Thermo Scientific

Dionex ICS-6000 Ion Chromatography System

Operator's Manual

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Thermo SCIENTIFIC

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Revision 01, February 2018: Initial product release.

Revision 02, January 2024: Removed references to constant voltage procedures.

Revision 03, March 2025: Added part number information and procedures.

Software version: Chromeleon 7.2.7 and later

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

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1.1 Dionex ICS-6000 System Overview

Figure 1-1. *Dual Dionex ICS-6000 System with RFIC-EG*

The Thermo Scientific™ Dionex™ ICS-6000 Ion Chromatography System offers a full range of Reagent-Free™ IC (RFIC™) components. RFIC-EG combines automated eluent generation and self-regenerating suppression to make IC easier and more powerful than ever before. It is no longer necessary to spend time preparing eluents and regenerants. All you need is deionized water—the IC system automatically generates eluent in the exact amount and concentration needed for your application, ensuring superior analytical results. In combination with capillary columns at flow rates of 0.010 mL/min, the Dionex ICS-6000 system can be used for long periods of continuous operation and minimal eluent consumption.

The dual-analysis capabilities (both simultaneous and sequential) of the Dionex ICS-6000 system let you maximize efficiency and throughput and minimize downtime. The modular system design lets you quickly configure and customize hardware.

The single-channel Dionex ICS-6000 can be configured to run either capillary IC applications or analytical (standard bore or microbore) IC applications.

- Capillary IC applications use 0.4 mm diameter columns with flow rates typically from 0.005 to 0.02 mL/min.
- Microbore IC applications use 2 mm diameter columns with flow rates typically from 0.2 to 0.5 mL/min.
- Standard bore IC applications use 4 mm diameter columns with flow rates typically from 1.0 to 2.0 mL/min.

A dual Dionex ICS-6000 system can be configured with any combination of the above application types (for example, one capillary IC channel and one microbore IC channel, or two capillary IC channels, or one microbore IC channel and one standard bore IC channel).

IMPORTANT **If you intend to operate the Dionex ICS-6000 system at pressures above 21 MPa (3000 psi), all installed consumables must be designed for high-pressure operation. This includes the Dionex eluent generator cartridge, eluent degasser, CR-TC 600, and (if required for the application) trap column. Operation of standard-pressure consumables at pressures above 21 MPa (3000 psi) will cause leakage. It will also result in irrevocable damage to the consumables and void the product warranty.**

1.1.1 Dionex ICS-6000 System Components

The table below identifies modules in the Dionex ICS-6000 product line, as well as additional products that can be added to a Dionex ICS-6000 system. Refer to the page number indicated here for a brief product overview.

Product Type	Product Name	Page
Pump	Dionex ICS-6000 Dual Pump	page 4
	Dionex ICS-6000 Single Pump	page 4
Eluent Generator	Dionex ICS-6000 Eluent Generator	page 4
Eluent Organizer	Dionex ICS-6000 Eluent Organizer	page 6
Detector/Chromatography Compartment	Dionex ICS-6000 Detector/Chromatography Module	page 6
IC Cube™ (inside DC)	Dionex ICS-6000 IC Cube	page 7
Detector (inside DC)	Dionex ICS-6000 Conductivity Detector	page 7
	Dionex ICS-6000 Electrochemical Detector	page 7
Accessory (inside DC)	Dionex Consumable Device Monitor	page 8
Accessory (inside DC)	Dionex ICS-6000 Automation Manager	page 8
Detector (outside DC)	Thermo Scientific Dionex ICS Series Photodiode Array Detector	page 9
	Thermo Scientific Dionex ICS Series Variable Wavelength Detector	page 9
Autosampler	Thermo Scientific Dionex ICS Series AS-AP Autosampler	page 8
	Thermo Scientific Dionex AS-DV Autosampler	page 9
Mass Spectrometer	Thermo Scientific ISQ™ EC	page 9

Dionex ICS-6000 Dual Pump (DP) and Dionex ICS-6000 Single Pump (SP)

Each Dionex ICS-6000 pump can be configured for either capillary IC applications or analytical (standard bore and microbore) IC applications. Capillary IC pumps are always isocratic (they deliver one eluent). Analytical IC pumps can be either isocratic or low-pressure proportioned gradient. Gradient pumps deliver gradient mixtures of up to four eluent components. The eluent composition selected for a gradient pump can be delivered as isocratic, isocratic proportioned, linear ramp, step, curved, or any combination of these.

The SP contains one of the following pump types:

- Isocratic capillary IC pump
- Isocratic analytical IC pump
- Gradient analytical IC pump

The DP contains two pumps in any combination of the three types listed above (for example, two isocratic capillary IC pumps, or two isocratic analytical IC pumps, or one isocratic capillary IC pump and one gradient analytical IC pump).

The second pump in the DP can be operated as a second-channel chromatography pump, an auxiliary dependent pump, or an auxiliary independent pump.

Capillary IC Capillary IC pumps operate at flow rates ranging from 0.001 to 3.0 mL/min and operating pressures up to 41 MPa (6000 psi).

Analytical IC Analytical IC pumps operate at flow rates ranging from 0.00 to 10.0 mL/min and operating pressures up to 41 MPa (6000 psi). Both standard bore and microbore IC applications are supported.

Dionex ICS-6000 Eluent Generator (EG)

The EG generates high purity acid or base eluents online from deionized water. The EG can be configured for single- or dual-channel operation. Each channel includes:

- A high-precision programmable current source (power supply)

For each channel, the following options must be ordered separately for installation inside the EG:

- A disposable eluent generator cartridge (Thermo Scientific™ Dionex™ EGC). Each cartridge contains the electrolyte concentrate solution appropriate for the eluent being generated.

  Three versions of Dionex EGC are available: one for capillary IC systems, one for analytical standard-pressure IC systems, and one for analytical high-pressure IC systems.

IMPORTANT **The recommended maximum operating pressure for the EG in an analytical IC system is 35 MPa (5000 psi) if a Dionex EGC 500 is installed or 21 MPa (3000 psi) if a Dionex EGC III is installed. Excessive backpressure may rupture the tubing inside the Dionex RFIC+ Eluent Degasser.**

- A Thermo Scientific™ Dionex™ Continuously Regenerated Trap Column (Dionex CR-TC 600) to remove any extraneous contaminants from the deionized water source. The Dionex CR-TC 600 is electrolytically-regenerated, which allows it to operate for extended periods without chemical regeneration.

  The Dionex CR-TC 600 is available in two versions: one for capillary IC systems and one for analytical IC systems.

- A high-pressure gas removal device that removes electrolysis gases created during eluent generation.

Analytical IC

Reagent-Free IC with Eluent Regeneration (RFIC-ER)

RFIC-ER™ is available as an option for Dionex ICS-6000 systems without an EG. Eluent regeneration uses the suppressor to reconstitute the starting eluent, allowing use of a single 4-liter bottle of eluent for up to four weeks. Because the system is a closed loop, it can run continuously, eliminating the need for recalibration or re-equilibration during the 28 days of nonstop operation. RFIC-ER uses carbonate, carbonate/bicarbonate, or MSA (methanesulfonic acid) eluents for isocratic separations on standard bore columns.

Dionex ICS-6000 Eluent Organizer (EO)

The EO holds eluent reservoirs in a liner that contains spills and leaks. Up to two EOs can be installed on top of the DC. Each EO accommodates up to four 1-liter or 2-liter reservoirs *or* up to two 4-liter reservoirs. The EO is typically ordered configured with four 2-liter reservoirs (P/N 072058).

All eluent reservoirs available for use with the DP/SP can be pressurized. If you plan to pressurize the eluent reservoirs, the optional EO Regulator Accessory and Stand (P/N AAA-074423) is required.

The Regulator Accessory includes a pressure regulator and gauge assembly with four outputs (for connections to four eluent reservoirs), as well as the tubing and connection fitting required. If more reservoirs are required, order a second regulator (P/N 074422).

Reagent-Free IC with Electrolytic Sample Preparation (RFIC-ESP)

RFIC-ESP™ systems enable a range of automated sample preparation techniques which use proprietary electrolytic devices to provide reduced cost and higher value analyses.

RFIC-ESP devices and techniques can be used for removing cations from an anion sample before analysis by using a Dionex CR-TC 600, or neutralizing a strongly acidic or basic solution—25% phosphoric acid or sodium hydroxide solutions, for example—with a Thermo Scientific™ Dionex™ AutoNeutralization™ device. A Thermo Scientific™ Dionex™ Electrolytic Water Purifier™ is available; this provides water of extremely high purity (backgrounds below sub ng/L levels are possible) for use in trace-level analytical work where use of a concentrator column is necessary.

Dionex ICS-6000 Detector/Chromatography Module (DC)

The DC provides a temperature-controlled environment for Dionex ICS-6000 chromatography components. The DC can accommodate components for two channels, plumbed either serially or in parallel. The DC is available in two versions:

- The standard DC is designed for applications that require an operating temperature of 18–40 °C in the upper compartment of the module.
- The low-temperature DC is designed for applications that require an operating temperature of 10–40 °C in the upper compartment of the module, such as the 2D-haloacetic acid (HAA) method.

The following components may be installed in the DC:

- Conductivity detectors
- Electrochemical detectors
- Injection valves
- Switching valves
- Guard and separator columns
- Suppressors
- Dionex Consumable Device Monitor
- Dionex ICS-6000 IC Cubes or Dionex ICS-6000 Automation Manager

Dionex ICS-6000 Conductivity Detector (CD)

The CD is a modular detector with an integrated cell. The CD has a signal range up to 15,000 µS and supports high background, nonsuppressed applications. The CD is installed in the upper compartment of the DC. For a dual system, two CDs can be installed.

Dionex ICS-6000 Electrochemical Detector (ED)

The ED is a modular detector and a modular cell. The ED supports multiple waveforms, multiple integration times, 3D amperometry data, and post-analysis data manipulation.

The ED cell can be configured with gold, silver, platinum, carbon, or glassy carbon working electrodes. The ED is installed in the upper compartment of the DC. For a dual system, two EDs can be installed.

Capillary IC

Dionex ICS-6000 IC Cube (IC Cube)

The IC Cube houses components for running capillary IC applications. Each IC Cube includes an injection valve, a column heater, and removable cartridges containing capillary IC components. Cartridges for the following components are available: carbonate removal device (Thermo Scientific™ Dionex™ CRD), suppressor, guard and separator columns, and EG degasser. The IC Cube is installed in the upper compartment of the DC. For a dual system, two IC Cubes can be installed.

Dionex Consumable Device Monitor

The optional Dionex Consumable Device Monitor is a plug-in card with its own USB connection. When installed in the DC, the Dionex Consumable Device Monitor uses RFID (radio-frequency identification) to monitor RFID-enabled consumables in the system. Data is stored on an RFID tag attached to the consumable. For more information about consumable tracking, see Section 1.1.3.

Analytical IC

Dionex ICS-6000 Automation Manager (AM)

The AM consists of a component mounting panel on a base tray. The AM provides mounting sites for sample preparation and post-column application components: high-pressure (switching) valves, low-pressure (solenoid) valves, reaction coils, etc. The AM is installed in the upper compartment of the DC, above the detector.

Dionex ICS Series AS-AP Autosampler (Dionex AS-AP)

The Dionex AS-AP provides high-performance, automated sample processing for ion chromatography applications. Key features of the Dionex AS-AP include:

- Excellent reproducibility, with RSDs less than 0.3% for full-loop injections
- All-PEEK™ flow paths, compatible with aqueous and reversed-phase eluents, safe from metal contamination
- Carousel and moving-needle design to guarantee reliable sampling from a variety of vial sizes and well plates
- 10 mL polystyrene sample vials with wide openings for large-volume injections and trace analysis
- High sample capacity, from 81 (10 mL vials) to 1152 (three 384-position well plates)
- Sample preparation function to automate sample and standard preparations, saving time and labor

Optional features of the Dionex AS-AP include sample tray temperature control, simultaneous injections, sequential injections, sample preparation, or fraction collection and reinjection, and 6-port or 10-port valves.

Dionex AS-DV Autosampler (Dionex AS-DV)

The Dionex AS-DV is a basic autosampler that is capable of delivering between 0.1 and 5.0 mL of sample (in 0.1 mL increments) to the sample loop or concentrator column in an ion chromatography system.

The Dionex AS-DV holds 50 vials (either 0.5 mL or 5.0 mL, or a combination of the two sizes). Vials can be sampled in any order and multiple samples can be taken from each vial. The autosampler remembers the vial size and volume delivered for each vial position, allowing multiple samples to be taken from a vial non-sequentially.

Dionex ICS Series Photodiode Array Detector (Dionex PDA)

The Dionex PDA optical detector is capable of measuring the absorbance spectrum from 190 to 800 nm. A deuterium lamp optimizes the UV range (190 to 380 nm) and a tungsten lamp optimizes the visible range (380 to 800 nm).

The Dionex PDA enables you to collect up to five single wavelengths (2D chromatograms) without being required to collect 3D data. Collecting chromatograms at individual wavelengths instead of from spectra offers two advantages: it eliminates the need to perform extractions for chromatograms that do not require spectral data and it conserves disk space.

Dionex ICS Series Variable Wavelength Detector (Dionex VWD)

The Dionex VWD is a dual-beam, variable wavelength photometer with one measurement and one internal reference beam. Spectral capability from 190 to 900 nm is provided by two light sources: a deuterium lamp for ultraviolet detection and a tungsten lamp for visible wavelength operation. The four-channel detector measures at up to four wavelengths simultaneously. The VWD contains a built-in holmium oxide filter for wavelength verification. To suppress higher-order radiation, two optical filters can be inserted (automatically) into the light path.

Thermo Scientific ISQ EC Mass Spectrometer

The ISQ EC single quadrupole mass spectrometer seamlessly integrates with the IC system. The advanced dual-role design provides exceptional low-molecular weight performance for quantitation of ions using IC-MS.

The ISQ EC mass spectrometer offers:

- Durable atmospheric pressure ionization (API) source for use with challenging sample matrices and innovative vacuum interlock designed for reliable operation
- High performing HESI-II electrospray to boost ionization efficiency and spray stability across a wide range of flow rates
- Built-in reference standard for automated instrument calibration
- Ultra-fast scanning supports simultaneous analyses of positive and negative ions
- Easy method development and optimization using new ion source technology

1.1.2 Dionex ICS-6000 System Control

Two types of system control are available for the Dionex ICS-6000:

- The Thermo Scientific™ Dionex™ Chromeleon™ 7 Chromatography Data System provides complete instrument control, data acquisition, and data processing functions. Communication between the system and Chromeleon is through connection to a USB (Universal Serial bus) port on the computer or a USB hub.
- The Thermo Scientific™ Dionex™ ICS-6000 App, when installed on the optional tablet, can be used for controlling basic instrument functions and for displaying system status information. The ICS-6000 App can display a real-time plot of detector output, but it cannot store data or provide data processing functions.

Chromeleon Chromatography Data System

The Chromeleon *ePanel Set* provides centralized system control. You can use the ePanel Set to view system status information and issue commands for controlling each module. The **Home** panel shows the overall system status and provides basic module control functions. Individual tabs provide quick access to additional functions for each module and detailed status and diagnostics functions (see Figure 1-2).

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

- With automated control, you create a list of control commands to be executed in chronological order. For more information about automated control, see Section 5.2.
- With direct control, you use the controls on an ePanel Set to issue commands and enter operating parameters. Direct control commands and parameter settings are executed as soon as they are entered.

Individual tabs on the ePanel Set provide access to detailed status and control functions for each system component (pump, detector, EG, and so on). A Home tab includes system status information, a signal plot, and controls for the most commonly used system functions.

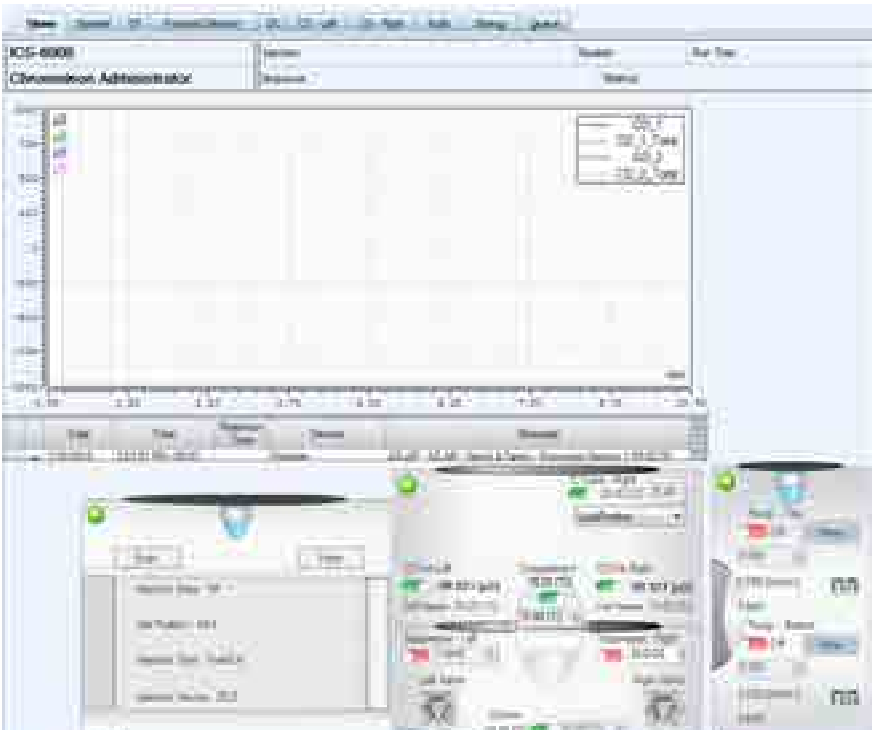


Figure 1-2. *Example Chromeleon ePanel Set*

For instructions on how to connect to the ePanel Set, see Section 4.4.

If the function to be performed is not available on the ePanel Set, click the **Command** icon on the Instrument toolbar above the ePanel Set (or press the **F8** key) to open the Chromeleon Command window (see Figure 1-3). From there, you can access all commands available for the system.

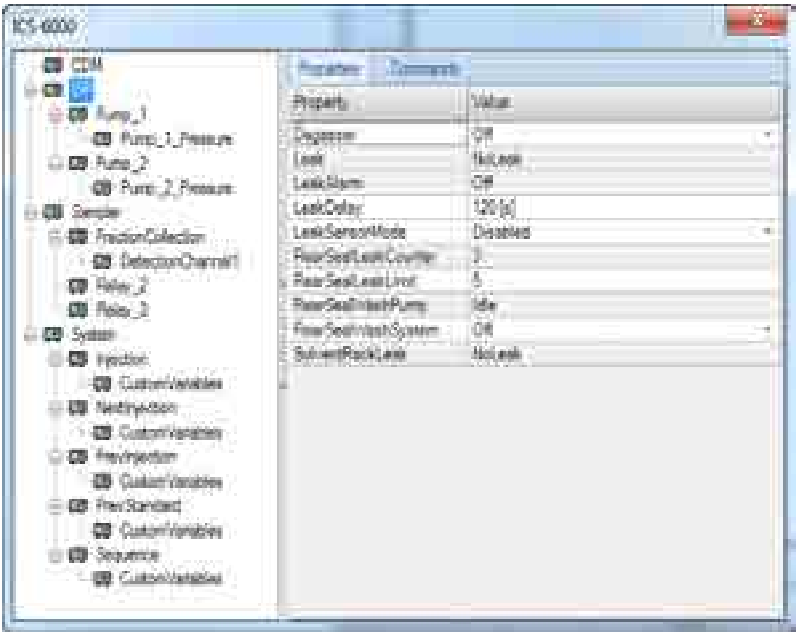


Figure 1-3. *Chromeleon Command Window*

ICS-6000 App

The optional ICS-6000 App can be installed on a tablet running under the Microsoft™ Windows™ 10 Pro operating system. The ICS-6000 App provides front panel control of the Dionex ICS-6000. The app can be used to view system status information and to directly control system functions.

The Home page (see Figure 1-4) shows the current status and the operation settings for the most commonly used system functions. You can select basic operating parameters from this page, as well as navigate to detailed status and control pages for system components. For details about the ICS-6000 App, see Chapter 6.

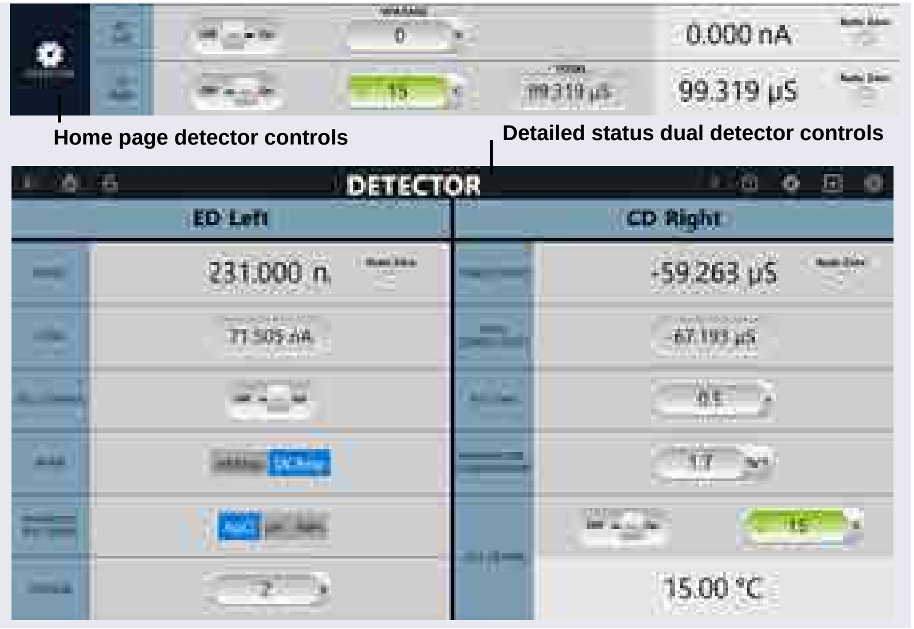


Figure 1-4. Example ICS-6000 App Home Page: Conductivity Detection System

1.1.3 Consumable Device Tracking

Many of the consumable devices used with the Dionex ICS-6000 are equipped with a memory chip that allows automatic identification of the device and tracking of various usage parameters. This functionality is implemented as follows:

- Wired communication is used for consumables with electrical cables, including eluent generator cartridges and electrolytic suppressors.
- RFID (radio-frequency identification) communication is used for non-powered consumables, including analytical columns and chemically-regenerated suppressors.

NOTE In order to track devices that use RFID communication, the Dionex Consumable Device Monitor must be installed in the Dionex ICS-6000 DC.

When consumable devices are equipped with device tracking, the following types of information can be stored on the device's memory chip:

- Identification parameters are stored in the device's memory at the factory. This information remains constant over the lifetime of the device. See Table 1-1 for a list of these parameters.
- Usage parameters are stored in the device's memory after the device is installed in the system. This information is updated as necessary to maintain a record of the status of the device. See Table 1-2 for a list of these parameters.

Identification and usage parameter information is displayed in Chromeleon in the Consumables Inventory window. To view the window, click **Consumables** on the Instrument toolbar above the ePanel Set. Information about RFID devices is also shown on the Consumables page of the ICS-6000 App.

The table below lists the consumable tracking information entered at the factory.

Parameter	Device Type	Description
Serial number	All	Nine-digit number that uniquely identifies each device.
Product type	All except Dionex EGCs	Identifies the device type. This information is used to determine compatibility among the various devices installed in a system.
Product ID	All except Dionex EGCs	Manufacturing part number.
Best use by date	All except Dionex EGCs	Last date the device can be installed in the system before additional validation tests are recommended to ensure proper operation.
Lot number	Devices that contain resin: guard and separator columns, etc.	Manufacturing lot of the resin used in the device.

Table 1-1. *Consumable Tracking Information Entered at the Factory*

Parameter	Device Type	Description
Capacity	Columns	Separation capacity of the resin in the column.
Maximum pump pressure allowed	Columns	Maximum pressure at which the column can be used.
Maximum temperature allowed	Guard, separator, and concentrator columns	Highest temperature at which the column can be used.
Column length Column ID Particle Size	Guard and separator columns	Length and interior diameter (in mm) of the column. The particle size (in µm) of the resin in the column.
QAR retention time QAR efficiency QAR asymmetry QAR resolution QAR pressure QAR flow rate	Separator columns	Various peak and system parameters from the column QAR (Quality Assurance Report).
Typical backpressure of column	Guard, concentrator, and trap columns	Backpressure typically created by the column.
Suppressor constant	Dionex DRS 600 suppressor	Stores the latest calibration results
Recommend-ed voltage setting	Dionex DRS 600 suppressor	Factory-recommended voltage setting

Table 1-1. *Consumable Tracking Information Entered at the Factory (Continued)*

The table below lists the consumable tracking information updated during use.

Parameter	Device Type	Description
Date of first installation	All	Date the device was first installed in the system.
Eluent types exposed to	All except Dionex EGCs	List of the last 10 eluents used with the device.
Total eluent volume seen	All except concentrator columns, Dionex EGCs	Total volume of eluent that has flowed through the device in its lifetime.
Number of injections	All except concentrator and trap columns, Dionex EGCs	Number of sample injections that have occurred while the device was installed in the system. The count increments when the injection valve is switched from Load to Inject during a sequence.
Weekly pump pressure data	All columns	Average of the pump pressure values measured at time 0.5 min of each Chromeleon instrument injection run during the week. Averages from the last 26 weeks are stored, as well as all values for weeks 1–2 of the life of the device.
Weekly pump flow rate data		Average of the pump flow rate values measured at time 0.5 min of each Chromeleon instrument injection run during the week. Averages from the last 26 weeks are stored, as well as all values for weeks 1–2 of the life of the device.
Total volume of injections	Guard and separator columns	Total volume of sample injected through the column in its lifetime.

Table 1-2. *Consumable Tracking Information Updated During Use*

Parameter	Device Type	Description
Maximum flow rate seen	Guard, separator, and trap columns	Maximum flow rate the column has been exposed to during its lifetime. Uses sample volume entered in Chromeleon injection.
Maximum temperature seen	Guard and separator columns	Maximum temperature the column has been exposed to during its lifetime.
Maximum pressure seen	Guard and separator columns	Maximum pressure the column has been exposed to during its lifetime.
Last separator column paired with	Guard, concentrator, and trap columns	Serial number and product ID of the separator column last used with the column.
Last guard column paired with	Separator, concentrator, and trap columns	Serial number and product ID of the guard column last used with the column.
Number of samples concentrated	Concentrator columns	Number of sample injections that have occurred while the concentrator column was installed in the system. The count increments when the injection valve is switched from Load to Inject during a sequence and a concentrator column is installed on the valve.
Total volume concentrated	Concentrator columns	Total volume of sample (in mL) injected through the concentrator column in its lifetime. Uses sample volume entered in Chromeleon injection.

Table 1-2. *Consumable Tracking Information Updated During Use (Continued)*

Parameter	Device Type	Description
Weekly background conductivity data	All suppressors	Average of the background conductivity values measured at time 0.5 min of each Chromeleon instrument injection run during the week. Averages from the last 26 weeks are stored, as well as all values for weeks 1–2 of the life of the device.
Weekly current data	Electrically regenerated suppressors, Dionex DRS 600 suppressors, and Dionex CR-TC 600	Average of the current values measured at time 0.5 min of each Chromeleon instrument method run during the week. For constant current devices, the current is the set value. Averages from the last 26 weeks are stored, as well as all values for weeks 1–2 of the life of the device.
Weekly voltage data	Electrically regenerated suppressors, Dionex DRS 600 suppressors	Average of the voltage values at time 0.5 min of each Chromeleon instrument injection run during the week. For constant current suppressors, the voltage is the measured value. Averages from the last 26 weeks are stored, as well as all values for weeks 1–2 of the life of the device.
Maximum voltage seen	Constant current suppressors	Maximum voltage applied to the suppressor during its lifetime.
Maximum current seen	Dionex CR-TC 600, Dionex DRS 600 suppressors	Maximum current applied to the suppressor or Dionex CR-TC 600 during its lifetime.
Total voltage hours seen	Constant current suppressors, Dionex DRS 600 suppressors	Total number of hours voltage has been applied to the suppressor during its lifetime.

Table 1-2. *Consumable Tracking Information Updated During Use (Continued)*

Parameter	Device Type	Description
Ion count	Dionex EGC	Ions remaining in the Dionex EGC, expressed as a percentage.

Table 1-2. *Consumable Tracking Information Updated During Use (Continued)*

1.2 Dionex ICS-6000 System Documentation

Every effort has been made to provide complete and accurate user documentation for the Dionex ICS-6000 system. The table below lists the primary sources of product information, and the formats in which this information is available.

Source	Part Number	PDF File	Printed Manual
Dionex ICS-6000 Ion Chromatography System Operator’s Manual	22181-97002	Yes	No
Dionex ICS-6000 Ion Chromatography System Installation Instructions	22181-97001	Yes	Yes
Dionex AS-AP Operator’s Manual	065361	Yes	No
Dionex AS-DV Operator’s Manual	065259	Yes	No
Dionex ICS Series Photodiode Array Detector Operator’s Manual	065147	Yes	No
Dionex ICS Series Variable Wavelength Detector Operator’s Manual	065141	Yes	No
Chromeleon 7 Installation Guide	7229.0003	Yes	Yes
Chromeleon 7 Quick Start Guide	7229.0004	Yes	Yes
Chromeleon 7 online Help	N/A	N/A	N/A

All Adobe™ PDF files listed above are available for download from the Thermo Fisher Scientific website or by contacting your local office. In addition, software manuals are provided as PDF files on the Chromeleon DVD and a printed copy of the Chromeleon installation instructions is provided in the software ship kit.

Full documentation (including installation guides, operation manuals, and so on) is also maintained in the Thermo Scientific Chromatography and Mass Spectrometry portal. This portal is regularly updated with the latest content, including video tutorials.

To access the doc portal, go to docs.thermofisher.com/ArdiaPlatform.

Consumables documentation: For complete information about Dionex columns, suppressors, eluent generator cartridges, and other consumables, refer to the appropriate product manual.

1.3 Dionex ICS-6000 System Operator's Manual

The electronic version (i.e., PDF file) of the Dionex ICS-6000 system operator's manual contains numerous links that you can click to go to other locations within the manual. These links include:

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

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

Chapter 1 Introduction	An overview of the Dionex ICS-6000 system; includes a brief description of the Dionex ICS-6000 modules, the software required for Dionex ICS-6000 operation, and the Dionex ICS-6000 user manuals.
Chapter 2 Description	Detailed descriptions of Dionex ICS-6000 system components and important operating features; includes an introduction to Chromeleon software.
Chapter 3 System Configurations	Detailed illustrations of component plumbing for several Dionex ICS-6000 system configurations.
Chapter 4 Getting Started	Tasks to be performed before beginning operation of the Dionex ICS-6000 system.
Chapter 5 Operation	Instructions for routine operation of the Dionex ICS-6000 system.

Chapter 6 ICS-6000 App Operation	An overview of the mobile app operating features.
Chapter 7 Shutdown	Short-term and long-term shutdown procedures for the Dionex ICS-6000 system.
Chapter 8 Maintenance	Routine preventive maintenance procedures for the Dionex ICS-6000 system.
Chapter 9 Troubleshooting	List of Chromeleon audit trail error messages and a list of minor problems that may occur during operation of the Dionex ICS-6000 system. Includes the possible cause of each message or problem, as well as the corrective action to take.
Chapter 10 Service	Instructions for routine service and parts replacement procedures the user can perform for the Dionex ICS-6000 system.
Appendix A Specifications	Specifications and installation site requirements for the Dionex ICS-6000 modules.
Appendix B Reordering Information	Spare parts for the Dionex ICS-6000 modules.

1.4 Safety Information

The Dionex ICS-6000 system was manufactured by Thermo Fisher Scientific at the following location: 355 River Oaks Parkway, San Jose, CA 95134-1991 U.S.A. The Dionex ICS-6000 system is designed for IC (ion chromatography) and HPLC (high-performance liquid chromatography) applications and should not be used for any other purpose. Operation of a Dionex ICS-6000 module in a manner not specified by Thermo Fisher Scientific may result in personal injury.

If there is a question regarding appropriate usage, contact Technical Support for Dionex products. In the U.S. and Canada, call 1-800-532-4752. Outside the U.S. and Canada, call the nearest Thermo Fisher Scientific office.

1.4.1 Safety Messages and Notes

This manual contains warnings and precautionary statements that can prevent personal injury and/or damage to the Dionex ICS-6000 system when properly followed. Safety messages appear in bold type and are accompanied by icons, as shown below.

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

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

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

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

Messages d'avertissement en français

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

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

MISE EN GARDE **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

ACHTUNG **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.

Capillary IC Sections preceded with the Capillary IC flag indicate that the information in the section applies to capillary IC systems only.

Analytical IC Sections preceded with the Analytical IC flag indicate that the information in the section applies to analytical IC systems only.

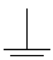
If a section is not flagged, the information in the section applies to both capillary IC and analytical IC systems.

1.4.2 Safety Symbols

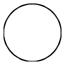
These symbols appear on the Dionex ICS-6000 modules or on labels affixed to the modules:


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 this operator’s manual for an explanation of the hazard and how to proceed.

1.5 Regulatory Compliance

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

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

The regulatory symbols on the model/data labels on each Dionex ICS-6000 module indicate that the system is in compliance with the following Safety and EMC standards:

- UL 61010-1:2012
- UL 61010-2-010:2015
- CAN/CSA-C22.2 No. 61010-1-12
- CAN/CSA-C22.2 No. 61010-2-010:15
- FCC Part 15 Subpart B (per ANSI C63.4: 2009) and Industry Canada ICES-003 Issue 5, August 2012 for a Class A Device

- Standards of countries other than Canada and the United States, as applicable (see Section 1.5.2)

The CE mark on the model/data of the Dionex ICS-6000 indicates that the system is in compliance with the following European Union Directives as is evidenced by compliance to the associated standard where appropriate:

- LVD Directive: 2014/35/EU by conforming to IEC/EN 61010-1:2010 (3rd edition) and IEC/EN 61010-2-010:2014 (3rd edition)
- EMC Directive: 2014/30/EU by conforming to EN 61326-1:2013, EN 61326-2-6:2006
- RED Directive: 2014/53/EU conforming to ETSI EN 301 489-1/3 V2.1.1:2017

1.5.1 FCC/IC Notices

This product may contain:

	RFID Module
FCC ID:	WZ4-NOVA001
IC:	5893A-NOVA2011

These devices comply with Part 15 of the FCC rules and Industry Canada license-exempt RSS standards. Operation of this device is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any modifications could void the user’s authority to operate the equipment.

Refer to the RFID module data sheet for additional module information.

AVIS FCC/IC

Ce produit peut contenir:

	RFID Module
FCC ID:	WZ4-NOVA001
IC:	5893A-NOVA2011

Cet appareil est conforme à la partie 15 des règles de la FCC et d'Industrie Canada RSS normes exemptes de licence. Le fonctionnement de cet appareil est soumis à la deux conditions suivantes:

1. Ce dispositif ne doit pas causer d'interférences nuisibles, et
2. Cet appareil doit accepter toute interférence reçue, y compris les interférences qui peuvent causer un mauvais fonctionnement.

Cet équipement a été testé et déclaré conforme aux limites d'un appareil numérique de classe A, conformément à la partie 15 des règles de la FCC. Ces limites sont conçues pour fournir une protection raisonnable contre les interférences nuisibles dans une installation résidentielle. Cet équipement génère, utilise et peut émettre de l'énergie radiofréquence et, se il ne est pas installé et utilisé conformément aux instructions, peut causer des interférences nuisibles aux communications radio. Cependant, il ne est pas garanti que des interférences ne se produiront pas dans une installation particulière. Si cet équipement provoque des interférences nuisibles à la réception radio ou de télévision, ce qui peut être déterminé en mettant l'équipement hors et sous tension, l'utilisateur est encouragé à essayer de corriger l'interférence par une ou plusieurs des mesures suivantes:

- Réorienter ou déplacer l'antenne de réception.
- Augmentez la distance entre l'équipement et le récepteur.
- Branchez l'appareil dans une prise sur un circuit différent de celui sur lequel le récepteur est branché.
- Consulter le revendeur ou un technicien radio / TV expérimenté.

Toute modification peut annuler le droit de l'utilisateur à utiliser l'équipement.

Pour plus d'information sur le module RFID, veuillez-vous référer à leur fiche technique.

1.5.2 International Compliance

The table below lists regulatory certificate numbers for the Dionex Consumable Device Monitor.

Country	Regulatory Certificate
Argentina	CNC COMISIÒN NACIONAL DE COMUNICACIONES Contiene modulo **CNC** ID C-20414
Australia/New Zealand	R-NZ ABN 81 145 810 [illegible]
Bahrain	2992
Bermuda	CTYPE-01228
Bolivia	ATT-DJ-RA-H-TL LP 15/2018
Brazil	ANATEL 1431-16-2716
Brunei	DTA-000621
Canada	5893A-NOVA001
Chile	14031/DO N42508/F26
China	N/A

Country	Regulatory Certificate
Costa Rica	sutel 10206-SUTEL-DGC-2017
European Union	CS22357
India	NR-ETA/7576-RLO (NR)
Indonesia	52847/SDPPI/2017
Japan	R 005-101230
Korea, Republic of	
Kuwait	2126
Malaysia	MCMC
Mexico	IFETEL: RCPSKSM16-0940
Peru	TRSS39743
Philippines	APPROVED
Qatar	CRA/SA/2017/R-6477
Russia	RU Д-US. АГ03.В.89713 EAC
Saudi Arabia	16022017-16022019-19346

Country	Regulatory Certificate
Singapore	Complies with IDA Standards Dealer's License No. N3167-17
South Africa	ICASA TA-2017/2610 APPROVED
Taiwan	N/A
Thailand This telecommunication equipment is in compliance with NTC requirements.	
Turkey	32423510-254.01-E.69329
United Arab Emirates	TRA REGISTERED No: DA48560/16 DEALER No: ER59193/17
United States of America	WZ4-NOVA001
Vietnam	ICT

1.5.3 WEEE Compliance

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the following symbol:

Thermo Fisher Scientific has contracted with one or more recycling or disposal companies in each European Union (EU) Member State, and these companies should dispose of or recycle this product. See www.thermoscientific.rohs for further information on Thermo Fisher Scientific's compliance with these Directives and the recyclers in your country.

Conformité DEEE

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

Thermo Fisher Scientific s'est associé avec une ou plusieurs sociétés de recyclage dans chaque état membre de l'Union Européenne et ce produit devrait être collecté ou recyclé par celle(s)-ci. Pour davantage d'informations, rendez-vous sur la page www.thermoscientific.fr/rohs.

WEEE Konformität

Dieses Produkt entspricht der EU Waste Electrical & Electronic Equipment (WEEE) Richtlinie 2002/96/EC. Es ist mit dem folgenden Symbol gekennzeichnet:

Thermo Fisher Scientific hat Vereinbarungen mit Verwertungs-/Entsorgungsfirmen in allen EU-Mitgliedsstaaten getroffen, damit dieses Produkt durch diese Firmen wiederverwertet oder entsorgt werden kann. Weitere Informationen finden Sie unter www.thermoscientific.de/rohs.

1.6 Deionized Water Requirements for IC

For eluent generation or when manually preparing eluent and regenerant, use ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Table 1-3.

Contaminant	Specification
Ions–Resistivity	>18.0 (megohm-cm)
Organics–TOC	<10 ppb
Iron/Transition Metals*	<1 ppb
Pyrogens	<0.03 (Eu/mL)
Particulates > 0.2 µm	<1 (units/mL)
Colloids–Silica	<10 ppb
Bacteria	<1 (cfu/mL)
* Iron/transition metal content not specified for ASTM Type I Water	

Table 1-3. *ASTM Filtered, Type I Deionized Water Specifications for Ion Chromatography*

ICS-6000 DP/SP DP/SP Description

2.1 DP/SP Features

A status bar on the front of the DP and SP includes buttons for controlling certain pump functions, as well as LEDs (light emitting diodes) that indicate the status of several pump functions (see Figure 2-1 and Figure 2-2).

