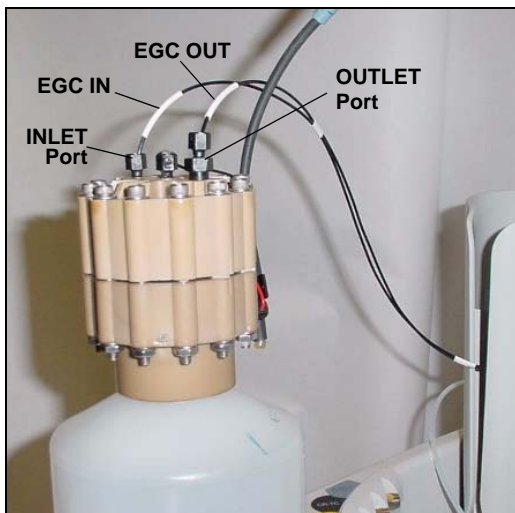


Figure 5-45. Disconnect the EluGen Cartridge Inlet and Outlet Port Lines

9. Follow the instructions in the EluGen cartridge manual, provided on the Dionex Reference Library CD-ROM (P/N 053891), to prepare an expended EluGen cartridge for disposal or to store a partially used EluGen cartridge for later use.
10. Remove the new EluGen cartridge from the shipping box.
11. Orient the EluGen cartridge with the fittings facing up and remove the plugs from the EluGen cartridge **INLET** and **OUTLET** ports (see [Figure 5-35](#)).

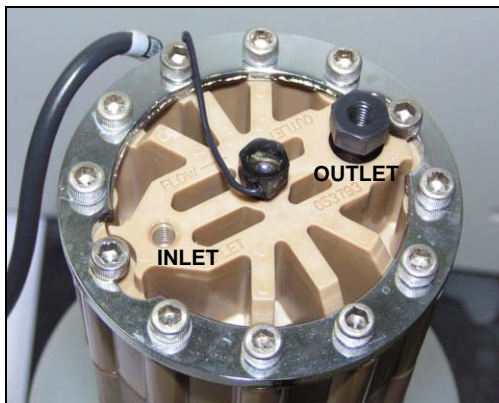


Figure 5-46. EluGen Cartridge Inlet and Outlet Ports



12. Set the EluGen cartridge in the service area on top of the ICS-2000 and orient it with the cable toward the EGC holder (see [Figure 5-36](#)).

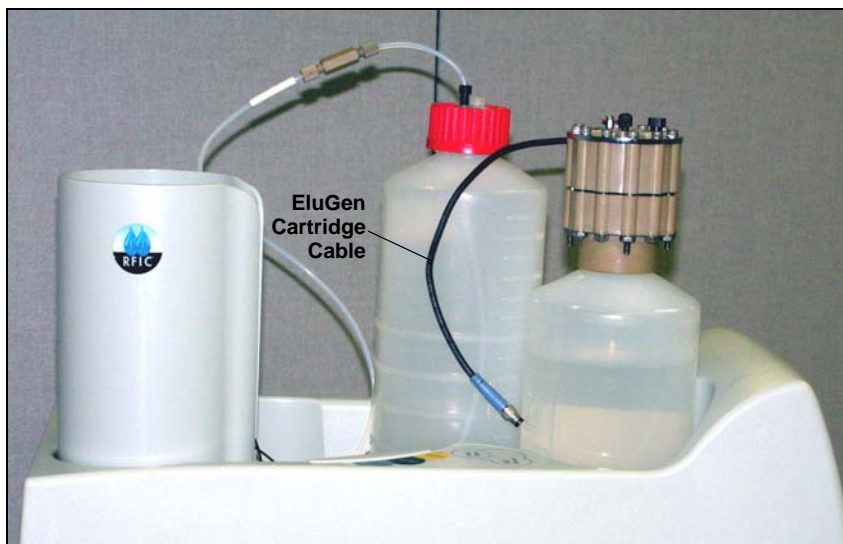


Figure 5-47. EluGen Cartridge in Service Area

13. Connect **EGC IN** to the EluGen cartridge **INLET** port.
14. Connect **EGC OUT** to the EluGen cartridge **OUTLET** port.
15. Turn the EluGen cartridge over (with the fittings facing down). **Shake the EluGen cartridge vigorously, and tap it with the palm of your hand 10 to 15 times. Check that all bubbles trapped in the eluent generation chamber are dislodged.**



The EluGen cartridge contains one of the following: a corrosive base (KOH, LiOH, or NaOH), a corrosive acid (MSA), or a concentrated  $K_2CO_3$  solution. Wear protective eyewear and gloves when handling the cartridge.



La cartouche d'EluGen contient un de ce qui suit: une base corrosive (KOH, LiOH, ou NaOH), un acide corrosif (MSA), ou une solution concentrée de  $K_2CO_3$ . Porter des lunettes et des gants protectives en manipulant la cartouche.



Die EluGen-Kassette enthält eine korrodierende Base (KOH, LiOH oder NaOH), eine korrodierende Säure (MSA) oder eine konzentrierte  $K_2CO_3$ -Lösung. Tragen Sie daher beim Umgang mit Kassette eine Schutzbrille und Handschuhe.

- Slide the EluGen cartridge down into the holder until it stops (see [Figure 5-48](#)). Make sure the cable remains out of the holder.

**NOTE** To avoid crimping the lines, do not twist the cartridge when you slide it into the holder. The lines are designed to coil inside the holder.



Figure 5-48. EluGen Cartridge Installed in the Holder

- Remove the plug from the **EGC-1** connector on top of the ICS-2000.
- Orient the cartridge's blue 4-pin electrical cable connector as shown in [Figure 5-49](#). Push it onto the **EGC-1** connector on the ICS-2000. Twist the ring on the cable connector fingertight to secure it.



Figure 5-49. Connecting the EluGen Cartridge Cable

- Remove the plug from the EluGen cartridge vent opening and connect the **EluGen cartridge VENT** line.

### Recording the EluGen Cartridge Serial Number in Chromeleon

The serial number is printed on a label on the EluGen cartridge.

1. Open the Server Configuration program (select **Start>Programs** (or **All Programs**)>**Chromeleon>Server Configuration**).
2. Double-click the ICS-2000 system icon. The properties dialog box for the ICS-2000 appears.
3. Click the **Eluent Generator** tab.
4. Select the **EGC-1** check box.
5. Enter the EluGen cartridge serial number. Verify that the cartridge type is **Carb**. If not, make sure the cartridge serial number has been entered correctly.

Continue on to one of the following sections, depending on the type of eluent to be generated:

- For carbonate eluent, go to [“Plumbing the EluGen Cartridge for Conditioning with Carbonate Eluent”](#) on page 5-54.
- For carbonate/bicarbonate eluent, go to [“Plumbing the EluGen Cartridge and EPM for Conditioning with Carbonate/Bicarbonate Eluent”](#) on page 5-57.

## Plumbing the EluGen Cartridge for Conditioning with Carbonate Eluent

Figure 5-50 illustrates the liquid flow path during the EluGen cartridge conditioning procedure with carbonate eluent.

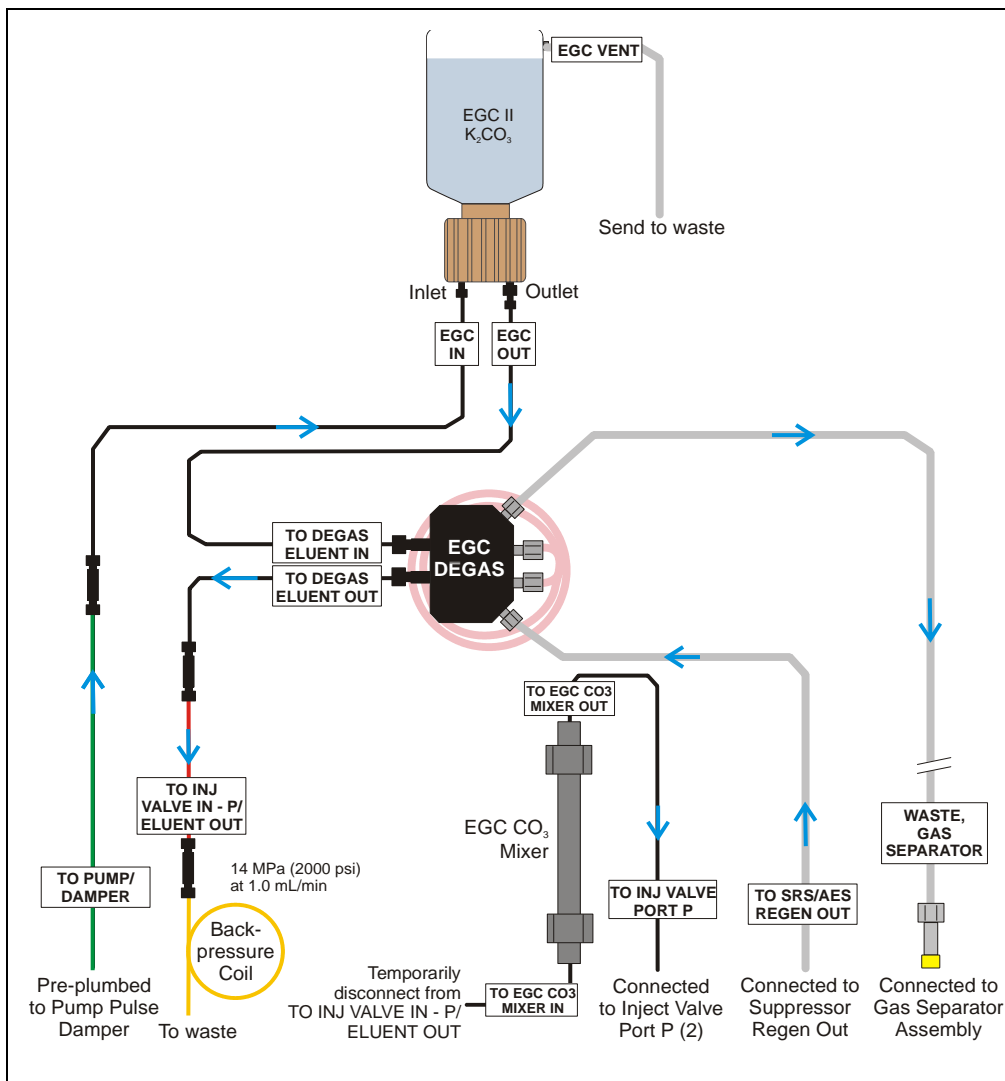
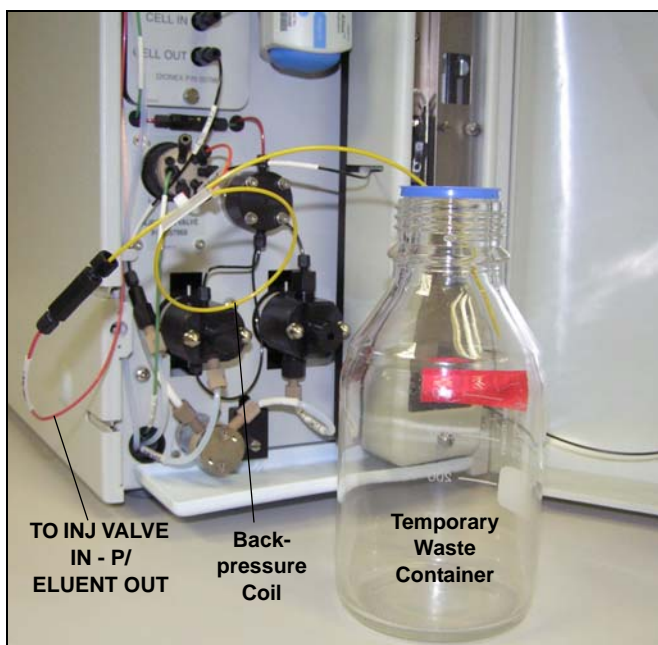


Figure 5-50. EluGen Cartridge Plumbing for Conditioning with Carbonate Eluent

1. Disconnect the **TO INJ VALVE IN - P/ELUENT OUT** line from the EGC CO<sub>2</sub> Mixer inlet.
2. Locate the yellow 0.5 mL/min, 7 MPa (1000 psi) backpressure coil (P/N 053765) and a 10-32 to 10-32 coupler (P/N 042627) in the ICS-2000 Ship Kit (P/N 064375).
3. Use the coupler to connect the **TO INJ VALVE IN - P/ELUENT OUT** line to one end of the backpressure coil (see [Figure 5-51](#)).
4. Direct the free end of the backpressure coil to a temporary waste container.



*Figure 5-51. Plumbing Connections for Conditioning the EluGen Cartridge with Carbonate Eluent*

### Conditioning the EluGen Cartridge

Always condition the EluGen cartridge for 30 minutes before initial use.

1. Make sure the eluent reservoir is filled with ASTM filtered, Type I (18-megohm) deionized water.
2. Verify that the suppressor is off.

**IMPORTANT**

**To avoid damaging the suppressor, always turn off the suppressor before conditioning the EluGen cartridge. The pump flow is on during conditioning, however, no flow reaches the suppressor.**

3. Verify that the **Automatically turn on with pump** option is not selected on the ICS-2000 touch screen **SUPPRESSOR** page (see [Section C.9](#)). Disabling this option lets you turn on the pump, without automatically turning on the suppressor.
4. From the ICS-2000 Control panel in Chromeleon or the ICS-2000 touch screen **HOME** page, set the pump flow rate to **1.00 mL/min**.
5. Turn on the pump.
6. From the Chromeleon Control panel or the touch screen **ELUENT GENERATOR** page, set the **EGC-1** concentration to **9 mM**.
7. Turn on the EGC-1 current.
8. Run at these settings for 30 minutes.
9. Turn off the EGC-1 current.
10. Turn off the pump.
11. Remove the backpressure coil.
12. Reconnect the **TO INJ VALVE IN - P/ELUENT OUT** line to the mixer inlet.

### Plumbing the EluGen Cartridge and EPM for Conditioning with Carbonate/Bicarbonate Eluent

Figure 5-52 illustrates the liquid flow path through the eluent generator during conditioning with carbonate/bicarbonate eluent.

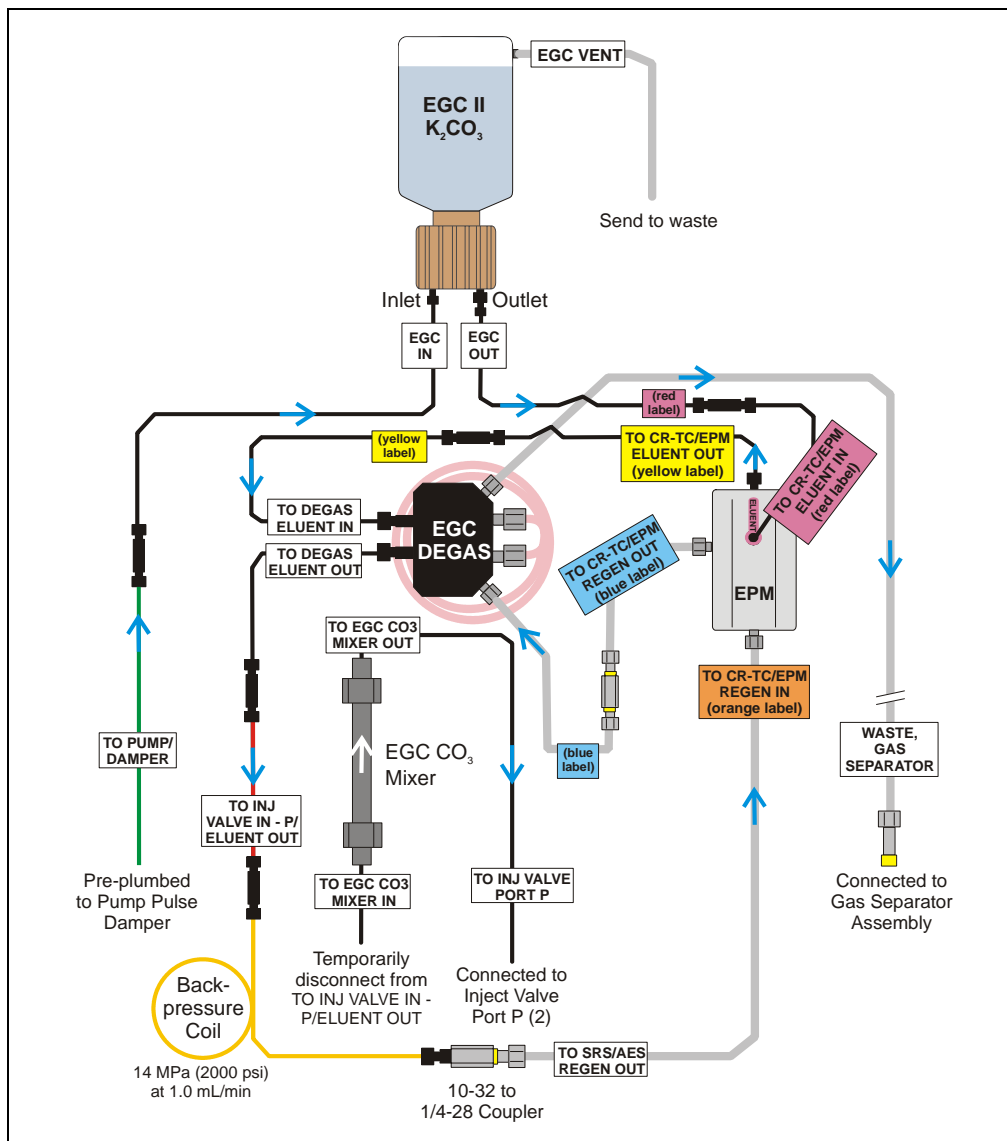


Figure 5-52. Plumbing for Conditioning with Carbonate/Bicarbonate Eluent

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1. Locate the yellow 0.5 mL/min, 7 MPa (1000 psi) backpressure coil (P/N 053765) and 10-32 to 1/4-28 coupler (P/N 042806) in the ICS-2000 Ship Kit (P/N 064375).
2. Disconnect the **TO INJ VALVE IN - P/ELUENT OUT** line from the EGC CO<sub>2</sub> Mixer inlet.
3. Connect one end of the backpressure coil to the **TO INJ VALVE IN - P/ELUENT OUT** line.
4. Connect the 10-32 to 1/4-28 coupler to the free end of the backpressure coil.
5. Disconnect the **TO SRS/AES REGEN OUT** line from the suppressor **REGEN OUT** port.
6. Connect the **TO SRS/AES REGEN OUT** line to the 10-32 to 1/4-28 coupler (see [Figure 5-53](#)).

**NOTE** The backpressure coil connection in [Figure 5-53](#) is temporary; it is required only during the conditioning procedure described in the next section.

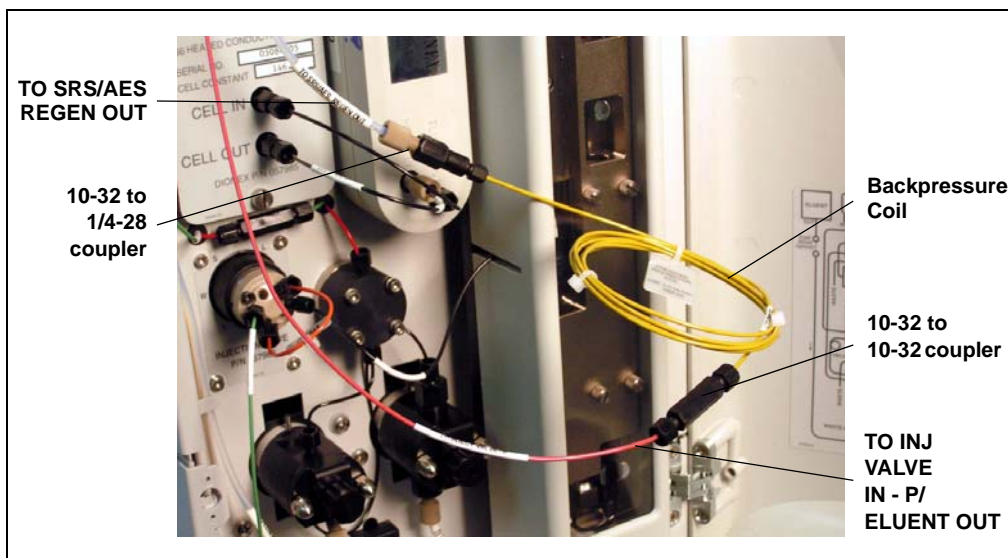


Figure 5-53. Backpressure Coil Connections for Conditioning the EPM with Carbonate/Bicarbonate Eluent



### Conditioning the EluGen Cartridge

Always condition the EluGen cartridge for 30 minutes before initial use.

1. Make sure the eluent reservoir is filled with ASTM filtered, Type I (18-megohm) deionized water.
2. Verify that the suppressor is off.

**IMPORTANT**

To avoid damaging the suppressor, always turn off the suppressor before conditioning the EluGen cartridge. The pump flow is on during conditioning, however, no flow reaches the suppressor.

3. Verify that the **Automatically turn on with pump** option is not selected on the ICS-2000 touch screen **SUPPRESSOR** page (see [Section C.9](#)). Disabling this option lets you turn on the pump, without automatically turning on the suppressor.
4. From the ICS-2000 Control panel in Chromeleon or the ICS-2000 touch screen **HOME** page, set the pump flow rate to **1.00 mL/min**.
5. Turn on the pump.
6. Select the following settings from the Chromeleon Control panel or the touch screen **ELUENT GENERATOR** page:
  - Set the **EGC-1** concentration to **9 mM**.
  - Set the **EGC-2** concentration to **1 mM**.
7. Turn on the EGC-1 and EGC-2 currents.
8. Run at these settings for 30 minutes.
9. Turn off the EGC-1 and EGC-2 currents.
10. Turn off the pump.
11. Remove the backpressure coil.
12. Reconnect the **TO INJ VALVE IN - P/ELUENT OUT** line to the mixer inlet.
13. Reconnect the **TO SRS/AES REGEN OUT** line to the suppressor **REGEN OUT** port.

### 5.18 Replacing the CR-TC

1. Turn off the pump from the ICS-2000 Control panel in Chromeleon or from the touch screen **HOME** page.
2. Follow the instructions in [Section 5.17.1, Step 2](#) through [Step 8](#) to disconnect the EluGen cartridge and CR-TC cables, cap the EluGen cartridge vent opening, remove the EluGen cartridge from the holder, and disconnect the inlet and outlet tubing.
3. Disconnect the line labeled **TO INJ VALVE IN - P/ELUENT OUT** from port **P (2)** on the injection valve and disconnect the line labeled **SRS/AES REGEN OUT** from the **REGEN OUT** port on the suppressor.
4. Lift up the holder and tilt it to view the bottom of the holder.
5. Brace the holder against the back corner of the ICS-2000.
6. Grasp the top of the CR-TC and lift up to disconnect it from the holder.
7. Disconnect the liquid lines from the four ports on the CR-TC (see [Figure 5-54](#)).

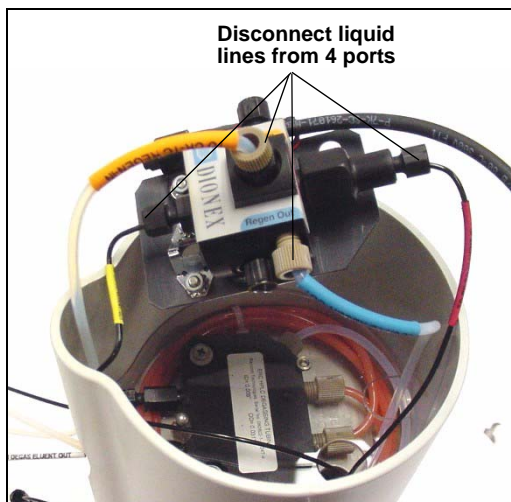


Figure 5-54. Disconnecting CR-TC Liquid Lines

8. Remove the CR-TC from the holder.
9. Remove the plugs from the ports on the new CR-TC (P/N 060477, anion; P/N 060478, cation). Reconnect the liquid lines that were disconnected in Step 7 to the corresponding ports on the new CR-TC.

10. Check that none of the lines are caught under the CR-TC and then push the CR-TC onto the metal stud inside the EGC holder. Push down until the CR-TC snaps into place (see [Figure 5-55](#)).

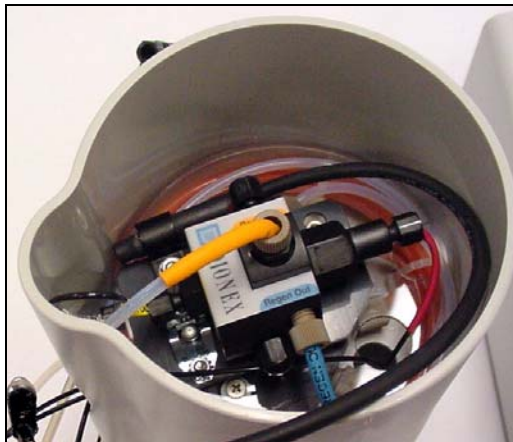


Figure 5-55. CR-TC Installed in Holder

11. Feed the CR-TC cable through the slot on the side of the EGC holder (see [Figure 5-56](#)).
12. Turn the EGC holder right-side up.

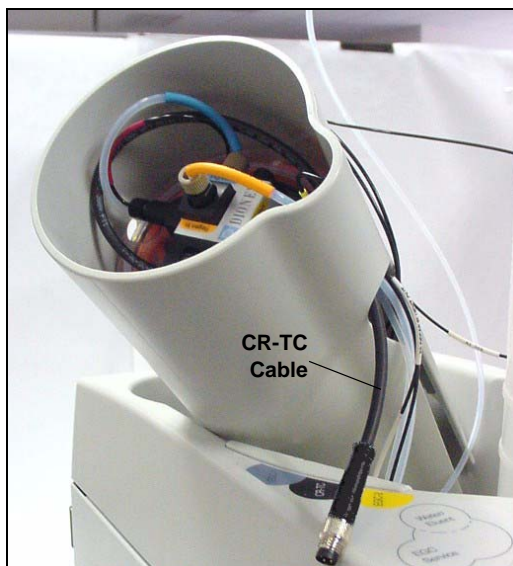


Figure 5-56. CR-TC Cable

13. Reconnect the **EGC IN** and **EGC OUT** lines to the EluGen cartridge inlet and outlet ports.
14. Turn over the EluGen cartridge (fittings facing down). Check for bubbles in the eluent generation chamber; if necessary, shake and tap the EluGen cartridge to remove bubbles.

15. Reinstall the EluGen cartridge in the holder.
16. Remove the cap on the luer adapter by twisting. **Save the cap.**
17. Twist the luer lock and **EGC VENT** line into the luer adapter.
18. Do not connect the EluGen cartridge cable until after hydrating the CR-TC.

## Hydrating the CR-TC

The CR-TC must be hydrated before initial use by running ASTM filtered, Type 1 (18 megohm-cm) deionized water through the CR-TC for 10 minutes, while bypassing the columns and suppressor.

[Figure 5-57](#) illustrates the liquid flow path through the CR-TC during the hydration procedure.

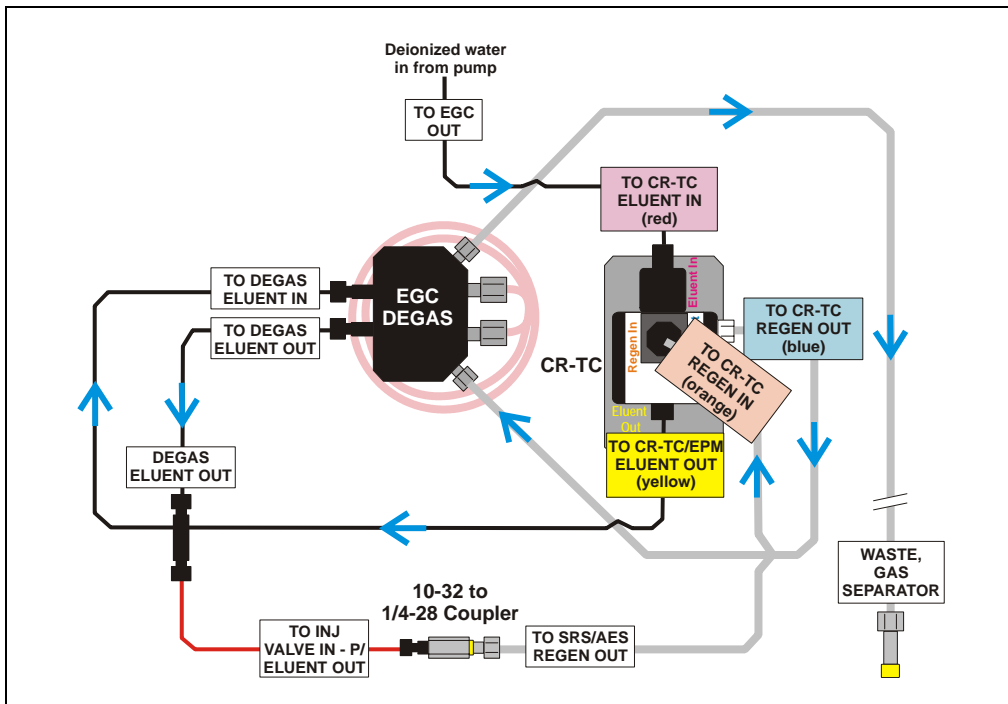


Figure 5-57. CR-TC Plumbing for Hydration

1. Locate the 10-32 to 1/4-28 coupler (P/N 042806) in the ICS-2000 Ship Kit (P/N 064375).
2. Use the coupler to connect the line labeled **TO INJ VALVE IN - P/ELUENT OUT** and the line labeled **SRS/AES REGEN OUT**.
3. Verify that the current to the suppressor is turned off.

**IMPORTANT**

**To avoid damaging the suppressor, always turn off the suppressor before hydrating the CR-TC. The pump flow is on during hydrating, however, no flow reaches the suppressor.**

4. Verify that the **Automatically turn on with pump** option is not selected on the ICS-2000 touch screen **ELUENT GENERATOR** page (see [Section C.8](#)). Disabling this option lets you turn on the pump, without automatically turning on the CR-TC.
5. Turn on the pump and set the flow to the rate recommended for your application. Pump deionized water through the CR-TC for at least 10 minutes.
6. Turn off the pump and disconnect the coupler.
7. Reconnect the line labeled **TO INJ VALVE IN - P/ELUENT OUT** to port **(P) 2** on the injection valve.
8. Reconnect the line labeled **TO SRS/AES REGEN OUT** to the **REGEN OUT** port on the suppressor.
9. Reconnect the CR-TC and EluGen cartridge cables.
10. If you disabled the **Automatically turn on with pump** option in [Step 3](#), select the option.

### 5.19 Replacing the EPM Electrolytic pH Modifier

1. Turn off the pump from the ICS-2000 Control panel in Chromeleon or from the touch screen **HOME** page.
2. Disconnect the EPM electrical cable from the **EGC-2** connector on the ICS-2000 top cover.
3. Disconnect the four liquid lines from the ports on the EPM.
4. Lift up the mounting bracket with the EPM attached and remove the bracket and EPM from the EGC holder.
5. Pull the EPM off the mounting bracket.
6. Remove the plugs from the ports on the new EPM (P/N 063175).
7. Push the EPM onto the ball studs on the mounting bracket (see [Figure 5-58](#)).

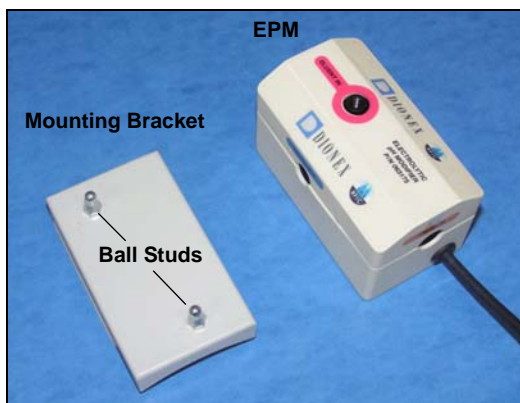


Figure 5-58. EPM and Mounting Bracket

8. Reinstall the mounting bracket with new EPM attached onto the EGC holder.
9. Reconnect the liquid lines that were disconnected in [Step 3](#) to the corresponding ports on the new EPM.
10. Connect the EPM electrical cable to the **EGC-2** connector.

### 5.19.1 Recording the EPM Serial Number in Chromeleon

The serial number is printed on a label on the EPM.

1. Open the Server Configuration program (select **Start** > **Programs** (or **All Programs**) > **Chromeleon** > **Server Configuration**).
2. Double-click the ICS-2000 system icon. The properties dialog box for the ICS-2000 appears.
3. Click the **Eluent Generator** tab (see [Figure 5-40](#)).
4. Select the **EGC-2** check box.
5. Enter the serial number of the EPM.
6. Verify that the cartridge type is **pH Mod**. If not, make sure the serial number was entered correctly.
7. Click **OK**.

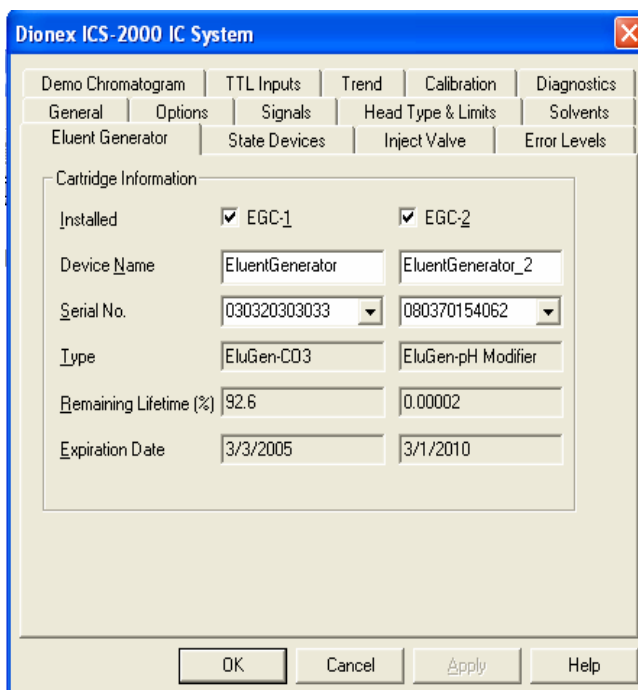


Figure 5-59. Eluent Generator Configuration Properties Example

## 5.19.2 Plumbing the EPM for Hydrating and Conditioning

Figure 5-52 illustrates the liquid flow path during hydration and conditioning.

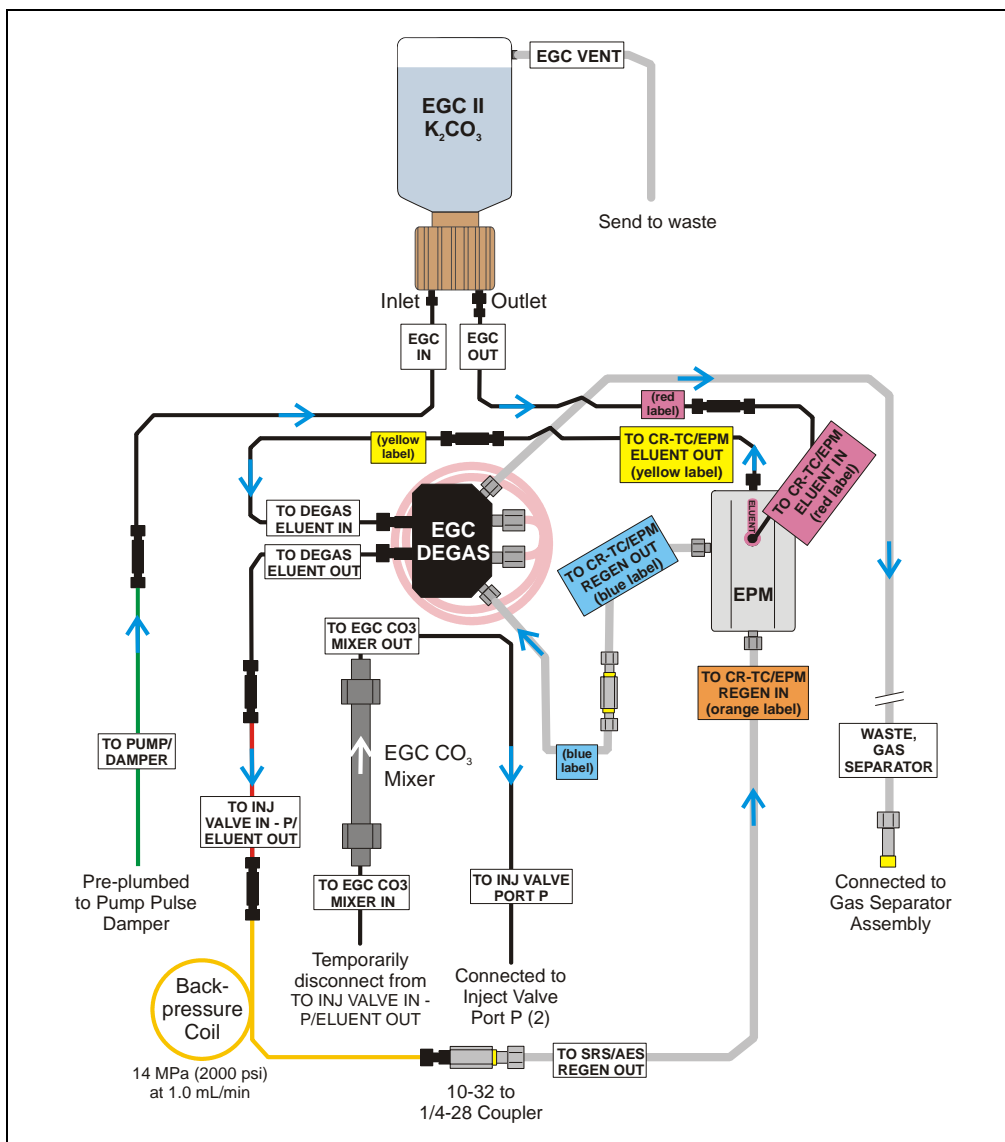
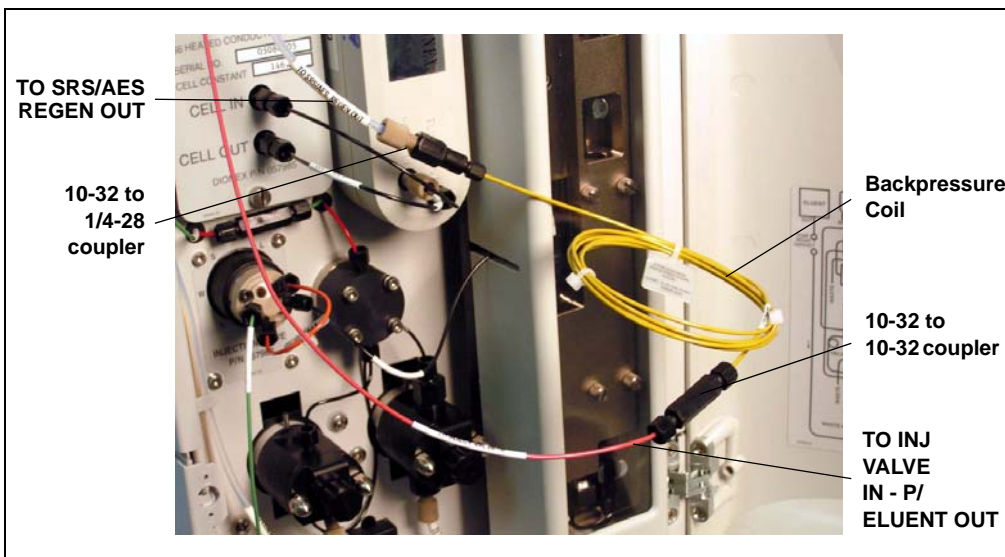


Figure 5-60. EluGen Cartridge and EPM Plumbing for Conditioning



1. Disconnect the **TO INJ VALVE IN - P/ELUENT OUT** line from the EGC CO<sub>2</sub> Mixer inlet.
2. Use a 10-32 to 10-32 coupler (P/N 042627) to connect the yellow 0.5 mL/min, 7 MPa (1000 psi) backpressure coil (P/N 053765) to the **TO INJ VALVE IN - P/ELUENT OUT** line.
3. Connect a 10-32 to 1/4-28 coupler (P/N 042806) to the free end of the backpressure coil.
4. Disconnect the **TO SRS/AES REGEN OUT** line from the suppressor **REGEN OUT** port.
5. Connect the **TO SRS/AES REGEN OUT** line to the 10-32 to 1/4-28 coupler (see [Figure 5-61](#)).

**NOTE** The backpressure coil connection in [Figure 5-61](#) is temporary; it is used only during the hydration and conditioning procedure described in the next section.



*Figure 5-61. Backpressure Coil Connections for Hydrating and Conditioning the EPM with Carbonate Eluent*

### 5.19.3 Hydrating and Conditioning the EPM

Follow the steps below to hydrate the EPM for 5 minutes and then condition the EPM for 30 minutes.

1. Fill the eluent reservoir with ASTM filtered, Type I (18-megohm) deionized water.
2. Verify that the suppressor is off.

**IMPORTANT**

**To avoid damaging the suppressor, always turn off the suppressor before conditioning the EPM and EluGen cartridge. The pump flow is on during conditioning, however, no flow reaches the suppressor.**

3. Verify that the EluGen cartridge is off.
4. Verify that the **Automatically turn on with pump** options are not selected on the ICS-2000 touch screen **SUPPRESSOR** page (see [Section C.9](#)) and **ELUENT GENERATOR** page (see [Section C.8](#)). Disabling these options lets you turn on the pump, without automatically turning on the suppressor and EluGen cartridge.
5. From the ICS-2000 Control panel in Chromeleon or the ICS-2000 touch screen **HOME** page, set the pump flow rate to **1.00 mL/min**.
6. Turn on the pump.
7. Run the pump for 5 minutes to hydrate the EPM.
8. Select the following settings from the Chromeleon Control panel or the touch screen **ELUENT GENERATOR** page:
  - Set the **EGC-1** concentration to **9 mM**.
  - Set the **EGC-2** concentration to **1 mM**.
9. Turn on the EGC-1 and EGC-2 currents.
10. Run at these settings for 30 minutes.
11. Turn off the EGC-1 and EGC-2 currents.
12. Turn off the pump.
13. Remove the backpressure coil and couplers from the **TO INJ VALVE IN - P/ELUENT OUT** and **TO SRS/AES REGEN OUT** lines.
14. Reconnect the **TO INJ VALVE IN - P/ELUENT OUT** line to the EGC CO<sub>3</sub> Mixer inlet.

15. Reconnect the **TO SRS/AES REGEN OUT** line to the suppressor **REGEN OUT** port.

## 5.20 Replacing the EGC CO<sub>3</sub> Mixer

### 5.20.1 Installing the New EGC CO<sub>3</sub> Mixer

1. Turn off the pump from the ICS-2000 Control panel in Chromeleon or from the touch screen **HOME** page.
2. Disconnect the inlet and outlet lines (labeled **TO EGC CO3 MIXER IN** and **TO EGC CO3 MIXER OUT**) from the existing mixer and pull the mixer off the mounting clips.
3. Orient the new EGC CO<sub>3</sub> Mixer (P/N 061686) with the outlet pointing upward and push it onto the mounting clips (see [Figure 5-62](#)). The mixer outlet must point upward to ensure thorough mixing of the eluent.

4. Connect the **TO EGC CO<sub>3</sub> MIXER IN** line to the mixer inlet and connect the **TO EGC CO<sub>3</sub> MIXER OUT** line to the mixer outlet.



Figure 5-62. ICS-2000 with an EGC CO<sub>3</sub> Mixer Installed

### 5.20.2 Filling the EGC CO<sub>3</sub> Mixer with Deionized Water

Before initial use, follow the steps below to temporarily fill the EGC CO<sub>3</sub> Mixer with deionized water. Then, follow the steps in the next section to fill the mixer with eluent of the required concentration for the application to be run.

1. Verify that the EGC-1 and EGC-2 currents are off.
2. Disconnect the EluGen cartridge inlet line (labeled **TO PUMP/DAMPER**) from the coupler that connects it to the green pump outlet line (see [Figure 5-63](#)).

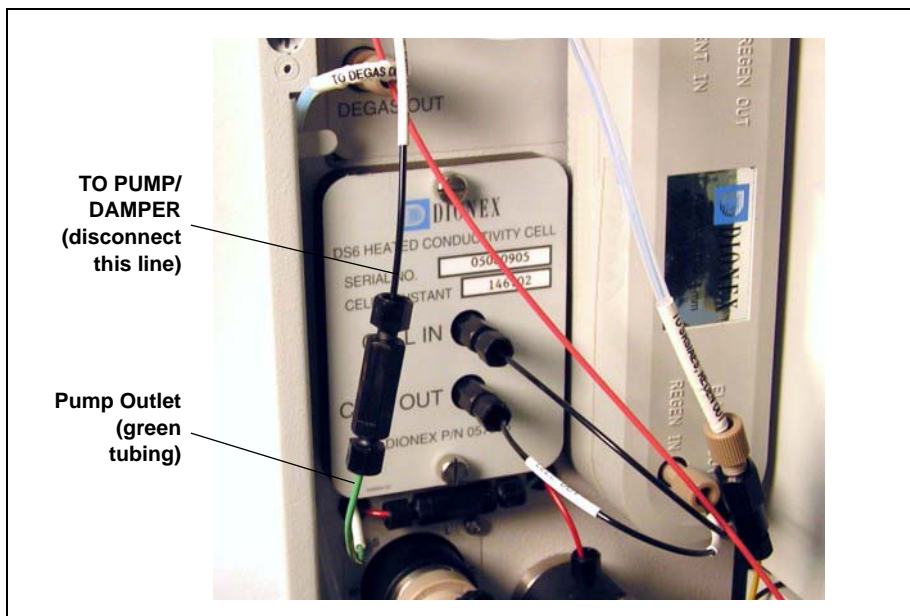


Figure 5-63. Disconnect the Cartridge Inlet and Pump Outlet

3. Disconnect the **TO EGC CO3 MIXER IN** line from the **TO INJ VALVE IN - P/ELUENT OUT** line.

4. Connect the pump outlet to the mixer inlet (see [Figure 5-64](#)).

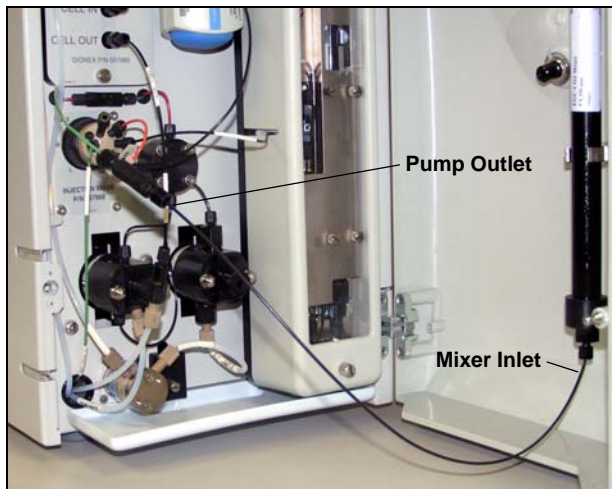


Figure 5-64. Pump Outlet Connected to Mixer Inlet for Mixer Hydration

5. Disconnect the mixer outlet line (labeled **TO INJ VALVE PORT P**) from port **P (2)** on the injection valve.
6. Direct the mixer outlet line to a temporary waste container, such as a beaker.
7. From the ICS-2000 Control panel in Chromeleon or the ICS-2000 touch screen **HOME** page, set the pump flow rate to **5.00 mL/min.**
8. Verify that the suppressor is off.

**IMPORTANT**

To avoid damaging the suppressor always turn off the suppressor before filling the mixer. The pump flow is on during filling, however, no flow reaches the suppressor.

9. Verify that the **Automatically turn on with pump** option is not selected on the ICS-2000 touch screen **SUPPRESSOR** page (see [Section C.9](#)). Disabling this option lets you turn on the pump, without automatically turning on the suppressor.
10. Turn on the pump.
11. Run the pump until the mixer is filled and there is a consistent flow of water exiting the mixer outlet.

It takes about 5 minutes to fill a 4-mm mixer and about 2 minutes to fill a 2-mm mixer.

12. Turn off the pump.

### 5.20.3 Filling the EGC CO<sub>3</sub> Mixer with Eluent

Before initial use, follow the steps in this section to fill the EGC CO<sub>3</sub> Mixer with the eluent required for the application to be run. The procedure varies slightly, depending on the type of eluent to be generated:

- For carbonate eluent, see [“Filling the EGC CO<sub>3</sub> Mixer with Carbonate Eluent”](#) below.
- For carbonate/bicarbonate eluent, see [“Filling the EGC CO<sub>3</sub> Mixer with Carbonate/Bicarbonate Eluent”](#) on page 5-77.

## Filling the EGC CO<sub>3</sub> Mixer with Carbonate Eluent

Figure 5-65 illustrates the liquid flow path through the eluent generator components during initial filling of the EGC CO<sub>3</sub> Mixer with carbonate eluent.

