



ICS-2100 Ion Chromatography System Operator's Manual

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ICS-2100 Ion Chromatography System

1.1 Introduction to Ion Chromatography (IC)

The Dionex ICS-2100 Ion Chromatography System (ICS-2100) 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](#)).

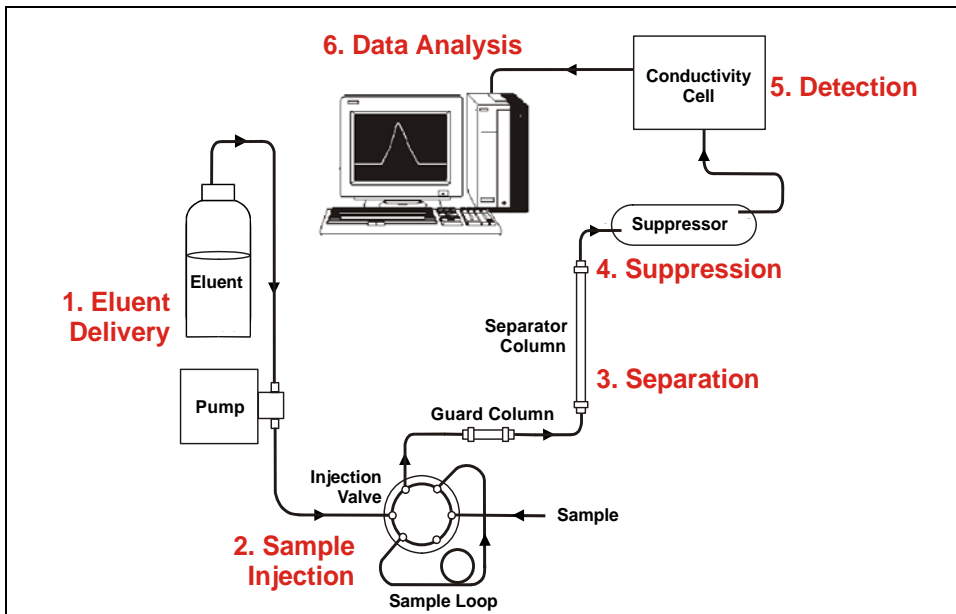


Figure 1-1. Ion Analysis Process

1. Eluent Delivery

- Eluent, a liquid that helps to separate the sample ions, carries the sample through the ion chromatography system. The ICS-2100 includes an eluent generator, which generates eluent online from deionized water.
- When the ICS-2100 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-2100 is controlled by Chromeleon® Chromatography Management System (the data collection system for the ICS-2100).

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-2100 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-2100, 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-2100, this is the Chromeleon® Chromatography Management System) 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-2100

The ICS-2100 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-2100 can be configured with a vacuum degas assembly for online eluent degassing. If desired, the second eluent generator power supply can be configured to power an auxiliary electrolytic device, such as a water purifier.

An optional second high-pressure valve (6-port or 10-port) can be installed for sample preparation applications.

ICS-2100 operation can be controlled in one of two ways:

- *Remotely*, with a personal computer running Microsoft® Windows® Vista or Windows XP and Chromeleon software (version 6.80 SR6a 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-2100 and Chromeleon, the ICS-2100 is connected to a USB (Universal Serial Bus) port on the computer or a USB hub. For details, see the ICS-2100 installation instructions. 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 this operator's manual contains numerous hypertext links that can take you to other locations within the file. These links include:

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

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

| | |
|--|---|
| Chapter 1 Introduction | Introduces ion analysis and the ICS-2100; explains the conventions used in this manual, including safety-related information. |
| Chapter 2 Features | Provides an overview of ICS-2100 operating features and system components; introduces the Chromeleon user interface. |
| Chapter 3 Operation and Maintenance | Provides operating instructions and describes routine preventive maintenance procedures. |
| Chapter 4 Troubleshooting | Lists problems, and presents step-by-step procedures for how to isolate and eliminate the cause of each problem. |
| Chapter 5 Service | Provides step-by-step instructions for routine service and parts replacement procedures that the user can perform. |
| Appendix A Specifications | Lists the ICS-2100 specifications and installation site requirements. |
| Appendix B Touch Screen Operation | Describes the operating features available from the front panel touch screen. |
| Appendix C TTL and Relay Control | Describes the ICS-2100 TTL and relay control features. |
| Appendix D Reordering Information | Lists spare parts for the ICS-2100. |

| | |
|--------------------------------|--|
| Appendix E FAQ | Provides answers to frequently asked questions about ICS-2100 operation. |
| Appendix F Glossary | Defines terms commonly used in ion analysis. |

1.3.1 Safety Messages and Notes

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.

1.4 Safety and Regulatory Information

The ICS-2100 was manufactured by Dionex Corporation at the following location: 527 Lakeside Drive, Sunnyvale, CA 94088-3603 U.S.A. The ICS-2100 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.

1.4.1 Safety Labels

The TUV T-Mark and cTUVus Mark safety labels and the CE Mark label on the system indicate that it is in compliance with the following standards:

EMC Susceptibility and Emissions

- EN 61326-1:2006

Safety

- CAN/CSA-C22.2 61010-1:2004
- UL 61010-1:2004
- EN 61010-1:2001

The symbols below appear on the ICS-2100 or on labels affixed to the ICS-2100.

 Alternating current

 Primary protective conductor terminal

 Secondary protective conductor terminal



Power supply is on



Power supply is off



Hot surface



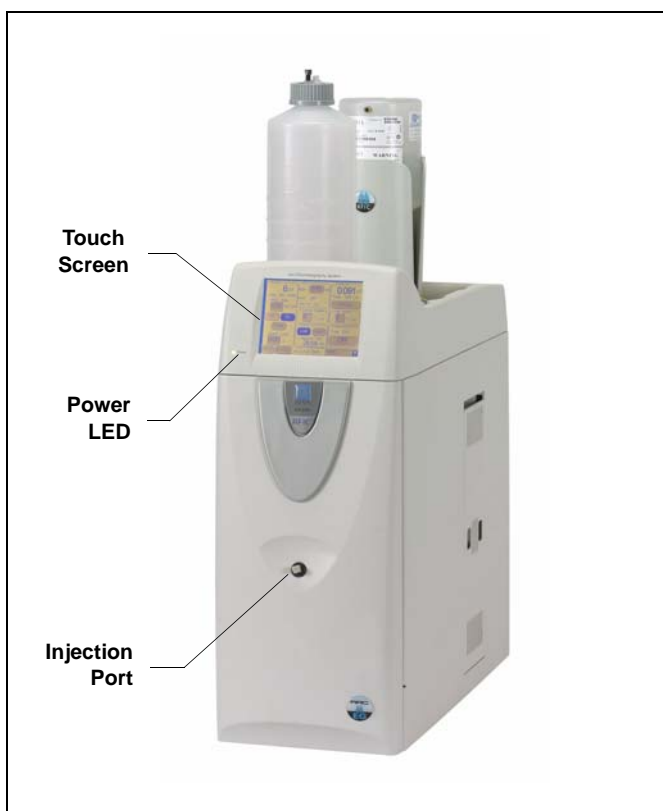
Indicates a potential hazard. Refer to the operator's manual for an explanation of the hazard and how to proceed.

This chapter describes key ICS-2100 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-2100.



Injection Port

The sample to be analyzed can be injected manually into the injection port, using a syringe. For automated sample injection, the ICS-2100 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-2100 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-2100 operating functions.

Figure 2-1. ICS-2100 Front Panel

Summary of Touch Screen Operation

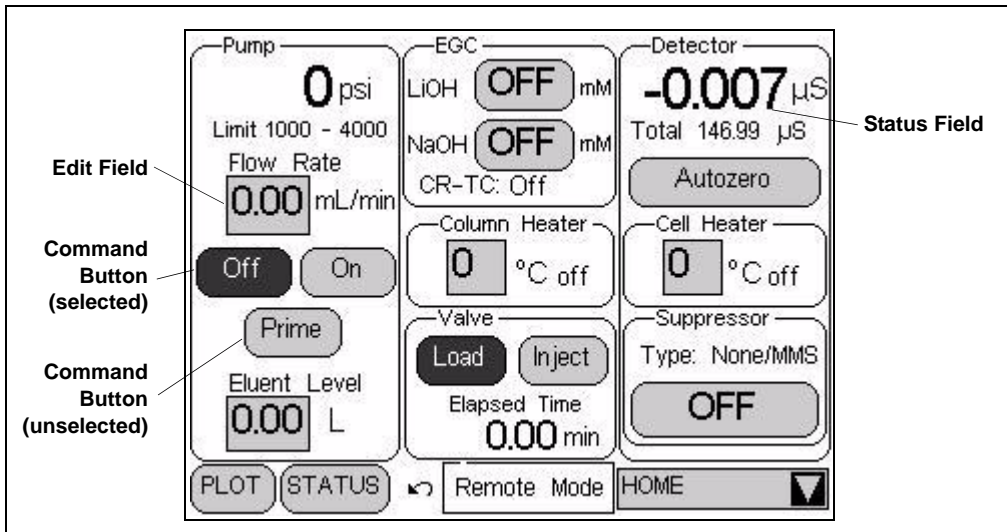



Figure 2-2. ICS-2100 Touch Screen Home  Page

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.

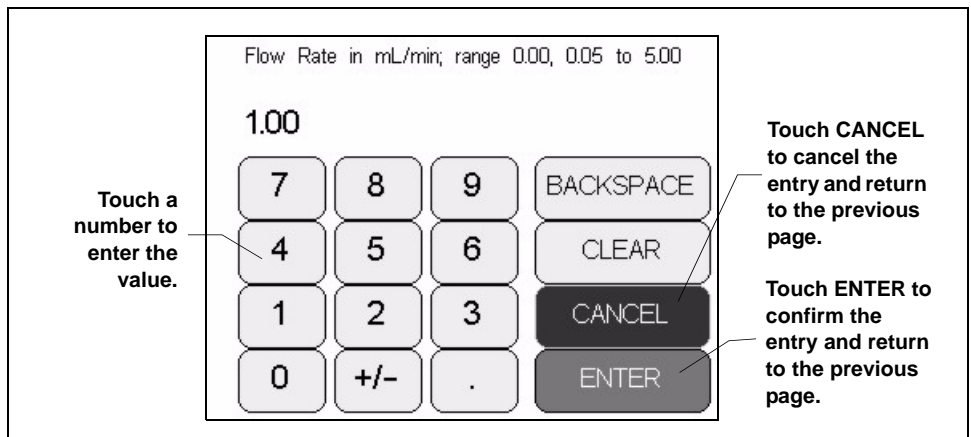



Figure 2-3. Number Keypad

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

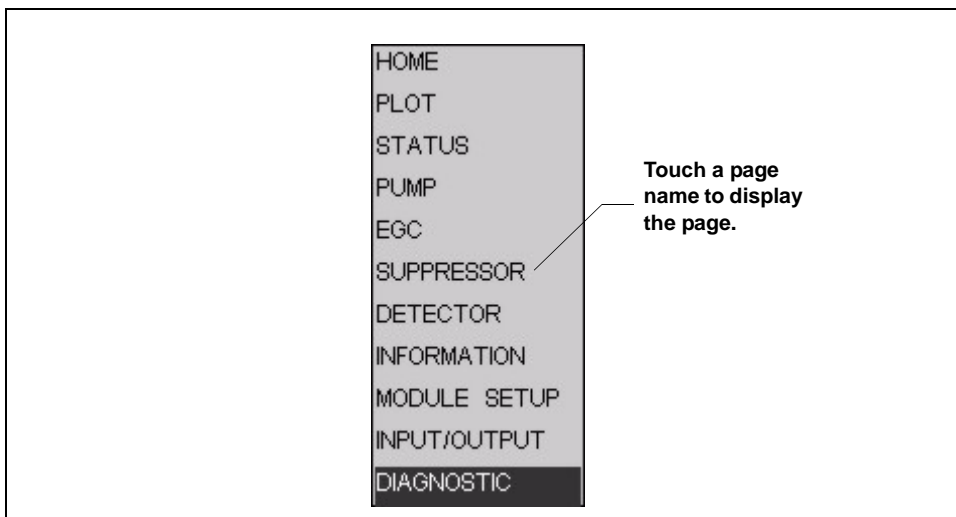


Figure 2-4. ICS-2100 Touch Screen Menu of Pages

- 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 B](#) for details about each touch screen page.

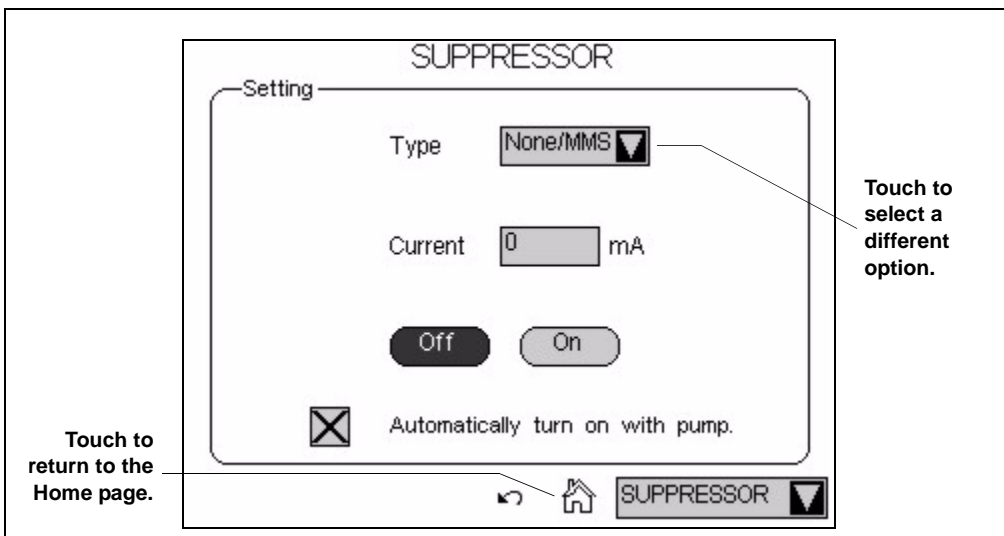




Figure 2-5. Suppressor Page

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

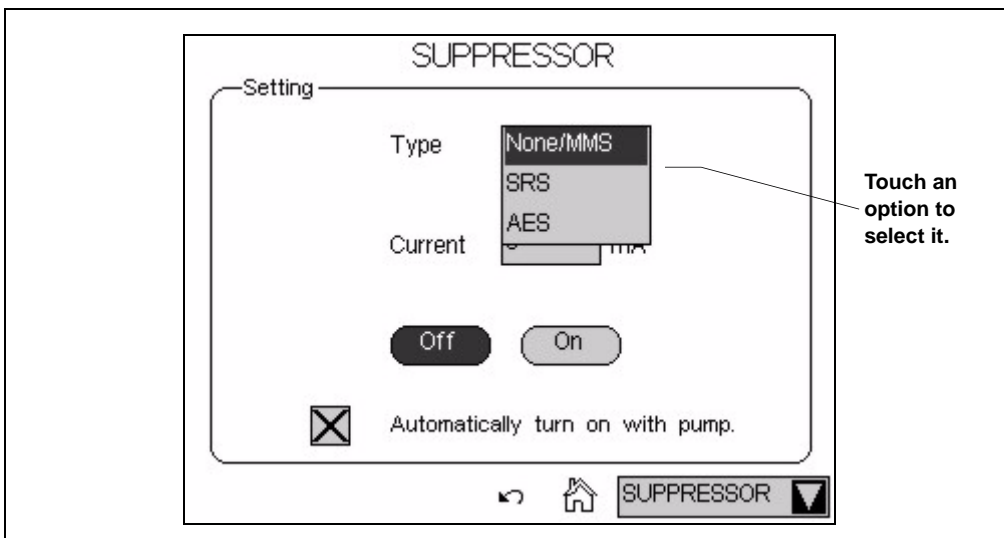
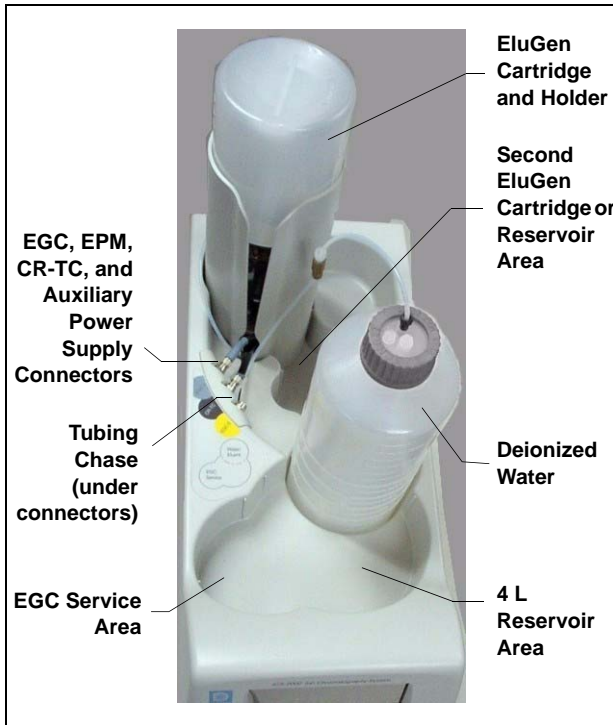


Figure 2-6. Suppressor Page: Selecting an Option

2.1.2 Top Cover

[Figure 2-7](#) illustrates the top cover of the ICS-2100.



EluGen Cartridge and Reservoir Storage

The top cover holds one or two EluGen® cartridges and up to two 2-L plastic reservoirs (P/N 044129) *or* one 4-L plastic reservoir (P/N 039164).

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-2100.

Figure 2-7. ICS-2100 (Top View)

EGC, EPM, CR-TC, and Auxiliary Power Supply 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. If a second EluGen cartridge is installed, it connects to the **EGC-2** connector. If the second eluent generator power supply is configured to power an auxiliary electrolytic device, it connects to the **EGC-2** connector. For details, refer to the ICS-2100 installation instructions.

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. For details, refer to the ICS-2100 installation instructions.

2.1.3 Component Panel

[Figure 2-8](#) shows the user-accessible components installed on the component panel behind the ICS-2100 front door.

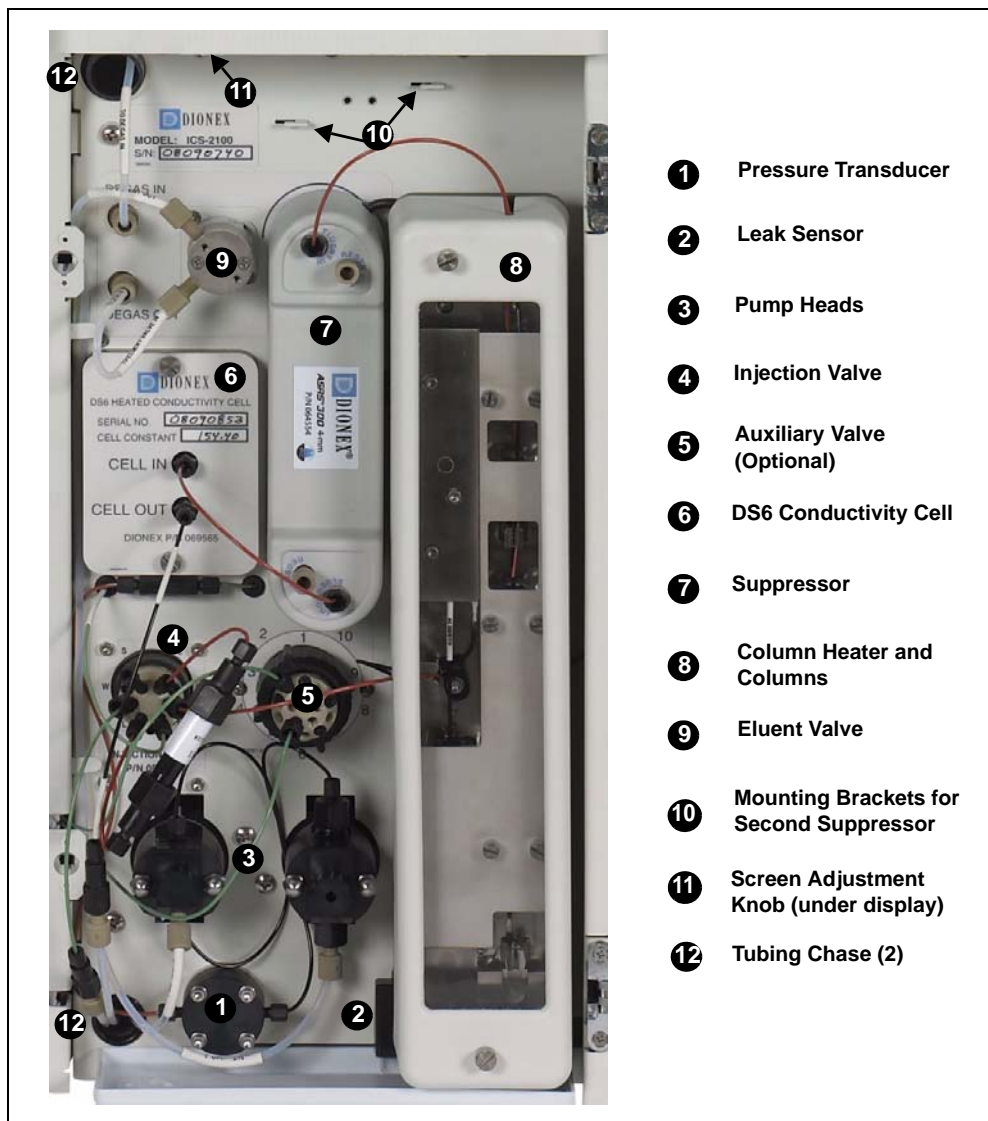


Figure 2-8. ICS-2100 Component Panel

Pressure Transducer

The pressure transducer measures the system backpressure.

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-2100 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.

Injection Valve

The injection valve is a six-port, electrically-activated Rheodyne valve. A 25- μ L sample loop (P/N 042857) is installed on the valve at the factory. See [Section 2.4.6](#) for details about valve operation.

Auxiliary Valve (Optional)

The auxiliary valve is a two-position, electrically-activated Rheodyne valve (6-Port Valve Kit, P/N 069472; 10-Port Valve Kit, P/N 069473). See [Section 2.4.6](#) for details about valve operation.

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 and 5 °C above the column oven temperature. See [Section 2.4.10](#) for details about the cell.

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-2100. See [Section 2.4.9](#) for details about the suppressor.

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 to at least 5 °C above the ambient temperature. See [Section 2.4.8](#) for details about the column heater.

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.

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 interior of the ICS-2100, to the rear panel.

2.1.4 Rear Panel

[Figure 2-9](#) illustrates the ICS-2100 rear panel.

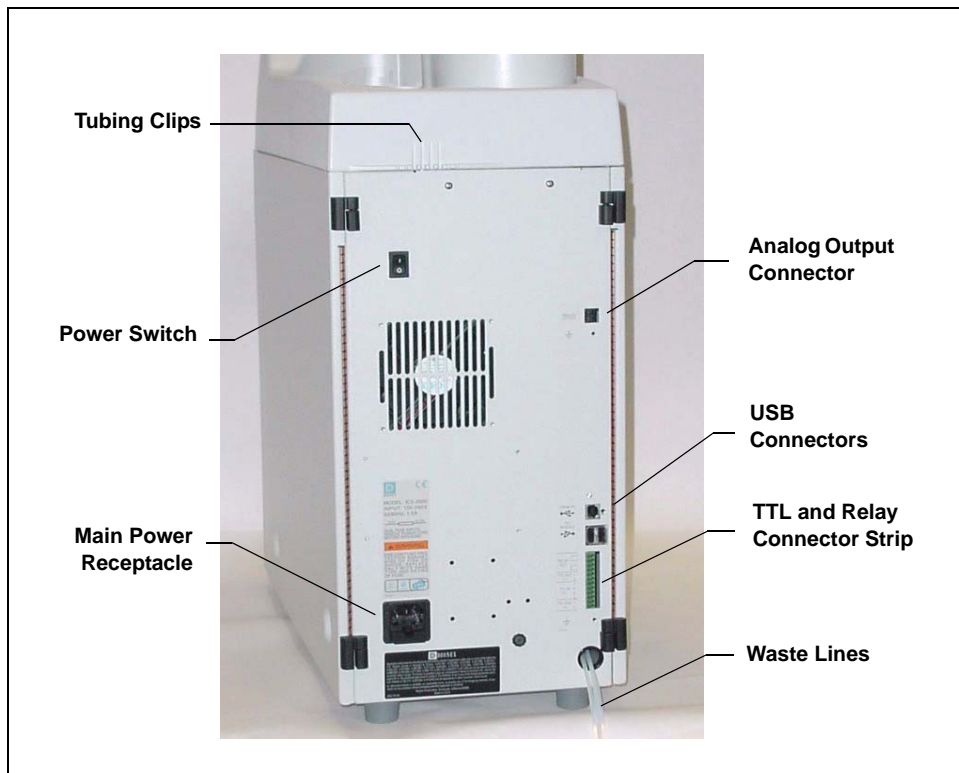


Figure 2-9. ICS-2100 Rear Panel

Analog Output Connector

The analog output connector outputs conductivity data (as a 0 to 1 V signal) to an integrator or recording device. For connection and setup information, refer to the ICS-2100 installation instructions.

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. For connection instructions, refer to the ICS-2100 installation 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 C.1](#) for connection instructions.

Tubing Chases

The lower chase routes tubing from the rear panel to the component panel.

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-2100.

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-2100 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 Flow Schematics

- [Figure 2-10](#) 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 2-11](#) illustrates the liquid flow path when the components required for producing carbonate/bicarbonate eluent are installed. The required components include an EGC II K₂CO₃ EluGen Cartridge, an EPM Electrolytic pH Modifier, and an EGC CO₃ Mixer.
- [Figure 2-12](#) illustrates the liquid flow path when the components required for producing carbonate eluent are installed. The required components include an EGC II K₂CO₃ EluGen Cartridge and an EGC CO₃ Mixer.

ICS-2100 Ion Chromatography System

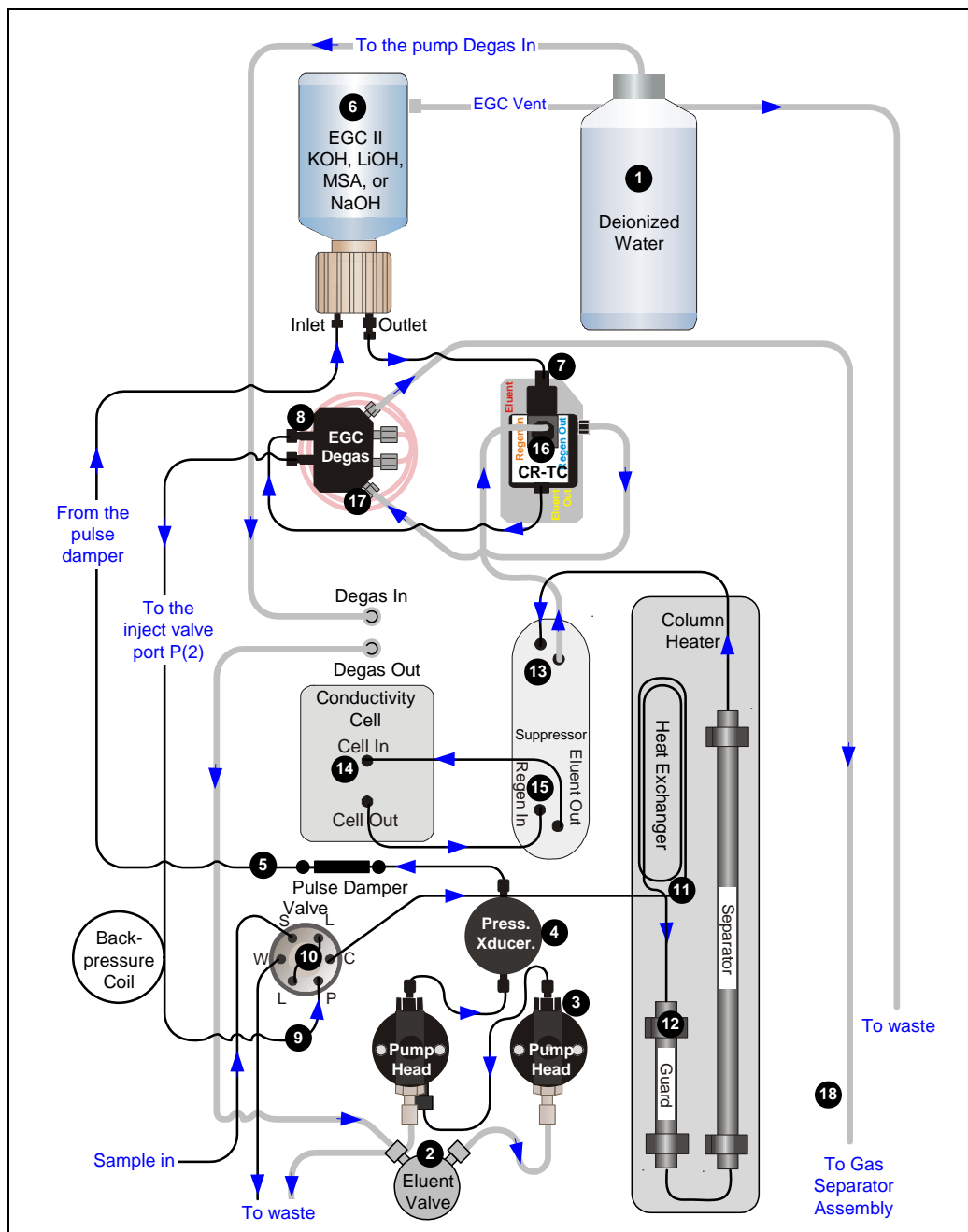


Figure 2-10. ICS-2100 Flow Schematic: KOH, LiOH, MSA, or NaOH Eluent Generation

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

Refer to [Figure 2-10](#) 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-2100 Ion Chromatography System

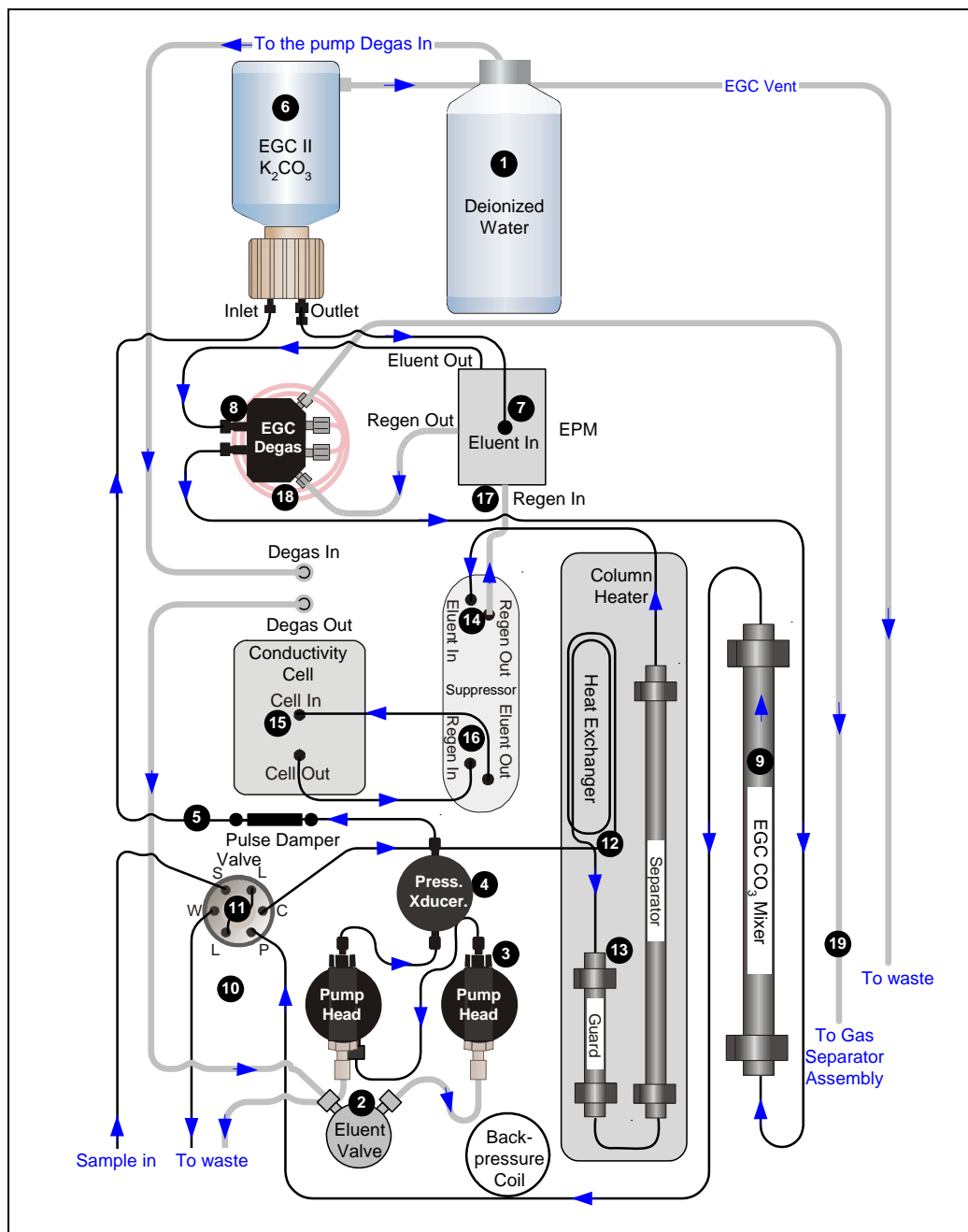


Figure 2-11. ICS-2100 Flow Schematic: Carbonate/Bicarbonate Eluent Generation

Flow Description for Carbonate/Bicarbonate Eluent Generation

Refer to [Figure 2-11](#) 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 CO₃ 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 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-2100 Ion Chromatography System

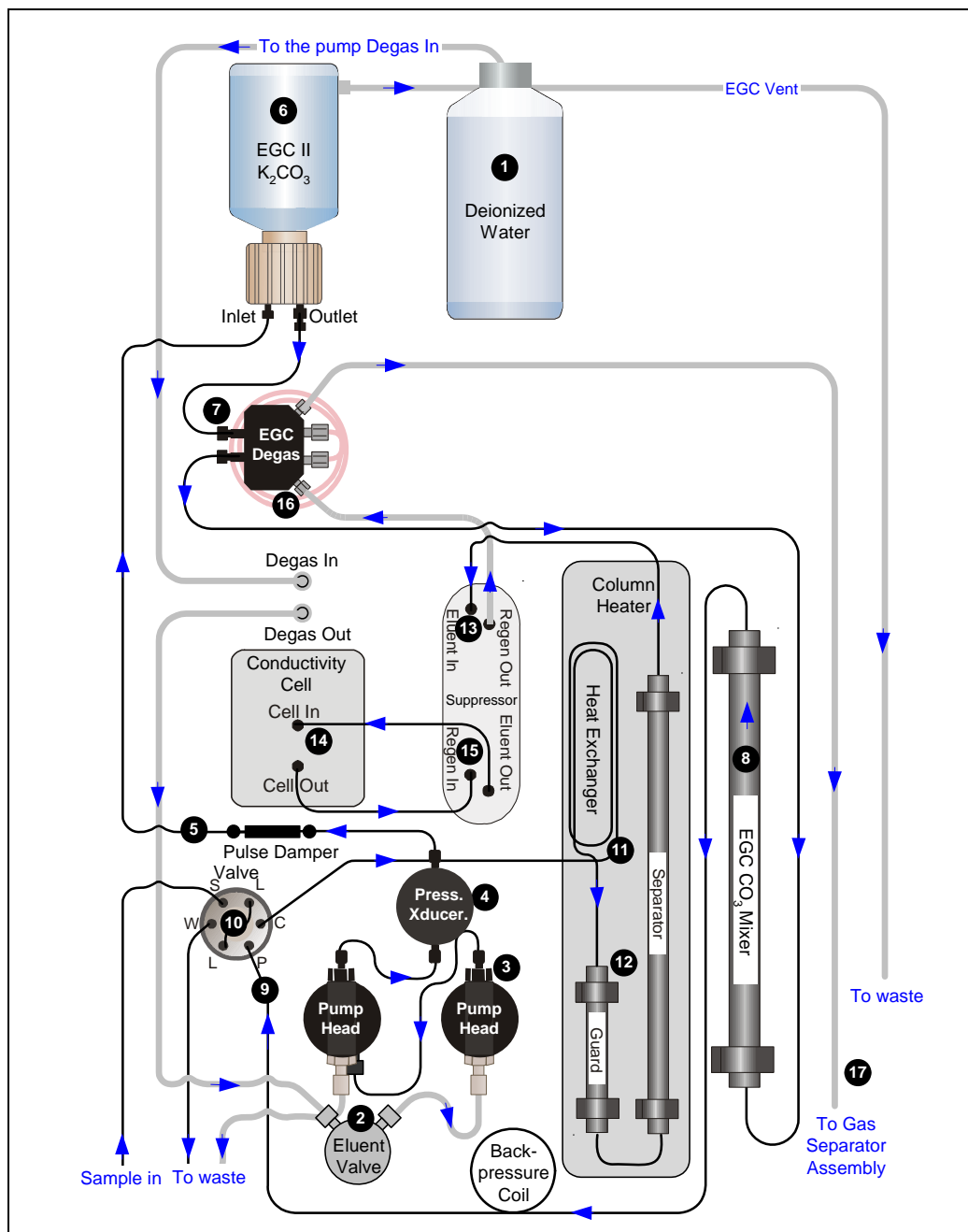


Figure 2-12. ICS-2100 Flow Schematic: Carbonate Eluent Generation

Flow Description for Carbonate Eluent Generation

Refer to [Figure 2-12](#) 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 CO₃ 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**.