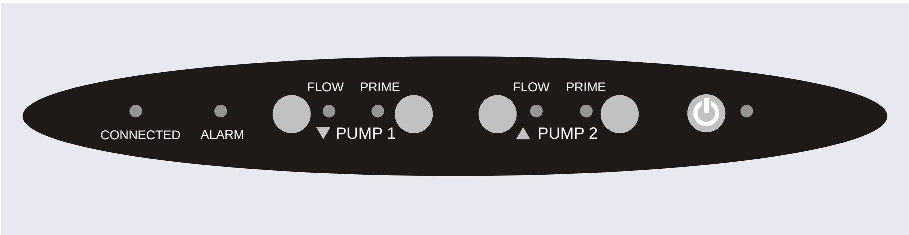


Figure 2-1. *DP Status Bar*

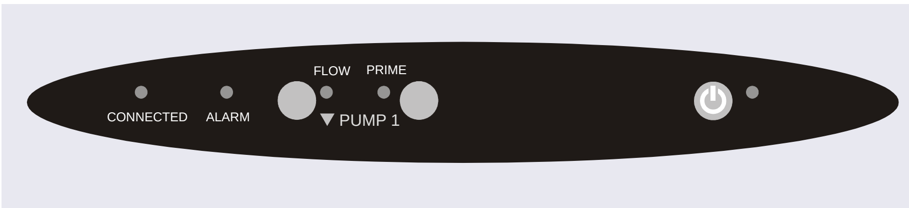


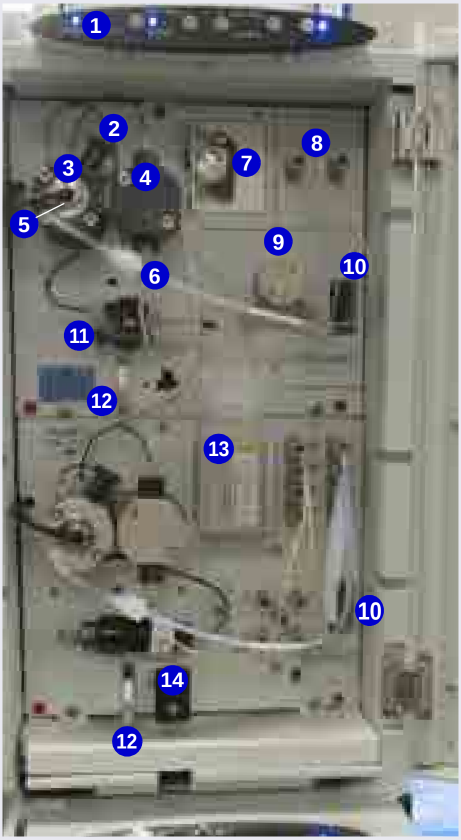
Figure 2-2. *SP Status Bar*

Button/LED Label	If the LED Is On	If the LED Is Flashing
CONNECTED	The DP/SP is connected to a Chromeleon instrument.	Does not flash.
ALARM	A DP/SP-related problem has occurred (for example, a pressure limit was activated). Check the Chromeleon audit trail for the cause.	Does not flash.
PUMP 1 FLOW* **PUMP 2 FLOW****	Use the **FLOW** button to start and stop the DP/SP flow. The LED indicates when the flow is on.	Does not flash.
PUMP 1 PRIME* **PUMP 2 PRIME****	Use the **PRIME** button to prime the DP/SP (see Section 10.3). The LED indicates whether the pump is being primed.	The pump is being primed.
POWER	Use this **POWER** button for routine on/off control of the DP/SP. When the power is on, this LED is lighted. To turn off the DP/SP, press and hold this **POWER** button for 2 seconds. **Note:** The main power switch is on the rear panel.	Does not flash.

* Pump 1 is always installed in the lower half of the DP/SP enclosure.
** This button is not present on the SP.

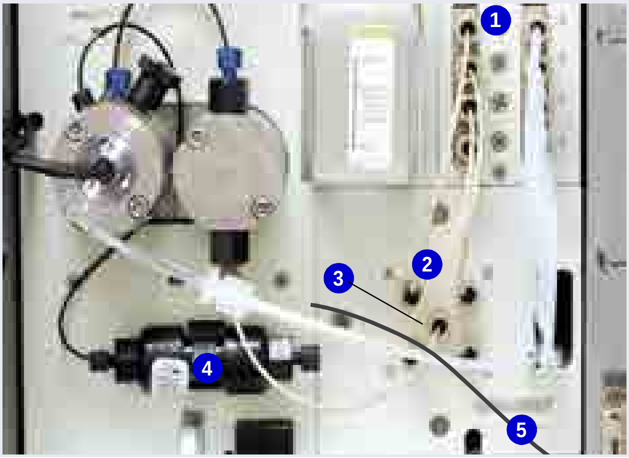
2.2 DP/SP Interior Components

The pump’s mechanical components are located directly behind the front door of the module. Figure 2-3 shows the mechanical components of a DP that contains a gradient analytical pump (pump 1) and an isocratic capillary pump (pump 2). Figure 2-4 identifies the pump components that are unique to a gradient analytical pump.



1. Status Bar
2. Priming Valve
3. Secondary Pump Head
4. Primary Pump Head
5. Pressure Transducer
6. Priming Waste Line
7. Peristaltic Pump (for seal wash system)
8. Vacuum Degas Chamber (one channel)
9. Eluent Supply On/Off Valve (isocratic pumps only)
10. Tubing Chase (2)
11. Pulse Damper Outlet (capillary pumps only)
12. Handle (2)
13. Piston Seal Wash Reservoir
14. Leak Sensor

Figure 2-3. *Example DP Interior Components:*
Pump 1: Analytical Gradient Pump
Pump 2: Capillary Isocratic Pump



1	Vacuum Degas Chambers (4 channels)
2	Proportioning Valve
3	Proportioning Valve Outlet to Primary Pump Head
4	Static Mixer
5	Pump Outlet to EG or Injection Valve

Figure 2-4. *Analytical Gradient Pump Components*

NOTE For easier access to pump components when performing service procedures, the pump panel can be pulled forward to the front of the pump compartment. First, check that the five red Phillips screws installed on the component mounting panel before shipment from the factory have been removed. Then, use the handles to pull the panel forward. The upper and lower component panels slide forward together.

2.2.1 Pump Heads

The DP/SP is a low-pulsation, serial dual-piston pump with electronic compressibility compensation. Two pump heads—a *primary* head and a *secondary* head—are connected in series. Eluent passes through both pump heads in succession.

The primary pump head delivers eluent at the selected flow rate, while simultaneously filling the secondary pump head. The latter serves as a reservoir and delivers eluent while the primary head carries out the refill stroke.

The characteristic feature of the patented isokinetic precompression phase is the programmed overlapping of the delivery strokes of the two pump heads. When delivering compressible liquids without controlled precompression, the pulsation increases as the operating pressure increases because part of the delivery stroke is required to compress eluent in the pump head.

During the precompression phase, pulsation is minimized. A patented secondary control system (automatic compressibility compensation) ensures highly constant eluent delivery. The flow rate remains constant in relation to the pressure.

2.2.2 Pressure Transducer

The secondary pump head contains a built-in pressure transducer to measure the system pressure. The instrument control firmware installed in the DP/SP precisely controls the pump motor speed to ensure flow rate accuracy and to maintain constant flow and constant pressure.

Analytical IC

2.2.3 Proportioning Valves (Gradient pump only)

In the gradient pump, which is available for analytical IC applications only, eluent flows from the eluent reservoirs, through the vacuum degas chambers, and into a four-way proportioning valve assembly (see Figure 2-4). Programmed percentages of each eluent are proportioned by the four valves.

2.2.4 Vacuum Degassing Module

The DP/SP vacuum degassing module provides continuous, online eluent degassing. Eluent quality significantly affects DP/SP performance, and vacuum degassing eluents is one way to ensure high eluent quality.

Degassing helps prevent bubbles (caused by eluent outgassing) from forming in the eluent proportioning valves (gradient pump only), pump heads, and detector cell. Degassing eluents is especially important when combining aqueous and nonaqueous components (for example, water and acetonitrile).

The vacuum degassing module is either single-channel (in an isocratic pump) or quad-channel (in a gradient pump). The module consists of:

- A degas chamber (with degassing membranes) with internal capacity of 670 µL per channel
- A dual-stage diaphragm vacuum pump
- An on-board vacuum sensor

- The electronics required to operate the vacuum pump
- Tubing, fittings, and other accessories

The vacuum degassing module is automatically activated when the DP/SP power is turned on. Allow about 10 minutes for the module to equilibrate.

NOTE Make sure the run time is long enough to ensure that the vacuum degassing module delivers the optimal degassing performance.

Manual Control of the Vacuum Degassing Module

The vacuum degassing module normally remains on continuously. To turn it off (for example, to investigate a leak), follow these steps:

1. Open the Chromeleon ePanel Set.
2. Press the **F8** key to open the Command window.
3. Select the pump name.
4. Select the **Degasser** property and select **Off**.
5. To turn on the degasser again, select **On**.

2.2.5 Piston Seal Wash System

The piston seal wash system consists of a peristaltic pump, a reservoir containing wash solution, and the connecting tubing. The wash solution is usually ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6.

When seal washing is activated, the back of the main piston seal is rinsed with wash solution; this prolongs seal lifetime by preventing eluent crystallization on the piston surfaces.

Notes About the DP Piston Seal Wash System

The piston seal wash system is designed for use with only one of the two pumps in a DP module. When the DP is shipped from the factory, the seal wash system is connected to pump 1 (the bottom pump). If necessary, connect the seal wash system to pump 2 (the top pump), instead. For instructions on how to replumb the system, see Section 4.6.

NOTE For users who need to operate a piston seal wash system for both pumps in the DP, Thermo Fisher Scientific offers the following options:

- The Dual-Serial External Seal Wash Kit (P/N 063518) contains the parts needed to connect an external seal wash reservoir to a DP module and to set up the piston seal wash system in the DP pump for serial operation.
- The Dual-Parallel External Seal Wash Kit (P/N 068661) contains the parts needed to connect a second seal wash pump and an external seal wash reservoir to a DP.
- Thermo Fisher Scientific also offers the Pump Waste Tubing Kit (P/N B51006291) for pumps without a piston seal wash installed. For installation instructions, refer to the *Dionex ICS-6000 Ion Chromatography System Installation Instructions* (Document No. 22181-97001).

Analytical IC

2.2.6 Static Mixer (Analytical IC only)

For an analytical pump, a GM-4 static mixer is installed after the secondary pump head (see Figure 2-3). In the gradient pump, the mixer helps to ensure that proportioned eluents are mixed thoroughly. In the isocratic pump, the mixer is optional, but can function as a pulse damper.

When a GM-4 is installed, the DP/SP gradient delay volume is 380 µL. The gradient delay volume (or *dwell volume*) is the volume of liquid in the system between the point where the gradient is formed and the point where it enters the column. This includes the mixer, transfer tubing, and swept volume in the injector or autosampler.

NOTE For users who need to operate a piston seal wash system for both pumps in the DP, Thermo Fisher Scientific offers the following options:

- The Dual-Serial External Seal Wash Kit (P/N 063518) contains the parts needed to connect an external seal wash reservoir to a DP module and to set up the piston seal wash system in the DP pump for serial operation.

- The Dual-Parallel External Seal Wash Kit (P/N 068661) contains the parts needed to connect a second seal wash pump and an external seal wash reservoir to a DP.

Analytical IC

2.2.7 High-Pressure Trap Column (Analytical IC only)

For an analytical pump, a high-pressure trap column can be installed after the secondary pump head, in place of the static mixer (see Section 2.2.6). Several Thermo Scientific high-pressure trap columns are available for use with the Dionex ICS-6000 system (see Table 2-1).

For details about a column, refer to the column manual.

High-Pressure Trap Column	Part Number
Dionex MFC 500	079017
Dionex ATC 500, 2 mm	079018
Dionex CTC 500, 2 mm	079019
Dionex ATC 500, 4 mm	075976
Dionex CTC 500, 4 mm	075977
Dionex ATC-HC 500	075978
Dionex ATC-HC 500 Borate	075979

Table 2-1. *Thermo Scientific Dionex High-Pressure Trap Columns*

Capillary IC

2.2.8 Pulse Damper (Capillary IC only)

For a capillary pump, 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.

2.3 DP/SP Flow Schematics

2.3.1 Isocratic Pump Flow Schematic

Figure 2-5 illustrates the liquid flow path through an isocratic pump.

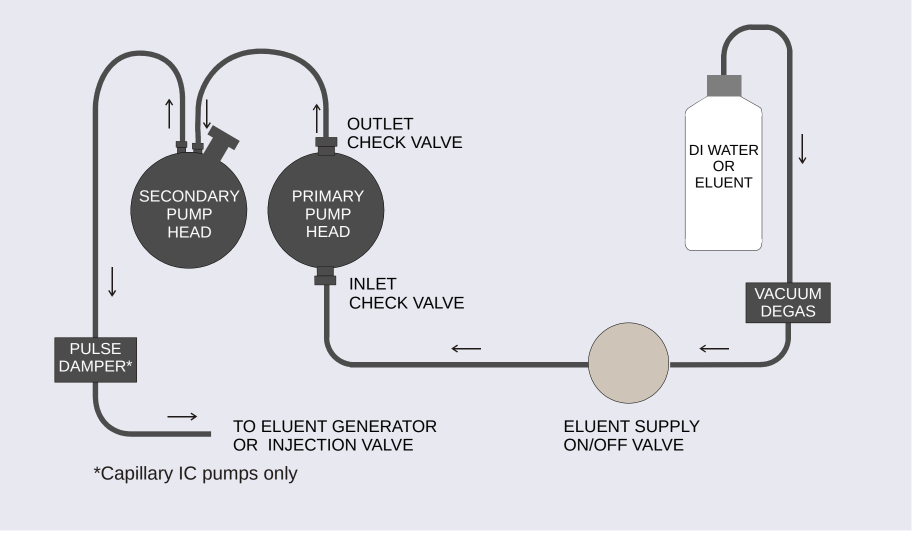


Figure 2-5. *Isocratic Pump Flow Schematic*

- Eluent flows from the reservoir, through the vacuum degas chamber, through the eluent supply on/off valve, and into the inlet check valve on the primary pump head.
- The inlet check valve opens, drawing eluent into the primary pump head. At the same time, the secondary piston pushes forward, pushing eluent into the system. After completing the intake, the primary piston pushes eluent through the outlet check valve and into the secondary pump head.
- Flow exits the secondary pump head and is directed to the eluent generator (if installed) or injection valve and then to the remainder of the chromatography system.

2.3.2 Gradient Pump Flow Schematic

Figure 2-6 illustrates the liquid flow path through a gradient pump.

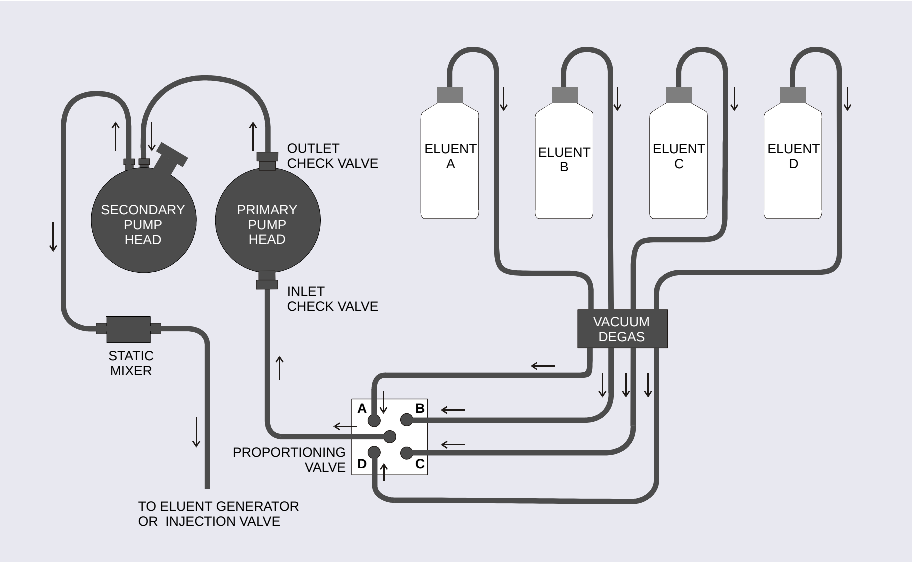


Figure 2-6. *Gradient Pump Flow Schematic*

- Eluent flows from the reservoirs and through the vacuum degas chambers. The selected proportions of eluent flow out of the proportioning valve assembly and into the inlet check valve on the primary pump head.
- The inlet check valve opens, drawing eluent into the primary pump head. At the same time, the secondary piston pushes forward, pushing eluent into the system. After completing the intake, the primary piston pushes eluent through the outlet check valve and into the secondary pump head.
- Flow exits the secondary pump head, continues through the static mixer, and is then directed to the eluent generator (if installed) or injection valve and then to the remainder of the chromatography system.

2.4 DP/SP Rear Panel

Figure 2-7 illustrates the rear panel of the DP/SP.

1. Tubing Chase (2)
2. Main Power Switch, Fuse Holder, and Power Receptacle
3. Digital I/O Port
4. Analog Pressure Output
5. USB Receptacle (“B” Connectors)
6. USB Ports (3) (“A” Connectors)
7. Exhaust Port from Vacuum Degas Module
8. Drain Port

Figure 2-7. *DP/SP Rear Panel*

Tubing Chases

The tubing chases route tubing from the front of the DP/SP, through the interior of the module, and to the rear panel.

Main Power Switch, Fuse Holder, and Power Receptacle

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

NOTE For routine on/off control, use the **POWER** button on the front of the DP/SP (see Figure 2-1 and Figure 2-2). To turn off the pump, press and hold the **POWER** button for 2 seconds.

The fuse cartridge contains two 2-amp IEC 60127-2 slow-blow fuses (P/N 954773). For instructions on how to change the fuses, see Section 10.9.

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

CAUTION

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

MISE EN GARDE

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.

VORSICHT

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

Digital I/O Port

The digital I/O port provides a connection to auxiliary devices. The connector includes three TTL inputs and four relay outputs. Table 2-2 indicates the functions assigned to the connector pins.

IMPORTANT

The maximum switching voltage of the relays is 24 V. The switching current must not exceed 100 mA.

Pin Number	Signal Name	Signal Level	Description
1	-----	-----	Not used
2	-----	-----	Not used
3	Relay 3 Out	Potential-free	Normally open
4	Relay 1 Out	Potential-free	Normally closed
5	Relay 2 Out	Potential-free	Normally closed
6	Relay 3 Out	Potential-free	Normally closed

Table 2-2. *25-Pin D-Sub I/O Port (Female)*

Pin Number	Signal Name	Signal Level	Description
7	Relay 1 Out	Potential-free	Common
8	Relay 2 Out	Potential-free	Common
9	Gnd	Ground	Ground
10	Gnd	Ground	Ground
11	Gnd	Ground	Ground
12	Gnd	Ground	Ground
13	-----	-----	Not used
14	Relay 4 Out	Potential-free	Normally open
15	Relay 4 Out	Potential-free	Common
16	Relay 4 Out	Potential-free	Normally closed
17	-----	-----	Not used
18	Relay 3 Out	Potential-free	Common
19	Relay 1 Out	Potential-free	Normally open
20	Relay 2 Out	Potential-free	Normally open
21	Vcc Out	+5V	+5V, 500 mA
22	TTL Input 1	TTL	Hold/Run
23	TTL Input 2	TTL	Stop
24	TTL Input 3	TTL	Start
25	-----	-----	Not used

Table 2-2. *25-Pin D-Sub I/O Port (Female) (Continued)*

Analog Pressure Output

The analog pressure output indicates the operating pressure of the pump. The pressure output is set to 50 mV/MPa (5 mV/14.51 psi). To monitor the pressure, connect the pressure output to a recorder or an A/D converter. These are the pin assignments for the 2-pin Cinch connector (P/N 8005.9001A):

Signal Level	Function
Inner ring:	Signal (pressure)
Outer ring:	Ground

The analog pressure output defaults to the pump 1 (bottom pump) output signal. To redirect the output to pump 2 (the top pump), follow these steps:

1. Open the Chromeleon ePanel Set.
2. Press the **F8** key to open the Command window.
3. Select the pump name.
4. Select the **AnalogOut** property and select **PumpTop**.

USB Connections

- One USB receptacle ("B" type connector) allows a connection from the PC on which Chromeleon is installed.
- Three USB (Universal Serial Bus) ports ("A" type connectors) are provided for connections to other Dionex ICS-6000 modules.

One 1.8 m (6 ft) USB cable (P/N 960777) is provided in the pump ship kit:

Pump Ship Kit	Part Number
DP Ship Kit Dual Capillary	072112
DP Ship Kit Dual Analytical	062463
DP Ship Kit Capillary and Analytical	072111
SP Ship Kit Capillary or Analytical	063342

Waste and Drain Lines

- One waste line is connected to the secondary pump head on each pump and is routed through the tubing chase to the rear of the DP/SP.
- The drain port removes any liquid that collects in the drip tray in the bottom of the DP/SP. A clear corrugated drain hose (P/N 055075) is connected to this port during installation.

Place the free ends of the waste lines and drain hose into a waste container. To maintain a positive siphon, position the waste container below the level of the pump.

IMPORTANT **For correct drainage, make sure the waste lines and drain hose are not bent, pinched, or elevated at any point. Do not allow the ends of the lines to be submerged in waste liquid.**

2.5 Eluent Reservoirs

The following reservoirs are available for use with the DP/SP:

- 1-liter plastic reservoir (P/N 063291)
- 2-liter plastic reservoir (P/N 062510)
- 4-liter plastic reservoir (P/N 063292)

CAUTION

Do not use the plastic reservoirs for offline vacuum degassing of eluents. The reservoirs were not designed for this purpose.

MISE EN GARDE

N'utilisez pas le réservoir en plastique pour le dégazage à vide hors ligne d'éluants. Le réservoir n'a pas été conçu à cette fin.

VORSICHT

Verwenden Sie keine Plastikbehälter zum Offline Vakkum-Entgasen von Eluenten. Die Behälter sind dafür nicht ausgelegt.

2.5.1 EO (Optional)

The Dionex ICS-6000 Eluent Organizer (EO) holds eluent reservoirs in a liner that contains spills and leaks. Up to two EOs can be installed on top of the DC. Each EO accommodates up to four 1-liter or 2-liter reservoirs *or* up to two 4-liter reservoirs. The EO is typically ordered configured with four 2-liter reservoirs (P/N 072058).

2.5.2 Pressurizing Eluent Reservoirs

All eluent reservoirs available for use with the DP/SP can be pressurized. Although the DP/SP does not *require* pressurized reservoirs, Thermo Fisher Scientific recommends pressurizing reservoirs with helium or nitrogen under the following circumstances:

- When using eluents that are sensitive to contamination.

- When combining aqueous and nonaqueous components (for example, water and acetonitrile). Pressurizable reservoirs allow eluents to be stored under a specific atmosphere.

CAUTION

Never pressurize eluent reservoirs above 0.07 MPa (10 psi). Pressurizing reservoirs above this limit can cause the reservoir to explode.

MISE EN GARDE

Ne mettez jamais les réservoirs d'éluants sous une pression supérieure à 0,07 MPa (10 psi).

VORSICHT

Setzen Sie den Eluentbehälter auf keinen Fall einem Druck über 0,07 MPa aus.

If you plan to pressurize the eluent reservoirs, an optional regulator kit is required. The kit is available in two versions:

- When the DC is installed as the topmost module in the system, the EO Regulator Kit (P/N 074422) is required. The kit includes a pressure regulator and gauge assembly with four outputs (for connections to four eluent reservoirs), as well as the tubing and connection fitting required.
- When the Dionex ICS Series Variable Wavelength Detector or Dionex ICS Series Photodiode Array Detector is installed as the topmost module in the system, the TC/VWD/PDA Regulator Bracket Kit (P/N 074424) is required. The kit includes the EO Regulator Kit described above, as well as a right-angle regulator bracket and mounting hardware. After attaching the bracket to the detector, you will mount the gas regulator assembly on the bracket.

If more reservoirs are required, order a second regulator (P/N AAA-074423).

For instructions on installing the regulator kits, refer to *Dionex ICS-6000 Ion Chromatography System Installation Instructions*.

2.5.3 Filtering Eluent

- Install an end-line filter (P/N 045987) on the end of each reservoir's eluent line. End-line filters are provided in the pump ship kit.
- A Dionex High-Pressure Inline Filter (P/N 044105) can be used to remove particulates down to 0.45 micron from eluent. Connect the inline filter between the pump outlet and the eluent inlet port on the injection valve. For details, see the instructions provided with the inline filter.

2.6 EG Front Features

The status bar on the front of the Dionex ICS-6000 Eluent Generator (EG) includes buttons that provide control of certain EG functions, as well as LEDs that indicate the status of several EG functions (see Figure 2-8).

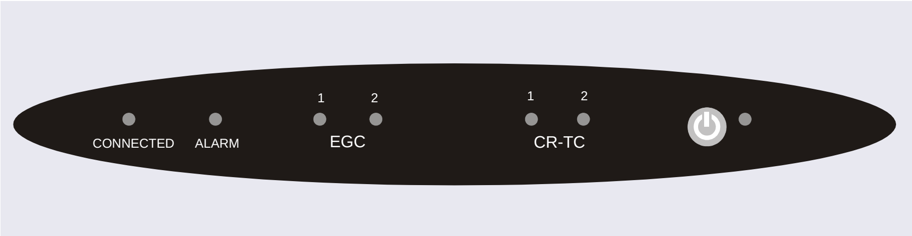


Figure 2-8. *EG Status Bar*

Button/LED Label	If the LED Is On	Comment
CONNECTED	The EG is connected to a Chromeleon instrument.	-----
ALARM	An EG-related problem has occurred (for example, the eluent generator cartridge (Dionex EGC) was disconnected).	Check the Chromeleon audit trail for the cause.
EGC 1 **EGC 2**	The Dionex EGC is on and is generating eluent.	EGC 1 is always installed in the left section of the component compartment. EGC 2, if present, is installed in the right section of the compartment.
CR-TC 1 **CR-TC 2**	The Dionex CR-TC 600 is on.	CR-TC 1 is always installed in the left section of the component compartment. CR-TC 2, if present, is installed in the right section of the compartment.

Button/LED Label	If the LED Is On	Comment
POWER ⏻	Use this **POWER** button for routine on/off control of the EG. When the power is on, this LED is lighted. To turn off the EG, press and hold this **POWER** button for 2 seconds.	The main power switch is on the EG rear panel.
NOTE: The EG status bar LEDs do not flash.		

2.7 EG Interior Components

The EG component compartment, which is located directly behind the front door, accommodates the components required for generating eluent in a single system or in both channels of a dual system. A component mounting panel divides the compartment into two sections:

- The left section is for a single-channel EG or for system 1 of a dual-channel EG.
- The right section is for system 2 of a dual-channel EG.

Each section holds the components for either a capillary IC or an analytical IC system. A dual-channel EG can hold components for two capillary IC systems, two analytical IC systems, or one system of each type.

Figure 2-9 shows the component panel for a capillary IC system. Figure 2-10 shows the component panel for an analytical IC system.

To access components for maintenance or service procedures, push down on the slide release latch and pull the tray forward until it reaches the stop.

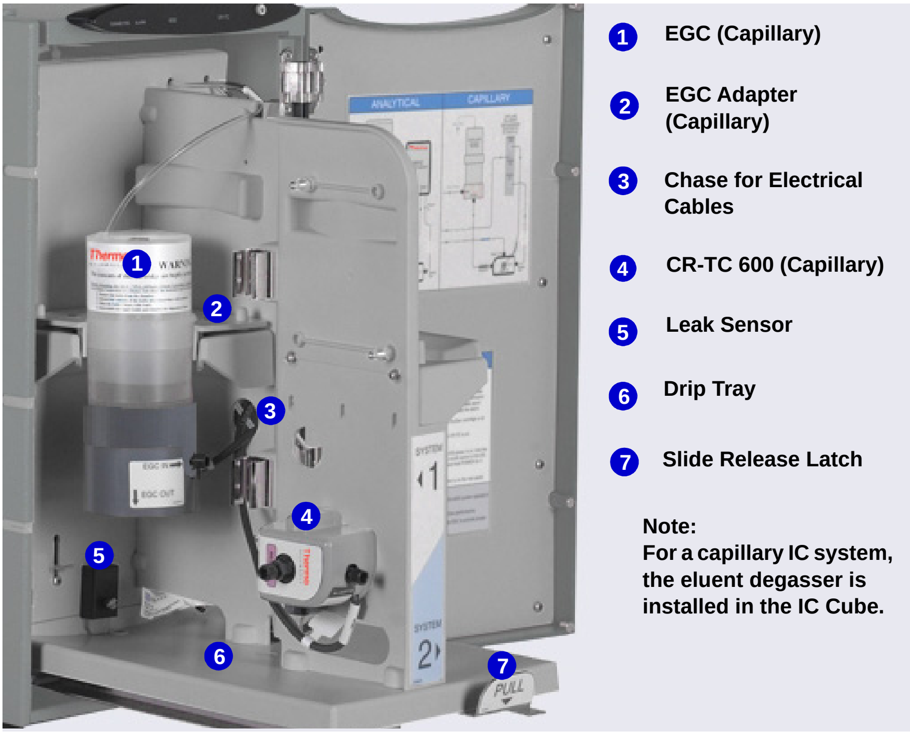
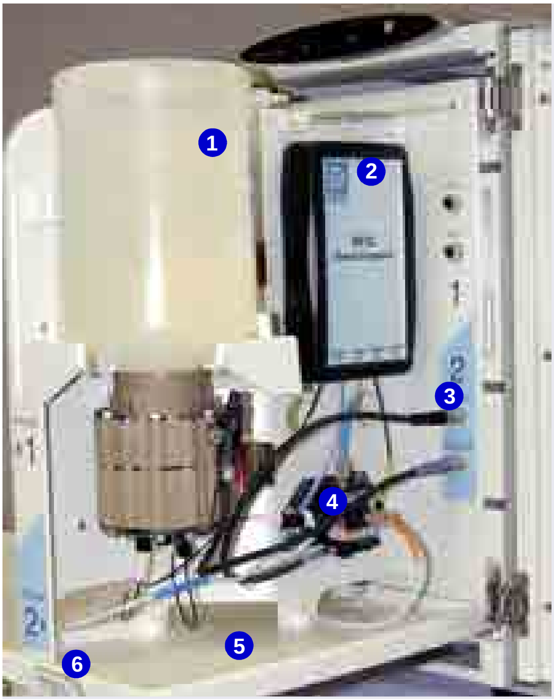


Figure 2-9. *Example EG Interior Components for a Capillary IC System (System 1 Shown)*



1. EGC III (Analytical)
2. RFIC+ Eluent Degasser (for Analytical IC only)
3. Electrical Cables
4. CR-TC 600 (Analytical)
5. Drip Tray
6. Slide Release Latch

Figure 2-10. *Example EG Interior Components for an Analytical (Standard-Pressure) IC System (System 2 of a Dual-Channel EG Shown)*

1. EGC 500 Analytical)
2. RFIC+ Eluent Degasser (for Analytical IC only)
3. Electrical Cables
4. CR-TC (Analytical)
5. Drip Tray
6. Slide Release Latch

Figure 2-11. *Example EG Interior Components for an Analytical (High-Pressure) IC System (System 1 Shown)*

Eluent Generator Cartridge (EGC)

Table 2-3 lists the versions of eluent generator cartridges available for use with the EG. Each Dionex EGC contains an electrolyte concentrate solution appropriate for the particular eluent generation. Each Dionex EGC is designed to be used in either a capillary IC system or an analytical IC system. A Dionex EGC designed for a capillary IC system cannot be used in an analytical IC system, and vice versa.

Analytical IC

Analytical IC systems typically include Dionex EGC 500 cartridges and (if required for the application) a Thermo Scientific Dionex EPM 500 Electrolytic pH Modifier. Although it is possible to operate high-pressure analytical systems with Dionex EGC III cartridges, this will limit the operating pressure to 21 MPa (3000 psi). For more information, refer to the Dionex EGC manual.

Dionex EGC Version	Part Number	Function
Eluent Generator Cartridges for Capillary IC Systems		
EGC KOH (Capillary)	072076	Generates potassium hydroxide eluent for anion exchange separations.
EGC MSA (Capillary)	072077	Generates methanesulfonic acid eluent for cation exchange separations.
Eluent Generator Cartridges and Accessories for Analytical IC Systems (Standard Pressure)		
EGC 500 K_2CO_3	088453	Generates potassium carbonate eluent for anion exchange separations.
EPM 500 Electrolytic pH Modifier	088471	Produces a carbonate/bicarbonate mixture when installed with the Dionex EGC 500 K_2CO_3. Requires a carbonate mixer: 2 mm (P/N 088467); 4 mm (P/N 088468).
EGC III KOH	074532	Generates potassium hydroxide eluent for anion exchange separations.
EGC III LiOH	074534	Generates lithium hydroxide eluent for anion exchange separations.
EGC III MSA	074535	Generates methanesulfonic acid eluent for cation exchange separations.
EGC III NaOH	074533	Generates sodium hydroxide eluent for anion exchange separations.
Eluent Generator Cartridges for Analytical IC Systems (High Pressure)		
EGC 500 K_2CO_3	088453	Generates potassium carbonate eluent for anion exchange separations.
EPM 500 Electrolytic pH Modifier	088471	Produces a carbonate/bicarbonate mixture when installed with the Dionex EGC 500 K_2CO_3. Requires a carbonate mixer: 2 mm (P/N 088467); 4 mm (P/N 088468).

Table 2-3. *Capillary and Analytical Dionex EGCs*

Dionex EGC Version	Part Number	Function
EGC 500 KOH	075778	Generates potassium hydroxide eluent for anion exchange separations.
EGC 500 MSA	075779	Generates methanesulfonic acid eluent for cation exchange separations.

Table 2-3. *Capillary and Analytical Dionex EGCs (Continued)*

Continuously Regenerated Trap Column (Dionex CR-TC 600)

The Dionex CR-TC 600 is a high-pressure, electrolytically-regenerated trap column. The column is designed to remove anionic or cationic contaminants in the eluent or deionized water and to reduce drift during gradient separations. Table 2-4 lists the versions of the Dionex CR-TC 600 that can be used with the EG.

Dionex CR-TC 600 Version	IC System Type	Part Number
Continuously Regenerated Anion Trap Column (Capillary); CR-ATC 600 (Capillary)	Capillary	072078
Continuously Regenerated Cation Trap Column (Capillary); CR-CTC 600 (Capillary)	Capillary	072079
Continuously Regenerated Anion Trap Column; CR-ATC 600	Analytical (All)	088662
Continuously Regenerated Cation Trap Column; CR-CTC 600	Analytical (All)	088663

Table 2-4. *Capillary and Analytical Dionex CR-TCs*

For more information, refer to the Dionex CR-TC manual.

NOTE Do not install a Dionex CR-TC 600 in the same channel as a Dionex EGC 500 K_2CO_3 or a Dionex EPM 500 Electrolytic pH Modifier.

NOTE The Thermo Scientific™ Dionex™ IonPac™ ATC-HC Trap Column (P/N 059604) or IonPac CTC-1 Trap Column

(P/N 040192) may be used with Dionex EGC III cartridges. The Thermo Scientific™ Dionex™ ATC-HC 500 Trap Column (P/N 075958) or IonPac CTC 500 Trap Column (P/N 075977) can be used with Dionex EGC 500 cartridges. However, all of these IonPac trap columns require off-line chemical regeneration. Contact Technical Support for Dionex products for more information.

Analytical IC

RFIC+ Eluent Degasser

For analytical IC systems, a Dionex RFIC+ Eluent Degasser (P/N 075522) is installed on the EG component mounting panel. The degasser contains a tubing assembly that purges the electrolysis gas from the freshly-generated eluent before it is directed to the separator column.

Capillary IC

For capillary IC systems, the eluent degasser is installed in the IC Cube (see Section 2.11.2).

Analytical IC

Backpressure Coil (Optional)

For analytical IC systems, the Dionex EGC requires at least 14 MPa (2000 psi) of system backpressure for removal of electrolysis gas (by the Dionex RFIC+ Eluent Degasser) 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 Dionex EGC **OUTLET** port. For details, see Section 10.15.

Analytical IC

EPM 500 Electrolytic pH Modifier and Carbonate Mixer

The Dionex EGC 500 K_2CO_3 can be used with a Dionex EPM 500 Electrolytic pH Modifier (P/N 088471) and a carbonate mixer (2 mm, P/N 088467; 4 mm, P/N 088468) to produce a carbonate/bicarbonate mixture for use with anion exchange separations on carbonate-based IonPac columns.

After the cartridge generates potassium carbonate eluent, the Dionex EPM adjusts the eluent concentration to produce the carbonate/bicarbonate mixture. The carbonate mixer provides mixing necessary to produce a homogeneous solution of electrolytically-generated K_2CO_3 and $KHCO_3$ eluent.

For more information about these products, refer to the Dionex EGC manual.

Leak Sensor

If liquid collects in the drip tray in the bottom of the EG, a leak sensor reports the leak to Chromeleon and an error message is displayed in the audit trail. In addition, the **Alarm** LED on the EG front panel lights.

Electrical Connections

Electrical connectors provide a connection from the components installed in the EG to the EG power supplies. There are two sets of electrical connectors (one per channel). Connections for the following Dionex components are provided:

- Two EGCs *or* one EGC and one EPM 500

  and

- Two CR-TC 600s

When operating with a Dionex EGC 500 K_2CO_3 and a Dionex EPM 500, the Dionex EGC is connected to the Dionex EGC power supply for one channel and the Dionex EPM 500 is connected to the Dionex EGC power supply for the second channel. Thus, the EG can accommodate only one such configuration.

2.8 EG Rear Panel

Figure 2-12 illustrates the rear panel of the EG.

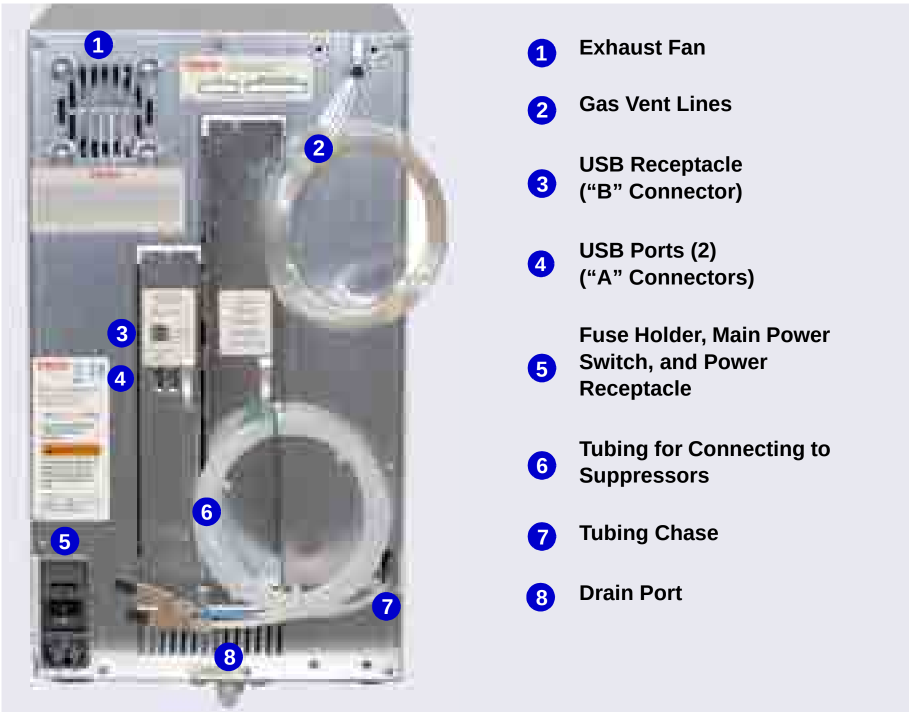


Figure 2-12. *EG Rear Panel*

Exhaust Fan

The exhaust fan cools the interior of the EG and exhausts any oxygen and hydrogen gases that escape during operation.

USB Connections

- One USB receptacle (“B” type connector) allows a connection from the PC on which Chromeleon is installed.
- Two USB (Universal Serial Bus) ports (“A” type connectors) are provided for connections to other Dionex ICS-6000 modules.

One 1.8 m (6 ft) USB cable (P/N 960777) is provided in the EG Ship Kit (P/N 072047).

Fuse Holder, Main Power Switch, and Power Receptacle

The fuse cartridge contains two 2-amp slow-blow fuses (P/N 954773). For instructions on how to change the fuses, see Section 10.16.

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

NOTE For routine on/off control, use the **POWER** button on the front of the EG (see Figure 2-8). To turn off the EG, press and hold the **POWER** button for 2 seconds.

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

CAUTION

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

MISE EN GARDE

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.

VORSICHT

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

Tubing Chase

The tubing chase routes tubing from the front of the EG, through the interior of the module, and to the rear panel.

Suppressor, Vent, and Drain Lines

- The lines exiting the tubing chase (white tubing) are for connecting the **REGEN IN** port on the Dionex RFIC$^+$ Eluent Degasser or Dionex EPM 500 Electrolytic pH Modifier to the **REGEN OUT** port on the suppressor.
- The gas vent lines (clear tubing) discharge the electrolysis gas (H_2 or O_2) that is vented from the Dionex EGC electrolyte reservoir and the Dionex RFIC$^+$ Eluent Degasser.

- The drain port removes any liquid that collects in the drip tray in the bottom of the EG. A clear corrugated drain hose (P/N 055075) is connected to this port during installation.

Place the free ends of the vent lines and drain hose into a waste container. To maintain a positive siphon, position the waste container below the level of the EG.

IMPORTANT **For correct drainage, make sure the vent lines and drain hose are not bent, pinched, or elevated at any point. Do not allow the ends of the lines to be submerged in waste liquid.**

2.9 EGC Flow Schematics

Liquid flows through the EG components in the following order:

- The pump delivers deionized water to the Dionex EGC. Direct current is applied to the Dionex EGC to produce eluent.
- The electrolytically-generated eluent flows to the Dionex CR-TC 600 (which traps ionic contaminants) and then into the degasser.
- After exiting the degasser, the eluent flows through the backpressure coil (if installed), through the injection valve to the separator column, and finally to the detector cell.
- The detector cell effluent is directed through the suppressor regenerant chamber, through the Dionex CR-TC 600 regenerant chamber, and finally to waste.

The flow paths for a capillary IC and an analytical IC system are the same. However, in a capillary IC system, a degasser cartridge is located in the IC Cube inside the DC. In an analytical IC system, the degasser is located inside the EG.

Capillary IC Figure 2-13 illustrates the liquid flow path through an EG configured for a capillary IC system.

Analytical IC Figure 2-14 illustrates the liquid flow path through an EG configured for an analytical IC system. Figure 2-15 illustrates the liquid flow path through an EG configured for a high-pressure analytical IC system.