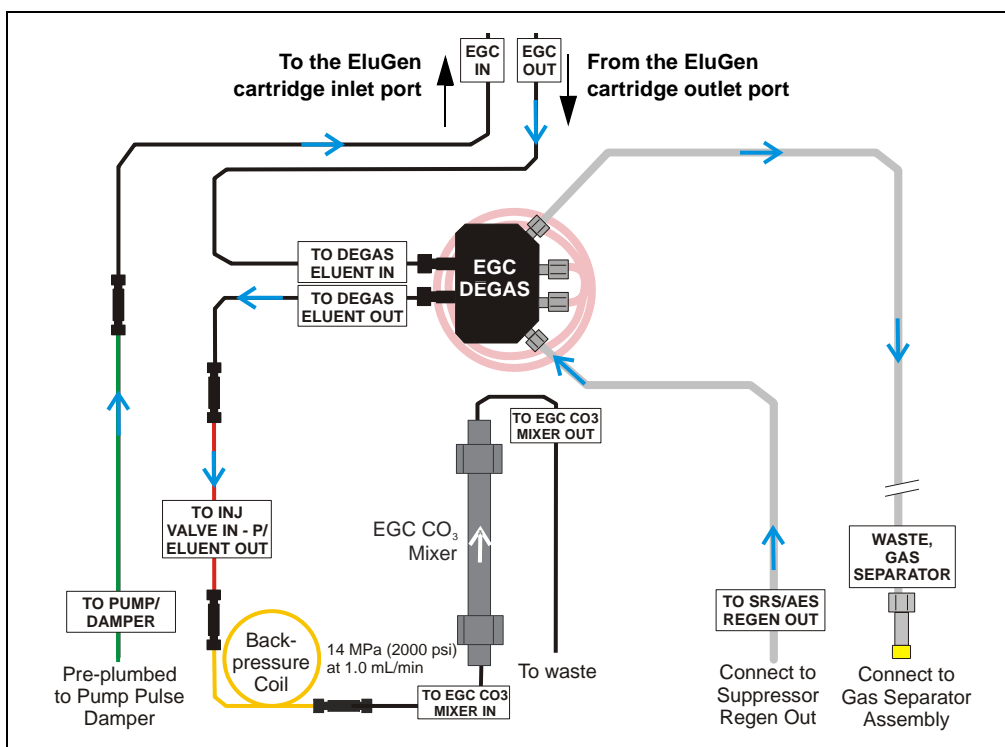


Figure 5-65. Plumbing for Initial Filling of the EGC CO<sub>3</sub> Mixer with Carbonate Eluent



1. Locate the yellow 0.5 mL/min, 7 MPa (1000 psi) backpressure coil (P/N 053765) and a 10-32 to 10-32 coupler (P/N 042627) in the ICS-2000 Ship Kit (P/N 064375).
2. Use the coupler to connect one end of the backpressure coil to the **TO INJ VALVE IN - P/ELUENT OUT** line.
3. Connect the other end of the backpressure coil to the coupler on the mixer inlet.

**NOTE** The backpressure coil connection is temporary; it is required only during initial filling of the mixer.

4. Direct the mixer outlet to a temporary waste container, such as a beaker.
5. Verify that the suppressor is off.

**IMPORTANT**

To avoid damaging the suppressor always turn off the suppressor before filling the mixer. The pump flow is on during filling, however, no flow reaches the suppressor.

6. Verify that the **Automatically turn on with pump** option is not selected on the ICS-2000 touch screen **SUPPRESSOR** page (see [Section C.9](#)). Disabling this option lets you turn on the pump, without automatically turning on the suppressor.
7. From the ICS-2000 Control panel in Chromeleon or the ICS-2000 touch screen **HOME** page, set the pump flow rate to the rate required for the application.
8. Turn on the pump.
9. Verify that the system backpressure is between 14 and 16 MPa (2000 and 2300 psi). If necessary, adjust the pressure by adding or removing backpressure tubing.
10. From the Chromeleon Control panel or the touch screen **ELUENT GENERATOR** page, set the **EGC-1** concentration to the value required for your application.
11. Turn on the **EGC-1** current.

12. Run at these settings until a consistent flow of eluent is exiting the mixer outlet. At a flow rate of 1 mL/min it will take about 16 minutes to fill a 4-mm mixer and about 5 minutes to fill a 2-mm mixer.

**NOTE** The void volume of the 4-mm mixer is about 16 mL. The void volume of the 2-mm mixer is about 5 mL.

13. Turn off the **EGC-1** current.
14. Turn off the pump.
15. Remove the backpressure coil from the **TO INJ VALVE IN - P/ELUENT OUT** line and the mixer inlet.
16. Retain the coupler on the mixer inlet.
17. Reconnect the **TO INJ VALVE IN - P/ELUENT OUT** line to the coupler on the mixer inlet.
18. Reconnect the mixer outlet line to port **P (2)** on the injection valve.

### Filling the EGC CO<sub>3</sub> Mixer with Carbonate/Bicarbonate Eluent

[Figure 5-66](#) illustrates the liquid flow path through the eluent generator components during initial filling of the EGC CO<sub>3</sub> Mixer with carbonate/bicarbonate eluent.

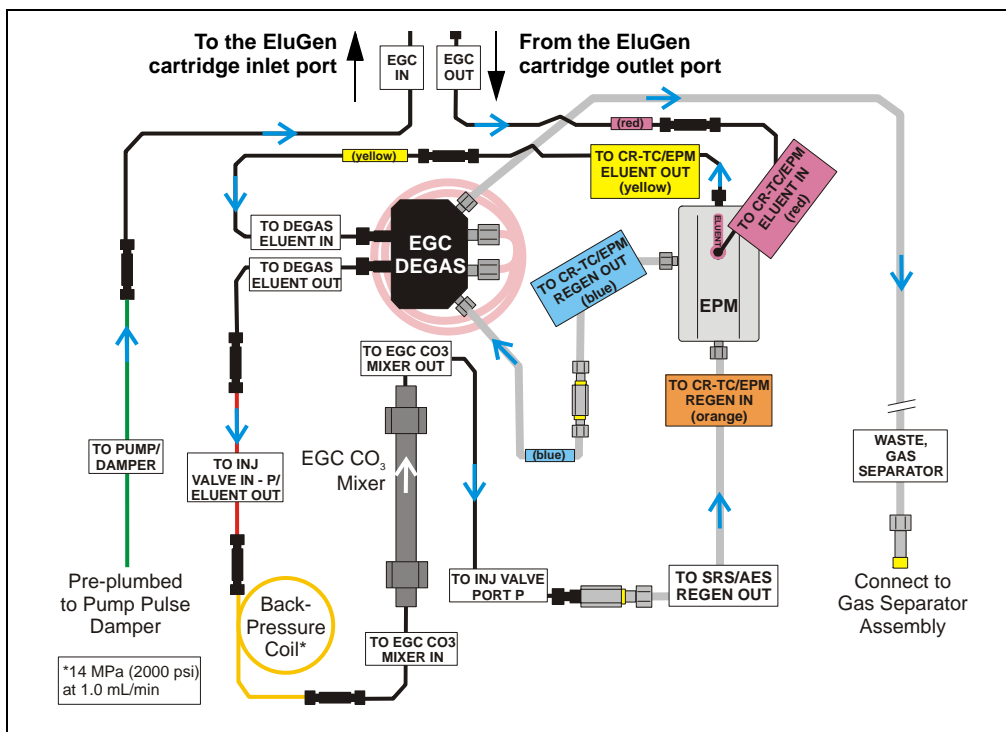


Figure 5-66. Plumbing for Initial Filling of the EGC CO<sub>3</sub> Mixer with Carbonate/Bicarbonate

## ICS-2000 Ion Chromatography System

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1. Locate the following items in the ICS-2000 Ship Kit (P/N 064375): a yellow 0.5 mL/min, 7 MPa (1000 psi) backpressure coil (P/N 053765), a 10-32 to 10-32 coupler (P/N 042627), and a 10-32 to 1/4-28 coupler (P/N 042806).
2. Use the 10-32 to 10-32 coupler to connect one end of the backpressure coil to the **TO INJ VALVE IN - P/ELUENT OUT** line (see [Figure 5-67](#)).
3. Connect the other end of the backpressure coil to the coupler on the mixer inlet.
4. Use the 10-32 to 1/4-28 coupler to connect the mixer outlet to the **TO SRS/AES REGEN OUT** line.

**NOTE** The backpressure coil connection is temporary; it is used only during initial filling of the mixer.

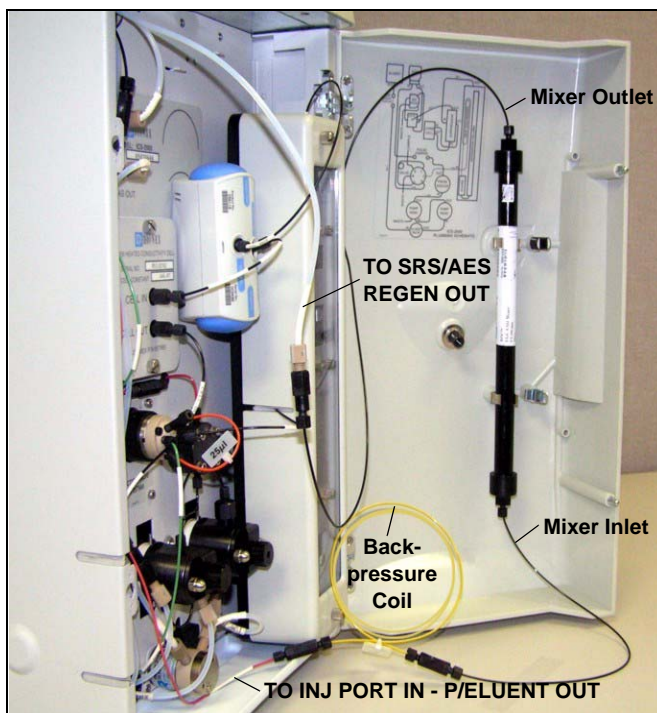


Figure 5-67. Mixer Connected Directly to Eluent Generator Outlet for Initial Filling

5. Verify that the suppressor is off.

**IMPORTANT**

To avoid damaging the suppressor always turn off the suppressor before filling the mixer. The pump flow is on during filling, however, no flow reaches the suppressor.

6. Verify that the **Automatically turn on with pump** option is not selected on the ICS-2000 touch screen **SUPPRESSOR** page (see [Section C.9](#)). Disabling this option lets you turn on the pump, without automatically turning on the suppressor.
7. Set the pump flow rate to the rate required for the application.
8. Turn on the pump.
9. Verify that the system backpressure is between 14 and 16 MPa (2000 and 2300 psi). If necessary, adjust the pressure by adding or removing backpressure tubing.
10. Set the **EGC-1** and **EGC-2** concentrations to the values required for your application. For example, for a 3.5 mM  $K_2CO_3$ /1.0 mM  $KHCO_3$  mixture, set the **EGC-1** concentration to 3.5 mM and the **EGC-2** concentration to 1.0 mM.
11. Turn on the **EGC-1** and **EGC-2** currents.
12. Run at the selected settings until the mixer is filled with the eluent mixture. At a flow rate of 1 mL/min it will take about 45 minutes to fill the 4-mm mixer and about 15 minutes to fill the 2-mm mixer.

**NOTE** The void volume of the 4-mm mixer is about 16 mL. The void volume of the 2-mm mixer is about 5 mL.

13. Turn off the **EGC-1** and **EGC-2** currents.
14. Turn off the pump.
15. Remove the backpressure coil from the **TO INJ VALVE IN - P/ELUENT OUT** line and the mixer inlet. Reconnect the two lines.
16. Disconnect the mixer outlet from the **TO SRS/AES REGEN OUT** line and remove the 10-32 to 1/4-28 coupler.
17. Reconnect the **TO SRS/AES REGEN OUT** line to the suppressor **REGEN OUT** port.
18. Reconnect the mixer outlet line to port **P (2)** on the injection valve.

### 5.21 Replacing the EGC Holder and Degas Assembly

#### 5.21.1 Disconnecting and Removing the EluGen Cartridge

1. Turn off the power to the ICS-2000.
2. Disconnect the following EGC holder liquid lines:
  - Disconnect the line labeled **TO INJ VALVE IN - P/ELUENT OUT** from either port **P (2)** on the injection valve, or if an EGC CO<sub>3</sub> Mixer inlet is installed, from the mixer inlet.
  - If a CR-TC is installed, disconnect the line labeled **TO SRS/AES REGEN OUT** from the **REGEN OUT** port on the suppressor.
  - Disconnect the line labeled **TO PUMP/DAMPER** from the pump damper.
  - Disconnect the line labeled **WASTE-GAS SEPARATOR** from the gas separator waste tube assembly installed on the waste container.
3. Disconnect the EluGen cartridge cable, and the CR-TC or EPM cable (if installed) from their respective connectors on the ICS-2000 top cover.



The EluGen cartridge contains one of the following: a corrosive base (KOH, LiOH, or NaOH), or a corrosive acid (MSA). Wear protective eyewear and gloves when handling the cartridge.



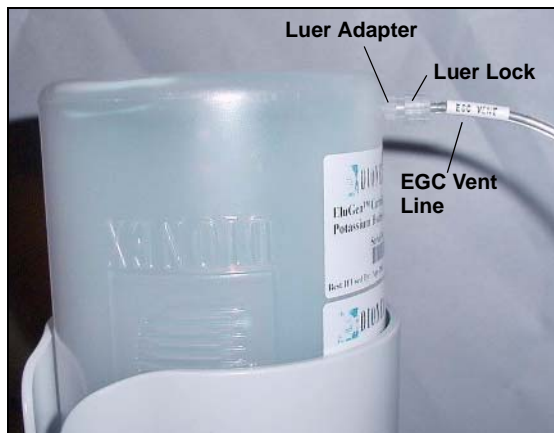
La cartouche d'EluGen contient un de ce qui suit: une base corrosive (KOH, LiOH, ou NaOH), ou un acide corrosif (MSA). Porter des lunettes et des gants protectives en manipulant la cartouche.



Die EluGen-Kassette enthält eine korrodierende Base (KOH, LiOH oder NaOH), oder eine korrodierende Säure (MSA). Tragen Sie daher beim Umgang mit Kassette eine Schutzbrille und Handschuhe.

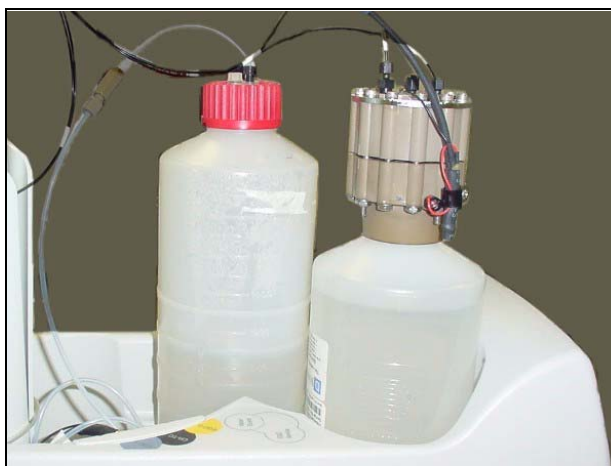
4. Remove the **EGC VENT** line (see [Figure 5-68](#)) from the EluGen cartridge by unscrewing the luer lock from the luer adapter.

If necessary, use a wrench to hold the luer adapter in place while unscrewing the vent line.



*Figure 5-68. EluGen Cartridge Vent Line and Luer Fitting*

5. Install the luer cap (P/N 053981), provided with the EluGen cartridge, onto the luer adapter. This prevents leaks from the vent opening when you turn over the EluGen cartridge (see [Step 8](#)).
6. If an EPM is installed, lift up the bracket with the EPM attached and remove it from the EGC holder.
7. Lift the EluGen cartridge straight up and out of the EGC holder.
8. Turn the cartridge upside down and set it in the EluGen cartridge service area on top of the ICS-2000 (see [Figure 5-32](#)).



*Figure 5-69. EluGen Cartridge in Service Area*

9. Disconnect the **EGC IN** and **EGC OUT** lines from the **INLET** and **OUTLET** ports on the cartridge.
10. Lift the EGC holder out of the top cover and pull the liquid lines through the tubing chase (see [Figure 5-70](#)) to remove them from the ICS-2000.



*Figure 5-70. Top Cover Tubing Chase*

11. If a CR-TC is installed, go on to [Section 5.21.2](#).
12. If an EPM is installed, go on to [Section 5.21.3](#).
13. If neither a CR-TC or EPM is installed, go on to [Section 5.21.4](#).



### 5.21.2 Removing the CR-TC and Reinstalling it in the New EGC Holder

1. Turn the holder upside down to view the CR-TC.
2. Grasp the top of the CR-TC and lift up to disconnect it from the holder.
3. Disconnect the liquid lines from the four ports on the CR-TC (see [Figure 5-54](#)).

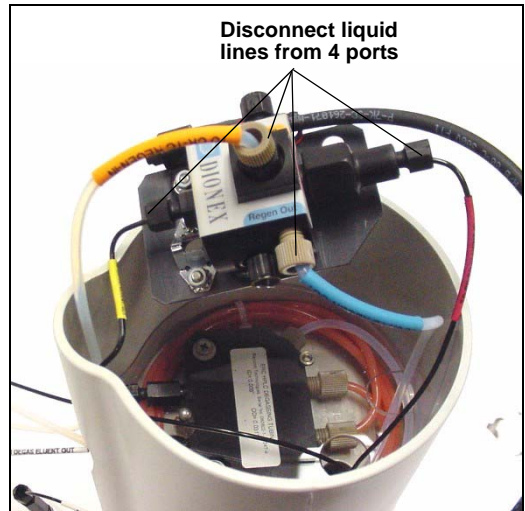


Figure 5-71. Disconnecting CR-TC Liquid Lines

4. Turn the new holder upside down (see [Figure 5-72](#)) and connect the liquid lines to the CR-TC.

**NOTE** To help retain the fittings and ferrules on the lines, remove the coupler from each line just before connecting the line to a port.

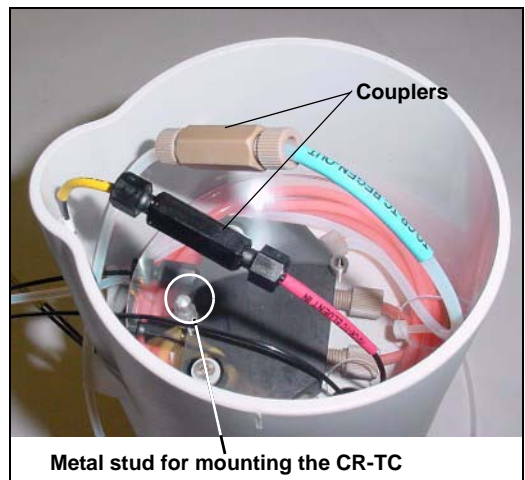


Figure 5-72. EGC Holder (upside down)

5. Check that none of the lines are caught under the CR-TC and then push the CR-TC onto the metal stud inside the EGC holder. Push down until the CR-TC snaps in place (see [Figure 5-73](#)).

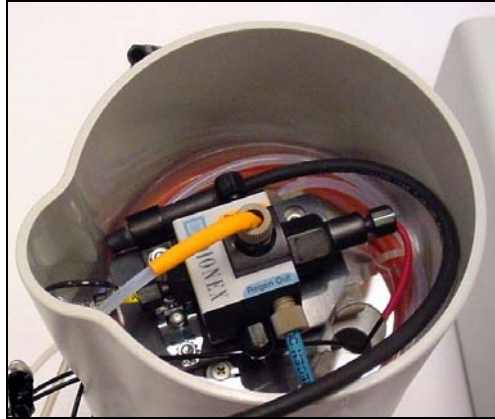


Figure 5-73. CR-TC Installed in Holder

6. Feed the CR-TC cable through the slot on the side of the EGC holder (see [Figure 5-74](#)).



Figure 5-74. CR-TC Cable

7. Turn the EGC holder right side up and set it on top of the ICS-2000.
8. Direct the **WASTE, GAS SEPARATOR** line from the top of the ICS-2000 to the rear panel. Snap the line onto one of the tubing clips on the rear panel. Connect the line to the gas separator waste tube (see [Section B.10.1](#)).

9. Feed the following liquid lines from the bottom of the holder through the tubing chase to the ICS-2000 front component panel.
  - **TO SRS/AES REGEN OUT**
  - **TO INJ VALVE IN - P/ELUENT OUT**
  - **TO PUMP/DAMPER**
10. Connect the lines to their respective locations:
  - Connect the line labeled **TO SRS/AES REGEN OUT** to the **REGEN OUT** port on the suppressor.
  - Connect the line labeled **TO INJ VALVE IN - P/ELUENT OUT** to port **P (2)** on the injection valve.
  - Connect the line labeled **TO PUMP/DAMPER** to the pulse damper.
11. Go on to [Section 5.21.5](#).

### 5.21.3 Removing the EPM and Reinstalling it in the New EGC Holder

1. Turn the EGC holder upside down to view the connections on the bottom of the holder.
2. Disconnect the following lines that connect from the EGC degas assembly inside the EGC holder to the EPM:
  - Disconnect the line labeled **TO CR-TC ELUENT IN** (red label) from the coupler that connects it to the line labeled **TO CR-TC/EPM ELUENT IN** (red label).
  - Disconnect the line labeled **TO CR-TC ELUENT OUT** (yellow label) from the coupler that connects it to the line labeled **TO CR-TC/EPM ELUENT OUT** (yellow label).
  - Disconnect the line labeled **TO CR-TC REGEN OUT** (blue label) from the coupler that connects it to the line labeled **TO CR-TC/EPM REGEN OUT** (blue label).
3. Remove the old EGC holder.

4. Thread the three lines from the EPM (red, yellow, and blue labels) through the opening on the side of the new holder (see [Figure 5-75](#)).

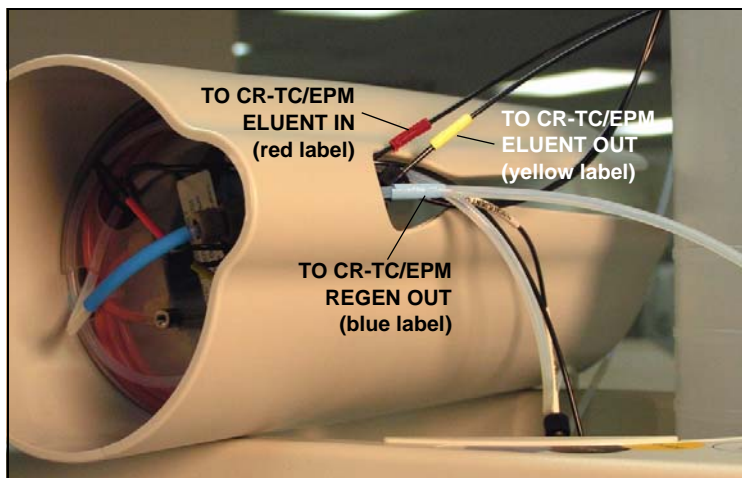


Figure 5-75. TO CR-TC/EPM Lines Outside of Holder

5. Turn the new EGC holder upside down (see [Figure 5-76](#)).

**NOTE** To help retain the fittings and ferrules on the lines, remove the coupler from each line just before connecting the line to a port.



Figure 5-76. EGC Holder (upside down)

6. Connect the lines from the EPM (red, yellow, and blue labels) to the corresponding lines in the holder.
7. Disconnect the line labeled **TO CR-TC/EPM REGEN IN** (orange label) from the **REGEN IN** port on the EPM and connect the new **TO CR-TC/EPM REGEN IN** line (orange label) to the port.

8. Turn the EGC holder right side up and set it in place on top of the ICS-2000.
9. Slide the EPM mounting bracket and connected EPM onto the side of the EGC holder.
10. Feed the following liquid lines through the tubing chase to the ICS-2000 front component panel.
  - **TO SRS/AES REGEN OUT**
  - **TO INJ VALVE IN - P/ELUENT OUT**
  - **TO PUMP/DAMPER**
11. Connect the lines to their respective locations:
  - Connect the line labeled **TO SRS/AES REGEN OUT** to the **REGEN OUT** port on the suppressor.
  - Connect the line labeled **TO INJ VALVE IN - P/ELUENT OUT** to the EGC CO<sub>3</sub> Mixer inlet.
  - Connect the line labeled **TO PUMP/DAMPER** to the pulse damper.
12. Direct the **WASTE, GAS SEPARATOR** line from the top of the ICS-2000 to the rear panel. Snap the line onto one of the tubing clips on the rear panel. Connect the line to the gas separator waste tube (see [Section B.10.1](#)).
13. Go on to [Section 5.21.5](#).

#### 5.21.4 Installing the New EGC Holder without a CR-TC or EPM

Follow the instructions in this section if a CR-TC or EPM is not installed.

1. Set the new EGC holder in place on top of the ICS-2000.
2. Feed the following liquid lines through the tubing chase to the ICS-2000 front component panel.
  - **TO SRS/AES REGEN OUT**
  - **TO INJ VALVE IN - P/ELUENT OUT**
  - **TO PUMP/DAMPER**
3. Connect the lines to their respective locations:
  - Connect the line labeled **TO SRS/AES REGEN OUT** to the **REGEN OUT** port on the suppressor.

- Connect the line labeled **TO INJ VALVE IN - P/ELUENT OUT** to the EGC CO<sub>3</sub> Mixer inlet.
  - Connect the line labeled **TO PUMP/DAMPER** to the pulse damper.
4. Direct the **WASTE, GAS SEPARATOR** line from the top of the ICS-2000 to the rear panel. Snap the line onto one of the tubing clips on the rear panel. Connect the line to the gas separator waste tube (see [Section B.10.1](#)).
  5. Go on to [Section 5.21.5](#).

### 5.21.5 Reinstalling the EluGen Cartridge

1. Pull the coiled black **EGC IN** and **EGC OUT** lines out from inside the EGC holder. Disconnect the **EGC IN** line from the coupler that connects it to the **EGC OUT** line.
2. Connect the **EGC IN** line to the EluGen cartridge **INLET** port (see [Figure 5-77](#)).
3. Remove the coupler and connect the **EGC OUT** line to the EluGen cartridge **OUTLET** port.

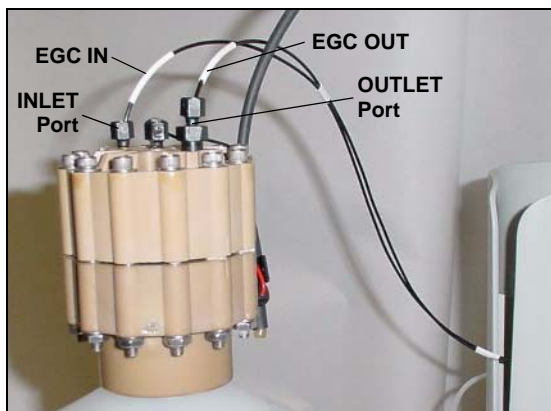


Figure 5-77. EluGen Cartridge Inlet and Outlet Port Connections

4. Turn over the EluGen cartridge (fittings facing down). Check for any bubbles in the eluent generation chamber, and if necessary, shake and tap the EluGen cartridge to remove them.
5. Reinstall the EluGen cartridge in the holder.
6. Reconnect the EluGen cartridge cable and the CR-TC or EPM cable (if installed).
7. Remove the cap from the luer adapter on the EluGen cartridge vent opening and re-connect the **EGC VENT** line.

# A • Specifications

---

## A.1 Electrical

**Main Power** 85 to 265 Vac, 47 to 63 Hz. The ICS-2000 power supply is auto-sensing and requires no voltage adjustment

**Fuses** Two 3.15 amp fast-blow IEC 127 fuses (P/N 954745)

## A.2 Physical

**Dimensions  
(without  
reservoir or  
EluGen  
cartridge)** Height: 56.1 cm (22.1 in)  
Width: 22.4 cm (8.8 in)  
Depth: 53.3 cm (21.0 in)

**Weight** 30 kg (66 lb)

**Decibel Level** < 52 dbA

## A.3 Environmental

**Operating  
Temperature** 4 to 40 °C (40 to 104 °F)

**Humidity** 5 to 95% relative humidity, noncondensing

**Operating  
Pressure** 35 MPa (5000 psi) maximum liquid path (tubing, valve, columns, etc.)

### A.4 Front Panel

<b>Power LED</b>	On when power is present; off when no power is present
<b>LCD Touch Screen</b>	<p>¼ VGA (320 x 240 pixels) liquid crystal display with touch screen, which provides:</p> <ul style="list-style-type: none"><li>• Local control of ICS-2000 components: pump, detector, suppressor, injection valve, eluent generator, CR-TC, column heater, vacuum degas, TTLs, and relays</li><li>• Display of conductivity data plot and operating status</li><li>• Local control of calibration and diagnostic functions</li></ul>

### A.5 Pump

<b>Type</b>	Dual-piston (in series), variable speed, 100 µL per revolution
<b>Flow Rate</b>	Settable range: 0.00 to 5.00 mL/min (without eluent generator) 0.10 to 3.00 mL/min (with eluent generator), in 0.01 increments Optimal Operational Range: 0.40 to 2.0 mL/min
<b>Flow Accuracy</b>	<1% of set value within the optimal operational range
<b>Flow Precision</b>	<0.2%
<b>Operating Pressure</b>	35 MPa (5000 psi), maximum
<b>High Pressure Limit</b>	0.7 to 34.4 MPa (100 to 5000 psi) (without eluent generator) 2.1 to 20.6 MPa (300 to 3000 psi) (with eluent generator)
<b>Low Pressure Limit</b>	0.0 to 33.7 MPa (0 to 4900 psi) (without eluent generator) 1.4 to 19.9 MPa (200 to 2900 psi) (with eluent generator)
<b>Delay Volume</b>	<800 µL
<b>Pressure Ripple</b>	<1% at 13.8 MPa (2000 psi) and 1.0 mL/min



## A.6 Detector

<b>Range</b>	0 to 15000 $\mu$ S (digital output)
<b>Temperature Compensation</b>	1.7% per $^{\circ}$ C
<b>Cell Drive</b>	8 kHz square wave
<b>Linearity</b>	Correlation >0.999 %RSD <5% to 800 $\mu$ S

## A.7 Conductivity Cell with Heat Exchanger

<b>Cell Body</b>	PEEK
<b>Electrodes</b>	Passivated 316 stainless steel
<b>Active Volume</b>	1.0 $\mu$ L
<b>Operating Temperature</b>	30 to 55 $^{\circ}$ C (86 to 130 $^{\circ}$ F); must be at least 7 $^{\circ}$ C above the ambient temperature
<b>Maximum Pressure</b>	2 MPa (300 psi)

## A.8 Injection Valve

<b>Injection Valve</b>	Two-position, six-port, electrically-activated valve with PEEK wetted components
------------------------	--

## A.9 Vacuum Degas Assembly

<b>Channel</b>	Single-channel degas channel with degas membranes
<b>Pump</b>	Dual-stage diaphragm vacuum pump
<b>Materials</b>	Wetted materials, PEEK, PTFE

## A.10 Column Heater

**Operating Temperature** 30 to 60 °C (86 to 140 °F); must be at least 5 °C above the ambient temperature

## A.11 Eluent Generator

**Concentration Range** Dependent on the EluGen cartridge type, the cartridge configuration (single or linked dual), and the flow rate. Refer to [Table A-1](#) and [Table A-2](#).

EluGen Cartridge	Eluent Concentration Range
K <sub>2</sub> CO <sub>3</sub>	0.1 to 15 mM at 0.1 to 1.0 mL/min flow 0.1 to X mM at 1.0 to 2.0 mL/min flow where X = 15/flow in mL/min
KOH	0.1 to 100 mM at 0.1 to 1.0 mL/min flow 0.1 to X mM at 1.0 to 3.0 mL/min flow where X = 100/flow in mL/min
LiOH	0.1 to 80 mM at 0.1 to 1.0 mL/min flow 0.1 to X mM at 1.0 to 3.0 mL/min flow where X = 80/flow in mL/min
MSA	0.1 to 100 mM at 0.1 to 1.0 mL/min flow 0.1 to X mM at 1.0 to 3.0 mL/min flow where X = 100/flow in mL/min
NaOH	0.1 to 100 mM at 0.1 to 1.0 mL/min flow 0.1 to X mM at 1.0 to 3.0 mL/min flow where X = 100/flow mL/min

Table A-1. Eluent Concentration Ranges for Single-Cartridge Configurations

EluGen Cartridges	Eluent Concentration Range	Comment
K <sub>2</sub> CO <sub>3</sub> /EPM Electrolytic pH Modifier	0.1 to 15 mM at 0.1 to 1.0 mL/min flow 0.1 to X mM at 1.0 to 2.0 mL/min flow X = 15/flow	The total of the eluent concentrations from the EluGen cartridge and the EPM must not exceed the specified range. The EPM concentration must not exceed 10 mM.
KOH/KOH KOH/MSA KOH/NaOH MSA/MSA MSA/NaOH NaOH/NaOH	0.1 to 50 mM at 0.1 to 1.0 mL/min flow 0.1 to X mM at 1.0 to 3.0 mL/min flow X = 50/flow	The eluent concentration range for each cartridge is cut by 50%.
LiOH/LiOH	0.1 to 40 mM at 0.1 to 1.0 mL/min flow 0.1 to X mM at 1.0 to 3.0 mL/min flow X = 40/flow	The eluent concentration range for each cartridge is cut by 50%.

*Table A-2. Eluent Concentration Ranges for Linked Dual-Cartridge Configurations*



## B • Installation

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This chapter provides instructions for the initial installation of the ICS-2000 Ion Chromatography System.

**NOTE** These installation instructions are also shipped with the ICS-2000 as a stand-alone printed manual (Document No. 031858).

**NOTE** The order of the steps is important. It is especially important to install Chromeleon before connecting the USB cable and turning on the ICS-2000 power.

### B.1 Facility Requirements

- Make sure the ICS-2000 installation site meets the power and environmental specifications listed in Appendix A.
- Provide a sturdy workbench for the ICS-2000 of a height that ensures convenient access to the interior of the ICS-2000.
- Allow at least 15 cm (6 in) behind the ICS-2000 for power connections and ventilation. For optimal performance, install the ICS-2000 in a draft-free location, out of the path of air conditioning and heating vents.
- (Optional) Provide a clean gas source regulated to between 0.55 and 0.83 MPa (80 and 120 psi) for pressurization of the eluent reservoir.
- Use ASTM filtered, Type I (18-megohm) deionized water when preparing eluent and regenerant.

## B.2 Unpacking the ICS-2000 System

1. After removing the ICS-2000 from the shipping box and removing the top layer of foam, remove the next layer of foam (see [Figure B-1](#)).

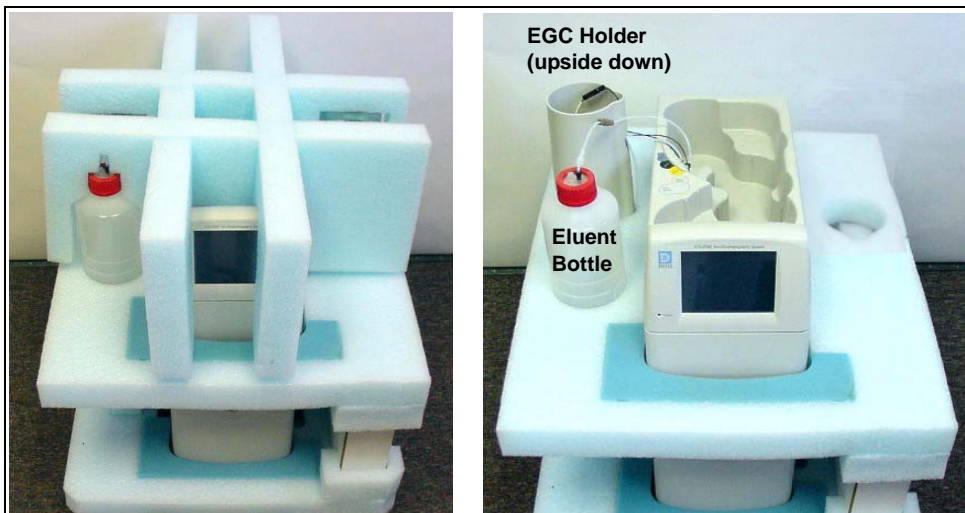


Figure B-1. Unpacking the ICS-2000

2. Set the eluent bottle on top of the ICS-2000 (see [Figure B-2](#)).
3. **TURN OVER THE EGC HOLDER**, and set it on top of the ICS-2000.



Figure B-2. ICS-2000 After Installing Eluent Bottle and EGC Holders

4. Remove the next layer of foam and remove the Ship Kit box (see [Figure B-3](#)).

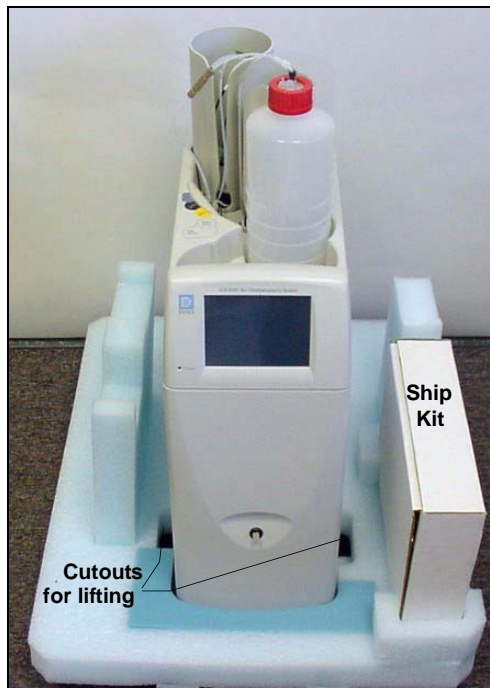


Figure B-3. ICS-2000 with Ship Kit

5. The bottom foam layer has two cutouts on either side of the ICS-2000 module; use these as handholds when lifting the module (see [Figure B-3](#)).
6. Lift the ICS-2000 out of the bottom layer of foam and set it on a workbench. Inspect the ICS-2000 for any shipping damage.



Two or more persons should lift the ICS-2000, which weighs 30 kg (66 lb). Lift the ICS-2000 only from each side of the cabinet bottom. Lifting from the front door will damage the door hinges.



Au moins deux personnes peuvent soulever le ICS-2000: il pèse 30 kg (66 lb). Ne soulevez le ICS-2000 que par chaque côté du fond de l'armoire. Son soulèvement par la porte du panneau avant endommagera les charnières de la porte.



Der ICS-2000 wiegt über 20 kg. Daher sollte das Gerät nur von zwei oder mehr Personen angehoben werden. Greifen Sie dazu an beiden Seiten unter das Gerät. Heben Sie den Autosampller nicht an der Vordertür an, da dadurch die Türangeln beschädigt werden könnten.

### B.2.1 Unpacking the Computer (North America only)

**NOTE** These instructions assume that Chromeleon software was installed on the computer before shipping.

1. Remove the central processing unit (CPU), keyboard, mouse, and all documentation from the computer box and place these items 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.4](#), “Installing the Chromeleon Software License.”

### B.2.2 Unpacking the Computer (outside North America)

1. Refer to *Installing the Chromeleon IC System* (Document No. 031883) to verify that the computer being used meets Chromeleon specifications. The manual is on the Dionex Reference Library CD-ROM (P/N 053891).
2. Remove the central processing unit (CPU), keyboard, mouse, and all documentation from the computer box and place these items 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. If Chromeleon is not installed on the computer, go on to [Section B.3](#), “Installing Chromeleon.”
6. If Chromeleon is already installed on the computer, go on to [Section B.4](#), “Installing the Chromeleon Software License.”



## **B.3 Installing Chromeleon**

### **NOTES**

- **Windows® 2000 or Windows XP is required for controlling the ICS-2000 with Chromeleon. Chromeleon version 6.5 SP2 or later is required.**
  - **To install Chromeleon, you must log onto Windows 2000 or XP with administrator privileges. Administrator privileges are not required to run Chromeleon.**
  - **For additional details about installing Chromeleon, refer to *Installing the Chromeleon Chromatography Management System with a Dionex Ion Chromatograph (IC)* (Document No. 031883)**
1. Turn on the computer power.
  2. Follow the Windows setup steps as they appear on the screen.
  3. Verify that the monitor display is set to a minimum of 1024 x 768 with 16 bit color.
  4. Insert the Chromeleon CD-ROM into the CD-ROM drive.
  5. The Chromeleon Setup menu appears.
  6. If the Setup menu does not appear automatically, go to the Autorun folder on the Chromeleon CD-ROM and double-click **autorun.exe**.
  7. Select **Launch Chromeleon Setup**.
  8. Setup now guides you through the installation procedure; follow the on-screen instructions as they appear.
  9. When prompted, select whether to add the Chromeleon Server Monitor to the Startup group. If you select yes, the Server Monitor starts automatically when the computer is started, and the program icon appears in the taskbar.
  10. After installing the software, restart the computer.
  11. Go on to [Section B.4](#), “Installing the Chromeleon Software License.”

**IMPORTANT**

**Installing DX-LAN Devices**

If you will also be installing a module that requires a DX-LAN interface connection, verify that the following steps are completed before continuing:

1. If it is not already installed, install the DX-LAN card in the module. Refer to the operator's manual for the module for installation instructions.
2. Install the DX-LAN card in the computer.
3. Connect the module to the DX-LAN.
4. Install the DX-LAN card driver.

Instructions for Steps 2 through 4 are in *Installing the Chromeleon Chromatography Management System with a Dionex Ion Chromatograph (IC)* (Document No. 031883).

## **B.4 Installing the Chromeleon Software License**

For the Chromeleon computer to control the ICS-2000, a valid software license must be installed. To install the license, you first install a dongle on the computer and then enter a license "Key Code" in Chromeleon. (A dongle is an adapter that is connected to the parallel PC interface or USB port. The dongle stores the serial number of a Chromeleon computer.)

**NOTE If the software license is managed with a License Server, a dongle is not required.**

1. Plug the dongle into the appropriate port on the computer (either the parallel or USB port, depending on the type of dongle). Tighten the connector screws on a parallel port dongle.
2. Microsoft Windows will automatically detect the USB dongle and launch the Found New Hardware Wizard. Complete the wizard by selecting the following options:
  - If asked whether Windows can connect to Windows Update to search for software, select **No, not this time**.

- Select the **Install the software automatically (Recommended)** option (see [Figure B-4](#)) (it is not necessary to insert a hardware installation CD or floppy disk).

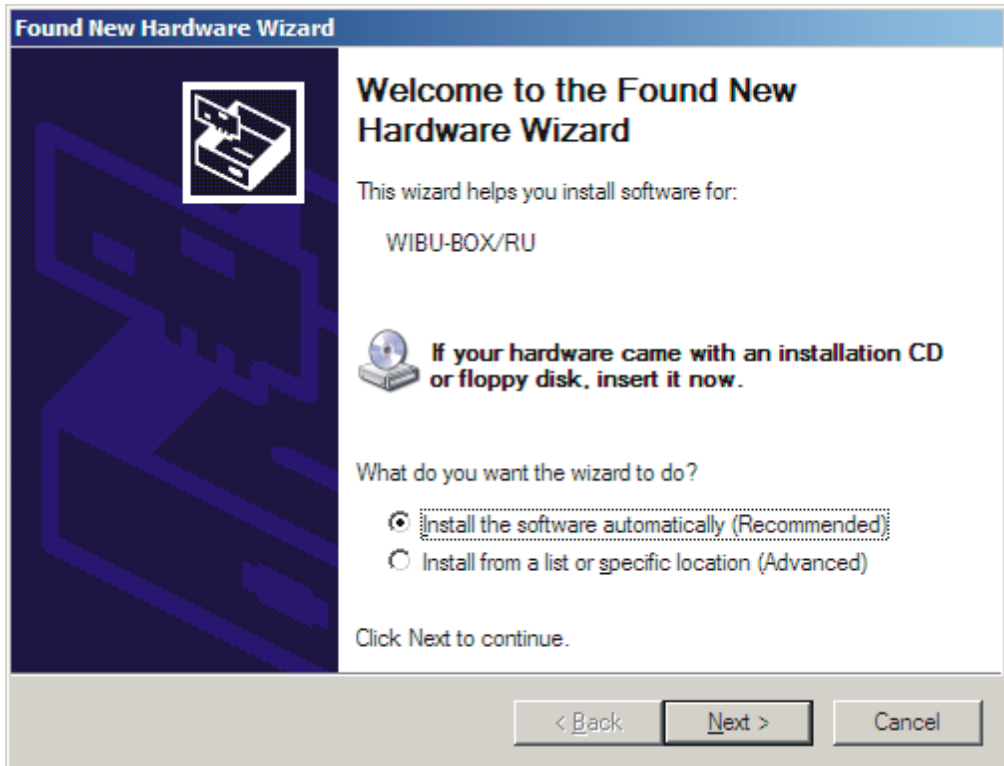


Figure B-4. Windows Found New Hardware Wizard

3. If it is not already running, start the Chromeleon Server Monitor by double-clicking the Server Monitor icon on the Windows taskbar.

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

4. If the server is not already running, start it by clicking **Start** (see [Figure B-5](#)).

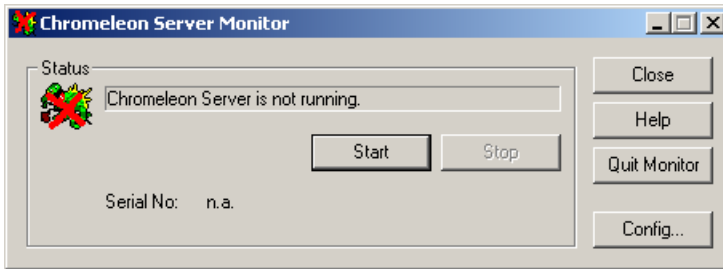


Figure B-5. Server Not Running

5. Check the server status:
- If “Chromeleon Server is running idle” is displayed, the license Key Code was entered before shipping the computer, and you can omit the remaining steps in this section. Click **Close** and go on to [Section B.5](#).
  - If “Chromeleon Server is running idle (Evaluation Mode)” is displayed (see [Figure B-6](#)), the license Key Code has not yet been entered. If this is the case, go on to [Step 6](#).

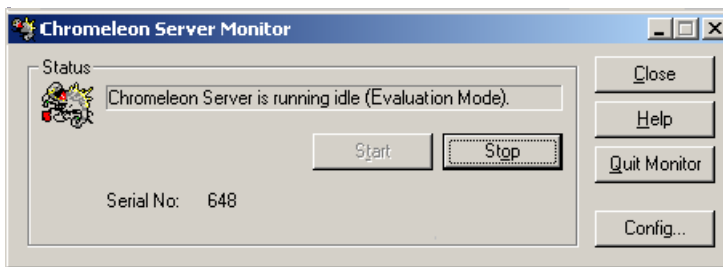


Figure B-6. Server Evaluation Mode

6. Open Chromeleon (select **Start>Programs** (or **All Programs**)>**Chromeleon>Chromeleon**).

7. Select **File>Preferences** to open the Preferences dialog box (see [Figure B-7](#)). Select the **License** tab and click **Dongle**. Enter the **Key Code** exactly as it appears on the Chromeleon Software License key code sheet. Click **OK**.

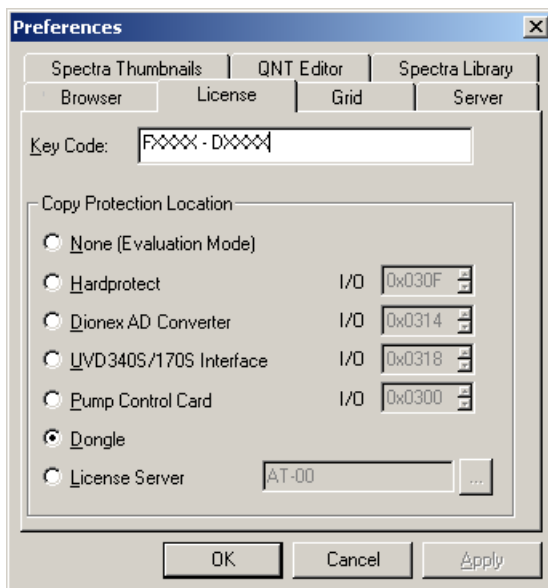


Figure B-7. Preferences: License Page

8. Check the Server Monitor status. It should now display “Chromeleon Server is running idle.” (see [Figure B-8](#)).

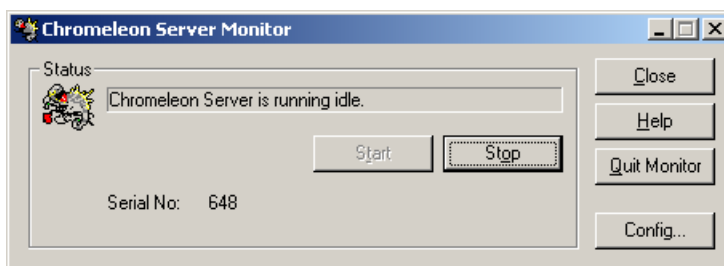


Figure B-8. Server Running

9. Click **Close** to close the Server Monitor window.
10. Go on to [Section B.5](#).

## B.5 Connecting the ICS-2000 to the Chromeleon PC

The ICS-2000 rear panel provides a USB receptacle for connecting the ICS-2000 to a USB port on the Chromeleon PC. The rear panel also provides two USB ports for connecting other Dionex USB-compliant modules to the system.

**IMPORTANT** Do not turn on the power to the ICS-2000 or other USB module(s) until after you connect the USB cable.

Before connecting the USB cable, verify that Chromeleon is installed. If not, Windows will be unable to identify the new USB device when the power is turned on. See [Section B.3](#) to install Chromeleon.

### B.5.1 Connecting the ICS-2000 to the PC

1. Locate the USB cable (P/N 960779) in the ICS-2000 Ship Kit (P/N 064375).
2. Plug the cable's "A" connector into a USB port on the Chromeleon PC and plug the cable's "B" connector into the USB receptacle (labeled **FROM PC**) on the ICS-2000 rear panel (see [Figure B-9](#)).