2.3 Chromeleon and Chromeleon Xpress

The ICS-2100 is controlled by a PC configured with Chromeleon Chromatography Management System or Chromeleon Xpress. Chromeleon Chromatography Management System provides complete instrument control, data acquisition, and data management. Chromeleon Xpress provides real-time control and monitoring of Dionex chromatography instruments, but does not include data management capabilities.

2.3.1 The Panel Tabset

The Chromeleon and Chromeleon Xpress *panel tabset* provides a centralized location for controlling system functions. A panel tabset for an ICS-2100 system typically includes the following Control panels:

- An ICS-2100 Control panel (see [Figure 2-13](#)) provides access to ICS-2100 functions. The label on the tab for this panel is the name of the timebase in which the ICS-2100 is configured.

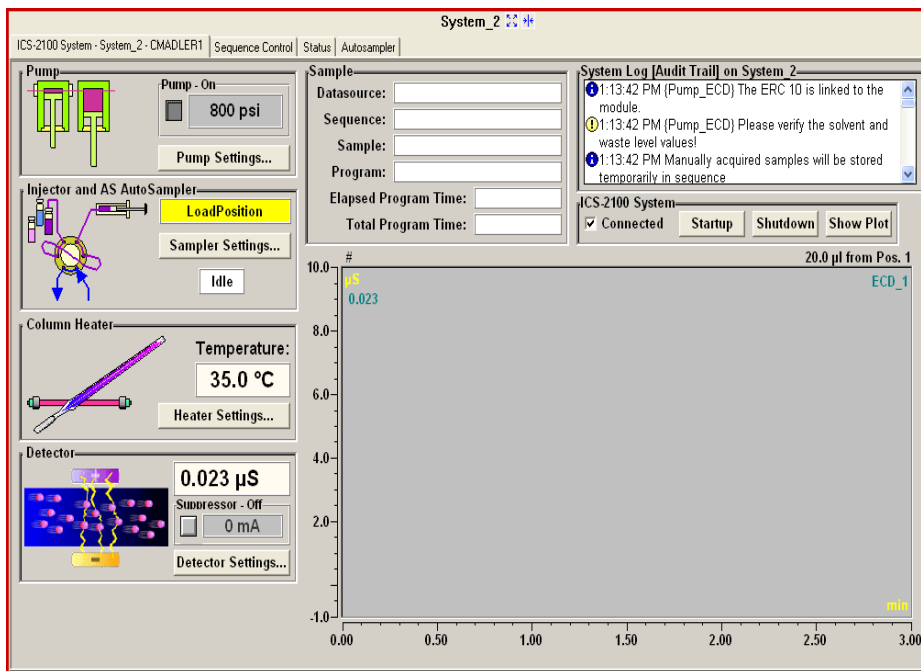
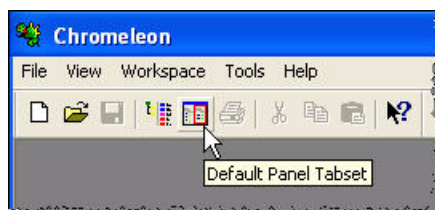


Figure 2-13. ICS-2100 Control Panel on the Panel Tabset

- A **Sequence Control** panel lets you define and run *sequences* (groups of sample injections to be analyzed in the order in which they are listed).
- A **Status** panel shows the overall system status.
- An **Autosampler** panel (included if the ICS-2100 is connected to an AS, AS-DV, or AS-HV Autosampler) provides access to autosampler functions.

To open the panel tabset, use one of the methods below:

- If Chromeleon is installed, start Chromeleon and click the **Default Panel Tabset** toolbar button, or select **View > Default Panel Tabset**.



- If Chromeleon Xpress is installed, start the application; this automatically displays the ICS-2100 panel tabset.

2.3.2 Software Control Modes

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

- With *direct* control, you select operating parameters and commands from the Control panels. Direct control commands are executed as soon as they are entered. See [Section 3.11.2](#) for details about direct control.
- With *programmed* control, you create a list of control commands to be executed in chronological order. Programs can be created automatically (with the help of a software wizard). See [Section 3.11.3](#) for details about programmed control.

2.3.3 System Wellness

System Wellness monitors the overall “health” of a chromatographic system. It provides built-in diagnostic and calibration features that help prevent unscheduled system shutdowns and assure reliable operation of system devices. For details about System Wellness, see [Section 5.1](#).

2.4 System Component Details

This section provides details about ICS-2100 system components, including the vacuum degas assembly, pump, eluent generator, injection valve, column heater, suppressor, auxiliary power supply, and conductivity cell.

2.4.1 Vacuum Degas Assembly (Optional)

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-2100 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-2100 monitors the degas pressure reading and turns the degas pump on and off as needed. Different degas operating modes can be selected from the touch screen **PUMP** page (see [Section B.7](#)) or from Chromeleon.

To select the degas operating options, open the Chromeleon Server Configuration program, right-click the ICS-2100 device in the timebase, and select **Properties**.

Select the **Options** tab (see [Figure 2-14](#)).

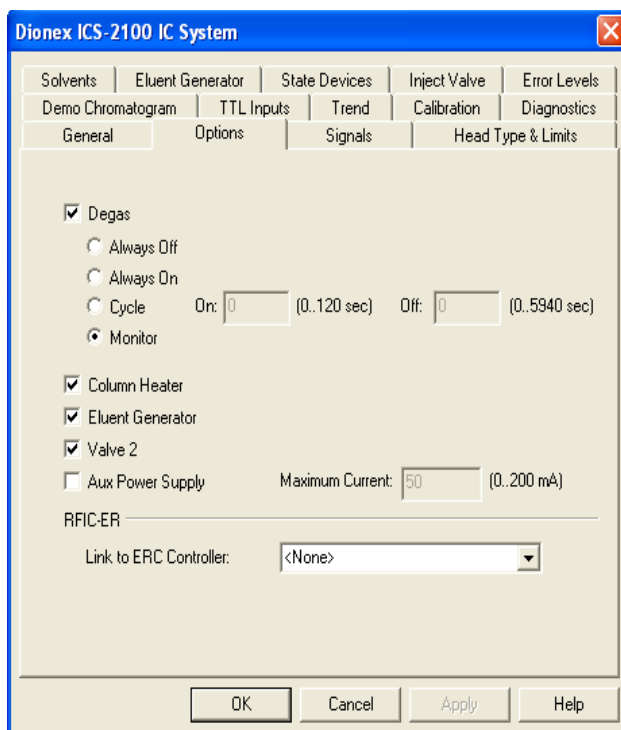


Figure 2-14. Server Configuration Properties: Degas Options

Degas 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-2100 monitors the degas pressure reading and turns the degas pump on and off as required.

2.4.2 Eluent Valve



Figure 2-15. 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 from the Chromeleon Control panel (see [Section 2.3.1](#)) or the touch screen **PUMP** page (see [Section B.7](#)). This lets you perform service procedures on pump components without eluent leaks occurring.

2.4.3 Pump

The ICS-2100 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 2-16](#)). 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.

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 5.16](#).

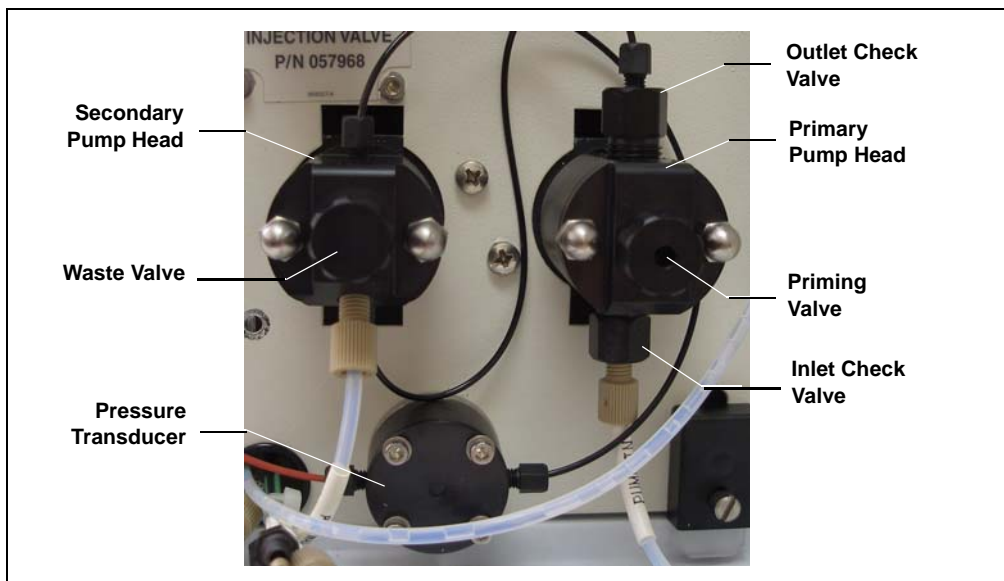


Figure 2-16. ICS-2100 Pump Components

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 2-16](#)).

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 pump flow 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 5.16](#).

Pressure Transducer

Flow exiting the secondary pump head is directed to the pressure transducer (see [Figure 2-16](#)), 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 B.7](#)). See [Section 4.2](#) 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. For connection instructions, refer to the ICS-2100 installation instructions.

For continued protection of the pump, replace the piston rinse seals (see [Section 5.7](#)) and O-rings in the seal wash assembly every 6 months, or whenever you replace the main piston seals for the ICS-2100 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-2100 (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 ₂ CO ₃ EluGen Cartridge | 058904 | Generates carbonate eluent for anion exchange separations. Note: Produces a carbonate/bicarbonate mixture when installed with the EPM Electrolytic pH Modifier (P/N 063175) and EGC CO ₃ 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-2100

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 B.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 2-2](#) and [Table 2-3](#).

Single-Cartridge Configuration

In the single-cartridge configuration, the ICS-2100 contains one EluGen cartridge.

| EluGen Cartridge | Eluent Concentration Range |
|--------------------------------|--|
| K ₂ CO ₃ | 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 2-2. Eluent Concentration Ranges for Single-Cartridge Configurations

Linked Dual-Cartridge Configuration

In the linked dual-cartridge configuration, the ICS-2100 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 ₂ CO ₃ /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 “Generating Carbonate/Bicarbonate Eluent” on page 41 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 2-3. 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-2100 top cover (see [Figure 2-7](#)). The cartridge holder also houses the high-pressure degas tubing assembly.

The ICS-2100 can control up to two EluGen cartridges. However, when operating with an EGC II K₂CO₃ 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. For connection instructions, refer to the ICS-2100 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 the ICS-2100 installation instructions.

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-2100:

- 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-2100. However, both IonPac trap columns require off-line chemical regeneration. Contact Dionex for more information.

EPM Electrolytic pH Modifier and EGC CO₃ Mixer

The EGC II K₂CO₃ EluGen Cartridge can be used with an EPM Electrolytic pH Modifier (P/N 063175) (see [Figure 2-17](#)) and an EGC CO₃ 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.

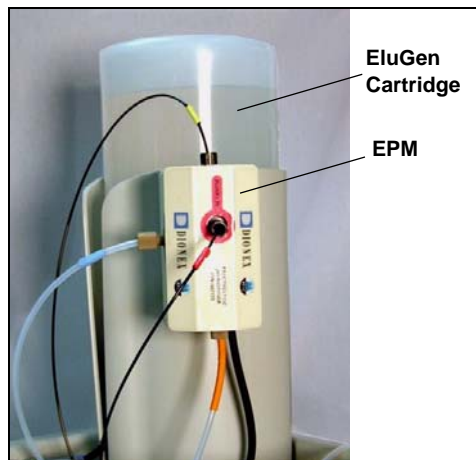


Figure 2-17. ICS-2100 with an EluGen Cartridge and EPM Installed

After the cartridge generates carbonate eluent, the pH Modifier adjusts the eluent concentration to produce the carbonate/bicarbonate mixture. The EGC CO₃ Mixer provides enough mixing to produce a homogenous solution of electrolytically-generated K₂CO₃ and KHCO₃ 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 K₂CO₃ 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 K₂CO₃ required for your application and set EGC-2 to the concentration of KHCO₃ required. In order to achieve the desired K₂CO₃/KHCO₃ eluent mixture, the K₂CO₃ cartridge must generate the total of the two setpoint concentrations.

For example, for a 3.50 mM K₂CO₃/1.00 mM KHCO₃ eluent, set EGC-1 to 3.50 mM and EGC-2 to 1.00 mM. When the eluent is generated, the K₂CO₃ cartridge generates 4.50 mM K₂CO₃, which is then modified by

the EPM to achieve the desired 3.50 mM K_2CO_3 /1.00 mM $KHCO_3$ mixture.

2.4.5 Auxiliary Power Supply (Optional)

The EGC-2 power supply can be configured as an auxiliary power supply for the operation of an electrolytic device such as a water purifier. The power supply operates in constant current mode and can be configured from 0 to 200 mA, with a maximum voltage of 35 V.

2.4.6 Injection Valve

The injection valve (P/N 057968) is a six-port, electrically-activated valve. A 25- μ L sample loop (P/N 042857) is installed on the valve at the factory.

The valve has two operating positions: Load and Inject (see [Figure 2-18](#)).

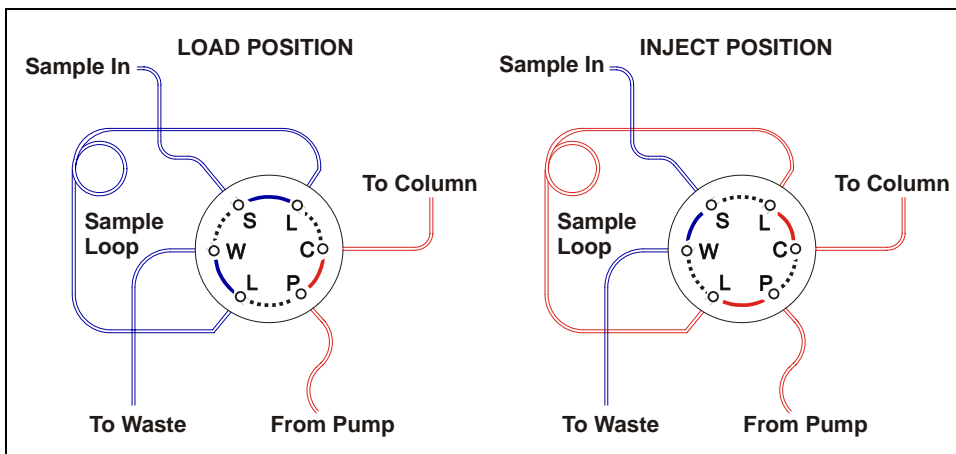


Figure 2-18. Injection Valve Flow Schematics

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 2-19](#) 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- μ 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- μ L loop can be replaced with a loop that has a different sample injection volume.

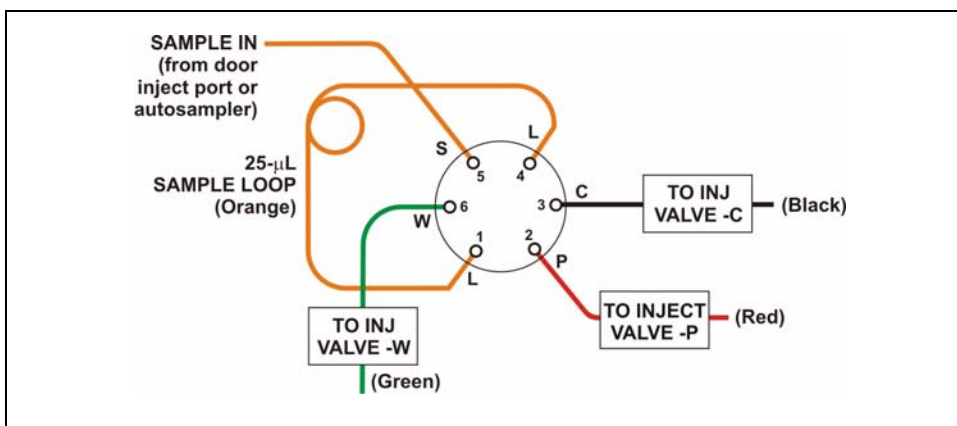


Figure 2-19. Injection Valve Plumbing

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.17.1](#) for details.

2.4.7 Auxiliary Valve (Optional)

The auxiliary valve is a high-pressure Rheodyne valve. The electrically-activated, 2-position PEEK valve is offered in both 6-port and 10-port models (6-Port Valve Kit, P/N 069472; 10-Port Valve Kit, P/N 069473). The auxiliary valve enables a variety of sample preparation activities, including:

- Online filtration
- Matrix elimination (for example, the removal of high backgrounds of chloride or organic material)
- Concentrator-based techniques
- Conditional injections (large loop/small loop applications where the data system monitors sample concentration and reinjects the sample, using the smaller loop, if the concentration is too high)
- AutoNeutralization™
- Matrix diversion prior to MS (mass spectrometry) detection

For more information, refer to *Installing the ICS-1100/ICS-1600/ICS-2100 Auxiliary Valve* (Document No. 065288). The manual is provided in the Auxiliary Valve Kit.

2.4.8 Column Heater



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

The heater temperature can be set to between 30 °C 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 4.2](#) for troubleshooting information.

For best results with 2-mm columns, a microbore heat exchanger (P/N 060943) should be installed in the column heater (see [Section 5.13](#)). The tubing connections between the injection valve and column heat exchanger, guard column and separator column, and separator column to detector cell should all use red 0.125-mm, 0.005-in ID PEEK tubing (P/N 044221), rather than the standard black tubing.

Figure 2-20. Column Heater

2.4.9 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-2100.

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).

2.4.10 DS6 Heated Conductivity Cell

The 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 μ 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 5.10](#) for cell replacement instructions.

3 • Operation and Maintenance

This chapter describes routine operating and maintenance procedures for the ICS-2100.

The ICS-2100 is designed for IC (ion chromatography) applications and should not be used for any other purpose. Operation of the ICS-2100 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-2100.

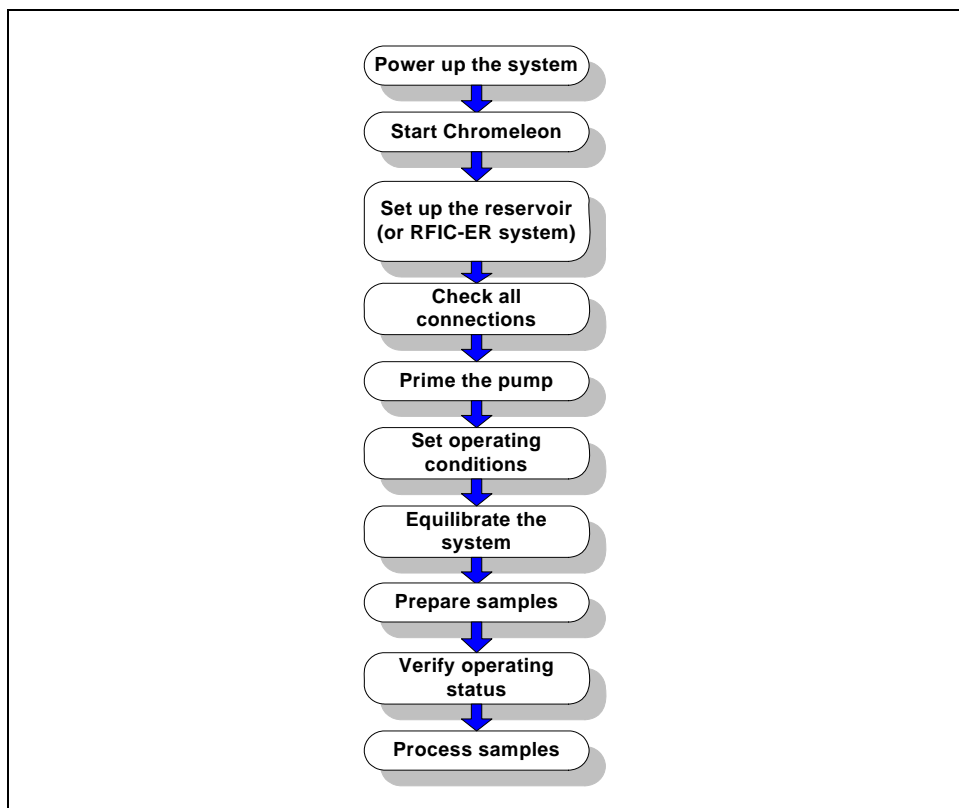


Figure 3-1. Operation Flow Chart

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.

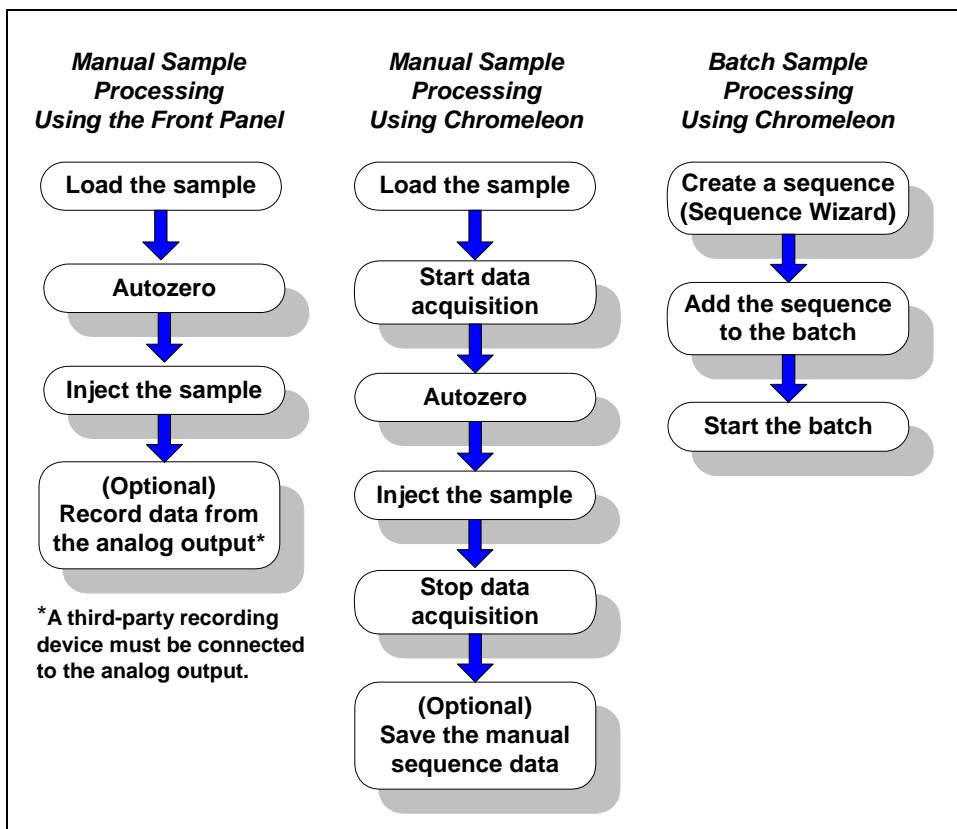


Figure 3-2. Sample Processing Overview

3.2 Turning On the System Power



Press the power switch on the ICS-2100 rear panel (see [Figure 3-3](#)) to turn on the system power. [Table 3-4](#) shows the ICS-2100 conditions at power-up.

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



Figure 3-3. ICS-2100 Rear Panel

| 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-2100 is turned on for the first time is 35 °C. |
| Column oven temperature | Set to the last value used. The default when the ICS-2100 is turned on for the first time is 30 °C. |
| Eluent generator | Off* |
| CR-TC | Off |
| EPM | Off* |
| * When you start the suppressor, eluent generator, or EPM, the value used last is restored. | |

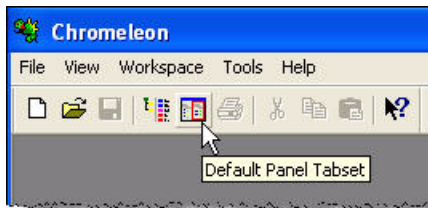
Table 3-4. ICS-2100 Power-Up Conditions

3.3 Connecting to Chromeleon

NOTE If you are beginning operation of an ICS-2100 that has not been configured in a timebase, refer to the ICS-2100 installation instructions for Chromeleon setup instructions.

1. Turn on the PC.
2. Start the Chromeleon Server, if it is not already running.
 - a. Check the Chromeleon Server Monitor icon on the Windows taskbar.
 - When the server is running, the icon is gray .
 - When the Server is not running, the icon is crossed out in red ). To start the server, right-click the icon and select **Start Server**.
 - b. If the Server Monitor icon is not on the Windows taskbar, click **Start > All Programs > Chromeleon > Server Monitor**. The Server Monitor opens. Click **Start** to start the server.
3. To start the Chromeleon client, click **Start** and select **All Programs > Chromeleon > Chromeleon**.

4. If Chromeleon is installed, the main window and Browser appear. Display the panel tabset by selecting **View > Default Panel Tabset** or by clicking the **Default Panel Tabset** toolbar button.



If Chromeleon Xpress is installed, starting the application automatically displays the panel tabset.

5. To display the ICS-2100 Control panel, click the tab labeled with the ICS-2100 timebase name (see [Figure 3-4](#)).

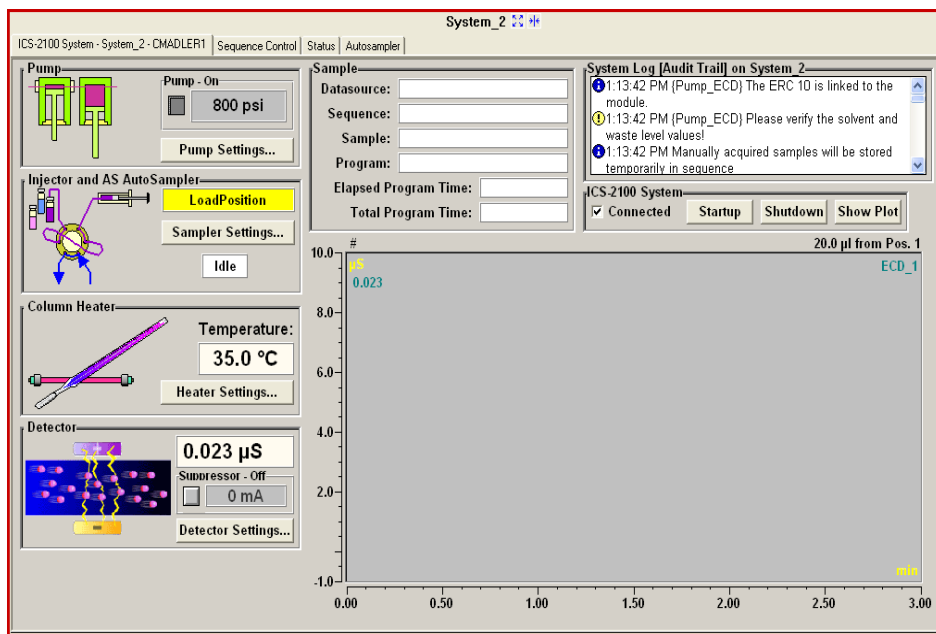


Figure 3-4. ICS-2100 Control Panel on the Chromeleon Panel Tabset

3.4 Set Up the Eluent Reservoir

The ICS-2100 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). For more information, refer to the ICS-2100 installation instructions.

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-2100 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 3-5](#))
- In the **Eluent Bottle** field in the **Pump Settings** window (accessed from the ICS-2100 Control panel on the Chromeleon panel tabset (see [Figure 3-4](#)))

The ICS-2100 determines the eluent usage by monitoring the flow rate and the length of time the pump is on, and updates the **Eluent Bottle** volume as the eluent is depleted. A warning appears if the level falls below 200 mL. Warnings are repeated at 100 mL and 0 mL.

IMPORTANT

In order for the level displayed in the Eluent Bottle box and gauge to be accurate, you must enter the level when the reservoir is filled. The ICS-2100 does not automatically detect when the reservoir is filled, nor when it is empty.

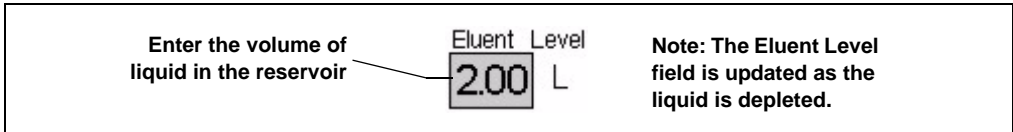


Figure 3-5. Home Page: Setting the Eluent Level

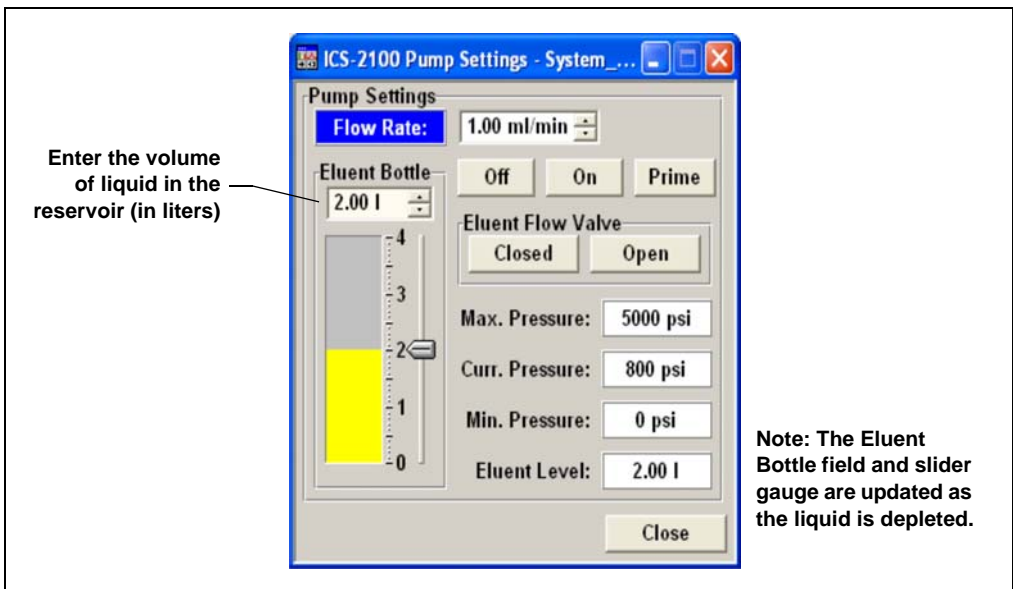


Figure 3-6. Pump Settings Windows: Setting the Eluent Level

The **STATUS** page (see [Figure 3-7](#)) 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 B.6](#) for details about the **STATUS PAGE**.

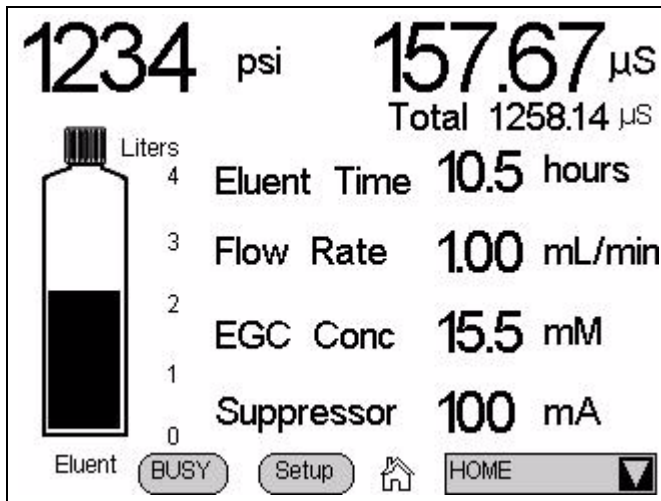


Figure 3-7. Status Page

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-2100 (see [Figure 3-8](#)).

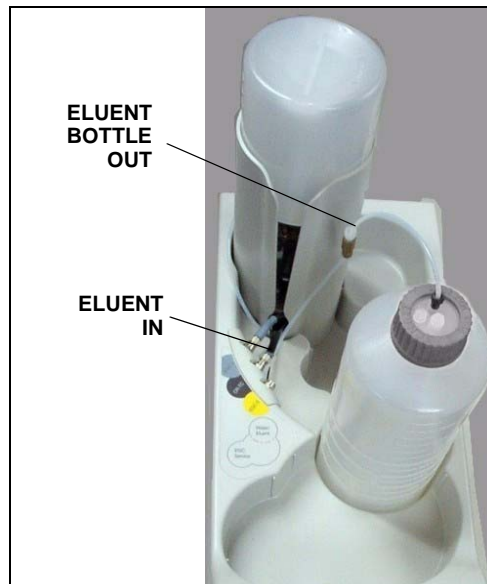


Figure 3-8. Reservoir Connections

3.5 Check All Connections

1. Make sure the eluent reservoir is filled and the tubing connecting the reservoir to the ICS-2100 tubing is securely connected (see [Figure 3-8](#)).
2. Make sure the eluent generator electrical cable (blue) is connected to the **EGC-1** connector.
3. Make sure the CR-TC electrical cable (black) is connected to the **CR-TC** connector.

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 5.16.1](#) for instructions on priming the lines with a syringe.

1. Verify that the priming valve on the primary pump head (see [Figure 3-9](#)) 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.

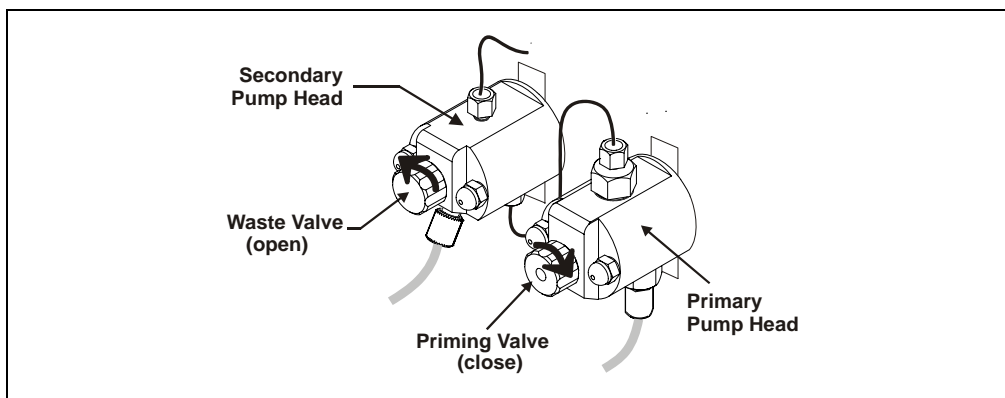


Figure 3-9. Priming the Pump

3. Press **Prime** on the Chromeleon Control panel or the ICS-2100 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-2100 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 and suppressor. The flow rate and suppressor current settings that were in effect when the system was shut down are restored.

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 is turned on.
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-2100 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 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 μS for a system set up for anion analyses and <2 μS 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 *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

NOTE Samples can be injected using either the standard injection valve or the optional auxiliary valve, if installed. For more information, see the Chromeleon Help or user's manual.

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-2100 front door.

For autosampler injections, the injection port tubing is disconnected from the ICS-2100 injection valve and replaced by the autosampler outlet tubing. Other setup requirements depend upon the model of autosampler.

Setup for an AS Autosampler

To use an AS Autosampler with the ICS-2100, the following requirements must be met:

- The ICS-2100 injection valve (or the auxiliary valve, if installed) must be specified as the injection valve and must be linked to the AS in the Chromeleon timebase.
- An injection valve should not be installed in the AS.

See the ICS-2100 installation instructions for AS connection instructions.

NOTE The ICS-2100 and the AS can be set up for stand-alone (front panel) operation. This requires a TTL cable connection between the ICS-2100 and the AS. See [Section D.3](#) for stand-alone setup instructions.

Setup for an AS-DV Autosampler

To use an AS-DV Autosampler with the ICS-2100, the following requirements must be met:

- The ICS-2100 injection valve must be linked to the AS-DV in the Chromeleon timebase.

Setup for an AS-HV Autosampler

For setup information for the AS-HV Autosampler, see the *AS-HV Autosampler Operator's Manual* (Document No. 065125). The manual is provided on the Dionex Reference Library CD-ROM (P/N 053891).

3.10.1 Loading Samples with a Syringe

1. Make sure the injection port on the ICS-2100 front door (see [Figure 2-1](#)) is connected to sample port **S** (5) on the injection valve (see [Figure 3-10](#)).

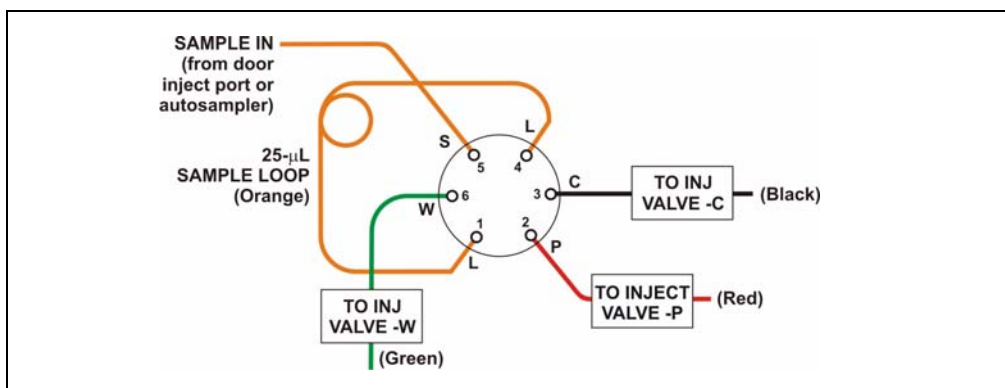


Figure 3-10. Injection Valve Connections

2. Fill the 1 cc syringe (P/N 016388) provided in the ICS-2100 Ship Kit (P/N 064375) with a calibration standard or sample.
3. Insert the syringe into the injection port on the ICS-2100 front door (see [Figure 2-1](#)).
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 3-10](#)) 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-2100 Ship Kit (P/N 064375) into the injection port on the ICS-2100 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-2100 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. (If necessary, refer to the Chromeleon Help or user manual for assistance.)
 - 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 3-4](#)) or touch the **Inject** button on the **HOME** page.
- **Automatically:** Include the Inject command in a Chromeleon program. (If necessary, refer to the Chromeleon Help or user manual for assistance.)