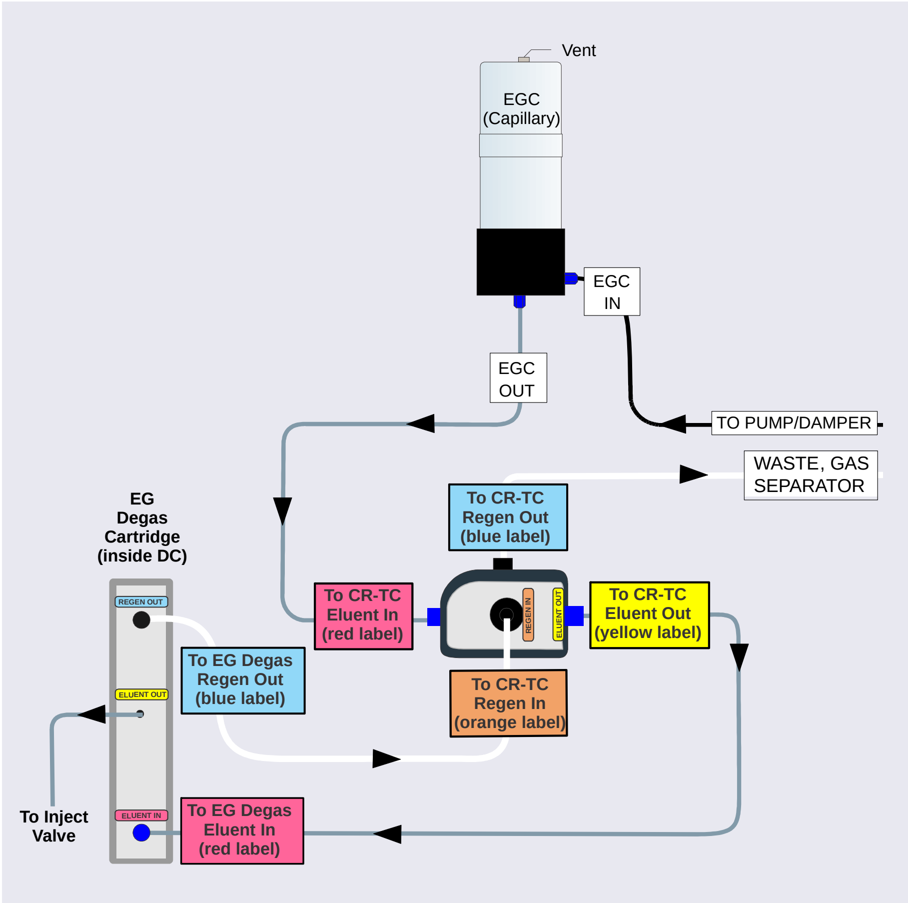


Figure 2-13. *EG Flow Schematic Example for Capillary IC*

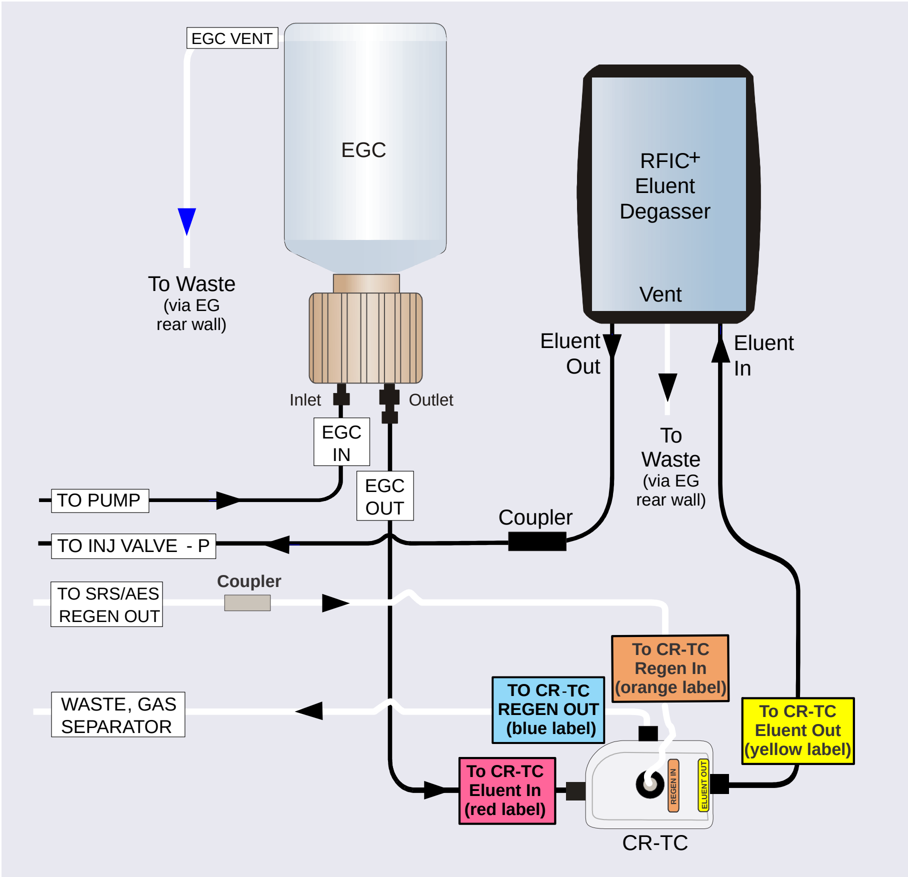


Figure 2-14. *EG Flow Schematic Example for Standard-Pressure Analytical IC*

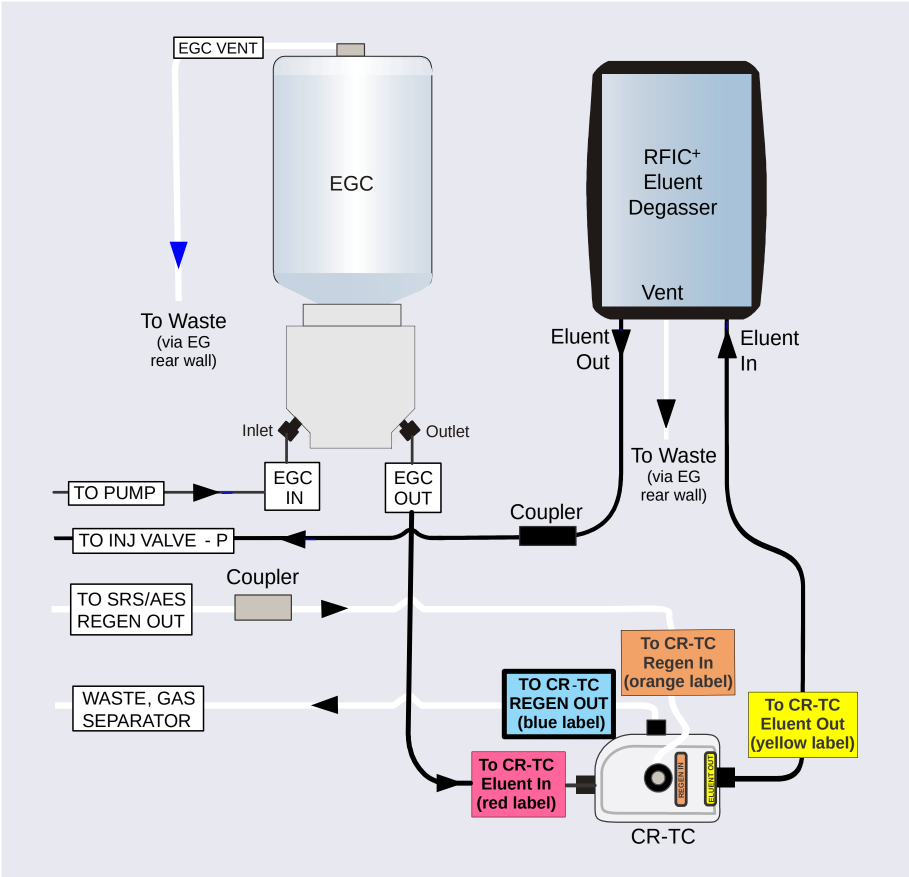


Figure 2-15. *EG Flow Schematic Example for High-Pressure Analytical IC*

NOTE Refer to the Dionex EGC 500 CO_3 Mixer manual for a flow schematic showing the components required to generate a carbonate/bicarbonate mixture.

2.10 DC Front Features

The status bar on the front of the Dionex ICS-6000 Detector/Chromatography Module (DC) (see Figure 2-16) includes buttons for controlling certain DC functions, as well as LEDs that indicate the status of several DC components and functions.

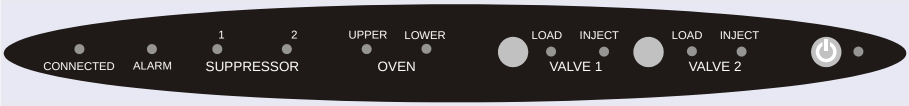


Figure 2-16. *DC Status Bar*

Button/LED Label	If the LED Is On	If the LED Is Flashing
CONNECTED	The DC is connected to a Chromeleon instrument.	Does not flash.
ALARM	The leak sensor is wet, or a valve or suppressor error occurred. Check the Chromeleon audit trail for the cause.	Does not flash.
SUPPRESSOR 1 **SUPPRESSOR 2**	The suppressor is on and current is being applied.	Does not flash.
OVEN UPPER	The upper compartment is at its set temperature.	The upper compartment is transitioning to the set temperature. The compartment is not ready for operation.
OVEN LOWER	The lower compartment is at its set temperature.	The lower compartment is transitioning to the set temperature. The compartment is not ready for operation.

Button/LED Label	If the LED Is On	If the LED Is Flashing
VALVE 1 LOAD **VALVE 2 LOAD** **VALVE 1 INJECT** **VALVE 2 INJECT**	Use the **VALVE 1** and **VALVE 2** buttons to manually switch the position of the DC injection valves. The LEDs indicate whether the valve is in the Load or Inject position.	Valve error. See Section 9.26 for troubleshooting.
⏻ **POWER**	Use this **POWER** button for routine on/off control of the DC. When the power is on, this LED is lighted. To turn off the DC, press and hold this **POWER** button for 2 seconds. **Note:** The main power switch is on the DC rear panel.	Does not flash.

NOTE The **VALVE 1** and **VALVE 2** buttons can be enabled and disabled in Chromeleon. When disabled, you can control the valve only from Chromeleon. To enable or disable a button, press the **F8** key to open the Command window, select the **Advanced** or **Expert** user level, and select the **Valve1Button** (or **Valve2Button**) property in the list of DC properties.

The two sample loading ports on the front of the DC (see Figure 2-17) can be connected to injection valves installed inside the DC. A syringe can then be used to manually load sample through the ports. For automated sample injection, the DC can be connected to an autosampler. For more information about sample injection, see Section 5.2.

Figure 2-17. *DC Sample Loading Ports*

2.11 DC Interior Components

The interior of the DC consists of two temperature-controlled compartments (upper and lower). To access the upper compartment, lift up the top door. To access the lower compartment, pull down the lower door.

The upper and lower compartments are isolated from each other in separate temperature zones. There is no common air flow between the two compartments. For details about DC temperature control, see Section 2.12.

The compartments can accommodate the components required for up to two IC systems. The following configurations are possible:

- Single system: one capillary IC system or one analytical IC system
- Dual system: two capillary IC systems, two analytical IC systems, or one system of each type (a “hybrid”)

Capillary IC

2.11.1 DC Interior Components for Capillary IC

In capillary IC systems, the upper compartment of the DC houses the required components. If the DC is used for capillary IC only, the lower compartment is unused.

The DC upper compartment consists of two sections:

- The top section houses one or two Dionex ICS-6000 IC Cubes (IC Cubes). For details about the IC Cube, see Section 2.11.2. The tray slides forward for easy access to components.
- The lower section houses one or two Dionex ICS-6000 Conductivity Detectors (CDs), one or two Dionex ICS-6000 Electrochemical Detectors (EDs), or one detector of each type.

  For details about the CD, see Section 2.14. For details about the ED, see Section 2.15.

Figure 2-18 shows the upper compartments of a DC that is configured for two capillary IC systems. Both systems are configured for conductivity detection.

1. IC Cube (System #1)
2. Conductivity Detector (Capillary) (System #1)
3. IC Cube (System #2)
4. Conductivity Detector (Capillary) (System #2)

Figure 2-18. *Example DC Interior View (Upper Compartment of a Dual IC System Shown)*

Capillary IC

2.11.2 IC Cube for Capillary IC

The IC Cube houses components for running capillary IC applications. The IC Cube is installed in the upper compartment of the DC. For a dual system, two IC Cubes can be installed.

NOTE When an IC Cube is installed, a Dionex ICS-6000 AM cannot be included in the DC.

Each IC Cube includes an injection valve and a column heater, as well as three component cartridges and a column tray that slide into the housing. Each cartridge or tray holds a capillary IC component and includes the plumbing required to connect the component to other IC Cube and system components.

Cartridges for the following components are available: carbonate removal device (Dionex CRD), suppressor, and EG degasser. The column tray holds guard and separator columns.

NOTE If the IC Cube does not include a Dionex CRD or suppressor, bypass cartridges must be installed. Bypass cartridges provide the internal plumbing connections required for eluent and regenerant flow between IC Cube components.

Figure 2-19 illustrates the features of the IC Cube.

1. CRD Cartridge or CRD Bypass Cartridge
2. Suppressor Cartridge or Suppressor Bypass Cartridge
3. Column Heater and Column Tray
4. EG Degas Cartridge
5. Injection Valve

Figure 2-19. *IC Cube Features*

Capillary IC

Dionex CRD Cartridge or CRD Bypass Cartridge

The Dionex CRD 200 (Capillary) cartridge (P/N 072054) contains a Dionex CRD 200 Carbonate Removal Device (Capillary). The Dionex CRD 200 (Capillary) removes the carbonate peak contributed by the sample in hydroxide eluent chemistries. Removal occurs immediately after suppression of the eluent, before the sample reaches the detector. The Dionex CRD 200 (Capillary) is optimized for operation at the flow rate range typically used with capillary columns.

The Dionex CRD and tubing connections inside the cartridge are not accessible. Tubing exits the front of the cartridge to allow connection to other capillary IC components.

Installation of a Dionex CRD 200 (Capillary) is optional. However, if one is not used, a Dionex CRD bypass cartridge (P/N 072056) must be installed. The bypass cartridge contains the plumbing connections necessary for eluent and waste flow through the system.

Capillary IC

Suppressor Cartridge or Suppressor Bypass Cartridge

Capillary suppressor cartridges are available in two versions: Thermo Scientific™ Dionex™ ACES 300 Anion Capillary Electrolytic Suppressor cartridge (P/N 072052) and Thermo Scientific™ Dionex™ CCES 300 Cation Capillary Electrolytic Suppressor cartridge (P/N 072053). Each cartridge holds a suppressor and the required tubing connections for eluent and regenerant flow to the suppressor. The suppressor and tubing connections inside the cartridge are not accessible. Tubing exits the front of the cartridge to allow connection to other capillary IC components.

When the cartridge is installed in the IC Cube, pins on the rear of the cartridge connect the suppressor to its power source. For details about the suppressors, refer to the suppressor manuals.

Installation of a suppressor is optional. However, if one is not used, a suppressor bypass cartridge (P/N 072055) must be installed. The suppressor bypass cartridge contains the plumbing connections necessary for eluent and waste flow through the system.

Capillary IC

Column Heater and Column Tray

The IC Cube column heater provides a temperature-controlled compartment for the capillary guard and separator columns. The heater temperature range is from 5 °C above the temperature of the upper DC compartment to 80 °C.

A column tray slides into the column heater and is secured with two thumbscrews. The column tray contains the capillary guard column (if included) and the capillary separator column. To access the columns, disconnect the inlet and outlet tubing, loosen the captive screws, and slide the tray out of the oven. The tray hinges open, providing access to the columns and column plumbing. The capillary columns are ordered separately. For information about how to replace columns and column tubing, see Section 10.25.2.

Capillary IC

EG Degas Cartridge

The EG degas (capillary) cartridge contains a tubing assembly that purges the electrolysis gas from eluent that has been generated by an EG. After passing through the degas tubing, the eluent is directed to the injection valve and then to the guard and separator columns.

The EG degas (capillary) cartridge also contains plumbing connections that route the regenerant flow from the suppressor out of the IC Cube to the regenerant inlet port of the Continuously Regenerated Trap Column (Capillary) in the EG.

If the system does not include an EG, the eluent inlet line from the EG degas cartridge is connected directly to the pump outlet. The regenerant outlet line is directed to waste.

Capillary IC

IC Cube Eluent and Regenerant Flow

The numbers on the schematic shown in Figure 2-20 indicate the flow path of eluent and regenerant through the plumbing connections on an IC Cube configured for conductivity detection.

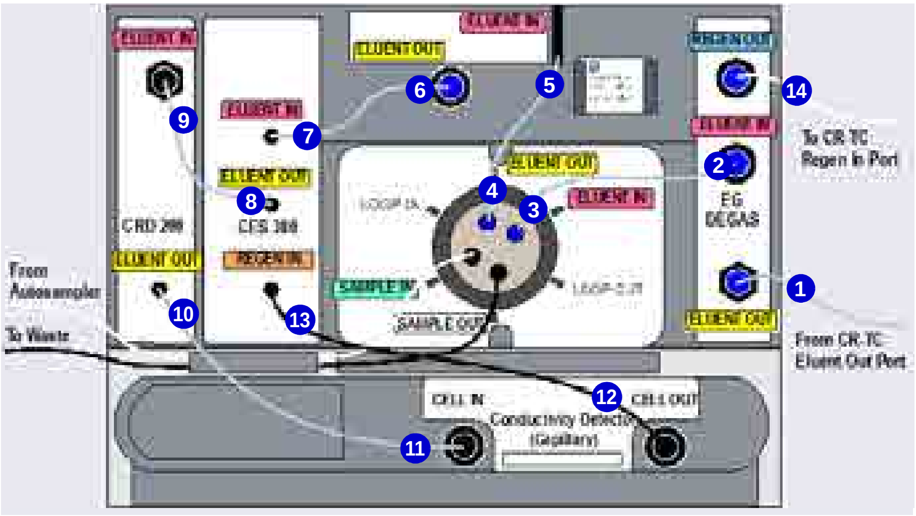


Figure 2-20. *IC Cube Eluent and Regenerant Flow Schematic for Conductivity Detection*

NOTE For the complete conductivity detection flow path, including the flow through components installed inside the IC Cube cartridges, see Section 2.14.3.

The numbers on the schematic shown in Figure 2-21 indicate the flow path of eluent and regenerant through the plumbing connections on an IC Cube configured for electrochemical detection.

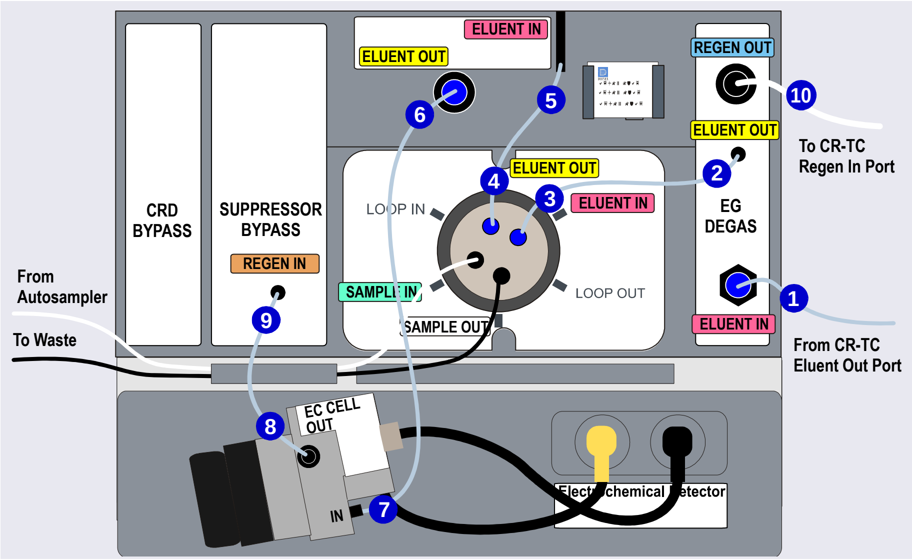


Figure 2-21. IC Cube Eluent and Regenerant Flow Schematic for Electrochemical Detection (PdH Electrode Shown)

Analytical IC

2.11.3 DC Interior Components for Analytical IC

Figure 2-22 shows the interior compartments of a DC that is configured with the components for two analytical IC systems. System #1 is used for electrochemical detection applications and system #2 is used for conductivity detection applications.

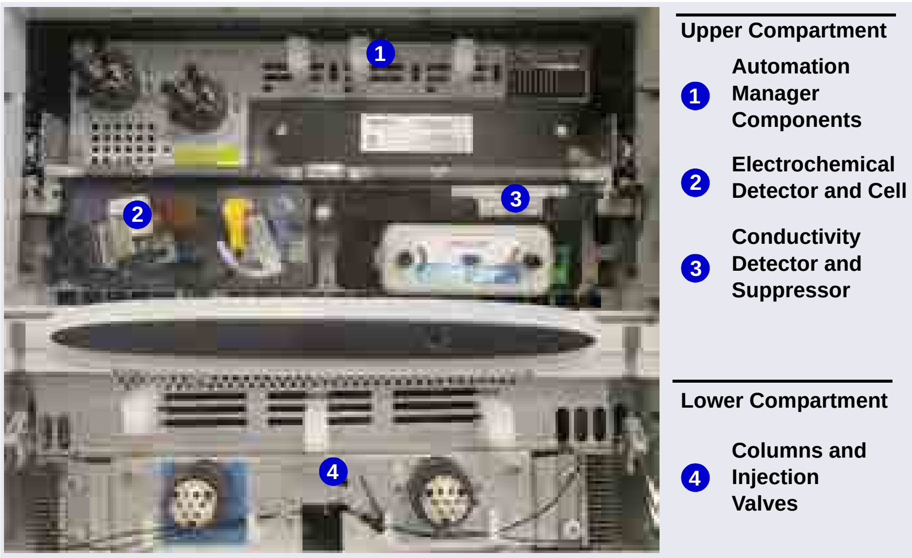


Figure 2-22. *Example DC Interior View (Dual Analytical IC System Shown)*

Upper Compartment Features for Analytical IC

The upper compartment consists of two sections:

- The top section houses the optional Dionex ICS-6000 Automation Manager (AM). The AM contains various components required for performing matrix elimination, large volume preconcentration, post-column reagent addition, and other functions. See Section 2.19 for details about the AM.
- The lower section houses one or two Dionex ICS-6000 Conductivity Detectors (CDs), one or two Dionex ICS-6000 Electrochemical Detectors (EDs), or one detector of each type. For details about the CD, see Section 2.14. For details about the ED, see Section 2.15.

- Suppressors for conductivity detection are also installed in the upper compartment. The following types of Thermo Scientific suppressors can be used:
  - Dionex™ ERS™ 500 Carbonate Electrolytically Regenerated Suppressor
  - Dionex™ ERS™ 500e Electrolytically Regenerated Suppressor
  - Dionex™ AMMS™ ICE 300 Anion Exchange Suppressor
  - Dionex™ DRS™ 600 Dynamically Regenerated Suppressor

The Dionex DRS can be operated in the **Legacy** mode, which uses constant current.

Specify the Dionex DRS power mode, as well as the current value applied to the suppressor, in the Chromeleon Instrument Method Wizard. For details, refer to the Chromeleon Help.

Analytical IC

Lower Compartment Features for Analytical IC

The lower compartment can hold up to two column sets (four columns) with IDs of 1 mm to 9 mm and lengths of 100 mm to 250 mm.

The lower compartment also holds one or two injection valves. Two valve versions (6-port and 10-port) are available. Both versions are electrically-activated, two-position valves. See Section 2.13 for details about the injection valves.

The compartment tray slides forward about 10 cm (4 in) for easy access to columns and valves. To pull the tray forward, use the handle installed in the center of the compartment (see Figure 2-23).

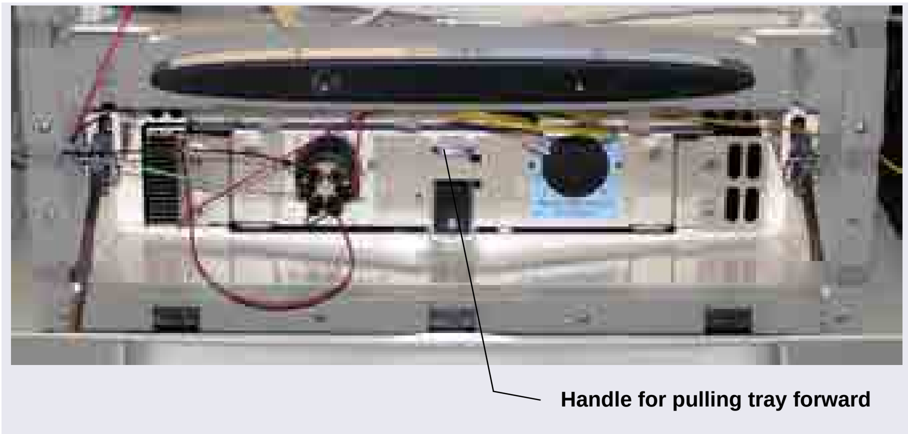


Figure 2-23. *DC Lower Compartment Tray Handle*

2.12 DC Temperature Control Zones

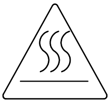
The following temperature control zones are possible with the DC, depending on the options installed:

- DC upper compartment
- DC lower compartment
- Heated conductivity cell
- IC Cube capillary column heater
- RCH-1 Reaction Coil Heater (installed in an AM)

Capillary IC
Analytical IC

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

MISE EN GARDE: Permettre aux composants chauffés de refroidir avant tout intervention.



VORSHICHT: Warten Sie erhitzte Komponenten erst nachdem diese sich abgekühlt haben.

The temperatures achieved for a particular zone can vary from the control range, depending on the ambient temperature (see Table 2-5).

Temperature Zone	Control Range	Settable Range	Achieved Temperature (Based on Ambient)
Upper compartment, standard DC	18 to 40 °C	• No suppressor installed: 15 to 40 °C • Suppressor(s) installed; RFIC-ER mode turned off for both suppressors: 15 to 35 °C • Suppressor(s) installed; RFIC-ER mode turned on for at least one suppressor: 15 to 30 °C • Capillary suppressor(s) installed: 10 to 20 °C **Note:** The allowable temperature setting in Chromeleon is limited to prevent damage to certain components.	• If no temperature-controlled devices (CD cell, IC Cube heater, or RCH-1) are on: Minimum temperature ≥ (ambient – 15 °C) • If a temperature-controlled device is set to 60 °C or above: Minimum temperature ≥ (ambient – 17 °C) **Note:** The achieved temperature can be reduced another few degrees by setting the DC upper compartment fan speed to high (see page 81). • Maximum temperature ≥ (ambient + 20 °C)

Table 2-5. *Achieved Temperatures per DC Temperature Zone*

Temperature Zone	Control Range	Settable Range	Achieved Temperature (Based on Ambient)
Upper compartment, low-temperature DC	10 to 40 °C	• No suppressor installed: 10 to 40 °C • Suppressor(s) installed; RFIC-ER mode turned off for both suppressors: 10 to 35 °C • Suppressor(s) installed; RFIC-ER mode turned on for at least one suppressor: 10 to 30 °C • Capillary suppressor(s) installed: 10 to 20 °C **Note:** The allowable temperature setting in Chromeleon is limited to prevent damage to certain components.	• If no temperature-controlled devices (CD cell, IC Cube heater, or RCH-1) are on: Minimum temperature ≥ (ambient – 17 °C) • If a temperature-controlled device is set to 60 °C or above: Minimum temperature ≥ (ambient – 17 °C) **Note:** The achieved temperature can be reduced another few degrees by setting the DC upper compartment fan speed to high (see page 81). • Maximum temperature ≤ (ambient + 20 °C)
Lower compartment	10 to 70 °C		Minimum temperature ≥ (ambient – 15 °C) Maximum temperature ≥ (ambient + 50 °C)
CD cell	15 to 60 °C		Minimum temperature ≥ (upper compartment temperature + 5 °C)
IC Cube column heater	15 to 80 °C		Minimum temperature ≤ (upper compartment temperature + 5 °C)

Table 2-5. *Achieved Temperatures per DC Temperature Zone (Continued)*

Temperature Zone	Control Range	Settable Range	Achieved Temperature (Based on Ambient)
RCH-1	20 to 80 °C		Minimum temperature ≥ (upper compartment temperature + 5 °C)

Table 2-5. *Achieved Temperatures per DC Temperature Zone (Continued)*

Minimum temperatures are also affected by the ambient humidity. If the humidity is high, the minimum temperatures achieved for a temperature zone are not as low as those achieved in a low ambient humidity environment.

NOTE A DC Temperature Calibration Kit (P/N 063782) is available. The kit includes the parts and instructions required to verify the temperature calibration of the DC upper and lower compartments and to recalibrate, if required.

To set the fan speed of the DC upper compartment to high:

1. Open the Chromeleon Instrument Configuration Manager.
2. Double-click the DC icon under the instrument.
3. Click the **Thermal Controls** tab and then double-click **Compartment_TC**.

4. Under **Fan**, click **High Speed** (see Figure 2-24).

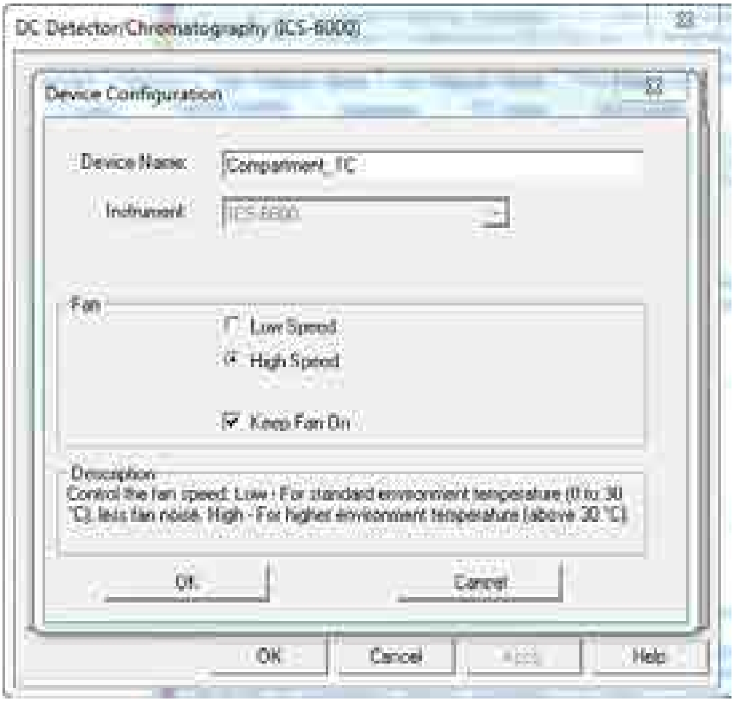


Figure 2-24. Setting the DC Upper Compartment Fan Speed

2.13 High-Pressure Valves

Up to four high-pressure valves can be installed in the DC. The following valve models are available:

- 4-port valve with 0.1 µL internal sample loop (P/N 00110-03-00039)
- 4-port valve with 0.2 µL internal sample loop (P/N 00110-03-00040)
- 4-port valve with 0.4 µL internal sample loop (P/N 074525)
- 6-port valve (P/N 075917)
- 10-port valve (P/N 075918)

Capillary IC

In a capillary IC system, one 4-port high-pressure valve is installed in each IC Cube. This valve is used for sample injection. Optionally, the 6-port valve can be installed instead of the 4-port valve. In addition to the injection valve, one or two high-pressure valves can be installed in the lower compartment. These valves can be used for applications requiring auxiliary valves.

Analytical IC

In an analytical IC system, one 6-port high-pressure valve is installed in the lower compartment for each system configured in the DC. This valve is used for sample injection. Optionally, one or two high-pressure valves can be installed on an AM (see Section 2.19). These valves can be used for applications requiring auxiliary valves.

Each valve has two operating positions. When configured as an injection valve, liquid flows through either the Load or Inject path, depending on the valve position. In the Load position, sample is loaded into the sample loop. In the Inject position, sample is swept to the column for analysis.

When configured as an auxiliary valve, the flow path through system components in each valve position depends on the component configuration.

2.13.1 4-Port Valve

The 4-port valve (P/N 064525) is the standard injection valve for capillary IC systems. The valve is installed in the IC Cube (see Figure 2-19). The valve typically has a 0.1 µL internal sample loop (P/N 00110-03-00041). Two options are available for the valve: a 0.2 µL internal sample loop (P/N 00110-03-00042) and a 0.4 µL internal sample loop (P/N 074699).

Figure 2-25 shows flow schematics for the 4-port valve.

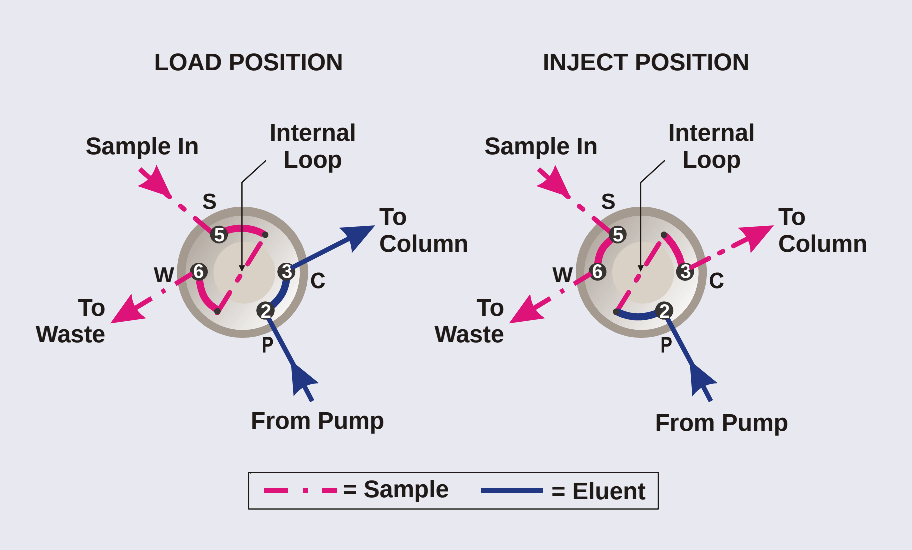


Figure 2-25. *Injection Valve Flow Schematics (4-Port Valve)*

- In the Load position, sample flows from the syringe or autosampler line (if installed), through the valve, and into the internal sample loop, where it is held until injection. Excess sample flows out to waste. Eluent flows from the pump, through the valve, and to the column, bypassing the sample loop.
- In the Inject position, eluent flows from the pump, through the internal sample loop, and on to the column, carrying the contents of the sample loop with it. Section 5.3.1 describes how to inject samples with an autosampler and Section 5.3.2 describes how to inject samples manually.

2.13.2 6-Port Valve

The 6-port valve (P/N 075917) is the standard injection valve for analytical IC systems. It is installed in the lower compartment of the DC (see Figure 2-22). Figure 2-26 shows flow schematics for the 6-port valve.

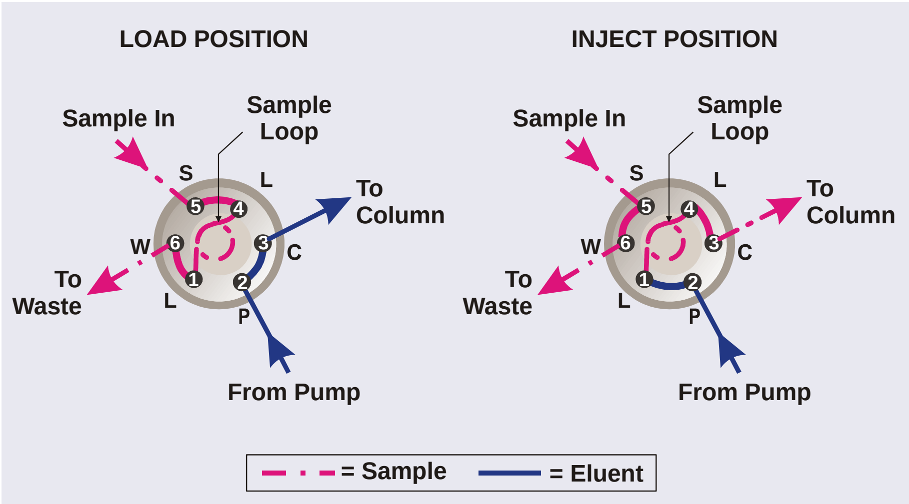


Figure 2-26. *Injection Valve Flow Schematics (6-Port Valve)*

- In the Load position, sample flows from the syringe or autosampler line (if installed), through the valve, and into the sample loop, where it is held until injection. Excess sample flows out to waste. Eluent flows from the pump, through the valve, and to the column, bypassing the sample loop.
- In the Inject position, eluent flows from the pump, through the sample loop, and on to the column, carrying the contents of the sample loop with it. Section 5.3.1 describes how to inject samples with an autosampler and Section 5.3.2 describes how to inject samples manually.

A 10 µL PEEK™ (polyether ether ketone) sample loop (P/N 042949) is installed between ports L (1) and L (4). Thermo Fisher Scientific offers sample loops in various sizes. If necessary, the preinstalled 10 µL loop can be replaced with a loop that has a different sample injection volume. Optionally, the following internal sample loops can be used:

- 0.1 µL internal sample loop (P/N 0010-03-00041)
- 0.2 µL internal sample loop (P/N 0010-03-00042)

- 0.4 µL internal sample loop (P/N 074699)

2.13.3 10-Port Valve

The 10-port valve (P/N 075918) is an optional valve, available for various applications. Figure 2-27 shows example flow schematics for the 10-port valve when it is connected for an application that uses a concentrator column.

NOTE Other plumbing configurations for the 10-port valve are possible, depending on the components to be connected to the valve and the application to be run. Refer to the appropriate Dionex Application Note for more information.

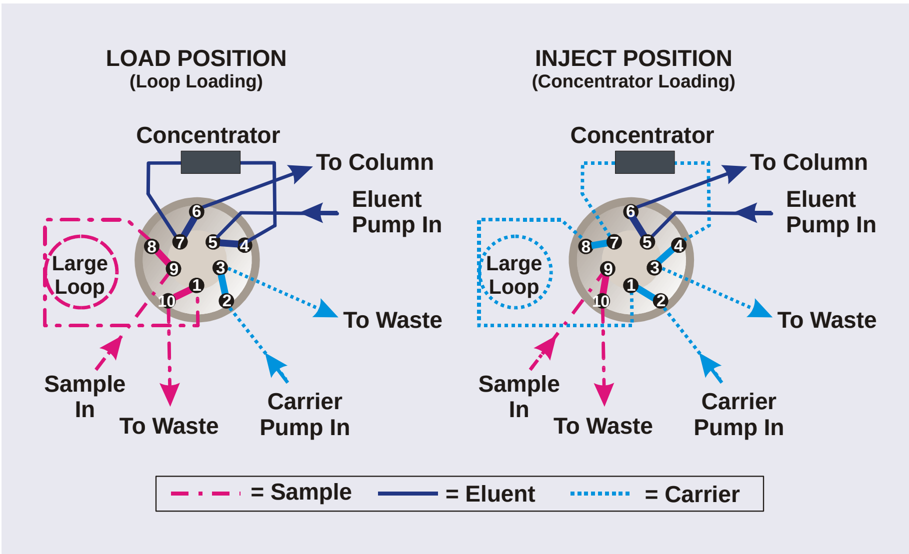


Figure 2-27. *Injection Valve Flow Schematics (10-Port Valve) Example Connections: Large Loop to Concentrator*

Liquid flows through either the Load or Inject path, depending on the valve position. For the example shown in Figure 2-27, the flow occurs as follows:

- In the Load position, sample flows from the syringe or autosampler line, through the valve, and into the sample loop. Excess sample flows out to waste. Eluent flows from the eluent pump, through the valve, through the concentrator column, and to the separator column. If sample was previously loaded onto the concentrator column, it is swept to the separator column for analysis.

- In the Inject position, carrier liquid flows through the sample loop and on to the concentrator column, carrying the contents of the sample loop with it. Excess flows out to waste. Eluent flows from the pump, through the valve, and to the separator column, bypassing the concentrator column.

2.14 CD Conductivity Detector

Each Dionex ICS-6000 Conductivity Detector (CD) consists of a heated conductivity cell and the electronics required for collecting the conductivity data and sending it to the computer and the analog output (if installed). The CD is installed in the upper compartment of the DC (see Figure 2-22).

The CD is available in two versions:

- A capillary CD (P/N 072041), for use in systems running capillary flow rates
- An analytical CD (P/N 079829), for use in systems running analytical (standard bore or microbore) flow rates

The features and functions of the two CD versions are the same. However, because the cell volumes of the two are different, the versions are not interchangeable. The CD version must match the system type (capillary IC or analytical IC). If the CD version and system type are mismatched, chromatograms will be affected; for example, there may be broad peaks or lowered sensitivity.

2.14.1 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 µL), 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.

To reduce the effect of temperature variation, the DC provides temperature control of both the DC compartment and the cell. A heater inside the cell regulates the cell temperature. The cell heater temperature range is from a low of 5 °C above the temperature of the upper DC compartment to a high of 60 °C.

Temperature Compensation

When the operating temperature is different from the temperature at which the cell was calibrated, built-in temperature compensation helps minimize changes in the baseline or in peak heights. The default temperature compensation is 1.7% per °C. This can be reset to between 0% and 3.0% per °C, depending on the eluent. If you notice that the baseline shifts up when the temperature increases, the compensation factor is too low and should be reset to a higher value.

To change the temperature compensation factor:

1. Open the Chromeleon ePanel Set.
2. Press the **F8** key to open the Command window.
3. Select the conductivity detector.
4. Select the **Temperature_Compensation** property and enter the value.

2.14.2 Suppressor

The suppressor reduces the eluent conductivity and enhances the conductivity of the sample ions, thereby increasing detection sensitivity. Installation of a suppressor is optional.