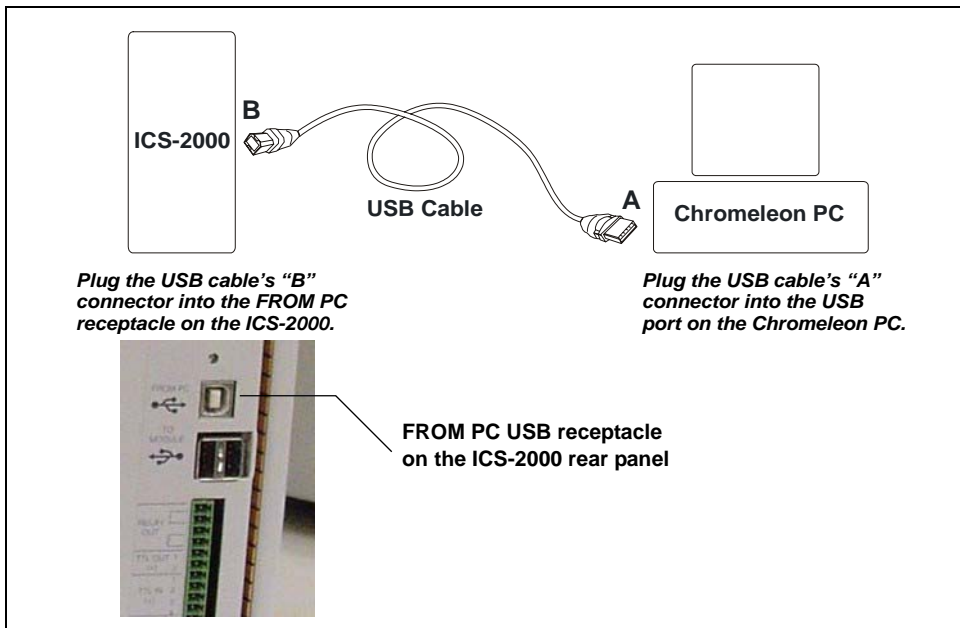


Figure B-9. Example Connections: One ICS-2000 Connected to the Computer

### B.5.2 Connecting Additional USB Devices

The ICS-2000 provides two USB ports for connecting additional Dionex USB-compliant modules to the system.

To connect an additional USB module, plug the “A” connector on a USB cable into an “A” port (labeled **TO MODULE**) on the ICS-2000 rear panel and plug the cable’s “B” connector into the USB receptacle on the USB module (see [Figure B-10](#)).

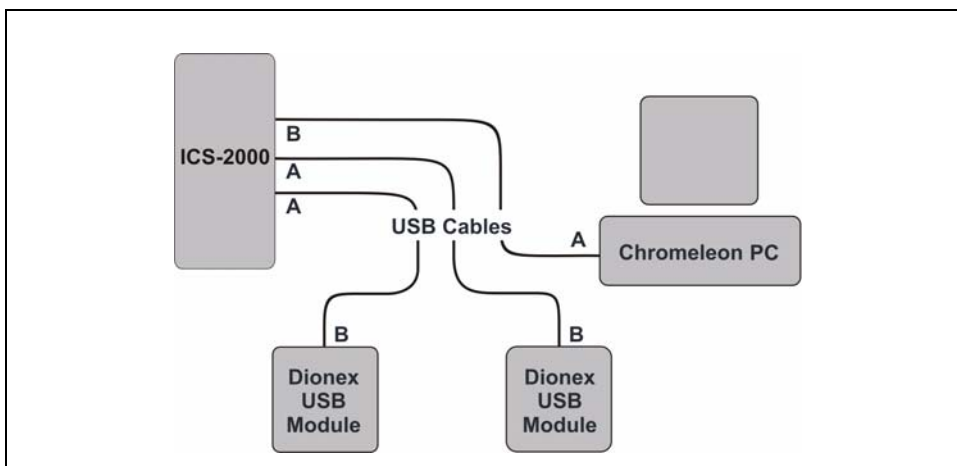


Figure B-10. Example Connections: Two Dionex USB Modules Connected to the ICS-2000

**NOTE** If the number of USB devices in the system exceeds the number of available USB ports, connect the devices to the system with a USB-compliant, full-speed external hub. One or more hubs is also required if the ICS-2000 or other USB device is more than 5 meters (16 ft) from the PC. Refer to the manual provided by the hub vendor for complete installation instructions.

**IMPORTANT**

The USB standard limits the USB cable length to 5 meters (16 ft). Each USB device can be separated from the PC by no more than five hubs. Thus, each USB device can be located no more than 30 meters (32 yds) from the PC.

## B.6 Connecting the Power Cord

Connect the power cord (IEC 320 C13) (ordered separately) from the main power receptacle on the rear panel to a grounded power source. The ICS-2000 power supply is auto-sensing, so no adjustment is required to select the line voltage.



**SHOCK HAZARD**—To avoid electrical shock, use a grounded receptacle. Do not operate the ICS-2000 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 ICS-2000 and is easily accessible.



Operation at AC input levels outside of the specified operating voltage range may damage the ICS-2000.



**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.

Go on to [Section B.7](#).



## B.7 Turning On the ICS-2000 Power

**IMPORTANT**

Before turning on the ICS-2000 power, verify that Chromeleon software is installed. See [Section B.3](#) for installation instructions. If Chromeleon is not installed first, Windows will be unable to identify the new USB device.



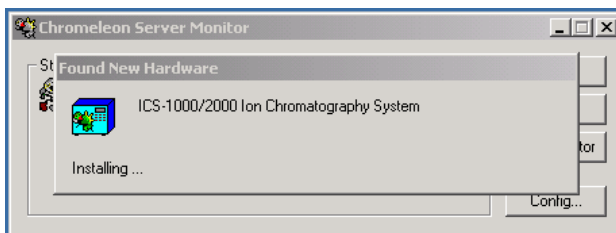
1. If it is not already on, turn on the computer power and log onto Windows 2000 or Windows XP as an administrator.
2. If the Chromeleon Server is not running (the icon on the taskbar is crossed out in red ), start the Server by right-clicking the icon and selecting **Start Server**. When the server starts, the icon changes to gray .
3. Press the power switch on the ICS-2000 rear panel (see [Figure B-11](#)) to turn on the power.

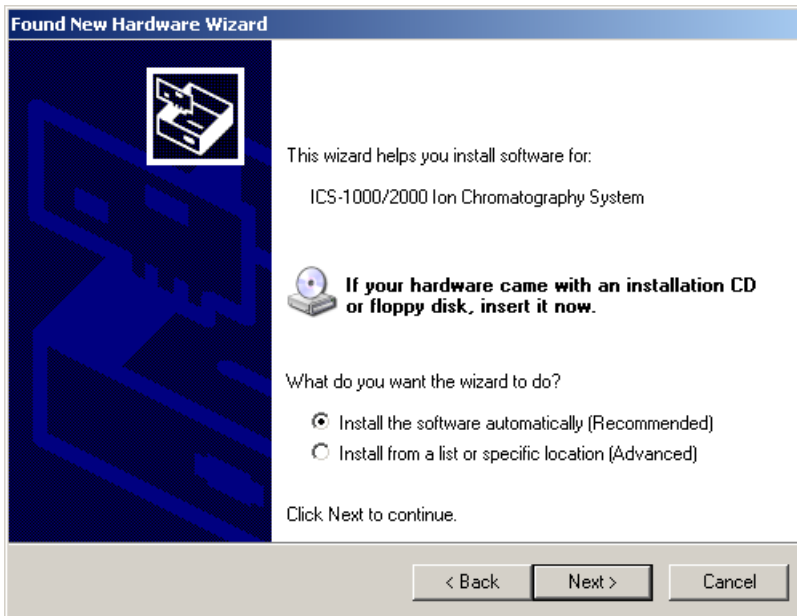


Figure B-11. ICS-2000 Rear Panel

4. Windows automatically detects the new USB device. A message flashes on the screen to inform you that new hardware was found.



- The Found New Hardware Wizard appears. This wizard installs the ICS-2000 device into the Windows Device Manager. Complete the wizard by selecting the following options:
  - If asked whether Windows can connect to Windows Update to search for software, select **No, not this time**.
  - Select the **Install the software automatically (Recommended)** option (see [Figure B-12](#)).



*Figure B-12. Windows Found New Hardware Wizard*

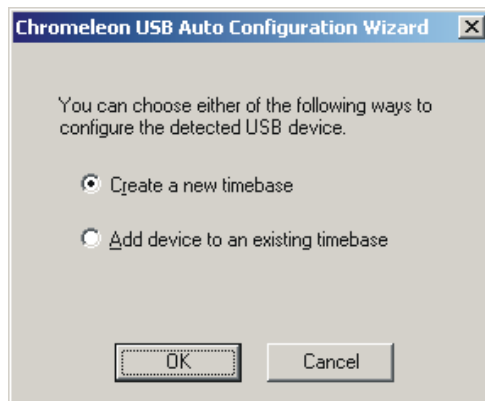
- After you click **Next**, Windows installs the software.
  - When the wizard finishes installing the software, click **Finish**.
- Go on to [Section B.8](#).

## B.8 Setting Up Chromeleon

**NOTE** This section provides brief instructions for setting up Chromeleon. For details about any of these steps, refer to the Chromeleon user's guide or online Help.

### B.8.1 Assigning the ICS-2000 to a Timebase

After the ICS-2000 power is turned on and the Windows Found New Hardware Wizard is finished, the Chromeleon USB Auto Configuration Wizard automatically appears. The wizard presents two options (see [Figure B-13](#)):



*Figure B-13. Chromeleon USB Auto Configuration Wizard: Page 1*

### To create a new timebase:

1. Select the **Create a new timebase** option and click **OK**.

Page 2 of the wizard appears (see [Figure B-14](#)).

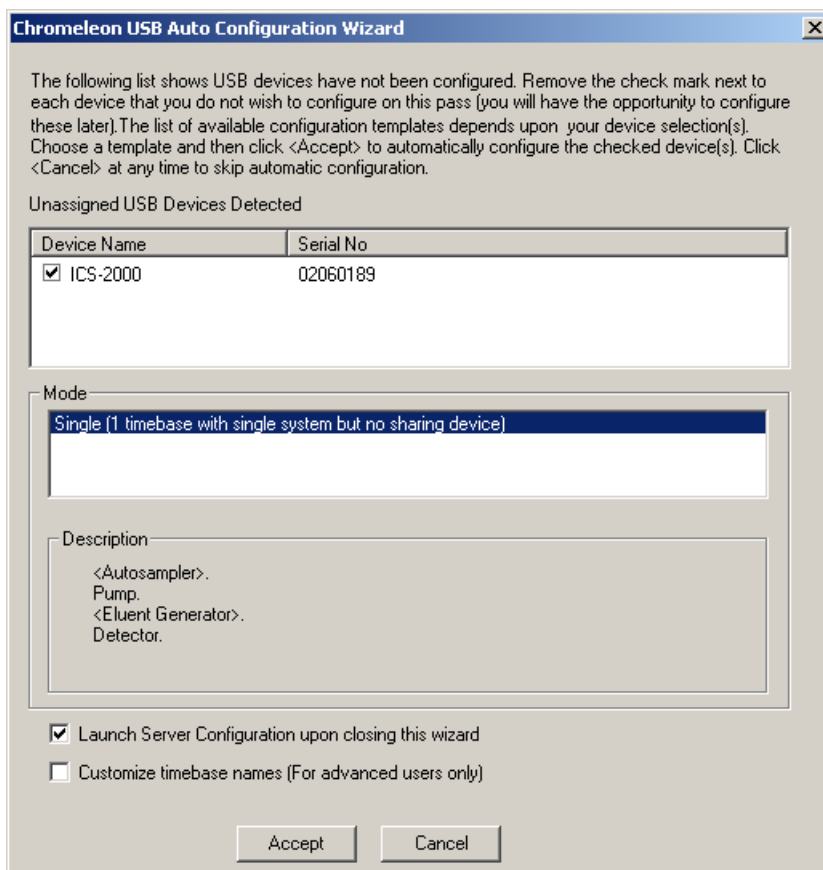


Figure B-14. Chromeleon USB Auto Configuration Wizard: Page 2

2. Review the names displayed in the **Unassigned USB Devices Detected** window. If the list includes the name of a device that you do not want to configure now, clear the check mark before the device name.

If you are installing more than one ICS-2000, you can verify the serial numbers for each by checking the label on the component panel. The serial number is also shown on the **INFORMATION** touch screen page.

3. In the **Mode** window, select a pre-defined configuration template for the new timebase. Typically for the ICS-2000, one configuration is available: **Single (1 timebase with single system but no sharing device)**. The **Description** box lists the devices included in the mode. Devices in brackets are optional.
4. Select the **Launch Server Configuration upon closing this wizard** check box.

The check box is disabled if the Server Configuration program is already running.

5. Click **Accept** to create a new timebase.

The Server Configuration automatically starts running when you close the wizard. If the Server Configuration was already running, it is updated with the new configuration information.

### **To add an unassigned USB device to an existing timebase:**

1. In the Chromeleon USB Auto Configuration Wizard, select the **Add device to an existing timebase** option and click **OK**.

This launches the Server Configuration program.

2. Select an existing timebase to which the ICS-2000 can be assigned.
3. When you finish making changes here, click **OK** to close the dialog box.

The Server Configuration program window appears.

### To verify the configuration:

1. In the Server Configuration program, click the + icon next to the server name to expand the folder. The timebase you created is displayed (see [Figure B-15](#)).

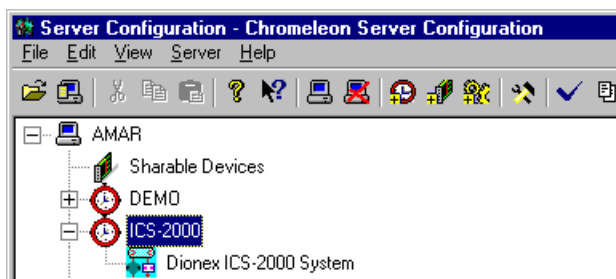


Figure B-15. Server Configuration with ICS-2000 Timebase

2. To verify that the ICS-2000 is correctly connected to the timebase, double-click its name under the timebase. Click **Yes** if the following message appears: “Communication to the device will be stopped...Do you want to continue?”

3. The ICS-2000 System dialog box opens (see [Figure B-16](#)). The **General** page shows the Device Name (**Pump\_ECD**), the Mode (**Live**), and the Module Serial No.

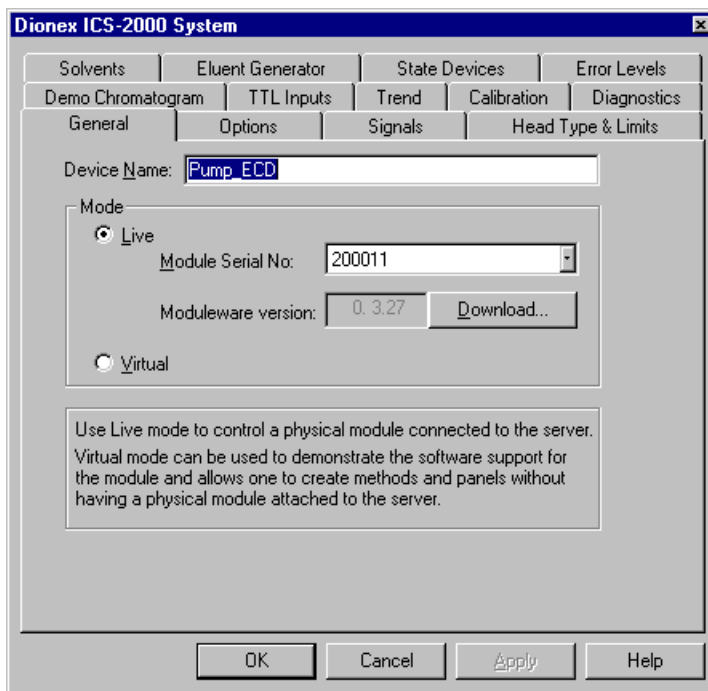



Figure B-16. ICS-2000 System Properties

4. Close the dialog box and then save the configuration (select **File>Save Installation**).
5. If you are going to add one or more DX-LAN devices to the timebase, go on to [Section B.8.2](#). Otherwise, exit the Server Configuration program and then go on to [Section B.9](#).

## B.8.2 Assigning DX-LAN Devices to the Timebase (Optional)

Follow the instructions in this section if you are adding one or more devices to the timebase that are connected to the PC through a DX-LAN interface (not through USB connections).

1. Follow the instructions in *Installing the Chromeleon Chromatography Management System with a Dionex Ion Chromatography (IC)* (Document No. 031883) to add the DX-LAN card to the server configuration as a sharable device.
2. Select the timebase that was created for the ICS-2000 (see [Figure B-17](#)); then, click the **Add device** icon  on the toolbar (or select **Edit>Add Device**).

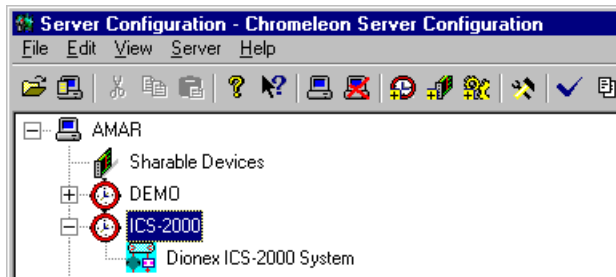


Figure B-17. Example: ICS-2000 Timebase

The Add device to timebase dialog box appears.



- Under **Manufacturers**, select **Dionex: IC Modules** and then select the device from the **Devices** list.

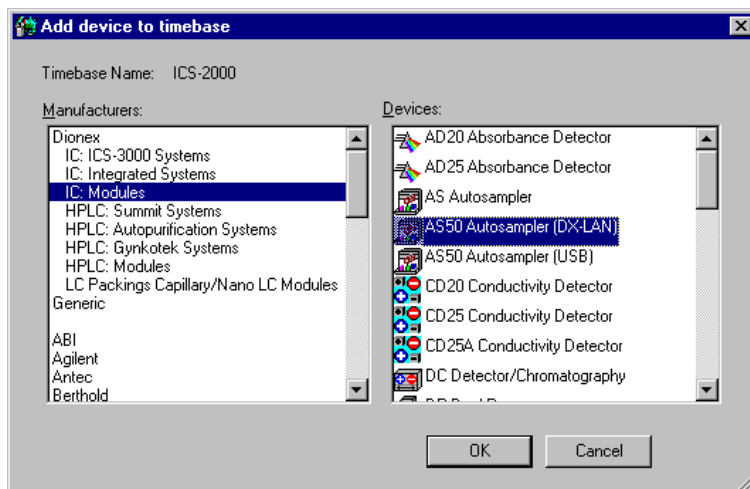


Figure B-18. Add Device to Timebase Dialog Box

- Click **OK**. A configuration properties dialog box for the device appears. [Figure B-19](#) shows an example of the properties for an AS50 Autosampler.

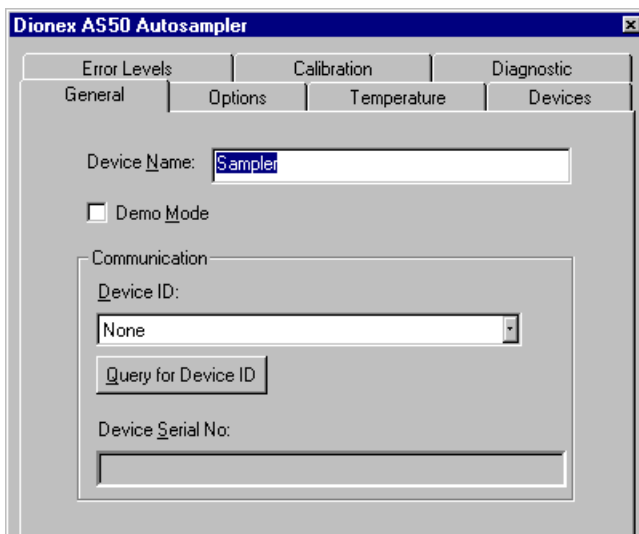


Figure B-19. AS50 Configuration Properties

5. On the **General** tab page, clear the **Demo Mode** check box if it is currently selected, and then select the DX-LAN Device ID number.  
**Note:** Devices display their DX-LAN ID numbers when their power is turned on.
6. Click **OK** to close the dialog box.
7. Save the configuration (select **File>Save Installation**).
8. Exit the Server Configuration program.
9. Go on to [Section B.9](#).

### B.9 Installing and Plumbing the Columns and Suppressor

**NOTE** This section provides brief installation and plumbing instructions for the columns and suppressor. Before beginning the installation, refer to the column and suppressor manuals for detailed start-up and installation instructions. The manuals are provided on the Dionex Reference Library CD-ROM (P/N 053891).

Before beginning:

- Remove the guard column, separator column, and suppressor from their boxes.
- Remove the fitting plugs from the ends of each column and from all ports on the suppressor.
- Discard any tubing temporarily connecting the suppressor ports.

#### B.9.1 Setting Up the Column Heater

1. Cut off the two shipping ties from the column heater and remove them (see [Figure B-20](#)).
2. Loosen the two thumbscrews on the heater cover (they remain attached to the cover).
3. Pull the heater cover straight out to remove it.

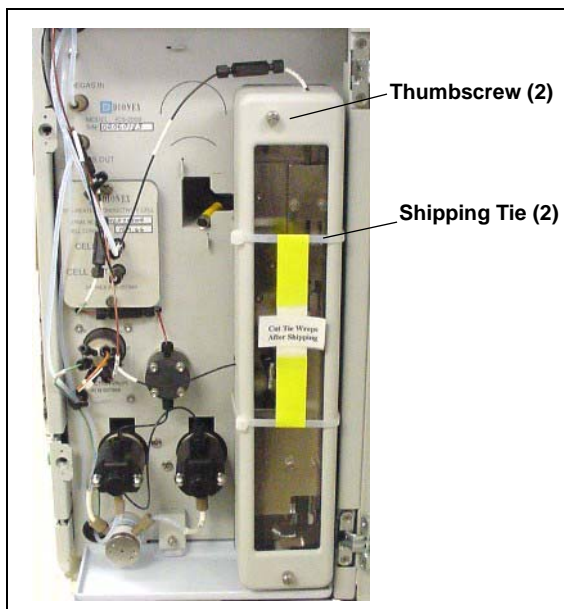


Figure B-20. ICS-2000 Column Heater Setup

4. Unscrew the six thumbscrews on the top metal plate (see [Figure B-21](#)) and remove the plate.
5. Go on to [Section B.9.2](#).

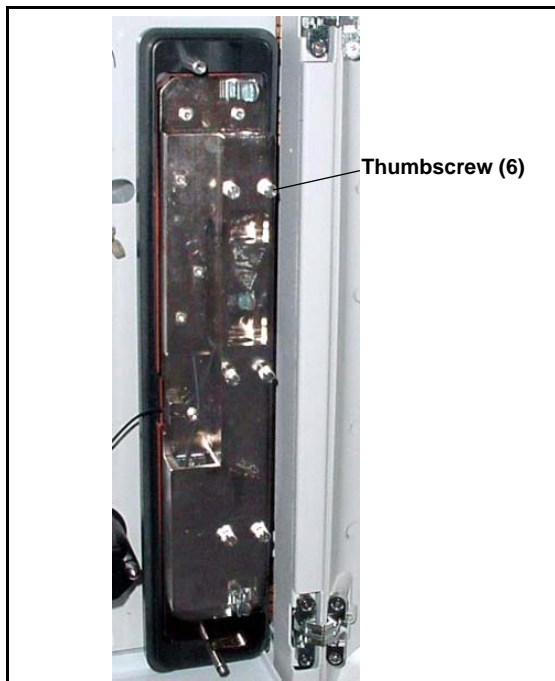


Figure B-21. ICS-2000 Column Heater Cover Removed

### B.9.2 Installing the Columns

1. Remove the coupler connecting **GUARD IN** and **GUARD OUT**.
2. Connect **GUARD IN** to the guard column inlet. Check the arrow on the column label; it should point down (flow away from the injection valve).
3. Connect **GUARD OUT** to the guard column outlet.
4. Push the guard column onto the back column clip.
5. Remove the coupler connecting **COL IN** and **COL OUT**.
6. Connect **COL IN** to the separator column inlet. Connect **COL OUT** to the separator column outlet. Check the arrow on the column label. It should point up (flow toward the cell).
7. Push the separator column onto the front column clips.
8. Replace the top metal plate on the column heater.

### B.9.3 Installing the Suppressor

1. Locate the suppressor mounting tabs on the component panel (see [Figure B-22](#)). Reach into the opening between the tabs and pull the yellow connector and attached cable slightly out of the opening.
2. Connect this cable to the cable from the suppressor (align the pins on the two connectors and push them together).

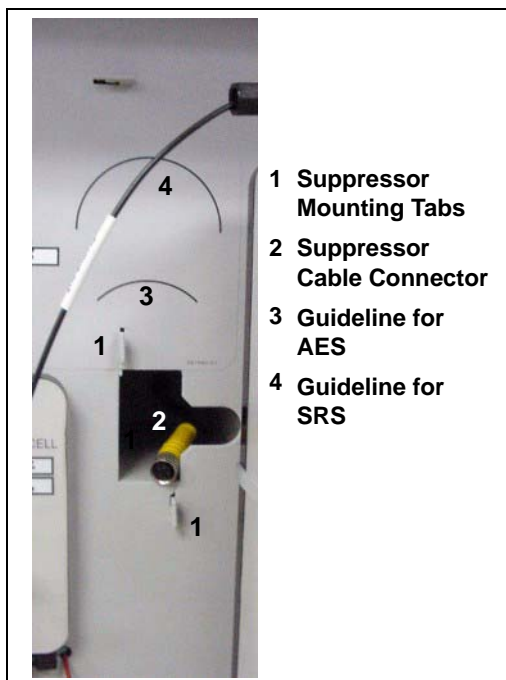


Figure B-22. Suppressor Mounting Tabs and Guidelines

3. Orient the suppressor with the **REGEN OUT** fitting on top and the cable to the right.
4. Feed the cable into the opening in the component panel.
5. Align the top of the suppressor with the guideline printed on the component panel (see [Figure B-22](#)) and align the slots on the rear of the suppressor with the tabs on the panel.

6. Press the suppressor onto the tabs and then slide it down to lock it in place. Pull slightly on the center of the suppressor to verify that it is securely fastened. [Figure B-23](#) shows an SRS suppressor installed on the component panel.
7. Remove the coupler connecting **ELUENT IN** and **ELUENT OUT** and connect these lines to the corresponding ports on the suppressor.



*Figure B-23. Suppressor Installed  
(SRS Shown)*

8. Remove the fitting plug from **REGEN IN** and connect it to the **REGEN IN** port on the suppressor. **Do not connect the REGEN OUT port until after completing the eluent generator setup** ([Section B.14](#)).
9. Replace the cover on the column heater, making sure the **GUARD IN** line is aligned with the slot on the side of the heater cover.
10. Go on to [Section B.10](#).

## B.10 Connecting the Waste Lines

The ICS-2000 has the following waste lines:

- **PUMP WASTE** carries prime waste from the pump.
  - **TO WASTE OUT** carries sample overflow from the injection valve.
  - **WASTE, GAS SEPARATOR** carries system waste from the suppressor.
1. Untape the coiled waste lines from the rear panel. Place the ends of the **PUMP WASTE** and **TO WASTE OUT** lines into a waste container.
  2. Direct the **WASTE, GAS SEPARATOR** line from the top of the ICS-2000 to the rear panel. Snap the line onto one of the tubing clips on the rear panel. Connect the line to the gas separator waste tube (see [Section B.10.1](#)).

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

### B.10.1 Installing the Gas Separator Waste Tube

1. Locate the gas separator waste tube assembly in the ICS-2000 Ship Kit (P/N 064375).
2. Connect the **WASTE, GAS SEPARATOR** line from the suppressor to one of the 3-mm (1/8-in) ID white Teflon lines on the gas separator waste tube assembly (see [Figure B-24](#)).

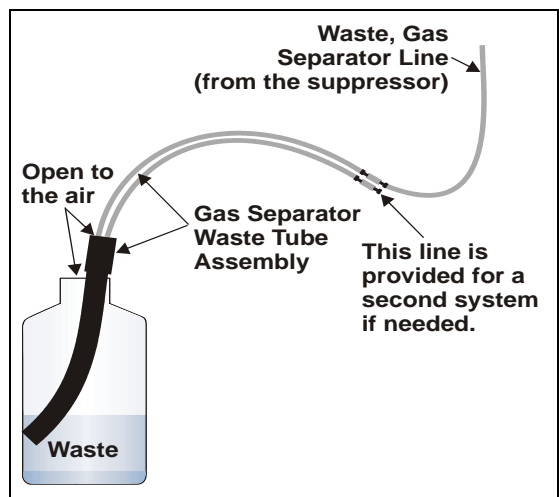


Figure B-24. Gas Separator Waste Tube Installation

3. Place the gas separator waste tube assembly into the waste container. Make sure the tubing junction (where the white Teflon tubing meets the black polyethylene tubing) is above the top of the container and

that the gas separator waste tube and the waste container are open to the atmosphere.

4. Go on to [Section B.11](#).



**DO NOT CAP THE WASTE CONTAINER:** The ICS-2000, Atlas Electrolytic Suppressor, and Self-Regenerating Suppressor (SRS) use an electrolytic process that results in the production of small amounts of oxygen or hydrogen gas. To ensure that the gas is not trapped in a closed container and allowed to concentrate, install a 1.3-cm (0.52-in) ID black gas separator waste tube (P/N 045460) in an uncapped waste container. Connect the Waste, Gas Separator line to the waste tube (see [Figure B-24](#)).



**NE FERMEZ PAS LE CONTENEUR DE GAZ RÉSIDUEL:** Le ICS-2000, le Atlas Electrolytic Suppressor, et le Self-Regenerating Suppressor (SRS) travaillent avec un proces d'électrolyse, qui produit des petites quantités de gaz d'oxygène ou d'hydrogène. Afin de garantir que le gaz ne soit pas enfermé dans un conteneur fermé et puisse s'y concentrer, connectez un tube noir à gaz résiduel (diamètre intérieur = 1,3 cm; n° de commande 045460) à un conteneur ouvert (non fermé). Connectez le conteneur résiduel au tube résiduel/gaz séparateur (désigné: « Waste, Gas Separator »).



**VERSCHLIESSEN SIE DEN ABFALLBEHÄLTER NICHT:** Der ICS-2000, Atlas Electrolytic Suppressor und Self-Regenerating Suppressor (SRS) verwenden einen Elektrolyseprozess, wodurch kleine Mengen an Sauerstoff und Wasserstoff entstehen. Führen Sie einen schwarzen Gasabscheiderschlauch (ID = 1,3 cm; Bestell-Nr. 045460) in einen offenen (unverschlossenen) Abfallbehälter, damit sich das Gas nicht in einem geschlossenen Behälter sammelt und aufkonzentriert. Verbinden Sie die mit Waste, Gas Separator bezeichnete Leitung mit dem Abfallschlauch.



## **B.11 Setting Up the Eluent Reservoir**

1. Rinse the eluent reservoir.
2. Fill the reservoir with ASTM filtered, Type I (18-megohm) deionized water.
3. Place the reservoir on top of the ICS-2000.
4. Install the cap and handtighten.

**NOTE** The ICS-2000 does not require pressurized reservoirs. However, if eluent is manually degassed or is sensitive to contamination, Dionex recommends pressurizing the reservoir with helium or nitrogen. See [Section B.21](#) for instructions.

5. Go on to [Section B.12](#).

## B.12 Setting the Eluent Level

After filling the reservoir, open the touch screen **HOME** page and enter the volume of liquid in the reservoir in the **Eluent Level** field (see [Figure B-25](#)), or enter the volume in the **Eluent Bottle** field on the Chromeleon Control panel (see [Figure B-26](#)). The ICS-2000 determines the eluent usage, by monitoring the flow rate and the length of time the pump is on, and updates the field as the eluent is used up. A warning is displayed if the level falls below 200 mL. The warning is repeated at 100 mL and at 0 mL.

**IMPORTANT**

In order for the eluent level displayed on the screen to be accurate, the level must be entered by the user when the reservoir is filled. The ICS-2000 does not automatically detect when the reservoir is filled, nor when it is empty.

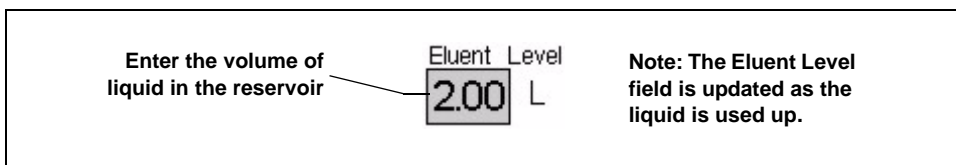


Figure B-25. Home Page: Setting the Eluent Level

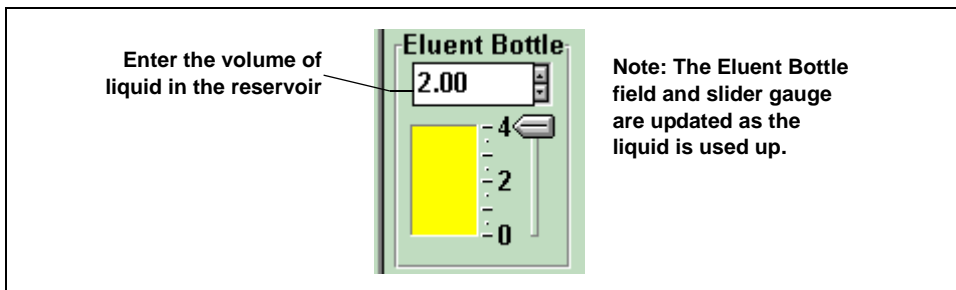


Figure B-26. Chromeleon Control Panel: Setting the Eluent Level

Go on to [Section B.13](#).

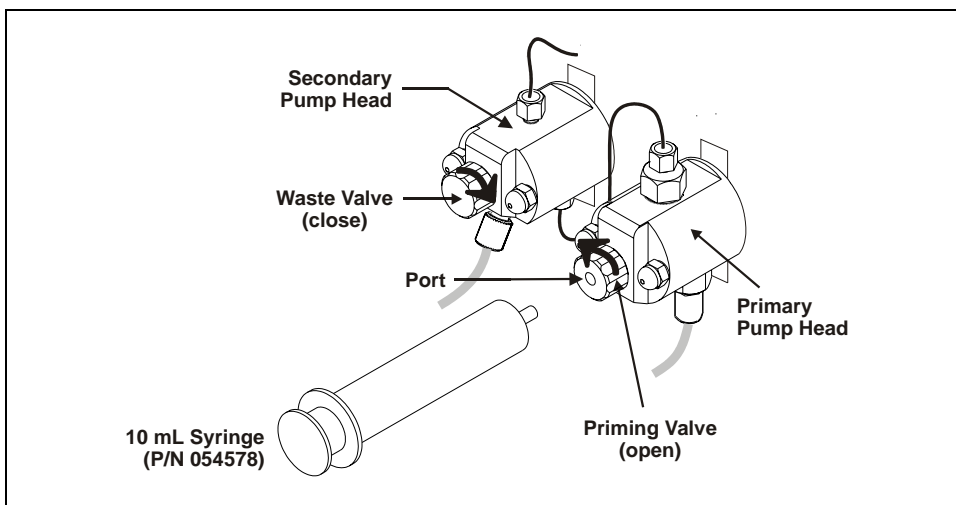
## **B.13 Priming the Pump**

1. Verify that the eluent reservoir is filled, the reservoir cap is installed and handtightened, and the liquid line from the ICS-2000 to the reservoir cap is connected (see [Section B.11](#)).
2. Verify that the waste lines are directed to a waste container.
3. The priming procedure consists of two parts:
  - Priming the eluent lines with a syringe (see [Section B.13.1](#)). Perform this procedure at initial installation, after changing eluents, or when eluent lines are empty.
  - Priming the pump heads with the **Prime** button (see [Section B.13.2](#)). Perform this procedure after the eluent lines are primed.


### B.13.1 Priming the Eluent Lines with a Syringe

**NOTE** Prime the eluent lines after initial installation, after changing eluents, or when eluent lines are empty.

1. Verify that the pump is turned off.
2. Connect a 10 mL syringe (P/N 054578) to the port in the priming valve on the primary pump head (see [Figure B-27](#)).



*Figure B-27. Priming the Eluent Lines*

3. Open the priming valve by turning it one-quarter to one-half turn counterclockwise.
4. On the ICS-2000 touch screen, touch the page name (for example, ) in the bottom right corner to open a menu of pages.

5. Touch **PUMP** to open the touch screen **PUMP** page (see [Figure B-28](#)). Under **Eluent Valve**, touch the **Open** button.

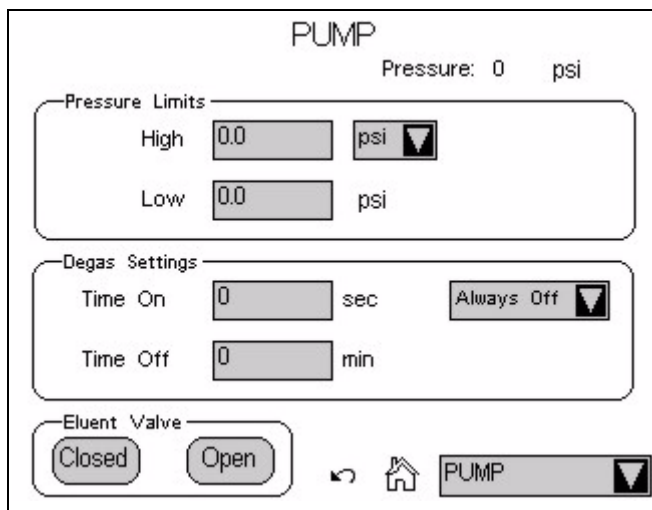


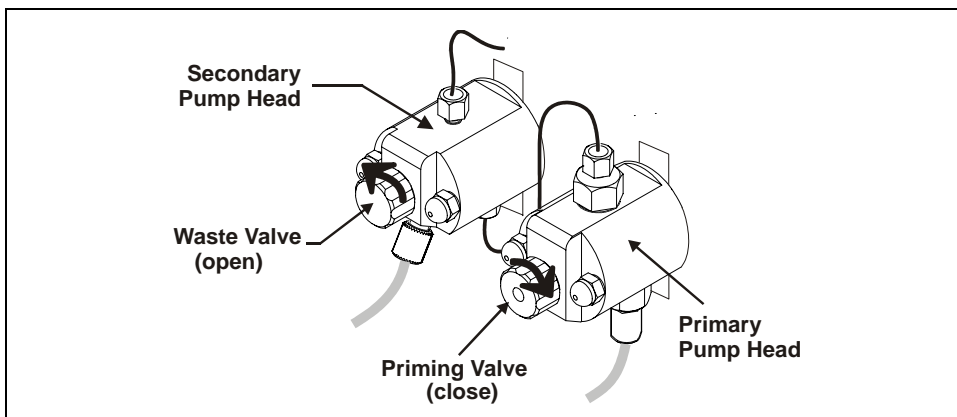
Figure B-28. Pump Page: Eluent Valve Open

6. Draw the syringe back to begin pulling eluent through the flow path. It may take several syringe draws to remove all air or previous eluent from the tubing. Draw out a minimum of 20 mL of eluent to ensure that the vacuum degas assembly is primed.
7. After priming the lines thoroughly, close the priming valve. **Do not overtighten the priming valve.**
8. Touch **Eluent Valve Closed** on the touch screen **PUMP** page.

### B.13.2 Priming the Pump Heads with the Prime Button

**NOTE** Perform this procedure after priming the eluent lines (see [Section B.13.1](#)).

1. Check that the priming valve on the primary pump head is closed (see [Figure B-29](#)).



*Figure B-29. Priming the Pump*

2. Open the waste valve on the secondary pump head by turning the knob one-quarter to one-half turn counterclockwise (see [Figure B-29](#)). Opening the valve directs the eluent flow path to waste and eliminates backpressure.
3. Touch **Prime** on the ICS-2000 touch screen **HOME** page. Confirm that the waste valve is open by pressing **OK** when the reminder message appears. The pump will begin pumping at approximately 3 mL/min.
4. Continue priming the ICS-2000 until no air bubbles are exiting the pump waste line.
5. Press **Pump Off**.
6. Close the waste valve. **Do not overtighten**. The pump is now ready for operation.
7. Go on to [Section B.14](#).

**NOTE** If the two standard priming procedures described above are unsuccessful, prime the pump with isopropyl alcohol. See [Section 5.15](#) for instructions.

## B.14 Setting Up the Eluent Generator

### Before Beginning

Remove the EluGen cartridge (EGC) and the other items to be installed from their shipping containers. Depending on the type of eluent to be generated, the other items may include a Continuously Regenerated Trap Column (CR-TC), an EPM Electrolytic pH Modifier, and/or an EGC CO<sub>3</sub> Mixer.

**NOTE** The EGC degas assembly is installed inside the EGC holder at the factory.



The EluGen cartridge contains one of the following: a corrosive base (KOH, LiOH, or NaOH), a corrosive acid (MSA), or a concentrated K<sub>2</sub>CO<sub>3</sub> solution. Wear protective eyewear and gloves when handling the cartridge.



La cartouche d'EluGen contient un de ce qui suit: une base corrosive (KOH, LiOH, ou NaOH), un acide corrosif (MSA), ou une solution concentrée de K<sub>2</sub>CO<sub>3</sub>. Porter des lunettes et des gants protectives en manipulant la cartouche.



Die EluGen-Kassette enthält eine korrodierende Base (KOH, LiOH oder NaOH), eine korrodierende Säure (MSA) oder eine konzentrierte K<sub>2</sub>CO<sub>3</sub>-Lösung. Tragen Sie daher beim Umgang mit Kassette eine Schutzbrille und Handschuhe.

Refer to the EluGen cartridge, CR-TC, and EPM manuals for the optimal operating conditions for your application. The manuals are provided on the Dionex Reference Library CD-ROM (P/N 053891).

### B.14.1 Eluent Generator Setup for KOH, LiOH, MSA, and NaOH Eluents

Follow the instructions in this section if you are installing a KOH, LiOH, MSA, or NaOH EluGen cartridge and a CR-TC.

- If you are installing a  $K_2CO_3$  cartridge, an EPM, and an EGC  $CO_3$  Mixer (for generating carbonate/bicarbonate eluent), go to [Section B.14.2](#).
- If you are installing a  $K_2CO_3$  cartridge and an EGC  $CO_3$  Mixer (for generating carbonate eluent), go to [Section B.14.3](#).

#### Overview

The eluent generator setup procedure for KOH, LiOH, MSA, or NaOH eluents consists of the following main steps:

- Installing the CR-TC.
- Installing the EluGen cartridge.
- Connecting the EluGen cartridge vent line.
- Recording the EluGen cartridge serial number in Chromeleon.
- Conditioning the EluGen cartridge.
- Hydrating the CR-TC.
- Completing the eluent generator setup.



### Items Required to Complete the Setup Procedure

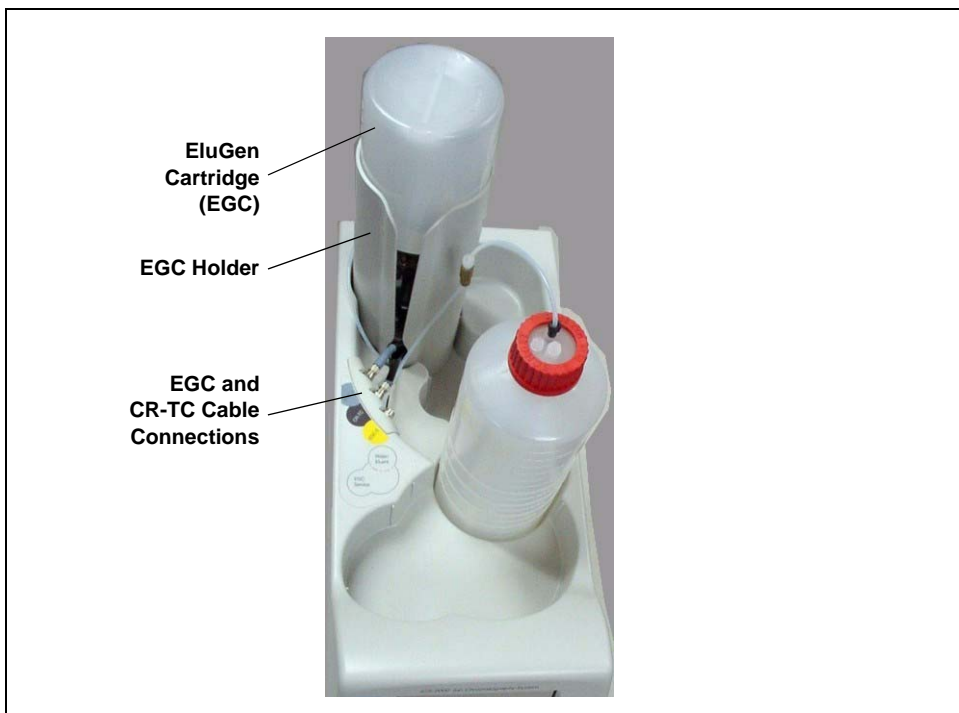
In addition to the EluGen cartridge and the CR-TC, you will need the following items to complete the eluent generator setup.

Item	P/N	Use To
Yellow 0.5 mL/min, 7 MPa (1000 psi) backpressure coil (supplied in the ICS-2000 Ship Kit (P/N 064375))	053765	Provide backpressure during setup procedures.
EluGen Cartridge Vent Line Tubing Kit (supplied with the cartridge)	063092	Vent the cartridge during operation.
10-32 to 1/4-28 coupler (supplied in the ICS-2000 Ship Kit)	042806	Temporary connection during setup procedures.
Temporary waste container (beaker, bottle, etc.) (not supplied)	n/a	Collect waste during setup procedures.
10-32 fittings 10-32 ferrules	043275 043276	Complete the connections
1/8-in fittings 1/8-in ferrules	052267 048949	Complete the connections

## ICS-2000 Ion Chromatography System

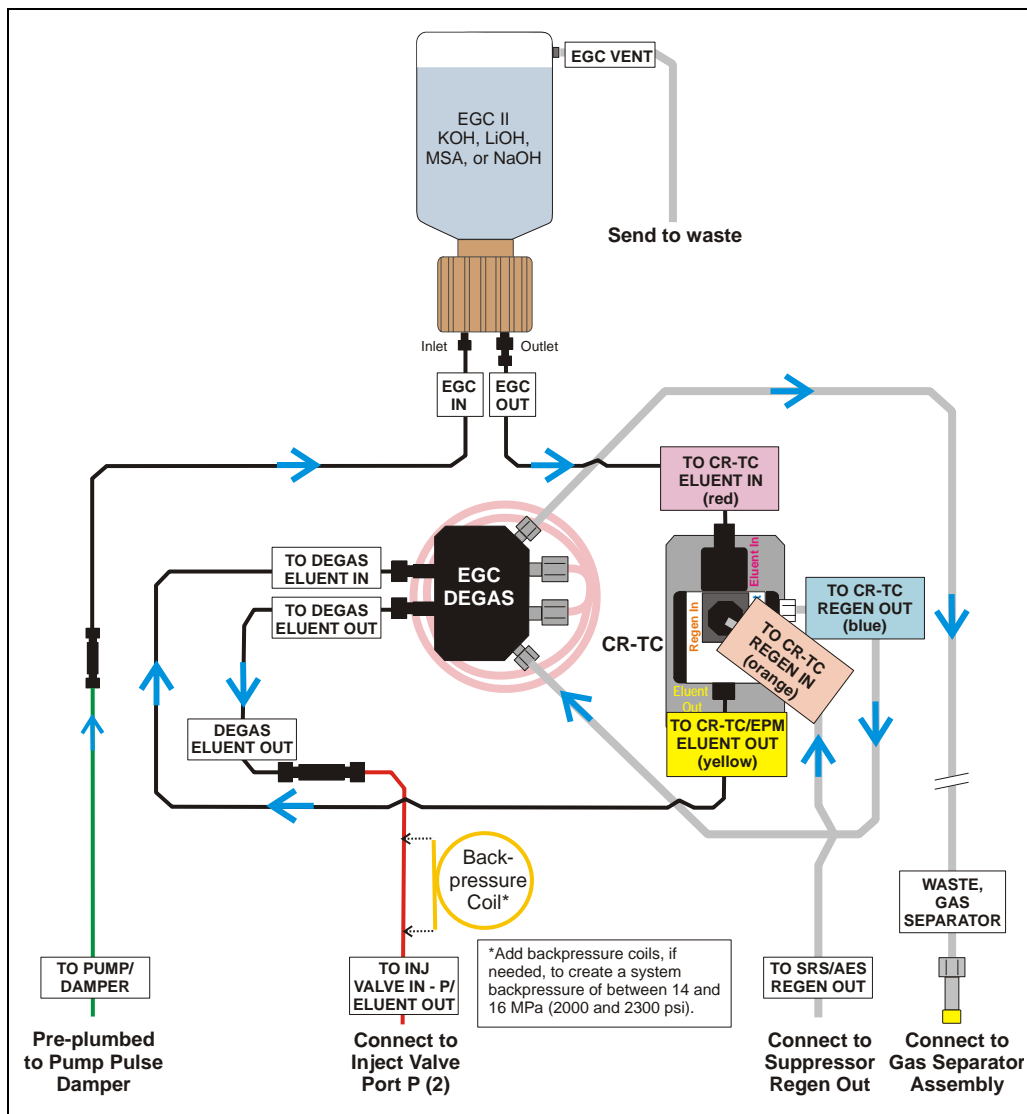
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[Figure B-30](#) illustrates the ICS-2000 after the EluGen cartridge is installed.