3.11 Processing Samples

Samples can be run manually (one at a time) or else they can be grouped and run automatically in 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-2100 memory. For a permanent record of the data, connect a recording device (chart recorder, integrator, etc.) to the analog output. See [Section B.21](#) for analog output connection instructions.

1. Complete the instructions in [Section 3.2](#) through [Section 3.8](#) to prepare the ICS-2100 for operation and to prepare the sample for processing.
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-2100 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

You can use Chromeleon or Chromeleon Xpress to create a list of samples (a sequence) to be processed automatically. For each sample, the sequence includes the following:

- A program with commands and parameters for controlling the ICS-2100 and autosampler (if used), and for acquiring sample data.
- A quantification method for peak identification and area determination.
- Additional sample processing parameters (sample name, sample type, injection volume, etc.).

After creating the sequence, you can start batch processing.

Summary of Automatic Sample Processing

1. Complete the instructions in [Section 3.2](#) through [Section 3.8](#) to prepare the ICS-2100 for operation and to prepare the sample for processing.
2. If an autosampler is installed, prepare and fill the sample vials and place them in the autosampler tray or cassette. Refer to the autosampler manual for detailed instructions. Autosampler manuals are provided on the Dionex Reference Library CD-ROM (P/N 053891).
3. If an autosampler is not installed, load the sample into the injection valve sample loop through the sample port on the ICS-2100 front door (see [Section 3.10.1](#)).
4. Use the Application Wizard to specify a program and quantitation method, and create a sequence:
 - a. On the **Sequence Control** panel, click **Application Wizard**.
 - b. Select an application template from the list (see [Figure 3-11](#)).

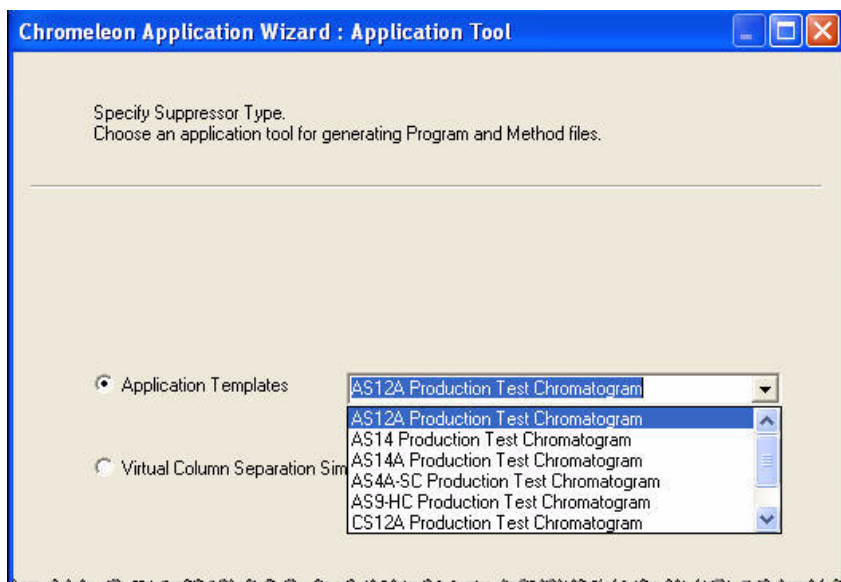


Figure 3-11. Application Wizard

- c. Click **Next >** and select the **in a new sequence via Sequence Wizard** option.
- d. Click **Next >** to go to the Sequence Wizard.
- e. Complete the steps in the Sequence Wizard, adding the desired number of samples and standards to the list. For help, click the **Help** button on the Sequence Wizard page.

After you click **Finish**, a sequence is created and a program appropriate for the selected application is copied to the sequence. If you are using Chromeleon, a quantification method is also copied to the sequence.

5. Load the sequence and start batch processing:
 - a. On the **Sequence Control** panel, click **Load Sequence**.
 - b. Select the sequence created in [Step 4](#) and click **Open**.
 - c. Click **Start Batch**.

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-2100 component panel (see [Figure 2-8](#)) for leaks or spills. Wipe up spills. Isolate and repair leaks (see [Section 4.3](#)). 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. Replace 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 5.7](#)).

- 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 5.7](#)).

Yearly

- Dionex recommends performing preventive maintenance annually, as well as before scheduled Performance Qualification tests. An ICS-2100 Preventive Maintenance Kit (P/N 057954) is available for this purpose.
- Rebuild the auxiliary valve, if installed (see [Section 5.4](#)).
- If an AS Autosampler is installed, perform the preventive maintenance procedure. The AS Preventive Maintenance Kit (P/N 060581) is available for this purpose.
- If an AS-DV Autosampler is installed, replace the tip and tubing. The AS-DV Preventive 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.

4 • Troubleshooting




This chapter is a guide to troubleshooting minor issues that may arise during operation of the ICS-2100. 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.

4.1 Error Messages

The Moduleware (the instrument control firmware installed in each ICS-2100 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-2100 Ion Chromatography System

The table below lists the most frequently observed ICS-2100 error messages. For troubleshooting assistance, refer to the page indicated in the table.

| Alarms and Error Conditions | See |
|--|-------------------------|
| Auxiliary power supply disconnected | page 74 |
| Auxiliary power supply over current | page 74 |
| Auxiliary power supply over voltage | page 75 |
| Auxiliary power supply stopped for zero flow | page 75 |
| Column heater exceeds safe temperature | page 75 |
| Column heater open circuit | page 76 |
| Column heater short circuit | page 76 |
| CR-TC over current | page 76 |
| CR-TC stopped for zero flow rate | page 77 |
| Degas calibration failed | page 77 |
| EGC board not present | page 77 |
| EGC-1 calibration error | page 78 |
| EGC-1 disconnected error | page 78 |
| EGC-1 invalid concentration | page 78 |
| EGC-1 invalid concentration vs. flow rate | page 78 |
| EGC-1 invalid flow rate | page 79 |
| EGC-1 over current | page 79 |
| EGC-1 over voltage | page 79 |
| EGC-2 calibration error | page 78 |
| EGC-2 disconnected error | page 78 |
| EGC-2 invalid concentration | |
| EGC-2 invalid concentration vs. flow rate | page 78 |
| EGC-2 invalid flow rate | page 79 |
| EGC-2 over current | page 79 |
| EGC-2 over voltage | page 79 |
| Hardware not present | page 80 |
| Leak sensor wet | page 80 |
| Load/Inject valve error | page 80 |

Table 4-5. Alarms and Error Messages Summary

| Alarms and Error Conditions | See |
|---|-------------------------|
| Option not installed | page 81 |
| Pressure slope calibration error | page 81 |
| Pump motor lost control | page 81 |
| Pump over pressure | page 82 |
| Pump pressure hardware error | page 82 |
| Pump stopped due to lost USB communication error | page 82 |
| Pump under pressure | page 83 |
| Second valve error | page 83 |
| Suppressor not connected | page 84 |
| Suppressor over current | page 84 |
| Suppressor over power | page 85 |
| Suppressor over voltage | page 85 |
| Suppressor stopped for zero flow rate | page 85 |

Table 4-5. Alarms and Error Messages Summary (Continued)

4.2 Troubleshooting Error Messages



AUXILIARY POWER SUPPLY DISCONNECTED

This error occurs when the auxiliary power supply is configured as active, but no device is connected.

To troubleshoot:

1. Connect the cable for the auxiliary device to the **EGC-2** power supply connector.
2. If there is no auxiliary device, open the Chromeleon Server Configuration program and remove this option from the ICS-2100 timebase.



AUXILIARY POWER SUPPLY OVER CURRENT

This error occurs when the device connected to the auxiliary power supply is attempting to draw more current than is allowed (200 mA) or is 20% higher than the set current.

To troubleshoot:

1. Check the cable connecting the device to the power supply for damage or a faulty connection.
2. If the error persists, refer to the manual provided by the device vendor for assistance.



AUXILIARY POWER SUPPLY OVER VOLTAGE

This error occurs when the device connected to the auxiliary power supply is attempting to operate at a higher voltage than is allowed (35 V).

To troubleshoot:

1. Check the cable connecting the device to the power supply for damage or a faulty connection.
2. If the error persists, refer to the manual provided by the device vendor for assistance.



AUXILIARY POWER SUPPLY STOPPED FOR ZERO FLOW RATE ERROR

When the pump flow stops, the auxiliary power supply automatically turns off (to prevent damage to the electrolytic device) and this error occurs.

To troubleshoot:

If the pump stopped unexpectedly, see [Section 4.6](#) for pump troubleshooting information.



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-2100 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 5.12](#)).



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 5.12](#)).



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) are on. The CR-TC is automatically turned off.

To troubleshoot:

If the pump stopped unexpectedly, see [Section 4.6](#) 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 IC related to the eluent generator, but the eluent generator controller board is either not installed or the ICS-2100 does not recognize the installed board.

To troubleshoot:

Contact Dionex for assistance. The 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:

1. Review the procedure to verify that you set up the ICS-2100 correctly and then rerun the calibration.
2. If the error message reappears, contact Dionex for assistance.



EGC-1 DISCONNECTED ERROR EGC-2 DISCONNECTED ERROR

This error occurs when 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 EluGen cartridge cable is connected to the **EGC-1** connector on the ICS-2100 top cover (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 when 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-2100 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 EluGen 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 4.6](#) 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 EluGen 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 4.6](#) for troubleshooting when there is no flow from the pump.



HARDWARE NOT PRESENT

This error indicates a problem in the ICS-2100 electronics.

To troubleshoot:

Contact Dionex for assistance. The ICS-2100 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 this error message appears.

To troubleshoot:

1. Locate the source of the leak by visually inspecting the tubing, fittings, and components on the component panel. Refer to [Section 4.3](#).
2. Tighten fittings or replace tubing and fittings as required. Refer to [Section 4.3](#) 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-2100 Moduleware reports an error to Chromeleon and this error message appears.

To troubleshoot:

1. If a sequence is being executed, terminate the sequence by selecting **Batch > Stop** in Chromeleon.
2. Try to toggle the valve from Load to Inject by clicking the **Load** and **Inject** buttons on the ICS-2100 Control panel in Chromeleon or on the touch screen **HOME** page.

3. Turn off the ICS-2100 power briefly and then restart.
4. If the problem persists, repeat [Step 2](#).
5. 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-2100 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-2100 electronics components cannot be serviced by the user.



PUMP OVER PRESSURE

If the system pressure exceeds the set limit for at least 0.5 second, 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 B.7.1](#)).

To troubleshoot:

1. Check for blockages in the liquid lines by working your way backward from the cell to the pump. See [Section 2.2](#) for the system flow schematics.
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 STOPPED DUE TO LOST USB COMMUNICATION ERROR

This error occurs if the ICS-2100 loses communication with Chromeleon.

To troubleshoot:

Verify that the USB cable is connected correctly from the ICS-2100 rear panel to the Chromeleon PC.



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 B.7.1](#)).

To troubleshoot:

1. Make sure the eluent reservoir is full.
2. Check for liquid leaks (see [Section 4.3](#)).
3. Check that the waste valve is closed.
4. Prime the pump (see [Section 5.16](#)).
5. Restart the pump.



SECOND VALVE ERROR

If the auxiliary valve fails to switch position within 1 second of being toggled, the ICS-2100 Moduleware reports an error to Chromeleon and this error message appears.

To troubleshoot:

1. If a sequence is being executed, terminate the sequence by selecting **Batch > Stop** in Chromeleon.
2. Try to toggle the valve from position A to position B by clicking the corresponding buttons on the ICS-2100 Control panel in Chromeleon (or by clicking the **Valve_2** commands under **Pump_ECD** in the Commands dialog box).
3. Turn off the ICS-2100 power briefly and then restart.
4. If the problem persists, repeat [Step 2](#).
5. If the problem persists, contact Dionex for assistance.



SUPPRESSOR NOT CONNECTED

This error occurs if you turn on the suppressor and the ICS-2100 cannot establish a connection with the suppressor.

To troubleshoot:

1. Check the suppressor cable connection (see [Section 5.11](#)).
2. If the error persists, contact Dionex for assistance. There may be a problem in the suppressor controller electronics. The ICS-2100 electronics components cannot be serviced by the user.



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-2100 electronics components cannot be serviced by the user.



SUPPRESSOR OVER POWER

This error occurs when, in order to maintain the selected current, the ICS-2100 is required to apply a higher voltage than the suppressor can support.

To troubleshoot:

1. Reduce the flow rate.
2. Rehydrate the suppressor. Refer to the suppressor manual for instructions. Suppressor manuals are included on the Dionex Reference Library CD-ROM (P/N 053891).
3. If the error persists, replace the suppressor (see [Section 5.11](#)).



SUPPRESSOR OVER VOLTAGE

This error occurs if you turn on the suppressor but the ICS-2100 cannot establish a connection with the suppressor.

To troubleshoot:

1. Check the suppressor cable connection (see [Section 5.11](#)).
2. If the error persists, replace the suppressor (see [Section 5.11](#)).



SUPPRESSOR STOPPED FOR ZERO FLOW RATE

This error message appears when you click the **Shutdown** button on the ICS-2100 Control panel in Chromeleon. 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 4.6](#) for pump troubleshooting information.

4.3 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 included 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-2100. If a line is blocked, replace it (see [Section 5.2](#)).

- **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 5.6](#)).

- **Leaking seal wash port**

Leaking from the seal wash port indicates a leaking piston seal. Replace the seal (see [Section 5.7](#)).

- **Damaged pump piston seal**

1. Replace the piston seal (see [Section 5.7](#)).
2. If the leak persists, replace the piston (see [Section 5.8](#)).

- **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 included 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 5.9](#)).
- **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 or auxiliary 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 included 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 valve (see [Section 5.4](#)).
- **Leaking detector 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.

4.4 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. Right-click the ICS-2100 device in the timebase and select **Properties**.
2. Select the **Options** tab (see [Figure 4-1](#)).

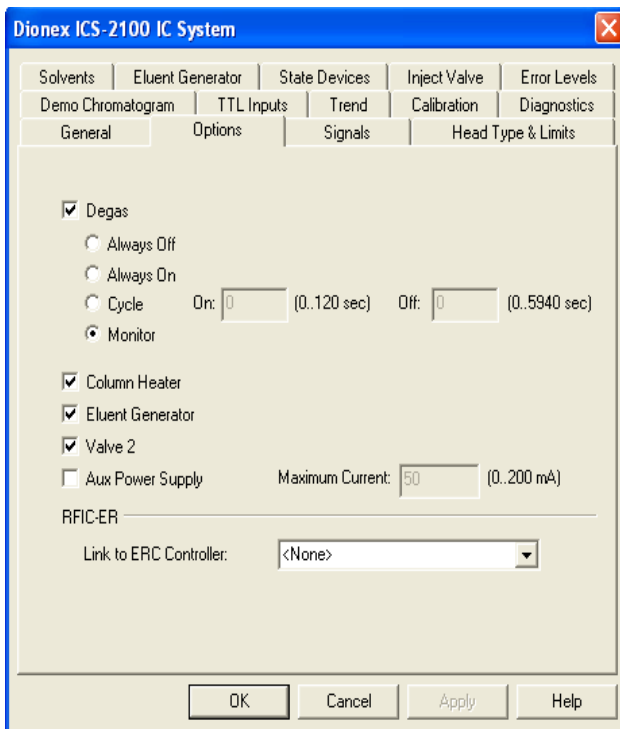


Figure 4-1. ICS-2100 Server Configuration Properties: Options

3. Verify that the **Degas** check box is selected.

4. Check the **Degas** 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 600 seconds. If **Cycle** is already selected, try increasing the time on or decreasing the time off.

NOTE Degas options can also be selected from the touch screen **PUMP** page (see [Section B.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 5.6](#)).

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

Use the open-end wrench (P/N 014605) provided in the ICS-2100 Ship Kit (P/N 064375) to tighten the two acorn nuts that attach the pump head to the pump housing (see [Figure 5-13](#)). Tighten the nuts evenly (12 in-lb torque).

If the leak persists, replace the piston seal (see [Section 5.7](#)).

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

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

- **Scratched pump piston**

Check the pump pistons for scratches and replace if necessary (see [Section 5.8](#)).

4.5 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 5.18](#)).
- **No communication between ICS-2100 and Chromeleon**
Verify that the USB cable is connected correctly. For connection and setup information, refer to the ICS-2100 installation instructions.
- **Pump is turned off**
Turn on the pump from either the Chromeleon Control panel or the ICS-2100 touch screen **HOME** page.
- **Flow rate is set to 0**
Set the flow rate from either the Chromeleon Control panel or the ICS-2100 touch screen **HOME** page.

4.6 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.**

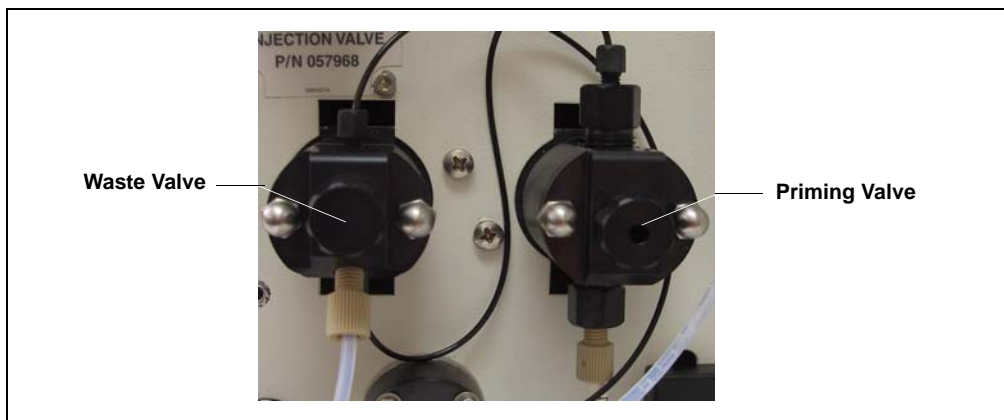


Figure 4-2. Waste and Priming Valves

- **Flow rate is set to 0**
Set the flow rate from the ICS-2100 Control panel in Chromeleon or from the touch screen **HOME** page.
- **Eluent valve is closed**
Open the eluent valve from the ICS-2100 Control panel in Chromeleon or from the touch screen **PUMP** page.
- **Pump not primed**
Prime the pump (see [Section 5.17](#)).
- **Broken pump piston**
Replace the piston (see [Section 5.8](#)).
- **Eluent generator degas tubing assembly ruptured**
Replace the EluGen cartridge holder (see [Section 5.19](#)).

4.7 Erratic Flow/Pressure Reading

- **Pump needs priming**
Prime the pump (see [Section 5.17](#)).

- **Damaged piston seal**

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

- **Dirty pump check valve**

Clean or replace the check valve (see [Section 5.6](#)).

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

4.8 Excessive System Backpressure

- **Restriction in the system plumbing**

Check all liquid lines for crimping or blockage. Make sure the ferrule fittings are not overtightened onto tubing. Refer to *Installation of Dionex Liquid Line Fittings* (Document No. 031432) for details. The manual is included 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 or replace the guard column.

- **Plugged injection valve or auxiliary valve passages**

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

4.9 Peak “Ghosting”

“Ghosting” is the appearance of extraneous peaks in a chromatogram. These may be late-eluting peaks from a previous injection. They may also 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**

Remake the eluent. Refer to the instructions in the column manual. The manual is included on the Dionex Reference Library CD-ROM (P/N 053891).

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 or auxiliary valve**

1. Rebuild the valve (see [Section 5.4](#)).
2. If the valve leak persists, contact Dionex for assistance.

4.10 Nonreproducible Peak Height or Retention Time

- **Column overloading**
Dilute the sample (see [Section 3.9.3](#)).
- **Liquid leaks**
Locate and eliminate the leaks (see [Section 4.3](#)).
- **Incomplete or imprecise filling of the sample loop**
 1. Fill the sample loop until excess sample exits the waste line.
 2. Inspect the 1-cc syringe (P/N 016388) and replace if damaged.
- **Pump not primed properly**
Prime the pump (see [Section 5.17](#)).

4.11 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.

4.12 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-2100.

- **No flow from pump**

This condition has several possible causes; see [Section 4.5](#) and [Section 4.6](#) for details.

- **Cell electronics malfunctioning**

Use the Chromeleon Wellness Panel diagnostics to test the electronics (see [Section 5.1](#) and the Chromeleon Help for instructions). If the variance reading is outside the tolerance range (less than 1 μ S), the electronics are malfunctioning. Contact Dionex for assistance. The ICS-2100 electronics cannot be serviced by the user.

4.13 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 (see [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 click **Autozero** on the ICS-2100Control panel in Chromeleon or the ICS-2100 touch screen **HOME** page.

- **Cell out of calibration**

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

4.14 Baseline Noise or Drift

- **Flow system leak; erratic baseline**

Check all fittings and liquid lines for leaks. Tighten or, if necessary, replace all liquid line connections. Refer to *Installation of Dionex Liquid Line Fittings* (Document No. 031432) for tightening requirements. The manual is included 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 5.17](#)).

- **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 ± 0.7 MPa (2300 ± 100 psi). See [Section B.17.1](#) 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-2100 and the ICS-2100 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 5.7](#)).

4.15 Vacuum Degas Assembly Does Not Run

- **Degas option not enabled in Chromeleon**
 1. Open the Chromeleon Server Configuration program. Right-click the ICS-2100 device in the timebase and select **Properties**.
 2. Select the **Options** tab (see [Figure 4-3](#)).

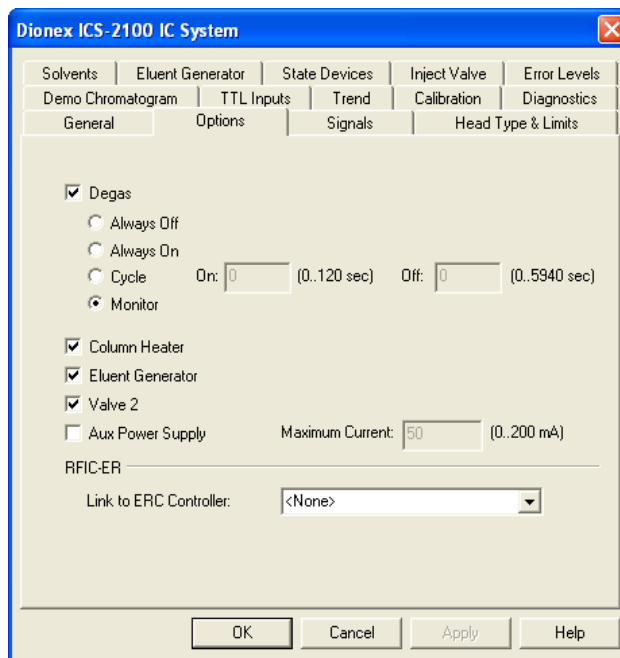


Figure 4-3. ICS-2100 Server Configuration Properties: Options

3. Verify that the **Degas** check box is selected.

4. Under **Degas**, verify that the **Always Off** option is *not* selected. If it is, select one of the following settings instead:
 - **Cycle**; also select **On**: 30 seconds and **Off**: 10 minutes
 - **Monitor**
5. If the **Degas** 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 options can also be selected from the touch screen **PUMP** page (see [Section B.7](#)).

IMPORTANT

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

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

This chapter describes ICS-2100 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. In the Chromeleon Browser, expand the **Dionex Templates\Panels\Wellness** folder.
2. Double-click **ICS-1100_1600_2100_Wellness_user.pan**.

The Wellness Panel opens (see [Figure 5-1](#)). If the controls on the Wellness panel are disabled, select **Control > Connect to timebase** and then select the ICS-2100 timebase.

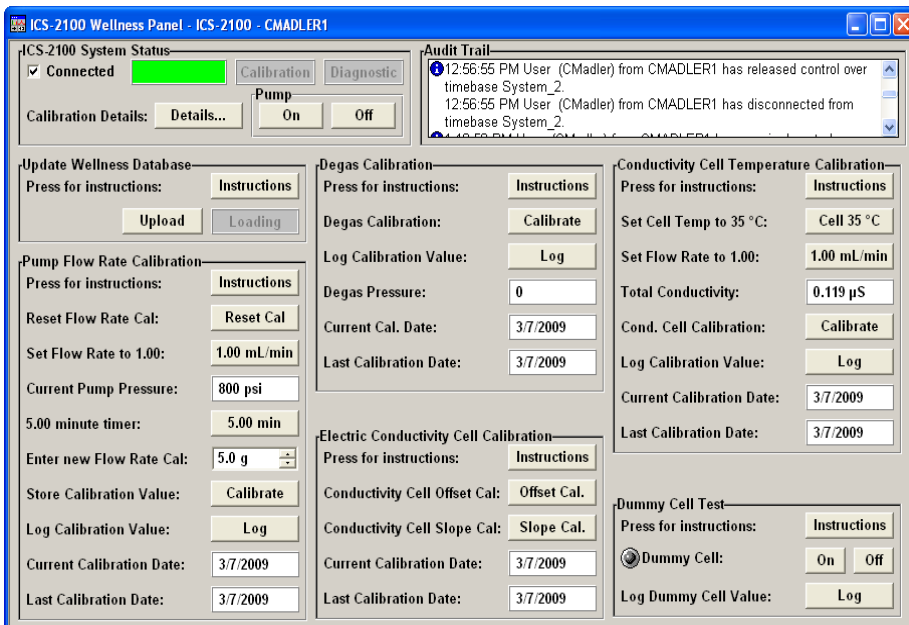


Figure 5-1. Chromeleon Wellness Panel

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-2100 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-2100.

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. A code is required to access the service pages.

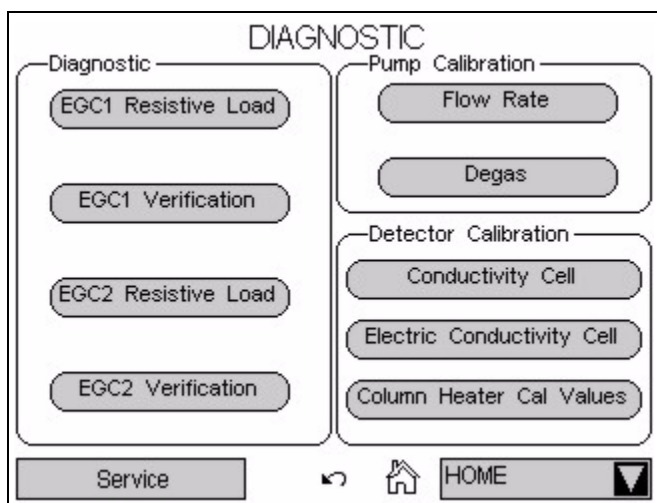


Figure 5-2. System Diagnostic Menu Page

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 5.10](#) 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-2100 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 ⁻⁶ |
| Medium | Offset 0.00000000 | Slope 0.39736432 X 10 ⁻⁶ |
| Coarse | Offset 0.00000000 | Slope 1.86264525 X 10 ⁻⁶ |

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-2100 touch screen.
3. When the offset calibration is complete, click **Slope Cal** on the Wellness Panel, or touch **Run Slope Cal** on the ICS-2100 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. Disconnect the line from the suppressor **REGEN IN** port to the cell outlet. Direct the cell outlet line to a waste container.
8. Verify that the backpressure is at least 7 MPa (1000 psi).
9. If you are using the touch screens to perform the calibration, open the **CONDUCTIVITY CELL** page (see [Figure 5-4](#)).

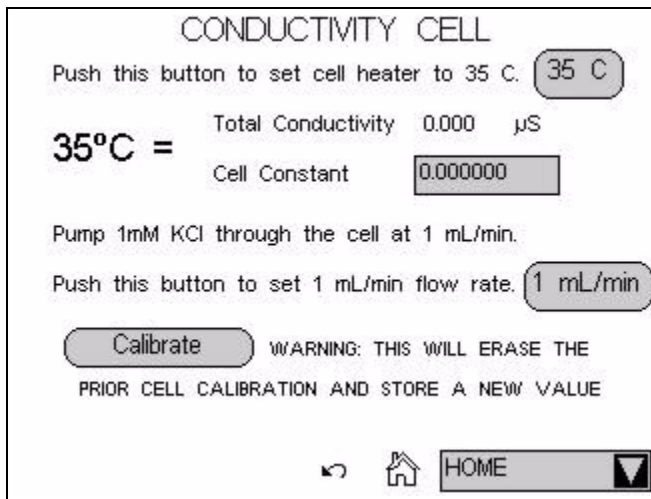


Figure 5-4. Conductivity Cell Page

10. On the Wellness Panel under **Conductivity Cell Calibration**, click **Cell 35 °C**, or touch **35 C** on the ICS-2100 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.

11. Select **1.00 mL/min** to begin pumping 1.00 mM KCl through the cell at 1.0 mL/min.
12. 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.

13. If you are using the Wellness Panel, click **Log** to record the new calibration values in the Audit Trail.
14. If you are using the 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**.
15. 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.
16. Reconnect the pump to the injection valve and reconnect the line from the suppressor **ELUENT OUT** port to the cell inlet.
17. Reconnect the cell outlet to the suppressor **REGEN IN** port.

5.1.4 Calibrating the Flow Rate

When to Calibrate

If you run the ICS-2100 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 ± 2 MPa (2000 ± 300 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-2100 Wellness Panel in Chromeleon (see [Section 5.1.1](#)), or open the ICS-2100 touch screen **FLOW RATE** page (see [Figure 5-5](#)).

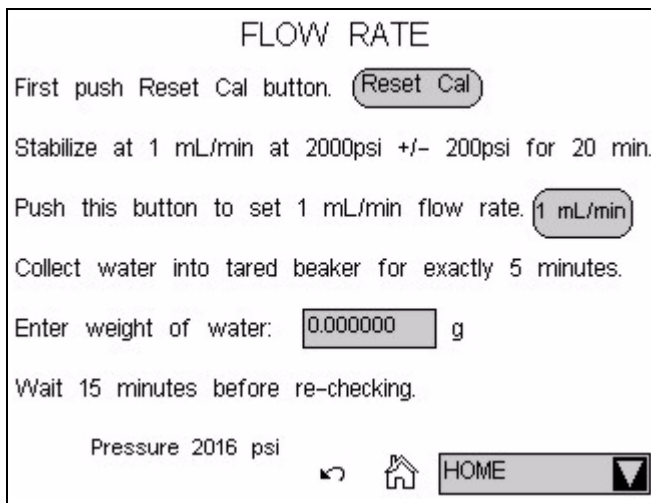


Figure 5-5. Flow Rate Page

2. Verify that there is 14 ± 1.4 MPa (2000 ± 200 psi) of backpressure.

3. On the Chromeleon Wellness Panel under **Pump Flow Rate Calibration**, select **Reset Cal**, or touch **Reset Cal** on the 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-2100.
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-2100 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-2100 Wellness Panel in Chromeleon (see [Section 5.1.1](#)), or open the ICS-2100 touch screen **PUMP DEGAS** page (see [Figure 5-6](#)).

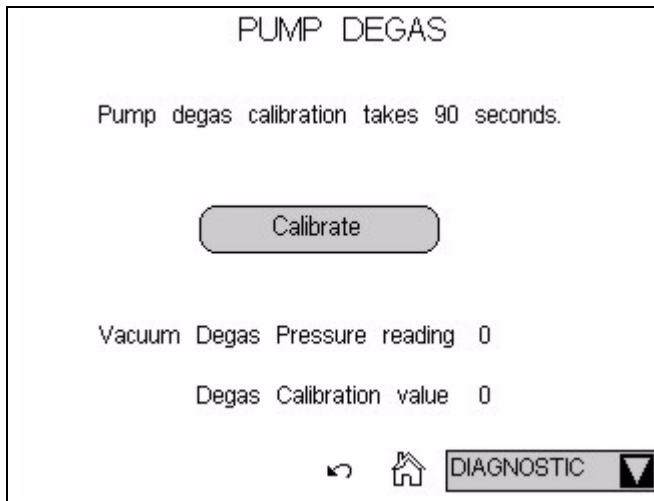


Figure 5-6. Pump Degas Page

2. On the Wellness Panel under **Degas Calibration**, select **Calibrate**, or touch **Calibrate** on the ICS-2100 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-2100 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 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 flow schematics 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 schematic, adding parts one at a time until an abnormal pressure increase (and hence, the restriction) is found.

3. If the restriction is in the tubing or fitting, remove the restriction by back flushing or by replacing the tubing or fitting (see [Section 5.3](#)).