The capillary and analytical CDs can operate with the following suppressors:

CD Type	Available Thermo Scientific Dionex Suppressors
Capillary CD	ACES 300 (Capillary), CCES 300 (Capillary)
Analytical CD	ADRS 600, AERS 500 Carbonate, AERS 500e, CDRS 600, CERS 500e, ACRS, CCRS

For details about any of the suppressors, including guidelines for selecting a suppressor for your application, refer to the suppressor manuals.

Capillary IC

Capillary IC Suppressor

The suppressor for a capillary IC system is installed inside an IC Cube capillary suppressor cartridge. For details about the IC Cube and the capillary suppressor cartridge, see Section 2.11.2.

Analytical IC

Analytical IC Suppressor

The analytical suppressor is installed on clips on the lower area of the analytical CD (see Figure 2-28). The suppressor cable plugs into the connector next to the detector.

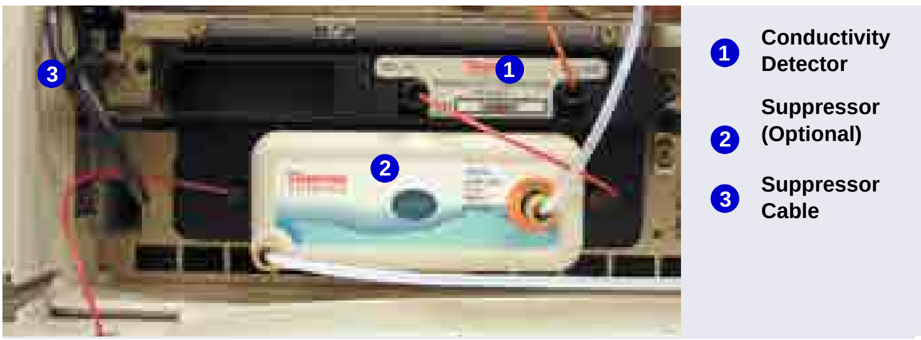


Figure 2-28. *Analytical Conductivity Detector with Suppressor (System #1)*

Analytical IC

NOTE It is also possible to control an analytical suppressor with a Dionex ICS-6000 Electrochemical Detector (ED). Mounting tabs for the suppressor are located on the front of the DC (next to the ED). The cable connection is the same as for the CD.

NOTE To prevent accumulation of oxygen or hydrogen gases, connect a gas separator waste tube (P/N 045460) to the suppressor waste line during installation For details, refer to *Dionex ICS-6000 Ion Chromatography System Installation Instructions*.

2.14.3 System Flow Schematics for Conductivity Detection

Figure 2-29 illustrates the flow path through a DC for a conductivity detection application using suppression in recycle mode. For information about other suppression modes, refer to the suppressor manuals.

NOTE The basic flow path is the same for both capillary IC and analytical IC systems. However, in capillary IC systems, connections to components installed inside IC Cube cartridges (columns, suppressor, and Dionex CRD) are not visible.

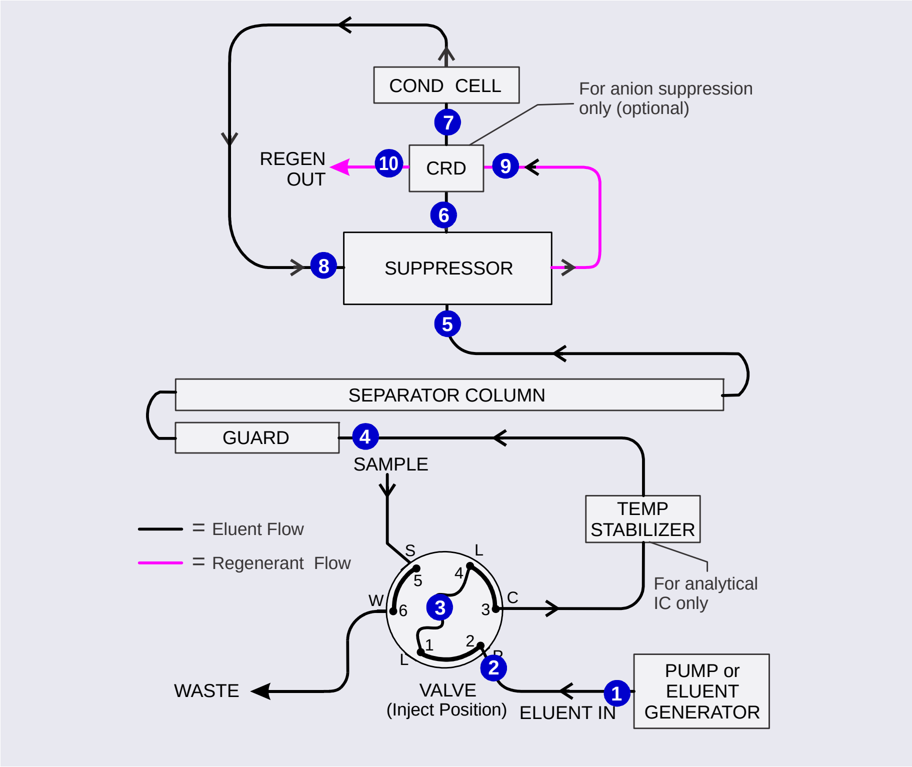


Figure 2-29. *DC Flow Schematic for Conductivity Detection (Suppression in Recycle Mode)*

- Eluent from the pump 1 flows into the injection valve 2.
- After sample is loaded into the sample loop 3 and the injection valve is toggled to the Inject position, eluent passes through the loop.
- The eluent/sample mixture is pumped first through a temperature stabilizer (analytical IC only), through the guard and separator columns 4, and then through the suppressor 5.
- From the suppressor, the mixture flows through a Dionex CRD 6 (if installed) to the cell 7, where the analytes are detected. A digital signal is sent to Chromeleon.
- Finally, the mixture flows out of the cell and is recycled back into the suppressor 8, where it is used as the water source for the regenerant

chamber. Flow is again routed through the Dionex CRD (if installed) 9 and then to waste 10.

Figure 2-30 illustrates the flow path through an EG and a DC for a conductivity detection application using suppression in recycle mode.

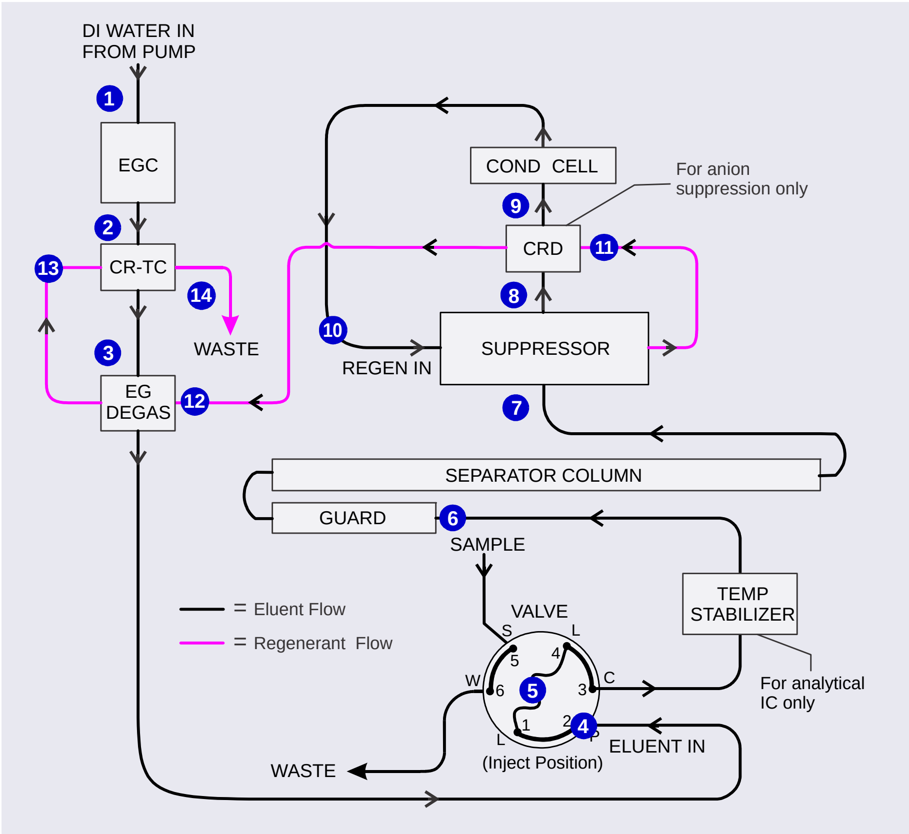


Figure 2-30. *EG and DC Flow Schematic for Conductivity Detection (Suppression in Recycle Mode)*

- Deionized water from the pump 1 enters the EGC, which generates the eluent. Eluent exits the Dionex EGC and passes through the Dionex CR-TC 2 (which traps ionic contaminants), through the EG degas tubing 3, and then into the injection valve 4.
- After sample is loaded into the sample loop 5 and the injection valve is toggled to the Inject position, eluent passes through the loop.

- The eluent/sample mixture is pumped through a temperature stabilizer (analytical IC only), through the guard and separator columns 6, and then through the suppressor 7.
- From the suppressor, the mixture flows through a Dionex CRD 8 (if installed) to the cell 9, where the analytes are detected. A digital signal is sent to Chromeleon.
- The mixture flows out of the cell and is recycled back into the suppressor 10, where it is used as the water source for the regenerant chamber. Regenerant flow is routed through the Dionex CRD 11 (if installed), through the EG degas tubing 12, through the Dionex CR-TC 13, and then out to waste 14.

2.15 ED Electrochemical Detector

One or two Dionex ICS-6000 Electrochemical Detectors (EDs) can be installed in the DC. Each complete ED assembly consists of an amperometric detection cell and the detector electronics required to collect data and send it to the computer and the analog output (if installed). The detector is installed in the upper compartment of the DC (see Figure 2-22). The cell mounts on the front of the detector. The detector electronics are not accessible to the user.

The ED can perform the following electrochemical detection modes:

- DC amperometry (see Section 2.20.1)
- Integrated amperometry—including pulsed amperometric detection (PAD) and integrated pulsed amperometric detection (IPAD) (see Section 2.20.2).

2.15.1 Electrochemical Detector Cell

The ED cell is a miniature flow-through amperometric detection cell that includes three different electrodes: a titanium cell body (the counter electrode), a working electrode, and either a combination pH-Ag/AgCl reference electrode (see Figure 2-31) or a PdH reference electrode (capillary system only).

The type of working electrode used depends on the application. Four conventional (non-disposable) working electrode types are available: gold, platinum, silver, and glassy carbon. Five disposable working electrode types are available: gold on two different substrates (polyester or PTFE [polytetrafluoroethylene]), silver, platinum, and carbon.

The ED cell can be used in both capillary IC and analytical IC systems. When used in a capillary IC system, the inlet tubing is made of PEEK. When used in an analytical IC system, the inlet tubing is made of titanium (see Figure 2-31).

1. **Working Electrode**
2. **Cell Body (counter electrode)**
3. **pH-Ag/AgCl Reference Electrode**
4. **Titanium Inlet Tubing (for analytical IC)**

Figure 2-31. *ED Cell with pH-Ag/AgCl Reference Electrode (Cell Configured for Analytical IC Shown)*

Cell Design

The ED cell is a thin-layer design. Eluent flows in a thin channel parallel to the surface of a flat disk electrode. The resulting smooth flow minimizes noise. The low volume (<0.2 µL) of the channel also allows operation with high-efficiency, narrow-bore columns and capillary columns. The cell design minimizes the electrical resistance between the working electrode and the counter electrode by positioning the counter electrode (the cell body) directly across the thin-layer channel from the working electrode. This results in a wide linear dynamic range. The inlet tubing is in electrical contact with the counter electrode and, through it, to ground. The working electrode current is processed using low noise analog amplifiers and filters.

ED Cell Solvent Compatibility

The ED cell can be used with common reversed-phase solvents such as methanol and acetonitrile. If a disposable working electrode on polyester substrate is used, the percentage of methanol should not exceed 30% and the percentage of acetonitrile should not exceed 10%. In addition, prolonged exposure (more than 8 hours) of disposable gold electrodes on polyester substrate to eluents containing hydroxide concentrations greater than 100 mM is not recommended. Shorter rinse periods of 10 to 20 minutes (for example, the carbonate removal step during monosaccharide and disaccharide chromatography) at high hydroxide concentrations do not affect the electrode performance. If sustained highly alkaline eluent conditions are required, use a disposable gold electrode on a PTFE substrate or a conventional gold electrode. Refer to *Product Manual for Disposable Electrode* (Document No. 065040) for additional eluent compatibility information.

Because conventional working electrode blocks are made of Kel-F™ and use a gasket made of Ultem™, there is no restriction on the concentration of organic solvents that can be used with them, providing the solvent is compatible with PEEK tubing.

There is also no restriction on the use of organic solvents when using disposable gold electrodes on a PTFE substrate and PTFE gaskets.

2.15.2 Combination pH-Ag/AgCl Reference Electrode

The pH-Ag/AgCl reference electrode is a standard combination pH electrode containing a glass membrane pH half-cell and a Ag/AgCl half-cell. The combination pH electrode monitors eluent pH.

The Ag/AgCl half-cell is typically used as the cell reference electrode. To minimize changes in the baseline, the combination pH-Ag/AgCl electrode can be used as the reference electrode during a pH gradient.

pH Dependence

The potentials at which many redox reactions take place on metallic electrodes are pH-dependent, with the potential shifting –0.059 V per pH unit. This is especially true for metal oxide formation, oxidation, and oxidative desorption. Since the reference potential of the combination pH-Ag/AgCl electrode also shifts –0.059 V per pH unit, pH-dependent potential shifts at the working electrode are canceled.

Correcting for pH Dependence

At an eluent pH of 7, the reference potential of the entire electrode is the same as that of the Ag/AgCl half-cell. As the eluent pH is increased, the pH half-cell potential decreases about 0.059 V per pH unit. For example, at an eluent pH of 12, the reference potential of the pH half-cell would be –0.295 V relative to the Ag/AgCl half-cell. Therefore, at pH 12, the potentials applied to the working electrode must be raised approximately 0.3 V when switching from the "Ag" reference to the "pH" reference.

In acidic eluents, the reference potential of the pH half-cell is positive with respect to the Ag/AgCl half-cell, and all applied potentials must be decreased by 0.059 V per pH unit when switching from the "Ag" reference to the "pH" reference.

IMPORTANT **Do not allow the pH-Ag/AgCl reference electrode to dry out. Make sure eluent is being pumped continuously through the cell at a low flow rate (for example, 0.05 mL/min). If the cell will not be used for a short time (less than 2 days), disconnect the tubing from the inlet and outlet fittings and install fitting plugs. For longer shutdowns, remove the electrode from the cell and store it in its storage cap (filled with saturated KCl solution). See Section 7.4 for detailed storage instructions.**

Monitoring the ED Cell pH Readout

Monitoring the pH readout of a solution with a known composition lets you detect any reference potential shift that may occur over time. This allows you to determine when the pH-Ag/AgCl reference electrode needs to be regenerated or replaced, thus improving the reproducibility of your analyses. For instructions on how to monitor the pH readout, see Section 4.1.2.

NOTE Monitor the pH when the pH-Ag/AgCl reference electrode is used in the Ag mode as well as in the pH mode.

Capillary IC

2.15.3 Palladium Hydrogen (PdH) Reference Electrode

The PdH reference electrode consists of palladium and platinum electrodes immersed in an aqueous solution. With a potential applied between the two electrodes, palladium is connected as a cathode and platinum as an anode. As a consequence of the applied potential, hydrogen gas is generated at the palladium electrode and oxygen gas at the platinum electrode. Whereas the oxygen gas is swept out of the cell in the liquid stream, a portion of the hydrogen gas is taken up by palladium metal. An equilibrium develops between molecular hydrogen in the liquid phase and the adsorbed hydrogen in palladium.

The palladium hydrogen electrode becomes a reference electrode with a half reaction of:

$H^+ + e- = \frac{1}{2} H_2$

Where the hydrogen is supplied by the following process:

$Pd + \frac{1}{2} H_2 \rightarrow Pd\text{-}H_{ads} \rightarrow Pd\text{-}H_{abs}$

The PdH reference electrode is thus similar to the standard hydrogen electrode, which is based on the same half reaction between the hydronium ions and molecular hydrogen. However, there are also some differences. For example, palladium is not as good a catalyst for the electrode half reaction as platinum. As a consequence, under identical conditions, the reference potential of the palladium hydrogen electrode differs from that of the standard hydrogen electrode by a constant potential. In addition, because hydronium ions are involved in the reference half reaction, the potential of the PdH electrode is pH dependent.

Waveforms for PdH Reference Electrodes in Chromeleon

When you create or edit an instrument method in Chromeleon, you can select a waveform created for use with the PdH reference electrode. To use a waveform that was created for a pH-Ag/AgCl electrode, select the waveform and then manually correct the potential values in the Waveform Editor. The formula for correction is provided in the Waveform Editor.

No pH Readout with the PdH Reference Mode

If the PdH electrode were connected to another reference electrode (for example, a Ag/AgCl electrode), the PdH electrode could serve as a pH indicator electrode. However, when the PdH electrode functions as a reference electrode, it cannot indicate pH. In the same manner, a glass electrode alone cannot measure pH; it must be used with a suitable reference electrode.

The pH readout of the ED cell is disabled when the PdH reference mode is selected.

2.16 DC Rear Panel

Figure 2-32 illustrates the rear panel of the DC.

1. Tubing Chase (2)
2. Switched AC Sockets
3. Fuse Holder, Main Power Switch, and Power Receptacle
4. External Low-Pressure Valve Mounting Slots
5. USB Receptacle ("B" Connector)
6. USB Ports (2) ("A" Connectors)
7. External Low-Pressure Valve Connectors
8. Analog Output and TTL/Relay Connectors
9. Drain Port

Figure 2-32. *DC Rear Panel*

Tubing Chases

The tubing chases route tubing from the front compartment, through the DC interior, and to the rear panel. Foam inserts insulate the chases.

Switched AC Sockets

The two AC receptacles can be used to control the power to external devices. Use Chromeleon to switch the power on and off. TTL inputs can also be used to control the AC sockets (see Section 2.17.4).

The AC receptacles are protected by two internal fuses. The fuses cannot be replaced by the user. Contact Technical Support for Dionex products for assistance.

Fuse Holder, Main Power Switch, and Power Receptacle

The fuse holder contains two 10-amp slow-blow fuses (P/N 954772). For instructions on how to change the fuses, see Section 10.24.

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

NOTE For routine on/off control, use the **POWER** button on the front of the DC (see Figure 2-17). To turn off the DC, press and hold the **POWER** button for 2 seconds.

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

CAUTION

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

MISE EN GARDE

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.

VORSICHT

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

USB Connections

The USB (Universal Serial Bus) receptacle (“B” type connector) allows connection to the PC on which Chromeleon software is installed.

The two USB ports (“A” type connectors) allow connection to other USB devices in the system (for example, the pump and eluent generator).

A 1.8 m (6 ft) USB cable (P/N 960777) is included in the DC Ship Kit (P/N 072011, standard DC; P/N 22171-62000, low-temperature DC).

External Low-Pressure Valve Outputs

Six outputs allow connection to externally-installed low-pressure (solenoid) valves. Low-pressure valves can be used for on/off control of liquid flow (for example, to turn flow on and off from a reagent reservoir). You control the outputs with Chromeleon.

Two low-pressure valves can be installed on a regulator stand. Four valves can be installed on the rear of the DC.

Analog Output, TTL, and Relay Connectors (Optional)

If the I/O option (P/N 062201) is installed, the following connections are provided:

- Two analog outputs (one for each detector)
- One +5V power output
- Two relay outputs
- Two TTL outputs
- Eight programmable TTL inputs

See Section 2.17 for details about the I/O option.

NOTE The I/O option and the Dionex Consumable Device Monitor are installed in the same slot. Therefore, only one of these options can be installed.

Dionex Consumable Device Monitor (Optional)

When the Dionex Consumable Device Monitor (P/N 22181-60031) is installed in the DC, one USB connector and one USB status LED are available.

See Section 2.18 for details about the monitor.

NOTE The I/O option and the Dionex Consumable Device Monitor are installed in the same slot. Therefore, only one of these options can be installed.

Drain Port

The drain port removes any liquid that collects in the drip tray in the bottom of the DC. The DC Ship Kit (P/N 072011, standard DC; P/N 22171-62000, low-temperature DC) includes parts for assembling a rigid drain line that can be routed from the drain port on the DC rear panel to either the rear, side, or front edge of the lab bench. The rigid drain line includes a vent to help prevent vapor lock and improve liquid flow to the drain.

During system installation, the rigid drain line is assembled and installed, after which a corrugated drain hose (P/N 055075) is connected to the rigid drain. Place the drain hose into a waste container or appropriate drain. To maintain a positive siphon, position the waste container below the level of the DC.

IMPORTANT **For correct drainage, make sure the corrugated drain hose is not bent, pinched, or elevated at any point. Do not allow the end of the hose to be submerged in waste liquid.**

NOTE To remove the corrugated drain hose from the drain port, grasp the hose at the area over the port where the hose is solid (not corrugated) and pull the hose straight off.

2.17 I/O Option

When the I/O option (P/N 062201) is installed, two 12-pin connector strips are on the DC rear panel. Figure 2-33 describes the functions assigned to each connector pin.

Connector Position	Pin Function		Description
1	+	Analog Det 1	16-bit analog output from detector #1
2	–		
3	+	Analog Det 2	16-bit analog output from detector #2
4	–		
5	+	+5V	+5 V, 200 mA
6	–	Gnd	Ground
7	N.O.	Rly 1	Solid state relay contacts output Connect for either normally open (N.O.) or normally closed (N.C.)
8	COM		
9	N.C.		
10	N.O.	Rly 2	Solid state relay contacts output Connect for either normally open (N.O.) or normally closed (N.C.) **Note:** Relays are capable of switching 2 A at 24 VDC.
11	COM		
12	N.C.		
1	+	TTL Out1	TTL Output 1 (332 Ω pull up to +5 V, 100 mA sink)
2	–	Gnd	Ground
3	+	TTL Out2	TTL Output 1 (332 Ω pull up to +5 V, 100 mA sink)
4	–	Gnd	Ground
5	+	TTL In 1	TTL Input 1 — **Note:** TTL input functions are assigned in software.
6	+	TTL In 2	TTL Input 2
7	+	TTL In 3	TTL Input 3
8	+	TTL In 4	TTL Input 4
9	+	TTL In 5	TTL Input 5
10	+	TTL In 6	TTL Input 6
11	+	TTL In 7	TTL Input 7
12	+	TTL In 8	TTL Input 8

***Figure 2-33.** Optional Rear Panel I/O Connector Strips*

2.17.1 I/O Option Connections

1. Locate the twisted pair of wires (P/N 043598) and 12-position connector plugs (P/N 923686) (see Figure 2-34) provided with the I/O option board.

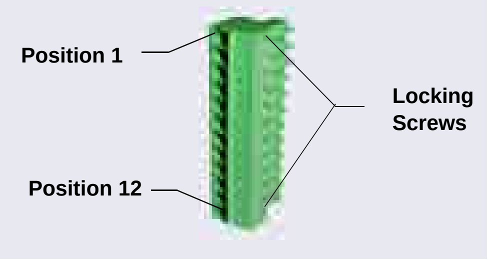


Figure 2-34. *12-Position Connector Plug*

2. For each I/O function to be used, connect an active wire (red) and a ground wire (black) to the 12-position connector plug at the appropriate pin locations. See Figure 2-33 or the label on the DC 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 ground pin.

CAUTION

When attaching wires to the connector plug, be careful not to allow stray strands of wire to short to an adjoining position on the connector.

3. Plug the connector into the appropriate 12-pin connector on the DC rear panel.
4. Connect the wires from the DC connector plug to the appropriate connector pins on the other modules. 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.

5. 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 the Chromeleon Instrument Configuration Manager (see Section 2.17.4).

2.17.2 Analog Outputs

When the I/O option is installed, two analog outputs (one for each detector) are installed on the DC rear panel (see Figure 2-32). The analog outputs supply a voltage signal proportional to the current measured by the detector cell. The outputs can be connected to an analog-to-digital (A/D) converter such as an integrator or other recording device. See Section 2.17.1 and the documentation for the device for connection instructions.

Several settings are available that let you configure the analog output signal for your detector and connected device (see Table 2-6). Select the preferred settings on the detector ePanel in Chromeleon (see Figure 2-44) or on the Analog page in the ICS-6000 App (see Section 6.1.11).

Analog Output Setting	Values	Description
Full-scale voltage	0.01, 0.10, or 1.00 V	Sets the voltage output of a full-scale detector response. The voltage to use depends on the recording device to which the analog output is connected. For example, if the analog output is connected to a device that accepts input voltages up to 1 V, select a full-scale voltage output of 1 V.
Range	Conductivity: 0.01 to 15,000 µS DC Amperometry: 50 pA to 300 µA Integrated Amperometry: 50 pC to 200 µC	Sets the full-scale detector response value. The range to use depends on the detector readings expected for the application. For example, selecting a range of 20 micro Siemens (µS) will limit you to viewing conductivity readings of 20 µS or less.
Recorder calibration	Zero, Full Scale, Normal	Use this setting to calibrate a recording device. Select **Zero** to set the output signal to zero volts. Select **Full Scale** to set the output signal to the selected full-scale voltage (0.01, 0.10, or 1.00 V). For normal operation, select **Normal** (the default) to output a signal corresponding to the detector output.

Table 2-6. *Analog Output Configuration Settings*

Analog Output Setting	Values	Description
Offset level	0 to 100%	Use this setting to adjust the zero position of the analog output when it is plotted. The value entered is a percentage of the full-scale analog output. An offset allows a recording device to plot the signal if it becomes negative. The offset level does not affect the magnitude of the output signal.
Polarity	Positive, Negative	Use this setting to set the polarity of the analog output signal to either positive (the default) or negative. For applications in which the analyte output is lower than the background signal, the polarity must be negative to display peaks instead of dips on the chromatogram.
Mark	10% of the full-scale analog output	Use this setting to send a positive pulse to the analog output as an event marker. A mark is typically used to indicate a sample injection.

Table 2-6. *Analog Output Configuration Settings (Continued)*

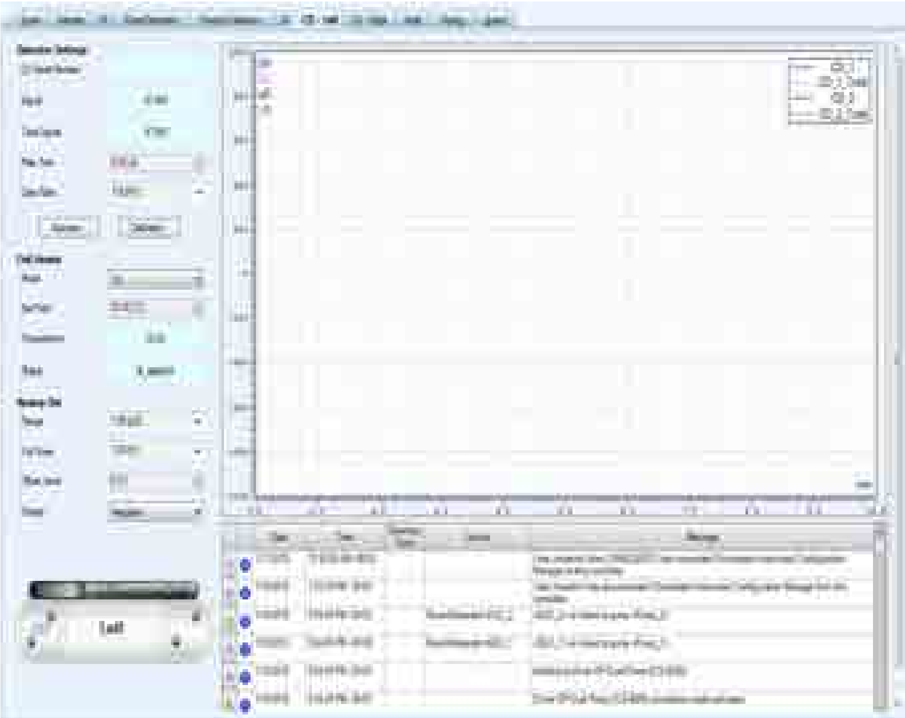


Figure 2-35. *Chromeleon Conductivity Detector ePanel*

2.17.3 Power, Relays, and TTL Outputs

The power, relays, and TTL outputs can be used to control functions in external devices such as an autosampler or other Dionex module.

Depending on which pins are connected, the relay connection can be either normally open (N.O.) or normally closed (N.C.) (see Figure 2-36). Choose the option that reflects the state the connected device should be in when the DC power is turned off:

- A normally open relay is open when the relay is switched off and closed when the relay is turned on.
- A normally closed relay is closed when the relay is off and is open when the relay is on.

The relays can be programmed to switch any low-voltage device. Switched current must be no more than 2 A at 24 VDC. See Section 2.17.1 and the documentation for the external device for connection instructions.

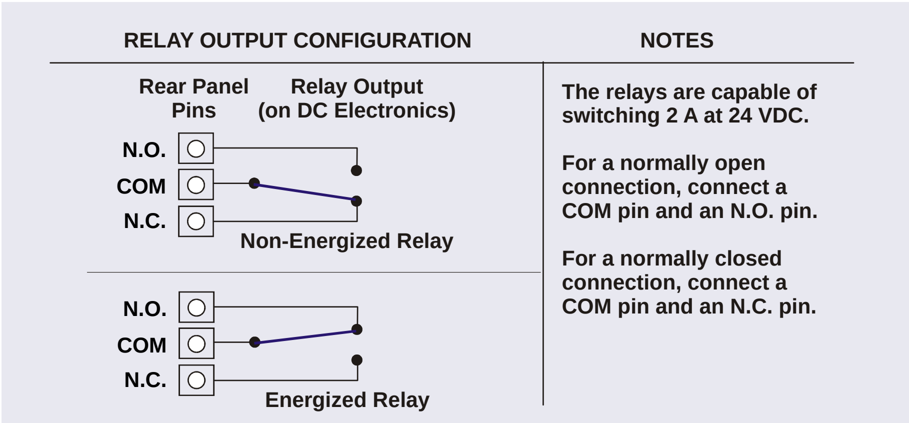


Figure 2-36. *Relay Output Configuration*

You can directly control the relay and TTL outputs from the Chromeleon ePanel Set or the TTL/Relay page in the ICS-6000 App.

To control a relay or TTL output from Chromeleon

You can control the power, relays, and TTL outputs from the DC ePanel in Chromeleon (see Figure 2-37).

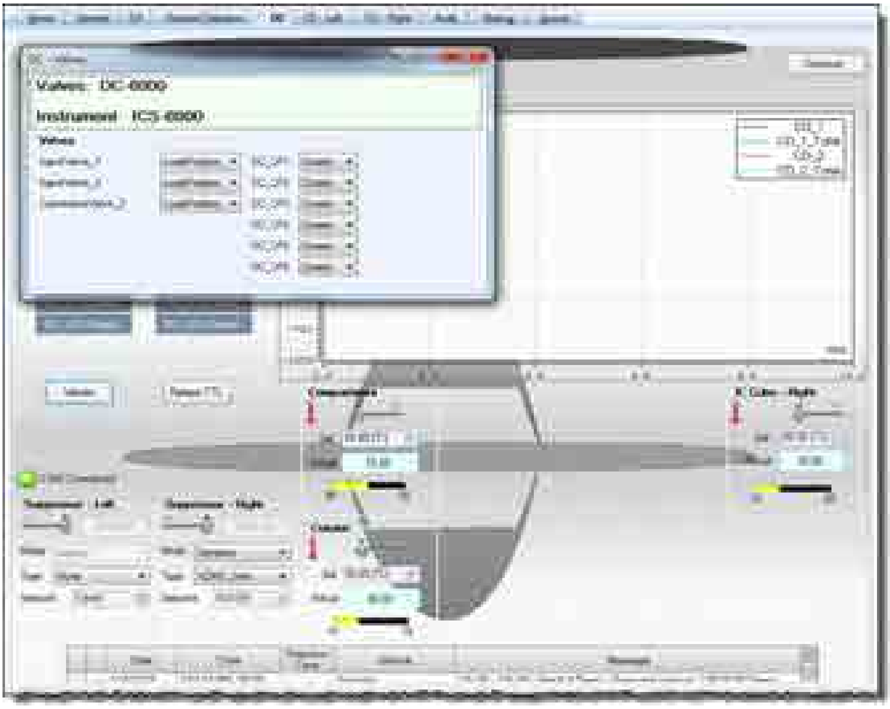


Figure 2-37. *Output Relays and TTL Control on DC ePanel*

NOTE It is possible to change the settings for the power, relays, and TTL outputs while an instrument method is running.

To control a relay or TTL output from the ICS-6000 App

1. On the quick access toolbar, tap the Accessories  icon and then select **TTL/RELAY** on the menu.
2. Select the TTL output and relay output settings (see Section 6.1.11).

2.17.4 TTL Inputs

When connected to a controlling device, the TTL inputs can be programmed to perform the following DC functions:

- Injection valves left and right (load/inject)
- AM high-pressure valves A and B (A/B)
- AM low-pressure valves A and B (open/closed)
- DC low-pressure valves A through F on the rear panel (open/closed)
- ED detectors 1 and 2 (on/off)
- CD/ED detectors 1 and 2 (auto-offset)
- CD/ED detectors 1 and 2 (mark)
- Suppressors 1 and 2 (on/off)
- Reaction coil heater (on/off)
- A/C relays 1 and 2 (open/closed)

Assigning TTL Input Functions

TTL input control functions are assigned in the Chromeleon Instrument Configuration Manager or on the TTL/Relay page in the ICS-6000 App. You can assign one or more functions to each input.

NOTE If two instruments are sharing the DC, the TTL input functions are shared between the instruments. For example, if TTL input 1 is assigned to control injection valve 1 in Chromeleon, that function is assigned to both instruments. You do not need to associate a TTL input with a particular instrument.

To select TTL input functions from Chromeleon

1. Open the Instrument Configuration Manager.
2. Double-click the DC icon under the instrument.

3. Select the **TTL Inputs** tab (see Figure 2-38).

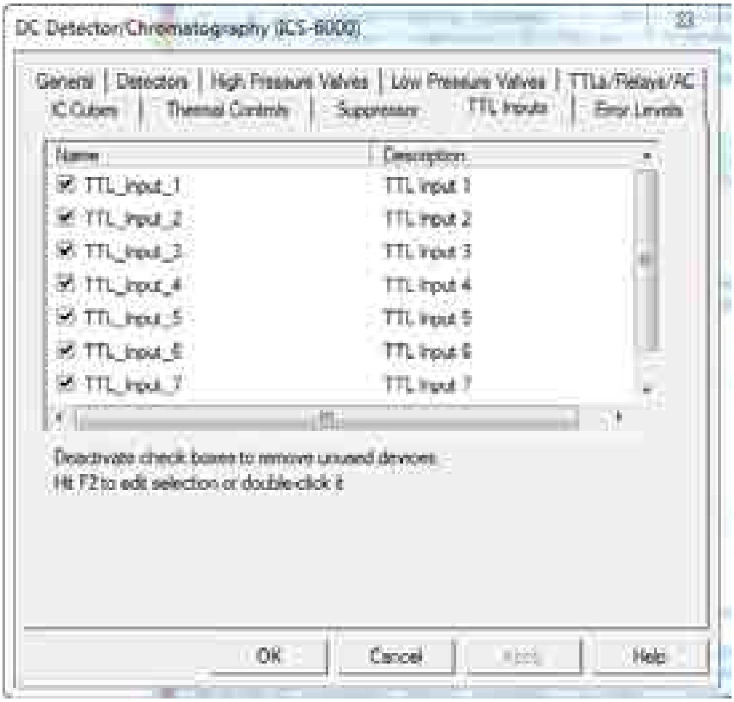


Figure 2-38. *DC Instrument Configuration Properties: TTL Inputs*

4. Select the name of the input and press the **F2** key (or double-click the name).

The Device Configuration dialog box for the selected input appears (see Figure 2-39).

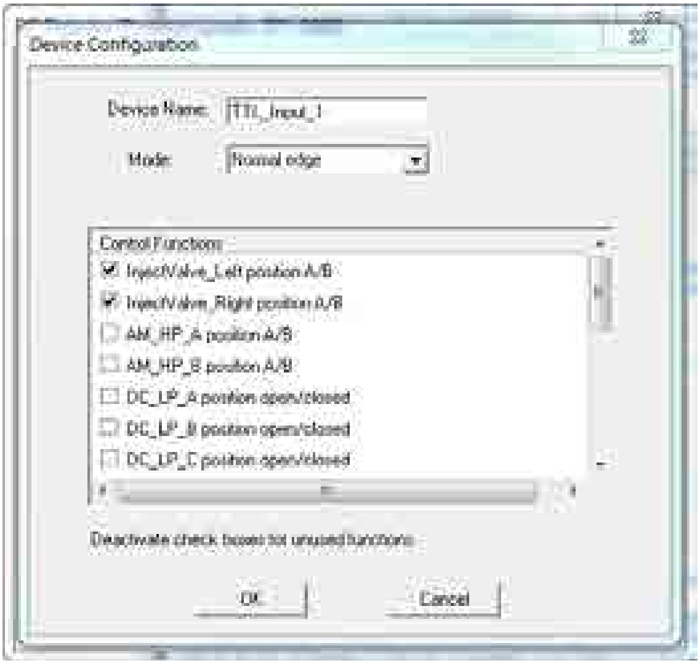


Figure 2-39. *Assign TTL Input Control Functions*

5. In the **Control Functions** list, select the check box of one or more functions to be controlled by this input. When connected to a controlling device, the device can send a signal to the input to trigger the selected functions.
6. By default, several functions are selected. Scroll down the list and disable all unwanted functions.

To select TTL input functions from the ICS-6000 App

1. On the quick access toolbar, tap the Accessories  icon and then select **TTL/RELAY** on the menu.
2. On the TTL/Relay page, tap **TTL INPUT**.
3. On the TTL Input page, select the functions to be controlled by each input.

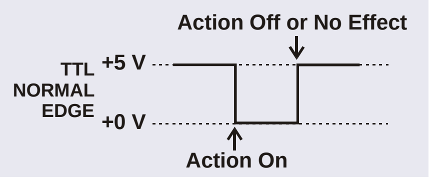
4. If the device connected to the TTL input does not send a normal edge signal, select the control type compatible with the device. To determine the correct type, refer to the documentation provided with the controlling device and to Section 6.1.12.

TTL Input Control Types

The DC TTL inputs respond to four types of signals, allowing them to accommodate a variety of controlling devices. The default control type, **Normal edge**, is compatible with the output signals provided by Dionex modules.

If the device connected to the DC 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 determine the correct type. Select the input control type in the Device Configuration dialog box for each TTL input (see Figure 2-39).

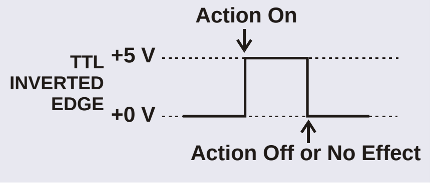
- *Normal Edge*: In normal edge operation, the negative (falling) edge of a signal turns on the function.



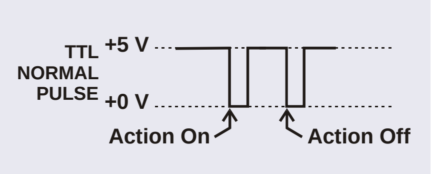
  The action of the positive (rising) edge depends on the function: For on/off or other functions that have two options, the rising edge turns off the function. However, for functions with only one option, the rising edge has no effect.

  For example, for the injection valve position, the falling edge switches the valve to Load and the rising edge switches the valve to Inject. Similarly, for the detector start/stop, the falling edge starts the detector and the rising edge stops it. For the detector mark and offset functions, the falling edge turns on the function and 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.

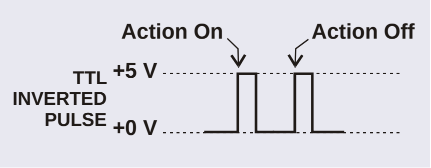


- *Normal Pulse*: In normal pulse operation, the negative (falling) edge of the TTL signal is the active edge and the positive (rising) edge is ignored.



  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.



2.18 Dionex Consumable Device Monitor

When the optional Dionex Consumable Device Monitor is installed in the DC, the system can determine operational conditions for RFID-enabled and wired consumables, as well as track and store usage and Wellness data.

Recorded data is displayed in the Consumables Inventory window in Chromeleon. Analysis of this data allows users to better understand how the consumable performance is affecting analytical results, how system conditions are affecting consumable performance, and how system hardware performance is affecting analytical performance.

The Dionex Consumable Device Monitor Kit (P/N 22181-60031) contains all the parts need to install the monitor.

Analytical IC

2.19 Automation Manager

The Dionex ICS-6000 Automation Manager (AM) provides a mounting location for various components used for performing matrix elimination, large volume preconcentration, post-column reagent addition, and other functions.

Each AM consists of a tray on which valves and other components are installed (see Figure 2-40). The tray is installed in the upper compartment of the DC (see Figure 2-22). Connections to other system components (pump, injection valve, reagent reservoirs, and so on) depend on the application. See Chapter 3 for the configuration schematic for your application.

Figure 2-40. *Dionex ICS-6000 Automation Manager*

NOTE Because the AM requires the full width of the DC upper compartment, an IC Cube cannot be installed in the DC when an AM is installed.