*Figure B-30. ICS-2000 with an EluGen Cartridge Installed (Top View)*

[Figure B-31](#) illustrates the liquid flow path through the eluent generator components after all setup steps are complete and the eluent generator is ready for operation.



*Figure B-31. Eluent Generator Flow Schematic with CR-TC:  
Use for Generating KOH, LiOH, MSA, or NaOH Eluent*

## Installing the CR-TC

1. Tilt the cartridge holder to view the bottom of the holder and brace the holder against the back corner of the ICS-2000 (see [Figure B-32](#)).



Figure B-32. Cartridge Holder (tilted to view the bottom)

2. Before installing the CR-TC, note the metal ball stud inside the bottom of the cartridge holder (see [Figure B-32](#)) and the bracket on the CR-TC mounting plate (see [Figure B-33](#)). These are used to mount the CR-TC inside the holder after it is plumbed.

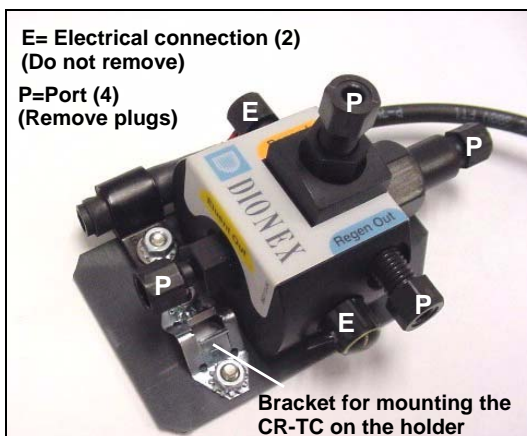


Figure B-33. CR-TC

3. Remove the plugs from the four ports, labeled “P” in [Figure B-33](#). Do not remove the two electrical connections, labeled “E” in the figure.

4. With the CR-TC oriented as shown in [Figure B-34](#), connect each line to the corresponding port on the CR-TC.

**NOTE** To help retain the fittings and ferrules on the lines, remove the coupler from each line just before connecting the line to a port.

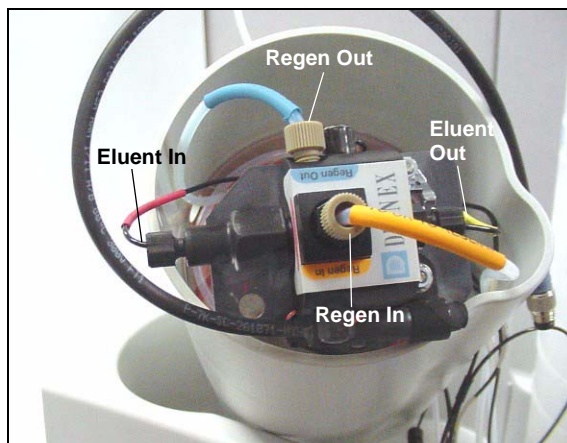


Figure B-34. Plumbed CR-TC

5. Check that none of the lines are caught under the CR-TC and then push the CR-TC onto the metal stud inside the EGC holder (see [Figure B-35](#)). Push down until the CR-TC snaps into place.

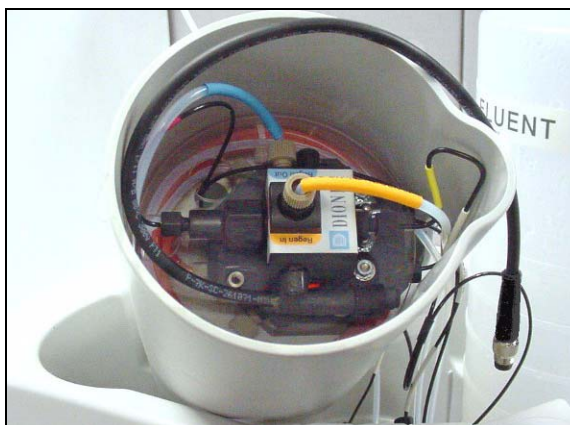
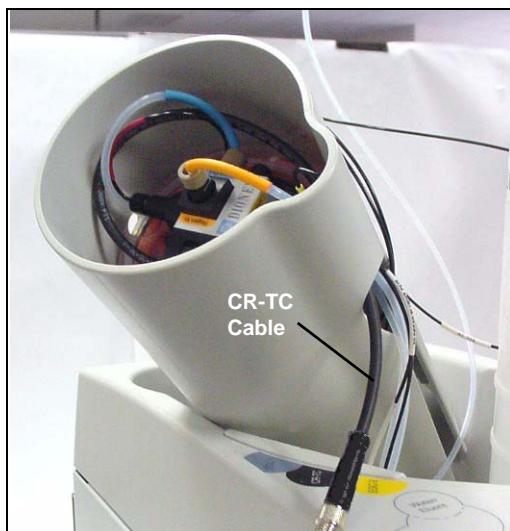


Figure B-35. CR-TC Installed in Holder

6. Feed the CR-TC cable through the slot on the side of the EGC holder (see [Figure B-36](#)).

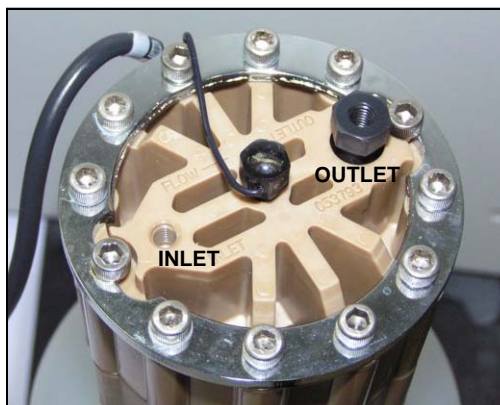


*Figure B-36. Installing the CR-TC*

7. Turn the EGC holder right-side up and set it back into position.

### Installing the EluGen Cartridge

1. Orient the EluGen cartridge with the fittings facing up and remove the plugs from the EluGen cartridge **INLET** and **OUTLET** ports (see [Figure B-37](#)).



*Figure B-37. EluGen Cartridge Inlet and Outlet Ports*

2. Set the EluGen cartridge in the service area on top of the ICS-2000 and orient it with the cable toward the EGC holder (see [Figure B-38](#)).



Figure B-38. EluGen Cartridge in Service Area

3. Pull the coiled black **EGC IN** and **EGC OUT** lines out slightly from the cartridge holder.
4. Disconnect the **EGC IN** line from the union that connects it to the **EGC OUT** line.
5. Connect **EGC IN** to the **EGC INLET** port (see [Figure B-39](#)).

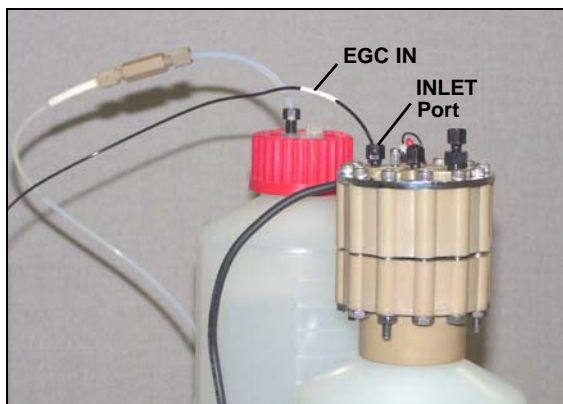


Figure B-39. EGC Inlet Port Connections

6. Locate the yellow 0.5 mL/min, 7 MPa (1000 psi) backpressure coil (P/N 053765) in the ICS-2000 Ship Kit (P/N 064375).
7. Connect one end of this coil to the EGC **OUTLET** port (see [Figure B-40](#)). Leave the other end of the coil unconnected.

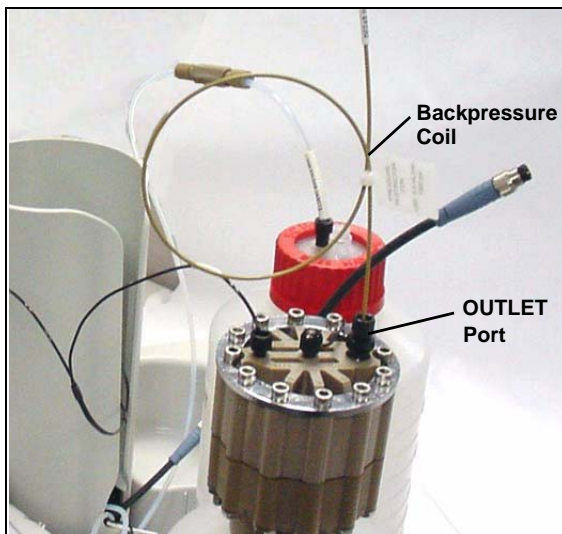


Figure B-40. EGC Outlet Connection for Conditioning the EGC

**NOTE** The backpressure coil connection is temporary; it is required only during the EluGen cartridge conditioning procedure described in [“Conditioning the EluGen Cartridge”](#) on page B-48.

8. Turn the EluGen cartridge over (with the fittings facing down). **Shake the EluGen cartridge vigorously, and tap it with the palm of your hand 10 to 15 times.** Check that all bubbles trapped in the eluent generation chamber are dislodged.



The EluGen cartridge contains one of the following: a corrosive base (KOH, LiOH, or NaOH), a corrosive acid (MSA), or a concentrated  $K_2CO_3$  solution. Wear protective eyewear and gloves when handling the cartridge.



La cartouche d'EluGen contient un de ce qui suit: une base corrosive (KOH, LiOH, ou NaOH), un acide corrosif (MSA), ou une solution concentrée de  $K_2CO_3$ . Porter des lunettes et des gants protectives en manipulant la cartouche.



Die EluGen-Kassette enthält eine korrodierende Base (KOH, LiOH oder NaOH), eine korrodierende Säure (MSA) oder eine konzentrierte  $K_2CO_3$ -Lösung. Tragen Sie daher beim Umgang mit Kassette eine Schutzbrille und Handschuhe.



- Slide the EluGen cartridge down into the holder until it stops. Make sure the cable and backpressure coil remain out of the holder (see [Figure B-41](#)).

**NOTE** To avoid crimping the lines inside the holder, do not twist the cartridge when you slide it into the holder. The lines are designed to coil inside the holder.



Figure B-41. Installing the EluGen Cartridge in the Holder

- Remove the plug from the **EGC-1** connector on top of the ICS-2000.
- Orient the cartridge's blue 4-pin electrical cable connector as shown in [Figure B-42](#). Push it onto the **EGC-1** connector on the ICS-2000. Twist the ring on the cable connector fingertight to secure it.



Figure B-42. Connecting the EluGen Cartridge Cable

## Connecting the Vent Line

1. Locate the vent line tubing kit (P/N 063092) supplied with the EluGen cartridge. Slide the label onto one end of the tubing and then push the barbed luer lock onto the tubing.
2. Unscrew and remove the plug from the vent opening on the side of the EluGen cartridge (see [Figure B-43](#)).



Figure B-43. EluGen Cartridge Vent Plug

3. Screw the luer adapter onto the vent opening. Remove the cap on the luer adapter by twisting. **Save the cap.**
4. Twist the luer lock and EluGen cartridge vent line into the luer adapter (see [Figure B-44](#)).

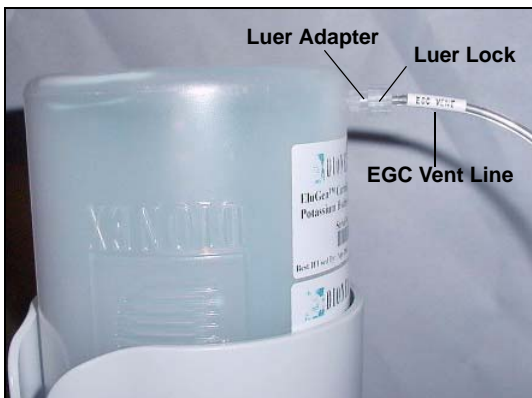


Figure B-44. Installing the EluGen Cartridge Vent Line

**NOTE** To prevent leaks from the EluGen cartridge, always replace the luer adapter cap before moving the EluGen cartridge.

5. Direct the EluGen cartridge vent line to the rear of the ICS-2000 and snap it onto one of the tubing clips on the rear panel.
6. Direct the vent line to the waste container and insert it down into the gas separator waste tube about 10 to 15 cm (4 to 6 in).

### Recording the EluGen Cartridge Serial Number in Chromeleon

The serial number is printed on the EluGen cartridge label.

1. Open the Chromeleon Server Configuration program (select **Start > Programs** (or **All Programs**) > **Chromeleon > Server Configuration**).
2. Double-click the ICS-2000 system icon. The properties dialog box for the ICS-2000 appears.
3. Click the **Eluent Generator** tab (see [Figure B-45](#)).
4. Select the **EGC-1** check box and enter the EluGen cartridge serial number.
5. Click **OK**.

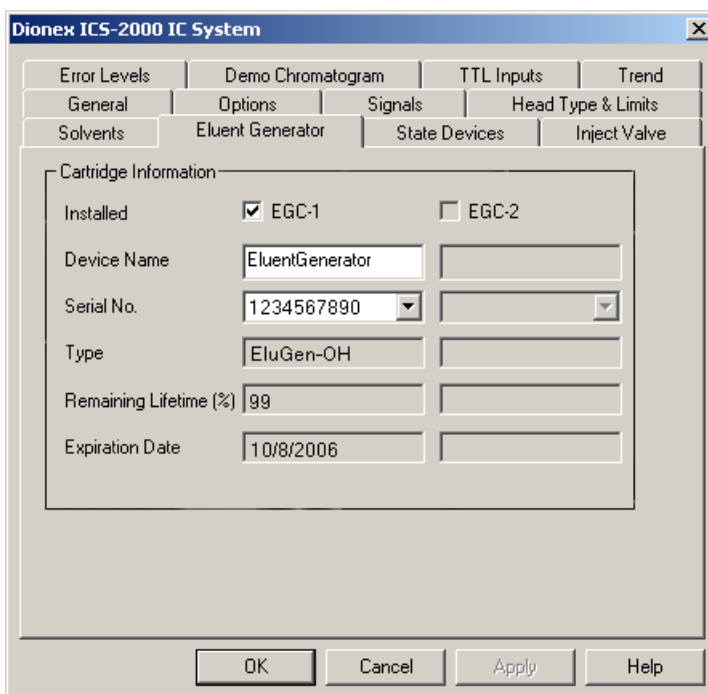


Figure B-45. Eluent Generator Configuration Properties Example

### Conditioning the EluGen Cartridge

After completing the installation steps described in the previous sections, condition the EluGen cartridge for 30 minutes.

1. Set a temporary waste container, such as a beaker, on top of the ICS-2000 and direct the yellow backpressure coil from the EluGen cartridge **OUTLET** port to the container.
2. On the ICS-2000 touch screen **HOME** page, set the pump flow rate to **1.00 mL/min**.
3. Touch the **EGC** button on the **HOME** page to open the **ELUENT GENERATOR** page. Set the EGC concentration to **50 mM**.
4. Verify that the suppressor and CR-TC are off.

**IMPORTANT**

To avoid damaging the suppressor and CR-TC, always turn off the suppressor and CR-TC before conditioning the EluGen cartridge. The pump flow is on during conditioning, however, no flow reaches the suppressor or CR-TC.

5. Verify that the **Automatically turn on with pump** options are not selected on the ICS-2000 touch screen **SUPPRESSOR** page (see [Section C.9](#)) and **ELUENT GENERATOR** page (see [Section C.8](#)). Disabling these options lets you turn on the pump, without automatically turning on the suppressor and CR-TC.
6. Verify that the eluent reservoir is filled with ASTM filtered, Type 1 (18 megohm-cm) deionized water (see [Section B.11](#)).
7. Turn on the pump.
8. Turn on the EluGen cartridge.
9. Run at the selected settings (1.00 mL/min at 50 mM) for 30 minutes.
10. Turn off the EluGen cartridge.
11. Turn off the pump.
12. Disconnect the EluGen cartridge cable.
13. Remove the backpressure tubing from the waste container and remove the waste container.
14. Lift the EluGen cartridge out of the holder, turn it over, and set it in the service area.

15. Disconnect the backpressure coil from the EluGen cartridge **OUTLET** port.
16. Connect the **EGC OUT** line to the **OUTLET** port (see [Figure B-46](#)).



*Figure B-46. EGC Inlet and Outlet Connections*

17. Turn over the EluGen cartridge. Check for bubbles; if necessary, shake and tap the EluGen cartridge to remove bubbles.
18. Reinstall the EluGen cartridge in the holder.
19. Do not reconnect the EluGen cartridge cable until after hydrating the CR-TC.

### Hydrating the CR-TC

Always hydrate the CR-TC before initial operation. This requires running ASTM filtered, Type 1 (18 megohm-cm) deionized water through the CR-TC for 10 minutes, while bypassing the columns and suppressor.

[Figure B-47](#) illustrates the liquid flow path through the CR-TC during the hydration procedure.

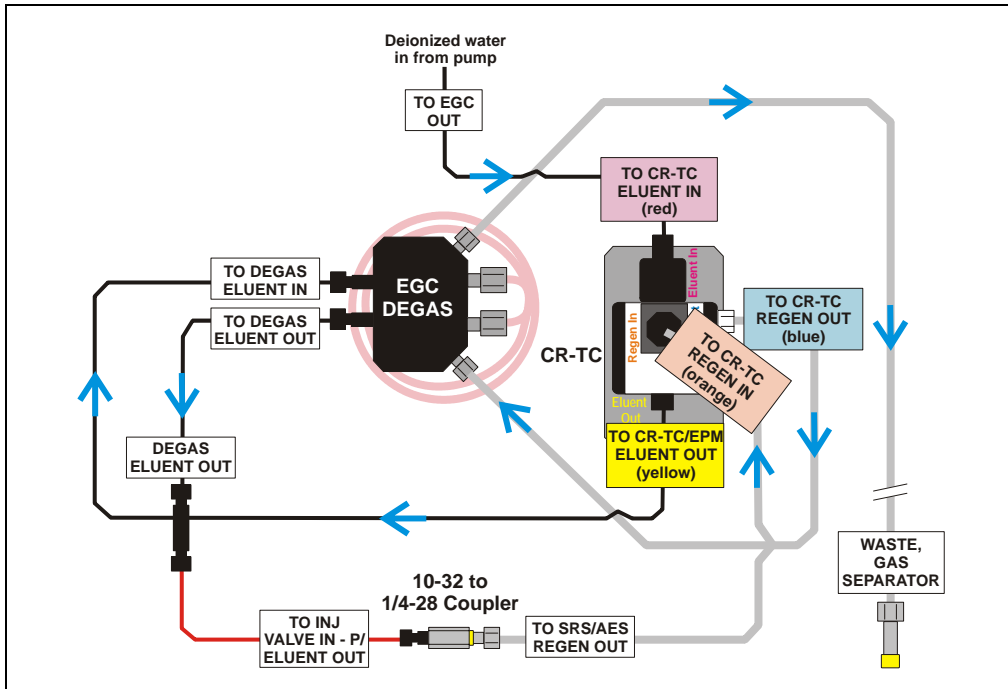


Figure B-47. CR-TC Plumbing for Hydration

1. Disconnect the **TO INJ VALVE IN - P/ELUENT OUT** line from port **P (2)** on the injection valve.
2. Disconnect the **TO SRS/AES REGEN OUT** line from the suppressor.
3. Use a 10-32 to 1/4-28 coupler (P/N 042806) to connect the **TO INJ VALVE IN - P/ELUENT OUT** line to the **SRS/AES REGEN OUT** line.
4. Verify that the suppressor is off.

**IMPORTANT**

To avoid damaging the suppressor, always turn off the suppressor before hydrating the CR-TC. The pump flow is on during conditioning, however, no flow reaches the suppressor.

5. Verify that the **Automatically turn on with pump** option is not selected on the ICS-2000 touch screen **SUPPRESSOR** page (see [Section C.9](#)). Disabling this option lets you turn on the pump, without automatically turning on the suppressor.

6. Turn on the pump and set the flow to the rate recommended for your application.
7. Pump deionized water through the CR-TC for at least 10 minutes.
8. Turn off the pump and remove the coupler.

### Completing the Eluent Generator Setup

1. Reconnect the **TO SRS/AES REGEN OUT** line to the **REGEN OUT** port on the suppressor.
2. Reconnect the **TO INJ VALVE IN - P/ELUENT OUT** line to port **P (2)** on the injection valve.
3. Reconnect the EluGen cartridge cable.
4. Remove the plug from the **CR-TC** connector on top of the ICS-2000
5. Orient the CR-TC's black 3-pin electrical cable connector as shown in [Figure B-42](#). Push it onto the **CR-TC** connector on the ICS-2000. Twist the ring on the cable connector and fingertighten to secure it.

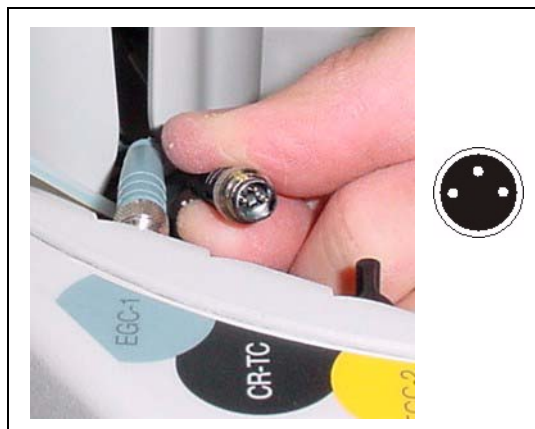


Figure B-48. Connecting the CR-TC Cable

**NOTE** Backpressure tubing may be required between the injection valve and the EGC degas eluent outlet. The EluGen cartridge requires 14 to 16 MPa (2000 to 2300 psi) of system backpressure for removal of electrolysis gas from the eluent produced by the cartridge. See [Section B.16.1](#) for details.

Go on to [Section B.15](#).

### B.14.2 Eluent Generator Setup for Carbonate/Bicarbonate Eluent

Follow the instructions in this section if you are installing a  $K_2CO_3$  cartridge, an EPM, and an EGC  $CO_3$  Mixer (for generating carbonate/bicarbonate eluent).

- If you are installing a  $K_2CO_3$  cartridge and an EGC  $CO_3$  Mixer (for generating carbonate eluent), go to [Section B.14.3](#).
- If you are installing a KOH, LiOH, MSA, or NaOH EluGen cartridge and a CR-TC, go to [Section B.14.1](#).

#### Overview

The eluent generator setup procedure for carbonate/bicarbonate eluent consists of the following main steps:

- Installing the EluGen cartridge.
- Connecting the EluGen cartridge vent line.
- Installing the EPM.
- Plumbing the EPM for conditioning.
- Recording the EluGen cartridge and the EPM serial numbers in Chromeleon.
- Conditioning the EluGen cartridge and the EPM.
- Installing the EGC  $CO_3$  Mixer.
- Temporarily filling the EGC  $CO_3$  Mixer with deionized water.
- Filling the EGC  $CO_3$  Mixer with eluent of the required concentration.
- Completing the eluent generator setup.

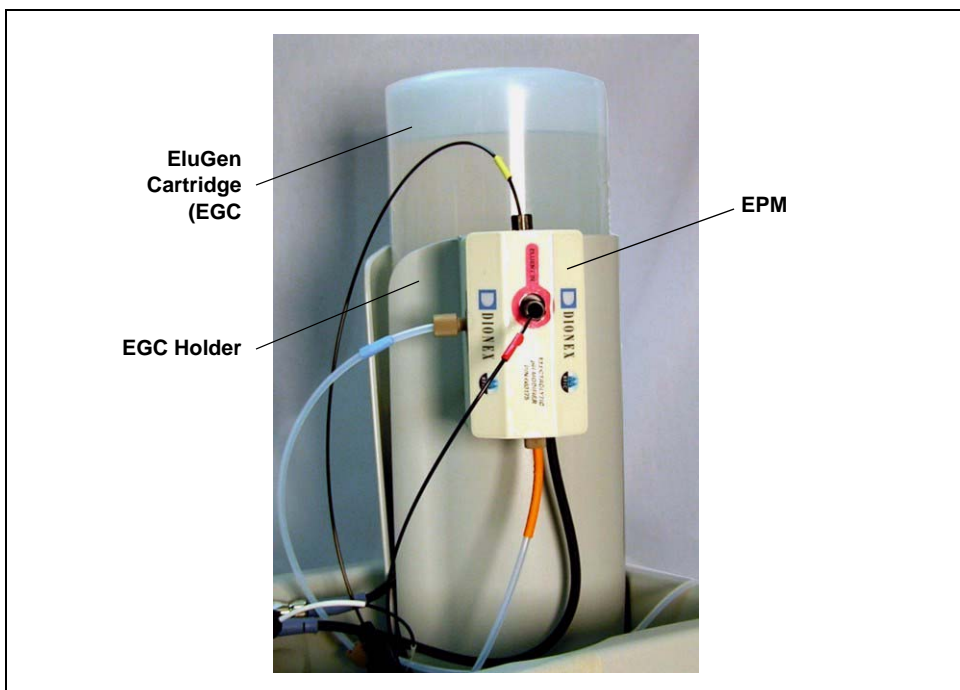


### Items Required to Complete the Setup Procedure

The following items are required to setup the EluGen cartridge, EPM, and EGC CO<sub>3</sub> Mixer. Except as noted, all items are supplied in the ICS-2000 Ship Kit (P/N 064375).

Item	P/N	Used To
EPM mounting bracket	063624	Mount the EPM on the EGC holder
35 cm (14 in) of black 0.25-mm (0.010-in) ID PEEK tubing	064340	Lengthen the line between the EGC degas eluent inlet and the EPM <b>ELUENT OUT</b> port
30 cm (12 in) of black 0.25-mm (0.010-in) ID PEEK tubing	064334	Lengthen the line between the EluGen cartridge outlet and the EPM <b>ELUENT IN</b> port
28 cm (11 in) of clear 1.58-mm (0.062-in) ID Teflon tubing	064337	Lengthen the line between the EGC degas regenerant inlet and the EPM <b>REGEN OUT</b> port
EluGen Cartridge Vent Line Tubing Kit (supplied with the cartridge)	063092	Vent the cartridge during operation
Yellow 0.5 mL/min, 7 MPa (1000 psi) backpressure coil	053765	Provide backpressure during setup procedures
EGC CO <sub>3</sub> Mixer mounting clips	063642	Install the mixer
Phillips head screwdriver (not supplied)	n/a	Install the EGC CO <sub>3</sub> Mixer mounting clips
35 cm (14 in) of black 0.25-mm (0.010-in) ID PEEK tubing	064346	Connect the EGC degas eluent outlet and the EGC CO <sub>3</sub> Mixer inlet
60 cm (24 in) of black 0.25-mm (0.010-in) ID PEEK tubing	064343	Connect the EGC CO <sub>3</sub> Mixer outlet to port <b>P (2)</b> on the injection valve
Temporary waste container (beaker, bottle, etc.) (not supplied)	n/a	Collect waste during setup procedures
10-32 to 10-32 coupler	042627	Complete the connections
10-32 to 1/4-28 coupler	042806	
10-32 fittings	043275	Complete the connections
10-32 ferrules	043276	
1/8-in fittings	052267	Complete the connections
1/8-in ferrules	048949	

[Figure B-49](#) illustrates the EluGen cartridge and EPM after installation.



*Figure B-49. ICS-2000 with an EluGen Cartridge and EPM Installed*

Figure B-50 illustrates the liquid flow path through the eluent generator components after all setup steps are complete and the eluent generator is ready for operation.

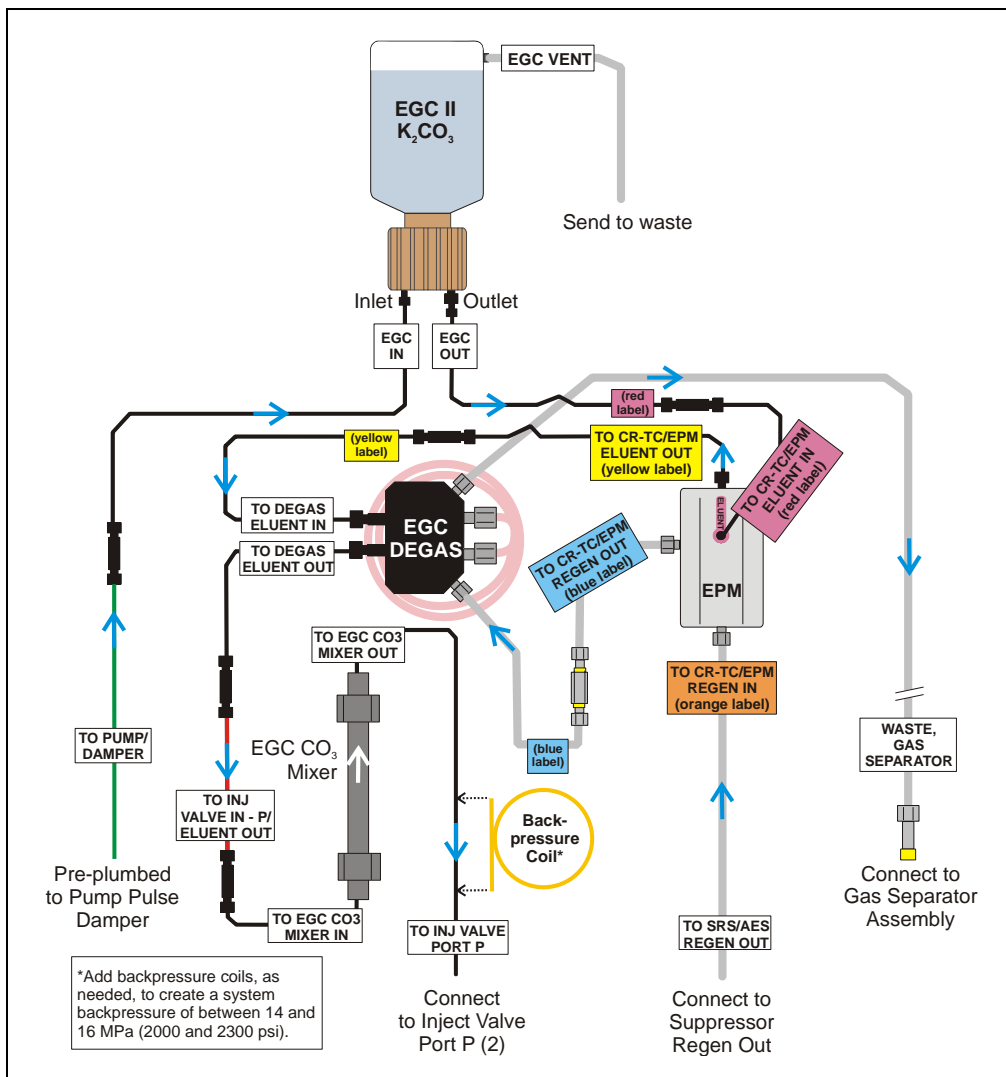


Figure B-50. Eluent Generator Flow Schematic with an EPM and EGC CO<sub>3</sub> Mixer: Use for Generating Carbonate/Bicarbonate Eluent

### Installing the EluGen Cartridge

1. Tilt the cartridge holder to view the bottom and brace the holder against the back corner of the ICS-2000 (see [Figure B-51](#)).



Figure B-51. Cartridge Holder (tilted to view the bottom)

2. Use the precut tubing assemblies included in the ICS-2000 Ship Kit to extend the length of three lines as described below:
  - a. Disconnect the **TO CR-TC ELUENT IN** line (red label) from the coupler that connects it to the **TO CR-TC ELUENT OUT** line (yellow label). Connect a 32 to 10-32 coupler to the end of the **TO CR-TC ELUENT IN** line and connect the 30 cm (12 in) length of black PEEK tubing (red labels) (P/N 064334) to the coupler (see [Figure B-63](#)).
  - b. Connect the 35 cm (14 in) length of black PEEK tubing (yellow labels) (P/N 064340) to the coupler on the **TO CR-TC ELUENT OUT** line (yellow label).
  - c. Disconnect the **TO CR-TC REGEN IN** line (orange label) from the coupler that connects it to the **TO CR-TC REGEN OUT** line (blue label). Connect the 28 cm (11 in) length of clear Teflon tubing (blue labels) (P/N 064337) to the coupler on the **TO CR-TC REGEN OUT** line (blue label).

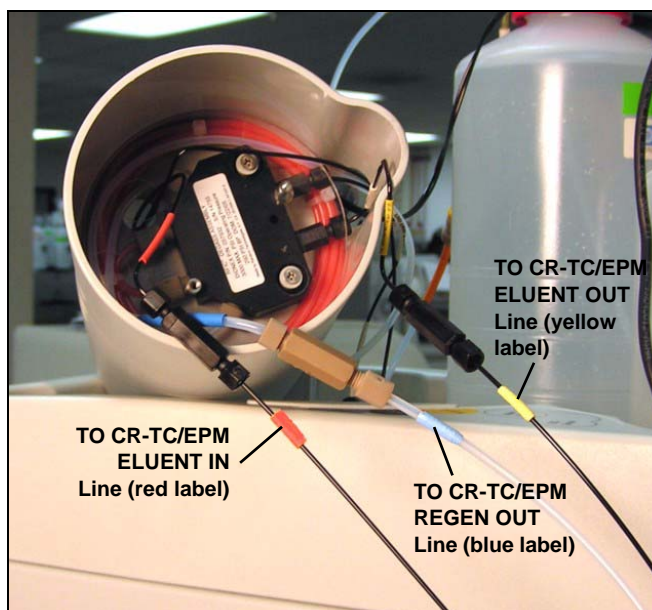
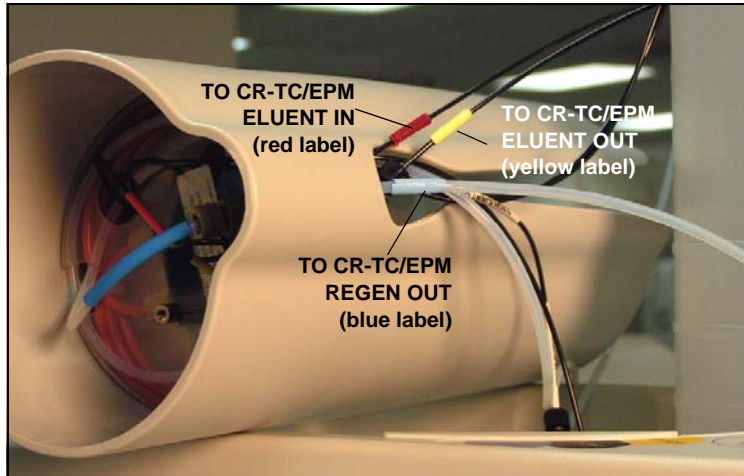


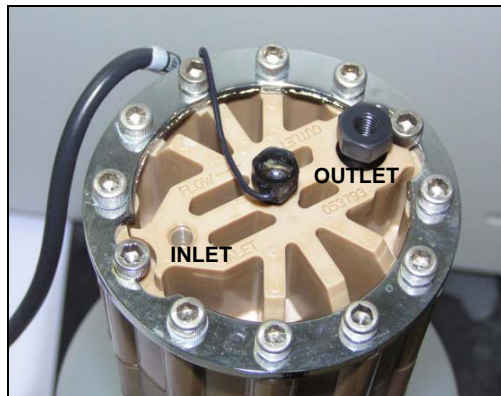
Figure B-52. EPM Eluent and Regen Line Extensions

3. Pull the **TO CR-TC REGEN IN** line (orange label) out of the opening on the side of the holder.
4. Thread the three extended lines (red, yellow, and blue labels) through the opening on the side of the holder (see [Figure B-53](#)).



*Figure B-53. TO CR-TC/EPM Lines Outside of Holder*

5. Turn the EGC holder right-side up and set it back into position.
6. Orient the EluGen cartridge with the fittings facing up and remove the plugs from the cartridge **INLET** and **OUTLET** fittings (see [Figure B-54](#)).



*Figure B-54. EluGen Cartridge Fitting Plugs*

7. Set the EluGen cartridge in the service area on top of the ICS-2000 and orient it with the cable toward the EGC holder (see [Figure B-55](#)).



Figure B-55. EluGen Cartridge in Service Area

8. Pull the coiled black **EGC IN** and **EGC OUT** lines out from inside the EGC holder. Disconnect the **EGC IN** line from the coupler that connects it to the **EGC OUT** line.
9. Connect the **EGC IN** line to the EluGen cartridge **INLET** port (see [Figure B-80](#)).
10. Remove the coupler and connect the **EGC OUT** line to the EluGen cartridge **OUTLET** port.

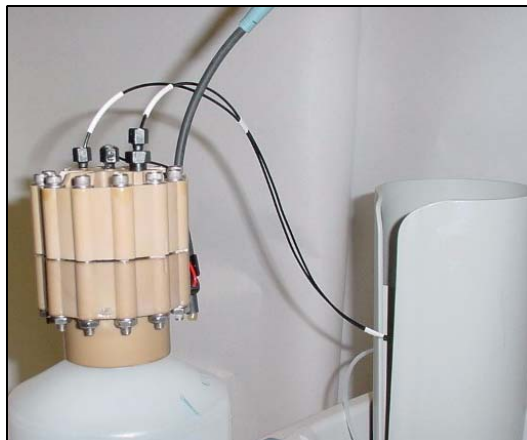


Figure B-56. EluGen Cartridge Inlet and Outlet Port Connections

11. Turn the EluGen cartridge over (with the fittings facing down). **Shake the EluGen cartridge vigorously, and tap it with the palm of your hand 10 to 15 times. Check that all bubbles trapped in the eluent generation chamber are dislodged.**



The EluGen cartridge contains one of the following: a corrosive base (KOH, LiOH, or NaOH), a corrosive acid (MSA), or a concentrated  $K_2CO_3$  solution. Wear protective eyewear and gloves when handling the cartridge.



La cartouche d'EluGen contient un de ce qui suit: une base corrosive (KOH, LiOH, ou NaOH), un acide corrosif (MSA), ou une solution concentrée de  $K_2CO_3$ . Porter des lunettes et des gants protectives en manipulant la cartouche.



Die EluGen-Kassette enthält eine korrodierende Base (KOH, LiOH oder NaOH), eine korrodierende Säure (MSA) oder eine konzentrierte  $K_2CO_3$ -Lösung. Tragen Sie daher beim Umgang mit Kassette eine Schutzbrille und Handschuhe.

12. Slide the EluGen cartridge down into the holder until it stops (see [Figure B-57](#)). Make sure the cable remains out of the holder.

**NOTE** To avoid crimping the lines, do not twist the cartridge when you slide it into the holder. The lines are designed to coil inside the holder.



Figure B-57. EluGen Cartridge Installed in the Holder



13. Remove the plug from the **EGC-1** connector on top of the ICS-2000.
14. Orient the cartridge's blue 4-pin electrical cable connector as shown in [Figure B-58](#). Push it onto the **EGC-1** connector on the ICS-2000. Twist the ring on the cable connector fingertight to secure it.



Figure B-58. Connecting the EluGen Cartridge Cable

### Connecting the EluGen Cartridge Vent Line

1. Locate the EluGen Cartridge Vent Line Tubing Kit supplied with the EluGen cartridge.
2. Slide the label onto one end of the tubing and then push the barbed luer lock onto the tubing.
3. Unscrew and remove the plug from the vent opening on the side of the EluGen cartridge (see [Figure B-59](#)).



Figure B-59. EluGen Cartridge Vent Plug

4. Screw the luer adapter onto the vent opening. Remove the cap on the luer adapter by twisting. **Save the cap.**
5. Twist the luer lock and EluGen cartridge vent line into the luer adapter (see [Figure B-60](#)).

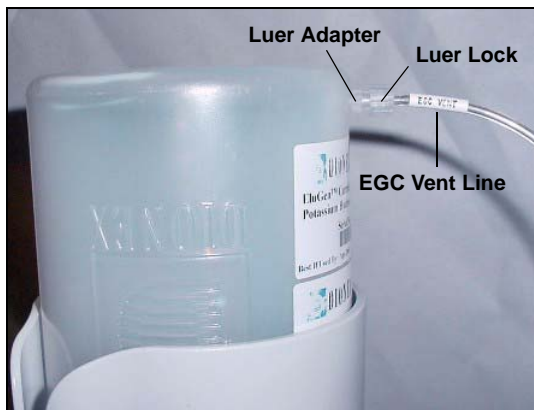


Figure B-60. Installing the EluGen Cartridge Vent Line

**NOTE** To prevent leaks from the EluGen cartridge, always replace the luer adapter cap before moving the EluGen cartridge.

6. Direct the vent line to the waste container and insert it down into the gas separator waste tube about 10 to 15 cm (4 to 6 in).

### Installing the EPM

1. Remove the plugs from the EPM eluent and regen liquid ports.
2. Push the EPM onto the ball studs on the mounting bracket (see [Figure B-61](#)).

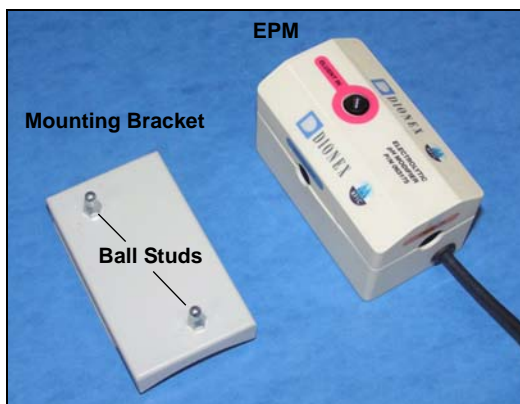


Figure B-61. EPM and Mounting Bracket

3. Lift the EluGen cartridge up slightly from the EGC holder and slide the EPM bracket onto the side of the holder (see [Figure B-62](#)).



*Figure B-62. EPM and Mounting Bracket Installed on EGC Holder*

4. Connect the following lines to the EPM:
  - Connect the **TO CR-TC/EPM ELUENT OUT** line (yellow label) to the **ELUENT OUT** port on the EPM (see [Figure B-63](#)).
  - Connect the **TO CR-TC/EPM ELUENT IN** line (red label) to the **ELUENT IN** port on the EPM.
  - Connect the **TO CR-TC/EPM REGEN IN** line (orange label) to the **REGEN IN** port on the EPM.
  - Connect the **TO CR-TC/EPM REGEN OUT** line (blue label) to the **REGEN OUT** port on the EPM.

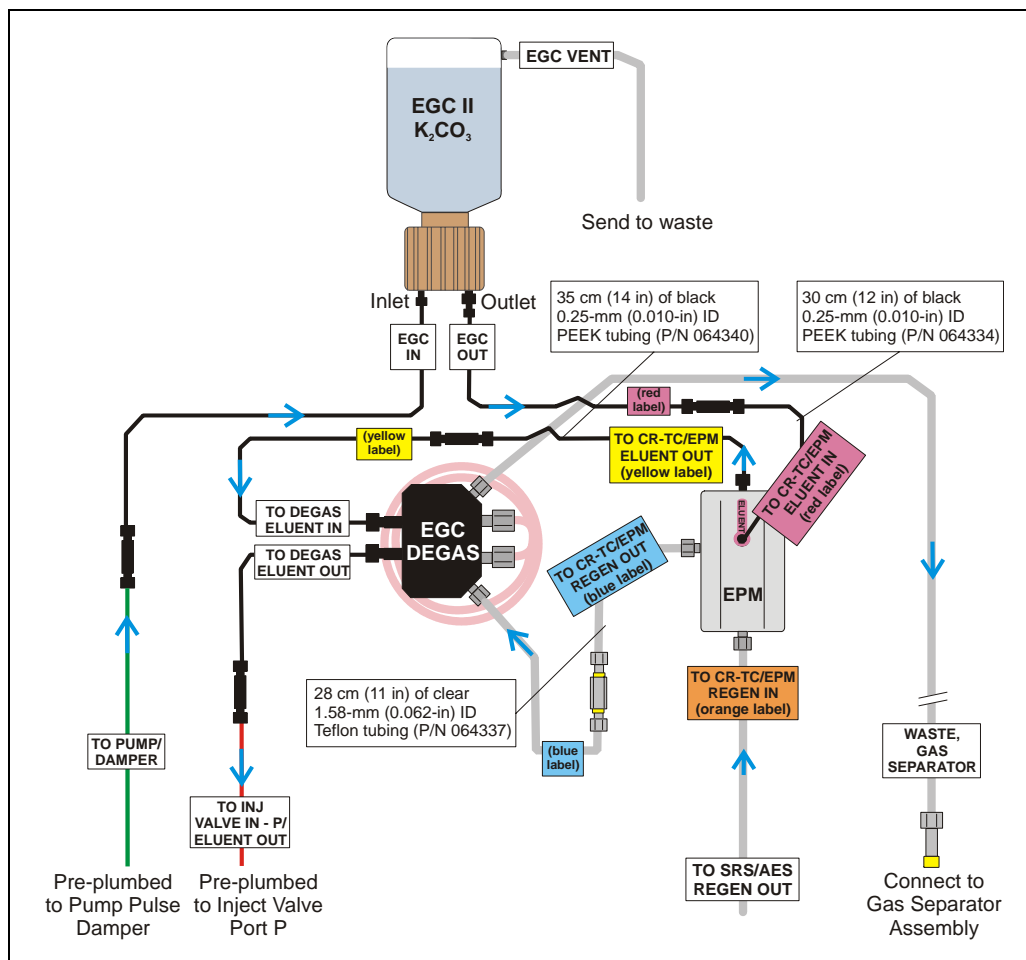


Figure B-63. EluGen Cartridge and EPM Plumbing with Tubing Extensions

5. Remove the plug from the **EGC-2** connector on top of the ICS-2000.
6. Connect the EPM electrical cable to the **EGC-2** connector.

### Recording the EluGen Cartridge and EPM Serial Numbers in Chromeleon

The serial numbers are printed on labels on the EluGen cartridge and EPM.

1. Open the Server Configuration program (select **Start > Programs (or All Programs) > Chromeleon > Server Configuration**).
2. Double-click the ICS-2000 system icon. The properties dialog box for the ICS-2000 appears.
3. Click the **Eluent Generator** tab (see [Figure B-45](#)).
4. Select the **EGC-1** check box and enter the EluGen cartridge serial number.
5. Select the **EGC-2** check box and enter the serial number of the EPM.
6. Click **OK**.

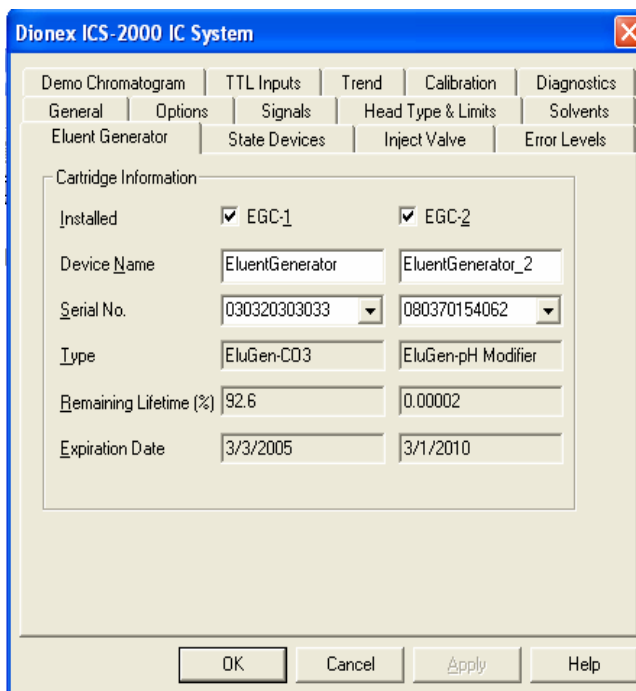


Figure B-64. Eluent Generator Configuration Properties Example

## Plumbing the EluGen Cartridge and EPM for Conditioning

Figure B-65 illustrates the liquid flow path through the EluGen cartridge and EPM during the conditioning procedure.