ICS-2100 Ion Chromatography System

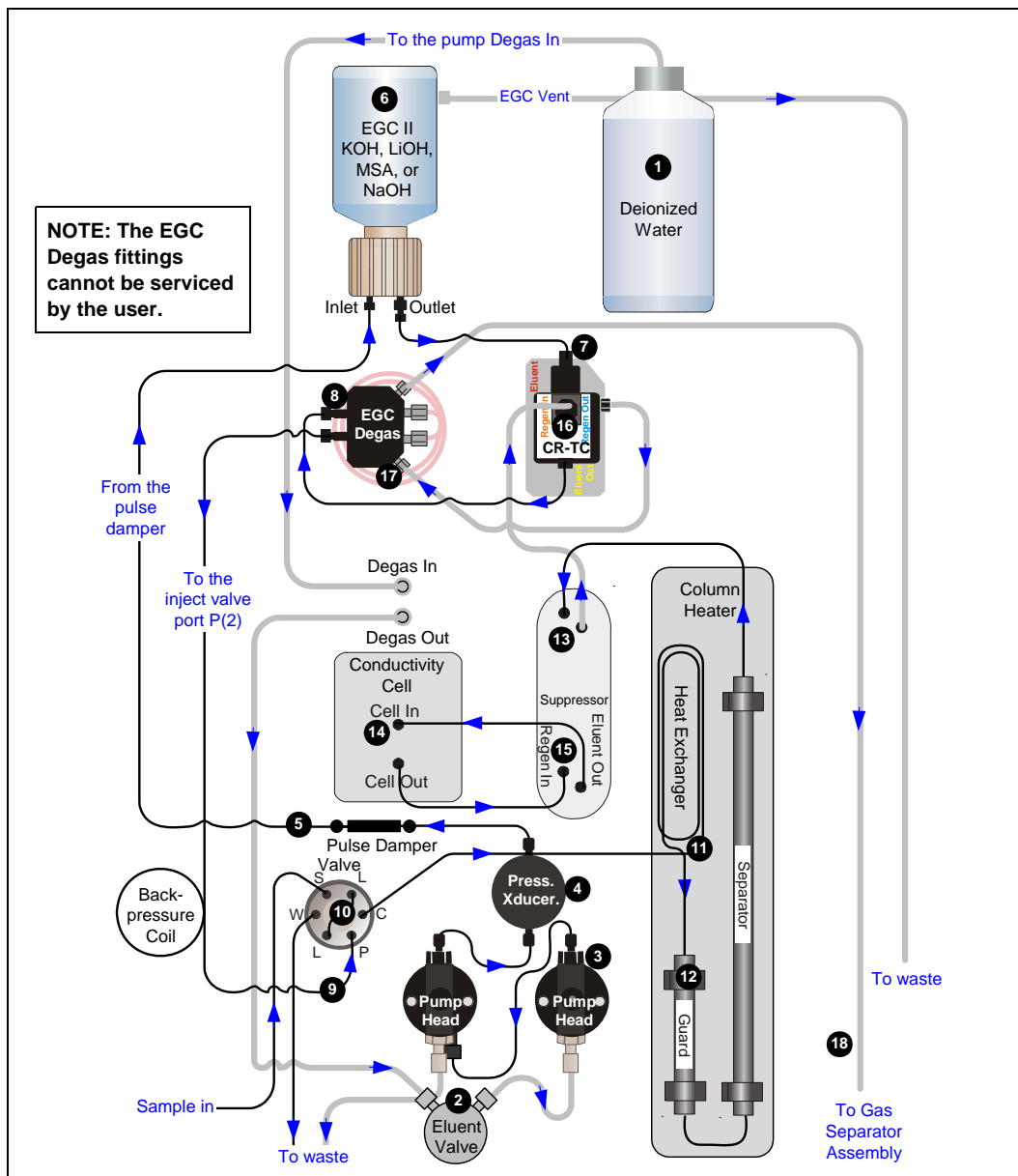


Figure 5-7. ICS-2100 Flow Schematic: KOH, LiOH, MSA, or NaOH Eluent Generation

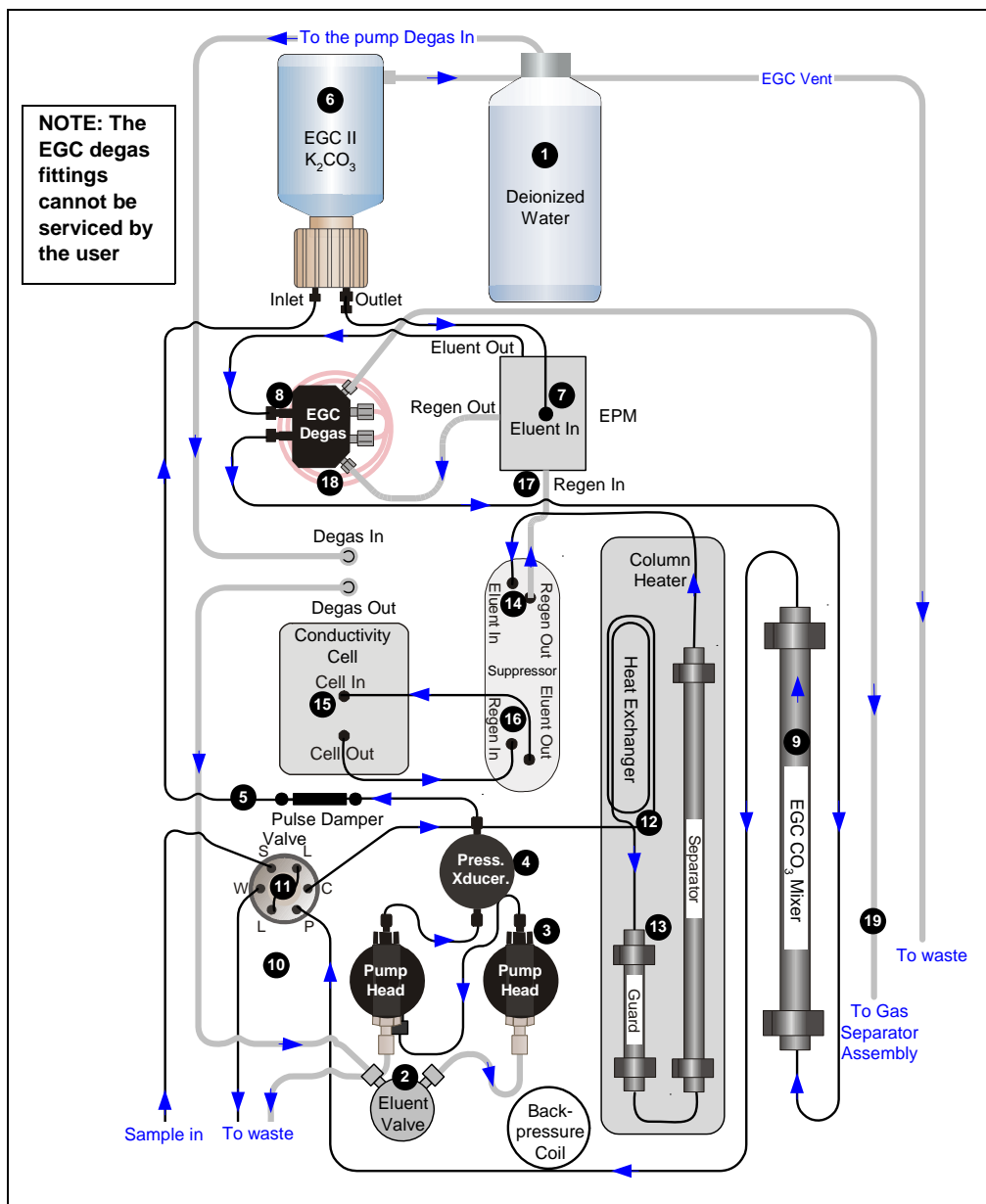


Figure 5-8. ICS-2100 Flow Schematic: Carbonate/Bicarbonate Eluent Generation

ICS-2100 Ion Chromatography System

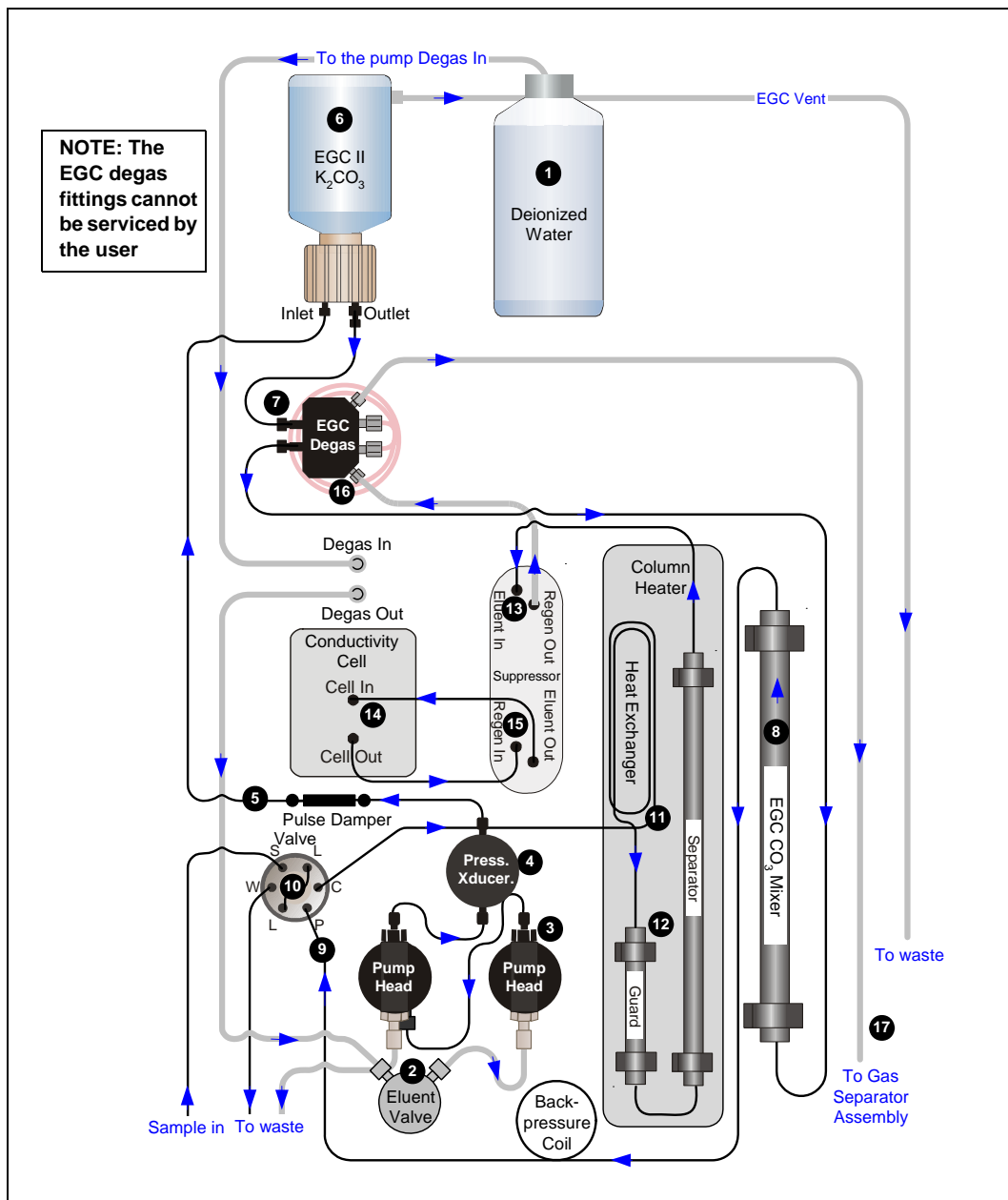


Figure 5-9. ICS-2100 Flow Schematic: Carbonate Eluent Generation

5.3 Replacing Tubing and Fittings

The ICS-2100 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 µL sample loop (P/N 042857) | Orange | Connection between ports L (1) and L (4) 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 included 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 or Auxiliary Valve

Dionex recommends rebuilding the injection valve and the auxiliary valve (if installed) annually. The Injection Valve Rebuild Kit (P/N 057896) contains all required replacement parts for one valve.

NOTE If you prefer, you can replace the auxiliary valve “pod,” instead of rebuilding the valve. Replacing the pod is easier and faster than rebuilding the auxiliary valve. For instructions, see [Section 5.5](#).

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.

1. Turn off the pump from the ICS-2100 Control panel in Chromeleon or from the touch screen **HOME** page.
2. Open the ICS-2100 front door.
3. Disconnect each liquid line connected to the 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](#)) or auxiliary valve.
6. Close the door.
7. Turn on the pump.

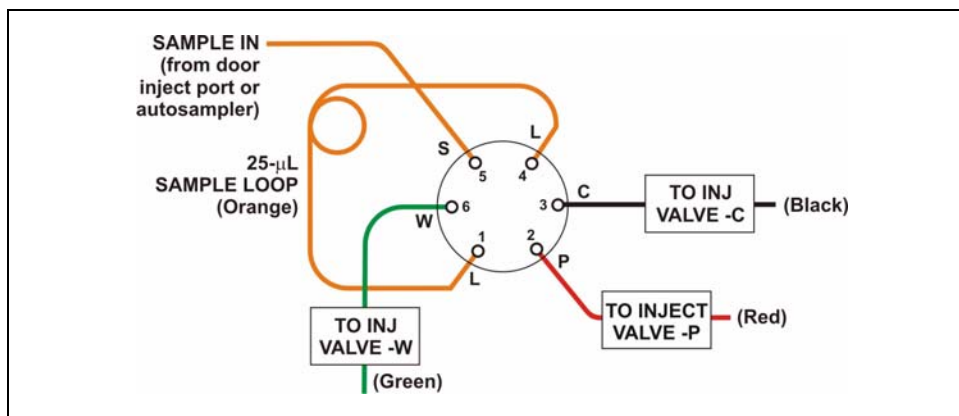


Figure 5-10. Injection Valve Plumbing

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

5.5 Replacing an Auxiliary Valve Pod

This procedure describes how to replace the mechanical part (the “pod”) of the optional auxiliary valve. This procedure is an alternative to rebuilding the valve (see [Section 5.4](#)).

NOTE If the valve electronics require service, contact Dionex. Electronics-related repair procedures must be performed by Dionex personnel.

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.

1. Turn off the pump flow from the ICS-2100 Control panel in Chromeleon or from the touch screen **HOME** page.
2. Open the ICS-2100 front door.
3. Disconnect each liquid line connected to the valve.
4. Unscrew the black locking ring on the front of the valve (see [Figure 5-11](#)) and remove the ring.
5. Grasp the front of the valve pod and pull firmly to remove it from the ICS-2100.

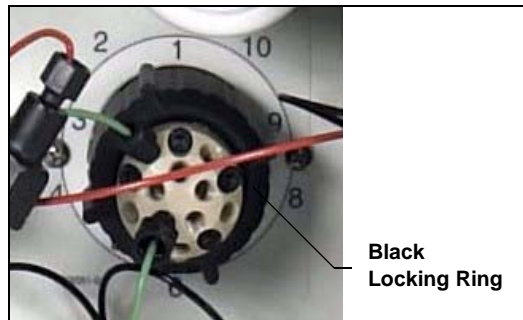


Figure 5-11. Unscrew the Valve Locking Ring

6. Check that the new pod (6-port, P/N 061947; 10-port, P/N 061948) has the correct number of ports for the valve being serviced.
7. Align the slots in the new pod with the runner in the valve holder on the ICS-2100 (see [Figure 5-12](#)). Valve pods are keyed to fit only one way (one slot is narrower than the other). Verify that the slots are aligned with their matching runners.

- Also verify that the two splines on the pod align with the matching splines inside the valve holder (see [Figure 5-12](#)). If necessary, twist the end of the pod to adjust the position of the splines.

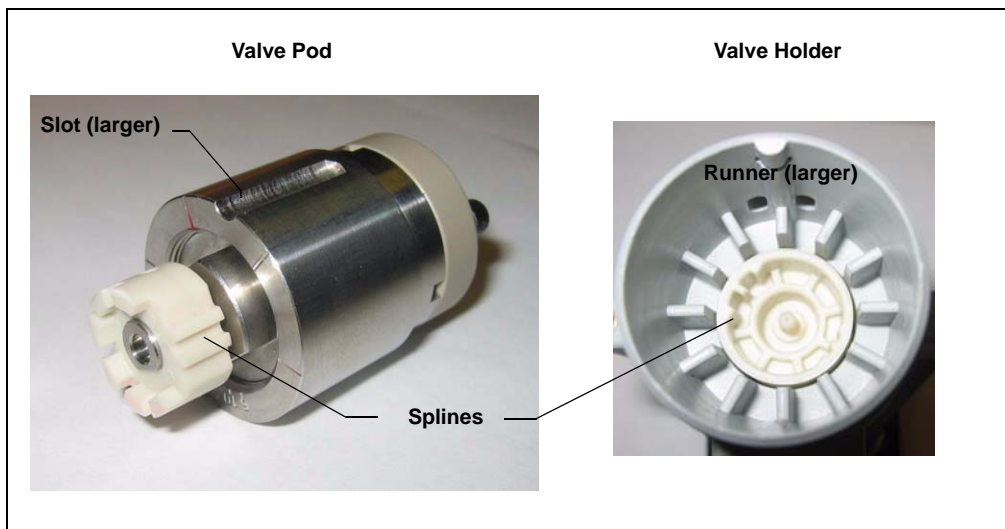


Figure 5-12. Valve Pod and Pod Holder

- Push the pod into the holder until it clicks into place. Replace the black locking ring.
- Reconnect all liquid lines to the valve.
- Turn on the pump flow. Check for leaks from the valve. Tighten fittings as required (see [Section 5.1.1](#)).
- Close the door.

5.6 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-2100 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-2100.
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 5-13](#)).
5. Use a 1/2-inch wrench to loosen both check valve assemblies. Remove the check valve assemblies from the pump head.

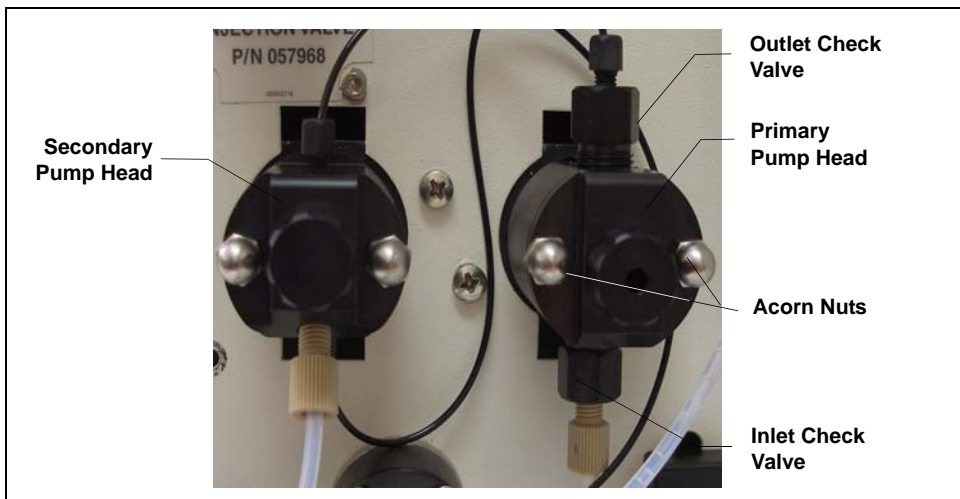
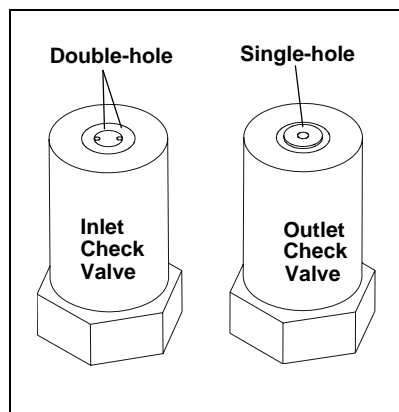


Figure 5-13. Pump Heads

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

- 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.



- 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.

IMPORTANT

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

- Reconnect the liquid lines. Turn on the ICS-2100 main power.
- Open the eluent valve from the ICS-2100 Control panel in Chromeleon or select **Eluent Valve Closed** on the touch screen **PUMP** page.
- Prime the pump (see [Section 5.17](#)).
- When the ICS-2100 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

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

5.7 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 5-16](#)). 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-2100 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-2100.
2. Disconnect all tubing connections to the pump head.
3. Locate the open-end wrench (P/N 014605) provided in the ICS-2100 Ship Kit (P/N 064375). Use the wrench to remove the two acorn nuts (see [Figure 5-13](#)) 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.

5. Place the head (front end down) on a clean work surface and lift off the spacer to expose the piston seal (see [Figure 5-14](#) or [Figure 5-15](#)).

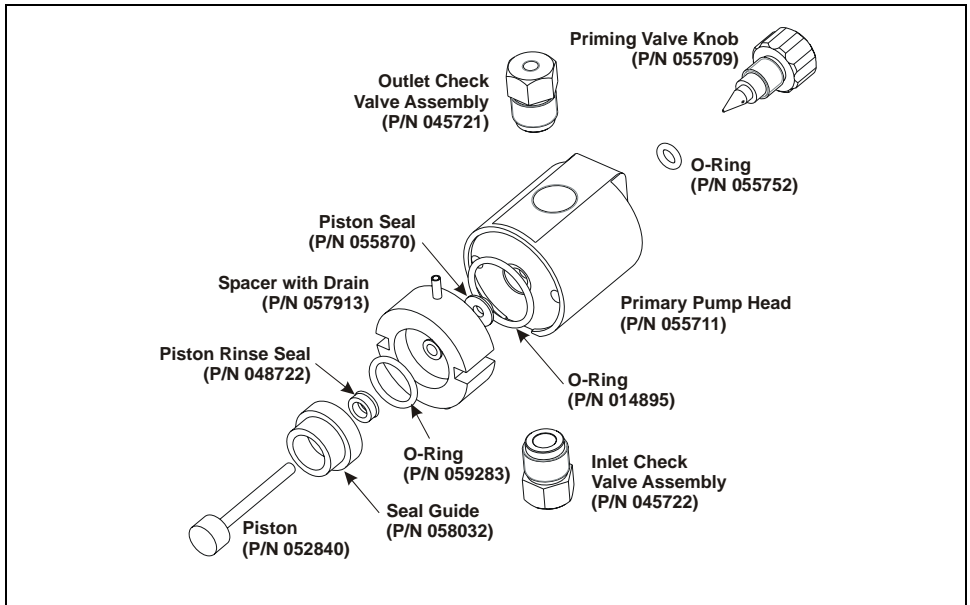


Figure 5-14. Primary Pump Head

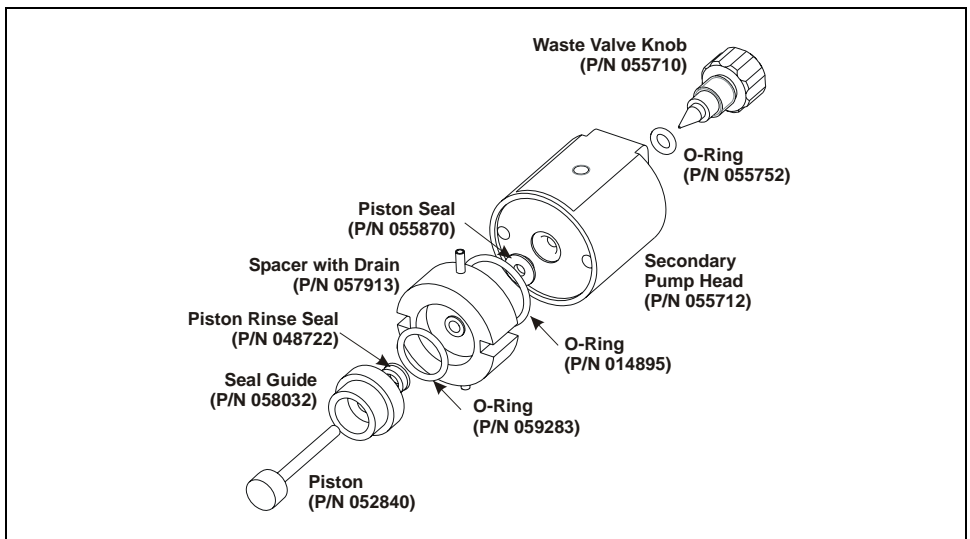
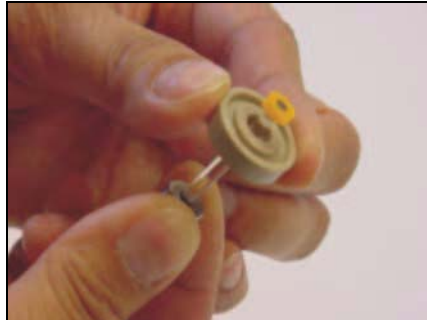


Figure 5-15. Secondary Pump Head

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 [Step 2](#) and [Step 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 5.17](#)).

5.8 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 5.7](#) to install a new piston (P/N 052840) and piston seal (P/N 055870).

5.9 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 ICS-2100 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-2100.
3. To remove the waste valve or priming valve from the pump head (see [Figure 5-16](#)), turn the knob counterclockwise until it is loose, and then pull the knob straight out of the cavity in the pump head.

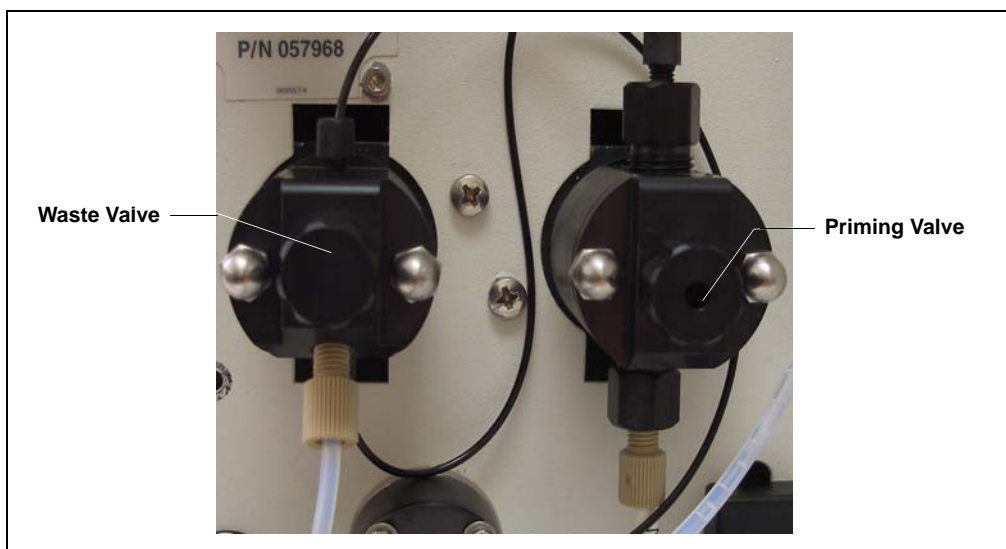


Figure 5-16. Waste and Priming Valves

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 5-17](#)). 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.

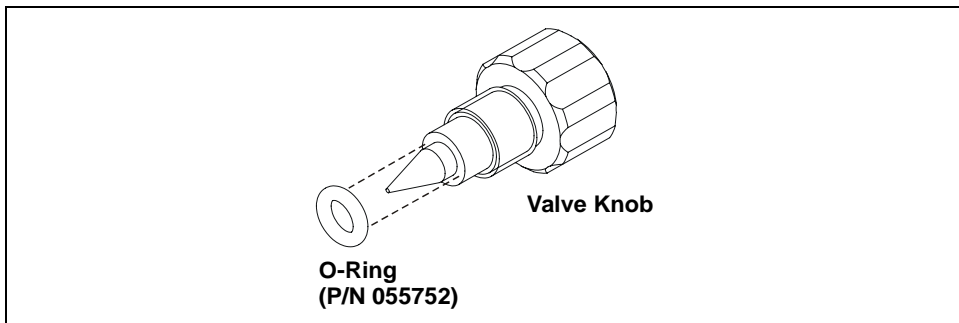


Figure 5-17. Waste Valve or Priming Valve O-Ring Replacement

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 5.17](#)).

5.10 Replacing the Conductivity Cell

1. Turn off the ICS-2100 power.
2. Open the front door and disconnect the tubing from the **CELL IN** and **CELL OUT** fittings (see [Figure 5-18](#), View A). Loosen the two screws on the cell front cover. The screws remain attached (see [Figure 5-18](#), View B).

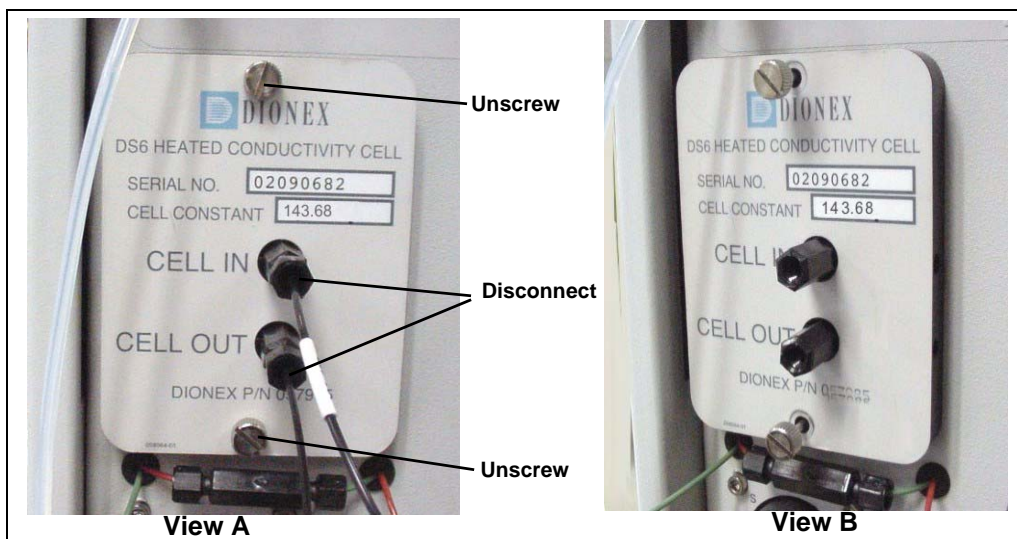


Figure 5-18. Removing the Cell Front Cover

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-2100 (see [Figure 5-19](#)).



Figure 5-19. Removing the Cell Assembly

5. Slide the new cell assembly straight 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-2100 when you push the assembly into the opening.
6. Tighten the screws on the cell front cover fingertight.
7. Close the side panel door and tighten the two mounting screws.
8. Reconnect the inlet and outlet lines.
9. Turn on the ICS-2100 power.
10. Calibrate the new cell in Chromeleon or on the ICS-2100 touch screen **DIAGNOSTIC** page. 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 μS , is automatically enabled. The slope value is applied to raw conductivity readings.
 - Entering the cell constant measured at the factory. The ICS-2100 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-2100.
- f. To ensure that the new values are recorded in the ICS-2100 memory, do not turn off the ICS-2100 power for at least 1 minute after downloading.

To calibrate the cell on the ICS-2100 touch screen **DIAGNOSTIC** page:

- a. Go to the **DIAGNOSTIC** page and touch **Electric Conductivity Cell**.
- b. On the **ELECTRIC CONDUCTIVITY CALIBRATION** page (see [Figure 5-20](#)), touch **Run Offset Cal**.

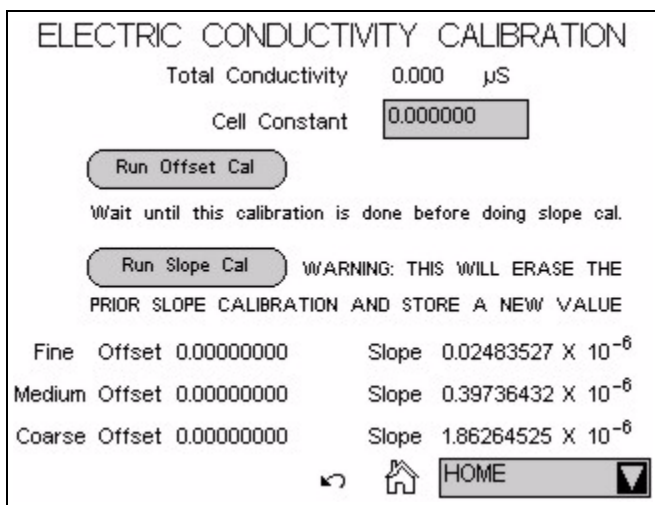


Figure 5-20. Electric Conductivity Calibration Page

- 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-2100 memory, do not turn off the ICS-2100 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**.

5.11 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-2100 Control panel in Chromeleon or from the touch screen **HOME** page.
3. Open the front door of the ICS-2100.
4. Disconnect the two eluent and the two regenerant lines from the suppressor.
5. To remove the suppressor from the component 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-2100 is outside the panel (see [Figure 5-21](#)).
7. Disconnect the suppressor cable (twist the ring on the yellow connector and pull the two connectors apart).

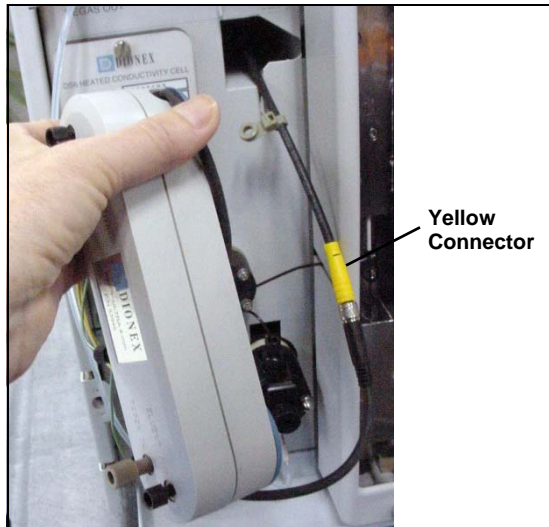


Figure 5-21. Removing the Suppressor

8. Connect the cable from the new suppressor to the ICS-2100 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 5-22](#)) 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-2100 front door.

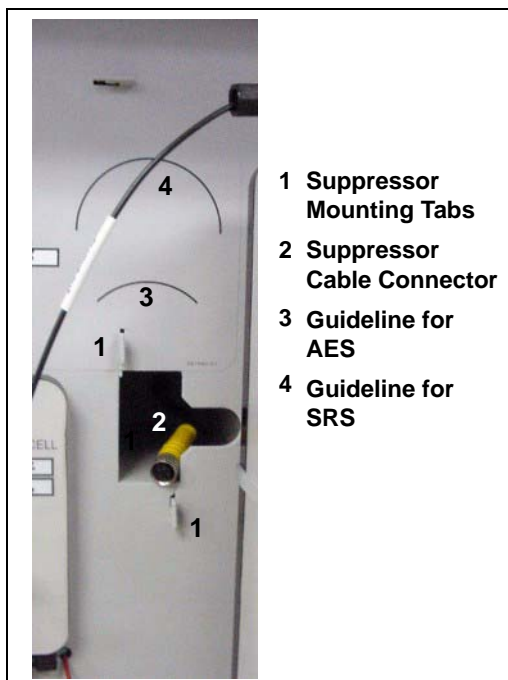


Figure 5-22. Suppressor Guidelines and Mounting Tabs on Component Panel

5.12 Replacing the Column Heater

1. Turn off the ICS-2100 power.
2. Open the front door of the ICS-2100.
3. 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 5-23](#)) and remove the plate.

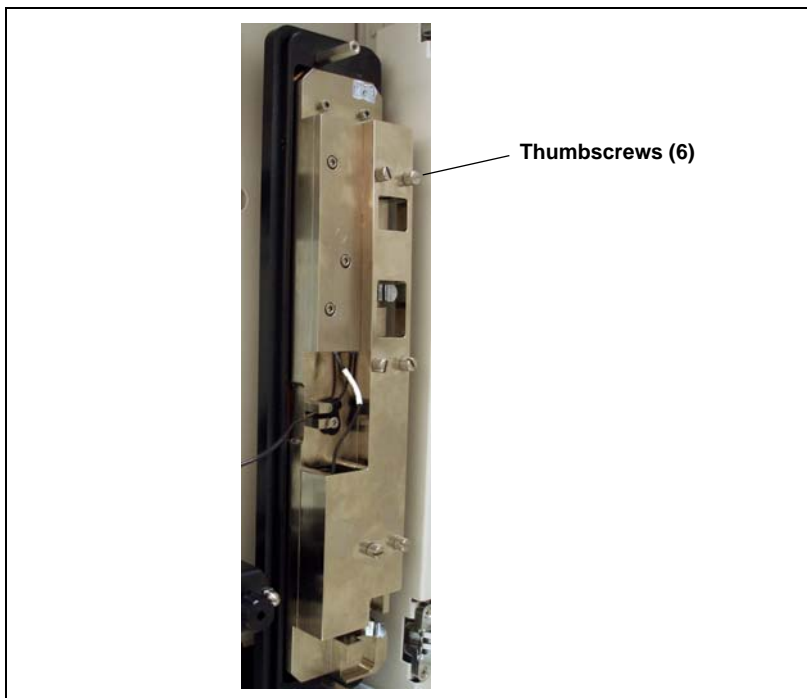


Figure 5-23. ICS-2100 Column Heater Cover Removed

- 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 069564) 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-2100 power.

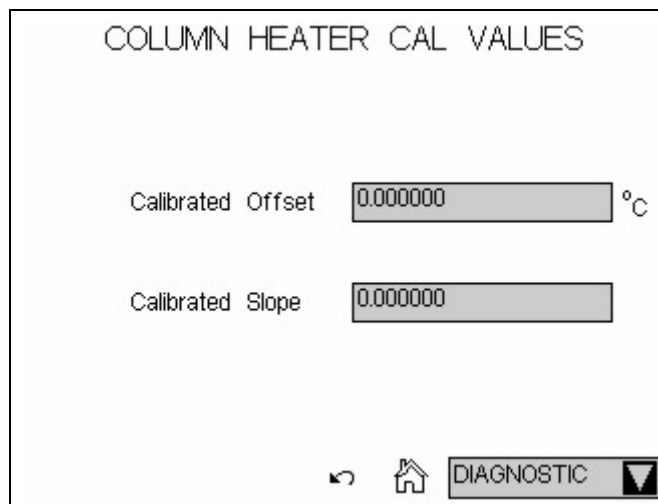
9. Enter the column heater calibration values in Chromeleon or on the ICS-2100 touch screen **DIAGNOSTIC** page as follows.

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-2100.
- d. To ensure the new calibration values are recorded in the ICS-2100 memory, do not turn off the ICS-2100 power for at least 1 minute after downloading the values.

To enter the calibration values on the ICS-2100 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 5-24](#)), enter the **Calibrated Offset** and **Calibrated Slope** values recorded in [Step 4](#).



COLUMN HEATER CAL VALUES

Calibrated Offset °C

Calibrated Slope

⏪ 🏠 DIAGNOSTIC ▼

Figure 5-24. Column Heater Cal Values Page

- c. To ensure the calibration values are recorded in the ICS-2100 memory, do not turn off the ICS-2100 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**.

5.13 Replacing the Column Heater Heat Exchanger

1. Turn off the ICS-2100 power.
2. Open the front door of the ICS-2100.
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 5-25](#)) and remove the plate.
6. Disconnect the heat exchanger inlet line from port C on the injection valve.

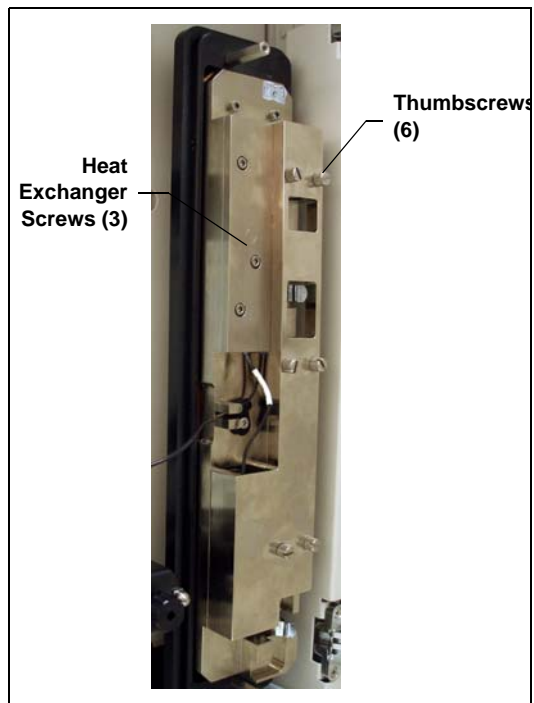


Figure 5-25. ICS-2100 Column Heater Cover Removed

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.

5.14 Replacing the Eluent Valve

1. Turn off the power to the ICS-2100.
2. Open the ICS-2100 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 you disconnect the liquid line from the valve in [Step 4](#).
4. Disconnect the two liquid lines connected to the eluent valve (see [Figure 5-26](#)).
5. Unscrew and remove the two screws that attach the valve to the component panel (see [Figure 5-26](#)). Save the screws.

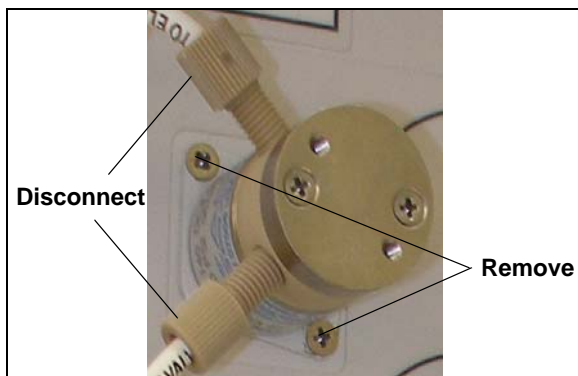


Figure 5-26. Eluent Valve

- 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-2100. Continue pulling until the connectors for the two cables are outside the panel (see [Figure 5-27](#)). Disconnect the cables.