The AM is available in the following configurations:

Components Included	Part Number
Two 10-port high-pressure valves Two low-pressure 3-way valves	075950
One 10-port high-pressure valve One low-pressure 3-way valve	075951
One 6-port high-pressure valve One low-pressure 3-way valve	075952
AutoPrep configuration: 10-port high-pressure valve AutoPrep sample loop AutoPrep standard loops	075953
AM tray with no valves	079833

Table 2-7. *AM Configurations*

In addition to the configurations described above, you can order the following components separately for installation on an AM:

AM Component	Part Number
High-pressure valve, 6-port	075917
High-pressure valve, 10-port	075918
Low-pressure valve, 3-way	061971
Low-pressure valve, 2-way	079848
RCH-1 Reaction Coil Heater	079849
Temperature stabilizer, standard bore, 0.25 mm (0.010 in) ID	062561
Temperature stabilizer, microbore, 0.125 mm (0.005 in) ID	062562

Table 2-8. *AM Components Available Separately*

Analytical IC

2.19.1 AM High-Pressure Switching Valves

Up to two high-pressure switching valves can be installed on an AM. Two models are available: 6-port (P/N 075917) and 10-port (P/N 075918). Both models are electrically-activated, two-position valves. Figure 2-41 and Figure 2-42 show the liquid flow path through the valve ports at each valve position.

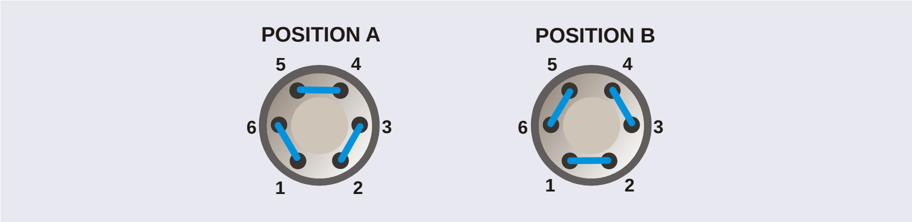


Figure 2-41. *High-Pressure Switching Valve Flow Schematics: 6-Port Valve*

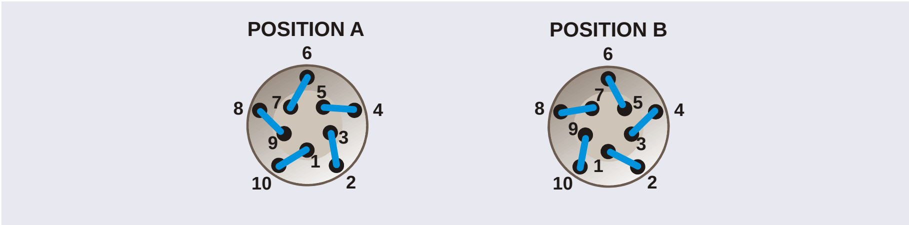


Figure 2-42. High-Pressure Switching Valve Flow Schematics: 10-Port Valve

Valve port connections to chromatography components vary, depending on the application. See Chapter 3 for the configuration schematic for your application.

Valves are controlled by Chromeleon (see Section 2.19.3).

Analytical IC

2.19.2 AM Low-Pressure Valves

Up to two low-pressure valves can be mounted on an AM. The valves are either two-way or three-way valves. The two-way valves provide on/off control of liquid flow in one direction, while the three-way valves provide on/off control in two directions (see Figure 2-43).

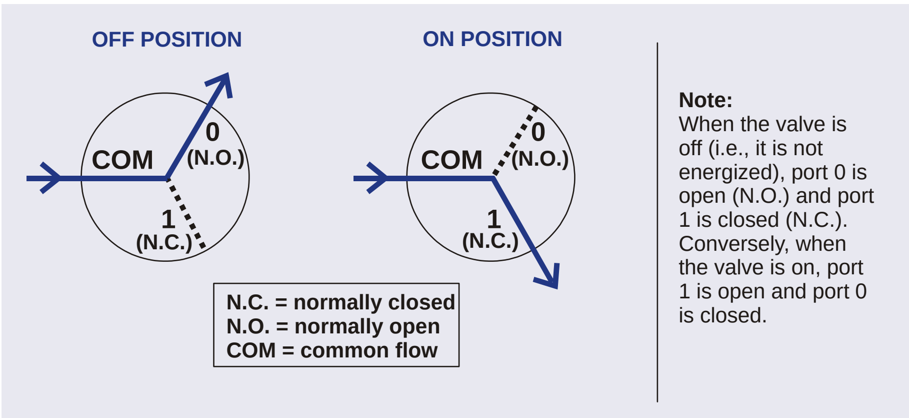


Figure 2-43. Three-Way Low-Pressure Valve Flow Schematics

Valve port connections to chromatography components vary, depending on the application. See Chapter 3 for the system flow schematic for your application.

Valves are controlled by Chromeleon (see Section 2.19.3).

Analytical IC

2.19.3 AM High- and Low-Pressure Valve Control

Chromeleon is used to control the high- and low-pressure valves. For automated control, commands for valve control can be included in a Chromeleon instrument method. To add AM valve control commands to an instrument method, use the **Script Editor** (see Figure 2-44).

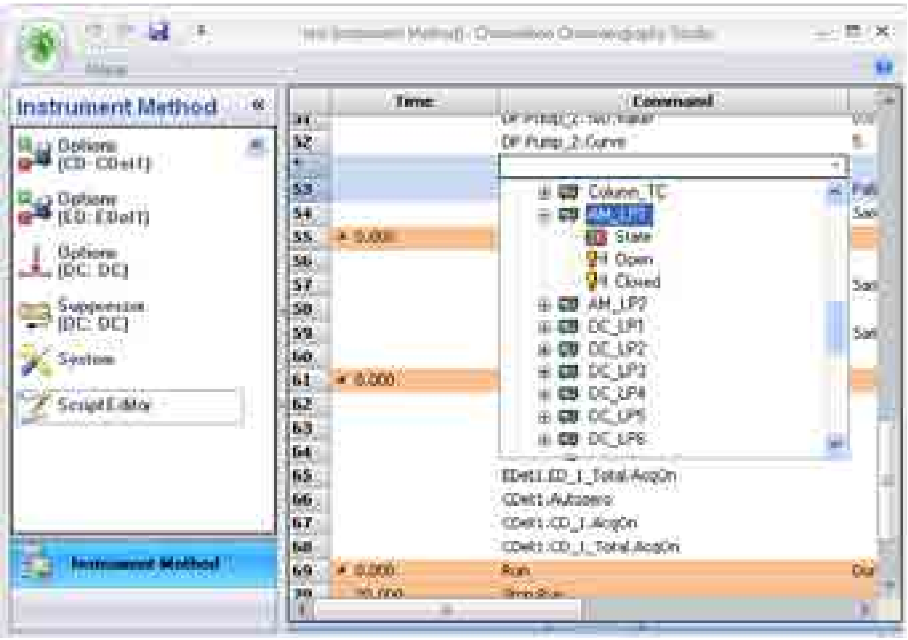


Figure 2-44. *Chromeleon Script Editor*

For manual control of AM valves from Chromeleon, execute commands from the DC ePanel in Chromeleon (see Figure 2-45).

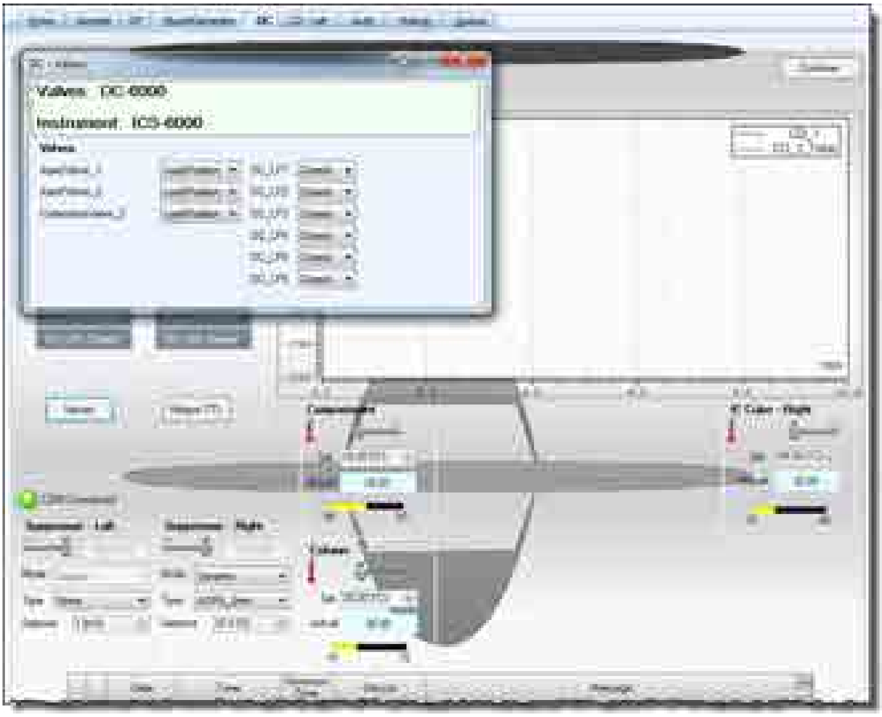


Figure 2-45. *Valve Control on DC ePanel in Chromeleon*

Analytical IC

2.19.4 RCH-1 Reaction Coil Heater

The RCH-1 Reaction Coil Heater (P/N 079849) can hold up to two reaction coils. The heater has an operating temperature range of from 5 °C above the temperature of the upper compartment up to 80 °C.

For automated control of the heater, commands can be included in a Chromeleon instrument method.

For direct control of the heater, use the controls on the DC ePanel in Chromeleon.

2.20 Electrochemical Detection Modes

The Dionex ICS-6000 ED can perform the following electrochemical detection modes:

- DC amperometry (see Section 2.20.1)
- Integrated amperometry—including pulsed amperometric detection (PAD) and integrated pulsed amperometric detection (IPAD) (see Section 2.20.2)

2.20.1 DC Amperometric Detection

In DC amperometry, a constant potential is applied to the working electrode. The potential can be entered in a Chromeleon instrument method.

The applied voltage can be changed up to 10 times during a run. The actual number of potential changes allowed depends on the available data storage capacity, which is determined by the length of the run and the data sampling rate.

For direct control, enter the potentials on the DC ePanel in Chromeleon.

2.20.2 Integrated and Pulsed Amperometric Detection

Integrated and pulsed amperometric detection are similar to DC amperometry (see Section 2.20.1) in that molecules are oxidized or reduced at the surface of an electrode. However, with these detection modes, a series of potential changes is repeated over time. By repeatedly pulsing between optimized high positive and negative potentials, the electrode surface is continually regenerated. Current is measured by integration during a portion of the repeating potential vs. time waveform. See Section 2.20.3 for more information about waveforms.

Pulsed Amperometric Detection

In pulsed amperometric detection (PAD), current is integrated at a single constant potential (see Figure 2-46).

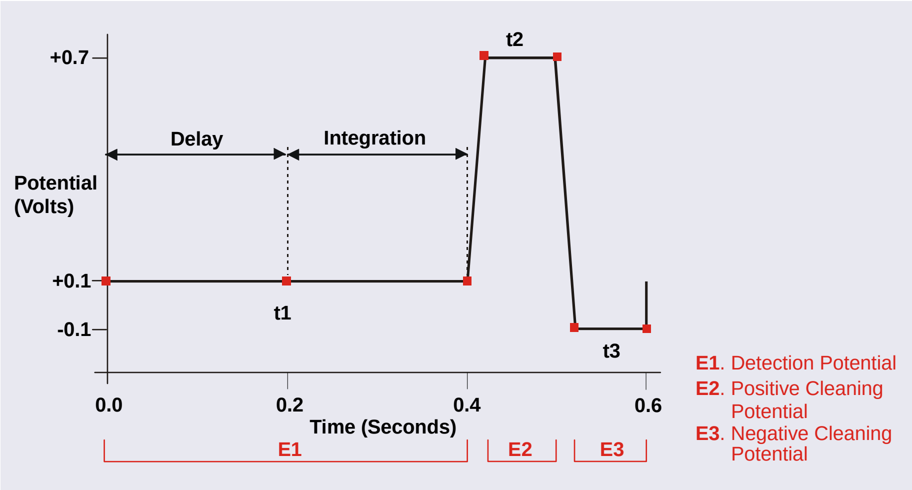


Figure 2-46. *Example Pulsed Amperometry Waveform*

The potentials (labeled E1, E2, and E3) are applied for durations t1, t2, and t3, respectively. At t1, the E1 potential is applied. After a delay, the signal is measured by integrating the current for a fixed time. Current integrated for a fixed time is charge and the units are coulombs. At t2 and t3, positive and negative cleaning pulses are added to the waveform. This waveform period repeats until the end of data acquisition or until another waveform is specified.

Integrated Pulsed Amperometric Detection

With integrated pulsed amperometric detection (IPAD), current is integrated at two or more potentials (see Figure 2-47).

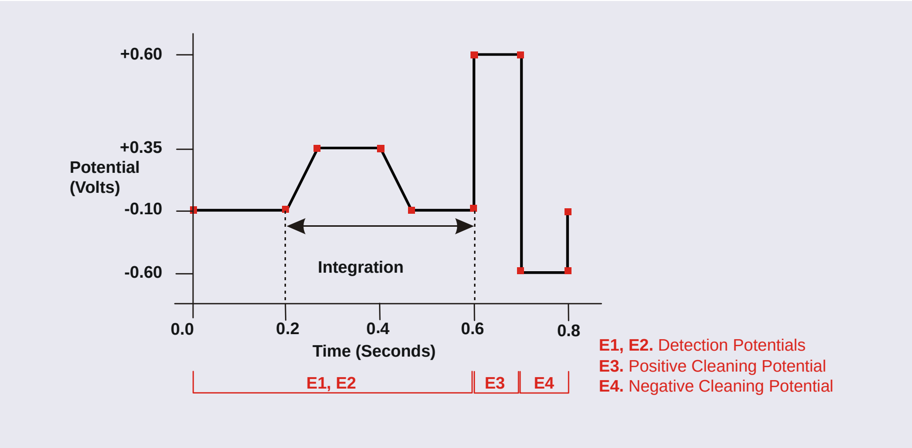


Figure 2-47. *Example Integrated Amperometry Waveform*

With the example waveform shown in Figure 2-47, the current is integrated both while the potential is swept across the metal oxide formation wave and also during the reverse sweep across the oxide reduction wave. This technique minimizes baseline shift and the peak dips that can occur when an eluting analyte's effect on oxide suppression is greater than the detector response from the analyte.

As with pulsed amperometric detection, the waveform period repeats until the end of data acquisition or until another waveform is specified.

2.20.3 Waveforms

A waveform is a series of steps, defined as points on a plot of potential vs. time. Waveforms must be defined for the integrated amperometry mode.

Integrated Amperometry Waveforms

Integrated amperometry waveforms are included in an instrument method in Chromeleon. Integrated amperometry waveforms have the following characteristics:

- The duration of one waveform period can be between 0.05 and 2.0 s, with a step resolution of 10 ms. A waveform can have no more than 100 steps.
- The maximum waveform period is 2.0 s. However, for 2D data, because only one data point is generated per waveform period, the effective maximum length of a waveform period depends on the *data collection rate* (the rate at which Chromeleon collects digital data points from the detector). The relationship is as follows:

  Data Collection Rate = 1/Waveform Period

- Multiple waveforms can be defined for a single run, provided they all have the same cycle duration. Up to 15 waveform changes per run are allowed.
- Each waveform can have only one integration interval. However, 3D amperometric data can be reprocessed after the run with integration intervals at multiple points in the waveform (see Section 2.20.4).
- The integration interval generates one integrated data point per waveform.

Chromeleon provides several preprogrammed waveforms.

You can use a preprogrammed waveform, without modification, or modify it for your application. You can also define a new waveform. Waveforms are defined and modified in the Waveform Editor

To view the Waveform Editor, click **Edit** on the **ED Options** page in the Instrument Method Wizard.

The waveform can also be selected in the ICS-6000 App (see Section 6.1.8).

Analytical vs. Scanning Waveforms

The preprogrammed analytical waveforms supplied with Chromeleon are designed for quantitative analysis of specific compounds (alcohols, amino acids, carbohydrates, etc.). With analytical waveforms, integration occurs either while a single constant potential is being applied over time (see the example waveform in Figure 2-46) or while a series of stepped potentials is being applied (see the example waveform in Figure 2-47).

With scanning waveforms, integration occurs while the potential is being increased linearly over time (see the example scanning waveform in Figure 2-48). Although scanning waveforms are typically not as useful for quantitative analysis as analytical waveforms, when used to collect 3D amperometric data, scanning waveforms can be optimized to provide characteristic I-t plots (see Section 2.20.4). Comparison of I-t plots of a known substance with an unknown can help to identify unknown peaks or to determine whether a substance is coeluting with another.

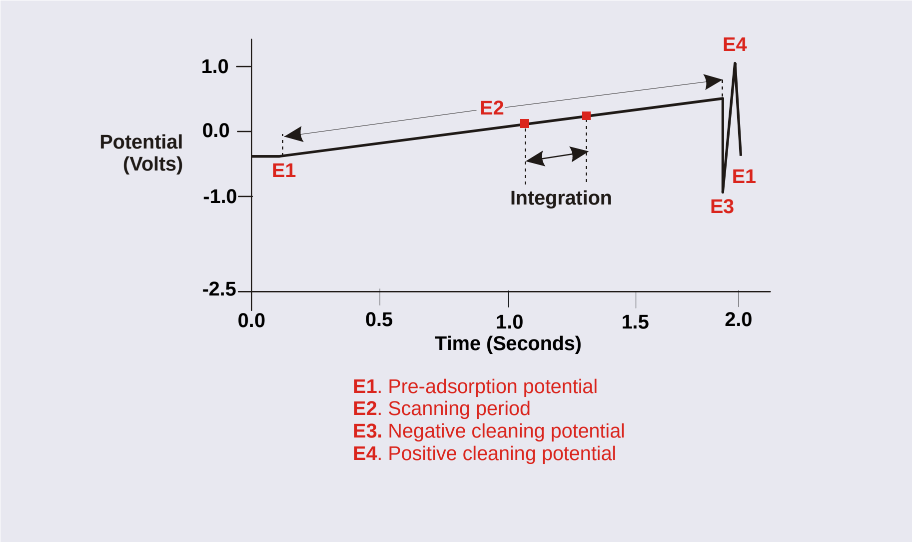


Figure 2-48. *Example Scanning Waveform*

2.20.4 Storing and Reprocessing Amperometry Data

Chromeleon provides storage of 2D and 3D pulsed amperometry and integrated amperometry data. For 2D data, Chromeleon stores the detector's response at each waveform period's integration interval. One integrated data point per waveform period is stored. This allows production of a chromatogram similar to the example shown in Figure 2-49. The retention time (in minutes) is on the x-axis and the detector response (in nanoCoulombs) is on the y-axis.

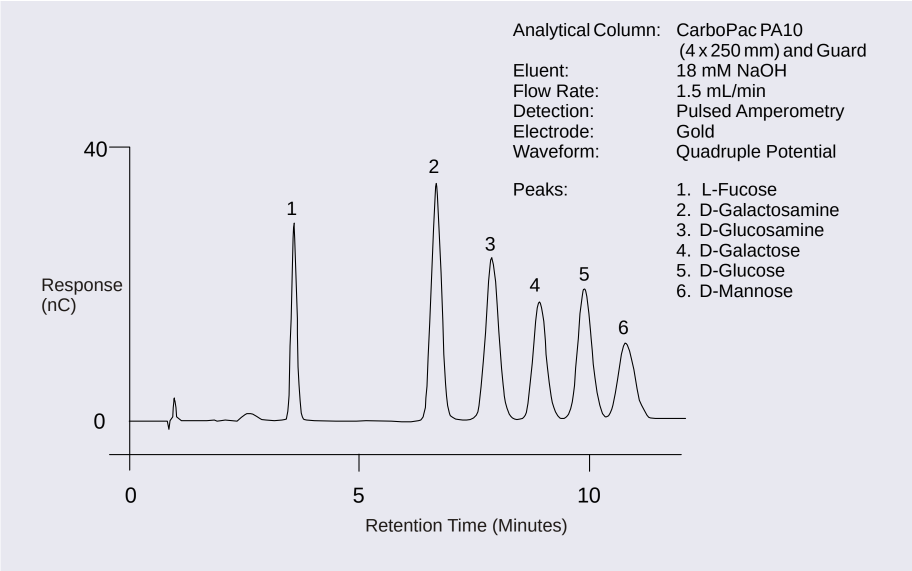


Figure 2-49. *Example Chromatogram for a Pulsed Amperometry Application*

For 3D amperometry data, Chromeleon stores raw data points at a rate of 1 KHz throughout the entire run. Each raw 3D data point is defined by the following attributes: the detector current (1) recorded at a particular waveform time (2) and at a specific retention time (3). As a result, the two-dimensional view of an integrated amperometry chromatogram (retention time vs. integrated current) is extended by a third dimension (waveform time). Thus, data is collected for the entire waveform period, not just the integration intervals.

3 • Configurations

3.1 Overview

This chapter provides example component and plumbing drawings for the following Dionex ICS-6000 system configurations:

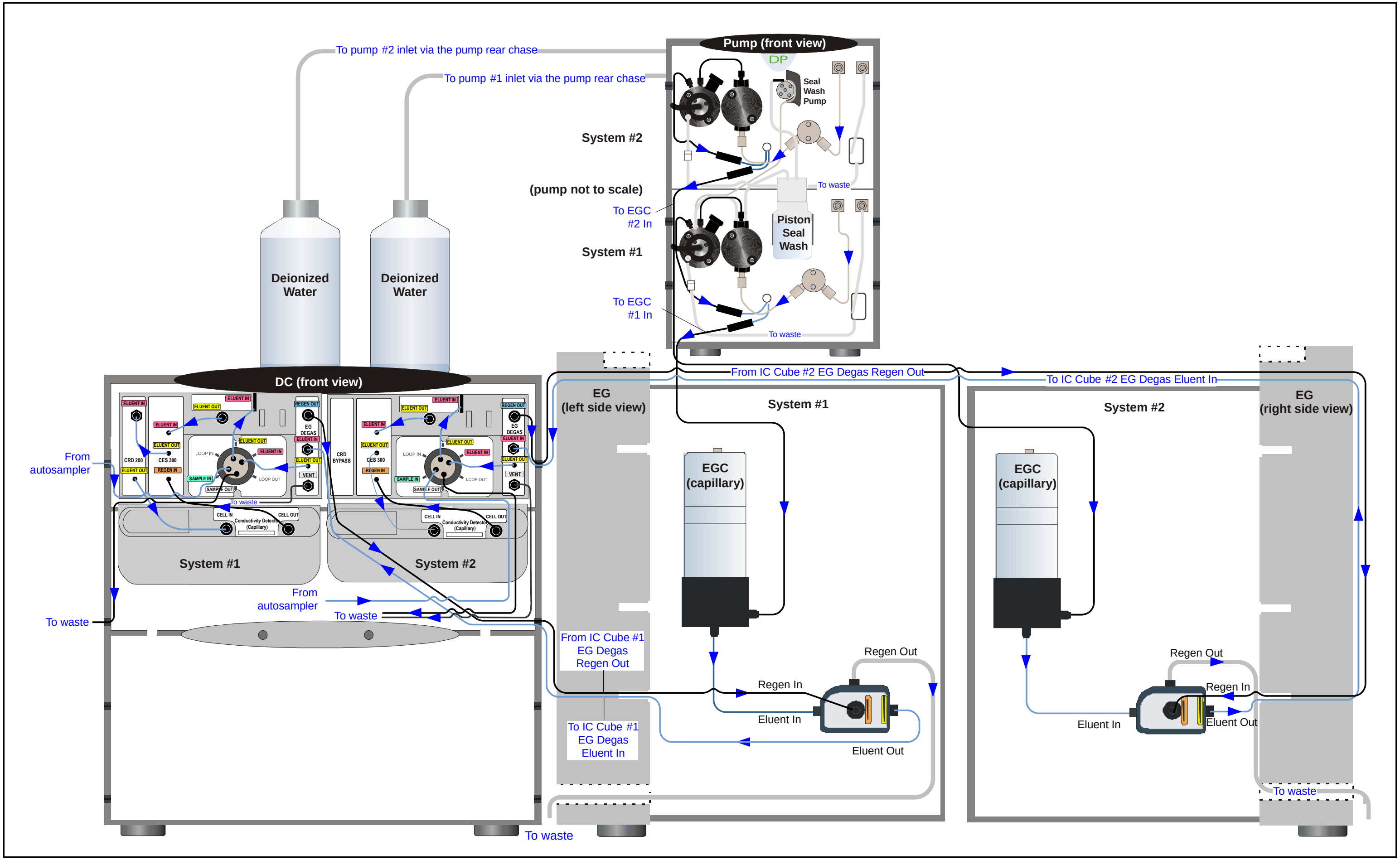


Figure 3-1. *Capillary IC: Dual RFIC-EG System (CD/CD)*

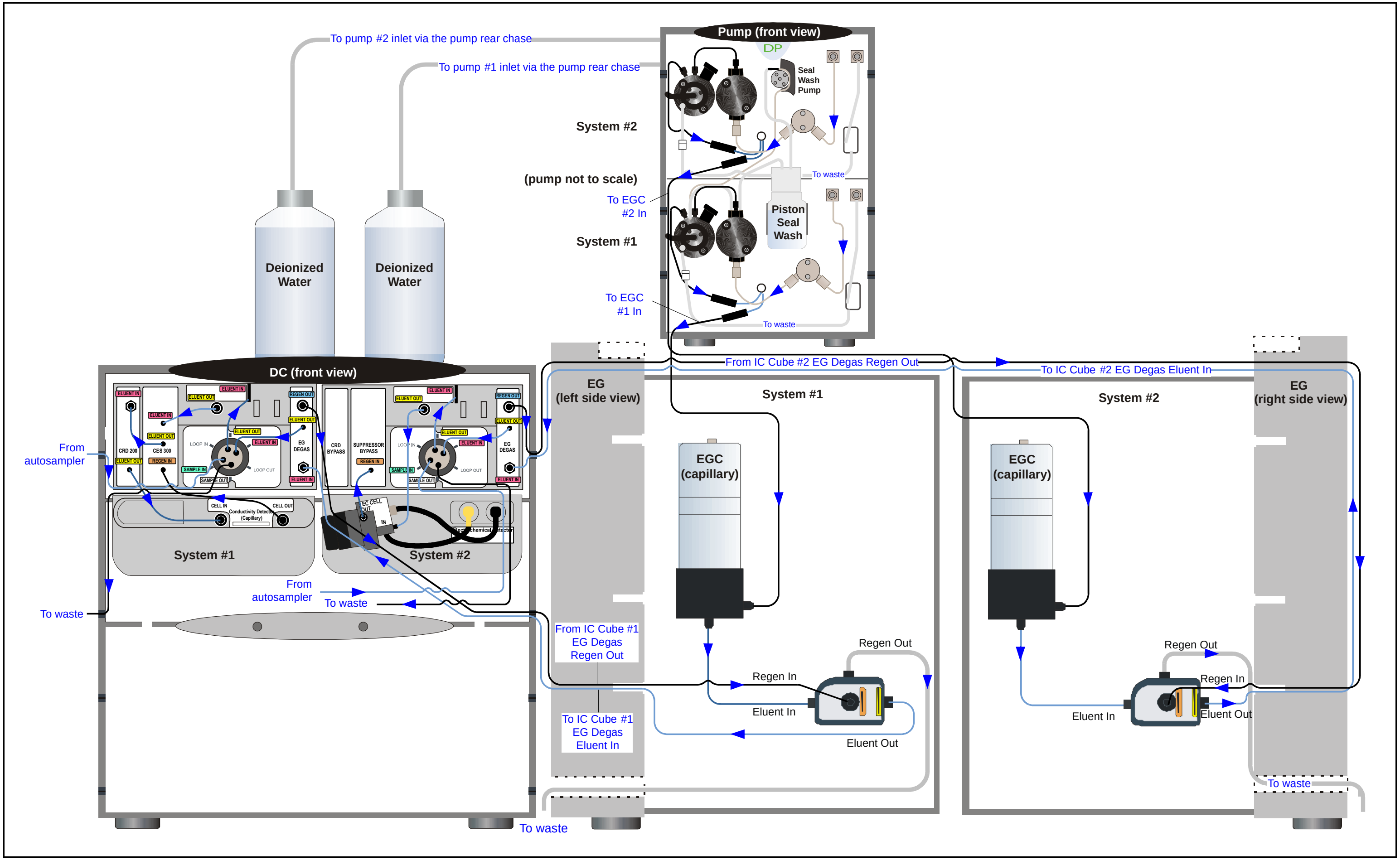


Figure 3-2. *Capillary IC: Dual RFIC-EG System (CD/ED)*

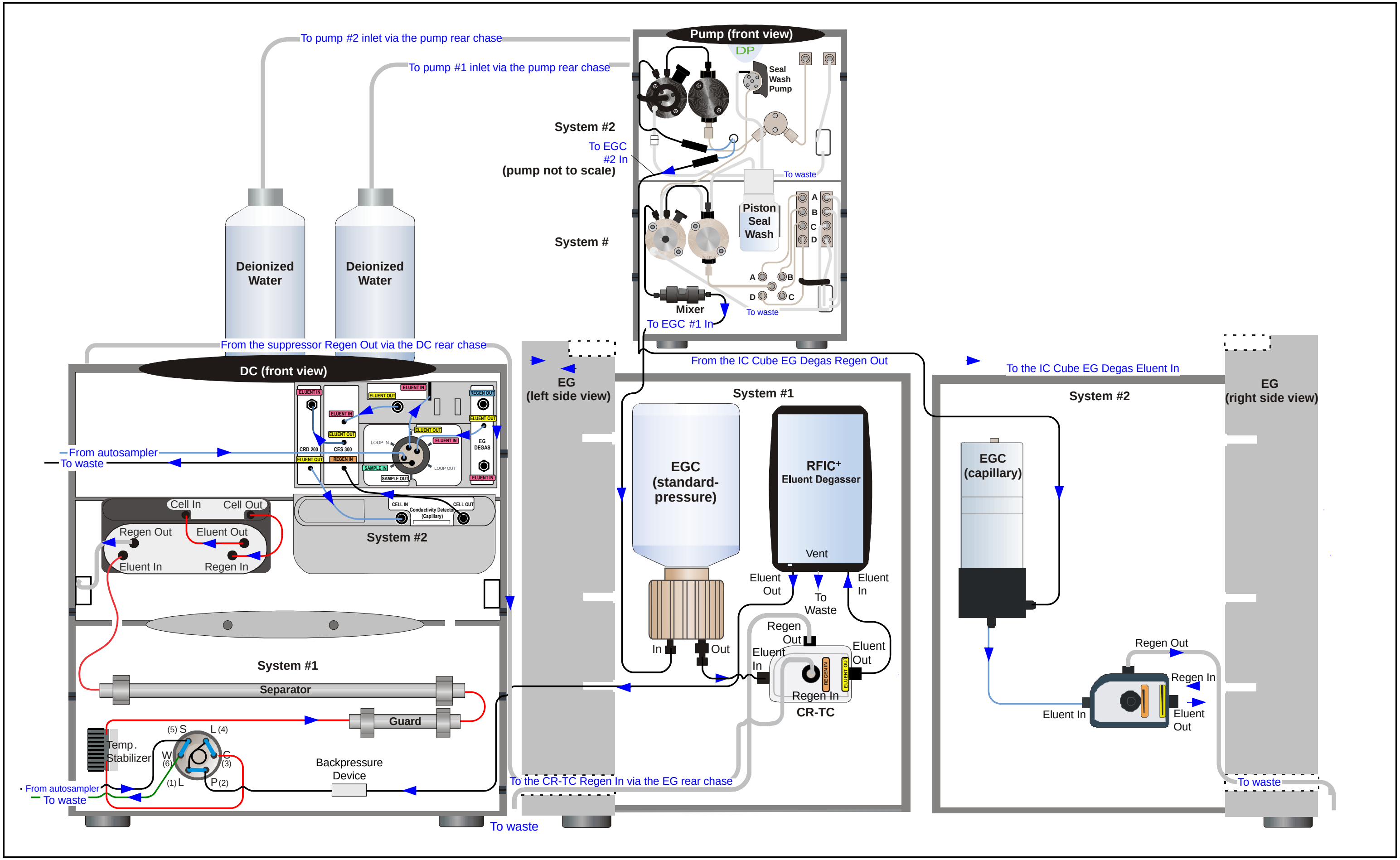


Figure 3-3. *Hybrid System: Dual RFIC-EG System (CD Analytical/CD Capillary)*

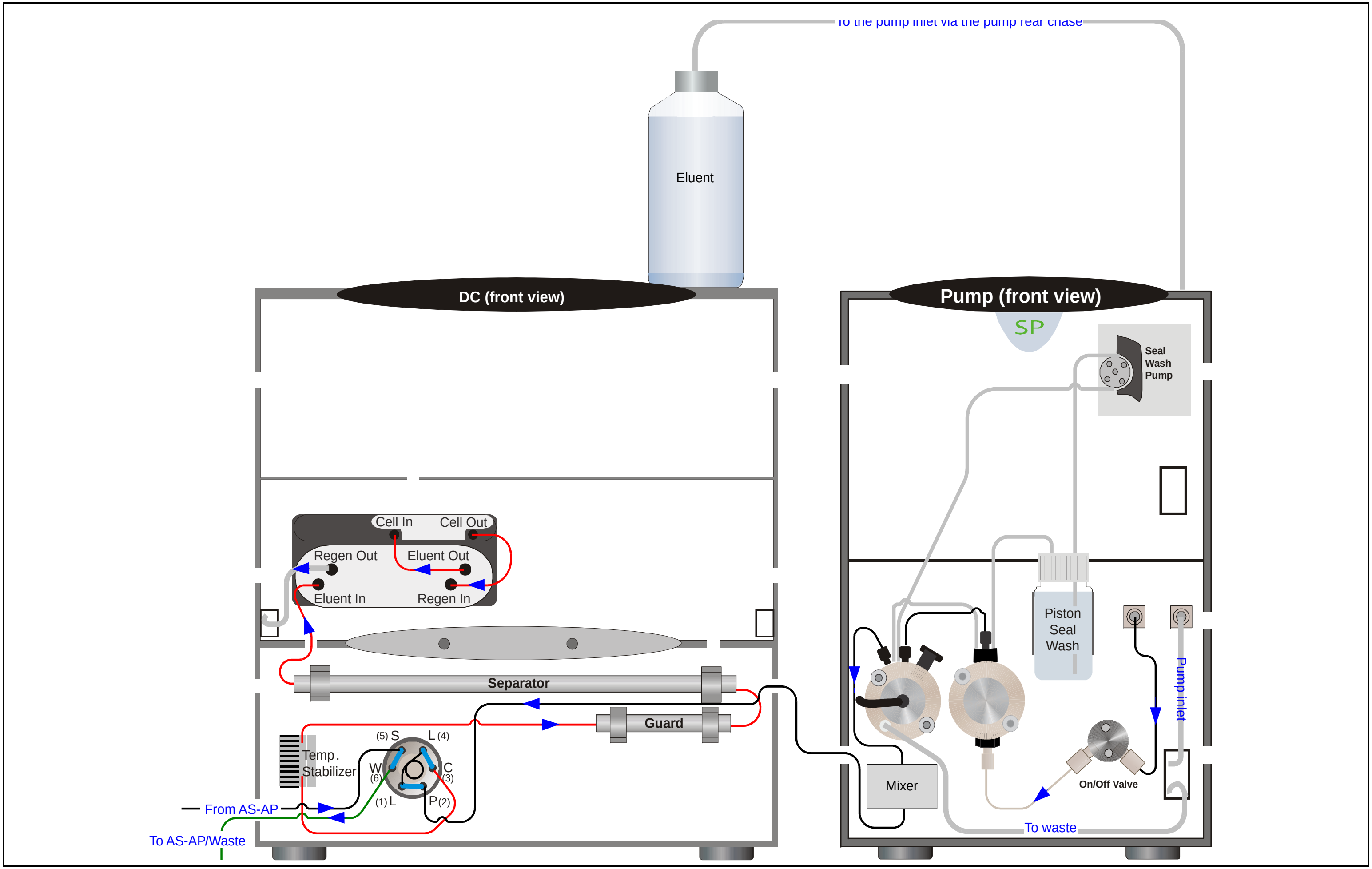


Figure 3-4. *Analytical IC: Single System with no EG (CD)*

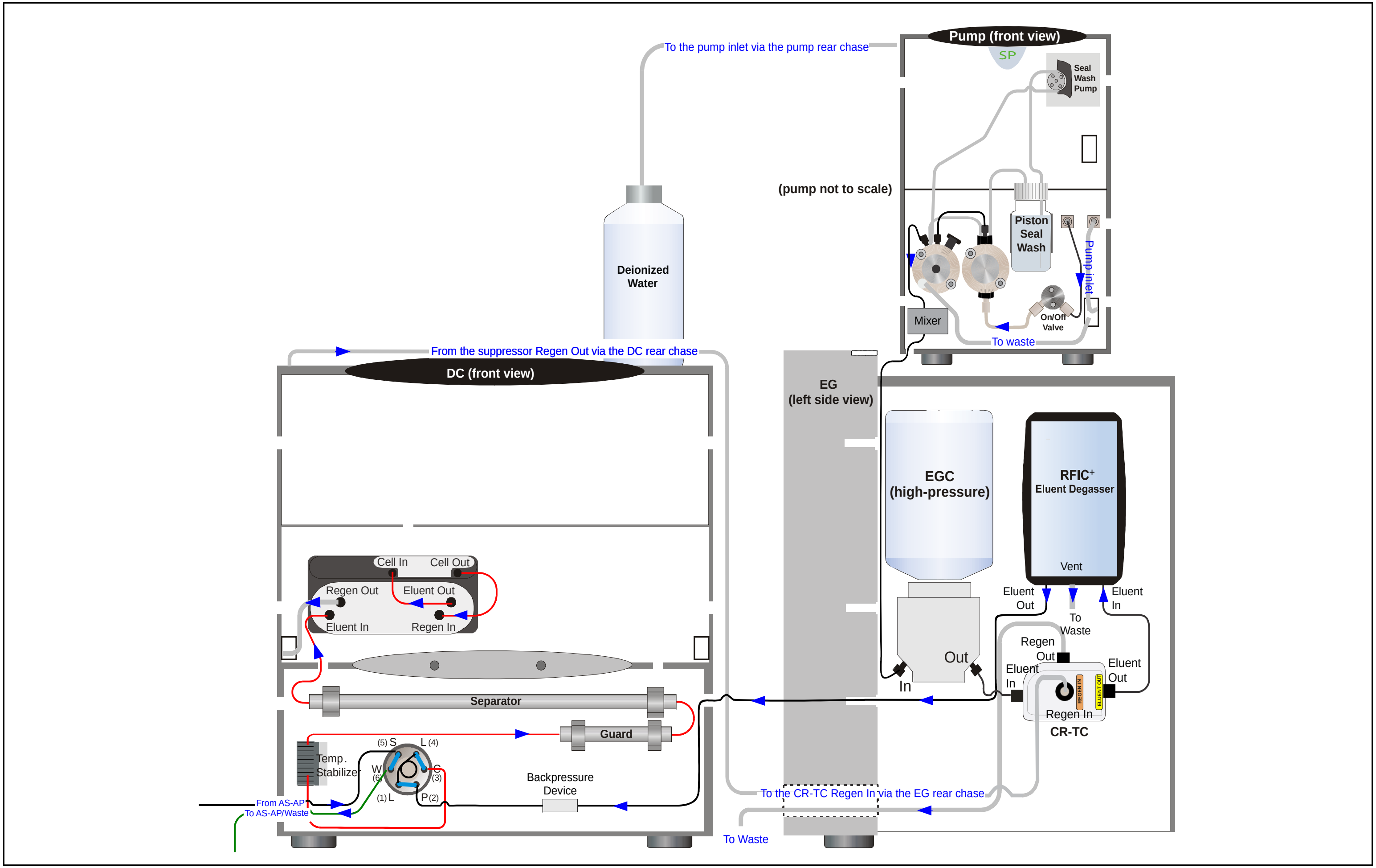


Figure 3-5. Analytical IC: Single RFIC-EG System (CD)

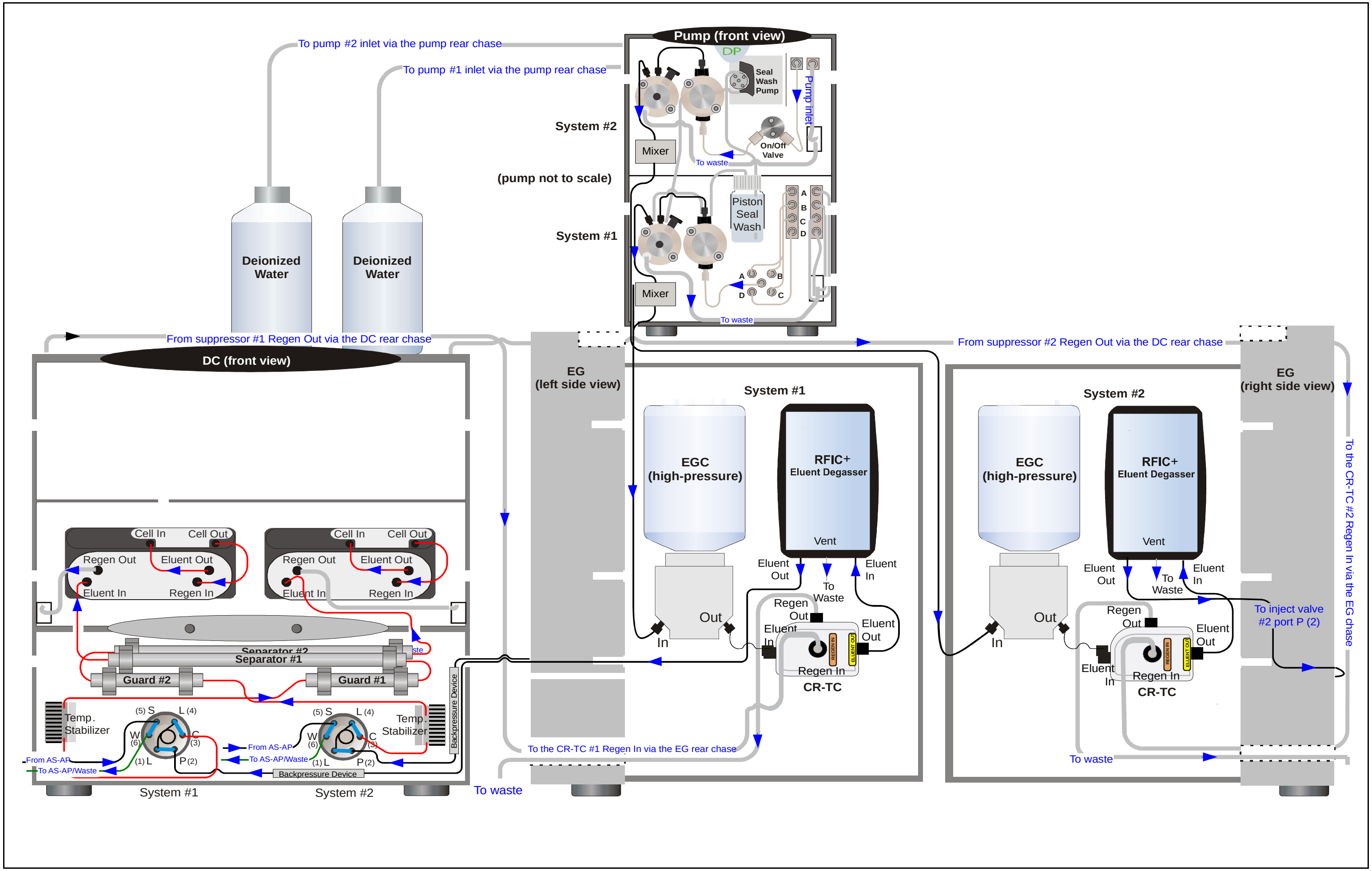


Figure 3-6. Analytical IC: Dual RFIC-EG System (CD/CD)