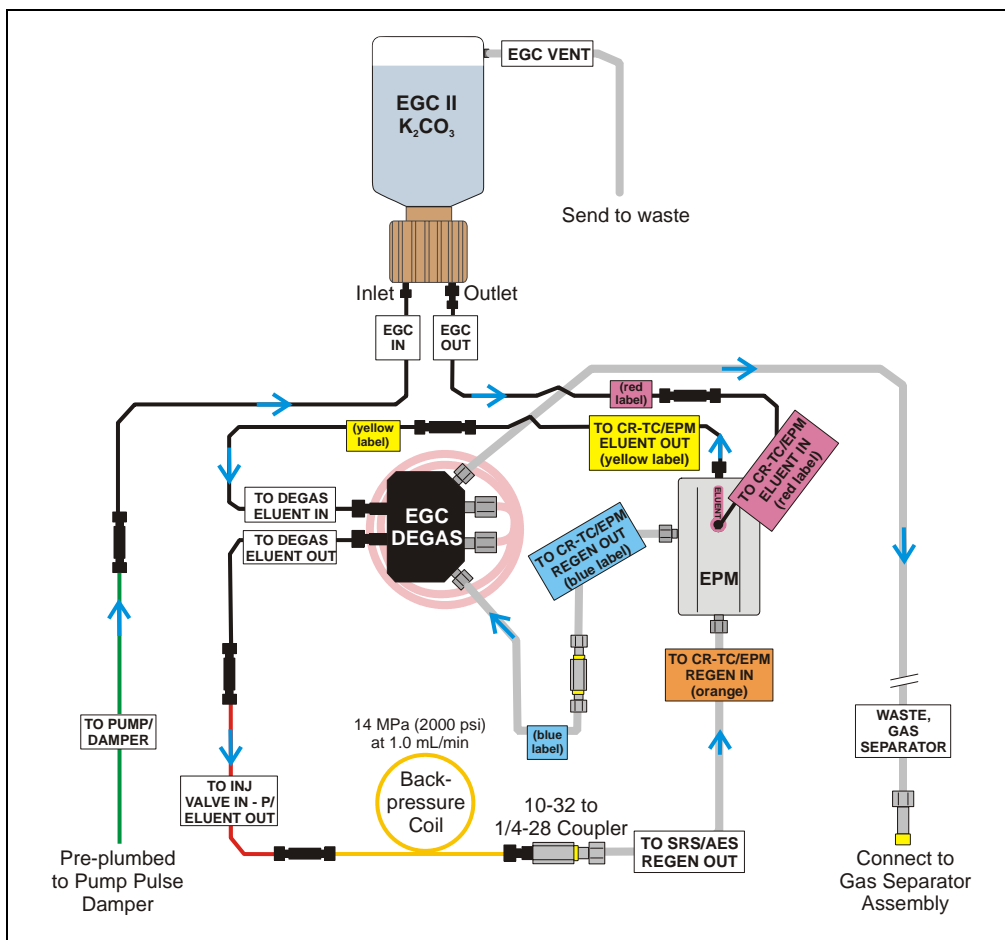
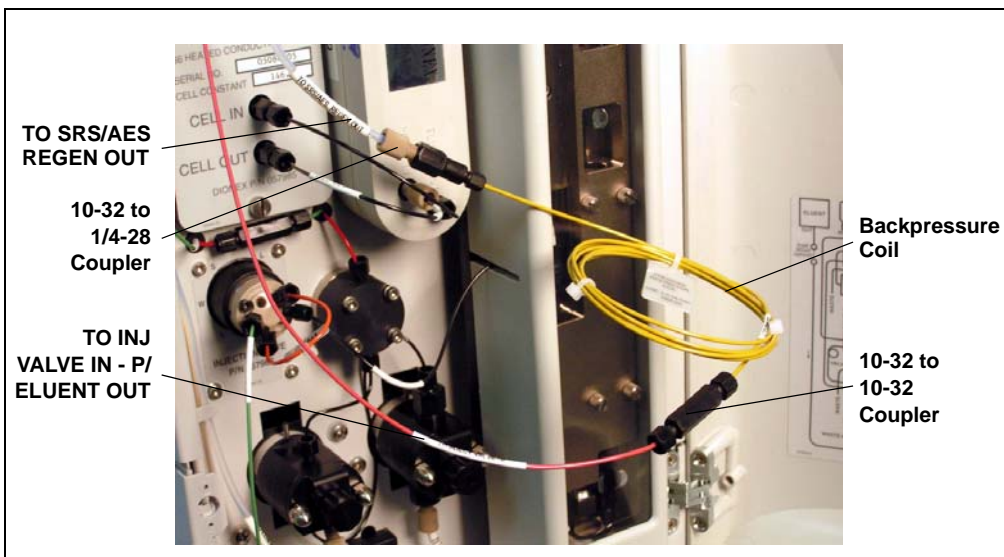


Figure B-65. EluGen Cartridge and EPM Plumbing for Conditioning with Carbonate/Bicarbonate Eluent

1. Disconnect the **TO INJ VALVE IN - P/ELUENT OUT** line from port **P (2)** on the injection valve.
2. Use a 10-32 to 10-32 coupler (P/N 042627) to connect the yellow 0.5 mL/min, 7 MPa (1000 psi) backpressure coil (P/N 053765) to the **TO INJ VALVE IN - P/ELUENT OUT** line.
3. Connect a 10-32 to 1/4-28 coupler (P/N 042806) to the free end of the backpressure coil.
4. Disconnect the **TO SRS/AES REGEN OUT** line from the suppressor **REGEN OUT** port.
5. Connect the **TO SRS/AES REGEN OUT** line to the 10-32 to 1/4-28 coupler (see [Figure B-66](#)).

**NOTE** The backpressure coil connection in [Figure B-66](#) is temporary; it is required only during the EPM and EluGen cartridge conditioning procedure described in the next section.



*Figure B-66. Backpressure Coil Connections for Conditioning the EluGen Cartridge and EPM with Carbonate/Bicarbonate Eluent*

### Conditioning the EPM and EluGen Cartridge

After completing the plumbing connections described in the previous sections, follow the steps below to hydrate the EPM for 5 minutes and then condition the EPM and EluGen cartridge for 30 minutes.

1. Make sure the eluent reservoir is filled with ASTM filtered, Type I (18-megohm) deionized water.
2. Verify that the suppressor is off.

**IMPORTANT**

To avoid damaging the suppressor, always turn off the suppressor before conditioning the EPM and EluGen cartridge. The pump flow is on during conditioning, however, no flow reaches the suppressor.

3. Verify that the **Automatically turn on with pump** option is not selected on the ICS-2000 touch screen **SUPPRESSOR** page (see [Section C.9](#)). Disabling this option lets you turn on the pump, without automatically turning on the suppressor.
4. On the ICS-2000 touch screen **HOME** page, set the pump flow rate to **1.00 mL/min**.
5. Turn on the pump.
6. Run the pump for 5 minutes to hydrate the EPM.
7. Touch the **EGC** button on the **HOME** page to open the **ELUENT GENERATOR** page.
8. Verify that the cartridge type for **EGC-1** is **Carb** and the type for **EGC-2** is **pH Mod**.

If the cartridge types are wrong, make sure the cartridge serial numbers were entered correctly in the Chromeleon Server Configuration program (see [“Recording the EluGen Cartridge and EPM Serial Numbers in Chromeleon”](#) on page B-65).

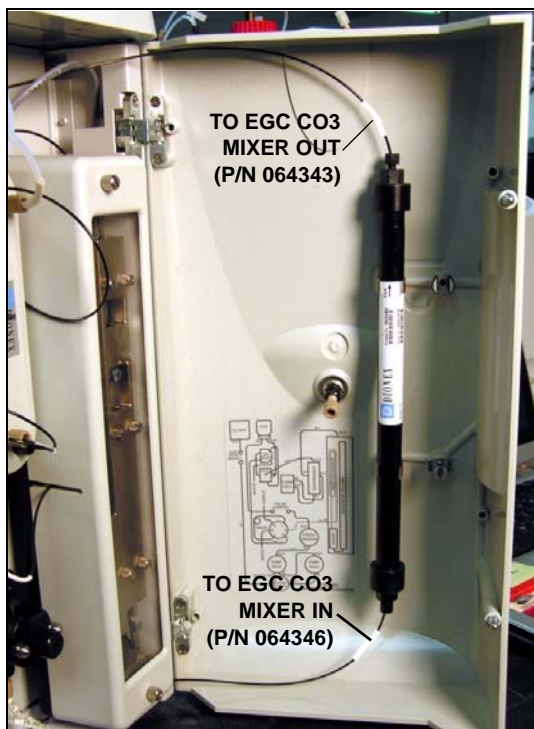
9. Select the following settings:
  - Set the **EGC-1** concentration to **9 mM**.
  - Set the **EGC-2** concentration to **1 mM**.
10. Turn on the EGC-1 and EGC-2 currents.
11. Run the EluGen cartridge and EPM at these settings for 30 minutes.



12. Turn off the EGC-1 and EGC-2 current.
13. Turn off the pump.

### Installing the EGC CO<sub>3</sub> Mixer

[Figure B-67](#) illustrates the EGC CO<sub>3</sub> Mixer after installation.



*Figure B-67. ICS-2000 with an EGC CO<sub>3</sub> Mixer Installed*

1. Use a Phillips head screwdriver to remove the existing small diameter mounting clips from the inside of the ICS-2000 door.
2. Install the larger diameter clips (P/N 063642) (see [Figure B-68](#)).

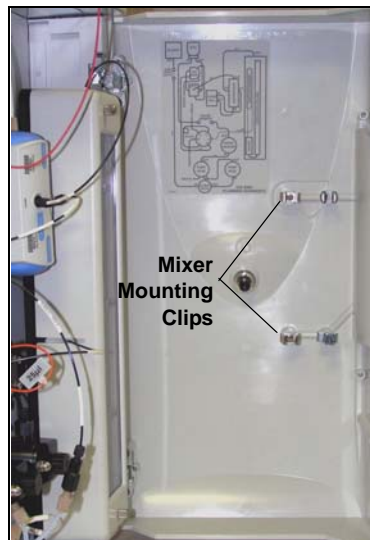


Figure B-68. Location of Mounting Clips for the EGC CO<sub>3</sub> Mixer

3. Orient the mixer with the outlet pointing upward and push it onto the clips (see [Figure B-69](#)). The mixer outlet must point upward to ensure thorough mixing of the eluent.
4. Locate the 35 cm (14 in) length of black PEEK tubing (white labels) (P/N 064346). Connect the end labeled **TO EGC CO<sub>3</sub> MIXER IN** to the mixer inlet.
5. Locate the 60 cm (24 in) length of black PEEK tubing (white labels) (P/N 064343). Connect the end labeled **TO EGC CO<sub>3</sub> MIXER OUT** to the mixer outlet.



Figure B-69. EGC CO<sub>3</sub> Mixer Installed on the ICS-2000 Door

### Filling the EGC CO<sub>2</sub> Mixer with Deionized Water

1. Verify that the EGC-1 and EGC-2 currents are off.
2. Disconnect the EluGen cartridge inlet line (labeled **TO PUMP/DAMPER**) from the coupler that connects it to the green pump outlet line (see [Figure B-70](#)).

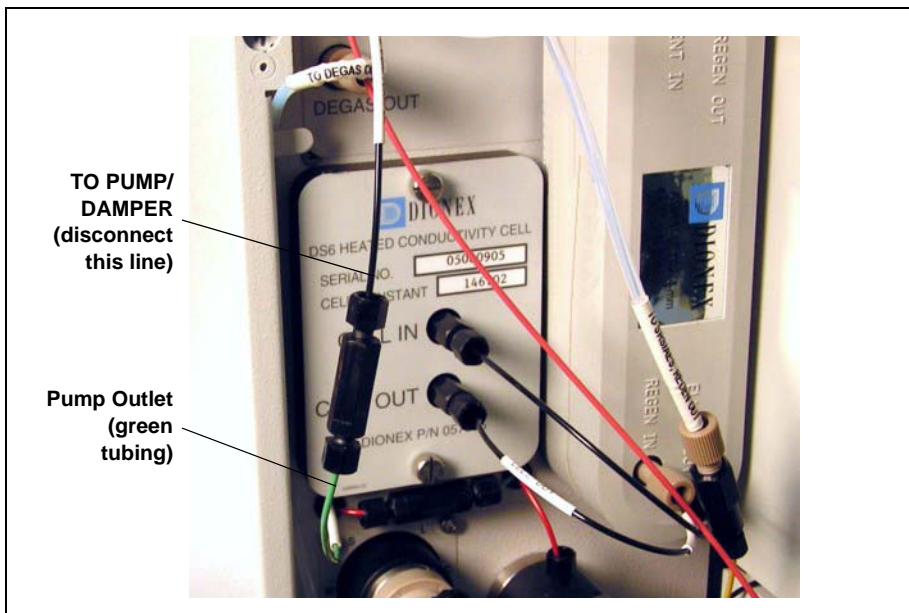
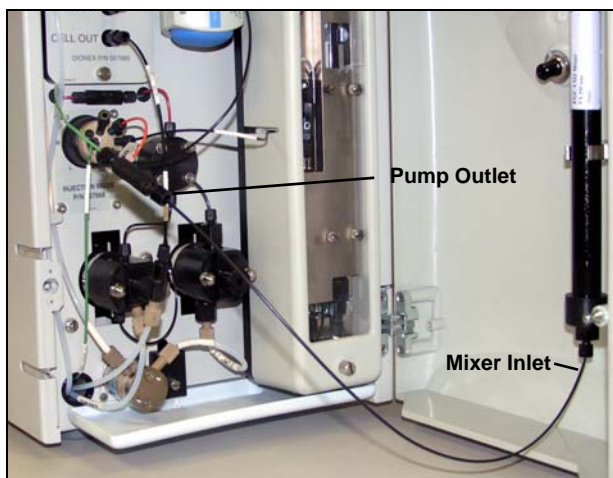


Figure B-70. EluGen Cartridge Inlet and Pump Outlet

3. Connect the pump outlet to the mixer inlet (see [Figure B-71](#)).



*Figure B-71. Pump Outlet Connected to Mixer Inlet for Mixer Hydration*

4. Direct the mixer outlet line to a temporary waste container, such as a beaker.
5. Verify that the suppressor is off.

**IMPORTANT**

To avoid damaging the suppressor, always turn off the suppressor before filling the mixer. The pump flow is on during filling, however, no flow reaches the suppressor.

6. Verify that the **Automatically turn on with pump** option is not selected on the ICS-2000 touch screen **SUPPRESSOR** page (see [Section C.9](#)). Disabling this option lets you turn on the pump, without automatically turning on the suppressor.
7. Set the pump flow rate to **5.00 mL/min**.
8. Turn on the pump.
9. Run the pump until the mixer is filled and there is a consistent flow of water exiting the mixer outlet.

It takes about 5 minutes to fill a 4-mm mixer and about 2 minutes to fill a 2-mm mixer.

10. Turn off the pump.

### Filling the EGC CO<sub>3</sub> Mixer with the Carbonate/Bicarbonate Eluent

Before initial use, follow the steps in this section to fill the EGC CO<sub>3</sub> Mixer with the carbonate/bicarbonate eluent concentration required for the application to be run.

[Figure B-72](#) illustrates the liquid flow path through the eluent generator components during initial filling of the EGC CO<sub>3</sub> Mixer with carbonate/bicarbonate eluent.

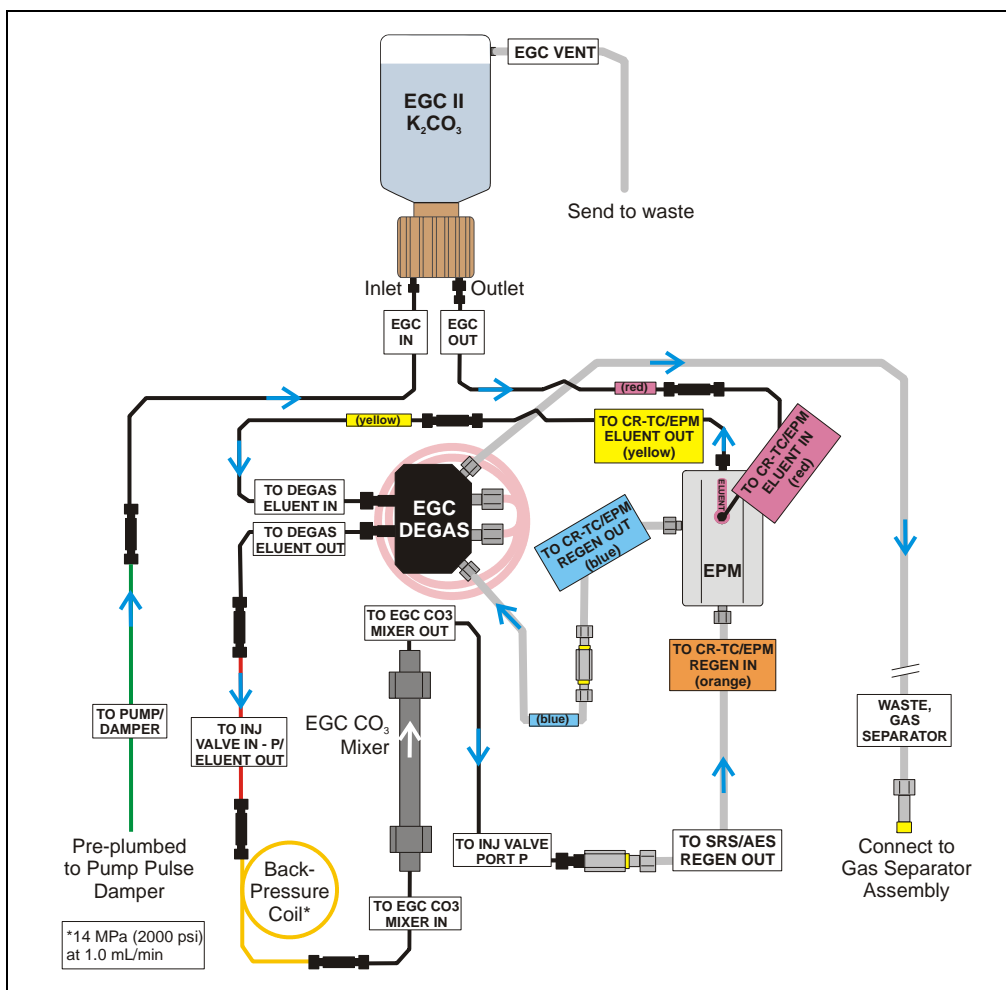
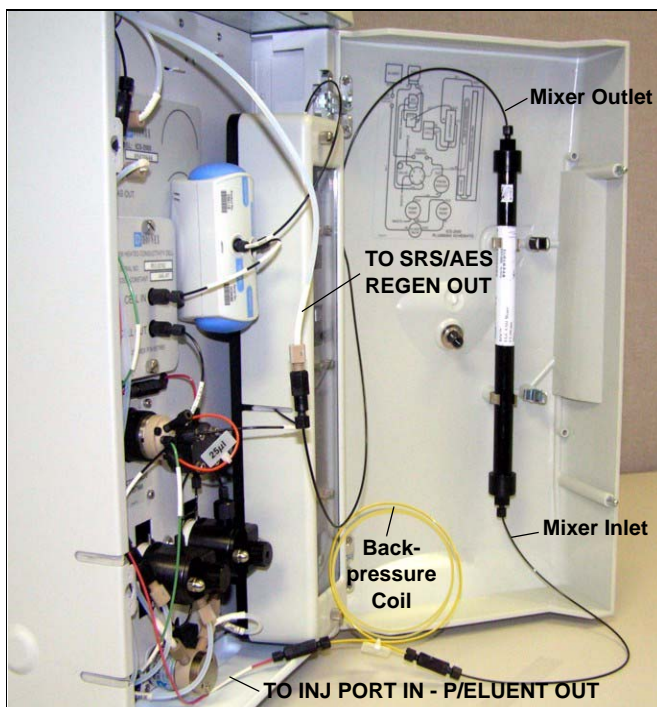


Figure B-72. EluGen Cartridge and EPM Plumbing for Initial Filling of the EGC CO<sub>3</sub> Mixer with Carbonate/Bicarbonate Eluent

1. Disconnect the pump outlet from the mixer inlet.
2. Reconnect the pump outlet and the EluGen cartridge inlet.
3. Connect a 10-32 to 10-32 coupler to the mixer inlet.
4. Disconnect the outlet of the yellow PEEK backpressure coil from the **TO SRS/AES REGEN OUT** line and then connect the backpressure coil to the mixer inlet (see [Figure B-73](#)).
5. Connect the mixer outlet to the **TO SRS/AES REGEN OUT** line.

**NOTE** The backpressure coil connection is temporary; it is required only during initial filling of the mixer.



*Figure B-73. Mixer Connected Directly to Eluent Generator Outlet for Initial Filling*

6. Verify that the suppressor is off.

**IMPORTANT**

To avoid damaging the suppressor, always turn off the suppressor before filling the mixer. The pump flow is on during filling, however, no flow reaches the suppressor.

7. Verify that the **Automatically turn on with pump** option is not selected on the ICS-2000 touch screen **SUPPRESSOR** page (see [Section C.9](#)). Disabling this option lets you turn on the pump, without automatically turning on the suppressor.
8. Set the pump flow rate to the rate required for the application.
9. Turn on the pump.
10. Verify that the system backpressure is between 14 and 16 MPa (2000 and 2300 psi). If necessary, adjust the pressure by adding or removing backpressure tubing.
11. Set the **EGC-1** and **EGC-2** concentrations to the values required for your application. For example, for a 3.5 mM  $K_2CO_3$ /1.0 mM  $KHCO_3$  mixture, set the **EGC-1** concentration to 3.5 mM and the **EGC-2** concentration to 1.0 mM.
12. Turn on the **EGC-1** and **EGC-2** currents.
13. Run at the selected settings until the mixer is filled with the eluent mixture. At a flow rate of 1 mL/min it will take about 45 minutes to fill the 4-mm mixer and about 15 minutes to fill the 2-mm mixer.

**NOTE** The void volume of the 4-mm mixer is about 16 mL. The void volume of the 2-mm mixer is about 5 mL.

14. Turn off the **EGC-1** and **EGC-2** currents.
15. Turn off the pump.
16. Remove the yellow PEEK backpressure coil from the **TO INJ VALVE IN - P/ELUENT OUT** line and the mixer inlet.
17. Disconnect the mixer outlet from the **TO SRS/AES REGEN OUT** line and remove the 10-32 to 1/4-28 coupler.
18. Reconnect the **TO SRS/AES REGEN OUT** line to the suppressor **REGEN OUT** port.

## Completing the Eluent Generator Setup for Carbonate/Bicarbonate Eluent

Figure B-74 illustrates the liquid flow path through the ICS-2000 after all setup steps are complete and the eluent generator is ready for operation.

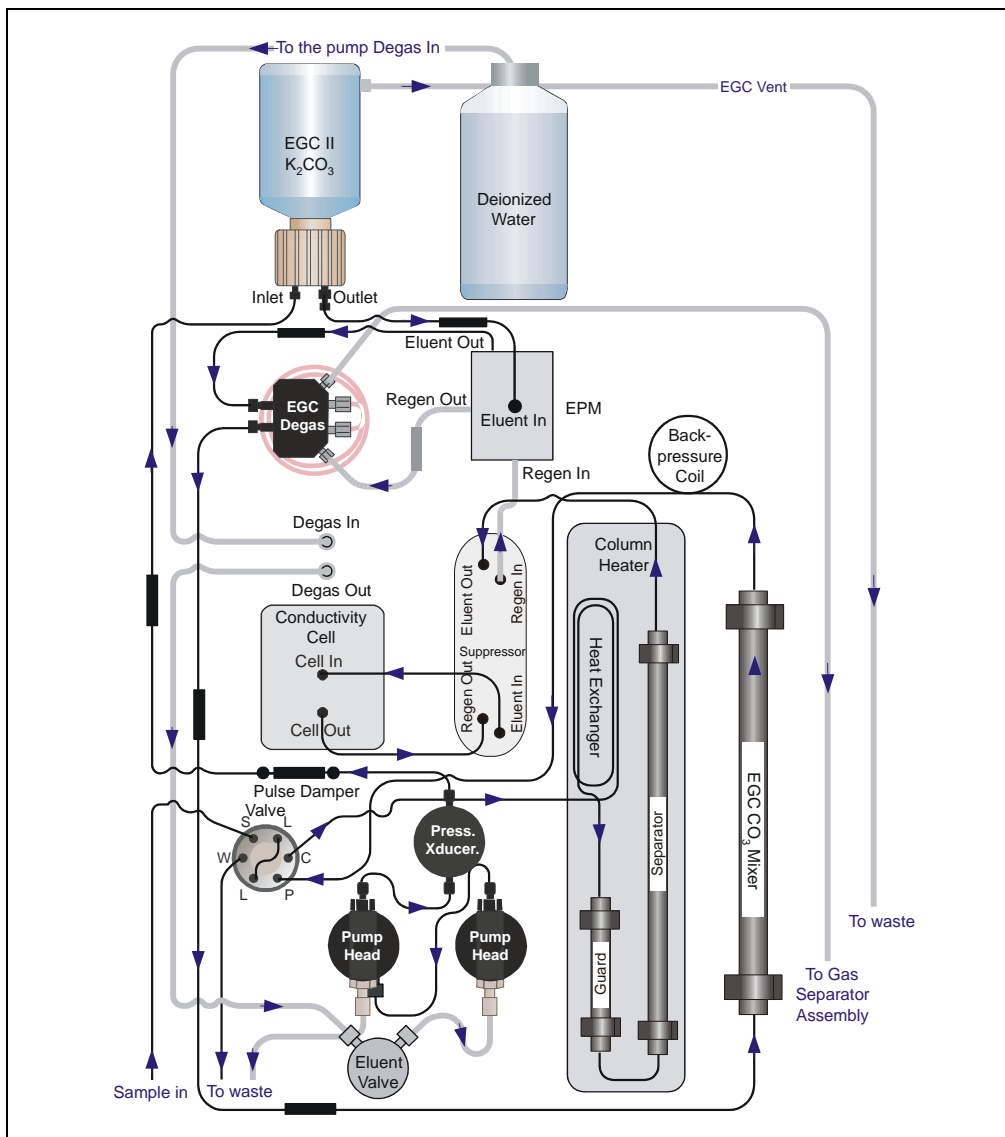


Figure B-74. ICS-2000 Flow Schematic: Carbonate/Bicarbonate Eluent Generation



1. Connect the **TO INJ VALVE IN - P/ELUENT OUT** line to the coupler attached to the mixer inlet line. Route this line along the back of the drip tray to prevent it from being pinched when the ICS-2000 door is opened and closed
2. Route the mixer outlet line to the back of the component panel (see [Figure B-75](#)).
3. Connect the mixer outlet line to port **P (2)** on the injection valve.



*Figure B-75. Mixer Outlet Routed to the Back of the Component Panel*

**NOTE** Backpressure tubing may be required between the injection valve and the EGC CO<sub>3</sub> Mixer outlet. The EluGen cartridge requires 14 to 16 MPa (2000 to 2300 psi) of system backpressure for removal of electrolysis gas from the eluent produced by the cartridge. See [Section B.16.1](#) for details.

Go on to [Section B.15](#).

### B.14.3 Eluent Generator Setup for Carbonate Eluent

Follow the instructions in this section if you are installing a  $K_2CO_3$  cartridge and an EGC  $CO_3$  Mixer (for generating carbonate eluent).

- If you are installing a KOH, LiOH, MSA, or NaOH EluGen cartridge and a CR-TC, go to [Section B.14.1](#).
- If you are installing a  $K_2CO_3$  cartridge, an EPM, and an EGC  $CO_3$  Mixer (for generating carbonate/bicarbonate eluent), go to [Section B.14.2](#).

#### Overview

The eluent generator setup procedure for carbonate eluent consists of the following main steps:

- Installing the EluGen cartridge and preparing for conditioning.
- Conditioning the EluGen cartridge.
- Installing the EGC  $CO_3$  Mixer.
- Filling the EGC  $CO_3$  Mixer with the eluent concentration required for the application.
- Completing the eluent generator setup.

### Items Required to Complete the Setup Procedure

In addition to the EluGen cartridge and the EGC CO<sub>3</sub> Mixer, you will need the following items to complete the eluent generator setup. Except as noted, all items are supplied in the ICS-2000 Ship Kit (P/N 064375).

Item	P/N	Use To
Yellow 0.5 mL/min, 7 MPa (1000 psi) backpressure coil	053765	Provide backpressure during setup procedures
EluGen Cartridge Vent Line Tubing Kit (supplied with the cartridge)	063092	Vent the cartridge during operation
EGC CO <sub>3</sub> Mixer mounting clips	063642	Install the mixer
Phillips head screwdriver (not supplied)	n/a	Install the EGC CO <sub>3</sub> Mixer mounting clips
35 cm (14 in) of black 0.25-mm (0.010-in) ID PEEK tubing	064346	Connect the EGC degas eluent outlet and the EGC CO <sub>3</sub> Mixer inlet
60 cm (24 in) of black 0.25-mm (0.010-in) ID PEEK tubing	064343	Connect the EGC CO <sub>3</sub> Mixer outlet to port <b>P (2)</b> on the injection valve
Temporary waste container (beaker, bottle, etc.) (not supplied)	n/a	Collect waste during setup procedures
10-32 fittings 10-32 ferrules	043275 043276	Complete the plumbing connections
1/8-in fittings 1/8-in ferrules	052267 048949	Complete the plumbing connections
10-32 to 10-32 couplers	042627	Complete the plumbing connections

Figure B-76 illustrates the liquid flow path through the eluent generator components after all setup steps are complete and the eluent generator is ready for operation.

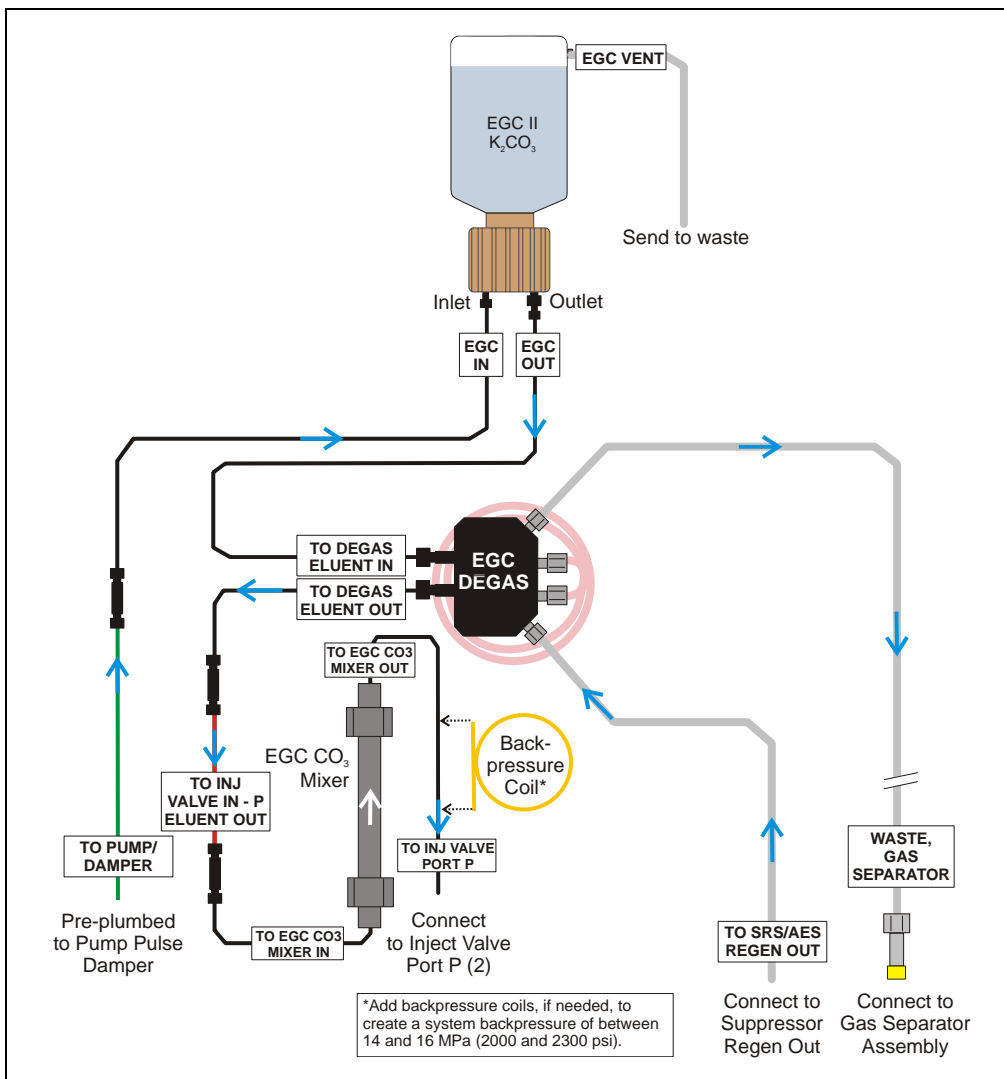


Figure B-76. Eluent Generator Flow Schematic with an EGC  $CO_3$  Mixer:  
Use for Generating Carbonate Eluent

### Installing the EluGen Cartridge and Preparing for Conditioning

Follow the steps in this section to install the EluGen cartridge and prepare it for conditioning before initial use.

[Figure B-77](#) illustrates the liquid flow path during the conditioning procedure.

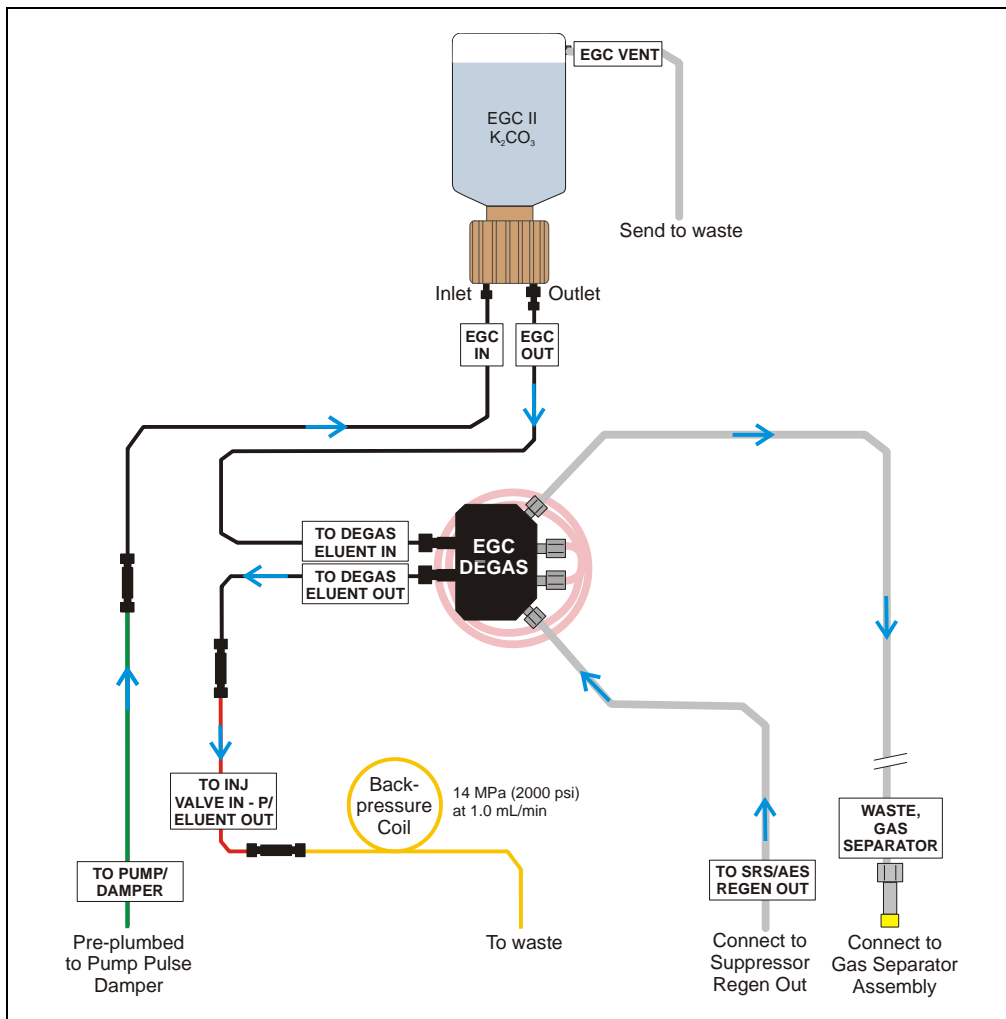


Figure B-77. EluGen Cartridge Plumbing for Conditioning with Carbonate Eluent

## ICS-2000 Ion Chromatography System

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1. Orient the EluGen cartridge with the fittings facing up and remove the plugs from the cartridge **INLET** and **OUTLET** fittings (see [Figure B-54](#)).

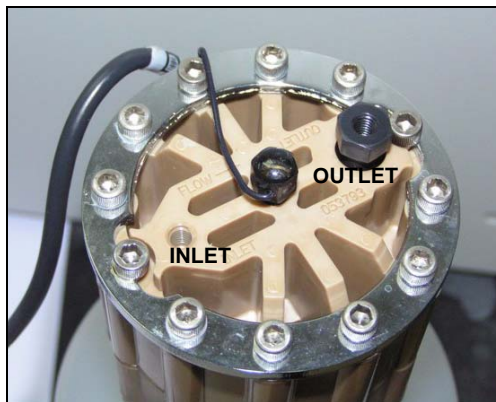


Figure B-78. EluGen Cartridge Fitting Plugs

2. Set the EluGen cartridge in the service area on top of the ICS-2000 and orient it with the cable toward the EGC holder (see [Figure B-79](#)).



Figure B-79. EluGen Cartridge in Service Area

3. Pull the coiled black **EGC IN** and **EGC OUT** lines out from inside the EGC holder. Disconnect the **EGC IN** line from the coupler that connects it to the **EGC OUT** line.
4. Connect the **EGC IN** line to the EluGen cartridge **INLET** port (see [Figure B-80](#)).
5. Remove the coupler and connect the **EGC OUT** line to the EluGen cartridge **OUTLET** port.

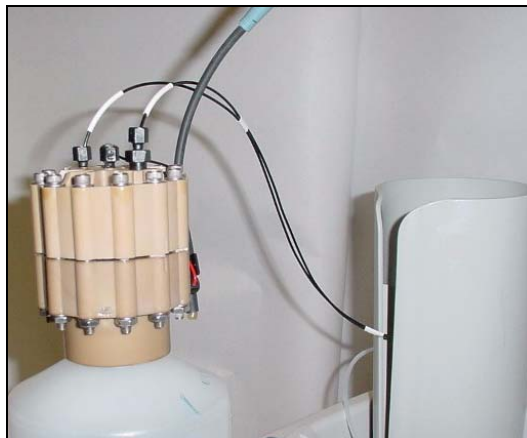


Figure B-80. EluGen Cartridge Port Connections

6. Turn the EluGen cartridge over (with the fittings facing down). **Shake the EluGen cartridge vigorously, and tap it with the palm of your hand 10 to 15 times. Check that all bubbles trapped in the eluent generation chamber are dislodged.**



CAUTION

The EluGen cartridge contains one of the following: a corrosive base (KOH, LiOH, or NaOH), a corrosive acid (MSA), or a concentrated  $K_2CO_3$  solution. Wear protective eyewear and gloves when handling the cartridge.



MISE EN GARDE

La cartouche d'EluGen contient un de ce qui suit: une base corrosive (KOH, LiOH, ou NaOH), un acide corrosif (MSA), ou une solution concentrée de  $K_2CO_3$ . Porter des lunettes et des gants protectives en manipulant la cartouche.



VORSICHT

Die EluGen-Kassette enthält eine korrodierende Base (KOH, LiOH oder NaOH), eine korrodierende Säure (MSA) oder eine konzentrierte  $K_2CO_3$ -Lösung. Tragen Sie daher beim Umgang mit Kassette eine Schutzbrille und Handschuhe.

- Slide the EluGen cartridge down into the holder until it stops (see [Figure B-81](#)). Make sure the cable remains out of the holder.

**NOTE** To avoid crimping the lines, do not twist the cartridge when you slide it into the holder. The lines are designed to coil inside the holder.



*Figure B-81. EluGen Cartridge Installed in the Holder*

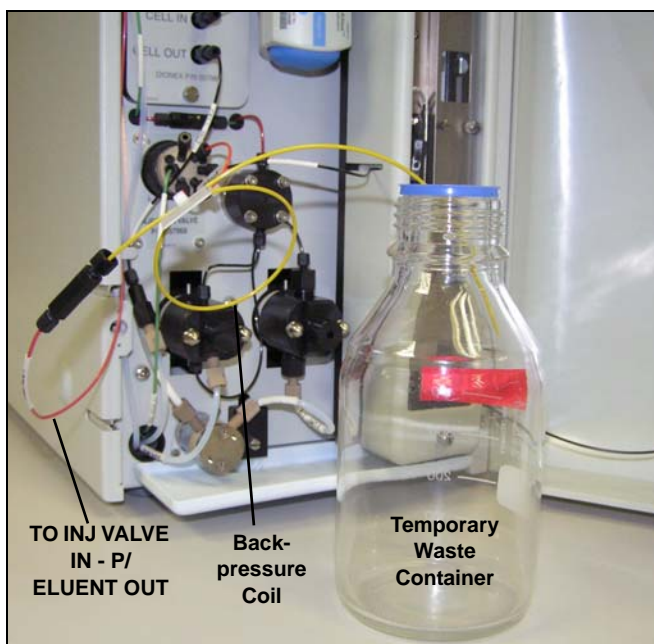
- Remove the plug from the **EGC-1** connector on top of the ICS-2000.
- Orient the cartridge's blue 4-pin electrical cable connector as shown in [Figure B-82](#). Push it onto the **EGC-1** connector on the ICS-2000. Twist the ring on the cable connector fingertight to secure it.



*Figure B-82. Connecting the EluGen Cartridge Cable*



10. Disconnect the **TO INJ VALVE IN - P/ELUENT OUT** line from port **P (2)** on the injection valve.
11. Use a 10-32 to 10-32 coupler (P/N 042627) to connect the **TO INJ VALVE IN - P/ELUENT OUT** line to one end of the yellow 0.5 mL/min, 7 MPa (1000 psi) backpressure coil (P/N 053765) (see [Figure B-83](#)).
12. Direct the free end of the backpressure coil to a temporary waste container.



*Figure B-83. Plumbing Connections for Conditioning the EluGen Cartridge with Carbonate Eluent*

### Installing the EluGen Cartridge Vent Line

1. Locate the EluGen Cartridge Vent Line Tubing Kit (P/N 063092) supplied with the EluGen cartridge.
2. Slide the label onto one end of the tubing and then push the barbed luer lock onto the tubing.
3. Unscrew and remove the plug from the vent opening on the side of the EluGen cartridge (see [Figure B-84](#)).



Figure B-84. EluGen Cartridge Vent Plug

4. Screw the luer adapter onto the vent opening. Remove the cap on the luer adapter by twisting. **Save the cap.**
5. Twist the luer lock and EluGen cartridge vent line into the luer adapter (see [Figure B-85](#)).

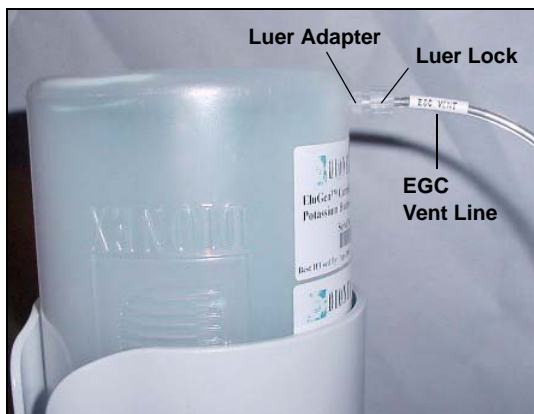


Figure B-85. Installing the EluGen Cartridge Vent Line

**NOTE** To prevent leaks from the EluGen cartridge, always replace the luer adapter cap before moving the EluGen cartridge.

6. Direct the EluGen cartridge vent line to the rear of the ICS-2000 and snap it onto one of the tubing clips on the rear panel.

7. Direct the vent line to the waste container and insert it down into the gas separator waste tube about 10 to 15 cm (4 to 6 in).

### Recording the EluGen Cartridge Serial Number in Chromeleon

The serial number is printed on the EluGen cartridge label.

1. Open the Chromeleon Server Configuration program (select **Start>Programs** (or **All Programs**)>**Chromeleon>Server Configuration**).
2. Double-click the ICS-2000 system icon. The properties dialog box for the ICS-2000 appears.
3. Click the **Eluent Generator** tab (see [Figure B-86](#)).
4. Select the **EGC-1** check box.
5. Enter the EluGen cartridge serial number and click **OK**.

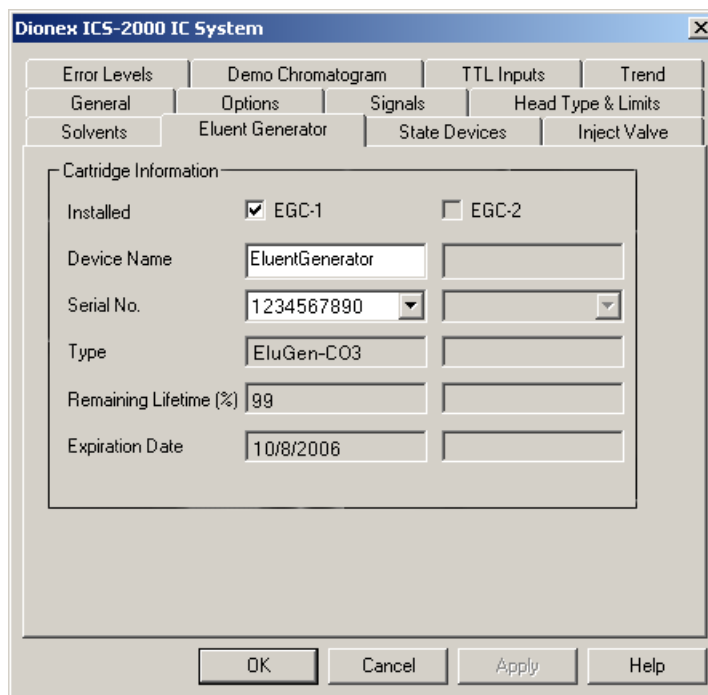


Figure B-86. Eluent Generator Configuration Properties Example

### Conditioning the EluGen Cartridge

After completing the installation steps described in the previous sections, condition the EluGen cartridge for 30 minutes before initial use.

1. Make sure the eluent reservoir is filled with ASTM filtered, Type I (18-megohm) deionized water.
2. Verify that the suppressor is off.

**IMPORTANT**

**To avoid damaging the suppressor, always turn off the suppressor before conditioning the EluGen cartridge. The pump flow is on during conditioning, however, no flow reaches the suppressor.**

3. Verify that the **Automatically turn on with pump** option is not selected on the ICS-2000 touch screen **SUPPRESSOR** page (see [Section C.9](#)). Disabling this option lets you turn on the pump, without automatically turning on the suppressor.
4. On the ICS-2000 touch screen **HOME** page, set the pump flow rate to **1.00 mL/min**.

5. Turn on the pump.

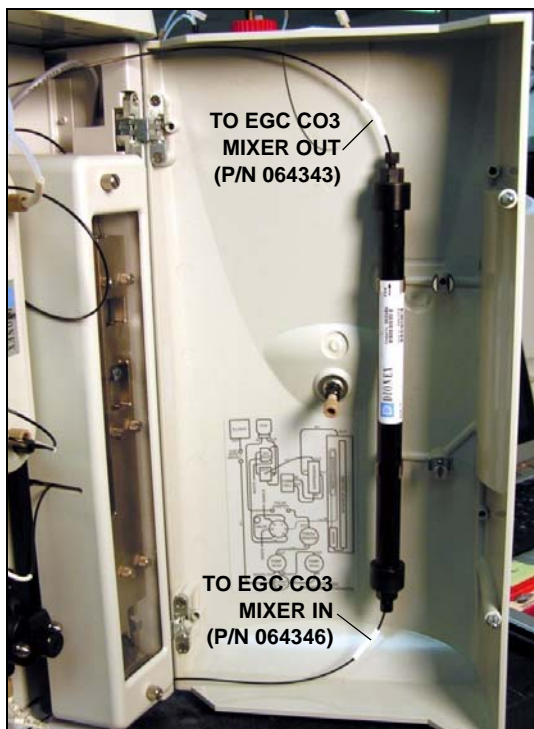
6. On the touch screen **HOME** page, touch the **EGC** button to open the **ELUENT GENERATOR** page. Verify that the cartridge type is **Carb**.

If the cartridge type is wrong, verify that the cartridge serial number was entered correctly in the Chromeleon Server Configuration program (see [“Recording the EluGen Cartridge Serial Number in Chromeleon”](#) on page B-87).

7. Set the **EGC-1** concentration to **9 mM**.
8. Turn on the EGC-1 current.
9. Run the EluGen cartridge at these settings for 30 minutes.
10. Turn off the EGC-1 current.
11. Turn off the pump.

### Installing the EGC CO<sub>3</sub> Mixer

[Figure B-67](#) illustrates the EGC CO<sub>3</sub> Mixer after installation.



*Figure B-87. ICS-2000 with an EGC CO<sub>3</sub> Mixer Installed*

## ICS-2000 Ion Chromatography System

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1. Use a Phillips head screwdriver to remove the existing small diameter mounting clips from the inside of the ICS-2000 door.
2. Install the larger diameter mounting clips (P/N 063642) (see [Figure B-88](#)).