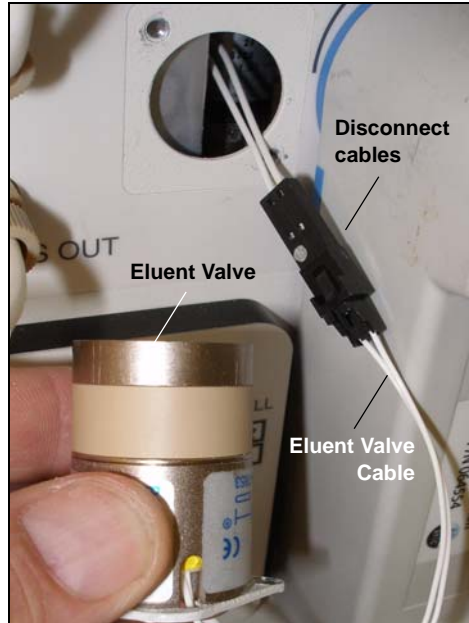


Figure 5-27. Eluent Valve Cable

- 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 5-28. Removing the Eluent Valve Mounting Plate

- Connect the cable from the new valve (P/N 057945) to the ICS-2100 cable. Feed the cables back inside the ICS-2100.

12. 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.
13. Turn on the power to the ICS-2100.
14. Prime the pump (see [Section 5.17](#)).

5.15 Replacing the Leak Sensor

1. Turn off the power to the ICS-2100.
2. Open the ICS-2100 front door.
3. Loosen the screw on the front of the leak sensor (see [Figure 5-29](#)). **Note:** The screw remains attached to the sensor.

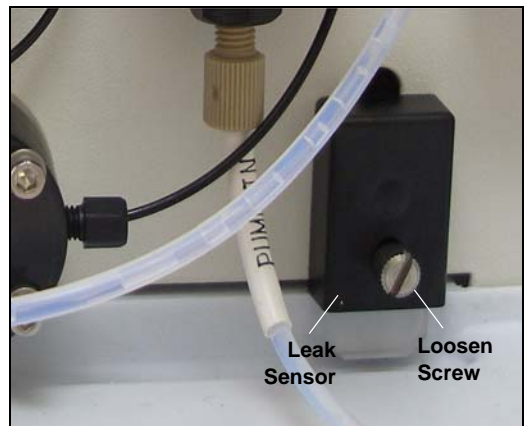


Figure 5-29. Leak Sensor

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-2100. Continue pulling the cable until the connectors for the two cables are outside of the panel (see [Figure 5-30](#)).
6. Disconnect the two cables.

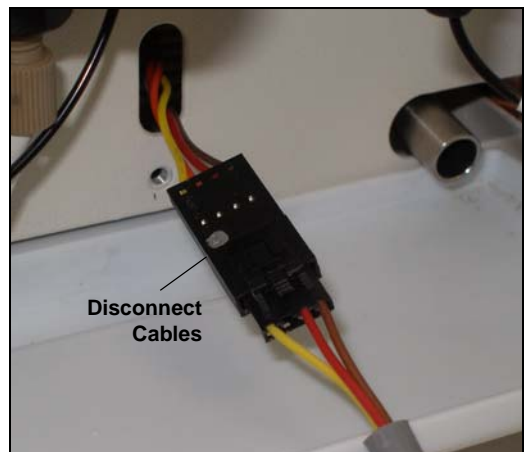


Figure 5-30. Leak Sensor Cable

7. Connect the cable from the new leak sensor (P/N 058053) to the ICS-2100 cable.
8. Feed the cables back inside the ICS-2100. 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.

5.16 Priming the Pump

1. Verify that the eluent reservoir is filled, the reservoir cap is installed and hand tightened, and the liquid line from the ICS-2100 to the reservoir cap is connected.
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 5.16.1](#)). 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 5.16.2](#)). Perform this procedure after the eluent lines are primed.

5.16.1 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 priming valve port on the primary pump head (see [Figure 5-31](#)).

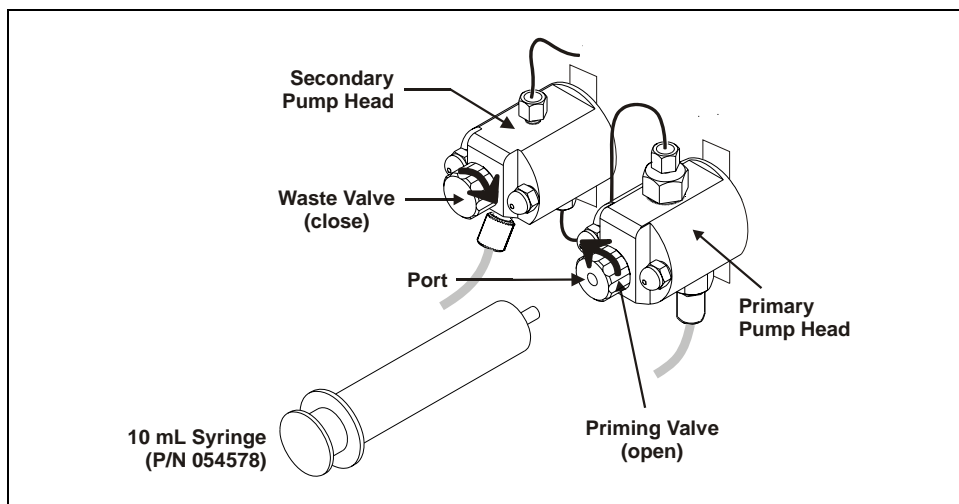


Figure 5-31. Priming the Eluent Lines

3. Open the priming valve by turning it one-quarter to one-half turn counterclockwise.
4. On the ICS-2100 Control panel in Chromeleon, click the **Pump Settings** button. The **Pump Settings** window opens (see [Figure 3-6](#)).
5. Under **Eluent Flow Valve**, click the **Open** button.
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.

NOTE If the vacuum degas assembly is installed, draw out an additional 20 mL of eluent.

7. After priming the lines thoroughly, close the priming valve. **Do not overtighten.**

5.16.2 Priming with the Prime Button

NOTE Perform this procedure after priming the eluent lines (see [Section 5.16.1](#)).

1. Check that the priming valve on the primary pump head is closed (see [Figure 5-32](#)).

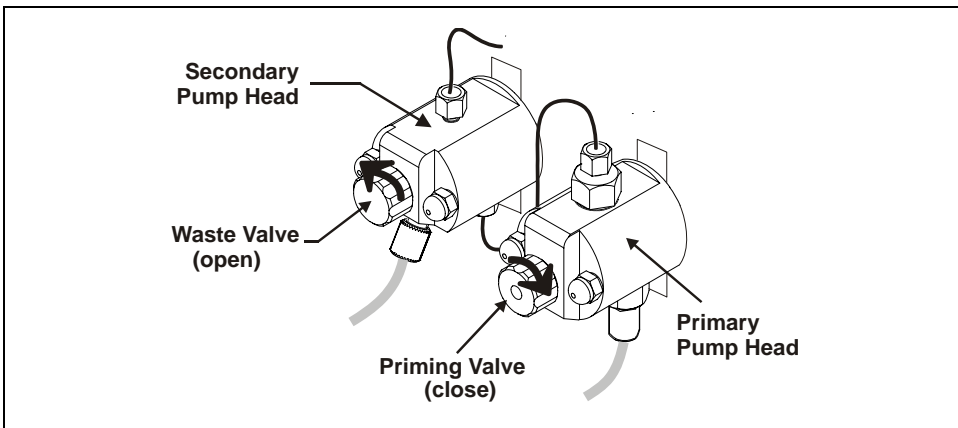


Figure 5-32. Priming the Pump

2. Open the waste valve on the secondary pump head by turning the knob one-quarter to one-half turn counterclockwise (see [Figure 5-32](#)). Opening the valve directs the eluent flow path to waste and eliminates backpressure.
3. In the **Pump Settings** window (see [Figure 3-6](#)), click the **Prime** button. Confirm that the waste valve is open by clicking **OK** when the reminder message appears. The pump will begin pumping at about 3 mL/min.
4. Continue priming the ICS-2100 until no air bubbles are exiting the pump waste line.
5. In the **Pump Settings** window, click **Pump Off**.
6. Close the waste valve. **Do not overtighten the valve.**

5.17 Priming the Pump with Isopropyl Alcohol

NOTE Prime the pump heads with isopropyl alcohol only if the two standard priming procedures described in [Section 5.16](#) 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 5-33](#)).
2. Open the waste valve on the secondary pump head (see [Figure 5-33](#)) by turning the knob one-quarter to one-half turn counterclockwise.

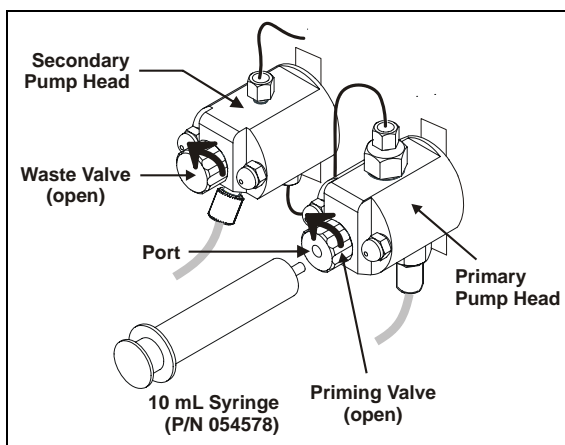


Figure 5-33. Priming the Pump Heads with IPA

3. In the **Pump Settings** window (see [Figure 3-6](#)), click **Pump On**.
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. Then, click the **Prime** button in the **Pump Settings** window to flush the heads with the desired eluent.

IMPORTANT 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. In the **Pump Settings** window, click **Pump Off**.

5.18 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-2100.



HAUTE TENSION—Débranchez le cordon d'alimentation principal de sa source et du panneau arrière du ICS-2100.



HOCHSPANNUNG—Ziehen Sie das Netzkabel aus der Steckdose und der Netzbuchse auf der Rückseite des ICS-2100.

2. The fuse holder is part of the main power receptacle (see [Figure 5-34](#)) on the ICS-2100 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.

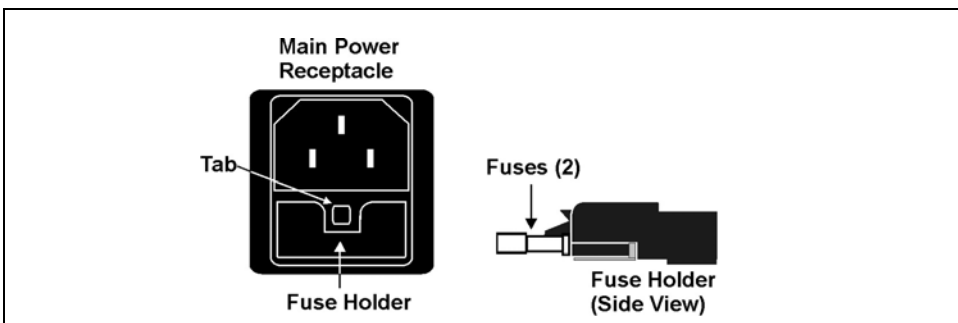


Figure 5-34. Main Power Fuse Holder

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.

5.19 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-Kartusche enthält eine korrosive Base (KOH, LiOH oder NaOH), oder eine korrosive Säure (MSA). Tragen Sie daher beim Umgang mit der Kartusche 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 5.19.1](#).
- To replace a K_2CO_3 cartridge, go to [Section 5.19.2](#).

5.19.1 Replacing a KOH, LiOH, MSA, or NaOH EluGen Cartridge

1. Turn off the pump from the ICS-2100 Control panel in Chromeleon or from the ICS-2100 touch screen **HOME** page.
2. Disconnect the EluGen cartridge cable from the **EGC-1** connector on the ICS-2100 top cover.
3. Disconnect the CR-TC cable from the **CR-TC** connector.

4. Remove the EluGen cartridge **VENT** line (see [Figure 5-35](#)) 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.

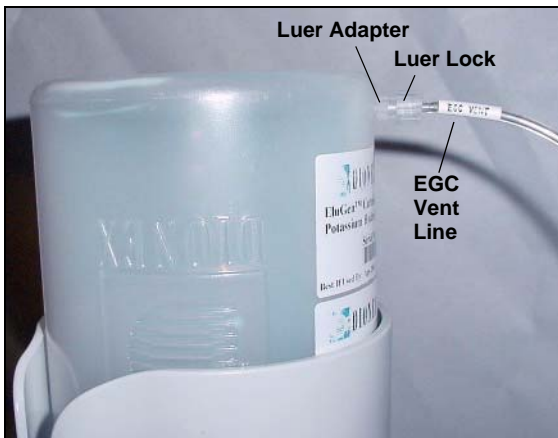


Figure 5-35. EluGen Cartridge Vent Line and Luer Fitting

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-2100 (see [Figure 5-36](#) and [Figure 5-37](#)).

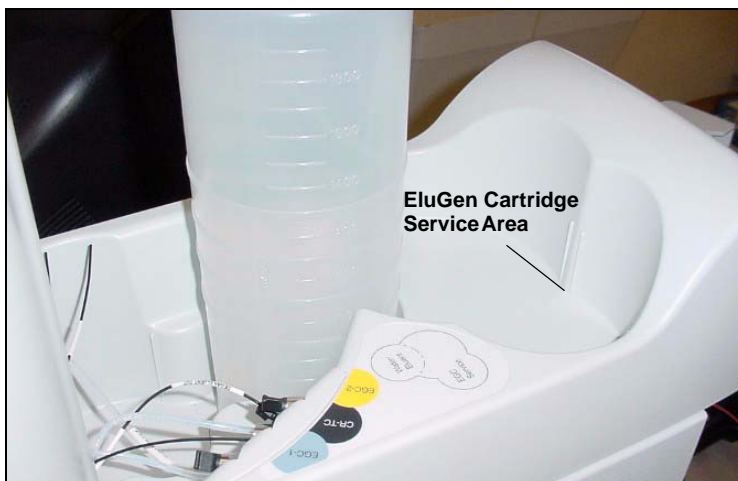


Figure 5-36. EluGen Cartridge Service Area

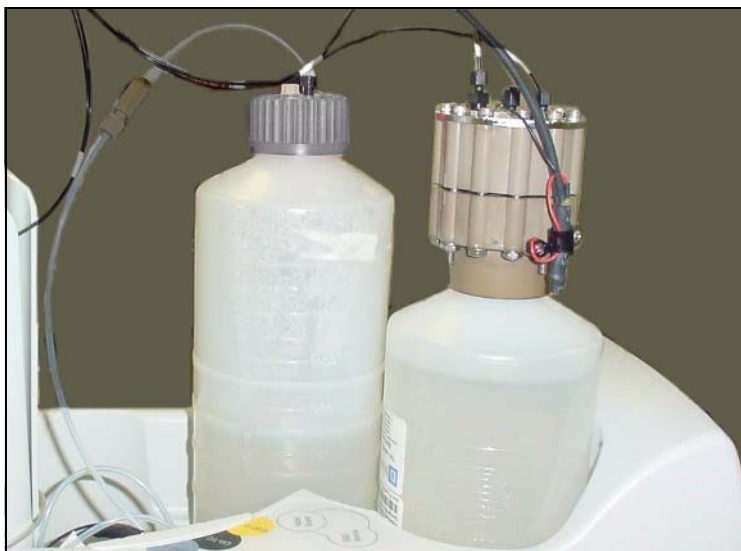


Figure 5-37. EluGen Cartridge in the Service Area

8. Disconnect the **EGC IN** and **EGC OUT** lines from the **INLET** and **OUTLET** ports on the EluGen cartridge (see [Figure 5-38](#)).

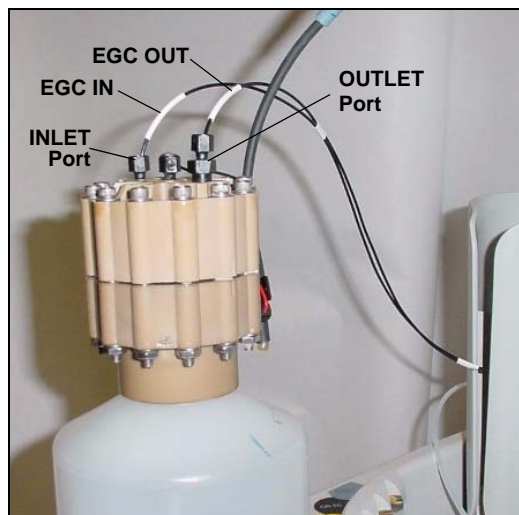


Figure 5-38. Disconnect the EluGen Cartridge Inlet and Outlet Port Lines

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 5-39](#)).

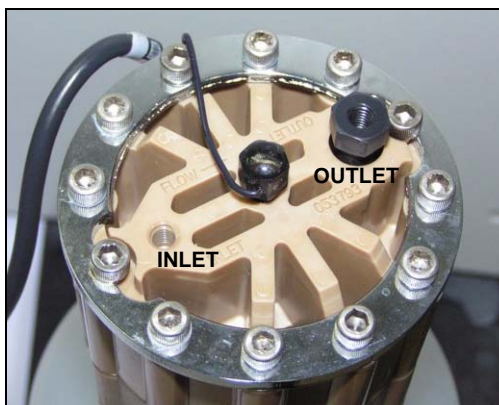


Figure 5-39. EluGen Cartridge Inlet and Outlet Ports

12. Set the EluGen cartridge in the service area on top of the ICS-2100 and orient it with the cable toward the EGC holder (see [Figure 5-40](#)).

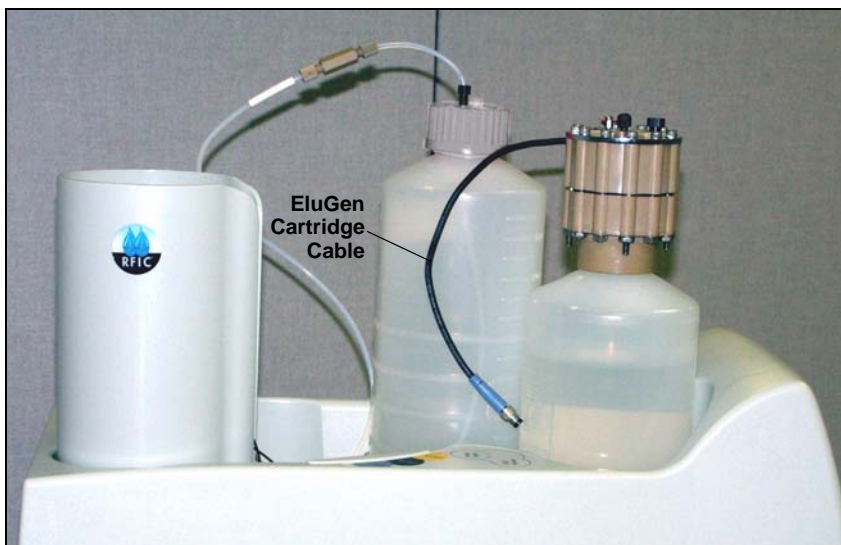


Figure 5-40. EluGen Cartridge in Service Area

13. Connect **EGC IN** to the EluGen cartridge **INLET** port.

14. Locate the yellow 0.5 mL/min, 7 MPa (1000 psi) backpressure coil (P/N 053765) in the ICS-2100 Ship Kit (P/N 064375).
15. Connect one end of this coil to the EluGen cartridge **OUTLET** port (see [Figure 5-41](#)). Leave the other end of the coil unconnected.

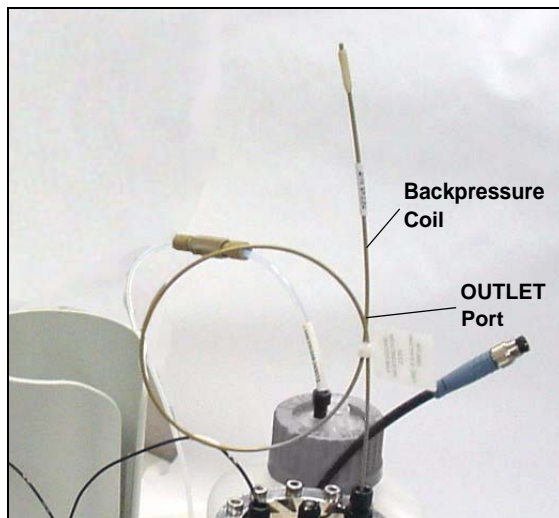


Figure 5-41. EluGen Cartridge Outlet Connection for Conditioning the Cartridge

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 150](#).

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.**



CAUTION

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.



MISE EN GARDE

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.



VORSICHT

Die EluGen-Kartusche enthält eine korrosive Base (KOH, LiOH oder NaOH), oder eine korrosive Säure (MSA). Tragen Sie daher beim Umgang mit der Kartusche 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 5-42](#)).

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 5-42. Installing the EluGen Cartridge in the Holder

- Orient the cartridge's blue 4-pin electrical cable connector as shown in [Figure 5-43](#). Push it onto the **EGC-1** connector on the ICS-2100. Twist the ring on the cable connector fingertight to secure it.



Figure 5-43. 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 > All Programs > Chromeleon > Server Configuration**).
2. Double-click the ICS-2100 system icon. The properties dialog box for the ICS-2100 appears.
3. Click the **Eluent Generator** tab (see [Figure 5-44](#)).
4. Select the **EGC-1** check box.
5. Enter the EluGen cartridge serial number and click **OK**.

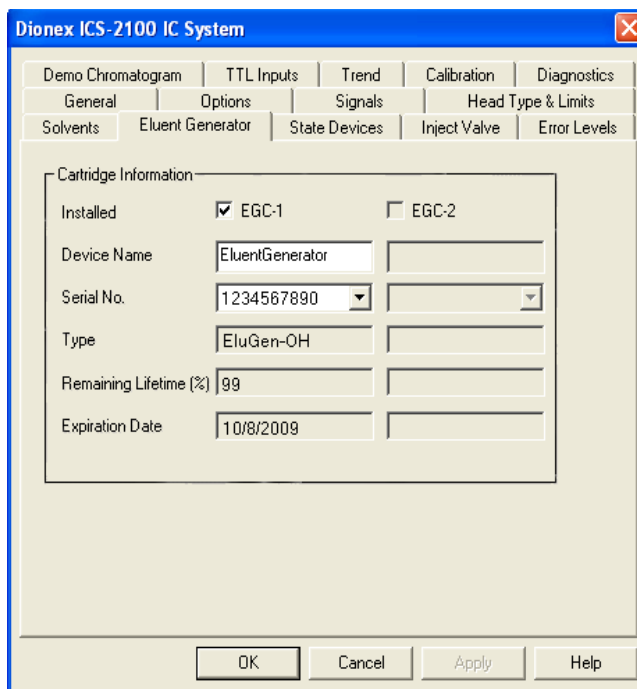


Figure 5-44. Eluent Generator Configuration Properties Example

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-2100 and direct the yellow backpressure coil from the EluGen cartridge **OUTLET** port to the container.
2. From the Chromeleon Control panel or the ICS-2100 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, the auxiliary electrolytic device attached to the **EGC-2** connector (if installed), and the CR-TC are off.

IMPORTANT

To avoid damaging the suppressor, auxiliary electrolytic device (if installed), and CR-TC, always turn them off before conditioning the EluGen cartridge. The pump flow is on during conditioning; however, no flow reaches the suppressor, auxiliary electrolytic device, or CR-TC.

4. Verify that the **Automatically turn on with pump** options are not selected on the touch screen **SUPPRESSOR** page (see [Section B.9](#)) and **ELUENT GENERATOR** page (see [Section B.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 5-45](#)).

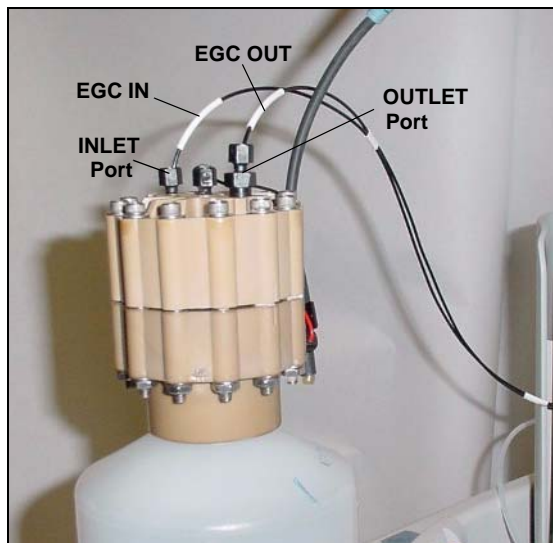


Figure 5-45. EluGen Cartridge Inlet and Outlet Connections

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.

5.19.2 Replacing a K_2CO_3 Cartridge

1. Turn off the pump from the ICS-2100 Control panel in Chromeleon or from the ICS-2100 touch screen **HOME** page.
2. Disconnect the EluGen cartridge cable from the **EGC-1** connector on the ICS-2100 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 5-46](#)) 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.

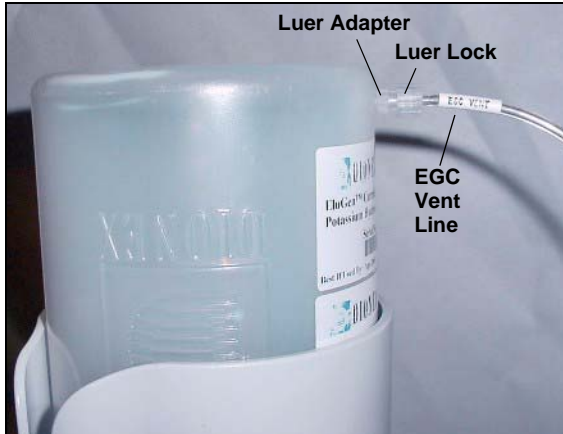


Figure 5-46. EluGen Cartridge Vent Line and Luer Fitting

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-2100 (see [Figure 5-47](#) and [Figure 5-48](#)).

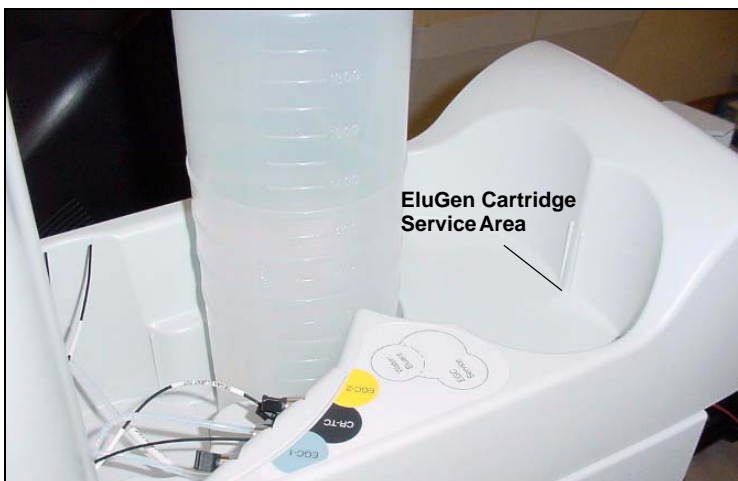


Figure 5-47. EluGen Cartridge Service Area



Figure 5-48. 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 5-49](#)).

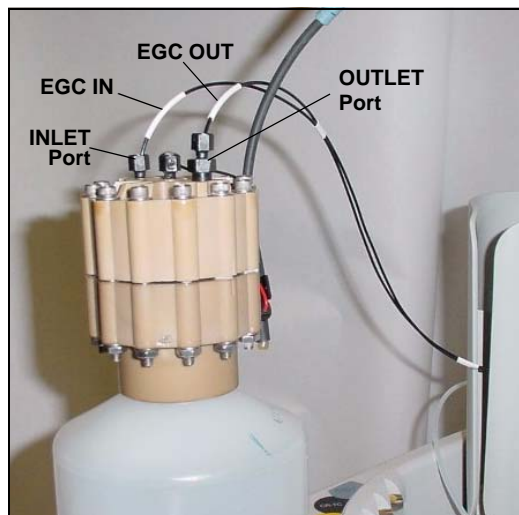


Figure 5-49. Disconnect the EluGen Cartridge Inlet and Outlet Port Lines

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 5-50](#)).

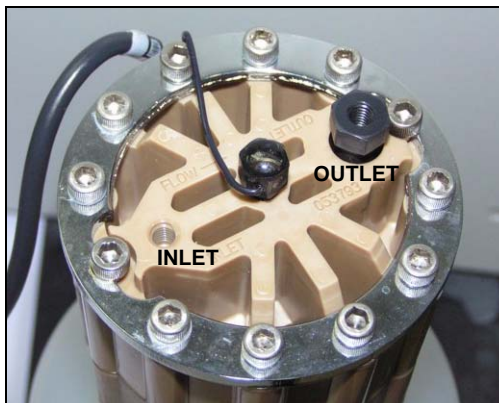


Figure 5-50. EluGen Cartridge Inlet and Outlet Ports

12. Set the EluGen cartridge in the service area on top of the ICS-2100 and orient it with the cable toward the EGC holder (see [Figure 5-51](#)).

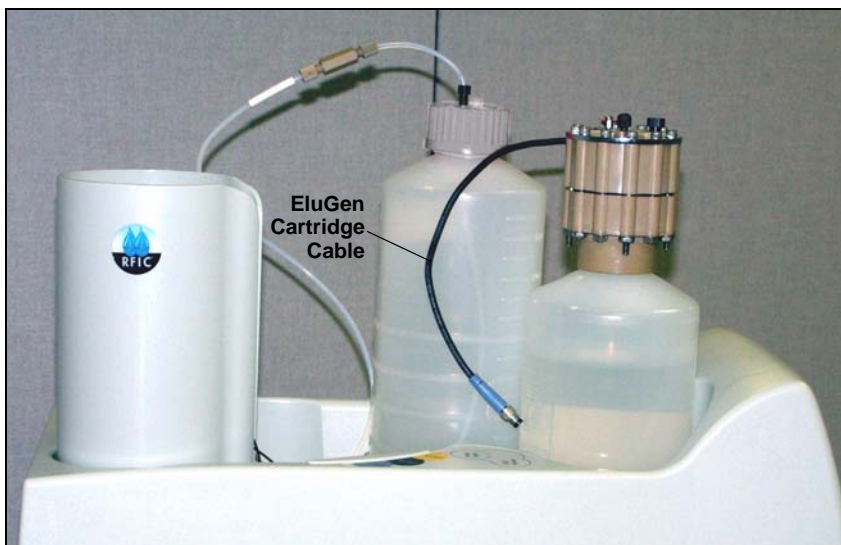


Figure 5-51. EluGen Cartridge in Service Area

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.**



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-Kartusche enthält eine korrosive Base (KOH, LiOH oder NaOH), oder eine korrosive Säure (MSA). Tragen Sie daher beim Umgang mit der Kartusche eine Schutzbrille und Handschuhe.

16. Slide the EluGen cartridge down into the holder until it stops (see [Figure 5-52](#)). 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 5-52. EluGen Cartridge Installed in the Holder

17. Remove the plug from the **EGC-1** connector on top of the ICS-2100.
18. Orient the cartridge's blue 4-pin electrical cable connector as shown in [Figure 5-53](#). Push it onto the **EGC-1** connector on the ICS-2100. Twist the ring on the cable connector fingertight to secure it.



Figure 5-53. 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 a label on the EluGen cartridge.

1. Open the Server Configuration program (select **Start** > **All Programs** > **Chromeleon** > **Server Configuration**).
2. Double-click the ICS-2100 system icon. The properties dialog box for the ICS-2100 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 was entered correctly.
6. Click **OK**.

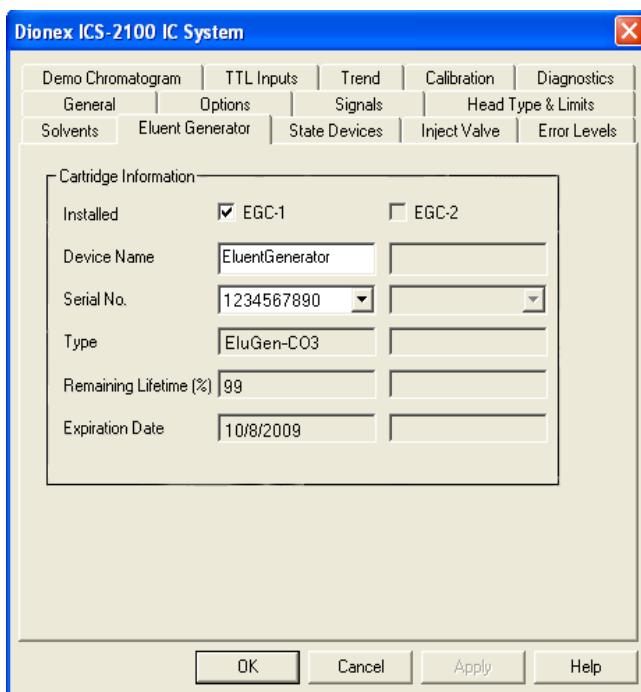


Figure 5-54. Eluent Generator Configuration Properties Example

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 159.](#)
- For carbonate/bicarbonate eluent, go to [“Plumbing the EluGen Cartridge and EPM for Conditioning with Carbonate/Bicarbonate Eluent” on page 162.](#)

Plumbing the EluGen Cartridge for Conditioning with Carbonate Eluent

Figure 5-55 illustrates the liquid flow path during the EluGen cartridge conditioning procedure with carbonate eluent.

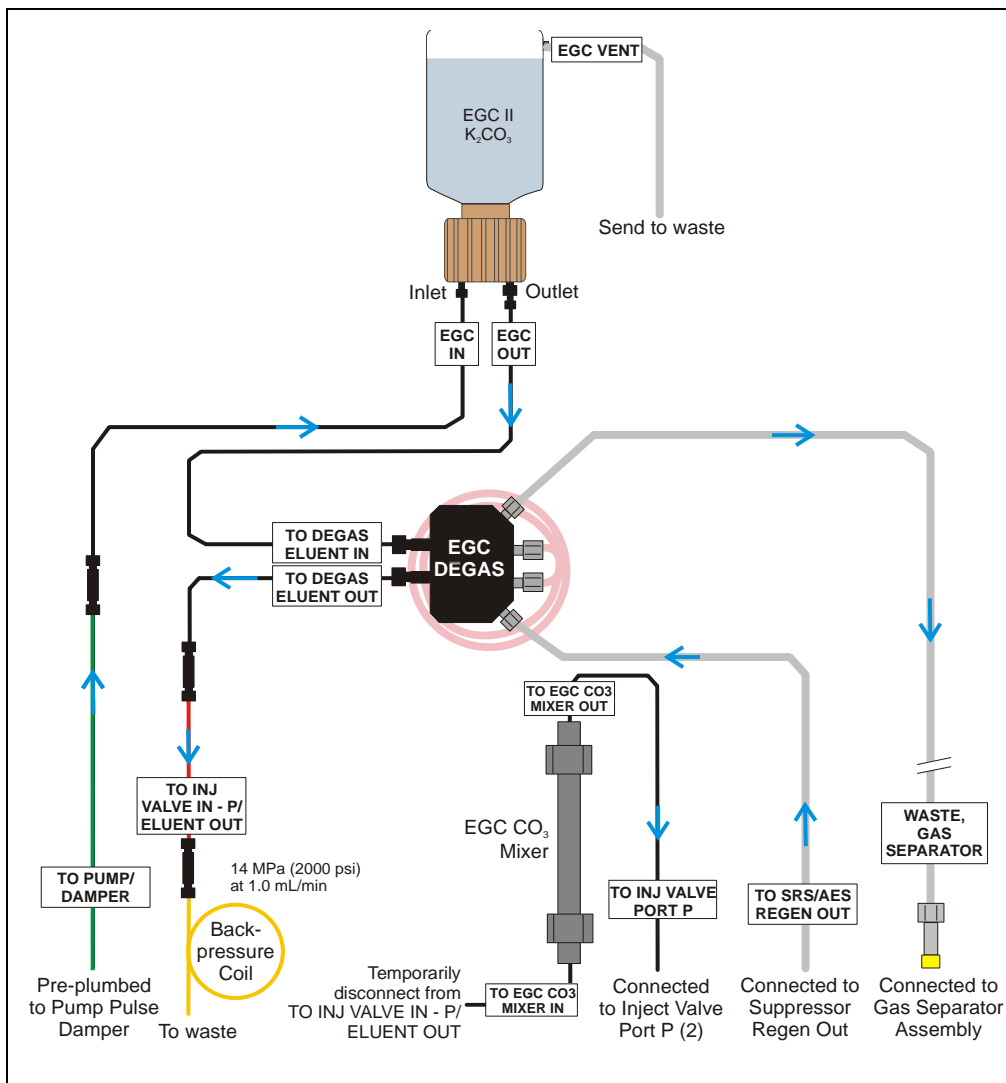


Figure 5-55. EluGen Cartridge Plumbing for Conditioning with Carbonate Eluent

ICS-2100 Ion Chromatography System

1. Disconnect the **TO INJ VALVE IN - P/ELUENT OUT** line from the EGC CO₃ 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-2100 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 5-56](#)).
4. Direct the free end of the backpressure coil to a temporary waste container.

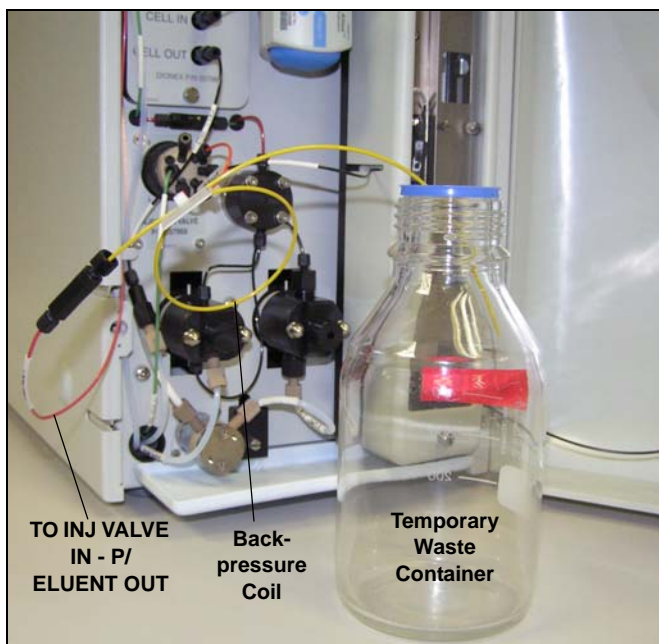


Figure 5-56. Plumbing Connections for Conditioning the EluGen Cartridge with Carbonate Eluent

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 and the auxiliary electrolytic device attached to the **EGC-2** connector (if installed) are off.