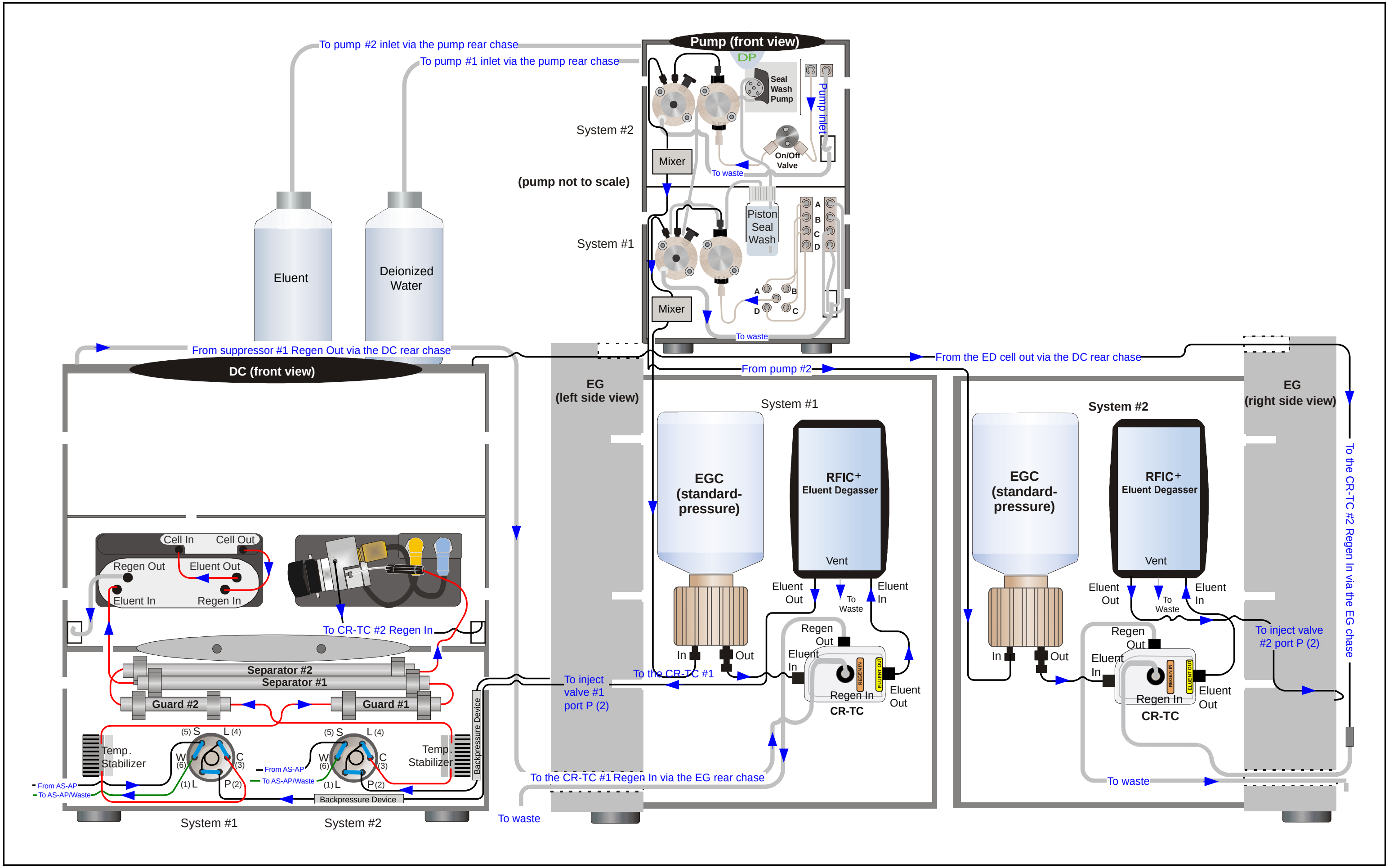


Figure 3-7. Analytical IC: Dual RFIC-EG System (CD/ED)

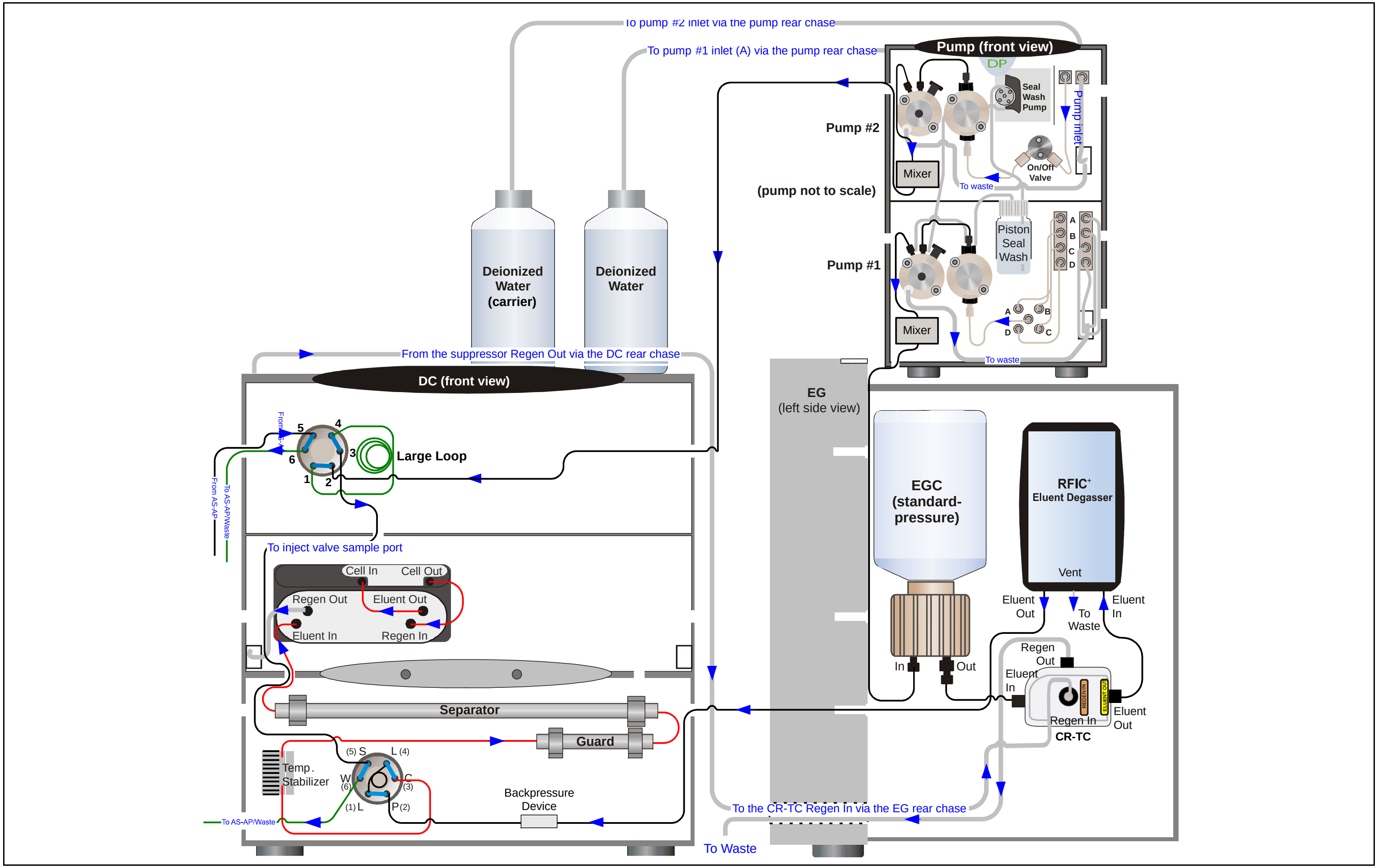


Figure 3-8. *Analytical IC: Single RFIC-EG System with Matrix Elimination Using a DP and a 6-Port Valve*

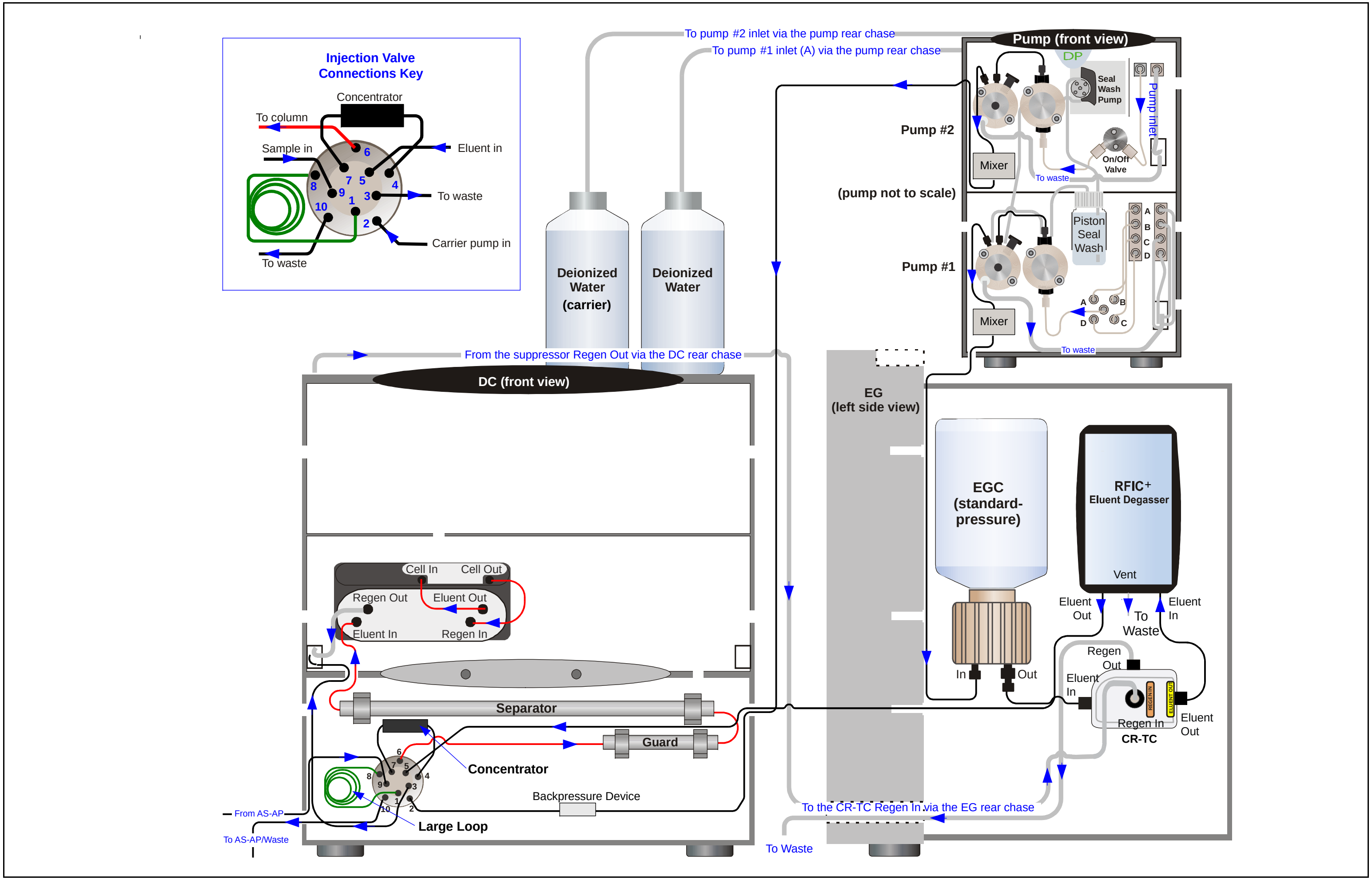


Figure 3-9. *Analytical IC: Single RFIC-EG System with Matrix Elimination Using a DP and a 10-Port Valve*

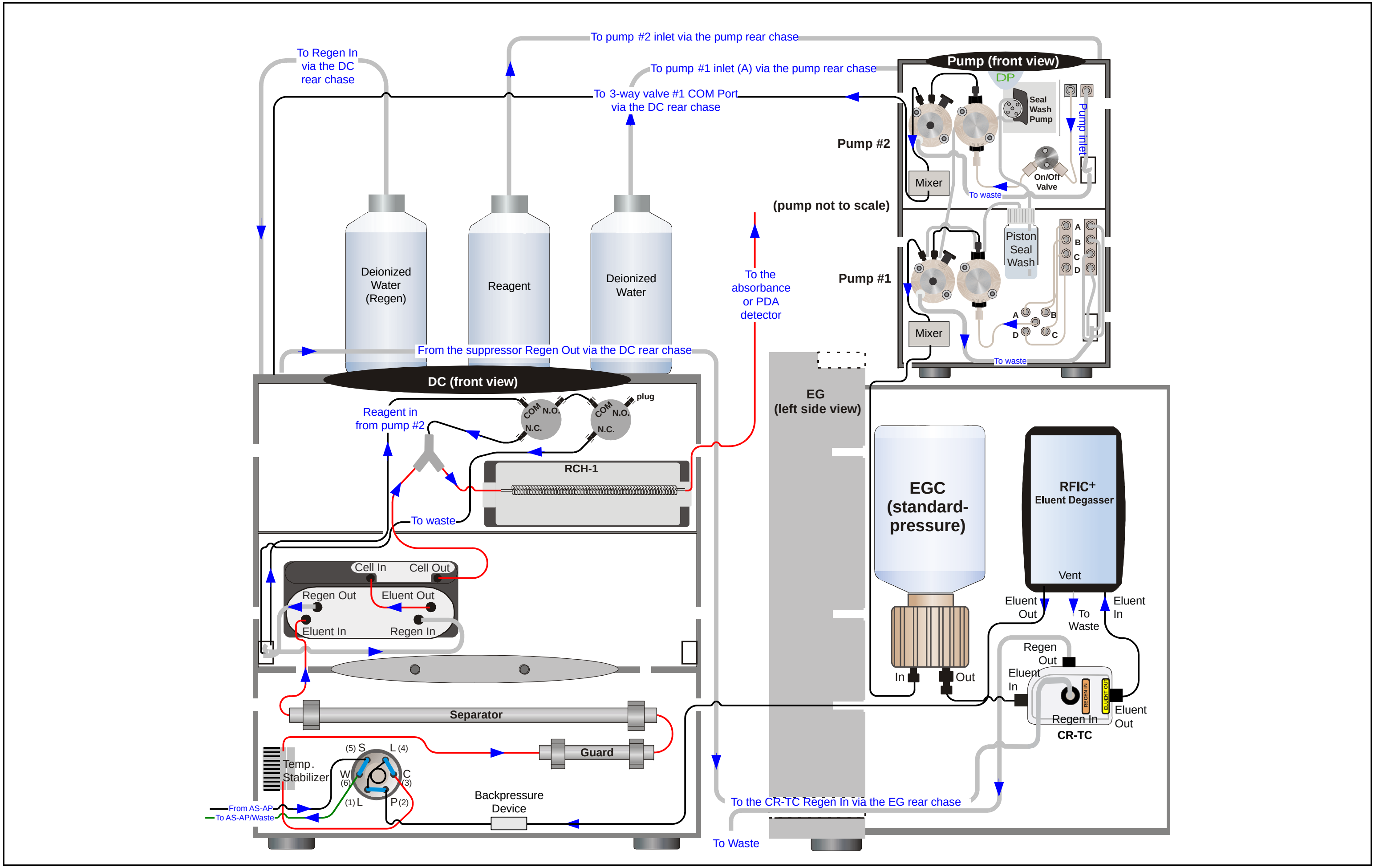


Figure 3-10. *Analytical IC: Single RFIC-EG System with Post-Column Reagent Addition (Bromate)*

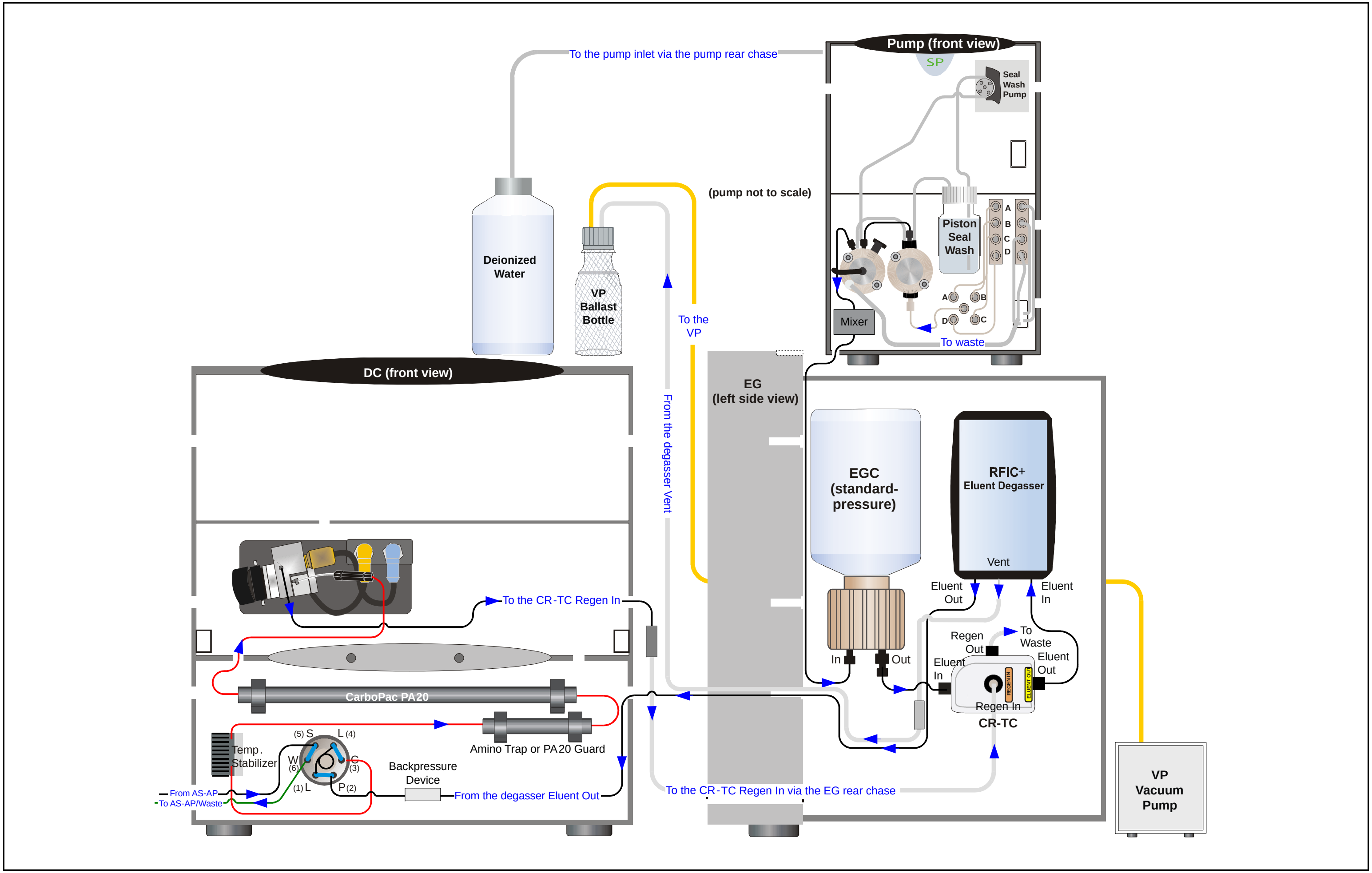


Figure 3-11. *Analytical IC: Single RFIC-EG System with ED and VP (for Carbohydrate Analysis)*

This section is an overview of the steps required to start up the Dionex ICS-6000 system components and prepare the system to run samples. The operating parameters (flow rate, compartment temperature, suppressor current, etc.) depend on the application you plan to run. Refer to the column manual, as well as the schematics in Chapter 3 of this manual, for the required operating parameters.

NOTE Before beginning operation, be sure to perform any special startup procedures required for the columns, suppressors, etc. Startup procedures are described in the quick start guides and manuals for the consumables.

4.1 Operating Precautions

4.1.1 EG Operating Precautions

Analytical IC

In an analytical IC system, the Dionex EGC requires at least 14 MPa (2000 psi) of system backpressure. This ensures optimal removal of electrolysis gas from the eluent produced by the cartridge.

During system equilibration, monitor the **Current Pressure** reading on the **Pump** ePanel in Chromeleon or in the pressure section on the Pump page in the ICS-6000 App. The pressure should remain between 14 and 35 MPa (2000 and 5000 psi) if a Dionex EGC 500 is installed or between 14 and 21 MPa (2000 and 3000 psi) if a Dionex EGC III is installed. If necessary, increase the system backpressure by installing a backpressure coil between the injection valve and the **ELUENT OUT** port on the Dionex EGC. For instructions, see Section 10.15.

IMPORTANT **The recommended maximum operating pressure for the EG in an analytical IC system is 35 MPa (5000 psi) if a Dionex EGC 500 is installed or 21 MPa (3000 psi) if a Dionex EGC III is installed. Excessive backpressure may rupture the tubing inside the Dionex RFIC$^+$ Eluent Degasser.**

CAUTION

DO NOT CAP THE WASTE CONTAINER: The Dionex ICS-6000 Eluent Generator (EG) and the electrolytic suppressors use an electrolytic process that results in the production of small amounts of oxygen or hydrogen gas. To ensure that the gas is not trapped in a closed container and allowed to concentrate, install a 1.3 cm (0.52 in) ID black gas separator waste tube (P/N 045460) in an uncapped waste container. Connect the Waste, Gas Separator line to the waste tube.

MISE EN GARDE

NE FERMEZ PAS LE CONTENEUR DE GAZ RÉSIDUEL: Le Dionex ICS-6000 Eluent Generator (EG) et les electrolytic suppressor travaillent avec un proces d´électrolyse, qui produit des petites quantités de gaz d´oxygène ou d´hydrogène. Afin de garantir que le gaz ne soit pas enfermé dans un conteneur fermé et puisse s´y concentrer, connectez un tube noir à gaz résiduel (diamètre intérieur = 1,3 cm; n° de commande 045460) à un conteneur ouvert (non fermé). Connectez le conteneur résiduel au tube résiduel/gaz séparateur (désigné: « Waste, Gas Separator»).

VORSICHT

VERSCHLIESSEN SIE DEN ABFALLBEHÄLTER NICHT: Der Dionex ICS-6000 Eluent Generator (EG) und electrolytic suppressors verwenden einen Elektrolyseprozess, wodurch kleine Mengen an Sauerstoff und Wasserstoff entstehen. Führen Sie einen schwarzen Gasabscheiderschlauch (ID = 1,3 cm; Bestell-Nr. 045460) in einen offenen (unverschlossenen) Abfallbehälter, damit sich das Gas nicht in einem geschlossenen Behälter sammelt und aufkonzentriert. Verbinden Sie die mit Waste, Gas Separator bezeichnete Leitung mit dem Abfallschlauch.

If you select a low flow rate that allows the system pressure to drop below 14 MPa (2000 psi) and you do not turn off the EG, the EG will continue to generate eluent at the concentration set for the last step of the last Chromeleon instrument method.

If this occurs, the eluent concentration will increase in proportion to the decrease in the flow rate. In extreme cases, excessive heat buildup can occur and damage the Dionex EGC.

For a complete list of operating precautions for Dionex EGCs and CR-TC trap columns, refer to the product manuals.

4.1.2 ED Cell Operating Precautions

To maintain good reproducibility of detection results:

- Prepare all eluents with ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6.
- Avoid contamination of the cell with incompatible eluents.
- Never apply potential to the electrode unless a stream of eluent or water is flowing through the cell.
- Do not allow a pH-Ag/AgCl reference electrode to dry out. Make sure that eluent is pumped continuously through the cell. If the cell will not be used for a short time (less than 2 days), disconnect the tubing from the inlet and outlet fittings and all fitting plugs. For longer shutdowns, see Section 7.4.
- Be careful to keep the polished surface of the ED cell body clean and dry when not in use. The gold, spring-loaded (pogo) contact must also remain clean and dry. If a salt bridge forms, it can cause an electrical short between the working electrode contact and the cell body.
- If the conventional (nondisposable) working electrode becomes discolored or if you notice a degradation in performance (for example, baseline noise or tailing peaks), polish the electrode as instructed in Section 10.27.4.
- Over the lifetime of the conventional working electrode, the surface may gradually become pitted or receded. Receded electrodes can be repaired by sanding with 600 grit sandpaper. Continue sanding until the metal surface is again flush with the Kel-F electrode block surface. Then, polish the electrode as instructed in Section 10.27.4.
- To help determine when the pH-Ag/AgCl reference electrode needs regenerating or replacing, monitor the pH value displayed on the detector panel in Chromeleon (see page 142).
- To have an alarm displayed in the audit trail if the pH exceeds certain values, set pH limits in Chromeleon (see page 143).

To monitor the pH-Ag/AgCl reference electrode pH from Chromeleon

1. At installation, calibrate the pH electrode (see Section 10.27.6).
2. When you run your first chromatographic instrument method, note the pH value displayed on the Chromeleon ePanel (see Figure 4-1).

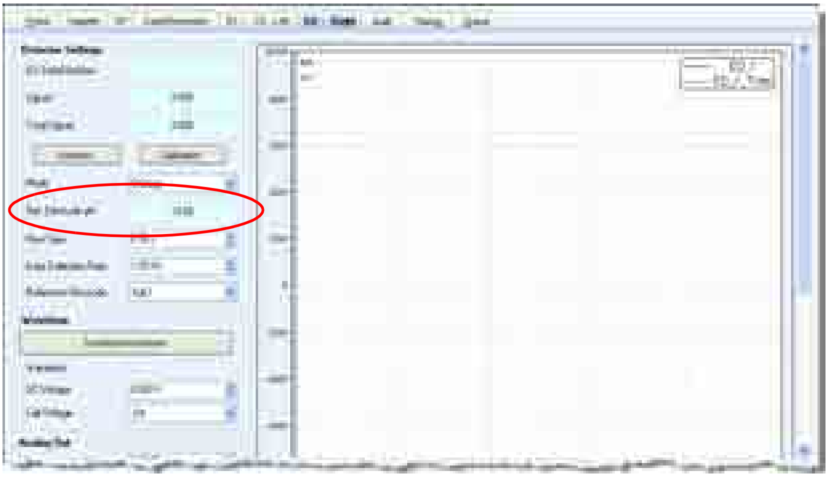


Figure 4-1. *Monitoring the pH-Ag/AgCl Reference Electrode pH*

3. Thereafter, monitor the pH value to determine whether there is a shift in the pH. A shift in the pH reading for the same eluent composition indicates a change in the Ag/AgCl reference potential.

   If the pH value shifts by 0.5 pH unit from the value first observed, check the pH-Ag/AgCl reference electrode (see Section 9.30.6).

To monitor the pH-Ag/AgCl reference electrode pH from the ICS-6000 App

1. At installation, calibrate the pH electrode (see Section 10.27.6).
1. When you run your first chromatographic instrument method, note the pH value displayed (see Figure 6-8). For details, see Section 6.1.7.
2. Thereafter, monitor the pH value to determine whether there is a shift in the pH. A shift in the pH reading for the same eluent composition indicates a change in the Ag/AgCl reference potential.

   If the pH value shifts by 0.5 pH unit from the value first observed, check the pH-Ag/AgCl reference electrode (see Section 9.30.6).

To set ED cell pH limits

You can set upper and lower pH limits in the Chromeleon Instrument Method Wizard. If the limits are exceeded, the audit trail displays an alarm.

NOTE To disable the alarm, set the upper limit to 14 and the lower limit to 0.

4.2 System Startup Checklist

- ☐ Prepare the samples (see page 143)
- ☐ Fill the autosampler vials and load the sample tray (see page 145)
- ☐ Start Chromeleon (see page 146)
- ☐ Set up the eluent reservoirs (see page 149)
- ☐ Set up the piston seal wash system (see page 150)
- ☐ Start the pump (see page 153)
- ☐ Set the pressure limits (see page 154)
- ☐ If an EG is installed, start the EG and set the eluent concentration (see page 155)
- ☐ Start the DC (see page 161)
- ☐ Equilibrate the system and verify operational readiness (see page 162)

NOTE You can use the Smart Startup feature in Chromeleon to automate system startup and equilibration. Refer to the Chromeleon Help for details.

4.3 Preparing Samples

This section provides basic information about collecting, storing, and preparing samples for analysis.

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

4.3.1 Collecting and Storing Samples

Collect samples in high-density polyethylene, polystyrene, or polycarbonate containers that have been thoroughly cleaned with ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6. Do not clean containers with strong acids or detergents; 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 micron 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 change in anion concentration.

4.3.2 Pretreating Samples

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

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

A Dionex Low-Volume High-Pressure Inline Filter (P/N 074505) is available for removing particulates down to 0.45 micron from samples. Connect the inline filter between the autosampler outlet and the sample inlet port on the injection valve. For details, see the instructions provided with the inline filter.

Before injection, pretreat samples that may contain high concentrations of interfering substances by putting them through Thermo Scientific Dionex OnGuard™ cartridges. Refer to the installation and troubleshooting guide for the OnGuard cartridge for instructions.

4.3.3 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.

To dilute the sample, use eluent or ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6. 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 samples 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.

4.3.4 Filling Sample Containers and Loading the Sample Tray

Follow the instructions in the autosampler manual to fill sample vials or well plates and load them into the sample tray or carousel.

Tips for Filling and Loading Dionex AS-AP Vials

- Fill the vials to the vial shoulder or lower. **Do not fill to the top.**
- During sampling, make sure the needle vent is not immersed in liquid.
- For 10 mL vials only: If necessary, raise the needle height inside the vial to position the vent above the liquid. Set the needle height in a Chromeleon instrument method.
- Install a cap on each vial. Make sure the septum is pushed fully into the cap and the cap is securely tightened.

Tips for Filling and Loading Dionex AS-AP Well Plates

- Put on powder-free latex gloves before handling well plates and covers to minimize sample contamination.

- Rinse well plates and covers thoroughly with deionized water before use to remove any contaminants.
- Air dry well plates completely to prevent any changes in sample concentration. If necessary, use 690 kPa (100 psi) nitrogen gas to assist in drying.
- In general, pipet the amount of sample to be drawn plus 70 µL. Refer to the autosampler manual for details about the sample volumes drawn for each type of injection.

Tips for Filling and Loading Dionex AS-DV Vials

- Fill the vials until the level in the vial reaches the top of the vial tray.
- Install a cap on each vial. Use the cap insertion tool (P/N 037987) to prevent contamination and ensure the cap is inserted to the proper depth.

4.4 Starting Chromeleon

4.4.1 Starting the Chromeleon Instrument Controller Service

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

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

4.4.2 Starting the Chromeleon Client

1. To start the Chromeleon client, click **Start** > **All Programs** > **Thermo Chromeleon 7** > **Chromeleon 7**.
2. To display the Chromeleon ePanel Set, click the **Instruments** Category Bar in the Console. Click your instrument on the Navigation Pane. Chromeleon connects to the instrument and displays the ePanel Set (see Figure 4-2).

By default, the ePanel Set opens to the **Home** ePanel. This panel displays basic status information for each instrument in the system. In addition, a limited number of device functions can be controlled directly from this panel and the audit trail can be accessed from here.

Figure 4-2. *Example Chromeleon ePanel Set*

4.5 Setting Up the Eluent Reservoirs

1. Rinse the eluent reservoirs with ASTM Type I (18 megohm-cm) filtered and deionized water.

   NOTE Always use ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6 to prepare eluent and regenerant or to rinse eluent reservoirs.

2. If an EG is not installed, prepare the eluent for the application. For instructions, refer to the column manual.
3. Fill the reservoirs with prepared eluent or deionized water (if an EG is installed).

   Locate the end-line filters (P/N 045987) provided in the pump ship kit:

Pump Ship Kit	Part Number
DP Ship Kit Dual Capillary	072112
DP Ship Kit Dual Analytical	062463
DP Ship Kit Capillary and Analytical	072111
SP Ship Kit Capillary or Analytical	063342

   Before installation, thoroughly rinse the end-line filter with ASTM Type I (18 megohm-cm) filtered and deionized water to remove any loose particles.

4. Install an end-line filter on the end of each reservoir’s eluent line.
5. Install the reservoir caps, making sure the end of each line extends to the bottom of the reservoir, and that each filter is submerged in liquid. This prevents air from being drawn through the eluent lines. Hand-tighten the caps.

   NOTE A Dionex High-Pressure Inline Filter (P/N 044105) can be used to remove particulates down to

0.45 micron from eluent. Connect the inline filter between the pump outlet and the eluent inlet port on the injection valve. For details, refer to the instructions provided with the inline filter.

4.6 Setting Up the Piston Seal Wash System

Replumbing the Seal Wash System (DP only) (Optional)

The standard piston seal wash system is designed for use with only one of the two pumps in a DP module. When the DP is shipped from the factory, the seal wash system is connected to pump 1 (the bottom pump). If you want to connect the seal wash system to pump 2 (the top pump), follow the instructions in this section.

NOTE For users who need to operate a piston seal wash system for both pumps in the DP, Thermo Fisher Scientific offers the following options:

- The Dual-Serial External Seal Wash Kit (P/N 063518) contains the parts needed to connect an external seal wash reservoir to a DP module and to set up the piston seal wash system in the DP pump for serial operation.
- The Dual-Parallel External Seal Wash Kit (P/N 068661) contains the parts needed to connect a second seal wash pump and an external seal wash reservoir to a DP.

1. Note the tubing connected from the peristaltic pump to the seal wash tube on the secondary pump head on pump 1 (see Figure 4-3, item 1). Disconnect this tubing from the pump head and connect it to the seal wash tube on the secondary pump head on pump 2.

1 Connection from peristaltic pump to secondary pump head

2 Connection between pump heads

3 Seal Wash Reservoir Inlet Line

4 Seal Wash Reservoir Outlet Line

Figure 4-3. *Piston Seal Wash Connections to Pump 1*

2. Disconnect the short piece of tubing between the primary and secondary pump heads on pump 1 (see Figure 4-3, item 2). Connect this tubing to the pump heads on pump 2.
3. Disconnect the seal wash reservoir inlet line from the primary pump head on pump 1 (see Figure 4-3, item 3). Connect the inlet line to the primary pump head on pump 2.
4. When you finish these connections, go to the next section to continue setting up the seal wash system.

Setting Up the Seal Wash System (All pumps)

1. Add ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6 to the seal wash reservoir (P/N 064155).

   The liquid level should be between the **Min.** and **Max.** markers on the reservoir label. **Do not overfill the reservoir.**

2. Place the cap on the reservoir and tighten fingertight.
3. Insert the reservoir into the holder on the component panel.
4. Check that the tubing is engaged in the peristaltic pump (see Figure 4-4). If it is not, lift the lever on the peristaltic pump up and to the right, insert the tubing neatly between the lever and the rotor, and release the lever to secure the tubing.

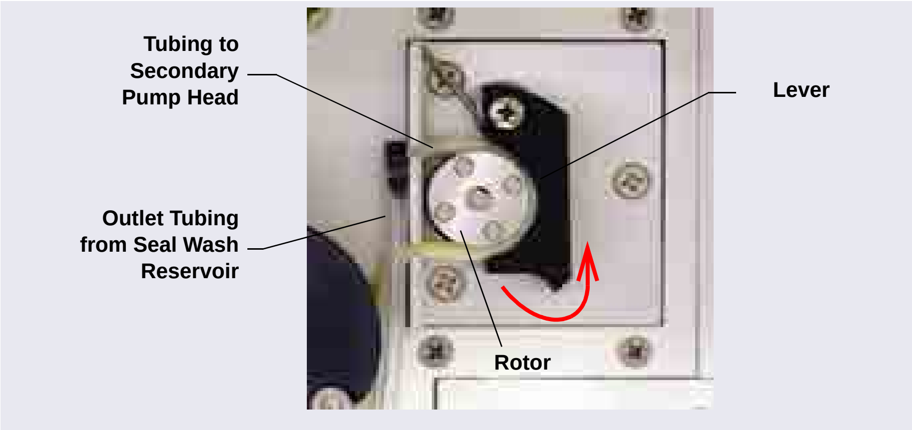


Figure 4-4. *Peristaltic Pump*

5. Follow these steps to activate the piston seal wash function:
   a. Open the Chromeleon ePanel Set.
   b. Press the **F8** key to open the Command window.
   c. Select the pump name.
   d. Click the **Properties** tab on the right pane of the window.
   e. Select the **RearSealWashSystem** property and select the **Interval** option.

4.7 Starting the Pump

1. Press the **POWER** button on the front of the DP/SP.
2. If any of the following conditions applies, prime the pump (see Section 10.3) before proceeding:
   - The eluent has been changed.
   - The eluent line is new (empty).
   - The eluent line contains air.
3. You can use either Chromeleon or the ICS-6000 App to prime the pump.
   - On the Chromeleon ePanel Set: Click the pump tab to display the pump ePanel (see Figure 4-5).
   - From the ICS-6000 App: Disconnect the system from Chromeleon, and then tap the **PUMP**  button on the Home page.

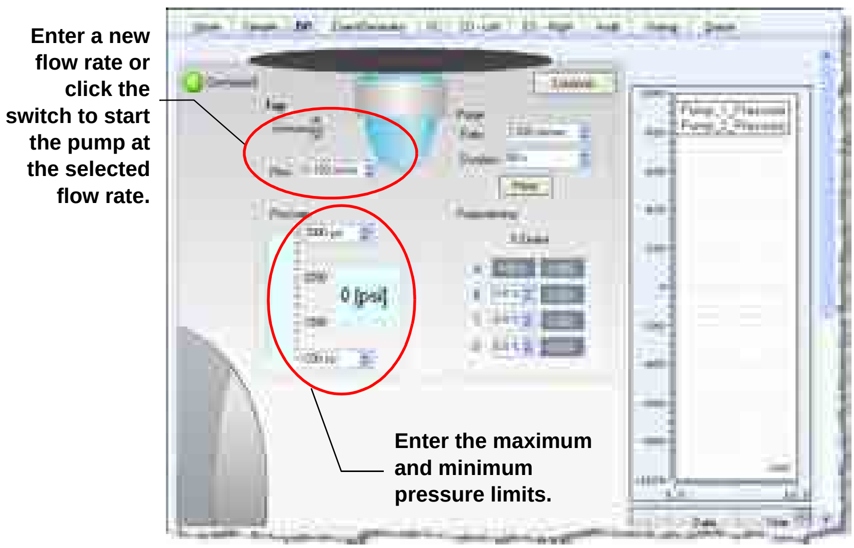


Figure 4-5. *Setting the Pump Flow Rate and Pressure Limits*

4. Enter the **Flow** rate required for your application. This starts the pump flow, also.

5. If the preferred flow rate is already selected but the pump flow is off, click the switch to start the pump at the selected flow rate.

   NOTE After starting the pump or changing the flow rate, wait at least 5 minutes (longer for flow rates below 1.0 mL/min) before beginning an analysis. This allows the DP/SP to stabilize the flow rate.

6. Enter the minimum and maximum pressure limits. Setting pressure limits ensures that the DP/SP automatically stops if a system malfunction occurs. Table 4-1 lists the default pressure limits for capillary and analytical pumps.

IMPORTANT **If your system includes a capillary pump linked to a Dionex EGC using the standard EG degas (capillary) cartridge (P/N 088231), the high pressure limit must be changed to 21 MPa (3000 psi).**

Pump Configuration	Default Low Pressure Limit	Default High Pressure Limit
Capillary pump not linked to a Dionex EGC	0	41 MPa (6000 psi)
Capillary pump linked to a Dionex EGC	1.4 MPa (200 psi)	34 MPa (5000 psi)[a]
Analytical pump not linked to a Dionex EGC	0	41 MPa (6000 psi)
Analytical pump linked to a Dionex EGC	1.4 MPa (200 psi)	21 MPa (3000 psi)
Analytical pump linked to high-pressure Dionex EGC	1.4 MPa (200 psi)	34 MPA (5000 psi)

Table 4-1. *Default Pressure Limits for DP/SP Pumps*

a. Change the default high pressure limit to 21 MPa (3000 psi).