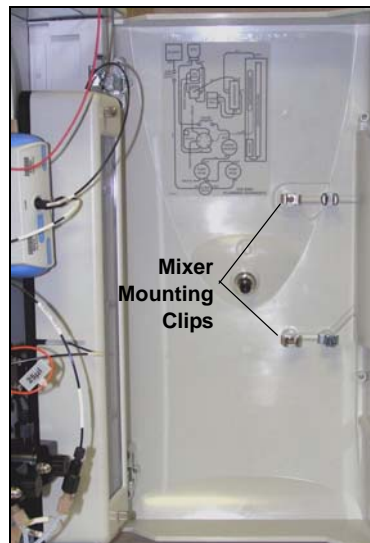


Figure B-88. Location of Mounting Clips for the EGC CO<sub>3</sub> Mixer

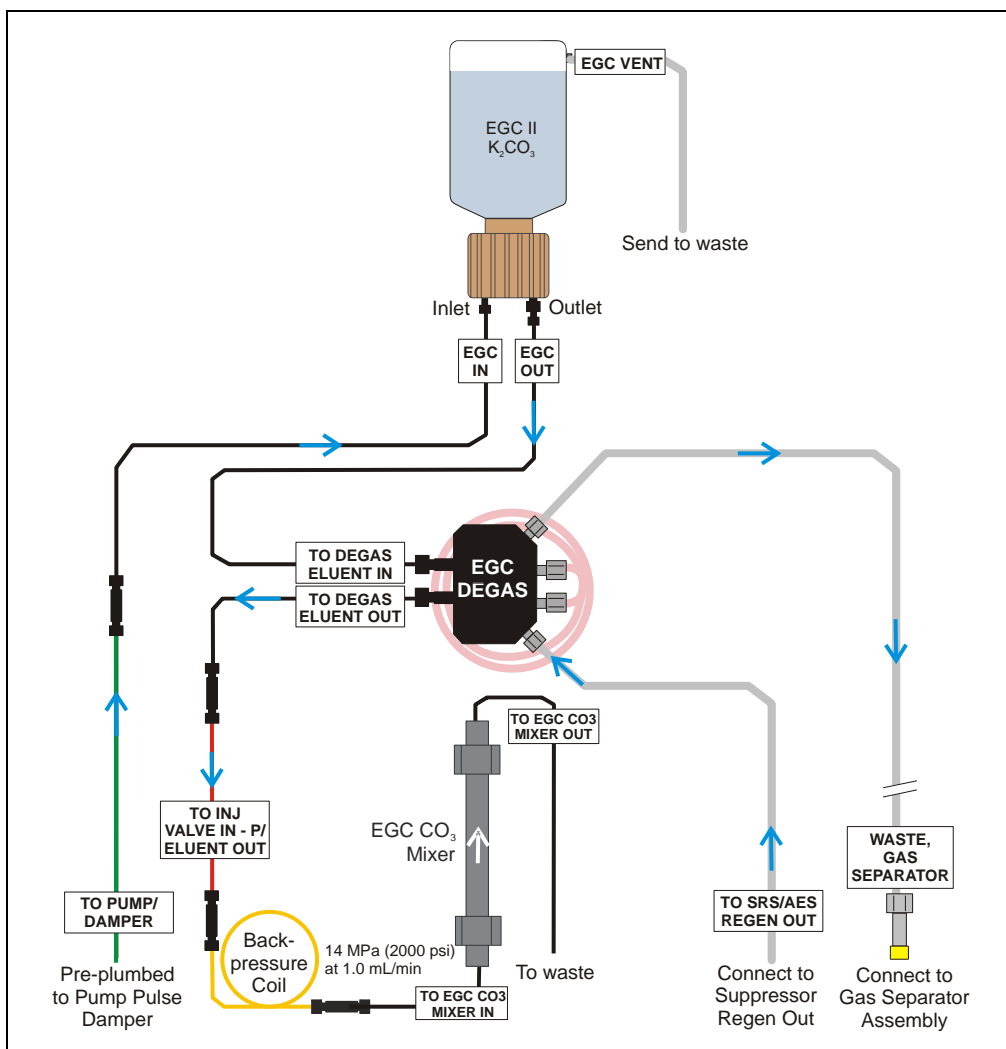
3. Orient the mixer with the outlet pointing upward and push it onto the clips (see [Figure B-89](#)). The mixer outlet must point upward to ensure thorough mixing of the eluent.
4. Locate the 35 cm (14 in) length of black PEEK tubing (white labels) (P/N 064346). Connect the end labeled **TO EGC CO<sub>3</sub> MIXER IN** to the mixer inlet.
5. Locate the 60 cm (24 in) length of black PEEK tubing (white labels) (P/N 064343). Connect the end labeled **TO EGC CO<sub>3</sub> MIXER OUT** to the mixer outlet.



Figure B-89. EGC CO<sub>3</sub> Mixer Installed on the ICS-2000 Door

### Filling the EGC CO<sub>3</sub> Mixer with the Carbonate Eluent

Before initial use, follow the steps in this section to fill the EGC CO<sub>3</sub> Mixer with the carbonate eluent required for the application to be run. [Figure B-90](#) illustrates the liquid flow path through the eluent generator components during initial filling of the EGC CO<sub>3</sub> Mixer with carbonate eluent.



*Figure B-90. Plumbing for Filling the EGC CO<sub>3</sub> Mixer with Carbonate Eluent*

1. Connect a 10-32 to 10-32 coupler to the mixer inlet and connect the outlet of the yellow PEEK backpressure coil to the coupler.
2. Direct the mixer outlet to the temporary waste container.
3. Verify that the suppressor is off.

**IMPORTANT**

To avoid damaging the suppressor and CR-TC, always turn off the suppressor before conditioning the EluGen cartridge. The pump flow is on during conditioning, however, no flow reaches the suppressor.

4. Verify that the **Automatically turn on with pump** option is not selected on the ICS-2000 touch screen **SUPPRESSOR** page (see [Section C.9](#)). Disabling this option lets you turn on the pump, without automatically turning on the suppressor.
5. Set the pump flow rate to the rate required for the application.
6. Turn on the pump.
7. Verify that the system backpressure is between 14 and 16 MPa (2000 and 2300 psi). If necessary, adjust the pressure by adding or removing backpressure tubing.
8. Set the **EGC-1** concentration to the value required for your application.
9. Turn on the **EGC-1** current.
10. Run at these settings until a consistent flow of eluent is exiting the mixer outlet. At a flow rate of 1 mL/min it will take about 16 minutes to fill a 4-mm mixer and about 5 minutes to fill a 2-mm mixer.

**NOTE** The void volume of the 4-mm mixer is about 16 mL. The void volume of the 2-mm mixer is about 5 mL.

11. Turn off the **EGC-1** current.
12. Turn off the pump.
13. Remove the yellow PEEK backpressure coil from the **TO INJ VALVE IN - P/ELUENT OUT** line and the mixer inlet.
14. Retain the coupler on the mixer inlet.



## Completing the Eluent Generator Setup for Carbonate Eluent

Figure B-91 illustrates the liquid flow path through the ICS-2000 after all setup steps are complete and the eluent generator is ready for operation.

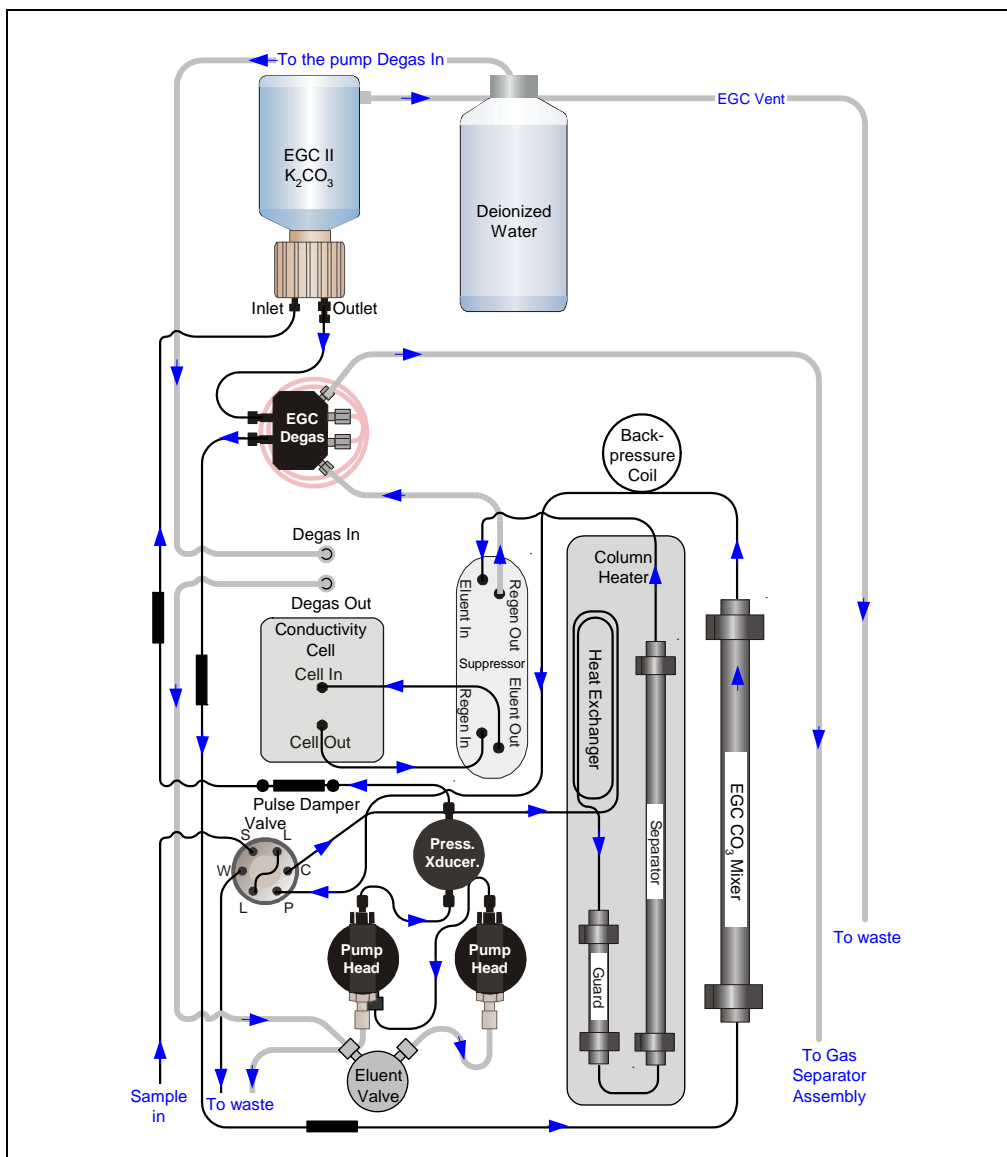


Figure B-91. ICS-2000 Flow Schematic: Carbonate Eluent Generation

## ICS-2000 Ion Chromatography System

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1. Connect the **TO INJ VALVE IN - P/ELUENT OUT** line to the coupler attached to the mixer inlet line. Route this line along the back of the drip tray to prevent it from being pinched when the ICS-2000 door is opened and closed.
2. Route the mixer outlet line to the back of the component panel (see [Figure B-92](#)).
3. Connect the mixer outlet line to port **P (2)** on the injection valve.



*Figure B-92. Mixer Outlet Routed to the Back of the Component Panel*

**NOTE** Backpressure tubing may be required between the injection valve and the EGC CO<sub>3</sub> Mixer outlet. The EluGen cartridge requires 14 to 16 MPa (2000 to 2300 psi) of system backpressure for removal of electrolysis gas from the eluent produced by the cartridge. See [Section B.16.1](#) for details.

Go on to [Section B.15](#).

## B.15 Setting Up a Chromeleon Application

Chromeleon provides application templates that let you quickly get started running. To use the application templates, you need to know the type of column and suppressor you will be using. This section shows how to create a *sequence* (a list of samples to be processed) and how to use an application template.

1. Identify the type of column and suppressor installed in the ICS-2000.
2. Start Chromeleon (select **Start>Programs>Chromeleon>Chromeleon**).  
The Chromeleon main window and Browser appear (see [Figure B-93](#)).

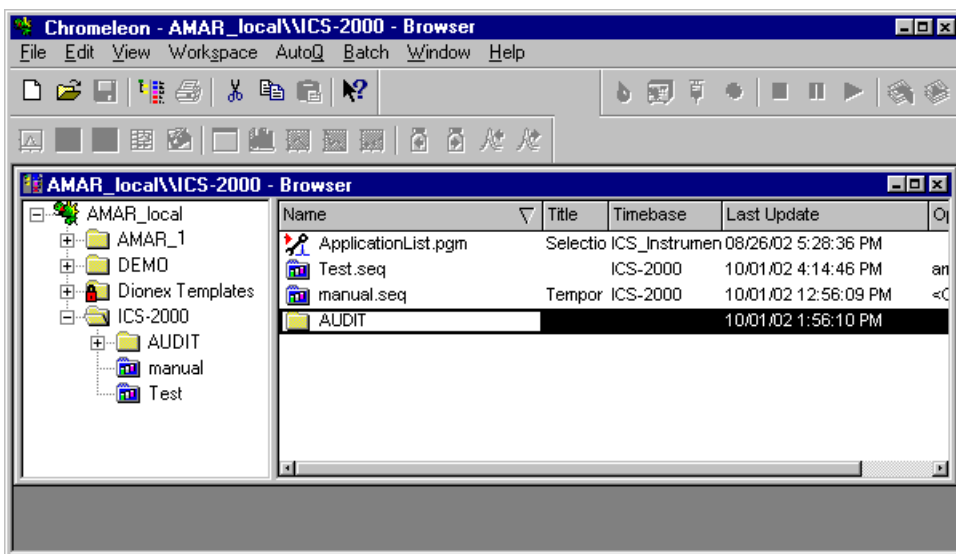
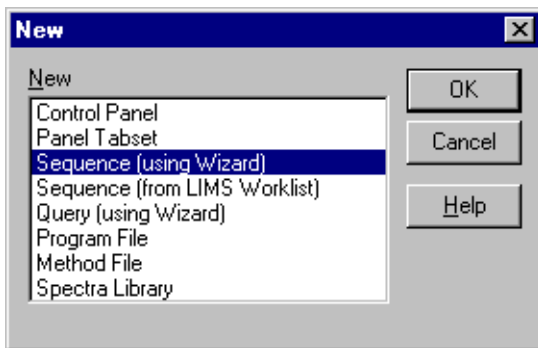


Figure B-93. Chromeleon Main Window and Browser

3. In the Browser, select **File>New** and select **Sequence (using Wizard)** (see [Figure B-94](#)).



*Figure B-94. Creating a New Sequence*

The Sequence Wizard Welcome page appears (see [Figure](#)).

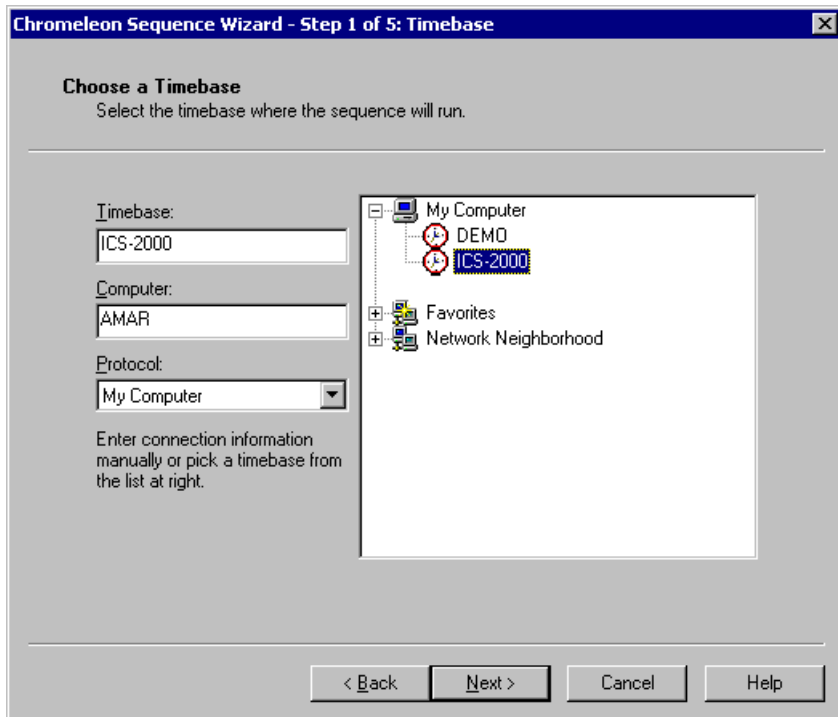


*Figure B-95. Sequence Wizard Welcome Page*

**NOTE** For details about a Sequence Wizard step, click the **Help** button on the Sequence Wizard page.

4. Click **Next>**.

The Sequence Wizard Timebase page appears (see [Figure B-96](#)).



*Figure B-96. Example: Sequence Wizard Step 1*

5. Select the ICS-2000 timebase and click **Next>**.

The Unknown Samples page appears (see [Figure B-97](#)).

The screenshot shows the 'Unknown Samples' dialog box in the Chromeleon Sequence Wizard. The title bar reads 'Chromeleon Sequence Wizard - Step 2 of 5: Unknown Samples'. The main area is titled 'Unknown Samples' and contains the instruction 'Generate samples from a template or import them via clipboard or from another sequence'. There are two tabs: 'Sequence Preview' (selected) and 'Rack Preview'. The 'Sequence Preview' tab shows a table with columns 'Name', 'Pos.', and 'Vol.'. Below the tabs are several input fields: 'Use template' (a dropdown menu), 'Import...' (a button), 'Template for Sample Name:' (a text field with a right arrow button), 'Number of Vials:' (a spinner box with '0' and range '[1...x]'), 'Injections per Vial:' (a spinner box with '1' and range '[1...99]'), 'Start Position:' (a spinner box with '1' and range '[1...99999]'), and 'Injection Volume:' (a spinner box with '20.0' and range '[0.1...100000.0 µl]'). An 'Apply >>' button is located below these fields. At the bottom of the dialog are four buttons: '< Back', 'Next >', 'Cancel', and 'Help'.

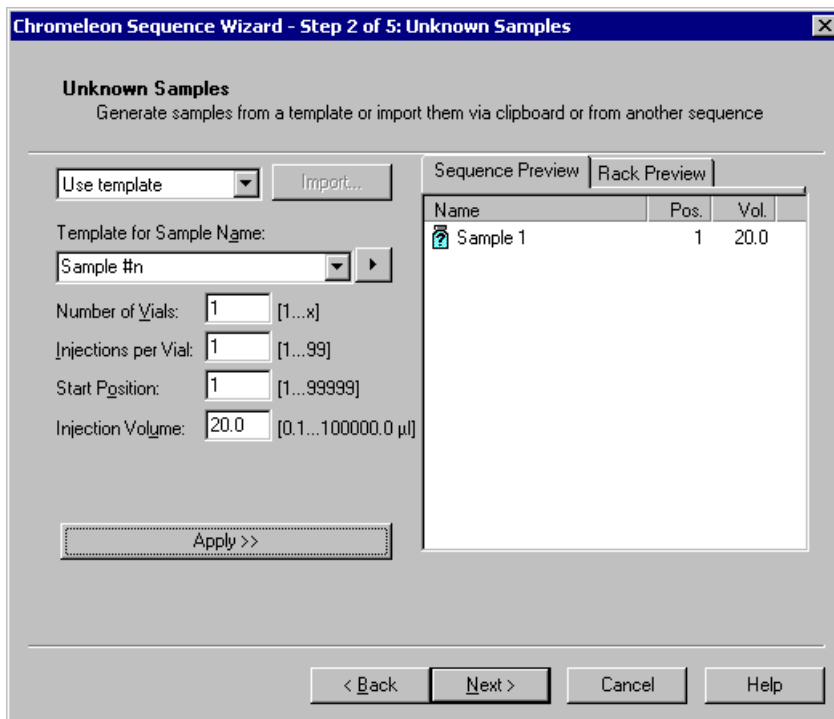
Figure B-97. Example: Sequence Wizard Step 2

6. Select **Use Template** from the drop-down list.
7. In the **Template for Sample Name** field, type **Sample**, click the right arrow, and select **Sample Number #n**.
8. In the **Number of Vials** field, type **1**.
9. Use default settings for the remaining parameters on the page.

**NOTE** You can edit the sequence later, to add more samples and select the injection parameters appropriate for your application.

10. Click **Apply>>**.

[Figure B-98](#) shows Sequence Wizard Step 2 after a sample is defined.



*Figure B-98. Example: Sequence Wizard Step 2 with Sample Defined*

11. Click **Next>**.

The Standard Samples page appears (see [Figure B-99](#)).

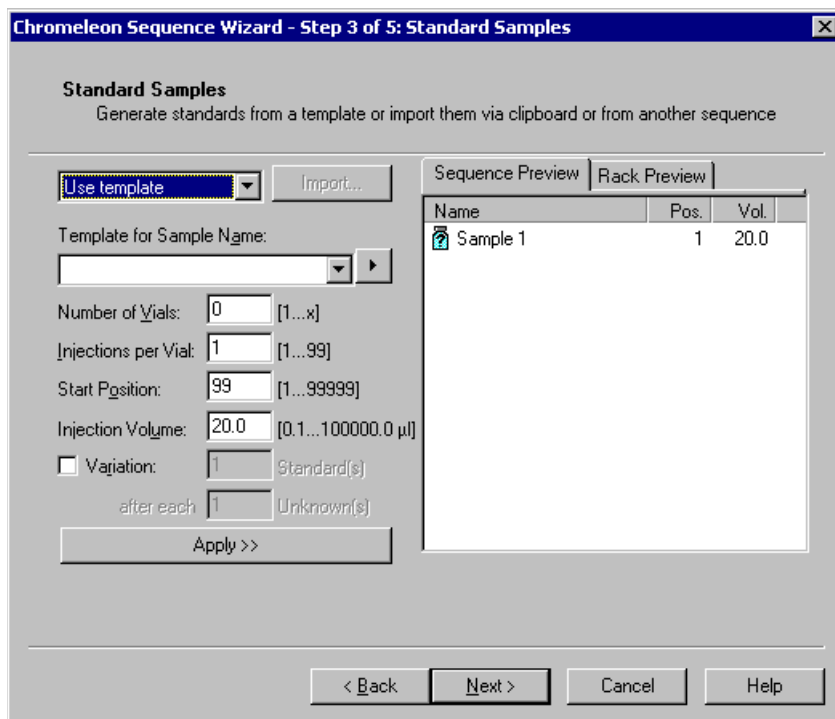


Figure B-99. Example Sequence Wizard Step 3

12. Click **Next>** to omit this step and define standard injections later. Or, define one or more standard injections, and then click **Next>**.

The Methods & Reporting page appears.



13. Select the **Use Application Template** check box.
14. From the drop-down lists, select the type of suppressor to be installed and then select the column.

In the example in [Figure B-100](#), the 4-mm ASRS suppressor and AS17 column are selected.

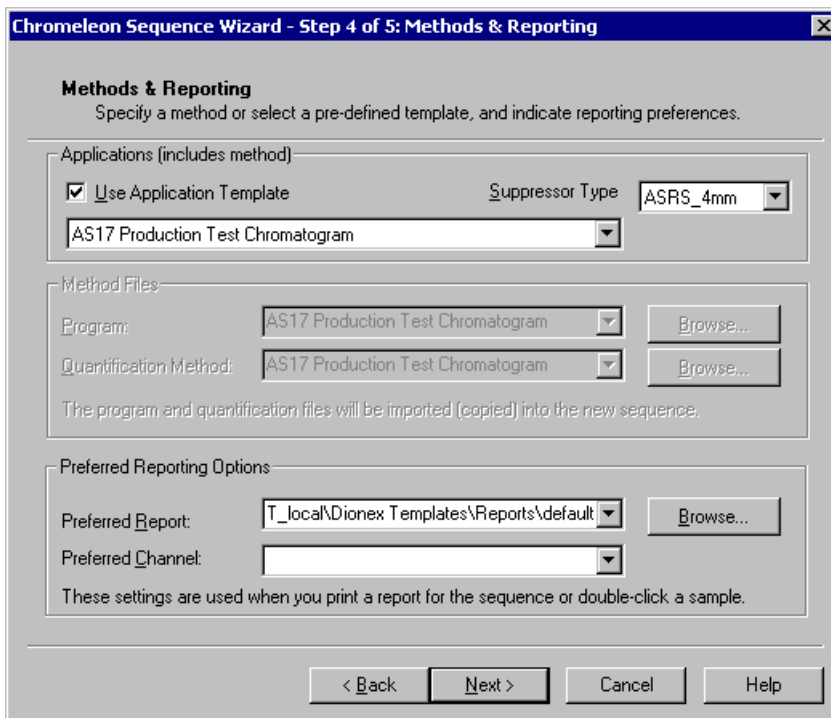
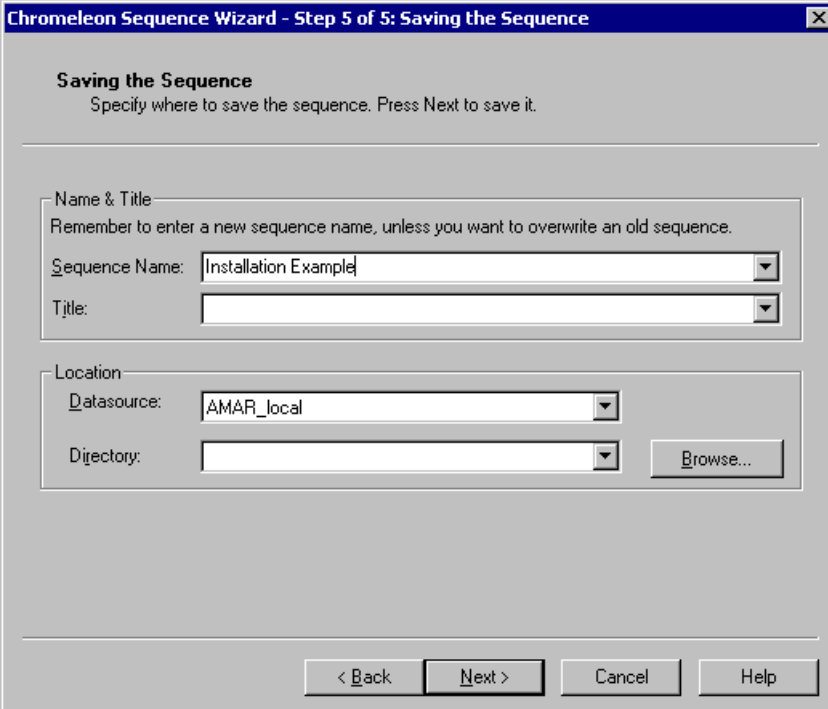


Figure B-100. Example: Sequence Wizard Step 4

15. To select a report template, click the **Browse** button, go to the Dionex Templates/Reports folder, and select a template (for example, **default**).
16. Click **Next>**.

The Saving the Sequence page appears.

17. Enter a name for the sequence and a location (see the example in [Figure B-101](#)).



The screenshot shows a dialog box titled "Chromeleon Sequence Wizard - Step 5 of 5: Saving the Sequence". The main heading is "Saving the Sequence" with the instruction "Specify where to save the sequence. Press Next to save it." The dialog is divided into two sections: "Name & Title" and "Location".

**Name & Title:** A note says "Remember to enter a new sequence name, unless you want to overwrite an old sequence." Below this are two dropdown menus: "Sequence Name" (containing "Installation Example") and "Title" (empty).

**Location:** Two dropdown menus: "Datasource" (containing "AMAR\_local") and "Directory" (empty). A "Browse..." button is located to the right of the "Directory" dropdown.

At the bottom of the dialog are four buttons: "< Back", "Next >", "Cancel", and "Help".

Figure B-101. Example: Sequence Wizard Step 5

18. Click **Finish>** and then click **Done** on the last page of the Sequence Wizard.

The Browser appears, displaying the sequence you created (see [Figure B-102](#)). Notice the three files in the top pane of the Browser window.

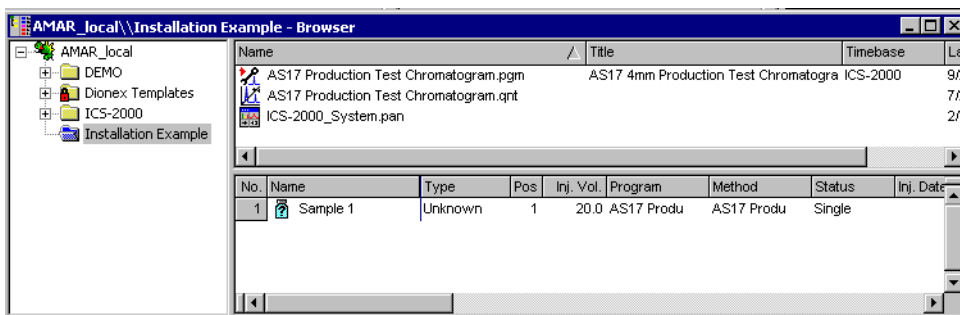


Figure B-102. Example Browser with Open Sequence

- The .pgm file (program) contains commands and parameters for controlling the ICS-2000, controlling the autosampler (if used), and acquiring sample data.
- The .qnt file (quantification method) contains peak identification and area determination parameters.
- The .pan file (Control panel) lets you control and/or monitor the ICS-2000 and other modules that are connected to the timebase.

**NOTE** The sequence that you create here is intended as a starting point only. You can add additional samples to the sequence, change injection parameters, and edit the .pgm and .qnt files. Refer to the Chromeleon online Help for details.

**NOTE** After completing the installation, see [Section 3.11](#) for how to process the samples and standards in the sequence.

19. Double-click the .pan file to open the Control panel for your system (see the example in [Figure B-103](#)).

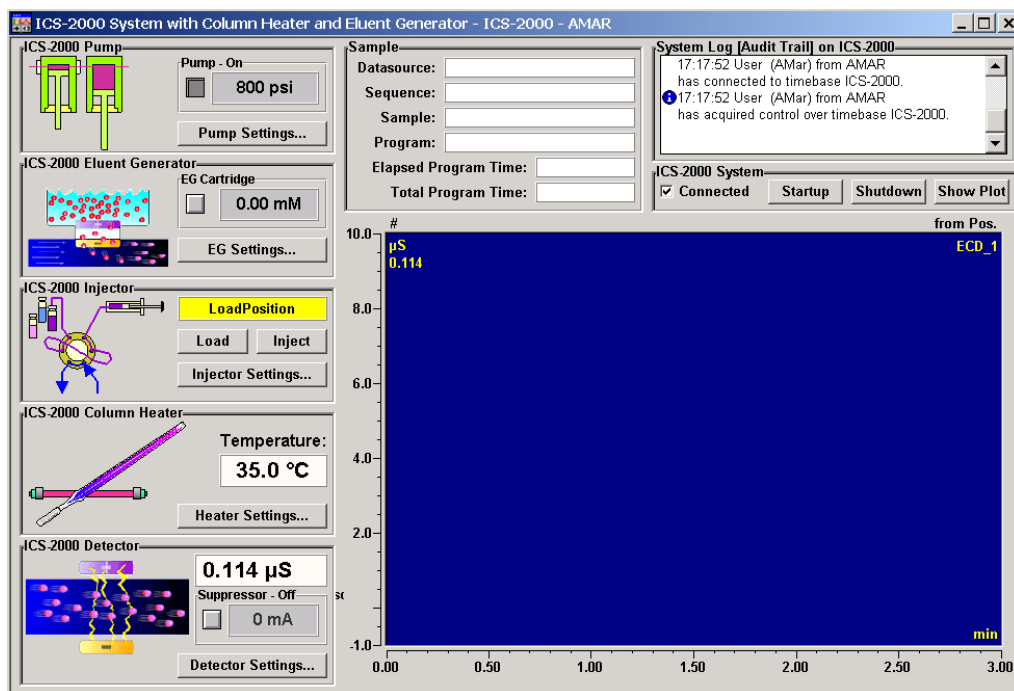


Figure B-103. ICS-2000 System Control Panel Example

**NOTE** If the Connected check box is not selected, click the box to connect the ICS-2000 to the Control panel.

### B.15.1 Verifying Chromeleon Communication

Verify that Chromeleon is communicating with the ICS-2000 by clicking the **Inject** and then the **Load** button on the Control panel. If communication is occurring, you will hear the valve actuate as it changes position. Go on to [Section B.12](#).

## **B.16 Equilibrating the System**

1. After priming the pump, turn on the pump and set the flow to the operating rate.
2. Flush the system for about 5 minutes to equilibrate.
3. Monitor the system pressure reading from the Chromeleon Control panel.

The EluGen cartridge requires at least 14 MPa (2000 psi) of system backpressure for removal of electrolysis gas from the eluent produced by the cartridge. A system backpressure of 16 MPa (2300 psi) is ideal. If the pressure is too low, install a backpressure coil (see [Section B.16.1](#)).

**IMPORTANT**

**The recommended maximum operating pressure for the eluent generator is 21 MPA (3000 psi). Excessive backpressure may rupture the tubing in the EGC degas tubing assembly.**

4. Check that liquid is flowing out of the suppressor **REGEN OUT** waste line and that the pressure is stable.
5. Monitor the baseline conductivity. In general, it should be <30  $\mu\text{S}$  for a system set up for anion analyses, and <2  $\mu\text{S}$  for a system set up for cation analyses. Equilibration time varies and it can take some time to reach these expected values.
6. Go on to [Section B.17](#).

### B.16.1 EluGen Cartridge Backpressure Requirements

The EluGen cartridge requires at least 14 MPa (2000 psi) of backpressure for optimal removal of electrolysis gas from the eluent produced by the cartridge. During system equilibration (see [Section B.16](#)), monitor the system pressure and verify that it is between 14 and 20 MPa (2000 and 3000 psi). A system backpressure of 16 MPa (2300 psi) is ideal.

If the pressure is too low, install a backpressure coil between the injection valve and the eluent outlet. The backpressure coils listed in the table below are included in the ICS-2000 Ship Kit (P/N 064375).

Connect one end of the backpressure coil to port **P (2)** on the injection valve; connect the other end to the **TO INJ VALVE IN - P/ELUENT OUT** line or to the mixer outlet, if an EGC CO3 Mixer is installed.

Part Number	Description	Flow Rate	Approximate Backpressure Added
053763	4-mm Backpressure Coil (red)	2.00 mL/min	7 MPa (1000 psi)
		1.00 mL/min	3.5 MPa (500 psi)
053762	4-mm Backpressure Coil (red)	2.00 mL/min	3.5 MPa (500 psi)
		1.00 mL/min	1.75 MPa (250 psi)
053765	2-mm Backpressure Coil (yellow)	0.50 mL/min	7 MPa (1000 psi)
		0.25 mL/min	3.5 MPa (500 psi)
053764	2-mm Backpressure Coil (yellow)	0.50 mL/min	3.5 MPa (500 psi)
		0.25 mL/min	1.75 MPa (250 psi)

### B.17 Verifying Operational Status

After the system has equilibrated, verify the actual pump pressure and stability by monitoring the pump pressure reading on the Chromeleon Control panel (or the touch screen **HOME** page). Write down the short-term pressure fluctuations; they should be less than 0.13 MPa (20 psi).

## **B.18 Connecting an AS or AS50 (USB) Autosampler (Optional)**

To use an AS or AS50 (USB) autosampler with the ICS-2000, the following requirements must be met:

- The ICS-2000 injection valve must be linked to the AS or AS50 (USB) in the Chromeleon timebase (see [Section B.18.2](#))
- An injection valve should not be installed in the AS or AS50 (USB) (see the note below)

After the AS or AS50 (USB) is connected to the ICS-2000 and the valve is linked in Chromeleon, all autosampler injection valve commands will control the ICS-2000 injection valve (whether issued from the AS or AS50 (USB) front panel or from Chromeleon). In addition, all AS or AS50 (USB) modes of injection (full-loop, partial-loop, partial-loop limited-sample, and others) are supported.

**NOTE** Dionex recommends using AS or AS50 (USB) models that do not have injection valves (see the list below). If a valve is installed in the autosampler, it is switched at the same time as the valve in the ICS-2000. This causes unnecessary wear on the autosampler valve. If required, the autosampler valve can be disconnected from the AS or AS50 (USB) electronics. If you wish to do this, contact Dionex for assistance. The AS or AS50 (USB) electronics components cannot be serviced by the user.

The following AS50 (USB) and AS models can be used with an ICS-2000:

<b>Part Number</b>	<b>Autosampler Model</b>	<b>Injection Valve</b>	<b>Sample Preparation</b>	<b>Sample Tray Cooling</b>
061130	AS50 (USB)	No	No	Yes
061132	AS50 (USB)	No	Yes	Yes
061134	AS50 (USB)	No	No	No
061136	AS50 (USB)	No	Yes	No
063102	AS	No	No	No
063103	AS	No	Yes	No
063106	AS	No	No	Yes
063107	AS	No	Yes	Yes

**NOTE** The ICS-2000 and the AS or AS50 (USB) can be set up for stand-alone (front-panel) operation. This requires a TTL cable connection between the AS or AS50 (USB) and the ICS-2000. See [Section D.3](#) for stand-alone setup instructions.

## B.18.1 AS or AS50 (USB) Connections

1. Place the autosampler to the left of the ICS-2000 on the workbench.
2. Open the ICS-2000 and autosampler doors.
3. The needle seal line that extends from the inject port in the autosampler is coiled inside the autosampler door, on the right side. Route this line through the autosampler right side slot (see [Figure B-104](#)) and the ICS-2000 left side slot to the ICS-2000 injection valve.

**IMPORTANT**

The needle seal line from the autosampler inject port to the ICS-2000 injection valve is calibrated for use with the ICS-2000. To ensure injection precision, do not shorten (by cutting) or lengthen this line, or replace it with a different (uncalibrated) line.

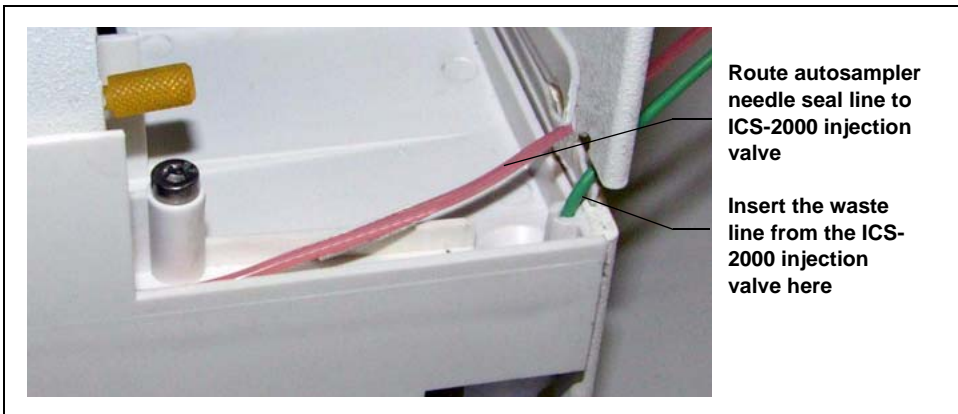


Figure B-104. Autosampler Drip Tray



## Connecting an AS or AS50 (USB) Autosampler (Optional)

4. Connect the needle seal line from the autosampler to port **S (5)** on the injection valve (see [Figure B-105](#)).

The green waste line that is connected to port **W (6)** on the injection valve (see [Figure B-105](#)) is connected with a coupler to a Teflon waste line (see [Figure B-106](#)) and routed through the tubing chase to the ICS-2000 rear panel.

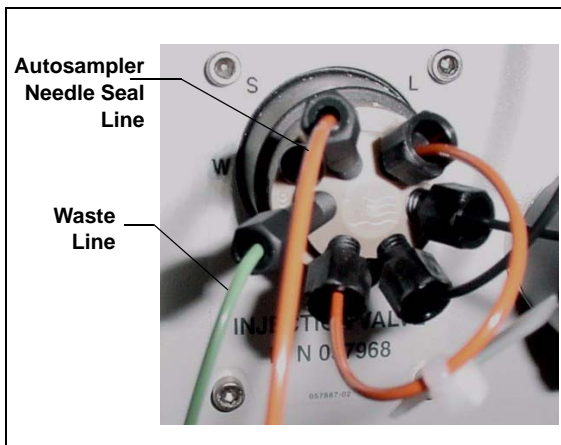


Figure B-105. ICS-2000 Injection Valve

5. Disconnect the green waste line (labeled **AS/AS50 TRAY**) from the coupler and route the line to the drip tray in the autosampler compartment.

You can either leave the disconnected Teflon waste line and coupler in the tubing chase, or pull the line out from the front.

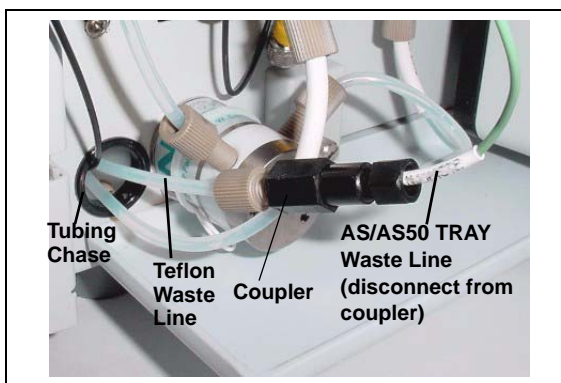


Figure B-106. Injection Valve Waste Line Coupler

6. Push the end of the green **AS/AS50 TRAY** line into the small round opening on the right side of the AS or AS50 (USB) tray (see [Figure B-104](#)).

### IMPORTANT

Make sure the injection valve waste line is not elevated above the injection valve at any point between the valve and the autosampler drip tray.

**NOTE** Bend the waste line tubing about 5-mm from the end to ensure it stays in place in the opening in the drip tray. When bending the tubing, be sure not to restrict the inner diameter.

### B.18.2 AS or AS50 (USB) Chromeleon Setup

1. If you have not already done so, add the autosampler to the Chromeleon timebase (see [Section B.8](#)).
2. In the ICS-2000 Server Configuration properties, verify that the injection valve is controlled by the autosampler. To do this:
  - a. Open the Chromeleon Server Configuration program and select the ICS-2000 device in the timebase.
  - b. Select **Properties** on the **Edit** menu.
  - c. Select the **Inject Valve** tab.
  - d. Verify that the **Pump\_InjectValve** check box is selected and that **AS** is listed in the **Controlled By** column (see [Figure B-107](#)).
  - e. If **ICS-2000** is listed in the **Controlled By** column, select the **Pump\_InjectValve** name and press the **F2** key. A dialog box appears. Select **AS** in the **Controlled by** drop-down list.

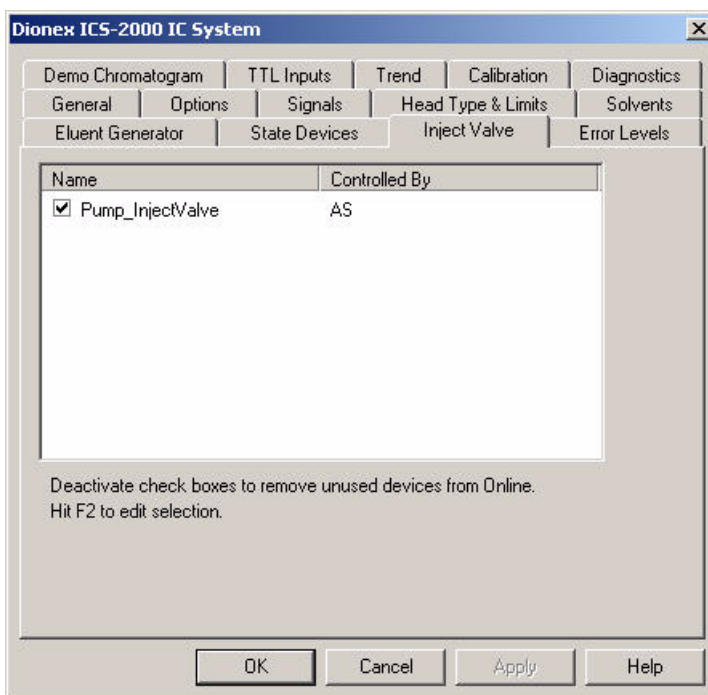


Figure B-107. ICS-2000 Inject Valve Server Configuration Properties

### B.19 Connecting an AS40 Automated Sampler (Optional)

1. Place the AS40 to the left of the ICS-2000 on the workbench.
2. Open the front door of the ICS-2000 and thread the outlet line from the AS40 through the left side slot at the front of the ICS-2000.
3. Connect the outlet line from the AS40 to port **S (5)** of the injection valve (see [Figure B-108](#)).

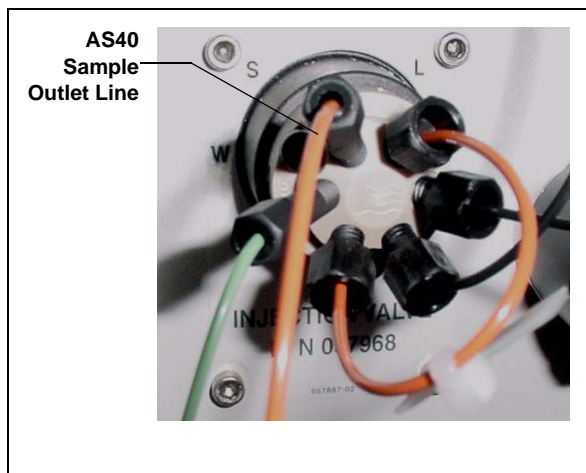


Figure B-108. ICS-2000 Injection Valve

4. Locate the relay control cable (P/N 047946) supplied with the AS40.
5. Remove the 2-position connector plug from the pair of wires labeled **LOAD** on the relay control cable.
6. Locate the 12-position connector plug (P/N 923686) in the ICS-2000 Ship Kit (P/N 064375) (see [Figure B-109](#)).
7. Attach the red wire from the relay control cable to position 1 on the plug, and attach the green wire to position 2. This will be used to connect the AS40 **LOAD** relay to **RELAY OUT 1** on the ICS-2000.

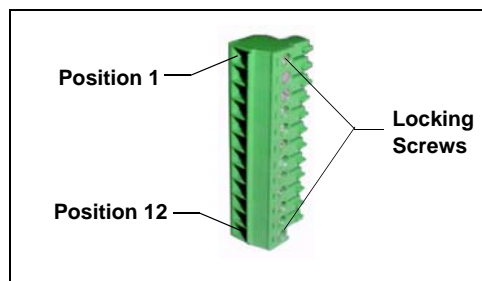


Figure B-109. 12-Position Connector Plug

To attach a wire to the plug, strip the end of the wire, insert it into the plug, and use a screwdriver to tighten the locking screw.



**When attaching wires to the connector plug, be careful not to allow stray strands of wire to short to the adjoining position on the connector.**

**NOTE** If RELAY OUT 1 is not available, you can connect to RELAY OUT 2 or to one of the TTL outputs. For RELAY OUT 2, connect the red wire to position 3 and the green wire to position 4. For TTL OUT 1, connect the red wire to position 5 and the green wire to position 11. For TTL OUT 2, connect the red wire to position 6 and the green wire to position 12.

8. Connect the relay control cable's 10-position connector plug to the **RELAY CONTROL** connector on the AS40 rear panel (see [Figure B-110](#)).
9. Plug the 12-position connector plug into the TTL and relay connector on the ICS-2000 rear panel (see [Figure B-110](#)). Make sure the red wire connects to position 1 and the green wire connects to position 2.

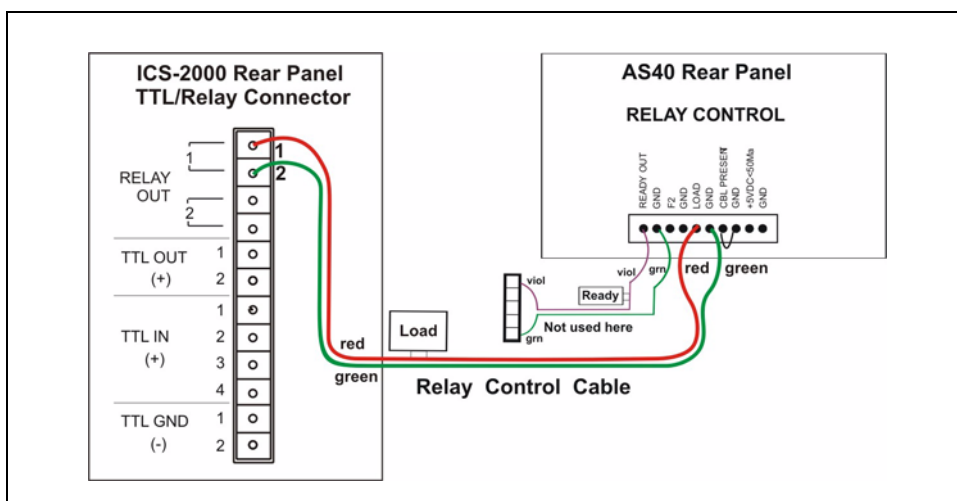


Figure B-110. Example AS40 Autosampler Connection

The AS40 Load relay is now dedicated to the ICS-2000 **RELAY OUT 1**. Use this relay for running with Chromeleon. When you set up the ICS-2000 application (see [Section B.15](#)), commands for controlling the AS40 Load relay and switching

the ICS-2000 injection valve are included by default in the program file (see [Figure B-111](#)).

```
AS12A Production Test Chromatogram - Commands
nm Production Test Chromatogram
Suppressor_Current = 2.5
Flow = 1.50
-2.300 Pump_ECD_Relay_1.Closed Duration=138.00 ; For AS40 injection.
0.000 Pump_ECD.Autozero
ECD_1.AcqOn
Pump_InjectValve.InjectPosition Duration=30.00
15.000 ECD_1.AcqOff
End
```

Figure B-111. Example Program for AS40 Control

## B.20 Connecting the Analog Output (Optional)

The analog output connector on the ICS-2000 rear panel outputs an analog voltage signal proportional to the conductivity measured by the cell. The selected data rise time (see [Section C.10.1](#)) filters the output. The analog output can be connected to an analog-to-digital converter such as an integrator or other recording device. Refer to the documentation for the device for connection instructions.

Analog output is 0 to 1V, scaled to the selected range (see [Section C.10.3](#)).

For an example setup for ICS-2000 stand-alone operation with an AS or AS50 (USB) autosampler, see [Section D.3](#).

## B.21 Pressurizing the Eluent Reservoir (Optional)

The ICS-2000 does not require pressurized reservoirs. However, if eluent is manually degassed or is sensitive to contamination, Dionex recommends pressurizing the reservoir with helium or nitrogen. The air regulator accessory bracket and other items needed for pressurizing the eluent reservoir must be ordered separately (P/N 060054).