IMPORTANT

To avoid damaging the suppressor (and auxiliary electrolytic device, if installed), always turn them off before conditioning the EluGen cartridge. The pump flow is on during conditioning; however, no flow reaches the suppressor or auxiliary electrolytic device.

3. Verify that the **Automatically turn on with pump** option is not selected on the ICS-2100 touch screen **SUPPRESSOR** page (see [Section B.9](#)). Disabling this option lets you turn on the pump, without automatically turning on the suppressor.
4. From the Control panel in Chromeleon or the 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 5-57 illustrates the liquid flow path through the eluent generator during conditioning with carbonate/bicarbonate eluent.

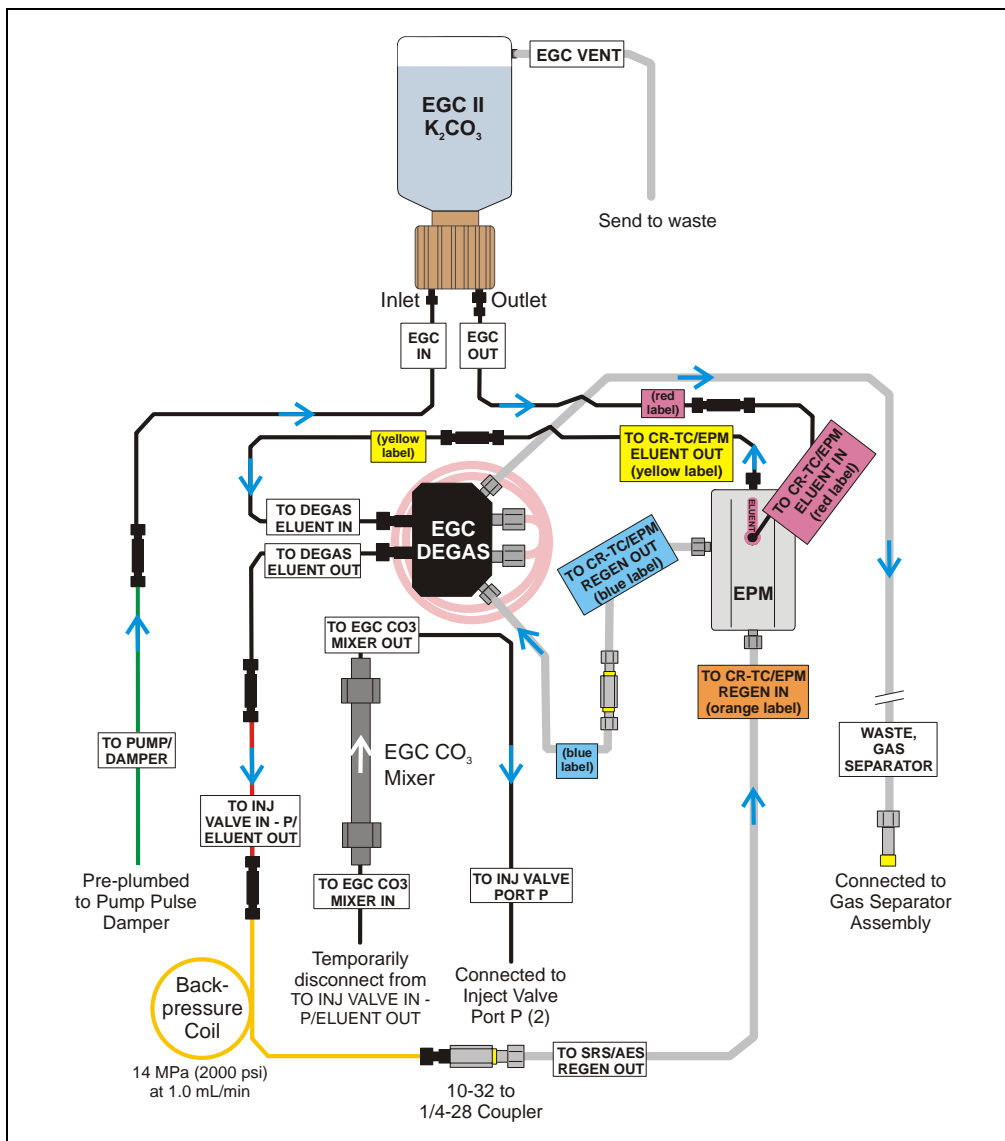


Figure 5-57. Plumbing for Conditioning with Carbonate/Bicarbonate Eluent

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-2100 Ship Kit (P/N 064375).
2. Disconnect the **TO INJ VALVE IN - P/ELUENT OUT** line from the EGC CO₃ 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 5-58](#)).

NOTE The backpressure coil connection in [Figure 5-58](#) is temporary; it is required only during the conditioning procedure described in the next section.

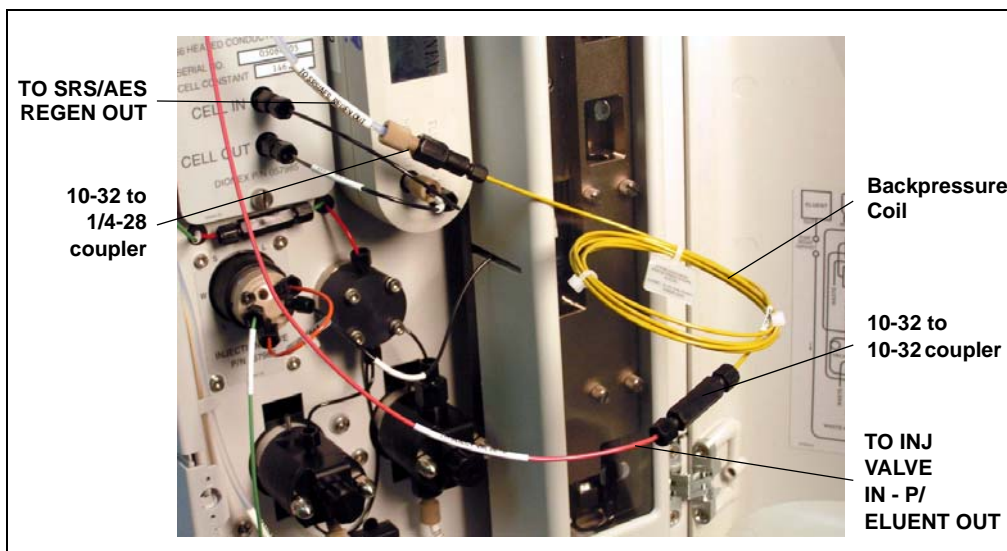


Figure 5-58. Backpressure Coil Connections for Conditioning the EPM with Carbonate/Bicarbonate Eluent

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 and the auxiliary electrolytic device (if installed) are off.

IMPORTANT

To avoid damaging the suppressor (and auxiliary electrolytic device, if installed), always turn them off before conditioning the EluGen cartridge. The pump flow is on during conditioning; however, no flow reaches the suppressor or auxiliary electrolytic device.

3. Verify that the **Automatically turn on with pump** option is not selected on the ICS-2100 touch screen **SUPPRESSOR** page (see [Section B.9](#)). Disabling this option lets you turn on the pump, without automatically turning on the suppressor.
4. From the ICS-2100 Control panel in Chromeleon or the 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.

5.20 Replacing the CR-TC

1. Turn off the pump from the ICS-2100 Control panel in Chromeleon or from the touch screen **HOME** page.
2. Follow the instructions in [Section 5.19.1, 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-2100.
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 5-59](#)).

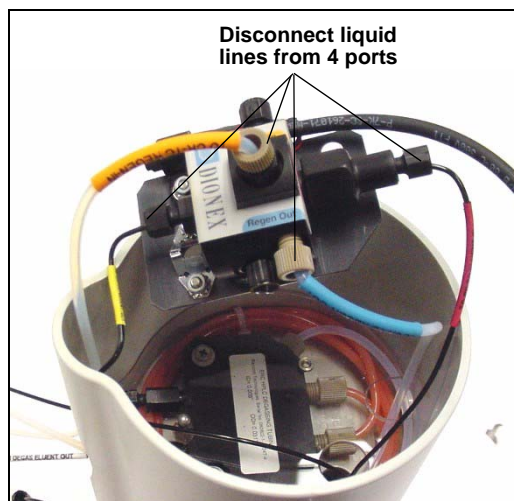


Figure 5-59. Disconnecting CR-TC Liquid Lines

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 5-60](#)).

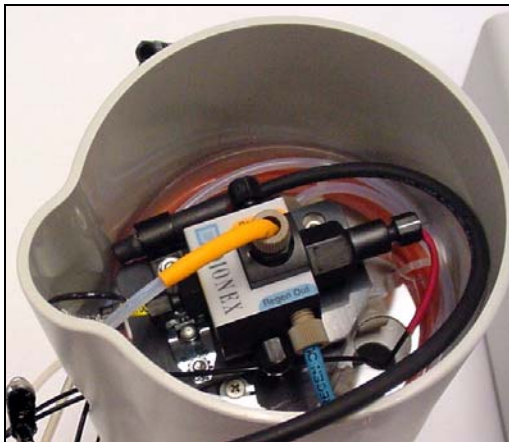


Figure 5-60. CR-TC Installed in Holder

11. Feed the CR-TC cable through the slot on the side of the EGC holder (see [Figure 5-61](#)).
12. Turn the EGC holder right-side up.



Figure 5-61. 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 5-62](#) illustrates the liquid flow path through the CR-TC during the hydration procedure.

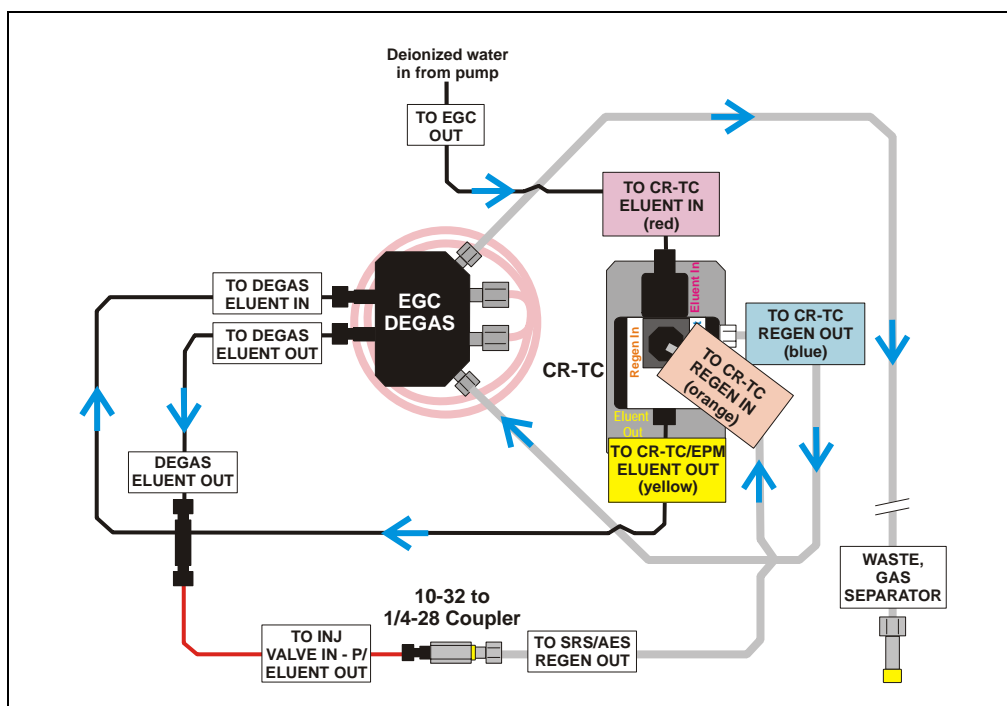


Figure 5-62. CR-TC Plumbing for Hydration

1. Locate the 10-32 to 1/4-28 coupler (P/N 042806) in the ICS-2100 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 and the auxiliary electrolytic device (if installed) is turned off.

IMPORTANT

To avoid damaging the suppressor and auxiliary electrolytic device (if installed), always turn them off before hydrating the CR-TC. The pump flow is on during hydrating; however, no flow reaches the suppressor or auxiliary electrolytic device.

4. Verify that the **Automatically turn on with pump** option is not selected on the ICS-2100 touch screen **ELUENT GENERATOR** page (see [Section B.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.

5.21 Replacing the EPM Electrolytic pH Modifier

1. Turn off the pump from the ICS-2100 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-2100 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 5-63](#)).

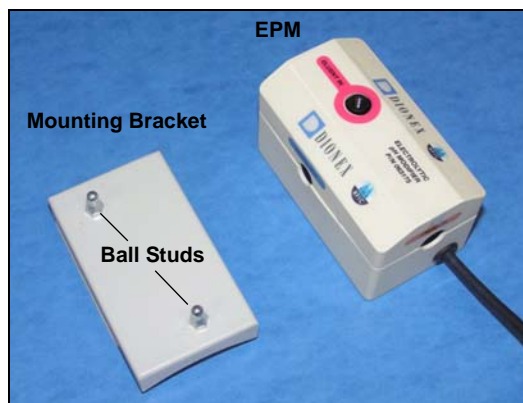


Figure 5-63. EPM and Mounting Bracket

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.

5.21.1 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 > All Programs > Chromeleon > Server Configuration**).
2. Double-click the ICS-2100 system icon. The properties dialog box for the ICS-2100 appears.
3. Click the **Eluent Generator** tab (see [Figure 5-44](#)).
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**.

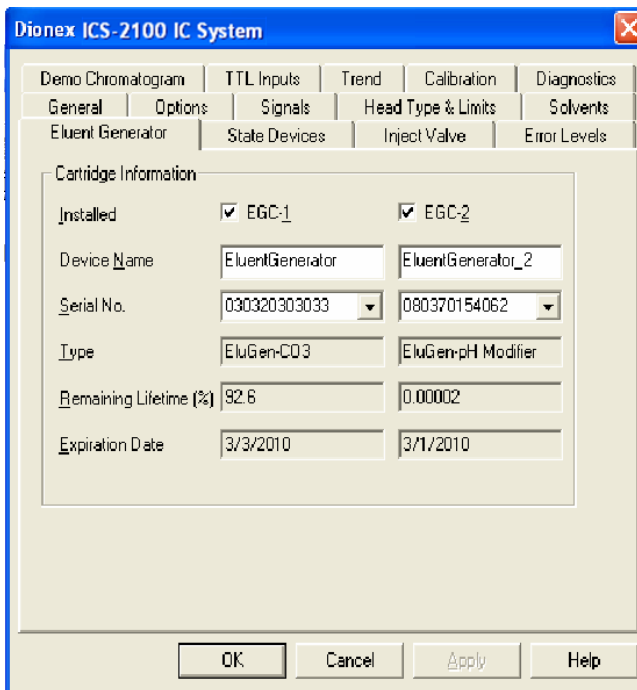


Figure 5-64. Eluent Generator Configuration Properties Example

5.21.2 Plumbing the EPM for Hydrating and Conditioning

[Figure 5-57](#) illustrates the liquid flow path during hydration and conditioning.

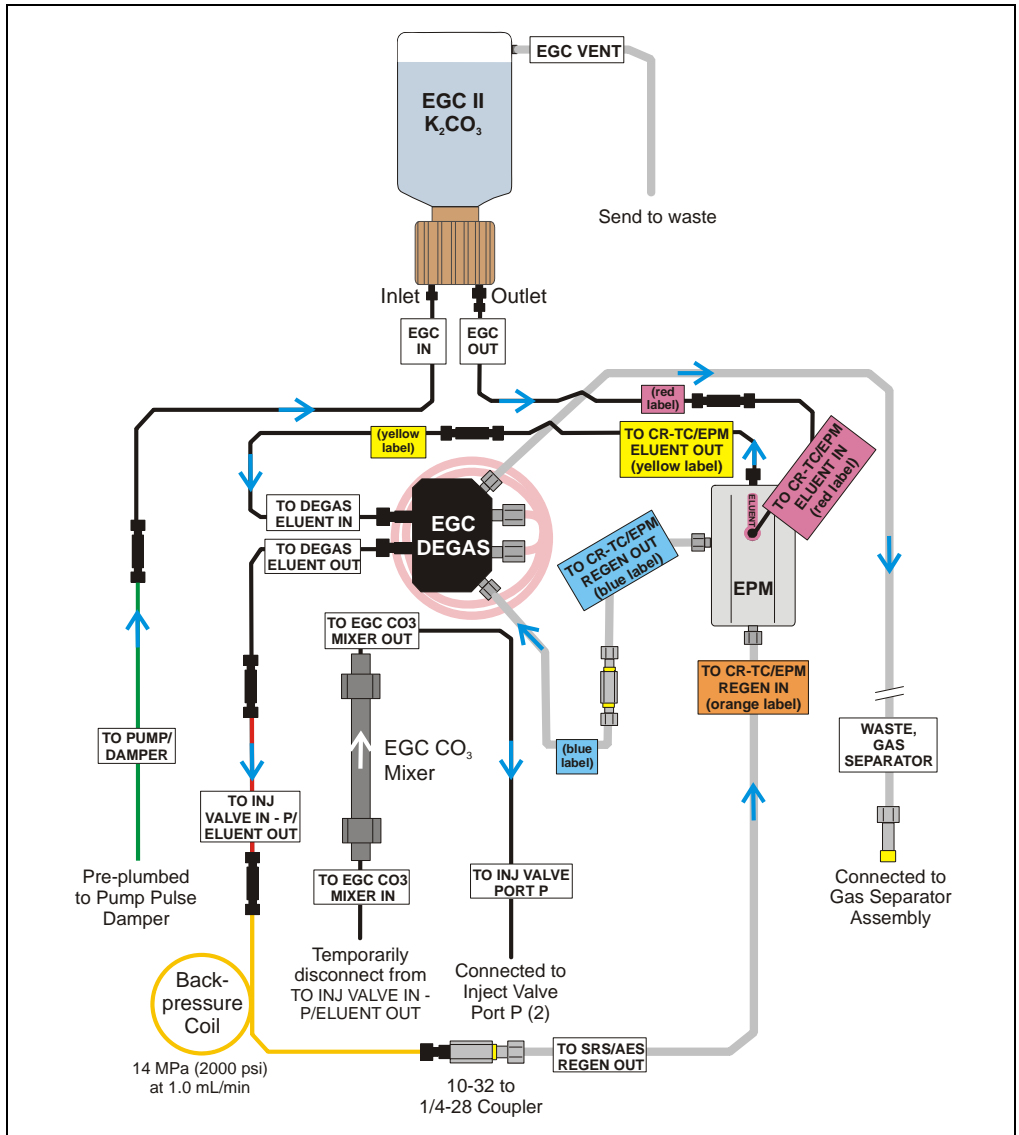


Figure 5-65. EluGen Cartridge and EPM Plumbing for Conditioning

ICS-2100 Ion Chromatography System

1. Disconnect the **TO INJ VALVE IN - P/ELUENT OUT** line from the EGC CO₂ 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 5-66](#)).

NOTE The backpressure coil connection in [Figure 5-66](#) is temporary; it is used only during the hydration and conditioning procedure described in the next section.

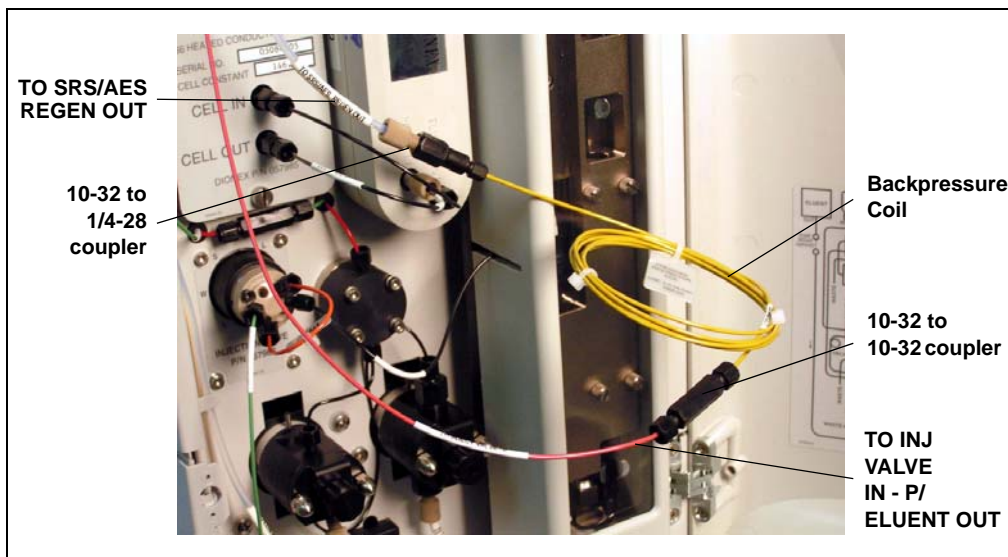


Figure 5-66. Backpressure Coil Connections for Hydrating and Conditioning the EPM with Carbonate Eluent

5.21.3 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 and the auxiliary electrolytic device (if installed) are off.

IMPORTANT

To avoid damaging the suppressor and auxiliary electrolytic device (if installed), always turn them off before conditioning the EPM and EluGen cartridge. The pump flow is on during conditioning; however, no flow reaches the suppressor or auxiliary electrolytic device.

3. Verify that the EluGen cartridge is off.
4. Verify that the **Automatically turn on with pump** options are not selected on the ICS-2100 touch screen **SUPPRESSOR** page (see [Section B.9](#)) and **ELUENT GENERATOR** page (see [Section B.8](#)). Disabling these options lets you turn on the pump, without automatically turning on the suppressor and EluGen cartridge.
5. From the ICS-2100 Control panel in Chromeleon or the ICS-2100 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 CO₃ Mixer inlet.
15. Reconnect the **TO SRS/AES REGEN OUT** line to the suppressor **REGEN OUT** port.

5.22 Replacing the EGC CO₃ Mixer

5.22.1 Installing the New EGC CO₃ Mixer

1. Turn off the pump from the ICS-2100 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 CO₃ Mixer (P/N 061686) with the outlet pointing upward and push it onto the mounting clips (see [Figure 5-67](#)). The mixer outlet must point upward to ensure thorough mixing of the eluent.

4. Connect the **TO EGC CO₃ MIXER IN** line to the mixer inlet and connect the **TO EGC CO₃ MIXER OUT** line to the mixer outlet.



Figure 5-67. ICS-2100 with an EGC CO₃ Mixer Installed

5.22.2 Filling the EGC CO₃ Mixer with Deionized Water

Before initial use, follow the steps below to temporarily fill the EGC CO₃ 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 5-68](#)).

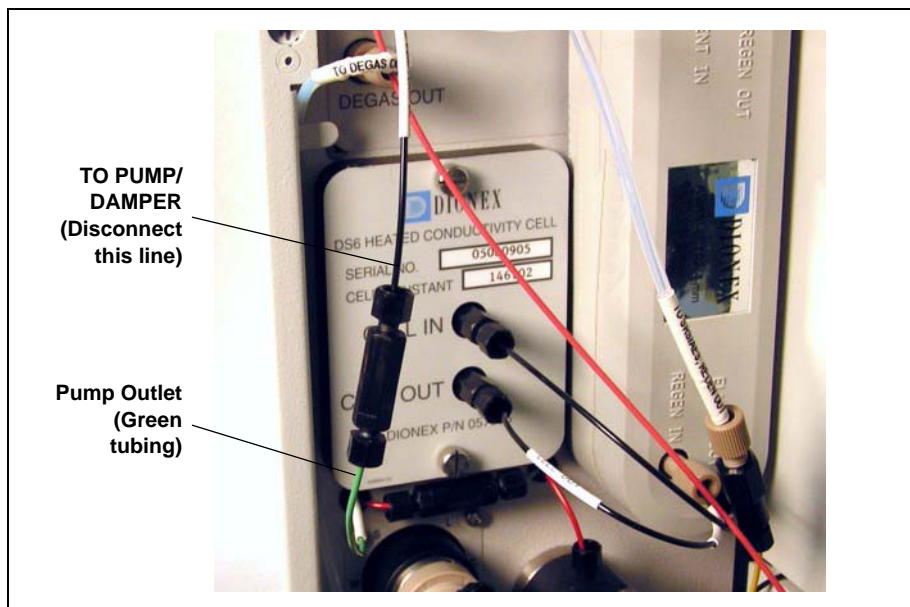


Figure 5-68. Disconnect the Cartridge Inlet and Pump Outlet

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 5-69](#)).

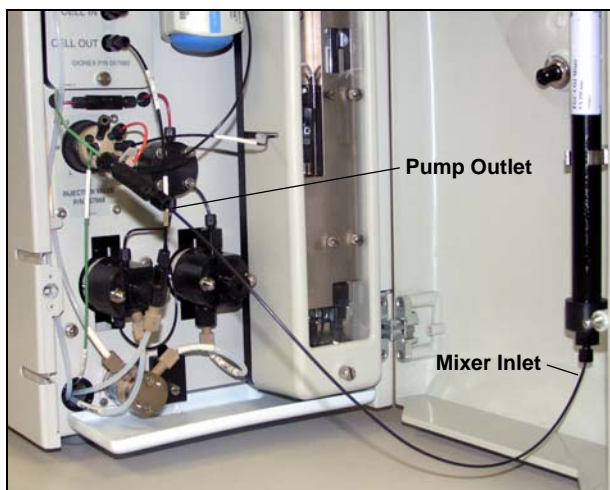


Figure 5-69. Pump Outlet Connected to Mixer Inlet for Mixer Hydration

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-2100 Control panel in Chromeleon or the ICS-2100 touch screen **HOME** page, set the pump flow rate to **5.00 mL/min.**
8. Verify that the suppressor and the auxiliary electrolytic device (if installed) are off.

IMPORTANT

To avoid damaging the suppressor and auxiliary electrolytic device (if installed), always turn them off before filling the mixer. The pump flow is on during filling; however, no flow reaches the suppressor or auxiliary electrolytic device.

9. Verify that the **Automatically turn on with pump** option is not selected on the touch screen **SUPPRESSOR** page (see [Section B.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.

5.22.3 Filling the EGC CO₃ Mixer with Eluent

Before initial use, follow the steps in this section to fill the EGC CO₃ 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 CO₃ Mixer with Carbonate Eluent”](#) below.
- For carbonate/bicarbonate eluent, see [“Filling the EGC CO₃ Mixer with Carbonate/Bicarbonate Eluent”](#) on page 182.

Filling the EGC CO₃ Mixer with Carbonate Eluent

[Figure 5-70](#) illustrates the liquid flow path through the eluent generator components during initial filling of the EGC CO₃ Mixer with carbonate eluent.

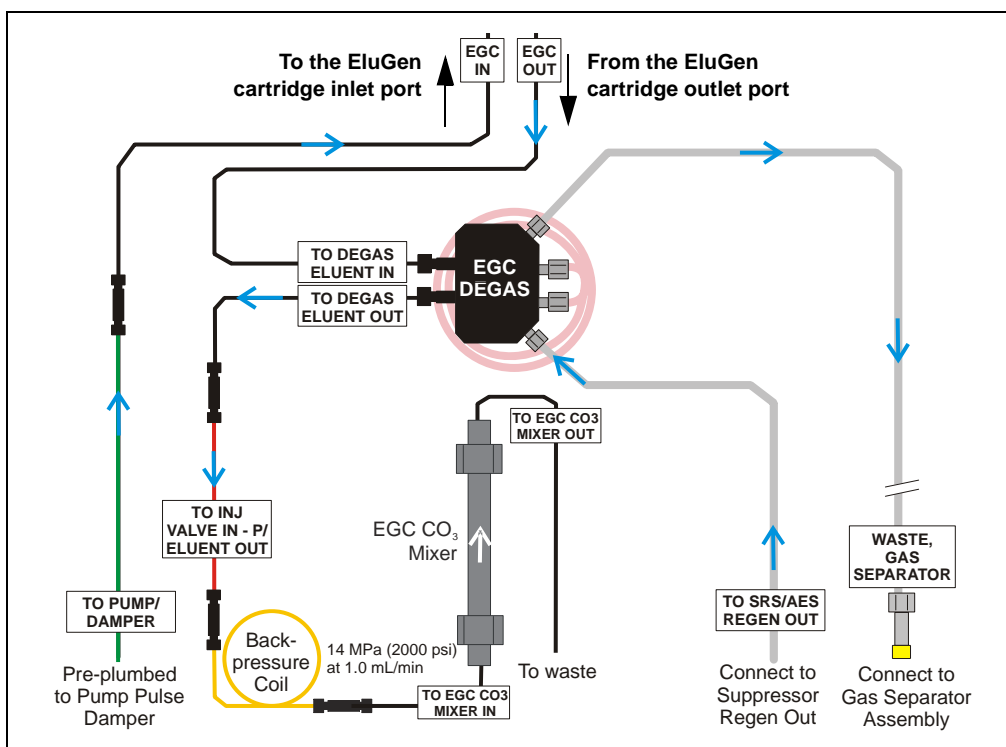


Figure 5-70. Plumbing for Initial Filling of the EGC CO₃ Mixer with Carbonate Eluent

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-2100 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 and the auxiliary electrolytic device (if installed) are off.

IMPORTANT

To avoid damaging the suppressor and auxiliary electrolytic device (if installed), always turn them off before filling the mixer. The pump flow is on during filling; however, no flow reaches the suppressor or auxiliary electrolytic device.

6. Verify that the **Automatically turn on with pump** option is not selected on the ICS-2100 touch screen **SUPPRESSOR** page (see [Section B.9](#)). Disabling this option lets you turn on the pump, without automatically turning on the suppressor.
7. From the ICS-2100 Control panel in Chromeleon or the 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 CO₃ Mixer with Carbonate/Bicarbonate Eluent

Figure 5-71 illustrates the liquid flow path through the eluent generator components during initial filling of the EGC CO₃ Mixer with carbonate/bicarbonate eluent.

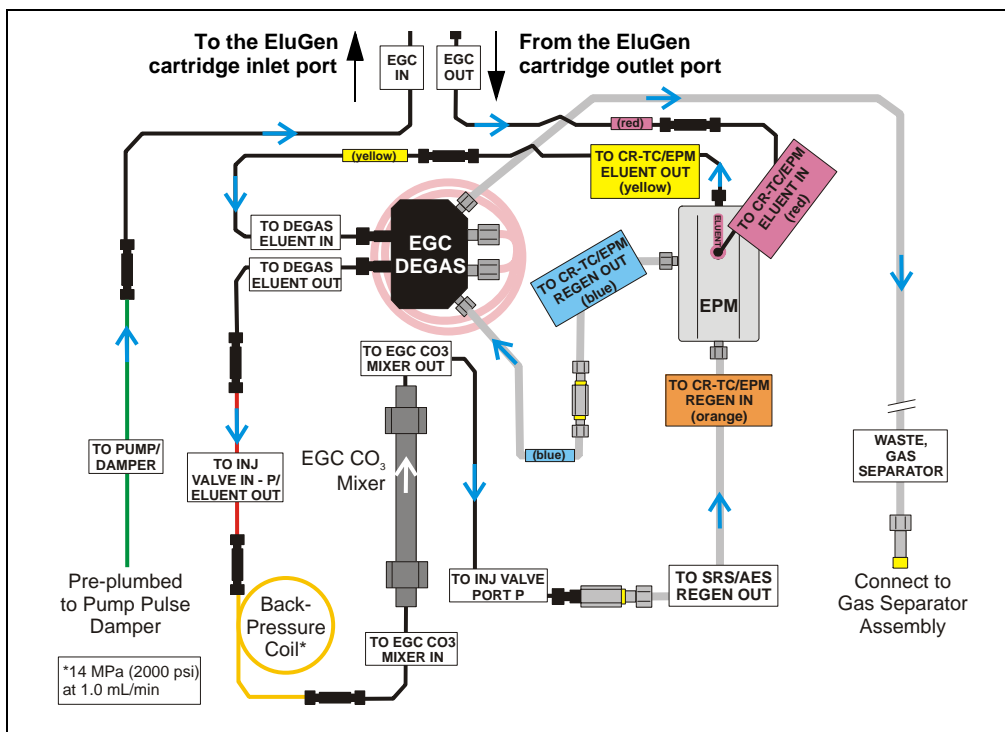


Figure 5-71. Plumbing for Initial Filling of the EGC CO₃ Mixer with Carbonate/Bicarbonate

1. Locate the following items in the ICS-2100 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 5-72](#)).
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.

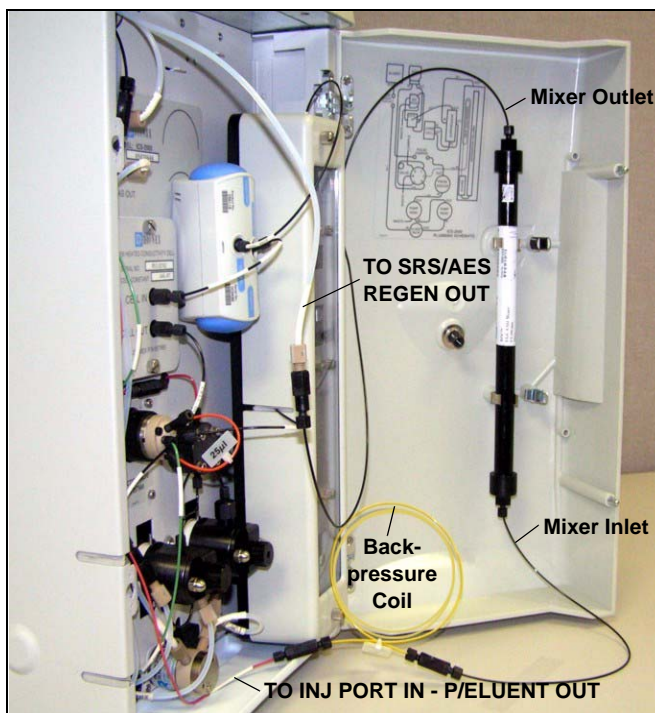


Figure 5-72. Mixer Connected Directly to Eluent Generator Outlet for Initial Filling

5. Verify that the suppressor and the auxiliary electrolytic device (if installed) are off.

IMPORTANT

To avoid damaging the suppressor and auxiliary electrolytic device (if installed), always turn them off before filling the mixer. The pump flow is on during filling; however, no flow reaches the suppressor or auxiliary electrolytic device.

6. Verify that the **Automatically turn on with pump** option is not selected on the touch screen **SUPPRESSOR** page (see [Section B.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.

5.23 Replacing the EGC Holder and Degas Assembly

5.23.1 Disconnecting and Removing the EluGen Cartridge

1. Turn off the power to the ICS-2100.
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 CO₃ 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-2100 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-Kartusche enthält eine korrosive Base (KOH, LiOH oder NaOH), oder eine korrosive Säure (MSA). Tragen Sie daher beim Umgang mit der Kartusche eine Schutzbrille und Handschuhe.

4. Remove the **EGC VENT** line (see [Figure 5-73](#)) 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.

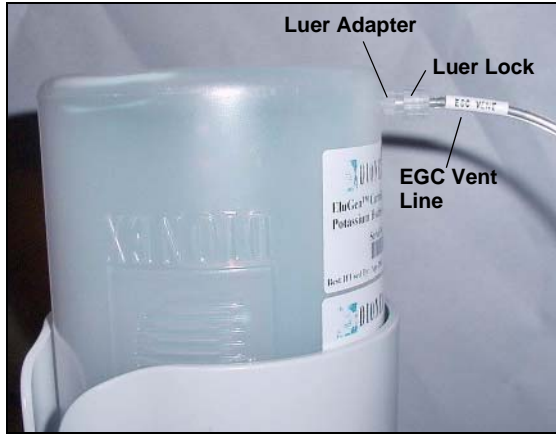


Figure 5-73. EluGen Cartridge Vent Line and Luer Fitting

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-2100 (see [Figure 5-36](#)).



Figure 5-74. 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 5-75](#)) to remove them from the ICS-2100.



Figure 5-75. Top Cover Tubing Chase

11. If a CR-TC is installed, go on to [Section 5.23.2](#).
12. If an EPM is installed, go on to [Section 5.23.3](#).
13. If neither a CR-TC or EPM is installed, go on to [Section 5.23.4](#).

5.23.2 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 5-59](#)).