4.8 Entering the Eluent Concentration

To enter the eluent concentration in Chromeleon

1. Press the **POWER** button on the front of the EG.
2. On the Chromeleon ePanel Set, click the **Eluent Generator** tab to display the Eluent Generator ePanel (see Figure 4-6).

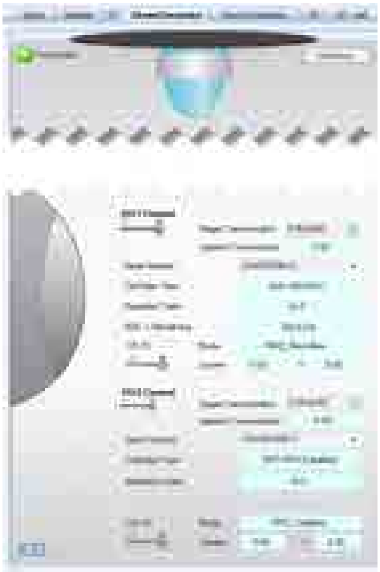


Figure 4-6. *Example EG ePanel in Chromeleon*

3. Enter a value in the **Target Concentration** box. For help in selecting an eluent concentration, see Section 4.9.

   If the pump flow is on, entering a new **Target Concentration** value automatically turns on the power to the Dionex EGC, also.

4. If the pump flow is off, first turn on the flow and then click the switch under **EG1 Control** (or **EG2 Control**). This turns on the power to the Dionex EGC at the selected **Target Concentration** value.

5. If the **CR-TC** switch is off, click the switch to turn on the power to the Dionex CR-TC 600.

To enter the eluent concentration in the ICS-6000 App

1. On the Home page, under **EGC**, tap the concentration button and enter the eluent concentration on the keypad.
2. Tap the pump **OFF/ON** button to turn on the flow.
3. Tap the **ON/OFF** button under **EGC** to turn on the Dionex EGC power.
4. Tap the **ON/OFF** button under **CR-TC** to turn on the Dionex CR-TC 600 power.

4.9 Selecting the Eluent Concentration

The allowable eluent concentration depends on several factors: the flow rate, suppressor type, Dionex EGC type, and cartridge configuration. For details, see Table 4-2 and Table 4-3.

Single-Cartridge or Independent Dual-Cartridge Configuration

In the single-cartridge configuration, the EG contains one Dionex EGC. In the independent dual-cartridge configuration, the EG contains two Dionex EGCs operating independently in separate systems (each cartridge is linked to a different DP/SP). For details, refer to the Dionex EGC manual.

Dionex EGC	Eluent Concentration Range
KOH (Capillary)	0.1 to 200 mM at 0.001 to 0.010 mL/min flow 0.1 to X mM at 0.010 to 0.030 mL/min where X = 2/flow
MSA (Capillary)	0.1 to 200 mM at 0.001 to 0.010 mL/min flow 0.1 to X mM at 0.010 to 0.030 mL/min where X = 2/flow
K_2CO_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

Table 4-2. *Eluent Concentration Ranges for Single-Cartridge and Independent Dual-Cartridge Configurations*

Dionex EGC	Eluent Concentration Range
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
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
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
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

Table 4-2. *Eluent Concentration Ranges for Single-Cartridge and Independent Dual-Cartridge Configurations*

Linked Dual-Cartridge Configuration

In the linked dual-cartridge configuration, the EG contains two Dionex EGCs, linked to a single pump. 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 Dionex EGC manual.

Dionex EGCs	Eluent Concentration Range	Comment
K_2CO_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 where X = 15/flow	The total of the eluent concentrations from both cartridges (Dionex K_2CO_3 and EPM) must not exceed the specified range. The Dionex EPM concentration must not exceed 10 mM. See the notes below for additional information.

Table 4-3. *Eluent Concentration Ranges for Linked Dual-Cartridge Configurations*

Dionex EGCs	Eluent Concentration Range	Comment
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 where X = 50/flow	The eluent concentration range for each cartridge is 50% of the range for an independent cartridge.
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 where X = 40/flow	The eluent concentration range for each cartridge is 50% of the range for a single-independent cartridge.
KOH (Capillary)/ MSA (Capillary)	0.1 to 100 mM at 0.001 to 0.01 mL/min 0.1 to X mM at 0.01 to 0.1mL/min where X = 1/flow	The eluent concentration range for each cartridge is 50% of the range for an independent cartridge.

Table 4-3. *Eluent Concentration Ranges for Linked Dual-Cartridge Configurations (Continued)*

Notes for Generating Carbonate/Bicarbonate Eluent

If a Dionex EGC 500 K_2CO_3 and a Dionex EPM 500 Electrolytic pH Modifier are installed (EGC_1 and EGC_2, respectively):

1. Set **EGC_1 Target Concentration** to the concentration of K_2CO_3 required for your application.
2. Set **EGC_2 Target Concentration** to the concentration of $KHCO_3$ required for your application.

The Dionex K_2CO_3 cartridge generates the total of the two target concentrations and the Dionex EPM modifies the total to achieve the $K_2CO_3/KHCO_3$ eluent mixture that you require.

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.

The Dionex K_2CO_3 cartridge generates 4.50 mM K_2CO_3 (indicated in the **Applied Concentration** field for the K_2CO_3 EGC). The Dionex EPM modifies the 4.50 mM K_2CO_3 eluent to achieve the required 3.50 mM K_2CO_3/1.00 mM $KHCO_3$ mixture.

4.10 Starting the DC

1. Press the **POWER** button on the front of the DC.
2. On the Chromeleon ePanel Set, click the **DC** tab to display the DC ePanel (see Figure 4-7).

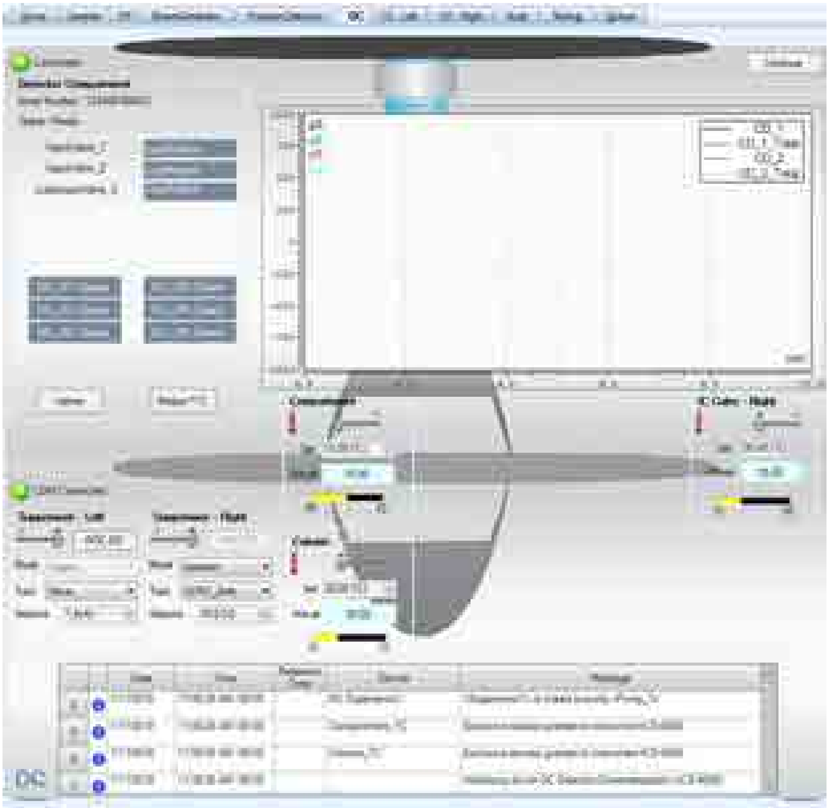


Figure 4-7. *Example DC ePanel in Chromeleon*

3. For each of the following temperature control devices installed in the DC—**Compartment**, **Column**, **Reaction Coil**, **IC Cube**—enter the preferred **Set** temperature. This turns on the device, also.

   If the preferred temperature is already selected, but the device is off, click the corresponding switch to turn on the device.

4. If a suppressor is installed: Under **Suppressor 1** (or **Suppressor 2**), select the suppressor **Type,** set the **Mode** to **On**, and enter the **Current** required for your application.
5. If a CD is installed: Click the **CD** tab to open the CD ePanel.
6. Under **Cell Heater**, set the **Cell Heater Mode** to **On** and enter the **Cell Heater Set Point**.

4.11 Equilibrating the System and Verifying Operational Readiness

NOTE You can also use the Smart Startup feature in Chromeleon to automate system startup and equilibration. Refer to the Chromeleon Help for details.

1. On the Chromeleon ePanel Set, verify that each Dionex device listed below (if installed in your system) is turned on and the selected setting for the device (flow rate, eluent concentration, temperature, and so on) is correct for your application:
   - Pump
   - EGC
   - CR-TC
   - EPM
   - Suppressor
   - Temperature control devices (DC compartment, DC column compartment, IC Cube, CD cell heater, reaction coil heater)
2. Click **Monitor Background** on the toolbar above the Chromeleon ePanel Set. Chromeleon begins plotting the detector signal and pump pressure readings.

3. View the detector signal and monitor the background. Refer to the column manual for the appropriate background for your application.
4. Offset the detector background and zero the reading by clicking the **Autozero** button.
5. Verify that the detector baseline is at the expected reading for your application and is stable. If the reading is too high, see Section 9.11 for troubleshooting information. If the baseline is drifting or is excessively “noisy” (there are large fluctuations in readings), see Section 9.2 for troubleshooting information.
6. Monitor the DP/SP pressure to make sure it is at the expected reading for the installed column and is stable.
7. Verify that all installed temperature control devices are at their set points and are stable.

   The system is now ready for operation.

Capillary IC Because capillary IC systems use low flow rates and consume very little eluent, you can leave a capillary IC system on at all times, allowing it to remain equilibrated and always ready to run the next sample.

5.1 Controlling Modules Directly

When the Dionex ICS-6000 system is not running automated analyses, you can directly control system modules by issuing commands from the ePanel Set in Chromeleon. For example, you can turn on the pump flow, set the eluent concentration, or set the compartment temperature.

To display the Chromeleon ePanel Set:

1. In the Console, click the **Instruments** Category Bar.
2. On the Navigation Pane, click the instrument that you want to control. Chromeleon connects to the instrument and displays the ePanel Set.

To issue direct control commands to a module:

1. On the ePanel Set, click the tab for the module.
2. Use the controls (buttons, sliders, etc.) on the ePanel to issue commands.
3. If the function that you want to perform is not available from the ePanel, press the **F8** key to open the Command window. You can access all commands available for the system from here.

5.2 Analyzing Samples

Figure 5-1 shows the basic steps used to analyze a sample in a chromatography system.

To analyze a sample with a Dionex ICS-6000 system, add sample injections to a Chromeleon sequence. The sequence determines how the group of injections will be analyzed, and the order in which they will be run. A sequence typically includes the following elements:

- A predefined list of commands and parameters for controlling Dionex ICS-6000 modules and acquiring sample data (called an *instrument method* in Chromeleon).
- The chromatographic data acquired for each injection.

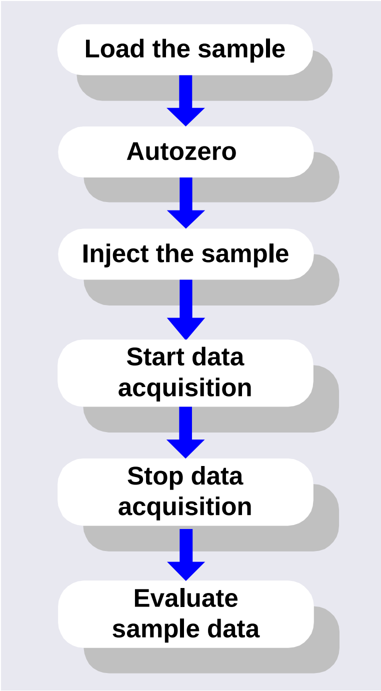


Figure 5-1. *Sample Analysis Overview*

- A predefined set of instructions for evaluating the acquired data (called a *processing method* in Chromeleon).
- Templates for displaying chromatographic data on the screen and for printing reports.

NOTE Chromeleon includes a Virtual Column Separation Simulator, a tool to help you determine the best operating parameters (column, eluent, flow rate, and temperature) for a particular analysis. Refer to the Chromeleon Help for details.

5.2.1 Creating a New Sequence in Chromeleon

Chromeleon offers two techniques for creating a new sequence: eWorkflows and the Sequence Wizard.

- eWorkflows provide predefined templates and rules for creating new sequences. If they have been defined for your laboratory, eWorkflows are the preferred method for creating a new sequence.
- The Sequence Wizard provides a series of dialog boxes that guide you through the sequence creation process.

Using eWorkflows

1. In the Console, click the **eWorkflows** Category Bar. On the Navigation Pane, click the eWorkflow name.
2. In the Work Area, click the instrument name and then click **Launch**.
3. The eWorkflow Wizard opens. Complete the steps in the wizard. For details about an eWorkflow Wizard page, click the **Help** icon .
4. After you finish the eWorkflow Wizard, the sequence is displayed in the Console Data view.

Using the Sequence Wizard

1. In the Console menu bar, click the **Create** button.
2. The Sequence Wizard opens. Complete the steps in the wizard, specifying the number of samples and standards that you want, and the instrument method, processing method, and report template to use. For details about a wizard page, click the **Help** icon .

   NOTE If preferred, you can create the sequence first and then specify the methods and report template later. You can also edit other details of the sequence (for example, add or remove samples) after you finish the wizard.

3. After you finish the wizard, the new sequence is displayed in the Console Data view.

5.2.2 Starting a Sequence in Chromeleon

1. Click **Start** on the sequence control bar.
2. The sequence is appended to the instrument queue and a Ready Check is performed. If the Ready Check passes and the instrument is not currently running another sequence, the sequence is started.

5.3 Loading Samples into the Sample Loop or Concentrator

Two methods are available for loading samples:

- Loading samples with an autosampler (see Section 5.3.1)
- Loading samples with a syringe through the sample loading ports on the DC front door (see Section 5.3.2)

5.3.1 Loading Samples with an Autosampler

1. Verify that the autosampler output line is connected to the sample port on the DC injection valve. Direct the waste line as required for this autosampler model.
2. Prepare and fill the sample vials (or well plates) and place them in the autosampler tray or carousel. Refer to the autosampler manual for detailed instructions.
3. Create a sequence in Chromeleon that specifies the vials or well plates from which to take sample injections and the order in which the injections should be run.
4. Specify a Chromeleon instrument method that includes the appropriate load and inject commands for the autosampler. For examples, see Section 5.4.

5.3.2 Loading Samples with a Syringe

This section describes two methods for using a syringe to load sample into the DC injection valve sample loop:

- Loading sample with a syringe through the sample loading port on the front of the DC (push method)
- Loading sample with a vacuum syringe through the sample loading port on the front of the DC (pull method)

Loading Samples with a Syringe (Push Method)

1. Verify that a luer adapter fitting is installed on the sample loading port on the front of the DC and that tubing is connecting the sample loading port to the sample port on the injection valve. If not, see Section 10.18 for connection instructions.
2. Fill a syringe with a calibration standard or sample.
3. Insert the syringe into the sample loading port on the front of the DC.
4. Verify that the injection valve is in the Load position. If it is not, switch the valve by clicking the valve control on the Chromeleon ePanel Set or by pressing the **VALVE** button on the front of the DC.
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. This prevents the sample from exiting the loop before injection.
7. Switch the injection valve to the Inject position.

5.3.3 Loading Samples with a Vacuum Syringe (Pull Method)

1. Verify that a luer adapter fitting is installed on the sample loading port on the front of the DC and that tubing is connecting the sample loading port and the injection valve. If this is not the case, see Section 10.18 for connection instructions.
2. Disconnect the waste line from the injection valve and replace it with a 25 to 30 cm (10 to 12 in) piece of PEEK or PTFE (polytetrafluoroethylene) tubing (see Figure 5-2).

3. Place the free end of the line into the sample.
4. Verify that the injection valve is in the Load position. If it is not, switch the valve by clicking the valve control on the Chromeleon ePanel Set or by pressing the **VALVE** button on the front of the DC.
5. Insert a 5 cc syringe into the sample loading port on the DC front door (see Figure 5-2) and pull out the plunger to draw the sample into the injection valve.
6. Switch the injection valve to the Inject position.

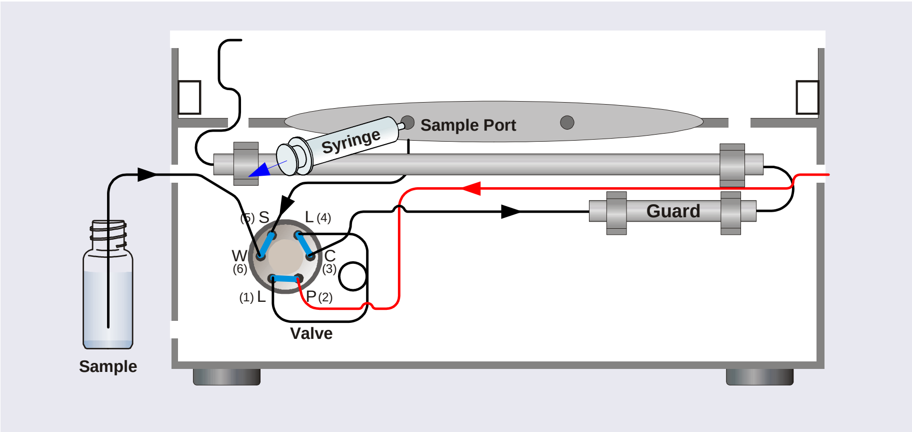


Figure 5-2. *Loading Sample with a Vacuum Syringe (Pull Method)*

5.4 Autosampler Commands for Loading and Injecting Samples

Commands for loading and injecting a sample using an autosampler are included in a Chromeleon instrument method. When you create an instrument method with the Chromeleon wizard, the specific autosampler commands required for your model of autosampler and the type of injection to be performed are added automatically.

An Inject command to switch the injection valve to the Inject position is always included. The Inject command occurs at time 0.00. This is when the sample enters the high-pressure side of the system and defines the beginning of a chromatogram. Wait commands to pause the instrument method while the autosampler is performing the injection are also included.

For the Dionex AS-DV, a Load command is required to switch the injection valve to the Load position. A separate Load command is not needed for the Dionex AS-AP.

Figure 5-3 shows the basic Chromeleon commands for controlling sample injection with a Dionex AS-AP.

	Time	Command	Value
59		DP.Pump_2.Curve	5
60		EDet1.CellControl	Off
61		EDet1.DC_Voltage	0 [V]
62	0.000	Inject	
63		Wait	Sampler.CycleTimeState, Hold
64		Wait	Sampler.Ready, Hold, Timeout
65		Sampler.Inject	
66	0.000	Start Run	
67		DP.Pump_1.Pump_1_Pressure.AcqOn	
68		DP.Pump_2.Pump_2_Pressure.AcqOn	

Figure 5-3. *Commands for Loading and Injecting a Sample with a Dionex AS-AP*

Figure 5-4 shows the basic Chromeleon commands for controlling sample injection with a Dionex AS-DV.

	Time	Command	Value
17		Pump_1.Flow	0.000
18		Sampler.LoadPosition	
19		Sampler.DeliverSample	
20		Sampler.EndSamplePrep	
21		Pump_1.%B.Value	0.0
22		Pump_1.%C.Value	0.0
23		Pump_1.%D.Value	0.0
24		Pump_1.Curve	5
25	0.000	Inject	
26		Wait	Sampler.CycleTimeState, Hold, Time
27		Sampler.Inject	
28	0.000	Start Run	

Figure 5-4. *Commands for Loading and Injecting Sample with a Dionex AS-DV*

For details about controlling an autosampler, refer to the operator's manual for your autosampler.

5.5 Setting Up Consumable Tracking

Trackable consumables are capable of wired or RFID-enabled communication with Chromeleon. This section presents an overview of how to manage trackable consumables installed in the Dionex ICS-6000. For more information, refer to Section 1.1.3 and the Chromeleon Help.

NOTE In order to track RFID-enabled devices, the Dionex Consumable Device Monitor (P/N 22181-60031) must be installed in the DC and then configured in the Dionex ICS-6000 instrument in the Chromeleon Instrument Configuration Manager.

5.5.1 Inspecting RFID Tags

RFID tag location and orientation are critical to ensuring reliable communication. Before performing an RFID read or write operation, check each installed consumable to verify that the following criteria are met:

- Columns should be installed in column clips. RFID tags should not touch the clips.
- RFID tags should be free in the air (for example, a tag must not be wrapped around a separator or guard column).
- RFID tags should be spaced far enough apart that the tags do not overlap.
- RFID tags should not touch bare metal.
- RFID tags should not be in direct contact with the floor, ceiling, sides, or front door of the DC.
- RFID tags should be parallel to the floor of the DC.
- RFID tags can extend toward the front or rear of the DC.

The following illustrations depict the correct installation of RFID tags.

In Figure 5-5, RFID tags are parallel to the floor of the DC, and point to both the front and rear of the module.

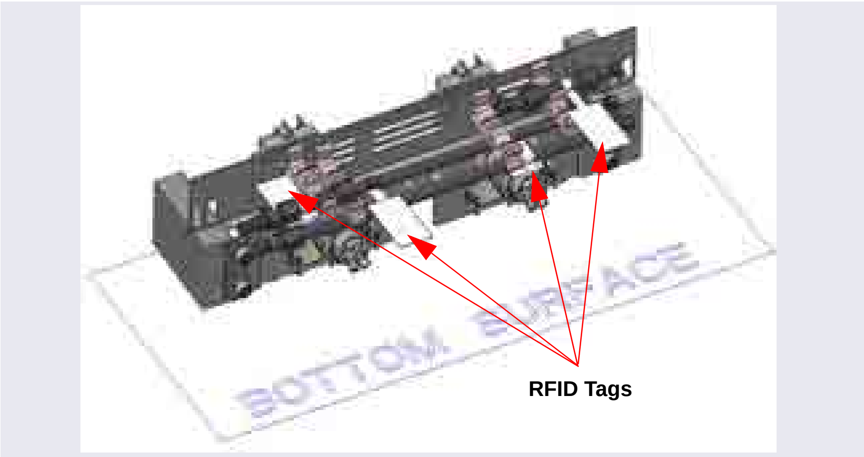


Figure 5-5. *RFID Tags Parallel to the DC Floor*

Figure 5-6 is a close-up view of RFID tags attached to columns. Tags can be rotated underneath the columns (to ensure that the tags do not touch the ceiling of the DC) and extend toward the valve panel at the rear of the module.

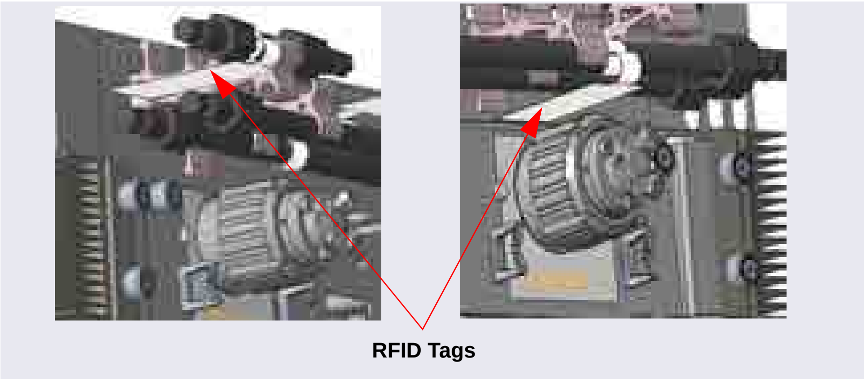


Figure 5-6. *RFID Tags Attached to Underside of Columns*

5.5.2 Scanning Consumables

1. In the Chromeleon Console, click the **Instruments** Category Bar.
2. On the Navigation Pane, click the name of the Dionex ICS-6000 instrument.
3. On the Instrument toolbar above the ePanel Set, click **Consumables**.

NOTE The Consumables button is not enabled until the Dionex Consumable Device Monitor is configured in the instrument.

4. Click **Inventory**. The Consumables Inventory window appears (see Figure 5-7).

Figure 5-7. *Consumables Inventory Window*

5. Click the **Rescan** button near the bottom of the inventory window. It may take up to 3 minutes for Chromeleon to scan all consumables. During this time, you may close the inventory window and perform other tasks in Chromeleon.

NOTE The names of any previously detected consumables may temporarily turn red while scanning is in progress. This does not indicate a problem.

6. When all trackable consumables have been scanned, check the results in the Consumables Inventory window:
   - Verify that all installed consumables are listed in the inventory window.
   - If a previously installed and detected consumable was not detected, its name is shown in red. Adjust the location and

orientation of the RFID tag attached to the consumable as necessary (see Section 9.29), and then click **Rescan** again.

7. For each consumable to be tracked, click the corresponding **Tracked** check box in the Consumables Inventory window.
   - A lock icon in the **Tracked** check box indicates that the consumable is currently assigned to another instrument (second flow path) and cannot be selected.
   - Consumables that use wired communication (including EGCs and suppressors) are automatically connected and do not need to be selected.
8. Accept the default information in the Groups column, unless more than one flow path or channel is configured in the same Chromeleon instrument (as with simultaneous and column switching applications). In that case, you must create two consumable groups (see Section 5.5.3).
9. Click **Thermal Assoc.** The Consumable Properties dialog box appears.
   a. Select the temperature zone in which the consumable is installed: **Compartment_TC** (DC upper compartment) or **Column_TC** (DC lower compartment).
   b. Click **OK** to close the dialog box and return to the inventory window.
10. If a CD is configured in the instrument, the CD_Total channel is monitored for detector background signal. Select either **CD1** or **CD2**.
11. When you finish selecting options, click **Approve**.
12. If this is a dual system, repeat the steps above for the second instrument or channel.

5.5.3 Creating a Consumable Group

Introduction

- A consumable group consists of a pump, detector (CD only), and any valves (and valve positions) used for column switching or flow path switching applications.
- Consumable groups are required for simultaneous systems (two pumps and flow paths) in a single instrument or for column switching or flow path switching applications, where valve position determines which

consumables are used. The consumable group determines when a particular set of consumables (flow path) is active.

- The consumables group definition is instrument-based. Thus, if two flow paths are created in a single Chromeleon instrument (as with simultaneous or column switching systems), two consumable groups must be created.
- Do not add autosampler diverter valves or valves used for sample injection to a consumable group.
- It is not necessary to create a consumable group for standard single systems (one flow path) or dual systems. Accept the default information in the Consumables Inventory window.

To create a consumable group

1. Click the **Groups** button near the bottom of the Consumables Inventory window. The Consumable Groups window appears (see Figure 5-8).

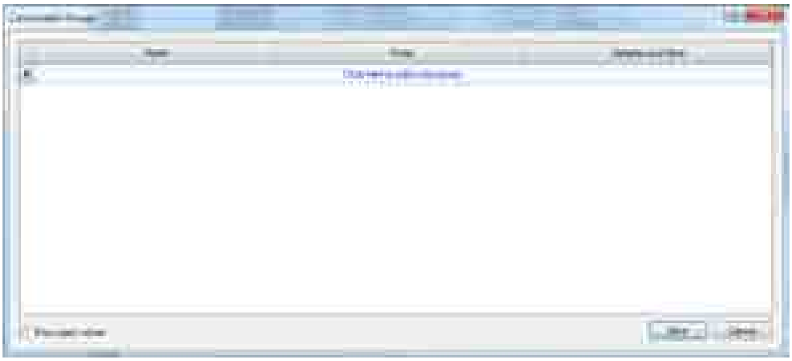


Figure 5-8. *Consumable Groups Window*

2. Click the row with the **“Click here to add a new group”** label.
3. Chromeleon uses the instrument name as the default consumable group name. Accept the default, or type a new name in the **Name** cell.
4. Select the pump for the specified instrument. If only one pump is configured in the instrument, the default pump name is Pump_1. In simultaneous configurations, the pumps determine the group and no valves are added to the group definition.

5. Select the appropriate valves and valve positions:
   - To include a valve in the consumable group, click the down arrow in the corresponding cell and select the valve.
   - If a valve normally used as an injection valve is being used as an auxiliary valve or a diverter valve in the instrument, select the **Show inject valves** check box. A column for each valve will be added to the dialog box.
6. Create a second group for any consumables connected to the second valve position, or for simultaneous configurations for any consumables connected to the second pump.

   Figure 5-9 is an example of a simple column switching application (controlled by one auxiliary valve or switching valve) which requires two groups, one for each valve position.

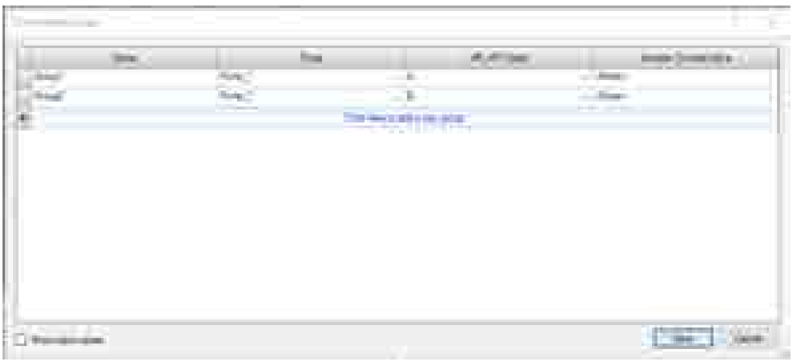


Figure 5-9. *Example Consumable Group: Column Switching Application (Automation Manager HP1 Valve Switches the Flow Path)*

7. Click **Save** to close the Consumable Groups window and return to the Consumables Inventory window.

8. In the Consumables Inventory window, assign consumables to each new group.

   Figure 5-10 is an example of how the inventory window might look if you assign consumables to multiple groups in the same Chromeleon instrument.

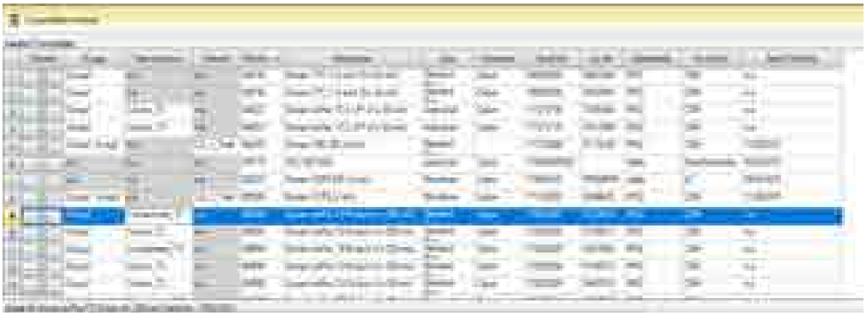


Figure 5-10. *Consumables Assigned to Two Consumable Groups in the Same Instrument*

5.5.4 Preparing to Remove and Store a Consumable

If you plan to remove a trackable consumable from the system and place it in storage, follow the steps below to first save all tracked information to the RFID tag attached to the consumable.

1. In the Consumables Inventory window, click **Store**.
2. Check the Chromeleon audit trail for an RFID-related error. If an error occurred during the write operation, adjust the location and orientation of the RFID tag as necessary (see Section 9.29), and then click **Store** again.

6 • ICS-6000 App Operation

This chapter describes the features of the ICS-6000 App when installed on the optional tablet.

6.1 Overview of ICS-6000 App Operation

The ICS-6000 App provides direct control of most Dionex ICS-6000 operating functions. When you select an operating command or parameter from the app, the command or parameter is executed immediately.

The Home page (see Figure 6-1) provides controls for the most commonly used operating functions. Use the Home page to view status information and enter basic operating parameters for your system. From the Home page, you can also access detailed pages for the various system devices (pump, valves, detector, and so on).

Figure 6-1. *Home Page Example*

NOTE If you temporarily connect your tablet to a wireless access point that includes a Dionex ICS-6000 other than the one required, be sure to remove or "forget" the profile for the alternate access point (on the **Settings** > **Wi-Fi** menu for the tablet) when you are finished. Otherwise, the required Dionex ICS-6000 will not be able to auto-connect to the correct access point.

6.1.1 Device Selection Bar

Each row on the Home page provides controls for monitoring and controlling a system device (pump, valve, detector, and so on). The column of buttons on the left side (see Figure 6-2) provides access to additional controls for each device. Tap a button to go to a device detail page. For example, tap the **PUMP** button to access additional pump controls.

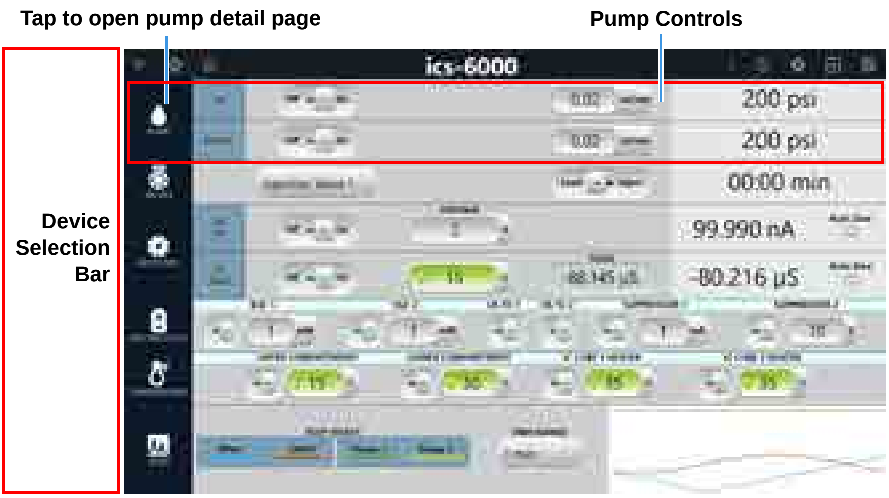


Figure 6-2. *Device Selection Controls on the Home Page*

6.1.2 Quick Access Toolbar

A quick access toolbar is available at the top of each ICS-6000 App page. The toolbar provides the features and functions described in Figure 6-3.

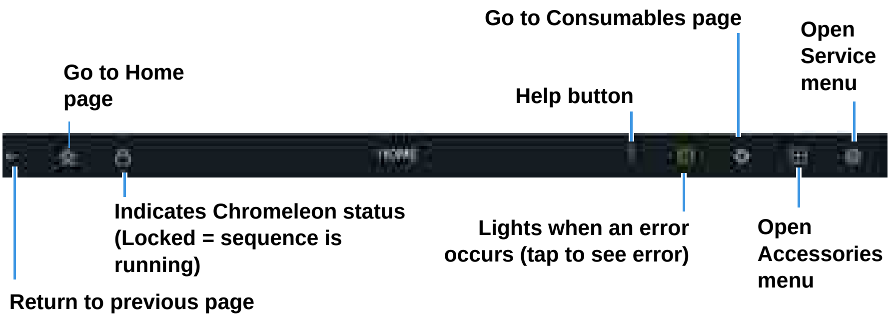


Figure 6-3. *Quick Access Toolbar Features*

Error Message List

If a problem occurs during operation of the Dionex ICS-6000, a message is displayed in the ICS-6000 App, as well as in the Chromeleon audit trail. In the app, the warning icon lights when an error message is logged. Tap the icon to see the error. You can view error messages in a list (see Figure 6-4) or one at a time. The list view displays the 100 most recent messages (more than 100 messages can be stored in memory).

Figure 6-4. *Error Messages: List View*

New error messages generated by Chromeleon are displayed for 10 seconds; new messages generated by the ICS-6000 App are displayed for 1 minute.

- To dismiss a message, tap the body of the message.

- To permanently remove a single message, tap the red "X" displayed at the end of the message.
- To permanently remove all messages, tap **Clear All** in the lower-right corner of the screen.

NOTE Removing a message from the ICS-6000 App does not remove the message from the Chromeleon audit trail.

NOTE Messages that instruct you to reboot the ICS-6000 App (for example, "Instrument configuration was changed on IPC and mobile app needs to be restarted") do not disappear automatically, cannot be dismissed, and are not displayed in the messages list.

For troubleshooting guidance for an error message, see Chapter 9.

6.1.3 Using the ICS-6000 App with Chromeleon

When the Dionex ICS-6000 is connected to Chromeleon and a sequence is not running, you can use either Chromeleon or the ICS-6000 App to change operational settings such as flow rate, eluent concentration, or suppressor current.

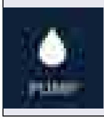
- When ICS-6000 App operation is enabled, the quick access toolbar displays an open white Lock icon.
- When the instrument is currently processing commands, the quick access toolbar displays a closed yellow Lock icon. To stop the current activity, enter a command in the app.
- When a Chromeleon sequence is running (indicated by a closed red Lock icon), ICS-6000 App operation is disabled. During a sequence run, system status information is updated in the app. However, if you attempt to change an operational setting from the app, a message warns that you are about to interrupt a running sequence. You can then choose to stop the running sequence or wait until the sequence is finished.

Help Button

The  icon opens the Help page, which provides access to the IC Knowledgebase (an interactive troubleshooting guide) and installation instructions for consumables.

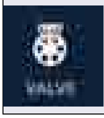
6.1.4  Home Page Details

Home Page Pump Controls

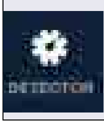
Control	Description
OFF/ON button	Toggles the flow off and on.
mL/min (or **mL/min**) button	Indicates/sets the flow rate. Tap the value to change the setting. The selected unit is highlighted in blue. Tap a unit to select it. This sets the flow rate unit for all ICS-6000 App pages that display flow rates.
pressure value	Indicates the current system pressure in psi, bar, or MPa.
	Tap the button to select different flow and pressure units and to monitor and control other pump functions (see Section 6.1.5).

Home Page Valve Controls

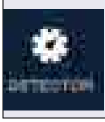
Control	Description
OFF/ON button	Toggles the flow off and on.
Valve name button	Indicates the currently selected valve (**INJECT VALVE**, **HP1 VALVE**, **LP1 VALVE**, or **LP2 VALVE)**. To select a different valve, tap the down arrow.
Time value (min)	Indicates the elapsed time from when the valve position was last changed.

Control	Description
	Tap the button to monitor and control all installed valves from one page (see Section 6.1.6).

Home Page Detector CD Controls

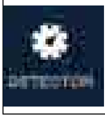
Control	Description
OFF/ON button	Toggles the CD cell heater off and on. The slider position and background color indicate the status (left/black = off; right/green = on). When you turn on the cell, the selected waveform starts running.
°C entry field	Control combines temperature setting and temperature status. Indicates the heater status. The background color indicates the status (green = temperature at setpoint; amber = temperature above or below setpoint).
TOTAL μS value	Indicates the total conductivity (without a background offset).
μS value	Indicates the offset reading (total conductivity minus background conductivity). To determine the background offset, allow the system to equilibrate after startup. At equilibration, the detector reading is the background signal of the eluent before sample injection. Tap the **AUTOZERO**  button to set the reading to zero.
VOLTAGE entry field	Indicates/sets the voltage setpoint. Tap the value to change the setpoint.
	Tap the button to control the cell heater, enter a rise time, or enter a temperature compensation factor (see Section 6.1.7).

Home Page Detector ED Controls (Integrated Amperometry Mode)

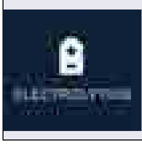
Control	Description
OFF/ON button	Toggles the ED cell heater off and on. The slider position and background color indicate the status (left/black = off; right/green = on). When you turn on the cell, the selected waveform starts running.
VOLTAGE entry field	Indicates/sets the voltage setpoint. Tap the value to change the setpoint.
pH value	Indicates the pH reading of the pH-Ag/AgCl reference electrode.
Electrode Reference button	Indicates/selects the reference electrode mode. The currently selected mode is highlighted in blue.
nC/nA value	Indicates the offset current reading (total current minus background current). To determine the background offset, allow the system to equilibrate after startup. At equilibration, the detector reading is the background signal of the eluent before sample injection. Tap the **AUTOZERO**  button to set the reading to zero.
	Tap the button to monitor the total current reading, select the waveform, or change the detector mode (see Section 6.1.7).

Home Page ED Controls (DC Mode)

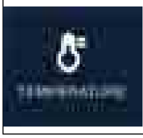
Control	Description
OFF/ON button	Toggles the ED cell power off and on. The slider position and background color indicate the status (left/black = off; right/green = on). When you turn on the cell, the selected waveform starts running.
pH value	Indicates the pH reading of the pH-Ag/AgCl reference electrode.
VOLTAGE button	Indicates/sets the voltage setpoint. Tap the value to change the setpoint.

Control	Description
nC value	Indicates the offset current reading (total current minus background current). To determine the background offset, allow the system to equilibrate after startup. At equilibration, the detector reading is the background signal of the eluent before sample injection. Tap the **AUTOZERO**  button to set the reading to zero.
	Tap the button to monitor the total current reading or change the detector mode (see Section 6.1.7).

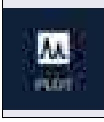
Home Page Electrolytics Controls (EGC, CR-TC 600, Suppressor, Dual Mode EGC)

Control	Description
OFF/ON button	Toggles the power to the electrolytic device. The slider position and background color indicate the status (left/black = off; right/green = on).
EGC mM, CR-TC V, SUPPRESSOR mA buttons	Indicates/sets the device setpoint (EGC eluent concentration, Dionex CR-TC 600 voltage, suppressor current). Tap the value to change a setpoint.
KMSA, MSA, KOH entry field	Indicates/sets the acidic or basic polarity. Tap the value to change the setpoint.
	Tap the button to view details about the EGC and to set the suppressor type and format (see (see Section 6.1.8)).