### B.21.1 Connect the Gas Source

1. Locate the barbed fitting (P/N 030071), pipe thread reducer (P/N 030087), 3-mm (1/8-in) ID tubing (P/N 040793), and ICS-2000 air regulator accessory (P/N 060054). These parts must be ordered separately.
2. Use the barbed fitting and pipe thread reducer to connect the 3-mm (1/8-in) ID tubing to a clean gas source, regulated to between 0.55 and 0.83 MPa (80 and 120 psi).
3. Push the other end of the tubing onto the inlet of the air regulator (see [Figure B-112](#)).
4. Remove the eluent reservoir cap.
5. Connect the gas line from the eluent reservoir cap to the gas line on the air regulator outlet.s
6. Slip the air regulator accessory bracket over the neck of the eluent reservoir (see [Figure B-112](#)).

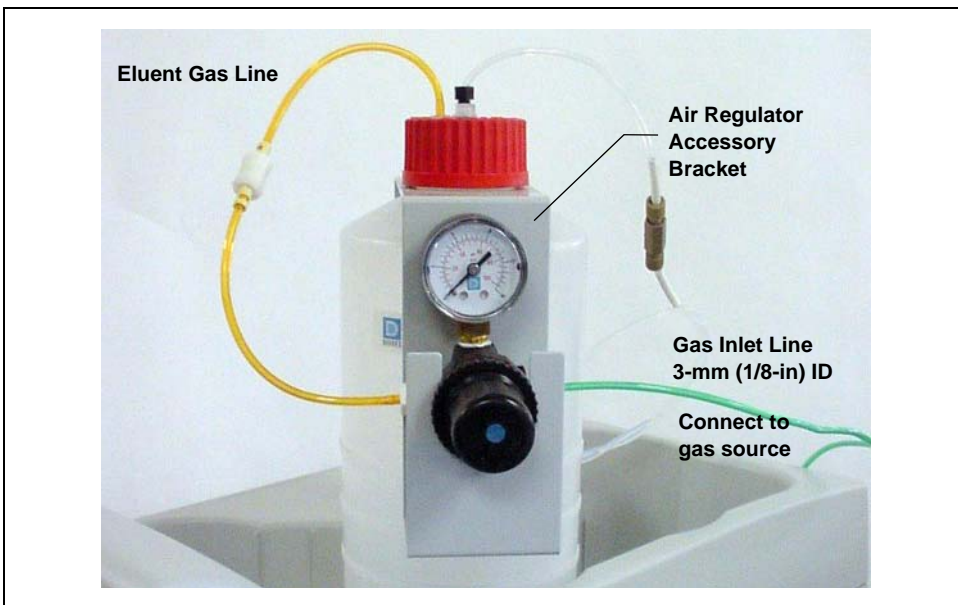


Figure B-112. ICS-2000 Pressurized Eluent Reservoir Connections (Optional)

### B.21.2 Pressurize the Eluent Reservoir

**NOTE** Do not pressurize the ICS-2000 until after the reservoir is plumbed.

1. Pull out the air regulator knob and turn it fully counterclockwise to ensure there is no pressure to the reservoir when the gas source is turned on.
2. Turn on the gas source.
3. Pull out the air regulator knob and turn it clockwise to pressurize the eluent reservoir.
4. Adjust the pressure to between 0.03 and 0.04 MPa (5 and 6 psi). Push the regulator knob back in.



**Do not pressurize the eluent reservoir above 0.07 MPa (10 psi).**



**Ne mettez jamais les réservoirs d'éluants sous une pression supérieure à 0,07 MPa (10 lb/po<sup>2</sup>).**



**Setzen Sie den Eluentbehälter auf keinen Fall einem Druck über 0,07 MPa aus.**

## B.22 Pump Continuous Seal Wash Connections (Optional)

The pump includes a seal wash assembly that can be set up to continuously rinse the back of the piston seals to remove salt crystals and prolong the life of the seals. Follow the steps below to set up this feature.

1. Fill a flush bottle with either deionized water or a combination of deionized water and 10% or 20% isopropyl alcohol. (Isopropyl alcohol will inhibit bacterial growth in the water.)
2. Place the flush bottle on top of the ICS-2000. During operation, gravity maintains flow through the pump heads.
3. The flush solution is carried to the piston seal wash assembly and out to waste via 1.5-mm (0.06-in) ID tubing (P/N 055847). Locate this tubing in the ICS-2000 Ship Kit (P/N 064375) and cut the tubing into three unequal pieces in the following lengths:
  - 117 cm (46 in)
  - 152 cm (60 in)
  - 15 cm (6 in)
4. Install the tubing as follows (see [Figure B-113](#) and [Figure B-114](#)):
  - a. Push the 117-cm (46-in) piece of clear tubing onto the drain tube on the bottom of the *secondary* pump head. Place the free end of this tubing in the flush bottle. Make sure the end of the tubing is near the bottom of the bottle.

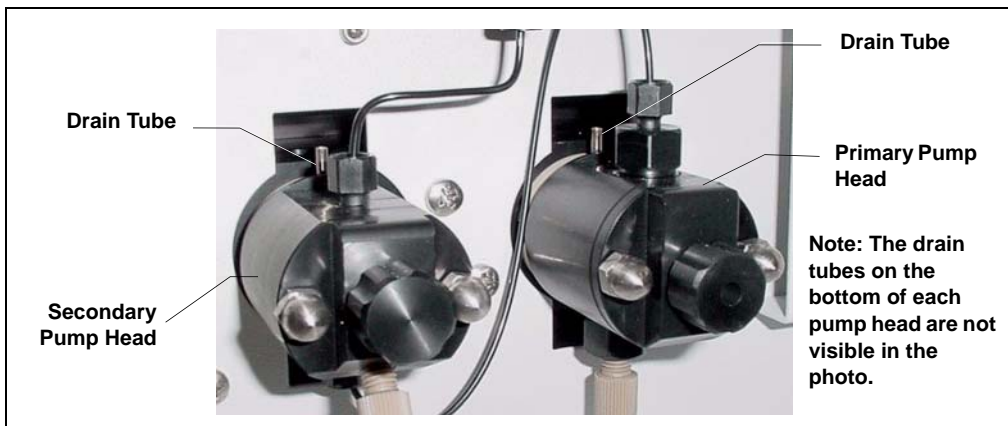


Figure B-113. Primary and Secondary Pump Heads with Drain Tubes



## Pump Continuous Seal Wash Connections (Optional)

- b. Push the 152-cm (60-in) piece of clear tubing onto the drain tube on the top of the *primary* pump head. This is the waste line. Route this waste line through the lower tubing chase and out the back of the ICS-2000.
- c. Push the 15-cm (6-in) piece of clear tubing over the drain tube on the top the *secondary* pump head. Push the other end of the tubing over the drain tube on the bottom of the *primary* pump head.
- d. Place a 10 mL syringe (P/N 054578) at the end of the waste line, press the syringe against the line to form a seal, and draw out all of the air.
- e. Push approximately 5 cm (2 in) of black 0.25-mm (0.01-in) ID tubing (P/N 057057) into the end of the waste line.

**NOTE** The black tubing creates a flow restriction. Assuming a height difference of about 76 cm (30 in) between the flush bottle and the waste container, this setup provides a flow of one drop of flush solution every 5 to 30 seconds.

- f. Place the end of the waste line in a waste container.
- g. This completes the piston seal wash installation. Periodically refill the flush bottle and empty the waste container as required.

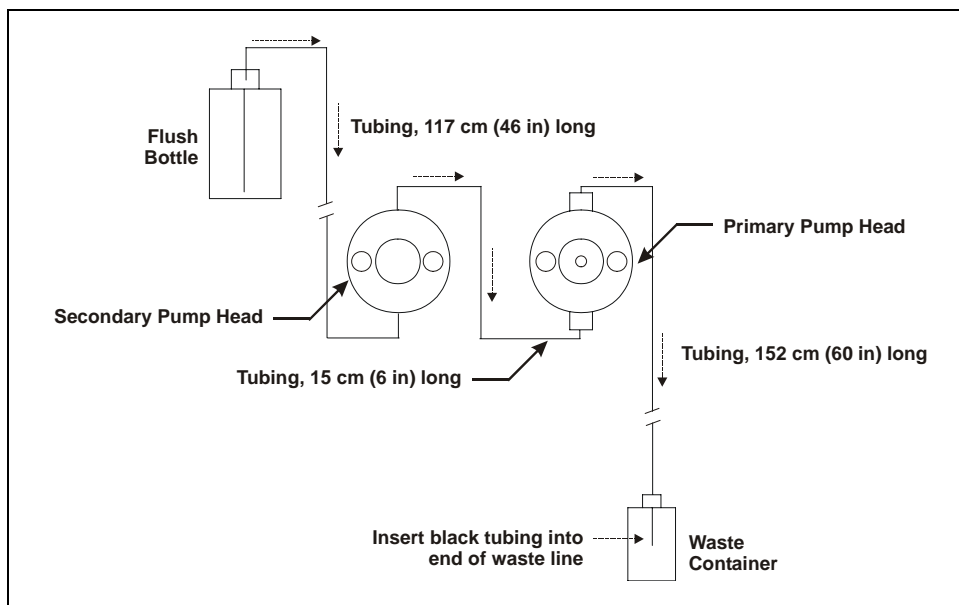


Figure B-114. Piston Seal Wash Flow Schematic

## B.23 Manually Connecting to a Control Panel

This section describes how to manually connect the ICS-2000 to a Control panel if you do not use the application templates described in [Section B.15](#).

1. In the Browser, expand the **Dionex Templates\Panels\Dionex\_IC\ICS-2000 System Panels** folder. Several System Control panels, corresponding to various system configurations, are provided.
2. Open the panel for your system configuration by double-clicking its name in the list. For example, if your system includes an ICS-2000 and an AS50 autosampler, double-click either **ICS-2000\_System\_AS50.pan** or **ICS-2000\_Traditional\_System\_AS50.pan**.

**NOTE** The two types of panels (system and traditional system) are similar in function, but have different “looks.” You can select either style, depending on your personal preference.

When the Control panel opens, the controls on the panel are not enabled (see [Figure B-115](#)).

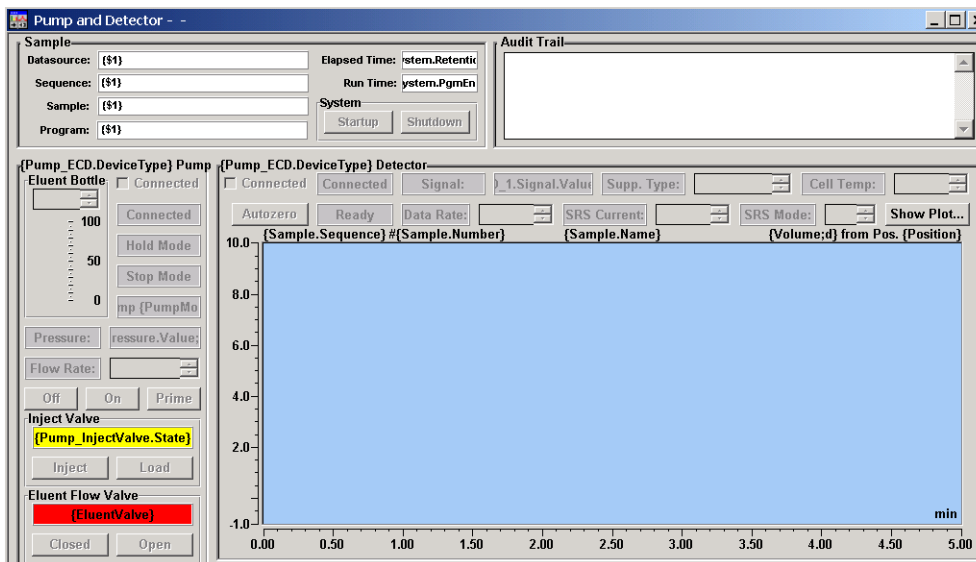


Figure B-115. ICS-2000 Traditional System Control Panel (Unconnected)

- To connect the Control panel to the ICS-2000, open the **Control** menu and click the name of the ICS-2000 timebase at the bottom of the menu.

The Control panel is now connected to the ICS-2000 and the controls are enabled (see [Figure B-116](#)).

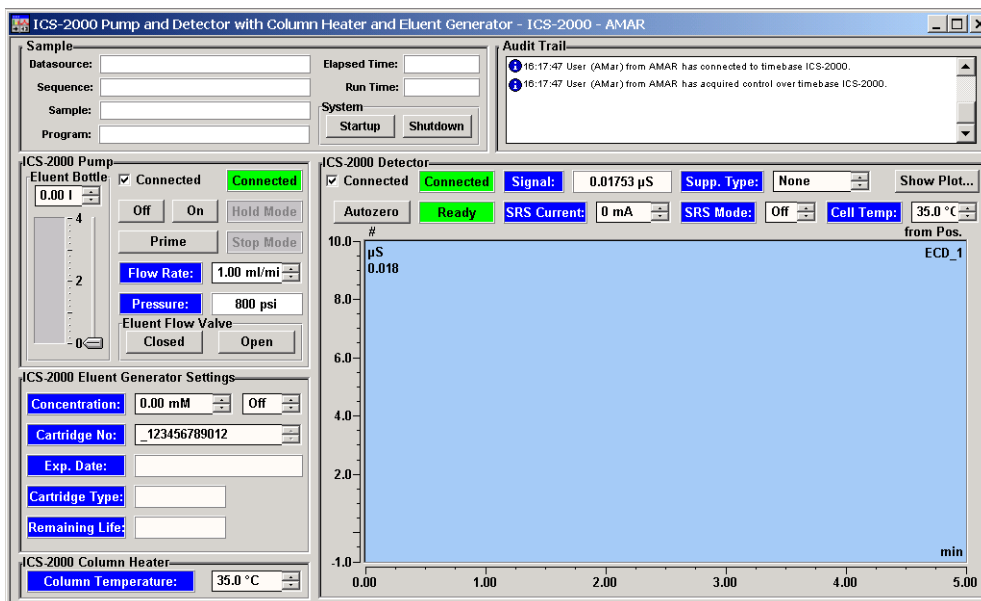


Figure B-116. ICS-2000 Traditional System Control Panel (Connected to the ICS-2000)

This completes the ICS-2000 installation procedure. For routine operating instructions, refer to [Chapter 3](#).

### B.24 Installation Troubleshooting

**Problem:** When the ICS-2000 power is turned on for the first time, a Windows message box appears asking for a USB configuration file (cmwdmusb.inf).

**Possible Cause:** The USB cable was connected and the power turned on before Chromeleon was installed.

**Solutions:**

Follow these steps to resolve the problem:

1. Click **Cancel** in the Windows message box.
2. Turn off the power to the USB device and unplug the USB cable from the computer.
3. Install Chromeleon (see [Section B.4](#)).
4. Reconnect the USB cable to the computer and turn on the power to the device. Windows will now automatically recognize the USB device.

# C • Touch Screen Operation

The LCD touch screen on the ICS-2000 front panel allows local control of most ICS-2000 functions. This chapter describes how to operate the ICS-2000 from the touch screen.

When the ICS-2000 starts up, the touch screen displays a startup page. This is followed by the **INFORMATION** page, which displays version and serial numbers and a list of installed options. After a few seconds, the **HOME** page (see [Figure C-1](#)) is displayed. The **HOME** page provides controls for all normal, daily operation of the ICS-2000.

## C.1 Using the Touch Screen

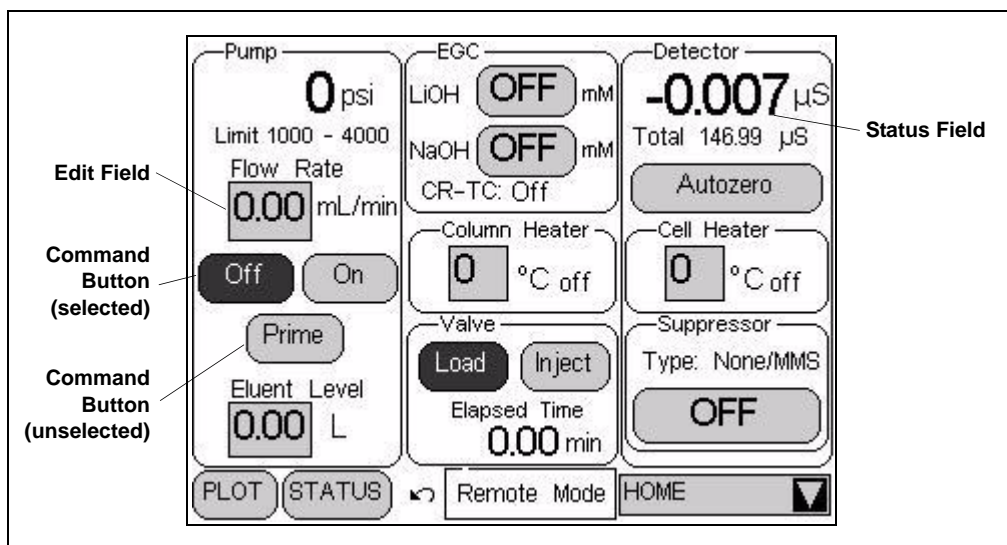






Figure C-1. ICS-2000 Touch Screen Home  Page

**NOTE** To adjust the screen contrast, open the front door and adjust the knurled knob under the screen (see [Figure 2-8](#)).

## ICS-2000 Ion Chromatography System

- Edit fields and command buttons have blue text on a lightly shaded background. Fields that display status information are not shaded.
- Edit fields have square corners while command buttons are rounded.
- To edit a field or select a command button, touch and release the field or button with your fingertip.

**NOTE** When you touch a button or edit field, the action takes effect when you lift your finger. If you unintentionally touch a button or field, you can cancel the action by sliding your finger away from the button or field before lifting.

- Touching a command button (for example, ) executes the command immediately.
- Selecting a command button changes the button's appearance to white text on a dark background (for example, ).
- Touching an edit field (for example, ) opens a page with a number keypad (see [Figure C-2](#)). Use the keypad to enter the desired numerical value for the field and then touch the **ENTER** button.

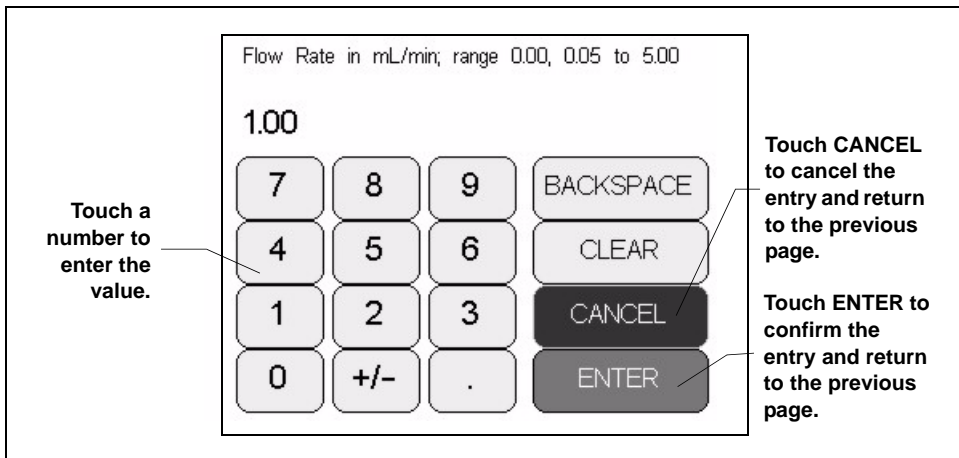



Figure C-2. Number Keypad

- Touching the page name (for example, ) in the bottom right corner opens a menu of pages (see [Figure C-3](#)).

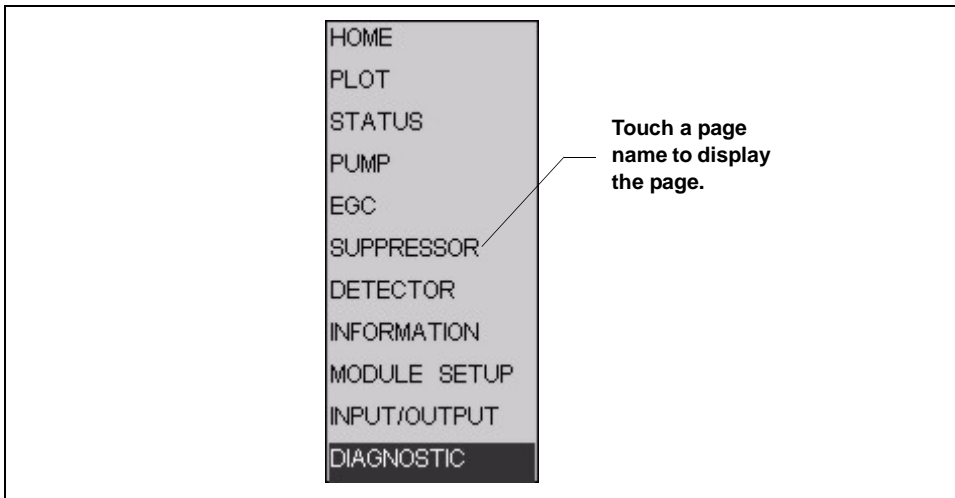


Figure C-3. ICS-2000 Touch Screen Menu of Pages

- Touching a page name on the menu of pages displays the selected page. For example, touching **SUPPRESSOR** displays the **SUPPRESSOR** page (see [Figure C-4](#)).

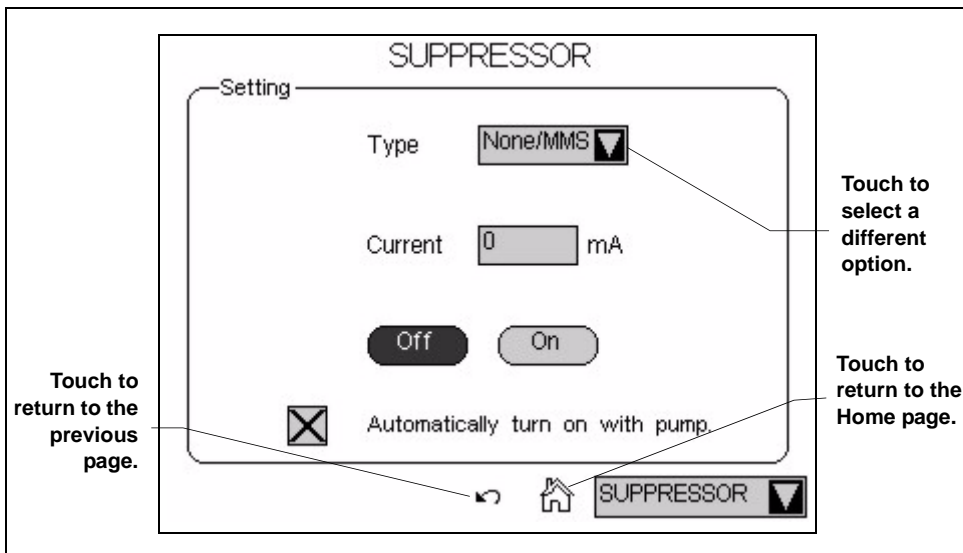




Figure C-4. Suppressor Page

- Touching  returns you to the **HOME** page.
- Touching  opens a list of options (see [Figure C-5](#)).

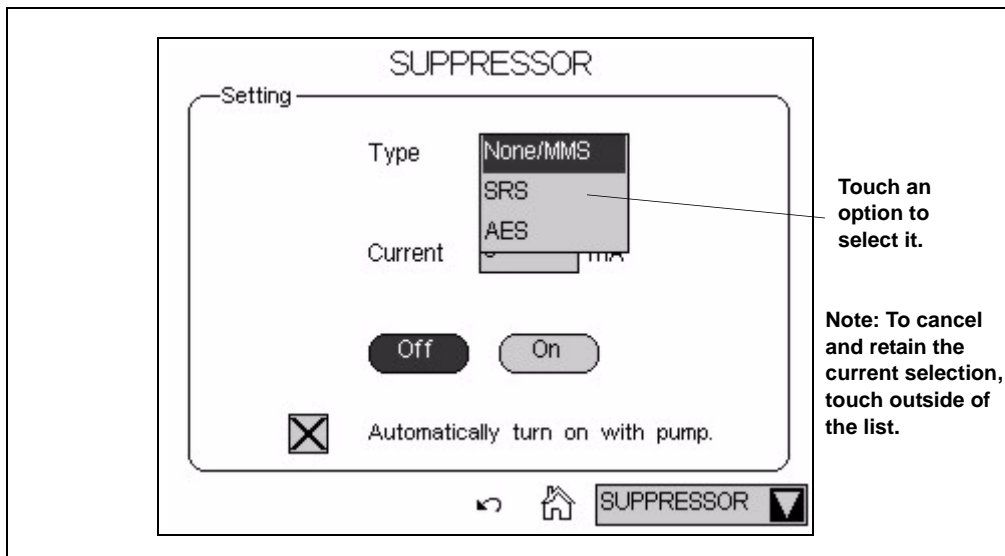


Figure C-5. Suppressor Page: Selecting an Option

## C.2 Using the Touch Screen with Chromeleon

**Remote Mode** When the ICS-2000 is connected to a Chromeleon Control panel, the status field at the bottom center of the **HOME** page displays **Remote Mode**. In this mode, most of the controls on the touch screen pages are disabled. This prevents touch screen commands from conflicting with Chromeleon commands.

In general, when the ICS-2000 is connected to Chromeleon, you can:

- View all ICS-2000 operational status information (pressure, flow rate, conductivity readings, etc.)
- Go to any of the touch screen pages
- View a plot of the conductivity data from the **PLOT** page and adjust the plot display using the controls on the page. See [Section C.5](#) for details.

To restore touch screen (local) control, clear the **Connected** check box on the Chromeleon Control panel.



### C.3 Overview of ICS-2000 Touch Screen Pages

Figure C-6 illustrates the organization of the ICS-2000 touch screen pages.

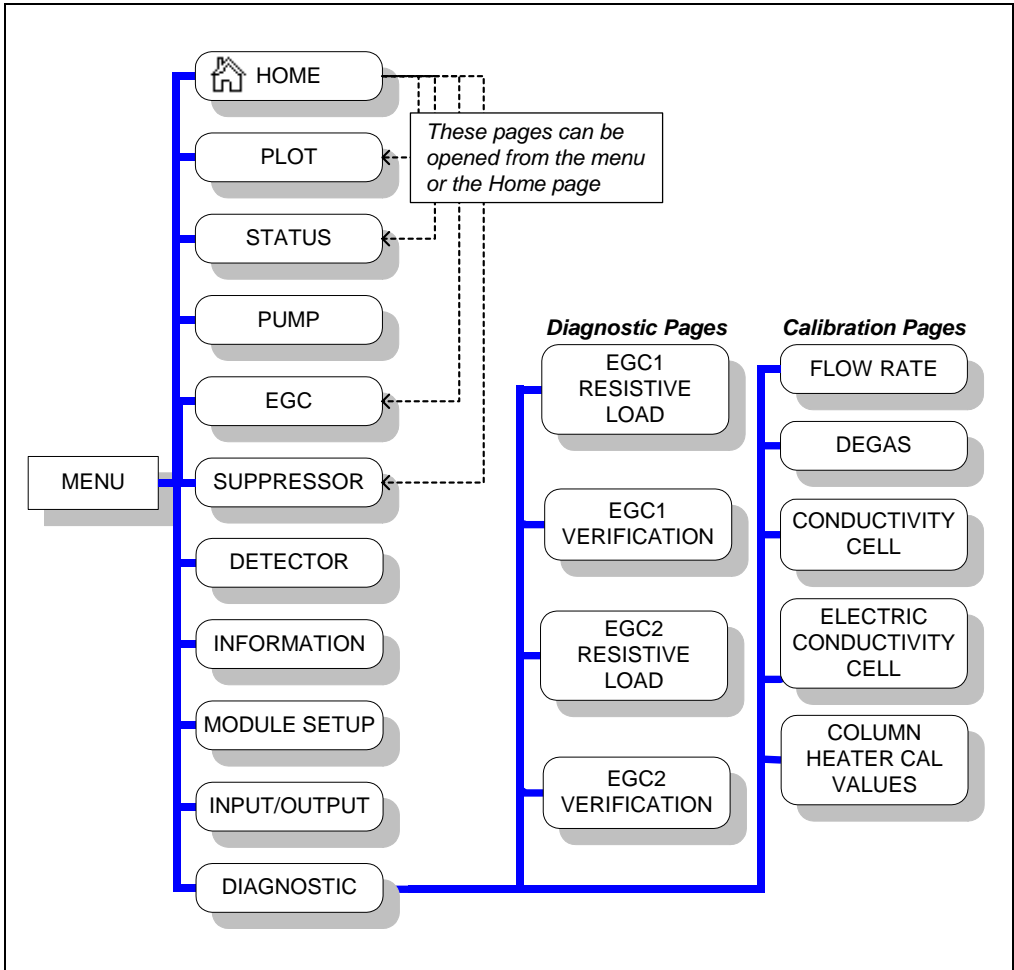


Figure C-6. Overview of ICS-2000 Touch Screen Pages

## C.4 Home Page

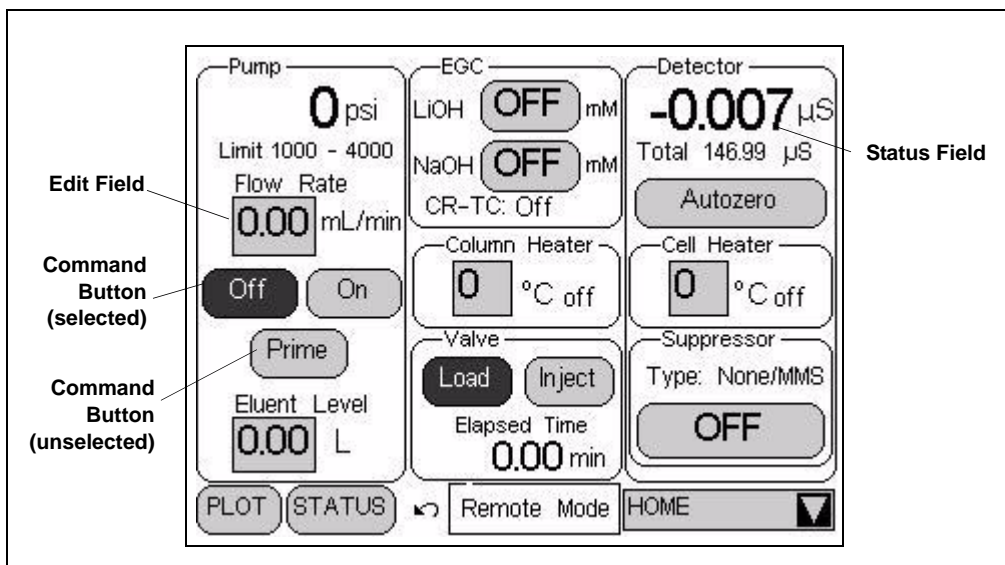
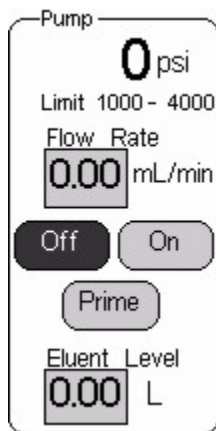


Figure C-7. ICS-2000 Touch Screen Home  Page

### C.4.1 Home Page Pump Controls



#### Pressure Display

The **HOME** page indicates the current pressure reading from the pressure transducer. The pressure unit can be set to psi (the factory default), MPa, or bar (see [Section C.7.1](#)).

The minimum and maximum pressure limits are displayed below the current pressure reading. If the pressure reading goes outside these limits, the pump is stopped and an error message appears in the Chromeleon Audit Trail and on the touch screen. See [Section 4.1](#) for troubleshooting information. See [Section C.7.1](#) for how to set the pressure limits.

#### Flow Rate

The flow rate can be set to 0.00 (which turns off the pump) and to between 0.05 and 5.00 mL/min. The recommended operating flow rate is between 0.40 and

2.00 mL/min. Refer to the column manual for the flow rate to use with your column and application. Column manuals are included on the Dionex Reference Library CD-ROM (P/N 053891).

### Pump On/Off Control

Touching the **On** button immediately starts the pump flow at the rate displayed in the **Flow Rate** field. Touching **Off** stops the flow.

### Prime

The **Prime** button is reserved for use during the pump head priming procedure. Touching the **Prime** button displays a confirmation page that reminds you to open the waste valve. Open the valve, and then touch the **OK** button to begin priming. Or, to exit the page without priming, touch the **Cancel** button. To stop priming, touch the **Off** button. During priming, the flow rate is approximately 3 mL/min. See [Section B.13](#) for detailed priming instructions.

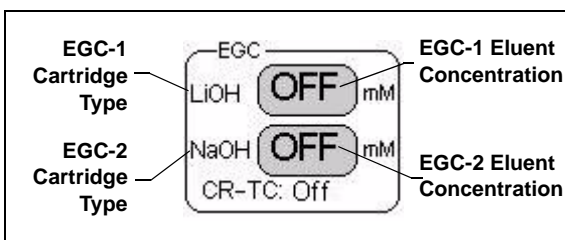
### Eluent Level

Use this field to monitor the amount of liquid in the eluent reservoir. When you fill the reservoir, enter the amount of liquid in the reservoir. For example, if the reservoir contains 200 mL and you add 1 liter, enter 1.2 liters. Thereafter, the ICS-2000 determines the eluent usage by monitoring the flow rate and the length of time the pump is on. The ICS-2000 updates the **Eluent Level** field as the eluent is used up. A warning first appears if the level falls below 200 mL. Warnings are repeated at 100 mL and 0 mL.

#### IMPORTANT

**In order for the eluent level displayed on the screen to be accurate, the level must be entered by the user when the reservoir is filled. The ICS-2000 does not automatically detect when the reservoir is filled, nor when it is empty.**

## C.4.2 Home Page EGC Controls



The **EGC** controls indicate the type and the eluent concentration of each installed EluGen Cartridge (EGC). The **CR-TC** field indicates whether the Continuously Regenerated Trap Column is on or off.

To determine the eluent concentration for your application, refer to the column manual. Column manuals are included on the Dionex Reference Library CD-ROM (P/N 053891). When the ICS-2000 is controlled from the front panel, only isocratic eluent delivery is possible. With isocratic delivery, the eluent composition and concentration remain constant throughout the run. When the ICS-2000 is under Chromeleon control, gradient delivery, in which the eluent concentration changes over time, is also possible.

To set the eluent concentration or to turn on or off the CR-TC, touch the concentration button. The **ELUENT GENERATOR** page appears (see [Section C.8](#)).

## C.4.3 Home Page Column Heater

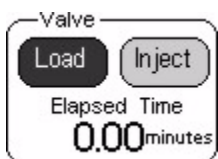


The temperature of the column heater can be controlled to between 30 and 60 °C. For optimal performance, set the column heater to at least 5 °C above the ambient temperature. To set the temperature, touch the **Column**

**Heater** field and enter the desired temperature on the number pad. To turn the column heater off, set the temperature to 0. The display to the right of the temperature setting indicates the heater status:

- = column temperature is at equilibrium
- ↑ column temperature is rising
- ↓ column temperature is falling
- Off column heater is off

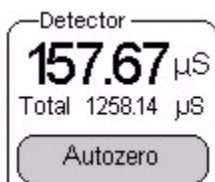
### C.4.4 Home Page Injection Valve Controls



The **Inject** and **Load** buttons select the position of the injection valve. A dark background and white text on a button indicates the current valve position. For details about the valve positions, see [Section 2.4.5](#).

The **ELAPSED TIME** field displays the amount of time since the last injection.

### C.4.5 Home Page Detector Controls



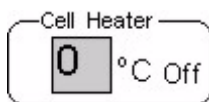
#### Conductivity Readings

The offset conductivity is displayed in large numbers above the total conductivity. The offset conductivity is the total conductivity minus the current offset.

To determine the offset, allow the system to equilibrate after startup. At equilibration, the conductivity reading is the background conductivity (the eluent conductivity before sample injection). Touch **Autozero** to zero the conductivity and offset this background reading from the total reading.

**NOTE** You can reverse the conductivity display to show the total conductivity in large type, with the offset conductivity below it in small type. Select this option on the **MODULE SETUP** page (see [Section C.12](#)).

#### Cell Heater Controls

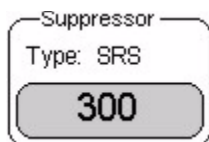


The temperature of the cell can be set to between 30 °C and 55 °C, but must be at least 7 °C above the ambient temperature. To set the temperature, touch the **Cell Heater** field and enter the desired temperature on the number pad.

To turn off the cell heater, set the temperature to 0. The display to the right of the temperature setting indicates the heater status:

- = cell temperature is at equilibrium
- ↑ cell temperature is rising
- ↓ cell temperature is falling
- Off cell heater is off

### Suppressor Controls

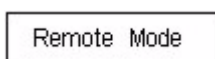


The **Suppressor** controls indicate the suppressor current setting and the type of suppressor installed.

To set the suppressor type, change the current setting, or turn the suppressor on or off, touch the suppressor button.

The **SUPPRESSOR** page appears (see [Section C.9](#)).

### C.4.6 Other Home Page Controls



This field displays **Remote Mode** when the ICS-2000 is connected to Chromeleon and **Local Mode** when the system is not connected to Chromeleon.



Opens the **PLOT** page, which provides a real-time plot of the detector conductivity output. See [Section C.5](#) for details.



Opens the **STATUS** page, which displays the status of various operating parameters. See [Section C.6](#) for details.

## C.5 Plot Page

The **PLOT** page provides a real-time plot of the detector conductivity output. To open the page, touch the **PLOT** button on the **HOME** page, or select **PLOT** from the menu of pages. The page can display up to 60 minutes of data. Data older than 60 minutes is discarded. You can view the plot and adjust the display when the ICS-2000 is under either local or computer control.

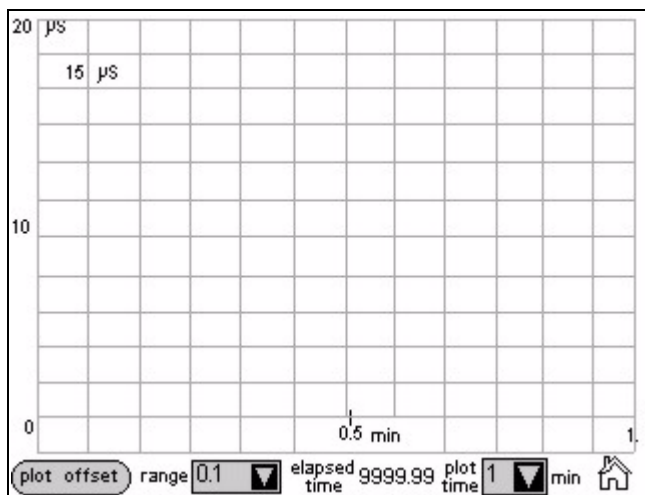


Figure C-8. Plot Page

### Plot Controls

- The **plot offset** button offsets the current background conductivity reading and sets the plot baseline to zero. Subsequent output is plotted in relation to the new zero point. Offsetting the plot does not affect the data sent to Chromeleon, the analog output, or the data displayed on other pages.
- The **range** field sets the highest conductivity reading displayed on the plot (the vertical scale). If the tops of peaks are cut off, select a higher range. If peaks are short, select a lower range. Select **Auto** to have the scaling of the signal plot automatically adjusted to the height of the signal.
- The **elapsed time** field displays the time since injection.
- The **plot time** field sets the length of time plotted on the page (the horizontal scale).

### C.6 Status Page

The **STATUS** page displays the current status of various operating parameters. To open this page, touch the **STATUS** button on the **HOME** page or select **STATUS** from the menu of pages.

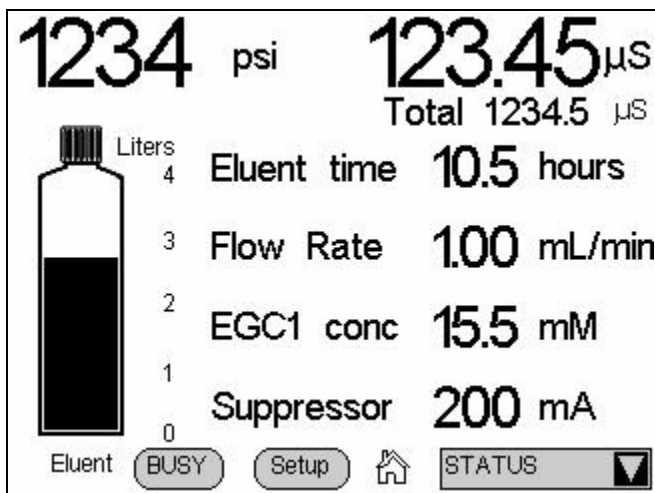


Figure C-9. Status Page

#### Status Page Controls

- Pressure and conductivity readings are the same as those displayed on the **HOME** page.
- The eluent bottle depicts the level of liquid in the eluent reservoir. The scale is always 0 to 4 liters (regardless of the size of reservoir installed). After filling the reservoir, go to the **HOME** page and enter the amount of liquid in the reservoir (see [Section C.4.1](#)). The ICS-2000 monitors the eluent usage, based on the flow rate and the length of time the pump is on. The “liquid” level in the bottle falls as the reservoir empties. An error message is first displayed on the screen when the level falls below 200 mL. The message is repeated at 100 mL and then at 0 mL.

#### IMPORTANT

In order for the eluent level displayed on the screen to be accurate, the level must be entered by the user when the reservoir is filled. The ICS-2000 does not automatically detect when the reservoir is filled, nor when it is empty.



- The fields to the right of the bottle display the status of four other operating parameters. You can choose from eight possible parameters to display here. [Figure C-9](#) shows the default parameters: **Eluent time**, **Flow rate**, **EGC conc**, and **Suppressor**. To select different parameters, touch the **Setup** button. See [Section C.6.1](#) for details about how to change the status parameters, and [Section C.6.2](#) for a description of each parameter.
- Touching the **Busy** button displays the **BUSY** page (see [Figure C-10](#)).



Figure C-10. Busy Page

## C.6.1 Viewing Other Status Parameters

Follow the steps below to view the status of a parameter that is not currently displayed on the **STATUS** page.

1. Touch the **Setup** button. A drop-down list replaces the label for each field, and the **Setup** button changes to **Apply** (see [Figure C-11](#)).

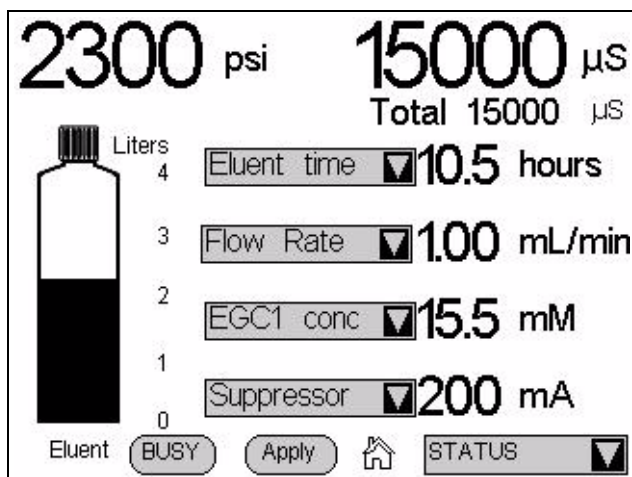


Figure C-11. Status Page Setup

2. Touch the down arrow next to the field you want to change. A list of the available status parameters appears (see [Figure C-12](#)).

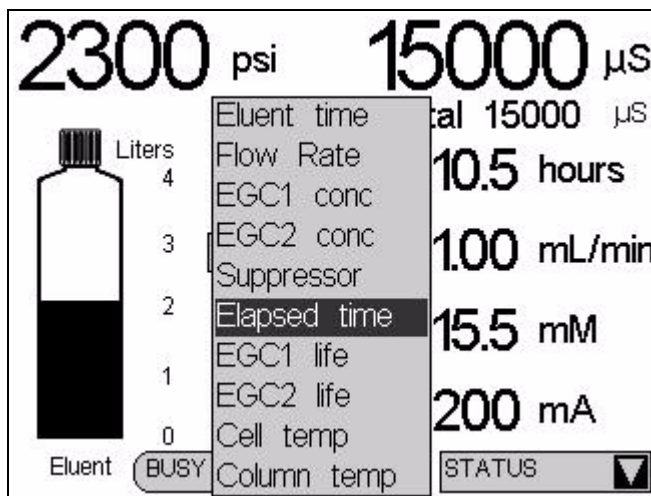


Figure C-12. Status Page Parameter List

3. Touch the parameter you want to display.
4. When finished, touch the **Apply** button.

## C.6.2 Status Parameter Details

Status Parameter	Description
<b>Eluent time</b>	The number of hours the eluent supply will last, if the pump runs continuously at the current flow rate.
<b>Flow rate</b>	The actual flow rate currently output by the pump.
<b>EGC1 conc</b> <b>EGC2 conc</b>	The actual concentration of eluent currently being generated by the EluGen cartridge (EGC1 or EGC2).
<b>Suppressor</b>	The actual current applied to the suppressor.
<b>Elapsed time</b>	The number of hours since the last injection.
<b>EGC1 life</b> <b>EGC2 life</b>	The percentage of ions remaining in the EluGen cartridge (EGC1 or EGC2).
<b>Cell temp</b>	The temperature of the cell heater (°C), followed by a status symbol (=, ↑, or ↓).
<b>Column temp</b>	The temperature of the column heater (°C), followed by a status symbol (=, ↑, or ↓).

### C.7 Pump Page

Use the **PUMP** page to set parameters related to pump operation, including pressure limits, pressure unit, vacuum degas pump settings, and eluent valve control. To open this page, select **PUMP** from the menu of pages. The current system pressure is displayed at the top of the screen.

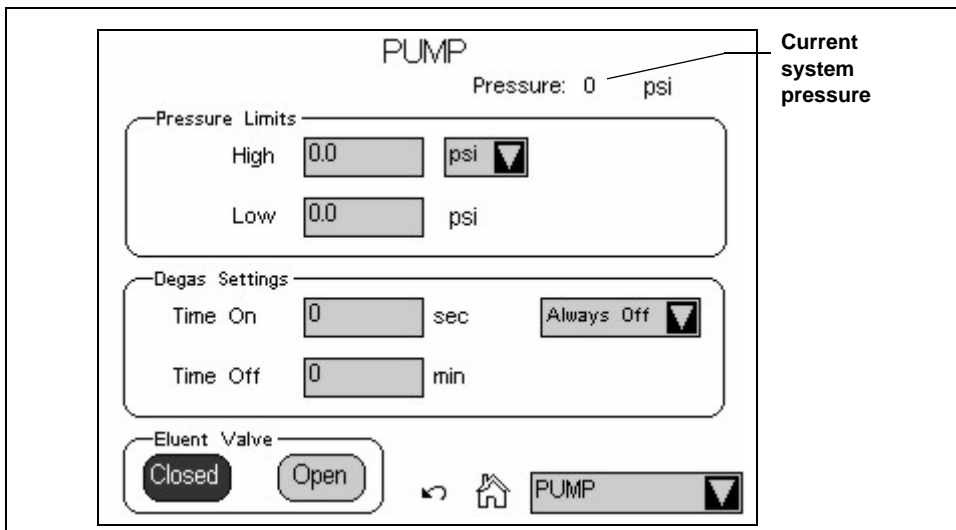


Figure C-13. ICS-2000 Touch Screen Pump Page

#### C.7.1 Setting Pump Pressure Limits and Selecting the Pressure Unit

The first time the power to the ICS-2000 is turned on, the maximum system pressure limit is 34.5 MPa (5000 psi) and the minimum pressure limit is 0. The eluent generator, however, requires a maximum high limit of 20.7 MPa (3000 psi) and a minimum low limit of 1.4 (200 psi). When you configure the eluent generator cartridge in Chromeleon (see [Section B.8](#)), the software sets the maximum and minimum limits for the pump automatically. If you are not using Chromeleon to control the ICS-2000, set the limits on the **PUMP** page.

- To change the high pressure limit, touch the **HIGH** field and enter the desired limit on the number pad. The high limit must be at least 0.7 MPa (100 psi) above the low limit.

- To change the low pressure limit, touch the **LOW** field and enter the desired limit on the number pad.

To select the pressure unit for all touch screen pages that display pressure values, touch the pressure unit field and select the desired unit on the list (**PSI**, **bar**, or **MPa**) (see [Figure C-14](#)).

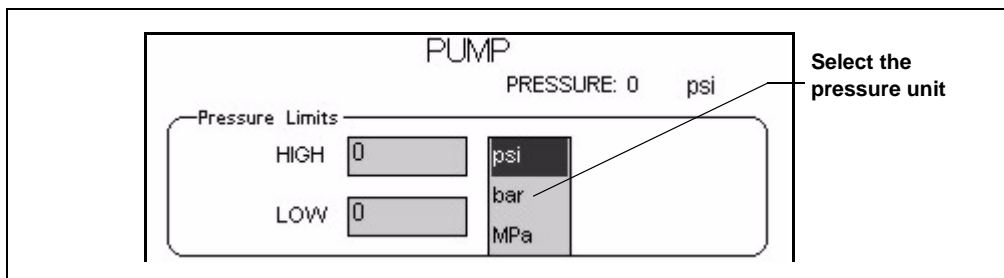


Figure C-14. Pump Page: Selecting the Pressure Unit

### C.7.2 Setting Degas Operating Parameters

By default, the ICS-2000 monitors the degas pressure reading and turns the degas pump on and off as required. To change the degas operating option:

1. Select **PUMP** from the menu of pages.
2. Under **Degas Settings**, touch the options drop-down list. A list of available options appears (see [Figure C-15](#)).