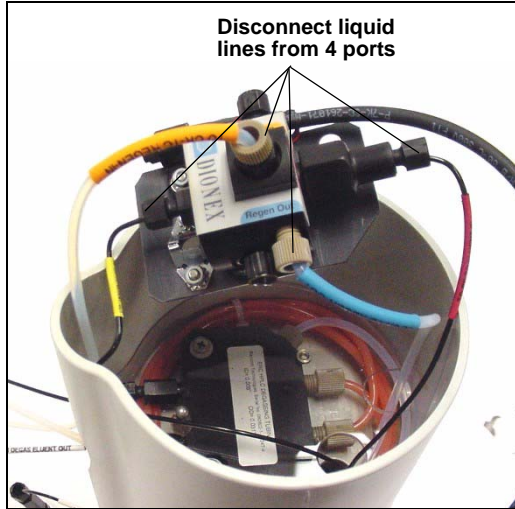


Figure 5-76. Disconnecting CR-TC Liquid Lines

4. Turn the new holder upside down (see [Figure 5-77](#)) 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.

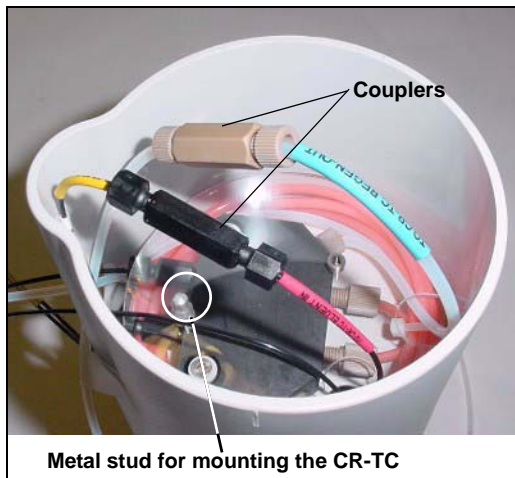


Figure 5-77. EGC Holder (upside down)

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 5-78](#)).

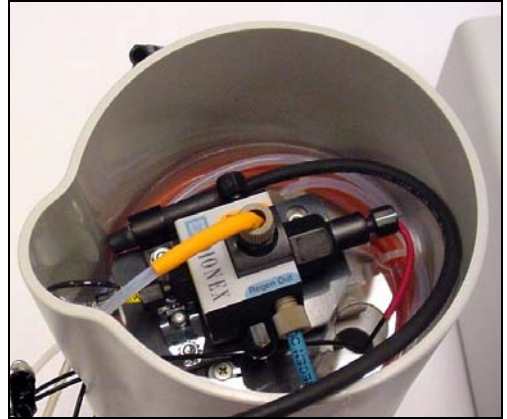


Figure 5-78. CR-TC Installed in Holder

6. Feed the CR-TC cable through the slot on the side of the EGC holder (see [Figure 5-79](#)).



Figure 5-79. CR-TC Cable

7. Turn the EGC holder right side up and set it on top of the ICS-2100.
8. Direct the **WASTE, GAS SEPARATOR** line from the top of the ICS-2100 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-2100 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 5.23.5](#).

5.23.3 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 5-80](#)).

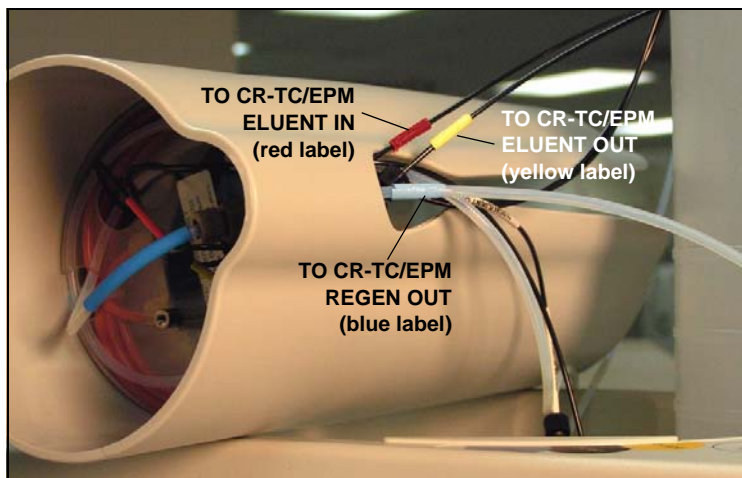


Figure 5-80. TO CR-TC/EPM Lines Outside of Holder

5. Turn the new EGC holder upside down (see [Figure 5-81](#)).

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 5-81. 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-2100.
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-2100 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 CO₃ 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-2100 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 5.23.5](#).

5.23.4 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-2100.
2. Feed the following liquid lines through the tubing chase to the ICS-2100 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 CO₃ 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-2100 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 5.23.5](#).

5.23.5 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 5-82](#)).
3. Remove the coupler and connect the **EGC OUT** line to the EluGen cartridge **OUTLET** port.

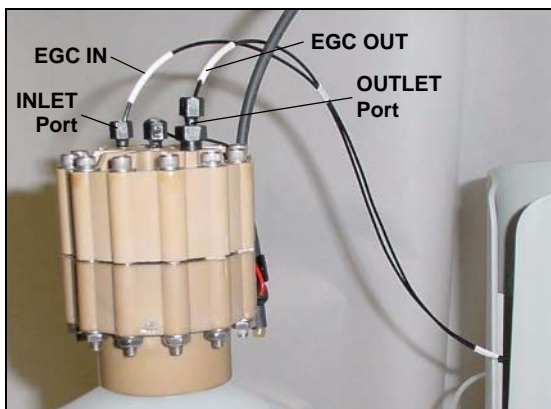


Figure 5-82. EluGen Cartridge Inlet and Outlet Port Connections

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).

Remove the cap from the luer adapter on the EluGen cartridge vent opening and re-connect the **EGC VENT** line.

A.1 Electrical

| | |
|-------------------|---|
| Main Power | 100 to 240 Vac, 50 to 60 Hz (Auto-sensing power supply; no manual voltage or frequency adjustment required) |
| 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 | 24.5 kg (54 lb) |
| Decibel Level | <52 dBA |
| Control Modes | Full control through front panel and Chromeleon software; alternative control through TTL or relay closure (two relay outputs, two TTL outputs, four programmable inputs) |
| USB Communication Protocol | One USB input; one built-in USB hub with two outputs |

A.3 Environmental

| | |
|------------------------------|---|
| Operating Temperature | 4 to 40 °C (40 to 104 °F); cold room-compatible (4 °C) as long as system power remains on |
| Operating Humidity | 5% to 95% relative humidity, noncondensing |
| Operating Pressure | 35 MPa (5000 psi) maximum liquid path (tubing, valve, columns, etc.) |

A.4 Front Panel

| | |
|-------------------------|---|
| Power LED | On when power is present; off when no power is present |
| LCD Touch Screen | ¼ VGA (320 x 240 pixels) liquid crystal display with touch screen, which provides: <ul style="list-style-type: none">• Local control of ICS-2100 components: pump, detector, suppressor, injection valve, eluent generator, CR-TC, column heater, vacuum degas, TTLs, and relays• Display of conductivity data plot and operating status• Local control of calibration and diagnostic functions |

A.5 Analytical Pump and Fluidics

| | |
|---------------------------|---|
| Type | Serial dual-reciprocating pistons, microprocessor-controlled constant stroke, variable speed |
| Construction | Chemically inert, metal-free PEEK pump heads and flow paths compatible with aqueous eluents of pH 0 to 14 and reversed-phase solvents |
| Operating Pressure | 0 to 35 MPa (0 to 5000 psi) |
| Flow Rate Range | 0.00 to 5.00 mL/min in 0.01 mL/min increments without changing pump heads |
| Flow Precision | <0.1% typical |

| | |
|-------------------------------|--|
| Flow Accuracy | <0.1% typical |
| Pressure Ripple | <1% at 13.8 MPa (2000 psi) and 1.0 mL/min |
| Eluent On/Off Valve | Standard feature |
| Piston Seal Wash | Dual-pump head; wash can be continuous when connected to rinse solution supply |
| Pressure Alarm Limits | <ul style="list-style-type: none">• Upper limit: 0 to 35 MPa or 0 to 5000 psi in one unit (MPa or psi) increments• Lower limit: Up to one unit lower than upper limit |
| Vacuum Degas | Optional feature; automatic control |
| Eluent Bottles | Polypropylene |
| Eluent Bottle Pressure | Not required |
| Leak Detection | Built-in optical sensor |

A.6 Eluent Generation

| | |
|--------------------------------------|--|
| Eluent Types | KOH, LiOH, NaOH, K ₂ CO ₃ , K ₂ CO ₃ /KHCO ₃ , MSA |
| Gradient Profiles | Optional feature; combination of unlimited number of linear, convex, and concave positive and negative gradient profiles |
| Concentration Increments | 0.01 mM |
| Flow Rate | 0.1 to 3.0 mL/min |
| Maximum Operating Pressure | 21 MPa (3000 psi) |
| Maximum Solvent Concentration | <ul style="list-style-type: none"> • Anion: 25% methanol • Cation: No solvents |
| Concentration Range | Dependent on the EluGen cartridge type, the cartridge configuration (single or linked dual), and the flow rate. Refer to Table A-6 and Table A-7 . |

| EluGen Cartridge | Eluent Concentration Range |
|--------------------------------|--|
| K ₂ CO ₃ | 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-6. Eluent Concentration Ranges for Single-Cartridge Configurations

| EluGen Cartridges | Eluent Concentration Range | Comment |
|--|--|--|
| K ₂ CO ₃ /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-7. Eluent Concentration Ranges for Linked Dual-Cartridge Configurations

A.7 Detector Electronics

| | |
|---------------------------------|--|
| Type | Microprocessor-controlled digital signal processor |
| Cell Drive | 8 kHz square wave |
| Detector Linearity | 1% up to 1 mS |
| Resolution | 0.00238 nS/cm |
| Full-Scale Output Ranges | <ul style="list-style-type: none">• Digital signal range: 0 to 15,000 μS• Analog signal range: 0 to 15,000 μS |
| Electronic Noise | ± 0.1 nS/cm when background conductivity is 0 to 150 μ S/cm ± 2 nS/cm when background conductivity is 151 to 3200 μ S/cm |
| Filter | Rise times from 0 to 10 s; user-selectable |
| Temperature Compensation | Fixed at 1.7% per 1 $^{\circ}$ C at cell temperature |
| Temperature Range | Ambient +7 $^{\circ}$ C; 30 to 55 $^{\circ}$ C |
| Temperature Stability | <0.01 $^{\circ}$ C |

A.8 Conductivity Cell with Heat Exchanger

| | |
|--|---|
| Cell Body | Chemically inert polymeric material |
| Cell Electrodes | Passivated 316 stainless steel; compatible with MSA |
| Cell Volume | <1 μ L |
| Maximum Cell Operating Pressure | 10 MPa (1500 psi) |
| Heat Exchanger | Inert, tortuous path for low axial dispersion |

Operating Temperature 30 to 55 °C (86 to 130 °F); must be at least 7 °C above the ambient temperature

A.9 Injection Valve

Injection Valve 6-port, 2-position Rheodyne valve with PEEK wetted components; electrically-activated

A.10 Auxiliary Valve (Optional)

Auxiliary Valve 6-port or 10-port, 2-position Rheodyne valve with PEEK wetted components; electrically-activated

A.11 Vacuum Degas Assembly

Channel Single-channel degas channel with degas membranes
Pump Dual-stage diaphragm vacuum pump
Materials Wetted materials, PEEK, Teflon

A.12 Column Heater

Operating Temperature 30 to 60 °C (86 to 140 °F); minimum 5 °C above ambient temperature. Settable range is equal to working range.
Temperature Stability ± 0.5 °C at sensor
Temperature Accuracy ± 0.5 °C at sensor, at 40 °C
Maximum Column Lengths 250 mm analytical column with 50 mm guard column

A.13 Auxiliary Power Supply (Optional)

Constant Current 200 mA maximum
Voltage 35 V maximum

A.14 Suppressors

| | |
|---|--|
| Chemical Suppression | 2 mm and 4 mm anion and cation, membrane suppression bed types |
| Displacement Chemical Regeneration | 2 mm and 4 mm anion and cation, membrane suppression bed types |
| Electrolytic Suppression | <ul style="list-style-type: none"> • Self-Regenerating: 2 mm and 4 mm anion and cation; both membrane and MonoDisk™ suppression bed types available • Self-Regenerating with External Water Mode: 2 mm and 4 mm anion and cation; both membrane and MonoDisk suppression bed types available |
| Current Control Range | <p>SRS (4 mm): 0 to 300 mA in 1 mA increments</p> <p>SRS (2 mm): 0 to 100 mA in 1 mA increments</p> <p>AES: 0 to 150 mA in 1 mA increments</p> <p>CMD: 0 to 500 mA in 1 mA increments</p> <p>SRN: 0 to 500 mA in 1 mA increments</p> |
| Salt Converter | 2 mm and 4 mm versions available |
| AMMS ICE® | 2 mm and 4 mm versions available |
| Carbonic Acid Removal for Anions | <p>ASRS® 300 with CRD 200 for hydroxide eluents</p> <p>ASRS 300 with CRD 300 for carbonate eluents</p> |
| Non-Suppressed | Supported |
| Suppressor Wear Parts | None; peristaltic pump and inline filters not required |
| Suppression Capacity | <p>Anion SRS 300 (4 mm): 200 µeq/min</p> <p>Cation SRS 300 (4 mm): 110 µeq/min</p> <p>Anion SRS 300 (2 mm): 50 µeq/min</p> <p>Cation SRS 300 (2 mm): 37.5 µeq/min</p> <p>Anion MMS 300 (4 mm): 150 µeq/min</p> <p>Cation MMS 300 (4 mm): 150 µeq/min</p> <p>Anion MMS 300 (2 mm): 37.5 µeq/min</p> <p>Cation MMS 300 (2 mm): 37.5 µeq/min</p> <p>Anion AES: 25 µeq/min</p> <p>Cation AES: 25 µeq/min</p> |

| | |
|--------------------|-----------------------------|
| Void Volume | SRS 300 (4 mm): <50 µL |
| | SRS 300 (2 mm): <15 µL |
| | MMS 300 (4 mm): <50 µL |
| | MMS 300 (2 mm): <15 µL |
| | AMMS ICE 300 (4 mm): <50 µL |
| | AMMS ICE 300 (2 mm): <15 µL |
| | Anion AES: <35 µL |
| | Cation AES: <35 µL |

A.15 Autosampler

| | |
|--|--|
| Automation Using Autosampler | Dionex AS, AS-DV, or AS-HV Autosampler (or third-party autosampler) |
| Sequential/Simultaneous Injection | May be available; depends on autosampler capabilities |
| Automated Dilution | Available with AS Autosampler <ul style="list-style-type: none">• Dilution Factor: 1:1 to 1:1000• Dilution Time: 15 seconds with sample overlap |
| Online Sample Degassing | Optional; CRD 200/300 required |
| Online Filtration | Available with an AS-DV Autosampler or an inline filter |
| Automation Flexibility | High, using Chromeleon software and post-run features |

A.16 System Software

| | |
|--|--|
| Software | Chromeleon Chromatography Management System or Chromeleon Xpress; validated for use with Windows Vista or Windows XP |
| Automated Procedure Wizards | Standard feature |
| System Smart Startup and Shutdown | Standard feature |

| | |
|--|---|
| System Wellness and Predictive Performance | Standard feature |
| Data Trending Plots | Numerical device parameters can be plotted |
| Virtual Column Simulator | <ul style="list-style-type: none">• Evaluation mode: Standard feature• Isocratic and gradient modes: Optional features |
| Application Templates | Standard feature |
| Automation Support for Third-Party Vendors | Fully controls over 300 different instruments from more than 30 manufacturers, including GC, HPLC, and MS |
| 3D Software for PDA, MS, and ED | Optional feature |
| Customizable System Control Panels | Standard feature |
| System Status Virtual Channels | Standard feature |
| Power Failure Protection | Standard feature |
| Sequential Injection | Standard feature |
| System Trigger Commands and Conditionals | Standard feature |
| Daily Audit Trail | Standard feature |
| Sample Audit Trail | Standard feature |
| Multiple Network Control and Network Failure Protection | Optional feature |

| | |
|---|---|
| Storage of System Calibration Settings | Factory, current, and previous calibration values are stored; the user can reset current values to factory or previous values |
| Customized Reporting | Standard feature; unlimited report workbooks |
| Automated System Qualification | Detailed, comprehensive qualification reports |

B • Touch Screen Operation

The LCD touch screen on the ICS-2100 front panel allows local control of most ICS-2100 functions. This chapter describes how to operate the ICS-2100 from the touch screen.

When the ICS-2100 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 B-1](#)) is displayed. The **HOME** page provides controls for all normal, daily operation of the ICS-2100.

B.1 Using the Touch Screen

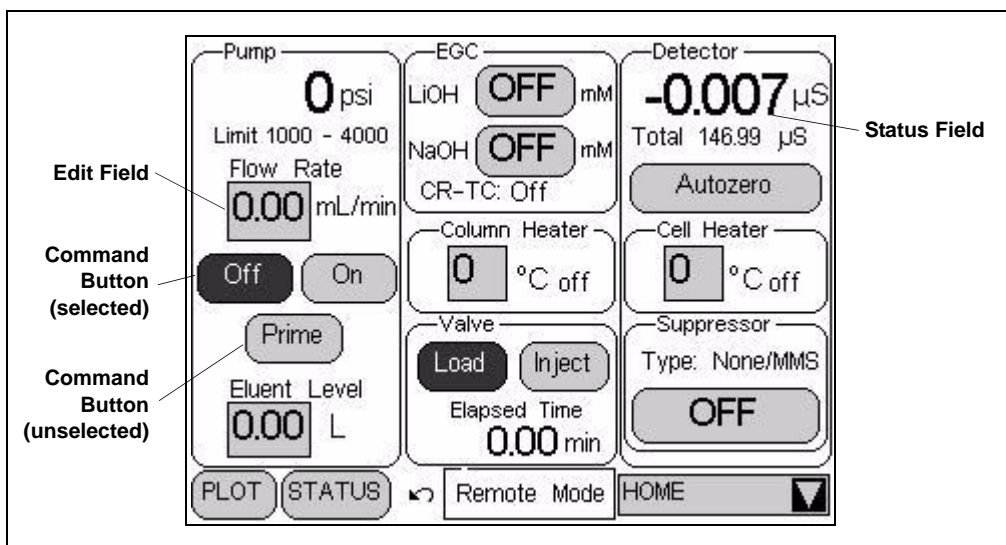






Figure B-1. ICS-2100 Touch Screen Home  Page

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

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- 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 B-2](#)). Use the keypad to enter the desired numerical value for the field and then touch the **ENTER** button.

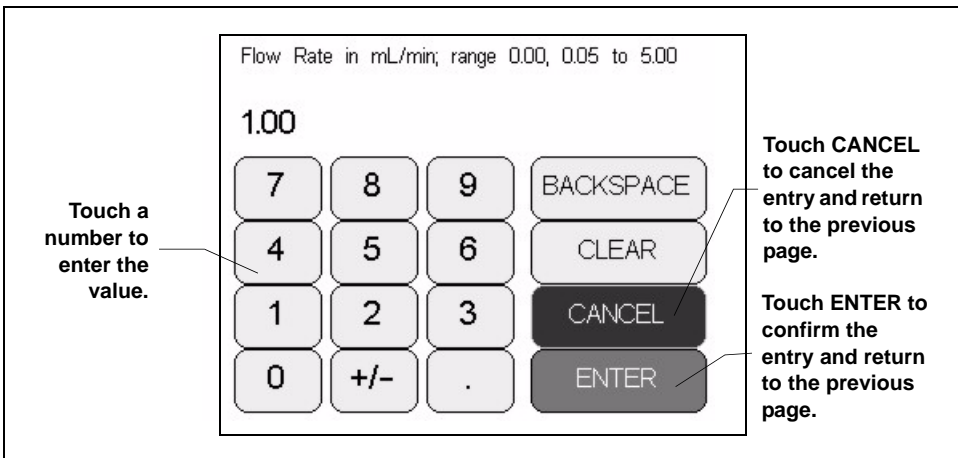



Figure B-2. Number Keypad

- Touching the page name (for example, ) in the bottom right corner opens a menu of pages (see [Figure B-3](#)).

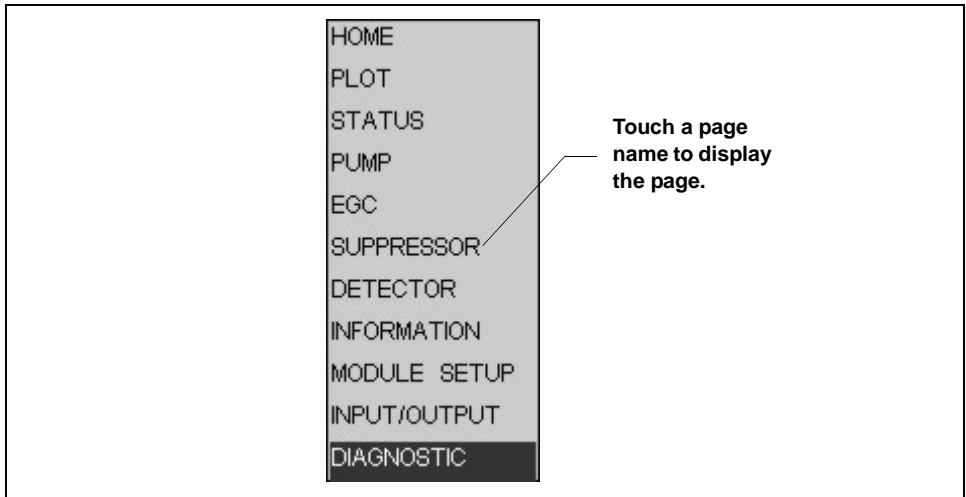


Figure B-3. ICS-2100 Touch Screen Menu of Pages

- Touching a page name on the menu of pages displays the selected page. For example, touching **SUPPRESSOR** displays the **SUPPRESSOR** page (see [Figure B-4](#)).

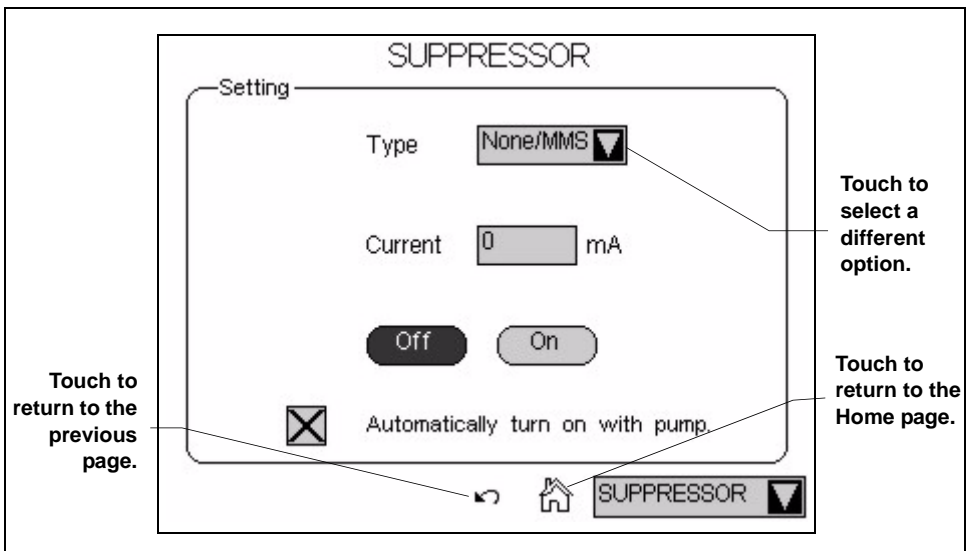




Figure B-4. Suppressor Page

- Touching  returns you to the **HOME** page.
- Touching  opens a list of options (see [Figure B-5](#)).

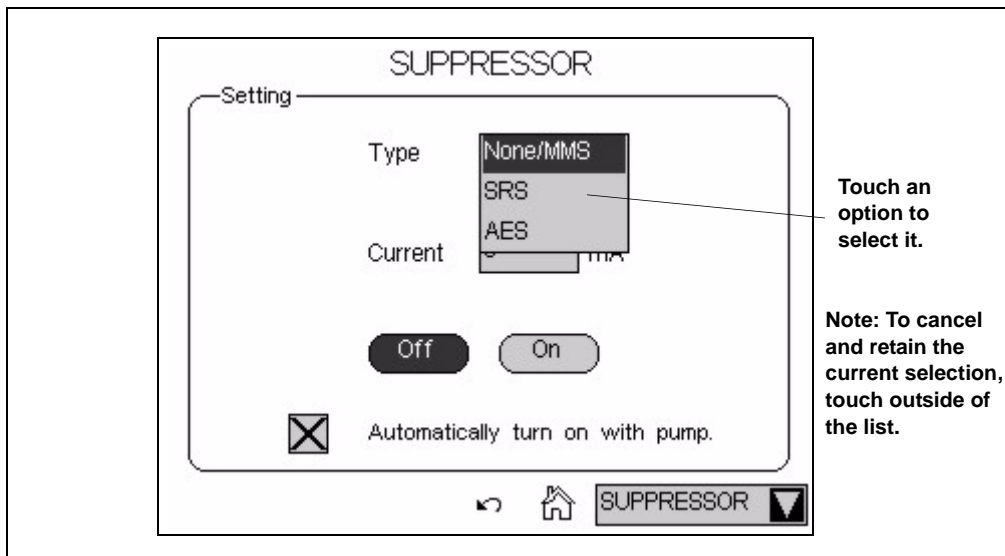


Figure B-5. Suppressor Page: Selecting an Option

B.2 Using the Touch Screen with Chromeleon

Remote Mode When the ICS-2100 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-2100 is connected to Chromeleon, you can:

- View all ICS-2100 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 B.5](#) for details.

To restore touch screen (local) control, clear the **Connected** check box on the Chromeleon Control panel.

B.3 Overview of ICS-2100 Touch Screen Pages

Figure B-6 illustrates the organization of the ICS-2100 touch screen pages.

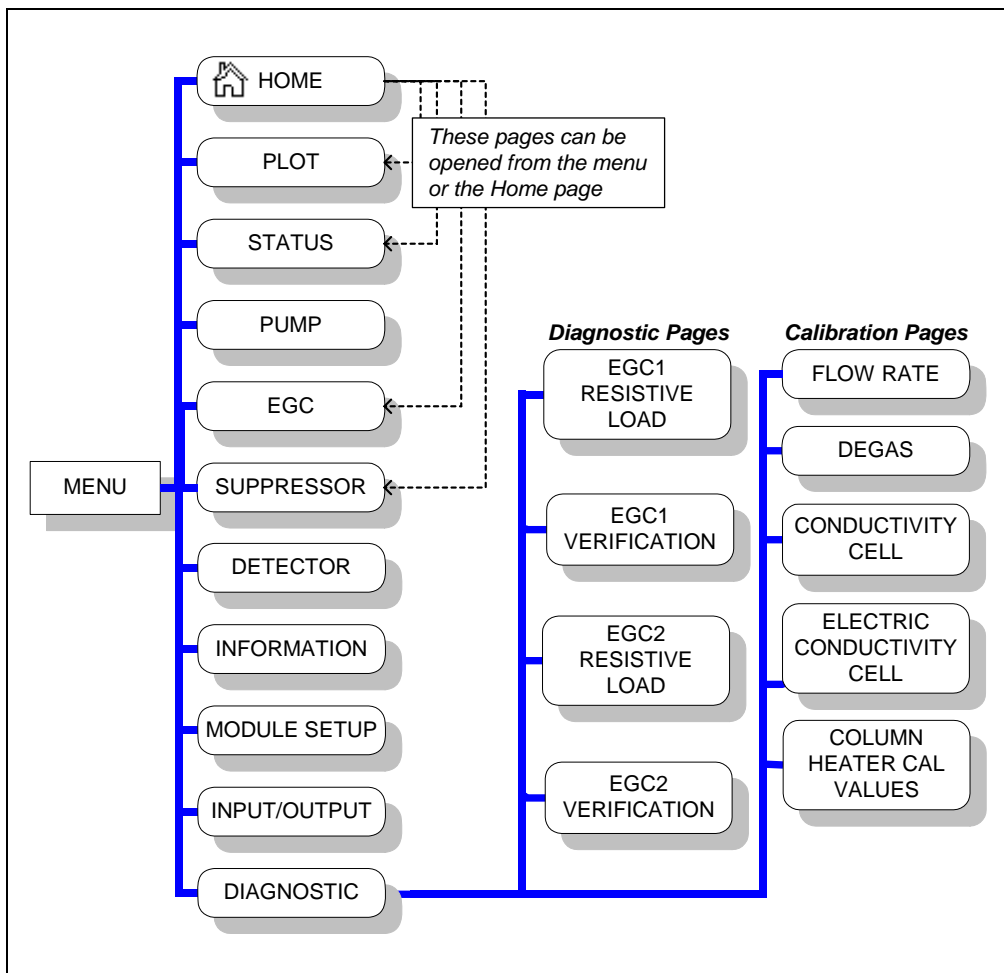


Figure B-6. Overview of ICS-2100 Touch Screen Pages

B.4 Home Page

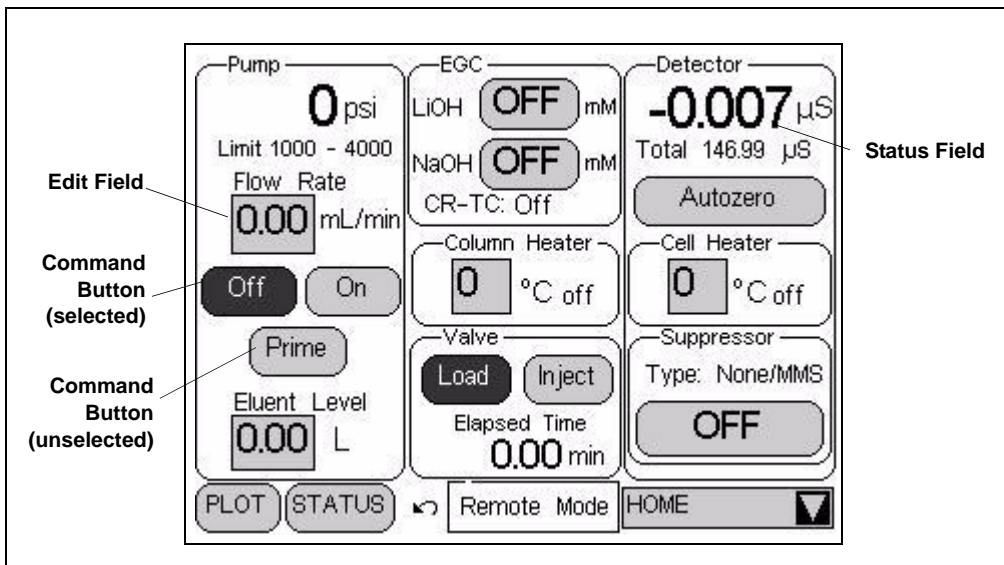
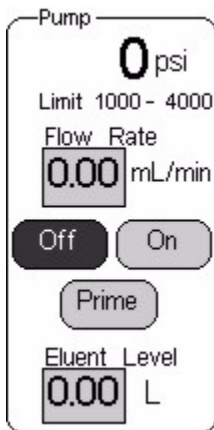


Figure B-7. ICS-2100 Touch Screen Home  Page

B.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 B.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 4.2](#) for troubleshooting information. See [Section B.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.

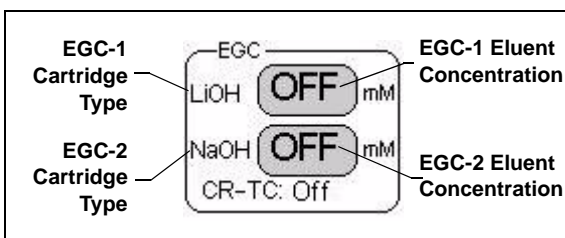
Eluent Level

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-2100 determines the eluent usage by monitoring the flow rate and the length of time the pump is on. The ICS-2100 updates the **Eluent Level** field as the eluent is depleted. 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-2100 does not automatically detect when the reservoir is filled, nor when it is empty.

B.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-2100 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-2100 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 B.8](#)).

NOTE When the EGC-2 is configured as an auxiliary power supply, the EGC-2 cartridge type field displays **AUX** and the EGC-2 eluent concentration field displays the actual current (in mA) of the auxiliary power supply.

B.4.3 Home Page Column Heater

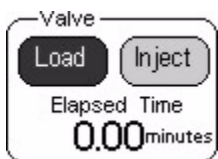


The temperature of the column heater can be controlled to between 30 and 60 °C. For optimal performance, set the column heater to at least 5 °C above the ambient temperature. To set the temperature, touch the **Column**

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

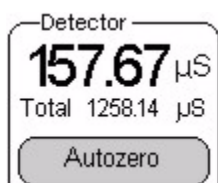
B.4.4 Home Page Injection Valve Controls



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 2.4.6](#).

The **ELAPSED TIME** field displays the amount of time since the last injection.

B.4.5 Home Page Detector Controls



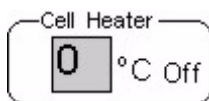
Conductivity Readings

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 B.12](#)).

Cell Heater Controls

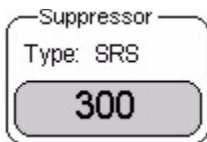


The temperature of the cell can be set to between 30 °C and 55 °C, but must be at least 7 °C above the ambient temperature. To set the temperature, touch the **Cell Heater** field and enter the desired temperature on the number pad.

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

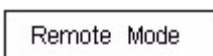


The **Suppressor** controls indicate the suppressor current setting and the type of suppressor installed.

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 B.9](#)).

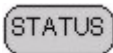
B.4.6 Other Home Page Controls



This field displays **Remote Mode** when the ICS-2100 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 B.5](#) for details.



Opens the **STATUS** page, which displays the status of various operating parameters. See [Section B.6](#) for details.

B.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-2100 is under either local or computer control.

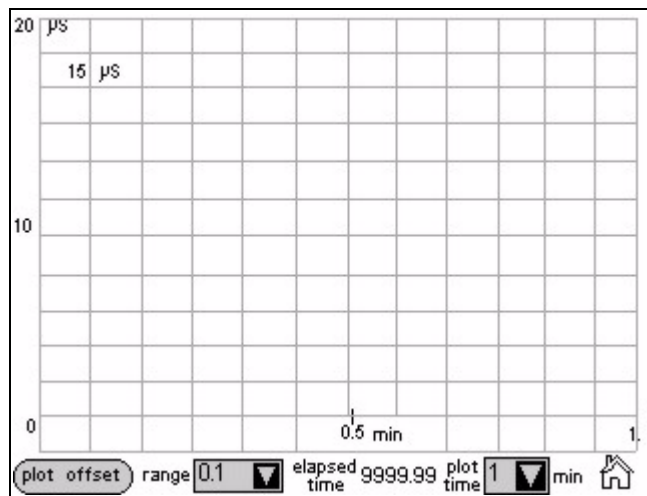


Figure B-8. Plot Page

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).

B.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.

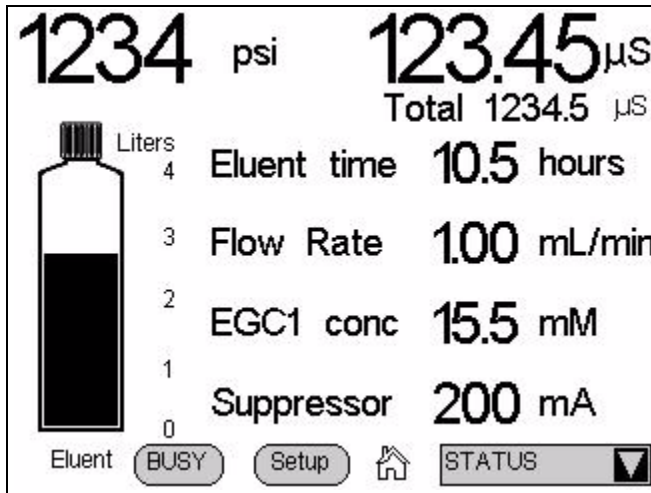


Figure B-9. Status Page

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 B.4.1](#)). The ICS-2100 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-2100 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 B-9](#) shows the default parameters: **Eluent time**, **Flow rate**, **EGC conc**, and **Suppressor**. To select different parameters, touch the **Setup** button. See [Section B.6.1](#) for details about how to change the status parameters, and [Section B.6.2](#) for a description of each parameter.
- Touching the **Busy** button displays the **BUSY** page (see [Figure B-10](#)).



Figure B-10. Busy Page

B.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 B-11](#)).

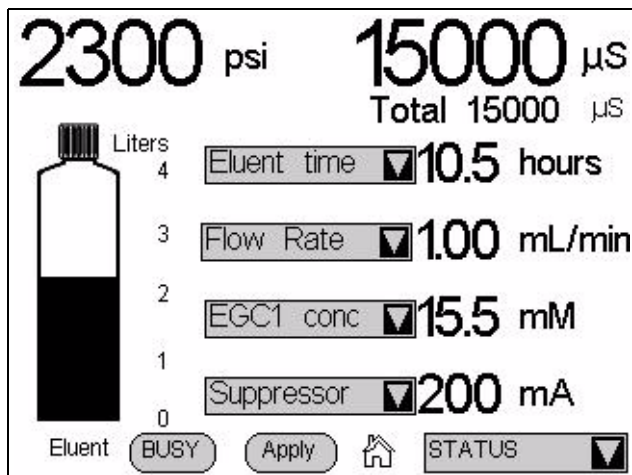


Figure B-11. Status Page Setup

2. Touch the down arrow next to the field you want to change. A list of the available status parameters appears (see [Figure B-12](#)).