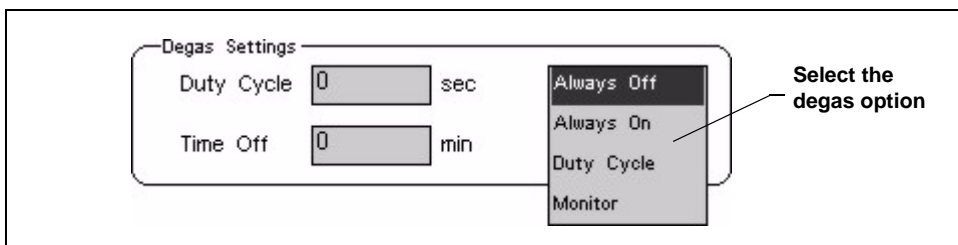


Figure C-15. Pump Page: Selecting Degas Options

**NOTE** Degas options can also be selected from the Chromeleon Server Configuration program (see [Section 2.4.1](#)).

3. Select the desired option:

**Always Off:** The degas pump is always off.

**Always On:** The degas pump is always on. This setting is reserved for test purposes by a Dionex Service Representative.

**IMPORTANT**

Select the **Degas Mode, Always On** option only when testing the vacuum degas assembly. Do not select the **Always On** option for routine use.

**Duty Cycle:** The degas pump cycles on and off according to the times specified in the **Duty Cycle** and **Time Off** fields. **Duty Cycle** specifies for how long the degas pump runs during a cycle; **Time Off** specifies the time between cycles.

**Monitor:** The ICS-2000 monitors the degas pressure reading and turns the degas pump on and off as required.

### C.7.3 Controlling the Eluent Valve



The eluent valve controls flow from the eluent reservoir. During routine operation, the valve opens and closes automatically when the pump flow is turned on and off. However, during eluent line priming, you can use the controls on the **PUMP** page to manually open the valve, allowing liquid to flow through the lines when the pump is off. See [Section B.13.2](#) for eluent line priming instructions.

## C.8 Eluent Generator Page

Use the **ELUENT GENERATOR** page to set the eluent concentration of each installed EluGen cartridge (EGC). You can also enter the serial number and view the expiration date and remaining life of each cartridge. This page also provides on/off control of a Continuously Regenerated Trap Column (CR-TC). To open the page, touch the **EGC** button on the **HOME** page or select **EGC** from the menu of pages.

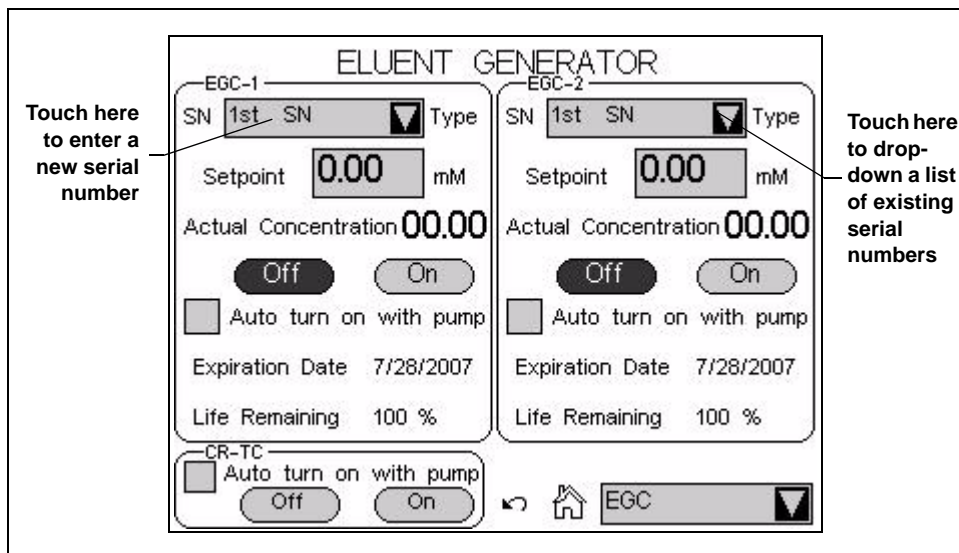


Figure C-16. Eluent Generator Page

### C.8.1 EGC Serial Number

The **Serial Number** field displays the serial number of the EluGen cartridge currently installed. After installing a new EluGen cartridge, enter the cartridge serial number. If you use Chromeleon to control the ICS-2000, enter the serial number in the Chromeleon Server Configuration (see [Section](#)), not on the **ELUENT GENERATOR** page. If you enter the serial number first in Chromeleon, the number is displayed on the **ELUENT GENERATOR** page. However, if you enter the serial number on the **ELUENT GENERATOR** page, it will not be available in Chromeleon.

If the ICS-2000 is not under Chromeleon control, enter the cartridge serial number by touching the **Serial Number** field on the **ELUENT GENERATOR** page (see [Figure C-16](#)) and entering the serial number on the keypad.

If you are reinstalling a cartridge that was used previously, touch the down arrow instead of the number field. A list of the last five entered serial numbers drops down. Choose the serial number of the cartridge from the list.

### C.8.2 Setting the Eluent Concentration

To set the concentration of eluent to be generated, touch the **Setpoint** field and enter the concentration on the keypad. If the ICS-2000 power is turned off, the setpoint value is restored when the power is turned on again. The **Actual Concentration** field displays the concentration of eluent currently being generated.

The suppressor type, EGC type, and flow rate determine the maximum eluent concentration for a particular application. To determine the eluent concentration for your application, refer to the column manual. Column manuals are included on the Dionex Reference Library CD-ROM (P/N 053891).

If a  $K_2CO_3$  EluGen cartridge and an EPM Electrolytic pH Modifier are installed (connected to EGC-1 and EGC-2, respectively), set EGC-1 to the concentration of  $K_2CO_3$  required for your application and set EGC-2 to the concentration of  $KHCO_3$  required. When the eluent is generated, the **EGC-1 Actual Concentration** field displays the total of the two setpoint concentrations. This is the actual concentration of  $K_2CO_3$  that the cartridge must generate in order to achieve the desired  $K_2CO_3/KHCO_3$  eluent mixture.

For example, for a 3.50 mM  $K_2CO_3$ /1.00 mM  $KHCO_3$  eluent, set EGC-1 to 3.50 mM and EGC-2 to 1.00 mM. When the eluent is generated, the **EGC-1 Actual Concentration** field will display, 4.50 mM.



### C.8.3 Controlling the Eluent Generator Power

- To manually control the eluent generator power, touch the **EGC Off** and **On** buttons on the **ELUENT GENERATOR** page.
- To automatically control the eluent generator power simultaneously with the pump flow, select **Auto turn on with pump**.

**NOTE** The eluent generator power always turns off when the pump is off, regardless of whether the “Automatically turn on with pump” option is selected.

### C.8.4 Monitoring the EluGen Cartridge Life

- The **Expiration Date** displayed on the **ELUENT GENERATOR** page is 2 years from the date of manufacture. Although you can continue operation with the cartridge after the expiration date, performance may be impaired until a new cartridge is installed.
- **Life Remaining** (displayed when an EluGen cartridge is installed) indicates the percentage of ions remaining in the cartridge. The ion percentage is counted down in 1% increments. Warning messages are displayed in the Chromeleon Audit Trail when the percentage falls below 30%. At 0%, an error message informs you that the ion count is depleted and the cartridge must be replaced before continuing operation.
- **Normalized Life Used** (displayed when an EPM is installed) indicates how much the EPM has been used. The value starts at 0 and counts up with use. A count of 1 means the EPM usage is approximately equal to the lifetime of one  $K_2CO_3$  cartridge.

### C.8.5 Controlling the CR-TC Power

- To manually control the CR-TC power, touch the **CR-TC Off** and **On** buttons on the **ELUENT GENERATOR** page (see [Figure C-17](#)).
- To automatically control the CR-TC power simultaneously with the pump flow, select **Auto turn on with pump**.

**NOTE** The CR-TC power always turns off when the pump is off, regardless of whether the “Automatically turn on with pump” option is selected.

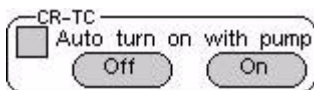


Figure C-17. Eluent Generator Page: CR-TC Controls

## C.9 Suppressor Page

Use the **SUPPRESSOR** page to specify the type of suppressor installed in the ICS-2000, turn the suppressor on and off, and select the amount of current supplied to the suppressor. To open this page, touch the suppressor button on the **HOME** page, or select **SUPPRESSOR** from the menu of pages.

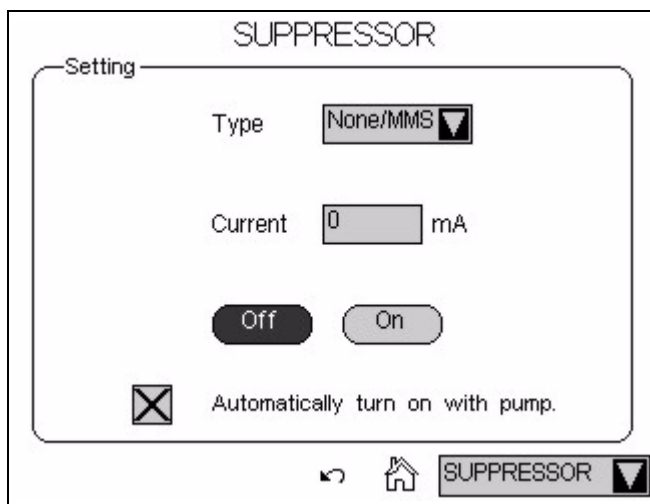


Figure C-18. Suppressor Page

### Suppressor Controls

- The suppressor type is typically selected at initial installation and does not need to be changed. However, if a different type of suppressor is installed later (or if the suppressor is removed from the system), touch the **Type** field and select the new suppressor type (**None/MMS**, **SRS**, or **AES**) from the list.
- To set the current, touch the **Current** field and enter the desired setting (in milliamperes) on the number pad.

The appropriate suppressor current setting depends on several variables: the suppressor type, the column, the eluent, and the flow rate. Refer to the suppressor manual for the recommended current setting for your application. The suppressor manuals are included on the Dionex Reference Library CD-ROM (P/N 053891).

**NOTE** When Chromeleon is used to control the ICS-2000, the **Program Wizard** automatically calculates the current required for the application.

- To manually control the suppressor power, touch the **Off** and **On** buttons.
- To automatically control the suppressor power simultaneously with the pump flow, select **Automatically turn on with pump**.

**NOTE** The suppressor always turns off when the pump is off, regardless of whether the “Automatically turn on with pump” option is selected.

### C.10 Detector Page

Use the **DETECTOR** page to set the data rise time and to select parameters for adjusting the analog output. To open this page, select **DETECTOR** from the menu of pages.

The screenshot shows the 'DETECTOR' configuration page. At the top, the title 'DETECTOR' is centered. Below it are several settings:

- Data Rise Time:** A numeric input field containing '1.00' followed by a dropdown arrow and the unit 'sec'.
- Conductivity Polarity:** A dropdown menu currently set to 'Normal'.
- Analog Out:** A rounded rectangular box containing four sub-settings:
  - Output:** A dropdown menu set to 'Normal'.
  - % Offset:** A numeric input field containing '0'.
  - Polarity:** A dropdown menu set to '+'.
  - Range:** A numeric input field containing '1' followed by a dropdown arrow and the unit 'µS'.

At the bottom of the page, there are three icons: a back arrow, a home icon, and a dropdown menu labeled 'DETECTOR'.

Figure C-19. Detector Page

### C.10.1 Setting the Data Rise Time

The data rise time determines the amount of filtering performed on the conductivity data. The rise time is a measure of how quickly the detector responds to a change in signal, and is defined as the time it takes the output signal to rise from 10% of its final value to 90% of its final value.

The selected data rise time is used to filter both the digital data output, which is sent to the computer and the **PLOT** page, and the analog data output. The default rise time is 2 seconds.

Choosing an appropriate rise time value can optimize performance by keeping the signal-to-noise ratio at a minimum level. A longer rise time allows averaging of the noise frequencies, and subsequently, the baseline will contain much less short-term noise. However, longer rise times may have the following effects on peaks:

- Peak shape will become asymmetric.
- The peak maximum will be shifted.
- The peak height will be reduced.

The rise time should be approximately 25% of the peak width at one-half the height of the narrowest peak of interest.

For example, for a peak width of 5 seconds, calculate the rise time as: (5 sec) 25% = 1.25 sec. Because 1.25 seconds is not one of the available settings for rise time, select the next fastest rise time, 1 second.

To set the data rise time, touch the **Data Rise Time** field and select the desired time from the list (see [Figure C-19](#)).

### C.10.2 Selecting the Conductivity Polarity

To change the polarity of the conductivity data, touch the **Conductivity Polarity** field. Select either **Normal** or **Inverted**. In applications in which the analyte output is lower than the background conductance, the polarity must be inverted to have peaks instead of dips on the chromatogram.

### C.10.3 Setting Analog Out Options

The analog output connector on the ICS-2000 rear panel outputs an analog voltage signal proportional to the conductivity measured by the cell. The output is filtered using the selected data rise time (see [Section C.10.1](#)). The analog output can be connected to an analog-to-digital converter device, such as an integrator or a chart recorder.

The **Analog Out** options on the **DETECTOR** page (see [Figure C-19](#)) let you configure the output for your application.

- **Output:** Select **Normal** to output a signal corresponding to the offset conductivity reading from the detector (see [“Conductivity Readings” on page C-9](#)) and the selected **Analog Out** parameters. Use the other two settings to calibrate an analog-to-digital converter device. Select **Zero** to set the output signal to zero volts. Select **Full Scale** to set the output signal to the full-scale voltage (1000 mV).
- **% Offset:** To adjust the zero position of the analog output when it is plotted, enter a percentage in the **% Offset** field. The value entered is a percentage of the full-scale analog output. An offset allows a recording device to plot the signal if it becomes negative. The offset percentage does not affect the magnitude of the output signal.
- **Polarity:** Select the polarity of the analog output signal: positive (the default settings) or negative. In applications in which the analyte output is lower than the background conductance, the polarity must be negative to have peaks instead of dips on the chromatogram.
- **Range:** Select the range in microSiemens ( $\mu\text{S}$ ) of a full-scale detector response. For the ICS-2000, the full-scale voltage is 1000 mV. For example, if the range is 100  $\mu\text{S}$ , then 1  $\mu\text{S}$  is equal to 10 mV from the analog output. The range to use depends on the conductivity readings expected for the application.

## C.11 Information Page

The **INFORMATION** page displays the version numbers of the ICS-2000 control programs (Moduleware and Boot Block), the serial number of the ICS-2000, and the options that are installed in the ICS-2000. The **INFORMATION** page is displayed at start-up. You can open the page from the menu of pages at any time.

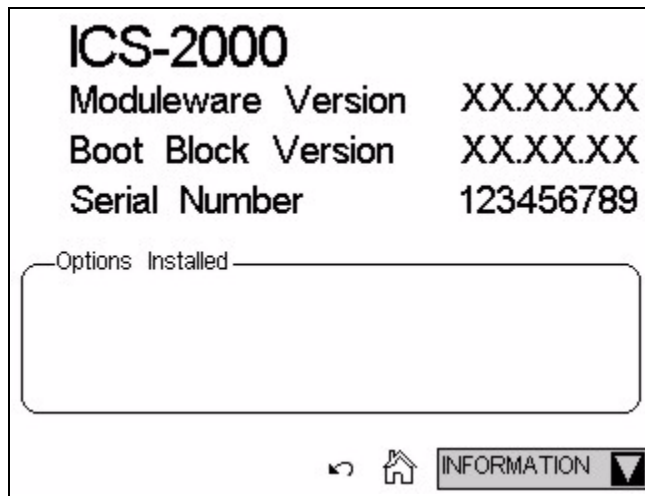


Figure C-20. Information Page

Moduleware is the firmware program installed in the ICS-2000 that controls instrument functions. Moduleware also sends status information and data to Chromeleon and receives control parameters from Chromeleon.

The Boot Block is the first program to be executed when the ICS-2000 power is turned on. It starts the Moduleware program.

## C.12 Module Setup Page

The **MODULE SETUP** page lets you select options for the touch screen display and conductivity readings. To open this page, select **SETUP** from the menu of pages.

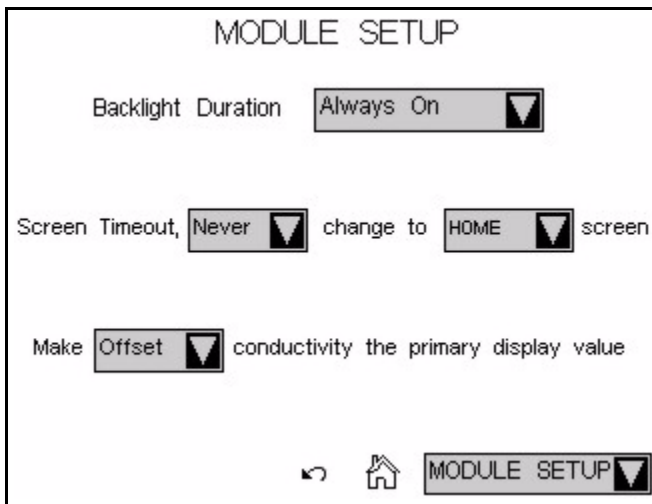
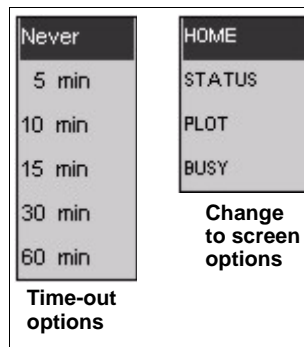


Figure C-21. Module Setup Page

### Module Setup Options

- Backlight Duration:** Select **2-hour time-out** to turn off the backlight after 2 hours if the touch screen is not used during that time. Select **Always On** to have the backlight remain on continuously.
- Screen Time-out:** If the touch screen is not used during the selected time-out, the display will change to show the screen selected from the list. For example, if you select **5 min** and **BUSY**, the display will change to the **BUSY** page (see [Figure C-10](#)) 5 minutes after the last time the touch screen was used. Select **Never** to always display the page that was used last.
- Conductivity Display:** Select either **Offset** (the default setting) or **Total** as the primary conductivity display value. The selected value is shown in large bold type on the **HOME** and **STATUS** screens, with the other value in smaller type.





## C.13 Input/Output Page

The **INPUT/OUTPUT** page provides control of the ICS-2000 TTL inputs and TTL and relay outputs. To open this page, select **INPUT/OUTPUT** from the menu of pages. For details about relay and TTL control, see Appendix D.

The screenshot displays the 'INPUT/OUTPUT' control page. It is divided into two main sections: 'Inputs' and 'Outputs'.  
**Inputs Section:**  
- TTL 1: Load/Inject  
- TTL 2: Autozero  
- TTL 3: Pump On  
- TTL 4: Mark  
- TTL Input Control Type: Normal Edge  
**Outputs Section:**  
- Relay 1: Open  
- Relay 2: Open  
- TTL 1: 5 Volts  
- TTL 2: 5 Volts  
At the bottom of the page, there are navigation icons: a back arrow, a home icon, and a button labeled 'INPUT/OUTPUT' with a dropdown arrow.

Figure C-22. Input/Output Page

## C.14 Diagnostic and Calibration Pages

Diagnostic and calibration functions can be performed either from the touch screen diagnostic and calibration pages or from the Chromeleon Wellness Panel. To open a touch screen diagnostic or calibration page, select **DIAGNOSTIC** from the menu of pages. The **DIAGNOSTIC** page opens (see [Figure C-23](#)). From there, you can select the type of diagnostic or calibration to perform.

For detailed instructions on how to perform the various calibration and diagnostic procedures, see [Section 5.1](#).

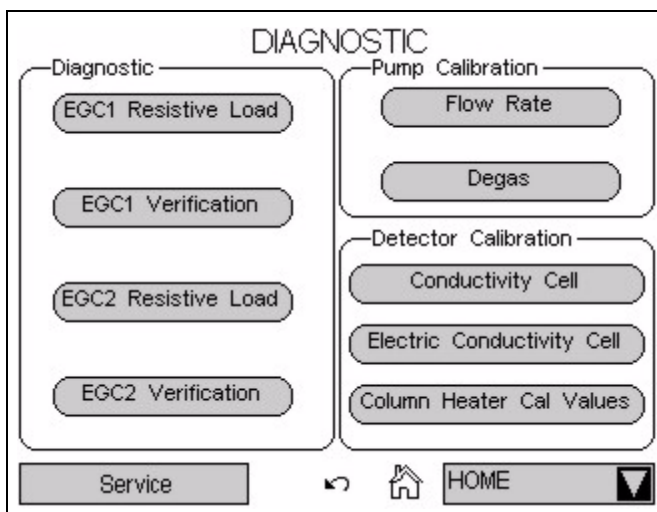


Figure C-23. System Diagnostic Menu Page

**NOTE** The Service button provides access to service functions that are performed only by Dionex personnel. An access code is required to go to the service pages.

# D • TTL and Relay Control

## D.1 TTL and Relay Connections

A 12-pin connector strip for TTL/relay control is located on the ICS-2000 rear panel. The connector provides two relay outputs, two TTL outputs, and four TTL inputs (see [Figure D-1](#)).

Pin Function	Connector Position	Description
RELAY OUT 1 2	1	Solid State Relay Contacts Output
	2	
	3	
	4	
TTL OUT (+) 1 2	5	TTL Output 1 (1 k $\Omega$ pull up to +5, 100 mA sink)
	6	TTL Output 2 (1 k $\Omega$ pull up to +5, 100 mA sink)
TTL IN (+) 1 2 3 4	7	TTL Input 1 — Inject/Load
	8	TTL Input 2 — Autozero
	9	TTL Input 3 — Pump/Suppressor On
	10	TTL Input 4 — Mark
TTL GND (-) 1 2	11	Ground
	12	Ground

**Note:** The TTL input functions can be reassigned to different inputs.

Figure D-1. TTL and Relay Connector on Rear Panel



Relay loads in excess of 200 mA or with included power supplies over 60 V may damage the relay drivers on the CPU.

The outputs can be used to control functions in external devices such as an autosampler or another Dionex module. When connected to a controlling device, the inputs can be programmed to perform the following ICS-2000 functions:

- Switch the injection valve position (load/inject)
- Perform an autozero command (set the conductivity to zero)
- Turn the pump on and off (also turns the suppressor on and off)
- Send a chart mark signal to the analog output. The mark is 10% of the full-scale voltage, and the duration is 0.5 seconds. A mark can be used, for example, to indicate the injection.

Relay outputs 1 and 2 can be programmed to switch any low-voltage control. Switched current must be less than 200 mA and 42 V peak.

### Connecting a TTL or Relay

1. Locate the twisted pair of wires (P/N 043598) and the 12-position connector plug (P/N 923687) (see [Figure D-2](#)) in the ICS-2000 Ship Kit (P/N 064375).
2. Follow these basic steps to connect the TTL or relays.

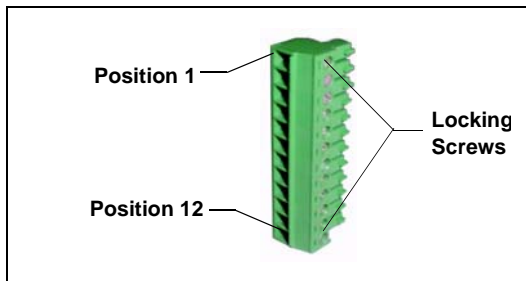


Figure D-2. 12-Position Connector Plug

- a. For each relay or TTL to be used, connect an active wire (red) and a ground wire (black) to the 12-position connector plug at the appropriate pin locations. Refer to [Figure D-1](#) or the label on the ICS-2000 rear panel for the connector pin assignments.

To attach a wire to the plug, strip the end of the wire, insert it into the plug, and use a screwdriver to tighten the locking screw. If necessary, multiple ground wires can be attached to a single TTL input/output ground pin.



**When attaching wires to the connector plug, be careful not to allow stray strands of wire to short to the adjoining position on the connector.**

- b. Plug the connector into the 12-pin connector on the ICS-2000 rear panel.

- c. Connect the wires from the ICS-2000 connector plug to the TTL or relay connector pins on the other module(s). Additional connector plugs are provided with other Dionex modules.

**NOTE** Check the polarity of each connection. Connect signal wires to signal (+) pins and ground wires to ground (-) pins.

3. If you connected a TTL input, verify that the correct function is assigned to the input and that the correct input control type is selected. Select different settings if necessary. Input functions and control types are assigned from either the **INPUT/OUTPUT** touch screen page or Chromeleon (see [Section D.1.1](#)).

### D.1.1 Selecting TTL Input Functions and Control Types

To select TTL input functions and the control type from Chromeleon, open the Chromeleon Server Configuration program and double-click the ICS-2000 icon under the timebase. Select the **TTL Inputs** tab (see [Figure D-3](#)).

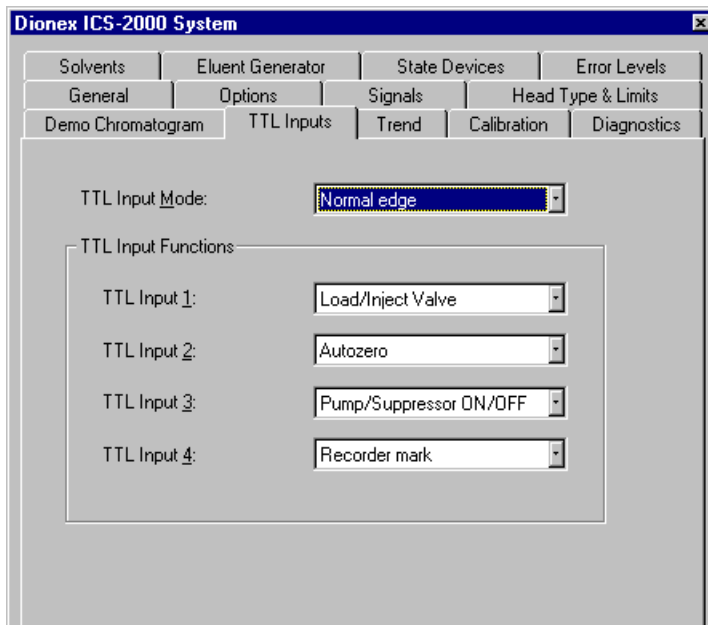


Figure D-3. ICS-2000 Server Configuration Properties: TTL Inputs

To select TTL input functions and the control type from the touch screen, go to the **INPUT/OUTPUT** touch screen page (see [Figure D-4](#)).

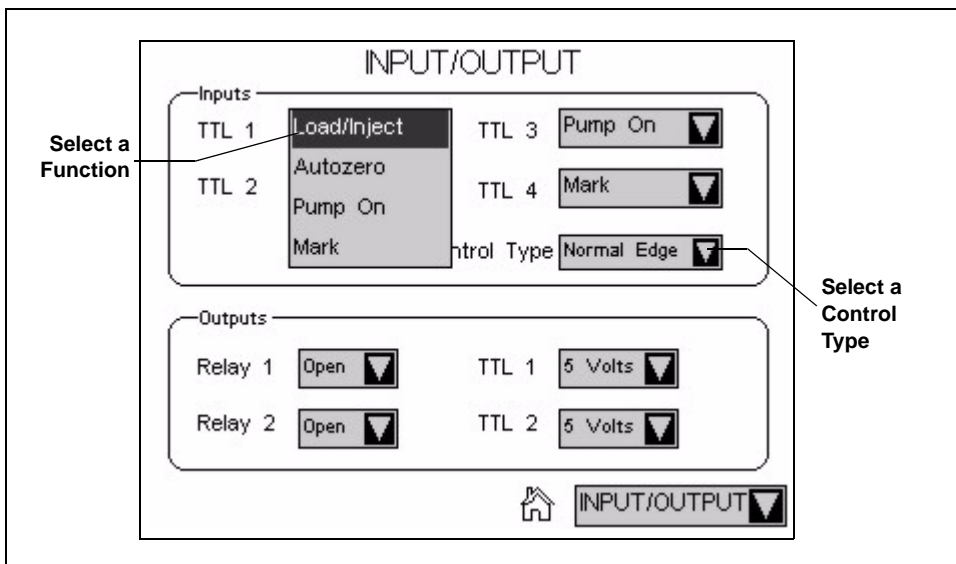
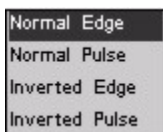


Figure D-4. Input/Output Page: Selecting TTL Functions

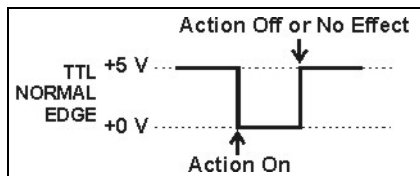
## TTL Input Control Types



The ICS-2000 TTL inputs respond to four types of signals to accommodate different controlling devices. The default control type, **Normal Edge**, is compatible with the output signals provided by Dionex modules.

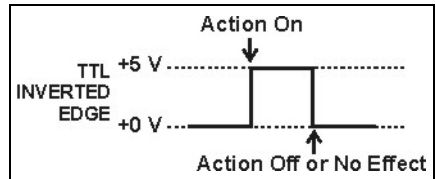
If the device connected to the ICS-2000 does not send a normal edge signal, select the appropriate control type. Refer to the documentation provided with the controlling device and the information below to select the correct type.

- **Normal Edge:** In normal edge operation, the negative (falling) edge of a signal turns on the function. For example, for the **Load/Inject** function, the negative edge switches the injection valve position to Load.

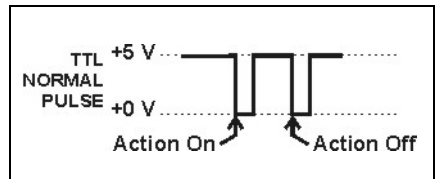


The action of the positive (rising) edge depends on the function: For the **Load/Inject** function, the rising edge switches the injection valve to the Inject position. For the **Pump On** function, the rising edge turns off the pump (and suppressor). For **Autozero** and **Mark**, the rising edge has no effect.

- *Inverted Edge*: The inverted edge mode works identically to the normal edge mode except that the positive and negative edges are reversed in function.

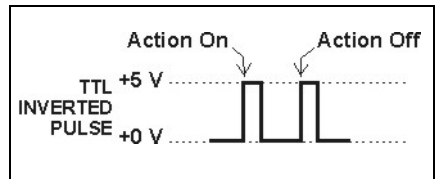


- *Normal Pulse*: In normal pulse operation, the negative (falling) edge of the TTL signal is the active edge and the positive (rising) edge is ignored.



A pulse width of 50 ms or more is guaranteed to be detected. A pulse width of 4 ms or less is guaranteed to be ignored. The action for pulse widths that are greater than 4 ms and less than 50 ms is undefined.

- *Inverted Pulse*: The inverted pulse mode operates identically to the normal pulse mode except that the positive and negative edges are reversed in function.



## D.2 Controlling TTL and Relay Outputs

The ICS-2000 provides two TTL outputs and two relay contacts for control of functions in external devices, such as an integrator or autosampler. The relay outputs can be used to switch any low-voltage control. Switched current must be less than 200 mA and 60 V peak blocking. The relay-contact closures are normally open. When the relay is closed, current flows to the connected device.



**Relay loads in excess of 200 mA or with included power supplies over 60 V may damage the relay drivers on the CPU.**

The TTL outputs are normally at 5 volts. Setting a TTL output to 0 volts turns on the action in the connected device.

The TTL and relay output states can be controlled from Chromeleon, either by issuing direct control commands from the Chromeleon Control panel or by including the commands in a control program. [Figure D-5](#) shows an example relay program command for controlling an AS40 autosampler.

```
AS12A Production Test Chromatogram - Commands
m Production Test Chromatogram
Suppressor_Current = 2.3
Flow = 1.50
-2.300 Pump_ECD_Relay_1.Closed Duration=138.00 ; For AS40 injection.
0.000 Pump_ECD.Autozero
ECD_1.AcqOn
Pump_InjectValve.InjectPosition Duration=30.00
15.000 ECD_1.AcqOff
End
```

Figure D-5. Example Program for AS40 Control

To control the TTL and relay output states from the touch screen, select **INPUT/OUTPUT** from the menu of pages. The **INPUT/OUTPUT** page appears (see [Figure D-4](#)).

- To set a relay, touch the relay field and select the desired state (**Open** or **Closed**). For example, if Relay 1 is connected to the Load input on an AS40 autosampler, touch the **Relay 1** field and select **Closed** to start the AS40 load cycle.
- To set a TTL outputs, touch the **TTL** field and select the desired state (**5 Volts** or **0 Volts**).



### D.3 Example Setup for Stand-Alone Operation

This section describes an example setup for *stand-alone operation* (operation without Chromeleon software) with an AS or AS50 (USB) autosampler and a third-party analog-to-digital converter and controller. If your configuration includes different devices, use the following steps as guidelines and refer to your product documentation for specific connection details.

#### Connect the AS or AS50 (USB) Autosampler

Follow the instructions in [Section B.18.1](#) to connect the AS or AS50 (USB) autosampler to the ICS-2000 injection valve.

#### Connect the TTLs and Relays

1. Locate two twisted pairs of wires (P/N 043598) and 12-position connector plugs (P/N 923686) (see [Figure D-6](#)) in the ICS-2000 and AS or AS50 (USB) Ship Kits.
2. Attach the wires to the connector plug positions indicated in [Figure D-7](#).

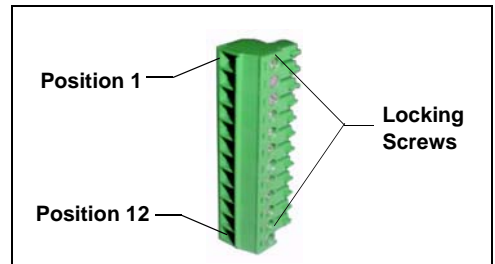


Figure D-6. 12-Position Connector Plug

To attach a wire to a connector plug, strip the ends of the wire, insert into the desired connector position, and tighten the locking screw with a screwdriver.



**When attaching wires to the connector plug, be careful not to allow stray strands of wire to short to the adjoining position on the connector.**

3. Plug the connector plugs into their respective TTL/Relay connectors on the rear panel of each module.

Make sure the red wires connect to active (+) pins on each module and the black wires connect to ground (-) pins.

# ICS-2000 Ion Chromatography System

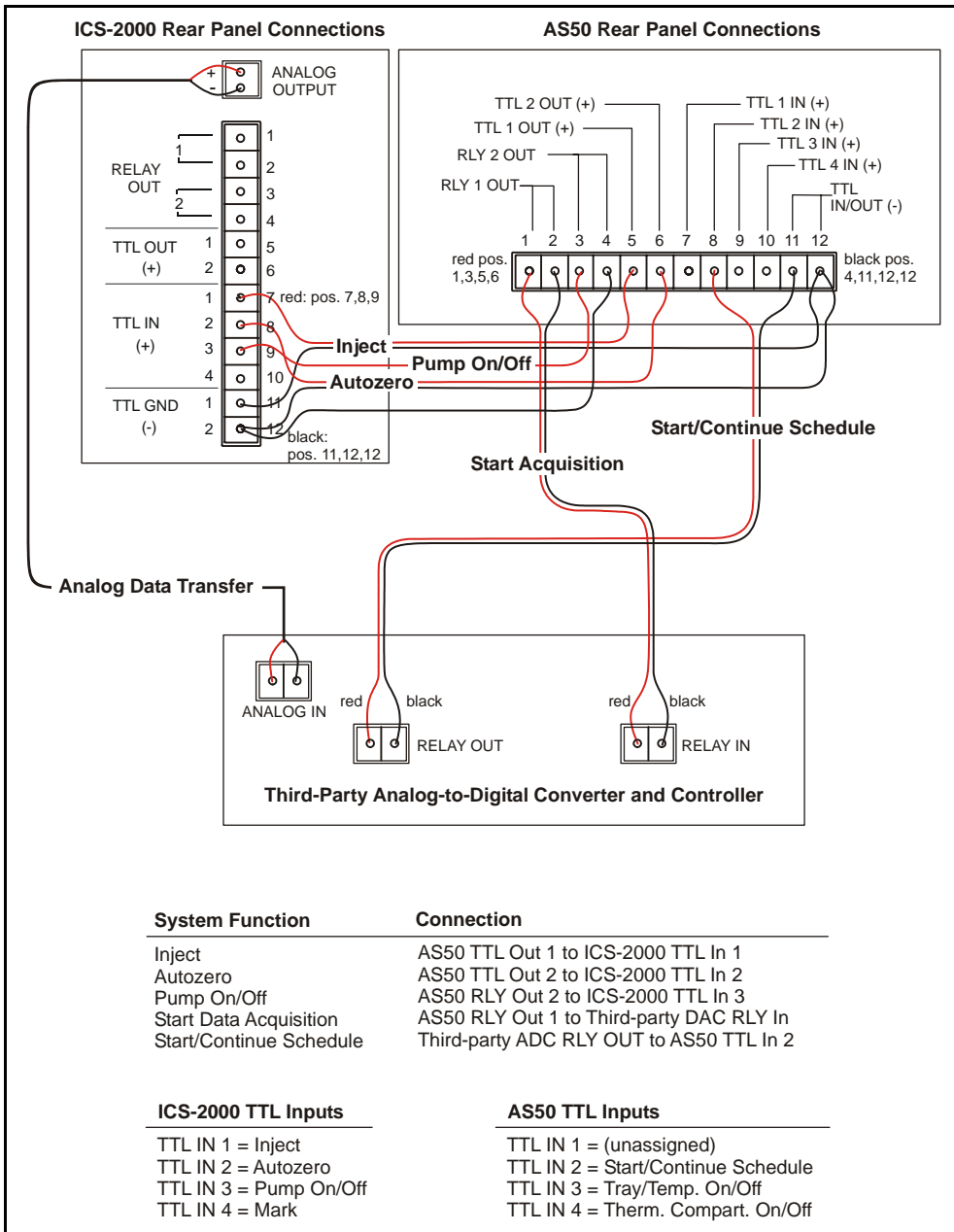


Figure D-7. Example Connections for Stand-Alone Operation

**Assign ICS-2000 Input Functions**

Go to the ICS-2000 **INPUT/OUTPUT** touch screen page and verify that the **Inject** function is assigned to TTL input 1, that Autozero is assigned to TTL input 2, and that the **TTL Input Control Type** is **Normal Edge** (see [Figure D-8](#)).

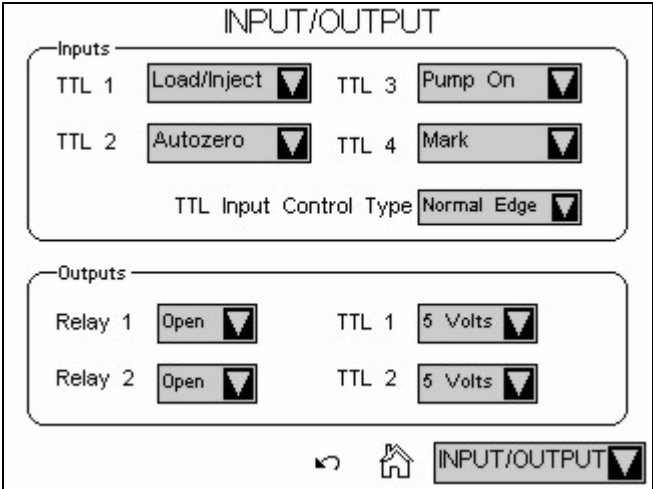


Figure D-8. Input/Output Page

**Enable AS or AS50 (USB) Control of the Injection Valve**

1. On the AS or AS50 (USB) front panel, press **Menu** and **0** to go to the **TIME FUNCTION OUT** screen. In the **LOAD/INJECT VALVE: TTL 1** field, select **ENABLED**.

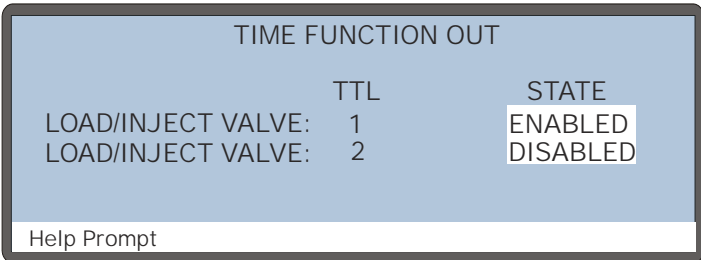


Figure D-9. AS or AS50 (USB) Time Function Out Screen

2. Turn the AS or AS50 (USB) power off and then back on.

You can now issue commands from the AS or AS50 (USB) to switch the ICS-2000 injection valve position.

### Connect the Analog Output

1. Locate the analog cable for the third-party analog-to-digital converter and controller.
2. Connect the analog input connector on the third-party controller to the **ANALOG OUTPUT** connector on the ICS-2000 rear panel (see [Figure D-7](#)).

### Configure the ICS-2000 Analog Output

Go to the ICS-2000 **DETECTOR** touch screen page and select the settings shown in [Figure D-10](#):

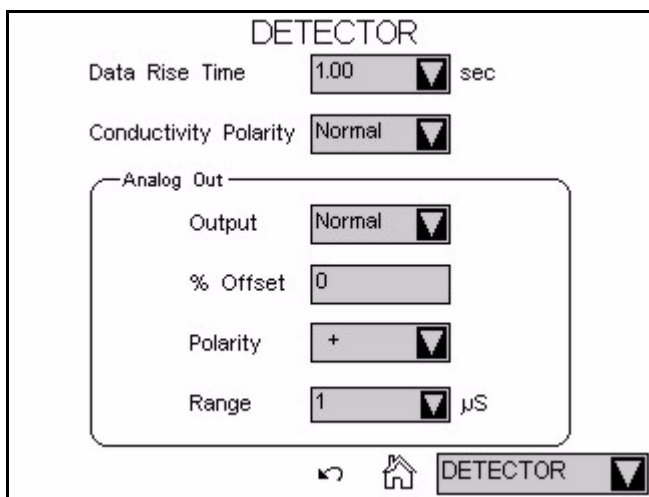


Figure D-10. Detector Page

**Create an AS or AS50 (USB) Method and Schedule**

[Figure D-11](#) is an example of AS or AS50 (USB) method timed events that can be used with the TTL/Relay connections shown in [Figure D-7](#).

		TIMED EVENTS			METHOD: 1	
TIME	VALVE	CSV	TTL1	TTL2	RLY1	RLY2
INIT	LOAD					
0.00	INJECT			1	1	1
0.50				0	0	1

Help Prompt

Figure D-11. Example AS or AS50 (USB) Method for Stand-Alone Operation

**Timed Event Notes:**

- At time INIT, the injection valve is set to Load.
- At time 0.00, the injection valve is set to Inject, an autozero is performed (TTL2=1), the data acquisition mark is sent (RLY1=1), and the pump is turned on (RLY2=1).
- At time 0.5, TTL2 and RLY1 are switched back to 0 to be ready for the next run. RLY2 remains at 1 to keep the pump on.
- TTL1 does not need to be set in the timed events because the Load and Inject commands control the ICS-2000 injection valve automatically (see [“Enable AS or AS50 \(USB\) Control of the Injection Valve”](#) on page D-9).

To run the above method, set up an AS or AS50 (USB) schedule. The example in [Figure D-12](#) includes a four-point calibration (Lines 1 – 4) followed by two samples (Lines 5 and 6).

SCHEDULE		EDIT	1	SAVE TO	1	RUN	1
MISSING VIAL ACTION:		SKIP					
LINE	VIAL#	INJ/	INJ	METHOD			
START-	END	VIAL	VOL(uL)				
1-4	1 - 4	3	25.0	1			
5	5 - 5	1	25.0	1			
6	6 - 6	1	5.0	1			

Help Prompt

Figure D-12. Example AS or AS50 (USB) Schedule for Stand-Alone Operation



## E • Reordering Information

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Part Number	Item
<i>Reservoirs</i>	
046548	2-L plastic reservoir assembly (includes stopper and cap)
039164	4-L plastic reservoir assembly (includes stopper and cap)
<i>Pump</i>	
057937	Primary pump head assembly
057938	Secondary pump head assembly
045721	Outlet check valve assembly, 10-32
045722	Inlet check valve assembly, 1/4-28
045994	Check valve cartridges
052840	Piston
055870	Piston seal
048722	Piston rinse seal
055752	O-ring for waste valve or priming valve
057945	Eluent valve
054578	10-cc syringe (for priming eluent lines)
<i>Eluent Generator</i>	
058904	EGC II K <sub>2</sub> CO <sub>3</sub> EluGen Cartridge
058900	EGC II KOH EluGen Cartridge
058906	EGC II LiOH EluGen Cartridge
058902	EGC II MSA EluGen Cartridge
058908	EGC II NaOH EluGen Cartridge
060477	CR-ATC (Anion Continuously Regenerated Trap Column)
060478	CR-CTC (Cation Continuously Regenerated Trap Column)
063175	EPM Electrolytic pH Modifier
061686	EGC CO <sub>3</sub> Mixer (for 4-mm columns)
063443	EGC CO <sub>3</sub> Mixer (for 2-mm columns)
058069	EGC holder and degas assembly

## ICS-2000 Ion Chromatography System

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Part Number	Item
-------------	------

### *Sample Loop and Injection Valve*

042857	25- $\mu$ L sample loop
057968	Injection valve
024305	Luer adapter fitting, 1/4-28 (for manual injections)
016388	1-cc syringe (for manual injections)
057896	Injection valve rebuild kit

### *Suppressors, Cell, and Column Heater*

056116	AAES Anion Atlas Electrolytic Suppressor
056118	CAES Cation Atlas Electrolytic Suppressor
053946	ASRS-Ultra 4-mm Anion Self-Regenerating Suppressor
053949	CSRS-Ultra 4-mm Cation Self-Regenerating Suppressor
057985	DS6 heated conductivity cell
058060	Column heater assembly
059979	Column heater heat exchanger, 0.25-mm (0.010-in) ID tubing
060943	Column heater heat exchanger, 0.125-mm (0.005-in) ID tubing
058062	Column heater cover assembly

### *Relay/TTL*

923686	12-position connector plug
043598	Twisted pair of wires

### *Miscellaneous*

954745	IEC 127 fast-blow fuses, rated 3.15 amps
060494	USB cable, 5 m (16 ft)
060392	External USB hub
058053	Leak detector

### *Maintenance Kits*

055647	AS40/ASM Preventive Maintenance Kit
060581	AS/AS50 Preventive Maintenance Kit
057954	ICS-2000 Preventive Maintenance Kit



## F.1 How do I hook up an autosampler?

For instructions on how to connect the ICS-2000 to an AS or AS50 autosampler, see [Section B.18](#) of this manual. To connect an AS40, see [Section B.19](#). Also refer to the autosampler operator's manuals, which are included on the Dionex Reference Library CD-ROM (P/N 053891).

## F.2 How do I print?

Click the Print toolbar button in Chromeleon (see [Section 2.2](#)).

## F.3 Why are the retention times moving?

Retention times can shift if the pump flow is erratic or if the column or eluent is contaminated. See [Section 4.6](#) for pump flow rate troubleshooting. If a contaminated column is suspected, clean the column as instructed in the column manual. The column manual is included on the Dionex Reference Library CD-ROM (P/N 053891).

## F.4 How do I adjust retention times?

Retention times are calculated during calibration. The **Use Recently Detected Retention Time** parameter in the Chromeleon QNT Editor (**General** tab) can be used to compensate for some types of retention time drifts; for example, evaporation of volatile components in pre-mixed solvents or an aging column. Refer to the Chromeleon online Help or user's guide for details.

## F.5 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).

### F.6 When should I replace the eluent generator cartridge?

The ICS-2000 monitors EluGen cartridge use and displays a message when it is time to replace the cartridge. The message appears on the front panel screen and in the Chromeleon Audit Trail. To view the remaining cartridge life, click **EG Settings** on the Chromeleon Control panel, or go to the touch screen **ELUENT GENERATOR** page (see [Section C.8](#)).

### F.7 How do I start Chromeleon?

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

### F.8 How do I delete data?

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

### F.9 How do I back up data?

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

### F.10 How do I shut off the system?

In Chromeleon, click the **System Shutdown** button on the Control panel (see [Figure 2-11](#)). On the ICS-2000, turn off the power switch on the rear panel (see [Figure 2-9](#)).

### F.11 How do I store columns?

Columns should be stored in eluent. See the column manual for complete instructions. The column manual is included on the Dionex Reference Library CD-ROM (P/N 053891).

## **F.12 How do I know when a column is dirty?**

See the troubleshooting section of the column manual.

## **F.13 How do I clean a column?**

See the troubleshooting section of the column manual.

## **F.14 Why is the conductivity high?**

Possible reasons for high conductivity include:

- The suppressor needs regeneration. See the suppressor manual for troubleshooting information. The suppressor manual is included on the Dionex Reference Library CD-ROM (P/N 053891).
- The cell is out of calibration. See [Section 5.1.3](#) for calibration instructions.
- See [Section 4.12](#) for additional troubleshooting information.



**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<sup>+</sup>) may be the counterion of a Cl<sup>-</sup> 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.

**Equivalent Conductivity ( $\lambda$ )**

The contribution of an ionic species to the total conductivity of a solution as measured in a standard cell having electrodes 1 cm<sup>2</sup> in area and exactly 1 cm apart.

**Guard Column**

A small column that 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)**

**H**eight **E**quivalent to a **T**heoretical **P**late. A measure of column efficiency which allows comparison between columns of different lengths.

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

Where: L = the column length (in 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; this is usually 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 that 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 that converts ion exchange sites in a MicroMembrane Suppressor back to the form that suppresses the eluent conductivity.

### **Resin**

See **Ion-Exchange Resin**.

### **Resolution (R)**

A measure of the separation between two sample components. This 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 separation; also called an 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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