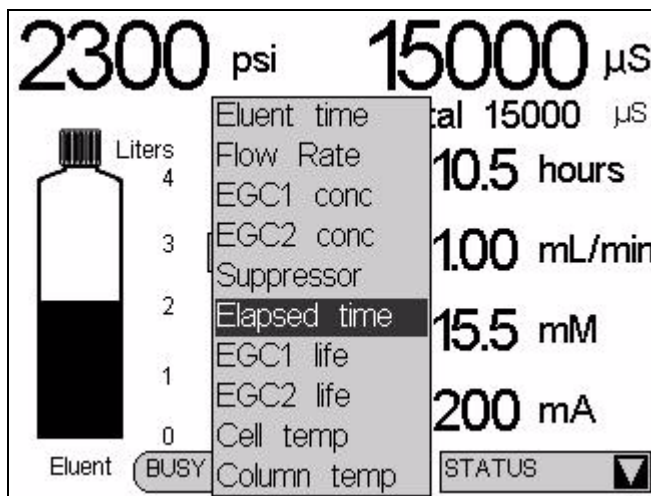


Figure B-12. Status Page Parameter List

3. Touch the parameter you want to display.
4. When finished, touch the **Apply** button.

B.6.2 Status Parameter Details

| Status Parameter | Description |
|---------------------|--|
| Eluent time | The number of hours the eluent supply will last, if the pump runs continuously at the current flow rate. |
| Flow rate | The actual flow rate currently output by the pump. |
| EGC1 conc | The actual concentration of eluent currently being generated by the EluGen cartridge (EGC1 or EGC2). |
| EGC2 conc | |
| AUX PS | The actual auxiliary power supply current in mA. This field replaces the EGC2 conc field when the EGC-2 power supply is configured as an auxiliary power supply. |
| Suppressor | The actual current applied to the suppressor. |
| Elapsed time | The number of hours since the last injection. |

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| Status Parameter | Description |
|--------------------------------------|--|
| EGC1 life EGC2 life | The percentage of ions remaining in the EluGen cartridge (EGC1 or EGC2). When the EGC-2 power supply is configured as an auxiliary power supply, the EGC2 life field will display N/A . |
| Cell temp | The temperature of the cell heater (°C), followed by a status symbol (=, ↑, or ↓). |
| Column temp | The temperature of the column heater (°C), followed by a status symbol (=, ↑, or ↓). |

B.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.

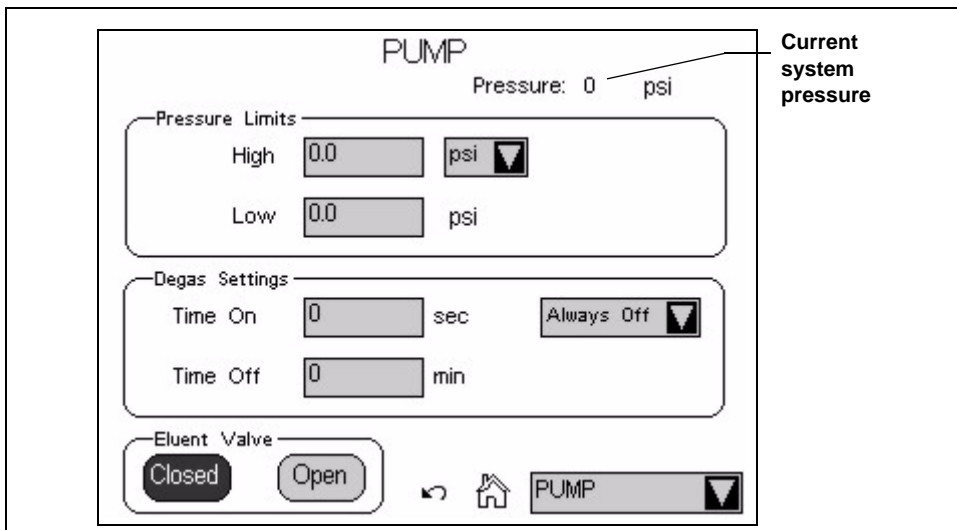


Figure B-13. ICS-2100 Touch Screen Pump Page

B.7.1 Setting Pump Pressure Limits and Selecting the Pressure Unit

The first time the power to the ICS-2100 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-2100, 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 B-14](#)).

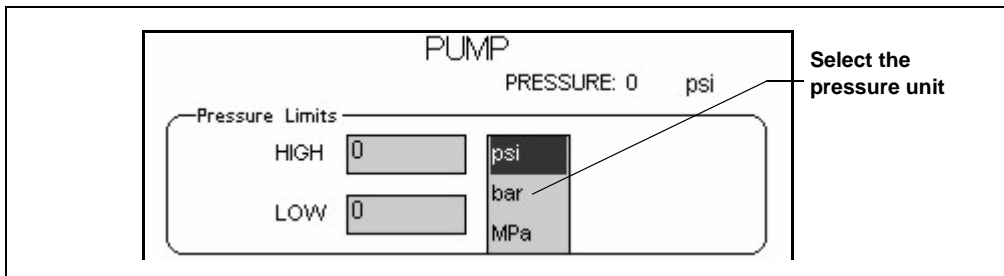


Figure B-14. Pump Page: Selecting the Pressure Unit

B.7.2 Setting Degas Operating Parameters (Optional)

By default, the ICS-2100 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 B-15](#)).

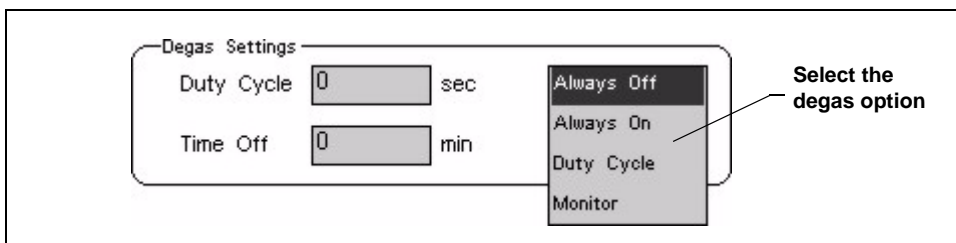


Figure B-15. Pump Page: Selecting Degas Options

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, 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-2100 monitors the degas pressure reading and turns the degas pump on and off as required.

B.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.

B.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.

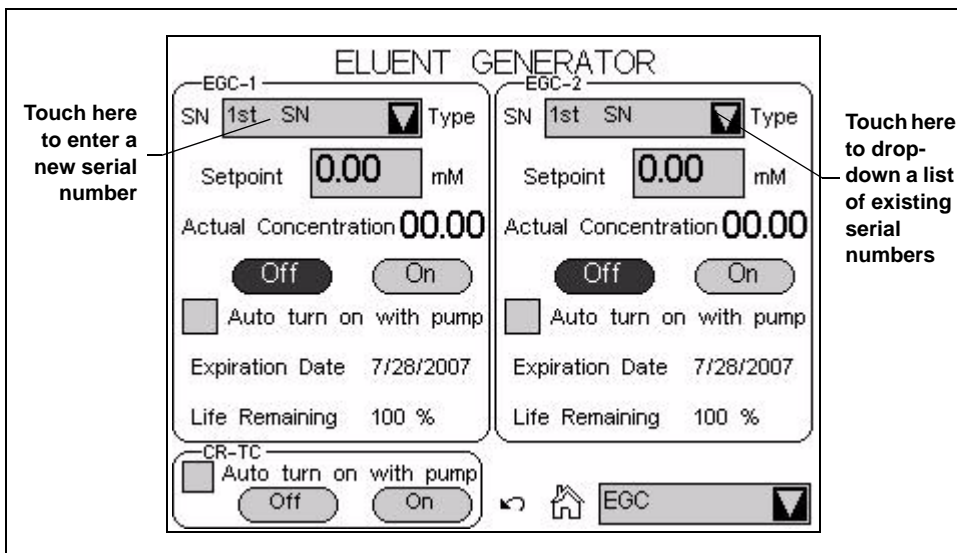


Figure B-16. Eluent Generator Page

B.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-2100, enter the serial number in the Chromeleon Server Configuration, 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-2100 is not under Chromeleon control, enter the cartridge serial number by touching the **Serial Number** field on the **ELUENT GENERATOR** page (see [Figure B-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.

NOTE When the EGC-2 power supply is configured as an auxiliary power supply, the EGC-2 **Serial Number** field displays **None**.

B.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-2100 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.

NOTE When the EGC-2 power supply is configured as an auxiliary power supply, the EGC-2 Setpoint and Actual Concentration fields display zeros.

B.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.

NOTE When the EGC-2 power supply is configured as an auxiliary power supply, the EGC-2 Off and On buttons are not functional and the field always displays Off.

- To automatically control the auxiliary power supply simultaneously with the pump flow, select **Auto turn on with pump** for the EGC-2 and configure a TTL output for control of this function.

B.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.

NOTE When the EGC-2 power supply is configured as an auxiliary power supply, the EGC-2 **Expiration Date** field is blank.

- **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.

NOTE When the EGC-2 power supply is configured as an auxiliary power supply, the EGC-2 Life Remaining field is blank.

- **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.

B.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 B-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.

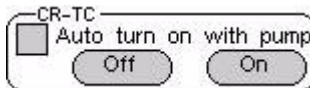


Figure B-17. Eluent Generator Page: CR-TC Controls

B.9 Suppressor Page

Use the **SUPPRESSOR** page to specify the type of suppressor installed in the ICS-2100, 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.

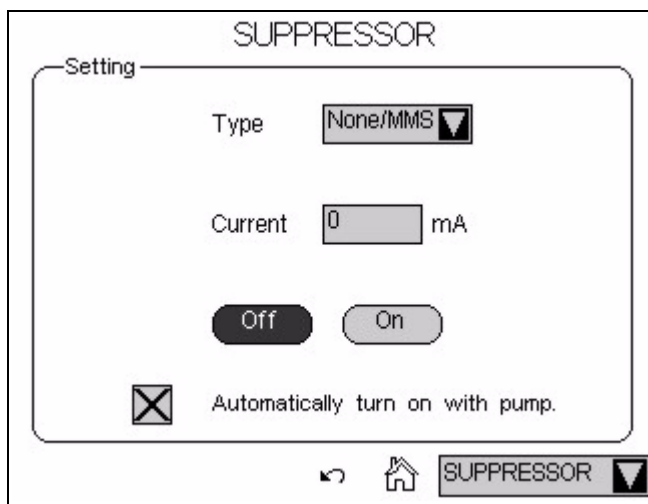


Figure B-18. Suppressor Page

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-2100, 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.

B.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 image shows a touch screen interface for the 'DETECTOR' page. At the top, the word 'DETECTOR' is displayed in a large font. Below it, there 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 showing 'Normal'.
- Analog Out:** A rounded rectangular box containing four settings:
 - Output:** A dropdown menu showing 'Normal'.
 - % Offset:** A numeric input field containing '0'.
 - Polarity:** A dropdown menu showing '+'.
 - Range:** A numeric input field containing '1' followed by a dropdown arrow and the unit 'µS'.

At the bottom of the screen, there are three icons: a back arrow, a home icon, and a dropdown menu labeled 'DETECTOR'.

Figure B-19. Detector Page

B.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: $(5 \text{ sec}) 25\% = 1.25 \text{ sec}$. 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 B-19](#)).

B.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.

B.10.3 Setting Analog Out Options

The analog output connector on the ICS-2100 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 B.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 B-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 215](#)) 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 (μS) of a full-scale detector response. For the ICS-2100, the full-scale voltage is 1000 mV. For example, if the range is 100 μS , then 1 μS is equal to 10 mV from the analog output. The range to use depends on the conductivity readings expected for the application.

B.11 Information Page

The **INFORMATION** page displays the version numbers of the ICS-2100 control programs (Moduleware and Boot Block), the serial number of the ICS-2100, and the options that are installed in the ICS-2100. The **INFORMATION** page is displayed at start-up. You can open the page from the menu of pages at any time.

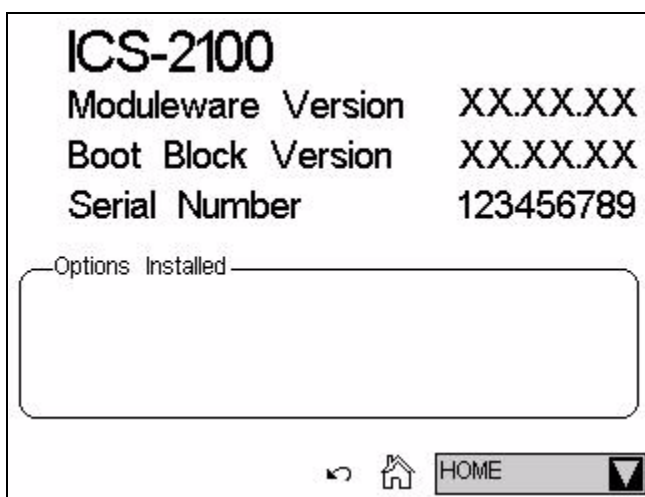


Figure B-20. Information Page

Moduleware is the firmware program installed in the ICS-2100 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-2100 power is turned on. It starts the Moduleware program.

B.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.

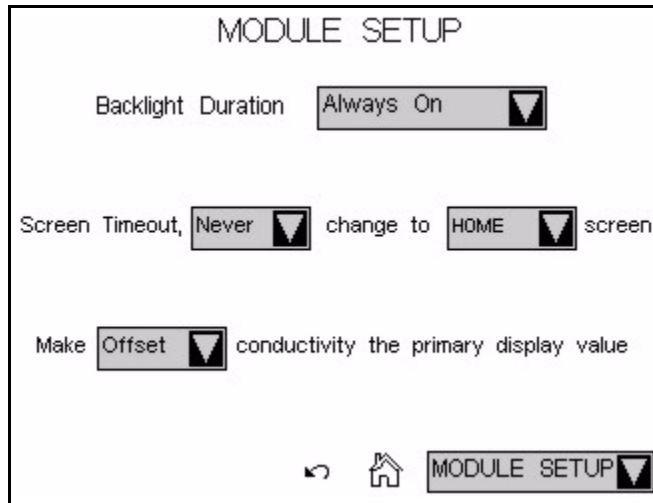
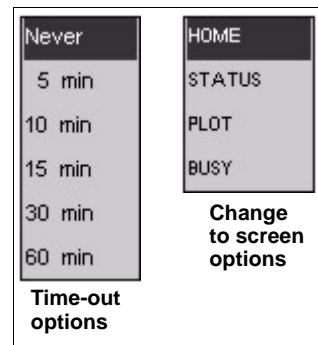


Figure B-21. Module Setup Page

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 B-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.



B.13 Input/Output Page

The **INPUT/OUTPUT** page provides control of the ICS-2100 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 C](#).

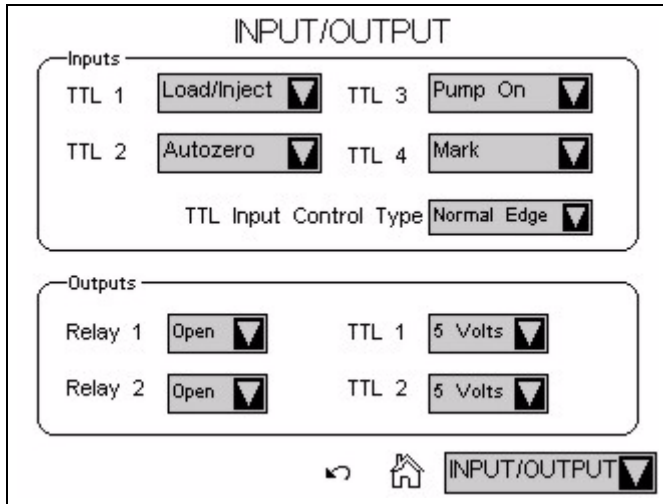


Figure B-22. Input/Output Page

B.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 B-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](#).

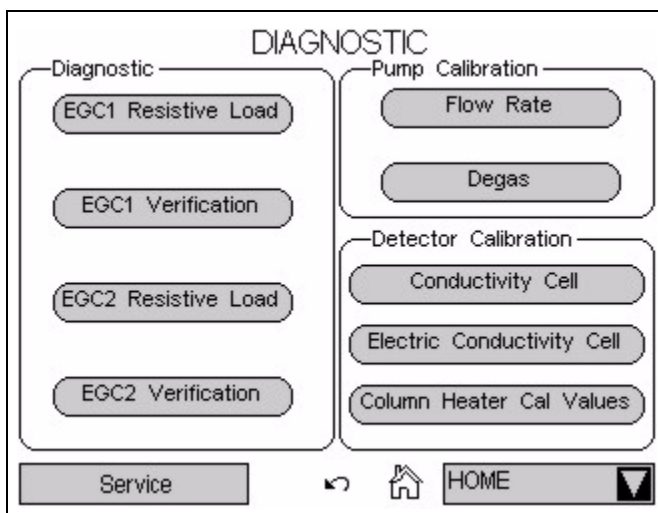


Figure B-23. System Diagnostic Menu Page

NOTE When the EGC-2 power supply is configured as an auxiliary power supply, pressing the **EGC2 Verification** button has no effect.

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.

C • TTL and Relay Control

C.1 TTL and Relay Connections

A 12-pin connector strip for TTL/relay control is located on the ICS-2100 rear panel. The connector provides two relay outputs, two TTL outputs, and four TTL inputs (see [Figure C-1](#)).

| Pin Function | Connector Position | Description |
|---------------------|--------------------|--|
| RELAY OUT 1 2 | 1 | Solid State Relay Contacts Output |
| | 2 | |
| | 3 | |
| | 4 | |
| TTL OUT (+) | 1 | 5 TTL Output 1 (1 k Ω pull up to +5, 100 mA sink) |
| | 2 | 6 TTL Output 2 (1 k Ω pull up to +5, 100 mA sink) |
| TTL IN (+) | 1 | 7 TTL Input 1 — Inject/Load |
| | 2 | 8 TTL Input 2 — Autozero |
| | 3 | 9 TTL Input 3 — Pump/Suppressor On |
| | 4 | 10 TTL Input 4 — Mark |
| TTL GND (-) | 1 | 11 Ground |
| | 2 | 12 Ground |

Note: The TTL input functions can be reassigned to different inputs.

Figure C-1. TTL and Relay Connector on Rear Panel

IMPORTANT

Relay loads in excess of 200 mA or with included power supplies over 60 V may damage the relay drivers on the CPU.

NOTE TTL 1 Input - Inject/Load applies only to the injection valve (not to the auxiliary valve, if installed).

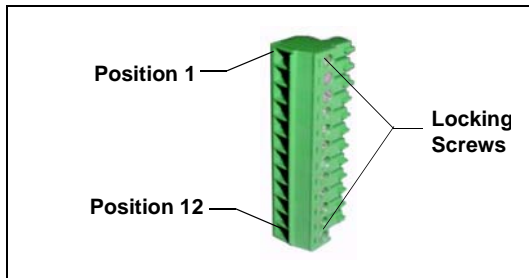
The outputs can be used to control functions in external devices such as an autosampler or another Dionex module. When connected to a controlling device, the inputs can be programmed to perform the following ICS-2100 functions:

- 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)
- Automatically turn on the optional auxiliary power supply simultaneously with the pump flow
- 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 C-2](#)) in the ICS-2100 Ship Kit (P/N 064375).
2. Follow these basic steps to connect the TTL or relays.



- 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 C-1](#) or the label on the ICS-2100 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.

IMPORTANT

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-2100 rear panel.
- c. Connect the wires from the ICS-2100 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 C.1.1](#)).

C.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-2100 icon under the timebase. Select the **TTL Inputs** tab (see [Figure C-3](#)).

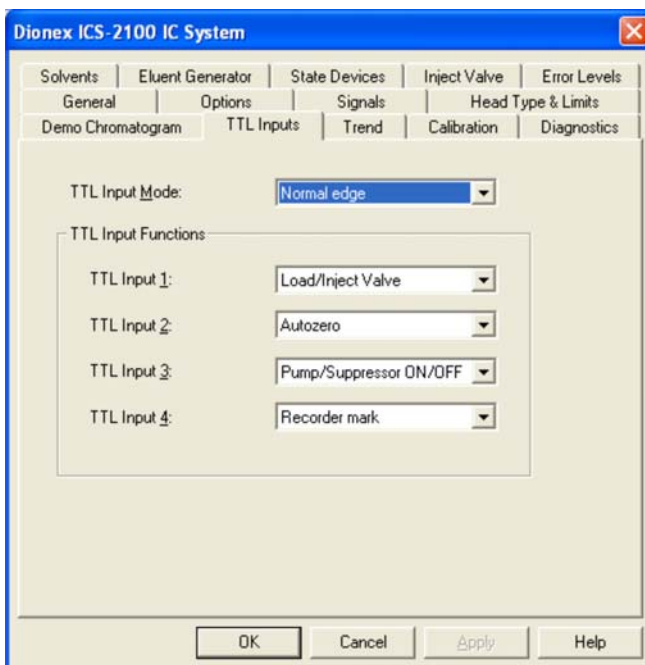


Figure C-3. ICS-2100 Server Configuration Properties: TTL Inputs

To select TTL input functions and the control type from the touch screen, go to the **INPUT/OUTPUT** touch screen page (see [Figure C-4](#)).

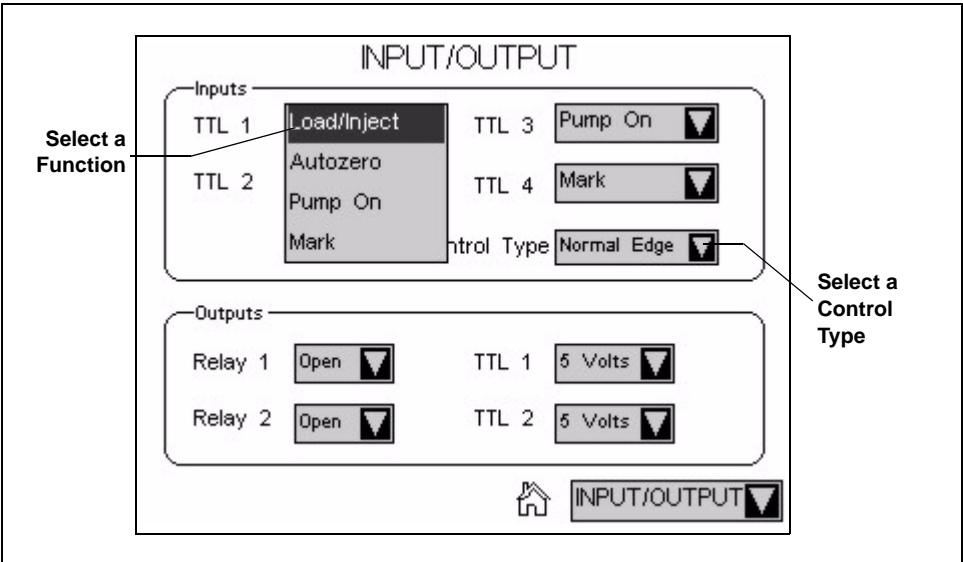
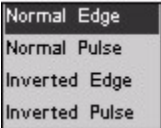


Figure C-4. Input/Output Page: Selecting TTL Functions

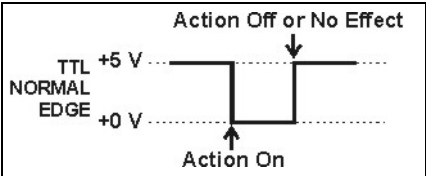
TTL Input Control Types



The ICS-2100 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.

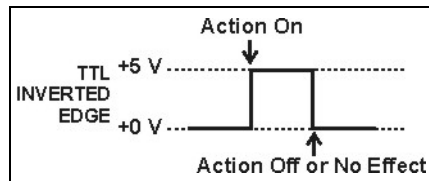
If the device connected to the ICS-2100 does not send a normal edge signal, select the appropriate control type. Refer to the documentation provided with the controlling device and the information below to select the correct type.

- *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.

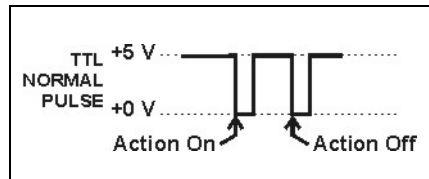


The action of the positive (rising) edge depends on the function: For the **Load/Inject** function, the rising edge switches the injection valve to the Inject position. For the **Pump On** function, the rising edge turns off the pump (and suppressor). For **Autozero** and **Mark**, the rising edge has 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.

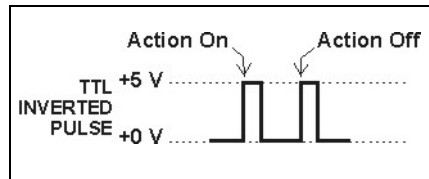


- *Normal Pulse*: In normal pulse operation, the negative (falling) edge of the TTL signal is the active edge and the positive (rising) edge is ignored.



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.



C.2 Controlling TTL and Relay Outputs

The ICS-2100 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.

IMPORTANT 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.

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 C-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 the autosampler, touch the **Relay 1** field and select **Closed** to start the load cycle.
- To set a TTL outputs, touch the **TTL** field and select the desired state (**5 Volts** or **0 Volts**).

C.3 Example Setup for Stand-Alone Operation

This section describes an example setup for *stand-alone operation* (operation without Chromeleon software) with an AS 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 Autosampler

Follow the instructions in the ICS-2100 installation instructions to connect the AS Autosampler to the ICS-2100 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 C-5](#)) in the ICS-2100 and AS Ship Kits.
2. Attach the wires to the connector plug positions indicated in [Figure C-6](#).

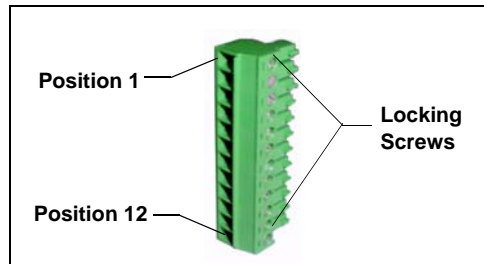


Figure C-5. 12-Position Connector Plug

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.

IMPORTANT

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.

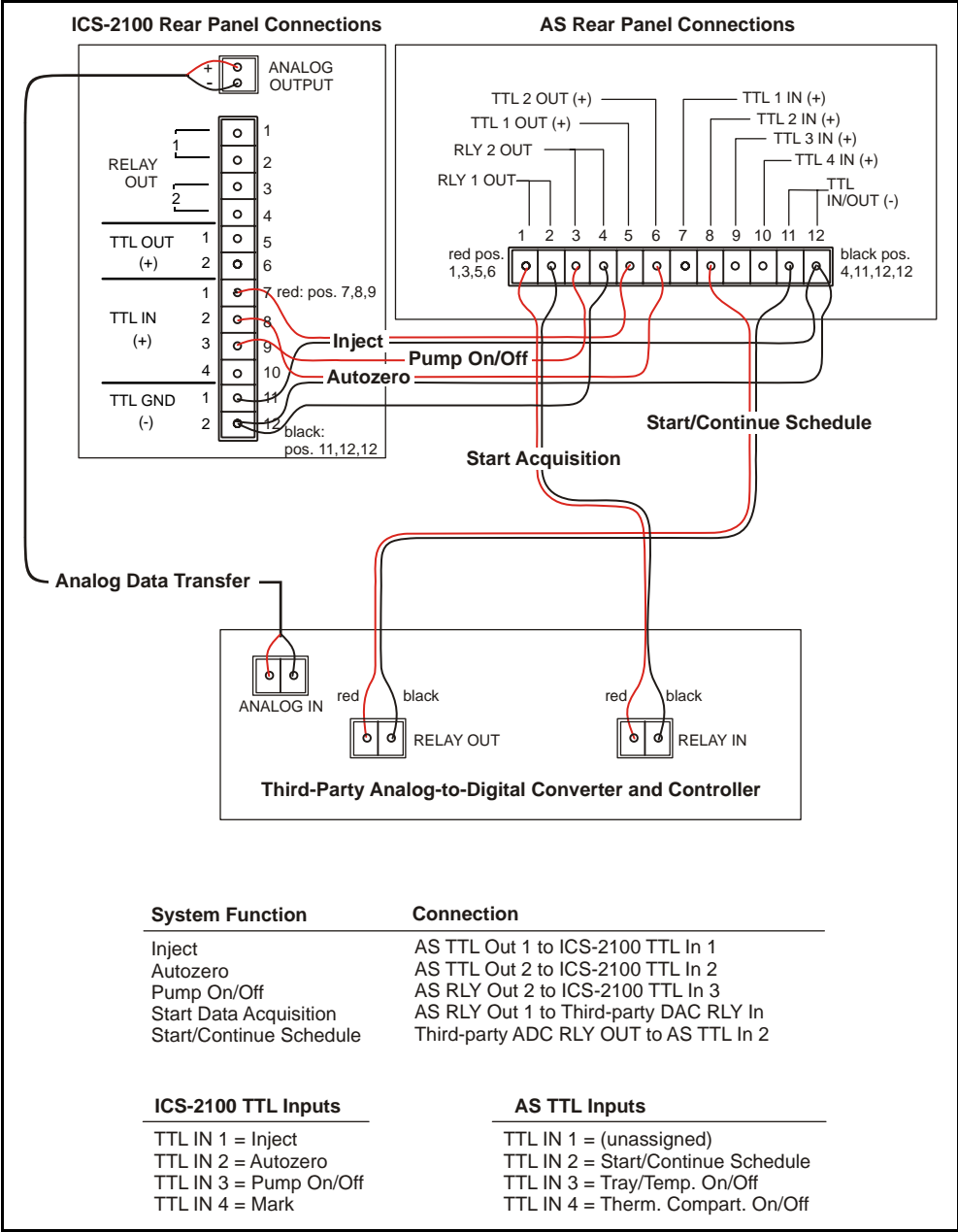


Figure C-6. Example Connections for Stand-Alone Operation

Assign ICS-2100 Input Functions

Go to the ICS-2100 **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 C-7](#)).

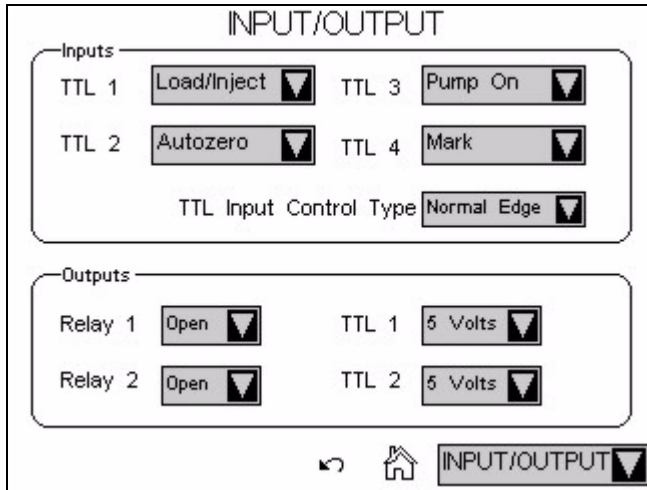


Figure C-7. Input/Output Page

Enable AS Control of the Injection Valve

1. On the AS front panel, press **Menu** and **0** to go to the **TIME FUNCTION OUT** screen. In the **LOAD/INJECT VALVE: TTL 1** field, select **ENABLED**.

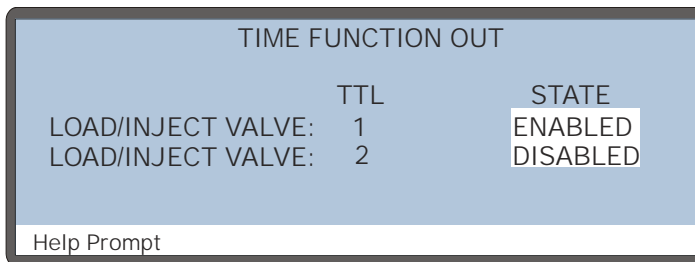


Figure C-8. AS Time Function Out Screen

2. Turn the AS power off and then back on.

You can now issue commands from the AS to switch the ICS-2100 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-2100 rear panel (see [Figure C-6](#)).

Configure the ICS-2100 Analog Output

Go to the ICS-2100 **DETECTOR** touch screen page and select the settings shown in [Figure C-9](#):

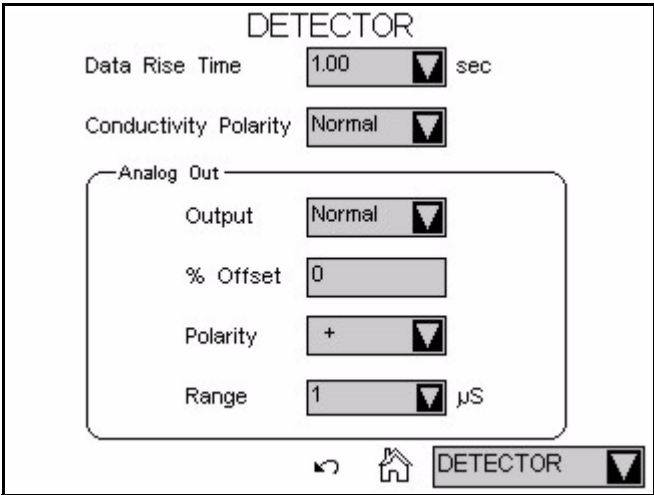


Figure C-9. Detector Page

Create an AS Method and Schedule

[Figure C-10](#) is an example of AS method timed events that can be used with the TTL/Relay connections shown in [Figure C-6](#).

| | | 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 C-10. Example AS 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-2100 injection valve automatically (see [“Enable AS Control of the Injection Valve” on page 248](#)).

To run the above method, set up an AS schedule. The example in [Figure C-11](#) includes a four-point calibration (Lines 1–4) followed by two samples (Lines 5 and 6).

| LINE | VIAL# | START- END | INJ/ VIAL | INJ VOL(uL) | METHOD |
|------|-------|------------|-----------|-------------|--------|
| 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 C-11. Example AS Schedule for Stand-Alone Operation

D • Reordering Information

| 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 ₂ CO ₃ 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 ₃ Mixer (for 4-mm columns) |
| 063443 | EGC CO ₃ Mixer (for 2-mm columns) |

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| Part Number | Item |
|---|---|
| 058069 | EGC holder and degas assembly |
| <i>Sample Loop and Injection Valve</i> | |
| 042857 | 25- μ 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 |
| <i>Auxiliary Valve</i> | |
| 069472 | Auxiliary Valve Kit (6-port valve) |
| 069473 | Auxiliary Valve Kit (10-port valve) |
| 057896 | Injection Valve Rebuild Kit (for use with auxiliary valve, also) |
| 061947 | Auxiliary valve pod assembly (6-port valve) |
| 061948 | Auxiliary valve pod assembly (10-port valve) |
| <i>Suppressors, Cell, and Column Heater</i> | |
| 056116 | AAES Anion Atlas Electrolytic Suppressor |
| 056118 | CAES Cation Atlas Electrolytic Suppressor |
| 064554 | ASRS 300 4-mm Anion Self-Regenerating Suppressor |
| 064556 | CSRS 300 4-mm Cation Self-Regenerating Suppressor |
| 064555 | ASRS 300 2-mm Anion Self-Regenerating Suppressor |
| 064557 | CSRS 300 2-mm Cation Self-Regenerating Suppressor |
| 057985 | DS6 heated conductivity cell |
| 069564 | 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 (for use with 2-mm columns) |
| 069469 | Column heater cover assembly |
| 052324 | Microbore tubing kit |
| <i>Relay/TTL</i> | |
| 923686 | 12-position connector plug |

| Part Number | Item |
|------------------------------------|--|
| 043598 | Twisted pair of wires |
| <i>Miscellaneous</i> | |
| 954745 | IEC 127 fast-blow fuses, rated 3.15 amps |
| 060494 | USB cable, 5 m (16 ft) |
| 060392 | External USB hub |
| <i>Preventive Maintenance Kits</i> | |
| 057954 | ICS-2100 Preventive Maintenance Kit |
| 060581 | AS Preventive Maintenance Kit |
| 055647 | AS-DV Preventive Maintenance Kit |

E.1 How do I hook up an autosampler?

For instructions on how to connect the ICS-2100 to an autosampler, refer to the ICS-2100 installation instructions. Also refer to the autosampler operator's manuals, which are included on the Dionex Reference Library CD-ROM (P/N 053891).

E.2 How do I print?

Click the **Print** toolbar button in Chromeleon.

E.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 4.7](#) 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).

E.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 Help or user's manual for details.

E.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).

E.6 When should I replace the eluent generator cartridge?

The ICS-2100 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 B.8](#)).

E.7 How do I start Chromeleon?

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

E.8 How do I delete data?

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

E.9 How do I back up data?

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

E.10 How do I shut off the system?

In Chromeleon, click the **System Shutdown** button on the ICS-2100 Control panel. On the instrument, turn off the power switch on the rear panel (see [Figure 2-9](#)).

E.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).

E.12 How do I know when a column is dirty?

See the troubleshooting section of the column manual.

E.13 How do I clean a column?

See the troubleshooting section of the column manual.

E.14 Why is the conductivity high?

Possible reasons for high conductivity include:

- The suppressor is not on. Turn on the suppressor from the Chromeleon Control panel or the ICS-2100 touch screen **SUPPRESSOR** page.
- 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 4.13](#) for additional troubleshooting information.

E.15 How do I configure and operate the auxiliary valve?

See *Installing the ICS-1100/ICS-1600/ICS-2100 Auxiliary Valve* (Document No. 065288), provided in the Auxiliary Valve Kit.

Analytical Column

Synonymous with **Separator Column**.

Band Spreading

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

Calibration Curve

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

Capacity Factor (k')

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

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

Where: t_r = retention time

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

Cell Constant (k)

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

$$k = \kappa / G$$

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

$$k = l / A$$

Where: l = length

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

Channeling

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

Column Efficiency (N)

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

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

Where: t_1 = the peak retention time (in seconds)

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

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

Synonymous with **Theoretical Plates**.

Column Selectivity (a)

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

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

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

t_0 = retention time of unretained components (void volume)

Concentrator Column

A short column used to retain and concentrate analytes from a measured volume

of relatively clean sample. This allows large volumes of sample to be injected, lowering concentration detection limits.

Conductivity

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

Counterion

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

% Crosslink

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

Equivalent Conductivity (λ)

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

Guard Column

A small column 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)

Height **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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