Home Page Temperature Controls (Compartment, Column, CD Cell)

Control	Description
OFF/ON button	Toggles the device power off and on. The slider position and background color indicate the status (left/black = off; right/green = on).
°C button	Indicates/sets the temperature setpoint of the device. To change a setpoint, tap the value.
	Tap the button to monitor the current temperature of the device (see Section 6.1.9).

Home Page Plot Controls

Control	Description
PLOT SELECT button	Indicates/selects the signal currently being plotted. A selected signal is highlighted in blue. Tap a signal name to select it. A detector signal and the pressure signal can be plotted simultaneously.
TIME button	Controls the length of time shown on the plot. Tap the button to select a different duration.
plot display	Displays a thumbnail view of the current plot.
	Tap the button to view the plot on a full page and select additional parameters (see Section 6.1.10).

6.1.5 Pump Page

Use the Pump page to set pump-related parameters that are not accessible on the Home page and to control optional pump accessories.

Pump Controls

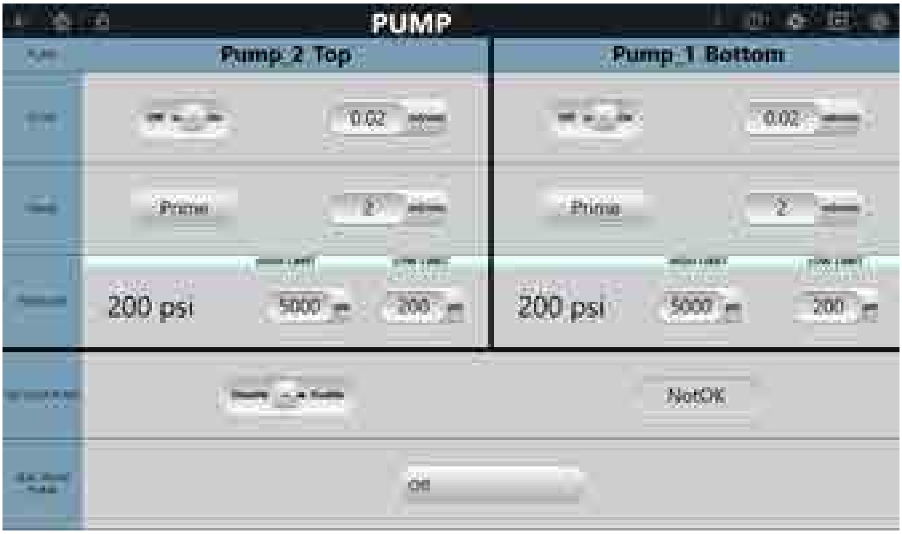


Figure 6-5. *Pump Page*

Flow Controls

Control	Description
OFF/ON button	Toggles the pump off and on. The slider position and background color indicate the status (left/black = off; right/green = on).
flow rate button **mL/min** (or **mL/min**)	Indicates/sets the flow rate. Tap the value to change the setting. The selected unit is highlighted in blue. Tap a unit to select it. This sets the flow rate unit for all ICS-6000 App pages that display flow rates.

Prime Controls

Control	Description
OFF/ON button	Toggles the priming function off and on. For detailed priming instructions, see Section 10.3.
flow rate button **mL/min** (or **mL/min**)	Indicates/sets the priming flow rate. Tap to open a numeric entry screen to set the flow rate.

Pressure

Control	Description
pressure value/unit selection button (**PSI**, **bar**, **MPa**)	Indicates the current system pressure in psi, bar, or MPa. The selected unit is highlighted in blue. Tap a unit to select it. This sets the pressure unit for all ICS-6000 App pages that display pressure values.
HIGH LIMIT/LOW LIMIT buttons	Indicate/define the allowed pressure range for system operation. • To set a high and low limit, tap the respective numeric values. The high limit must be at least 0.34 MPa (50 psi) above the low limit. • The first time the Dionex ICS-6000 power is turned on, the maximum system pressure limit is 41 MPa (6000 psi) and the minimum pressure limit is 0. The eluent generator requires a maximum high limit of 35 MPa (5000 psi) and a minimum low limit of 1.4 MPa (200 psi).

Vacuum Pump

Control	Description
DISABLE/ENABLE button	Toggles the vacuum pump between disabled (always off) and enabled (always on).
VACUUM OK (or **VACUUM NOT OK**)	Indicates the status of the vacuum. If the vacuum is not okay, see the troubleshooting information in Section 9.17.

Seal Wash Pump

Control	Description
INTERVAL (ON) button	Indicates/determines whether the pump is off, automatic, or will run in intervals. Tap to select the setting.

6.1.6  Valve Page

Use the Valve page to monitor and control each valve installed in the system. The page shows only the valves installed in the system.

Figure 6-6. *Valves Page for a System with Four Valves.*

Valve Controls

Control	Description
INJECT VALVE slider	Indicates the current status of each installed valve. To change the status, tap the button. The slider position and background color indicate the status (left/black = load; right/green = inject).
IC CUBE slider	Indicates the current status of each valve installed in the IC Cube. To change the status, tap the button. The slider position and background color indicate the status (left/black = load; right/green = inject).
TIME value (min)	• High-pressure valves: Indicates the elapsed time since the last injection. • Low-pressure valves: Indicates the elapsed time since the last valve position change.
A/B slider	Indicates the active valve.
CLOSED/OPEN slider	Indicates the active valve. To change the status, tap the button. The slider position and background color indicate the status (left/black = closed; right/green = open).

6.1.7 Detector Page

Use the Detector page to monitor and control the detector. The page display varies, depending on the number and type of detectors installed.

CD Detector

Figure 6-7. *CD Detector Page: CD Heater On*

CD Detector Controls

Control	Description
CONDUCTIVITY reading	Indicates the offset reading (total current minus background current). To determine the background offset, allow the system to equilibrate after startup. At equilibration, the detector reading is the background signal of the eluent before sample injection. Tap the **AUTOZERO** button to set the reading to zero.
TOTAL CONDUCTIVITY reading	Indicates the total conductivity (without a background offset).
RISE TIME button	Indicates/sets the rise time setting. Tap the value to change the setting. For details, see Section 6.1.7.
TEMPERATURE COMPENSATION button	Indicates/sets the temperature compensation setting. Tap the value to change the setting. The CD has built-in temperature compensation that helps minimize changes in the baseline or in peak heights if the operating temperature is different from the temperature at which the cell was calibrated. The default temperature compensation is 1.7% per °C. This can be reset to between 0% and 3.0% per °C, depending on the eluent. If you notice that the baseline shifts up when the temperature increases, the temperature compensation is too low and should be reset to a higher value.
CELL HEATER set	Indicates/sets the cell heater temperature. The background color indicates the status (black = off; yellow = not at setpoint; green = at setpoint). Tap a value to change the setpoint.
OFF/ON button	Toggles the cell heater power off and on. The slider position and background color indicate the status (left/black = off; right/green = on).
CELL HEATER reading	Indicates the current cell heater temperature.

ED Detector.

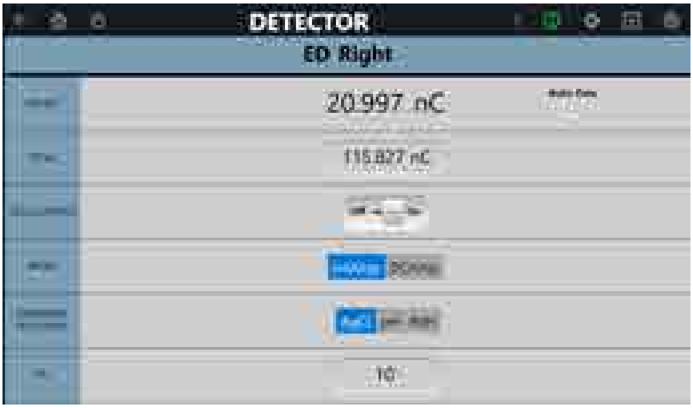


Figure 6-8. ED Detector Page Mode: Reference Settings

Figure 6-9. ED Detector Page: Integrated Amperometry Mode, PdH Reference Electrode

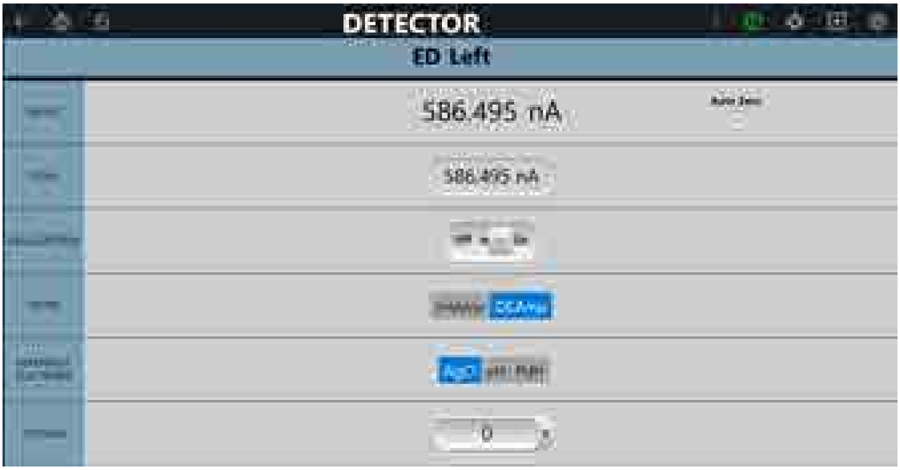


Figure 6-10. *ED Detector Page: DC Amperometry Mode, AgCl Reference Electrode*

ED Detector Controls

Control	Description
OFFSET reading	Indicates the offset reading (total current minus background current). To determine the background offset, allow the system to equilibrate after startup. At equilibration, the detector reading is the background signal of the eluent before sample injection. Tap the **AUTOZERO**  button to set the reading to zero.
TOTAL reading	Indicates the total current (NO background offset).
CELL CONTROL slider	Toggles the cell power off and on. • For integrated amperometry: When you turn on the cell, the selected waveform starts running. • For DC amperometry: When you turn on the cell, the selected voltage is applied constantly to the working electrode.

<table>
<tr><th>Control</th><th>Description</th></tr>
<tr><td>MODE setting</td><td>Indicates the current detector mode (integrated amperometry or DC amperometry). The selected mode (Int Amp or DC Amp) is highlighted in blue. Tap the mode name to change the mode locally.
Mode = Int Amp, reference electrode = AgCl or pH, show PH value.
Mode = Int Amp, reference electrode = PdH, show electrode power control.
Mode = DC Amp, reference electrode = AgCl or pH, show DC voltage.
Mode = DC Amp, reference electrode = PdH, show DC voltage and electrode power control.</td></tr>
<tr><td>REFERENCE ELECTRODE setting</td><td>Indicates the currently selected reference electrode mode (highlighted in blue). Tap a mode to select it.
Two reference electrode types are available for the ED:
Combination pH-Ag/AgCl reference electrode (mode = AgCl or pH).
Palladium hydrogen (PdH) reference electrode (mode = PdH).</td></tr>
<tr><td>pH VALUE reading</td><td>Indicates the reported ED pH value.</td></tr>
<tr><td>ELECTRODE CONTROL button</td><td>Toggles the PdH power off and on. The slider position and background color indicate the status (left/black = off; right/green = on). When you turn on the cell, the selected waveform starts running.</td></tr>
<tr><td>WAVEFORM SELECTION drop-down list</td><td>Indicates the selected waveform, which is downloaded from Chromeleon.</td></tr>
<tr><td>VOLTAGE setting</td><td>(DC amperometry mode only)
Indicates/sets the voltage setpoint. When the cell power is on, this voltage is applied constantly to the working electrode. Tap the button to change the setpoint.</td></tr>
</table>

CD and ED Detector

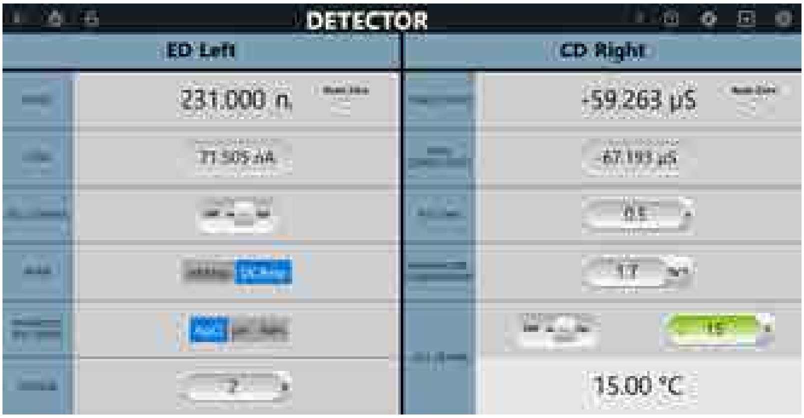


Figure 6-11. *Detector Page: ED and CD Installed*

Data Rise Time

The data rise time determines the amount of filtering performed on the CD. 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 screen, and the analog data output. The default rise time is 2 seconds.

Selection of 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:

- The peak shape will become asymmetric.
- The peak maximum will be shifted.
- The peak height will be reduced.

The rise time should be approximately 25% of the peak width at one-half the height of the narrowest peak of interest. For example, for a peak width of 5 seconds, calculate the rise time as: (5 sec) 25% = 1.25 sec. Because 1.25 sec is not an available setting for rise time, select the next fastest rise time, 1 sec.

6.1.8 Electrolytics Page

Use the Electrolytics page to monitor and control each electrolytic device installed in the system. Only the electrolytic devices currently installed are displayed on the page. The total number of electrolytic devices that can be installed is determined by the installed power supply option. The control arrangement is: (left) top pump channel, (right) bottom pump channel, and (lower rows) modules not connected to a pump.

Electrolytics for Multi Cartridge EGC

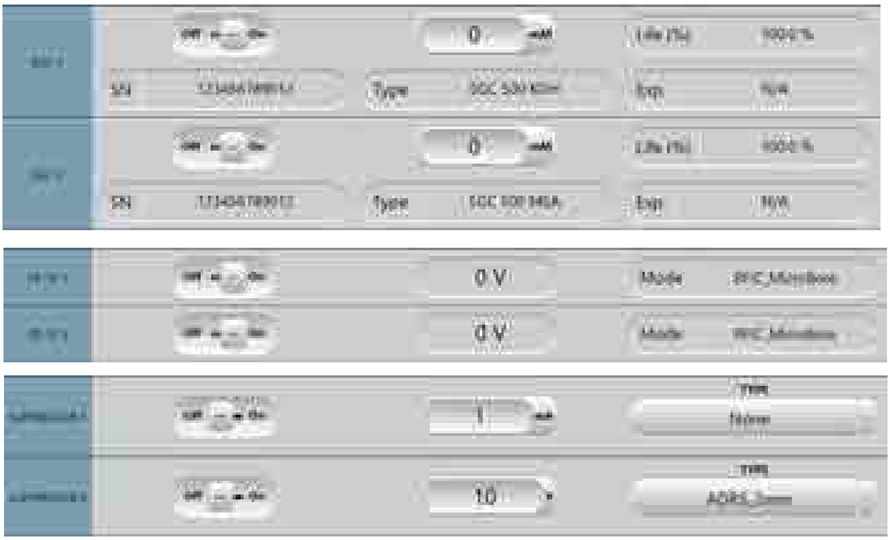


Figure 6-12. *Electrolytics Page: Multi Cartridge Mode*

Multi Cartridge EGC Controls

Control	Description
OFF/ON button	Toggles the Dionex EGC off and on. The slider position and background color indicate the status (left/black = off; right/green = on). When you turn on the power, the Dionex EGC begins generating eluent at the currently selected concentration setting. **Note** The Dionex EGC power is always turned off when the pump flow is off.
CONCENTRATION SETPOINT selector	Indicates/sets the eluent concentration. Tap the value to change the setpoint. To determine the eluent concentration required for your application, refer to the column manual.
LIFE reading	Displays the percentage of the remaining ion capacity in the Dionex EGC. (The remaining life is also displayed on the Consumables page.)
SERIAL NUMBER reading	Displays the serial number of the installed Dionex EGC.
TYPE reading	Displays the type of Dionex EGC installed.
EXPIRATION reading	Displays the expiration date of the installed Dionex EGC. The date is 2 years from the date of manufacture. Although you can continue operation with the cartridge after this date, performance may be impaired until a new cartridge is installed.

Multi Cartridge CR-TC 1, CR-TC 2 Controls

Control	Description
OFF/ON button	Toggles CR-TC off and on. The slider position and background color indicate the status (left/black = off; right/green = on).
VOLTAGE reading	Indicates the current CR-TC drive voltage.
MODE reading	Indicates the current CR-TC mode.

Multi Cartridge Suppressor Controls

Control	Description
OFF/ON toggle	Toggles the suppressor off and on. The slider position and background color indicate the status (left/black = off; right/green = on).
CURRENT/VOLTAGE selector Suppressor 1/ Suppressor 2	Indicates/sets the current (for the Legacy power mode) or voltage (for the Dynamic power mode). To change the setpoint, tap the value. **Note** The Dionex DRS is the only suppressor capable of operation in the Dynamic power mode. For more information, refer to the suppressor manual.
TYPE setting Suppressor 1/ Suppressor 2	Indicates the current mode. When a type can be selected, a drop-down menu is available.

Suppressor Controls

Control	Description
OFF/ON button	Toggles the suppressor power off and on. The slider position and background color indicate the status (left/black = off; right/green = on). The suppressor power is always turned off when the pump flow is off.
mA button	Indicates/sets the suppressor current (for the Legacy power mode) or voltage (for the Dynamic power mode). To change the setpoint, tap the value. The appropriate setting depends on the suppressor type, the column, and other variables. Refer to the suppressor manual for the recommended setting for your application.
TYPE	Displays the type of installed suppressor.
FORMAT	Displays the format of the installed suppressor.

6.1.9 Temperature Page

Use the Temperature page to monitor and set most temperature-controlled devices installed in the system. Only the devices currently installed in the system are displayed on the page.

Figure 6-13. *Temperature Page*

Compartment, Column, IC Cell Controls

Control	Description
OFF/ON button	Toggles the compartment heater off and on. The slider position and background color indicate the status (left/black = off; right/green = on).
°C button	Indicates/sets the temperature setpoint of the compartment heater. • A yellow exclamation point on the button indicates that the current temperature is either above or below the setpoint. • A green check mark on the button indicates that the current temperature is at the setpoint.
°C value field	Displays the current temperature of the device.

6.1.10  Plot Page

Use the Plot page to view the most recent detector and pump pressure data in graphical form. Up to 60 minutes of collected data can be displayed on the plot. Data older than 60 minutes is not saved, and is unavailable for plotting. Data points are collected continuously.

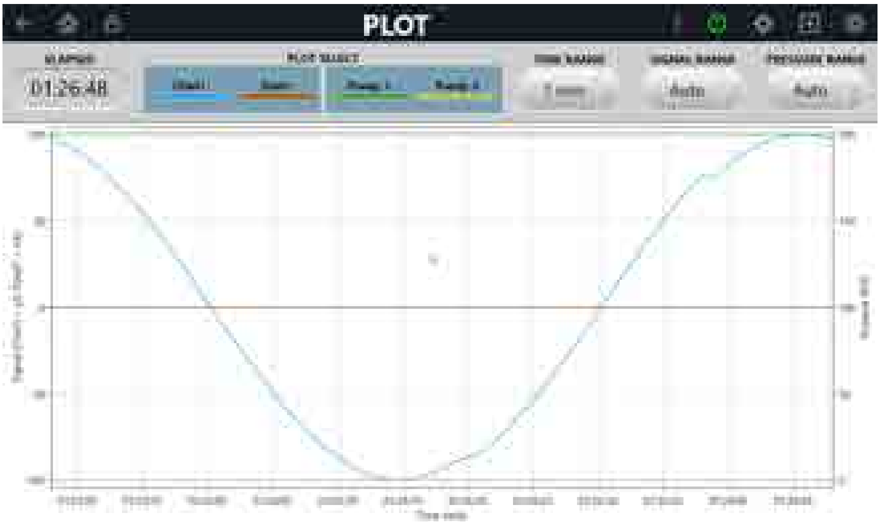


Figure 6-14. *Plot Page*

Plot Controls

Control	Description
ELAPSED reading	Displays the elapsed time (in minutes) since data acquisition either started or stopped.
PLOT SELECT buttons	Indicates the signals currently selected for plotting. Selected signals are highlighted in blue. Up to four signals can be plotted. The back-down color shows the plot selections (button down = blue; button up =gray). The first detector signal selected is plotted on the primary (left) axis. Detector 1, light blue; Detector 2, brown; Pump 1, dark green; Pump 2, light green. The pump pressure signal is always plotted on the secondary axis.
TIME RANGE value	Indicates/sets the length of time displayed on the plot (the horizontal axis scale). Tap the button to select a different number of minutes.
SIGNAL RANGE value	Indicates/sets the highest detector reading displayed on each signal axis (the scale of each vertical axis). Tap the button to select a different signal range for an axis. If the tops of peaks are cut off, select a higher range. If peaks are short, select a lower range. To have the scaling of the signal plot automatically adjust to the height of the signal, select **AUTO**. The range for the pressure signal is always **AUTO**.
PRESSURE RANGE value	Indicates/sets the right scale of the plot. Tap the button to select a different signal range. If the tops of peaks are cut off, select a higher range. If peaks are short, select a lower range. To have the scaling of the signal plot automatically adjust to the height of the signal, select **AUTO**. The range for the pressure signal is always **AUTO**.

6.1.11 TTL/Relay Accessory Page

The TTL/Relay page displays the status of the TTL inputs, provides access to the TTL Input page, and provides control of TTL and relay outputs.

To open the TTL/Relay Accessory page

On the ICS-6000 App quick access toolbar, tap the Accessories icon, and then tap **TTL/Relay** on the menu.

Figure 6-15. *TTL/Relay Input Page*

TTL Input Controls

Control	Description
TTL 1 (2, 3, 4) INPUT STATUS	Indicates the voltage (0 V or 5 V) of each TTL input.

TTL Output Controls

Control	Description
TTL 1 (2) OUTPUT	Indicates/sets the TTL output status: **0 V** (on) or **5 V** (off). Tap the button to toggle the output. The TTL outputs are normally at **5** volts. Setting a TTL output to 0 volts turns on the function in the connected device.

Relay Output Controls

Control	Description
RELAY OUTPUT	Indicates/sets the relay output status (**CLOSE** or **OPEN)**. Tap the button to toggle the position. The slider position and background color indicate the status (left/black = off; right/green = on). The relay outputs can be connected to be either normally open or normally closed. For connection instructions, see Section 2.16 and Section 2.17.

6.1.12 Consumables Page

The Consumables page displays information about wired and RFID-enabled consumable devices detected by the system. From this page, you can also initiate a manual scan for RFID-enabled devices in the system, and enable or disable use of detected devices in the system.

The information is presented in a table that includes a row for each detected device and a column for each identification and usage parameter tracked by the system. You can scroll vertically and horizontally to see additional devices and parameters.

For details about the various parameters that are tracked, see Section 1.1.3. Note that not all parameters are available for all devices; if a parameter is not tracked for a particular device, **N/A** is displayed in the column.

When a consumable is tracked by a wired communication system rather than RFID, the **Rescan** check box for the consumable is always selected and you cannot initiate a manual scan. If you are unsure how a particular consumable is tracked, scroll to the right until the **Detected by** column is displayed.

To open the Consumables Page

On the ICS-6000 App quick access toolbar, tap the Consumables icon.

Figure 6-16. *Consumables Page Example*

To initiate a manual scan for RFID-enabled devices

Tap the **Rescan** button.

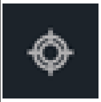
To disable use of a detected RFID-enabled device in the system

If the detected device is not installed in the system, clear the corresponding check box and tap the **Approve** button.

To remove an unused detected device from the list

Move the device at least 30 cm (2 ft) away from the system, and then tap the **Rescan** button. The device will no longer be detected.

Consumable Inventory Controls

Control	Description
PARTS display	Displays a read-only list with the part number, name, serial number, lot number, and “best if used by” date for each detected item.
RESCAN button	Checks for devices added without the automatic scan feature. The button allows a rescan to detect all nearby devices and repopulate the list.
	Tap the button to view the read-only pages with information about wired and RFID-enabled consumables. This page scrolls horizontally and vertically.

6.1.13 pH Calibration Page

You can calibrate the pH of the ED pH electrode from the mobile app.

To open the pH Calibration page

On the ICS-6000 App quick access toolbar, tap the icon and then tap **CALIBRATION** on the menu.

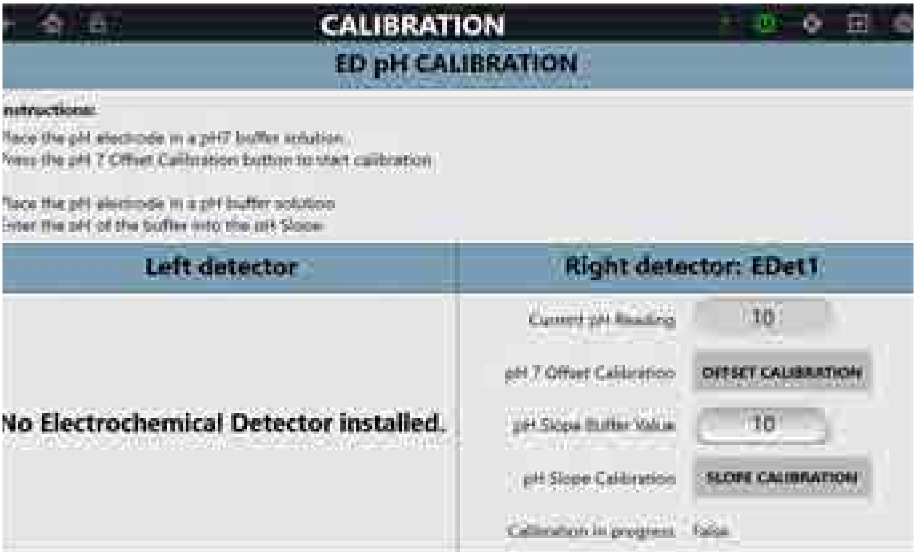


Figure 6-17. *ED pH Calibration Page*

Calibration Output Controls

Control	Description
pH value	Indicates the pH reading of the ED pH value (0V or 5V).
pH 7 value	Indicates the pH reading of the ED pH offset (0V or 5V).
pH SLOPE BUFFER control	Indicates/sets the relay output status (**CLOSE** or **OPEN**). Tap the button to set the buffer value.
START SLOPE value	Indicates the pH reading of the ED calibration pH slope (0V or 5V).

Control	Description
CALIBRATION status	Indicates whether a calibration is in progress (**TRUE** or **FALSE**).

6.1.14 Information

The Information page lists various details about the Dionex ICS-6000, including the system serial number, installed firmware version, and currently installed options. All information is read-only.

To open the Information page

On the ICS-6000 App quick access toolbar, tap the Service  icon and then tap **INFORMATION** on the menu.

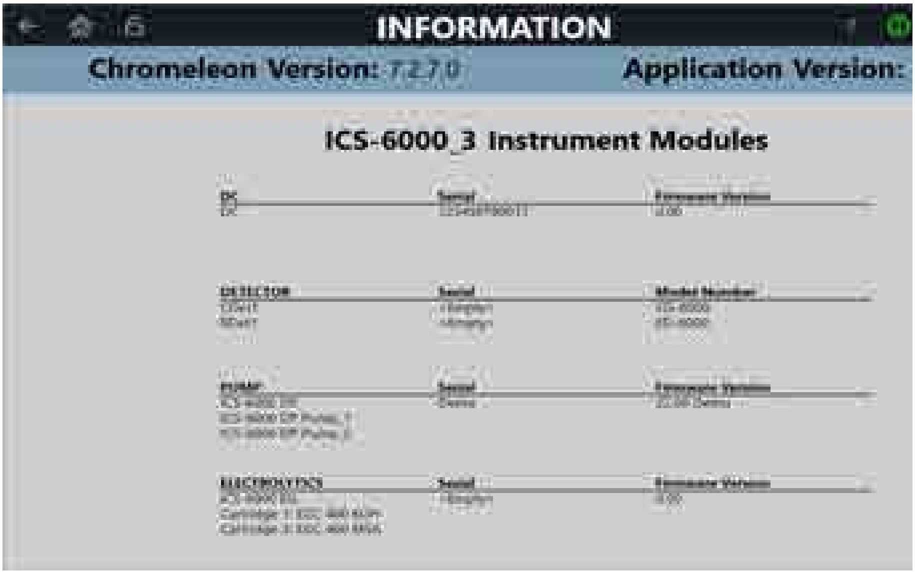


Figure 6-18. *Information Page*

ICS-6000 DP/SP DP/SP Shutdown

If the Dionex ICS-6000 Dual Pump (DP) or Dionex ICS-6000 Single Pump (SP) will not be operated for a period of one week or more, follow the instructions below:

- Fill the pump with methanol (or a similar alcohol, such as 2-propanol or ethanol). If the eluents in the pump are not miscible with water, replace the eluents step-by-step.
- Fill the seal wash reservoir with wash solution (see Section 2.2.5).
- Rinse out buffers. This will reduce the time required for column equilibration when you resume operation.
- Disconnect the tubing from the peristaltic pump on the component panel: lift the lever up and to the right, remove the tubing, and release the lever (see Figure 7-1).

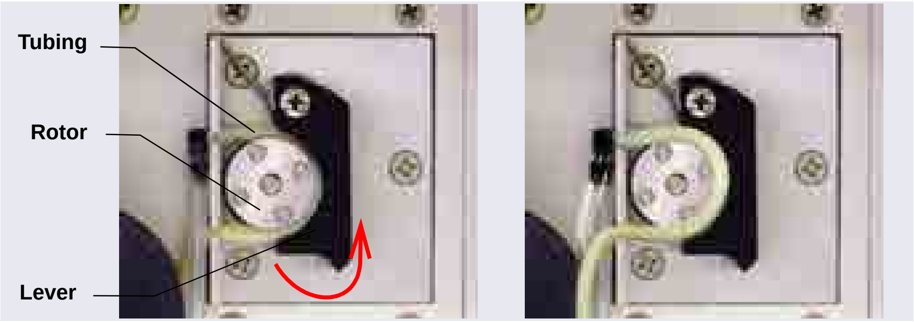


Figure 7-1. *Peristaltic Pump for Seal Wash System*

Before shipping the pump:

- Empty the seal wash reservoir.
- Disconnect the tubing from the peristaltic pump on the component panel: press the lever to the right, remove the tubing, and release the lever (see Figure 7-1).

ICS-6000 EG

EG Shutdown

7.1 Short-Term Shutdown

A short-term shutdown is one that lasts no more than 3 months. To prepare the EG for a short-term shutdown:

1. Turn off the EG, including all consumables installed in the EG (the Dionex CR-TC 600, suppressor, and so on).
2. Verify that the current to the Dionex EGC and the suppressor is off.

IMPORTANT **Supplying power to the Dionex EGC when there is no eluent flow can severely damage the cartridge.**

3. Store the Dionex EGC in the EG during the shutdown.

To restart the EG:

1. Select the parameters for the analysis on the Chromeleon ePanel Set. For EG startup information, see Section 4.8.
2. Analytical IC: In an analytical IC system, if the EG has been shut down for more than 3 to 4 days, hydrate the suppressor as instructed in the product manual.
3. Let the system equilibrate before collecting data.

7.2 Long-Term Shutdown

A long-term shutdown is one that lasts 3 months or more. To prepare the EG for a long-term shutdown:

1. Turn off the EG, including all consumables installed in the EG (the Dionex CR-TC 600, suppressor, and so on).
2. Verify that the current to the Dionex EGC and the suppressor is off.

IMPORTANT **Supplying power to the Dionex EGC when there is no eluent flow can severely damage the cartridge.**

3. If you plan to store the Dionex EGC in the EG, no further action is required.

   If you plan to store the cartridge outside the EG (for example, in the original shipping container), follow the instructions in Section 10.12.1 to remove the Dionex EGC from the EG and the instructions in Section 10.12.3 to store the Dionex EGC.

To restart the EG:

1. Select the parameters for the analysis on the Chromeleon ePanel Set. For EG startup information, see Section 4.8.
2. Condition the Dionex EGC. For instructions, see "Conditioning the New Capillary Dionex CR-TC 600" on page 357 or "Conditioning the Analytical EGC" on page 353.
3. Hydrate the Dionex CR-TC 600 (see Section 10.13.2).
4. Hydrate the suppressor as instructed in the suppressor manual.
5. Let the system equilibrate before collecting data.

Before shipping the EG:

1. Follow the instructions in Section 10.12.1 to remove the Dionex EGC from the EG.
2. Plug all fittings. Tighten the vent fitting (capillary Dionex EGC or high-pressure analytical Dionex EGC) or cap the vent port (standard-pressure analytical Dionex EGC). This will prevent the evaporation of water in the electrolyte reservoir.

IMPORTANT **Make sure the Dionex EGC packaging conforms to hazardous material shipping requirements. Refer to the Material Safety Data Sheet (MSDS) shipped with the Dionex EGC for the chemical description.**

7.3 Consumables Storage

The columns, suppressors, and other consumable items used with a Dionex ICS-6000 system have various short- and long-term storage requirements. Refer to the manuals for the individual products for instructions.

7.4 ED Cell Storage

7.4.1 ED Cell Short-Term Storage

If the cell will not be used for a short period of time (less than 2 days), disconnect the tubing from the inlet and outlet fittings and all fitting plugs.

NOTE If the pH-Ag/AgCl reference electrode remains in the cell but eluent is not being pumped through the cell, the pH-Ag/AgCl reference electrode frit may partially dry out. If this occurs, regenerate the electrode by soaking it in a solution containing 1 M KCl and 1 M HCl.

7.4.2 pH-Ag/AgCl Reference Electrode Long-Term Storage

If the cell will not be used for 2 days or more, remove the pH-Ag/AgCl reference electrode and store it in a solution of saturated KCl, as instructed in the procedure below.

1. Prepare a saturated solution of KCl in ASTM filtered, Type I (18 megohm-cm) deionized water that meets the specifications listed in Section 1.6.
2. Locate the cap in which the electrode was shipped and fill it two-thirds full with the prepared KCl solution.
3. Remove the pH-Ag/AgCl reference electrode from the cell.
4. Insert the electrode into the cap and screw on the cap (see Figure 7-2).

5. Make sure there is no air bubble in the cap. Add more KCl solution if needed.

Figure 7-2. *pH-Ag/AgCl Reference Electrode in Storage Cap*

This section describes routine maintenance procedures for the Dionex ICS-6000 system that users can perform. All other maintenance procedures must be performed by a Technical Support Representative for Dionex products.

For information about maintenance procedures for the Dionex EGC, CR-TC 600 trap column, or suppressor, refer to the appropriate product manual.

8.1 System Maintenance Checklists

8.1.1 Daily Maintenance

- ☐ Check for leaks.
- ☐ Wipe up liquid spills.
- ☐ Check eluent reservoirs for microbial growth; clean reservoirs and replace eluent as needed.
- Analytical IC ☐ Check eluent reservoir levels and refill as needed.
- Analytical IC ☐ Check waste containers and empty as needed.

For detailed daily maintenance instructions for each module, see:

DP/SP	page 221
EG	page 223
DC	page 225

8.1.2 Weekly Maintenance

- ☐ Check end-line filters on eluent lines. When the filters are new, they are pure white. Replace filters if they become discolored, if bacterial buildup is evident, or if eluent flow is blocked. See Section 4.5 for instructions.
- ☐ Check for plugged or blocked tubing connections.
- Capillary IC ☐ Check eluent reservoir levels and refill as needed.

Capillary IC

☐ Check waste containers and empty as needed.

For detailed weekly maintenance instructions for each module, see:

DP/SP	page 221
EG	page 223
DC	page 225

8.1.3 Periodic Maintenance

☐ Clean eluent reservoirs (when making fresh eluent or as needed) (see Section 10.2.1).

☐ (Optional) Have a Technical Support Representative for Dionex products perform the performance qualification (PQ) procedure for IC systems.

For detailed periodic maintenance instructions for each module, see:

DP/SP	page 222
EG	Not applicable
DC	page 225

8.1.4 Annual Maintenance

☐ Thermo Fisher Scientific recommends performing preventive maintenance on each module (except the EG) annually. Preventive Maintenance Kits contain all the required parts for these procedures.

- DP/SP (Analytical) Preventive Maintenance Kit (P/N 075970)
- DP/SP (Capillary) Preventive Maintenance Kit (P/N 075039)
- The DC preventive maintenance procedure consists of rebuilding each high-pressure valve installed in the module. Order the appropriate kit for your system:
    - 0.1 µL Internal Loop High-Pressure Valve Maintenance Kit (P/N 22181-62026)
    - 0.2 µL Internal Loop High-Pressure Valve Maintenance Kit (P/N 22181-62027)
    - 0.4 µL Internal Loop High-Pressure Valve Maintenance Kit (P/N 075040)

- 6-Port High-Pressure Valve Maintenance Kit (P/N 075974)
- 10-Port High-Pressure Valve Maintenance Kit (P/N 079053)

ICS-6000 DP/SP

DP/SP Routine Maintenance

This section describes routine maintenance procedures that users can perform for the Dionex ICS-6000 Dual Pump (DP) or Dionex ICS-6000 Single Pump (SP). All other maintenance procedures must be performed by a Technical Support Representative for Dionex products.

8.2 DP/SP Daily Maintenance

- Check for leaks at the following locations: the eluent proportioning valves (gradient pump only), vacuum degas chambers, and eluent reservoirs. Tighten or replace any leaking fittings.
- Wipe up liquid spills and rinse dried reagents off pump components with deionized water. Dry the leak sensor thoroughly; if the sensor is not dry, it will remain activated and continue to report a leak to the audit trail.
- Check the liquid level in the seal wash reservoir. The liquid level should remain between the **Min.** and **Max.** markers on the reservoir label.
- Check eluent reservoirs for microbial growth; clean reservoirs and replace eluent as needed. Rinse each eluent reservoir thoroughly (inside and out) with ASTM filtered, Type I (18 megohm-cm) deionized water that meets the specifications listed in Section 1.6. Dry with clean, particulate-free air. If a reservoir still appears dirty, or if there is a slimy film on the interior, clean the reservoir as instructed in Section 10.2.1.

Analytical IC

- Check the liquid level in each eluent reservoir and refill as required.

8.3 DP/SP Weekly Maintenance

- The end-line filters (P/N 045987) on the eluent lines may need to be replaced weekly, depending on water quality and eluent conditions. For example, replace the filters weekly when using a Dionex EGC to generate carbonate/bicarbonate eluent.

  When the end-line filters are new, they are pure white. Replace the filters whenever they become discolored, if bacterial buildup is evident, or if eluent flow is blocked.

NOTE It is especially important to regularly replace end-line filters when using aqueous eluents. Aqueous eluents may contaminate the filters with bacteria or algae, causing cause flow restrictions to the pump.

End-line filters are provided in the pump ship kit.

Pump Ship Kit	Part Number
DP Ship Kit Dual Capillary	072112
DP Ship Kit Dual Analytical	062463
DP Ship Kit Capillary and Analytical	072111
SP Ship Kit Capillary or Analytical	063342

Before installation, thoroughly rinse the end-line filter with ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6 to remove any loose particles.

- Replace the seal wash solution. ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Table 1.6 on page 31 is appropriate for most applications.
- Check the tubing connected to the peristaltic pump. If the tubing is blocked or crimped, replace it (see Section 10.7).

Capillary IC

- Check the liquid level in each eluent reservoir and refill as required.

8.4 DP/SP Periodic Maintenance

- Make fresh eluent as needed.
- Replace piston seals every 6 to 12 months (see Section 10.5).

Capillary IC

- Clean eluent reservoirs every 3 months with methanol or isopropyl alcohol (see Section 10.2.1).

8.5 DP/SP Annual Maintenance

Thermo Fisher Scientific recommends performing preventive maintenance annually. The following kits are available:

- DP/SP (Analytical) Preventive Maintenance Kit (P/N 075970)
- DP/SP (Capillary) Preventive Maintenance Kit (P/N 075039)

ICS-6000 EG EG Routine Maintenance

This section describes routine maintenance procedures for the Dionex ICS-6000 Eluent Generator (EG) that users can perform. All other maintenance procedures must be performed by a Technical Support Representative for Dionex products.

For information about maintenance procedures for the Dionex EGC, trap column, or suppressor, refer to the appropriate product manual.

8.6 EG Daily Maintenance

- Locate and repair leaks inside the EG (see Section 10.11) and wipe up liquid. Rinse dried eluents off components with deionized water.
- Rinse the EG drip tray with deionized water (to prevent formation of salt crystals) and dry the drip tray thoroughly. Rinse and dry the leak sensor, also; if the sensor is not dry, it will remain activated and continue to report a leak to the audit trail.
- Check the waste container and empty as needed.

8.7 EG Weekly Maintenance

- Check all lines for crimping. Move (or reroute) pinched lines and replace damaged lines (see Section 10.10). For help in isolating the cause of a tubing restriction, see Section 10.11.
- Monitor the system backpressure. A gradual increase in backpressure can indicate clogging of the Dionex EGC inlet frit from particulates in the eluent water.

8.8 EG Annual Maintenance

- Check the expiration date and remaining lifetime of the Dionex EGC on the Eluent Generator ePanel in Chromeleon.

DC Routine Maintenance

ICS-6000 DC

This section describes routine maintenance procedures for the Dionex ICS-6000 Detector/Chromatography Module (DC) that users can perform. All other maintenance procedures must be performed by a Technical Support Representative for Dionex products.

8.9 DC Daily Maintenance

- Check the DC components for leaks or spills. Wipe up spills. Isolate and repair leaks (see Section 9.27). Rinse off any dried eluent with ASTM filtered, Type I (18 megohm-cm) deionized water that meets the specifications listed in Section 1.6.
- Check the waste container and empty as needed.

NOTE If you are using an electrochemical detector, review the special maintenance considerations described in Section 4.1.2.

8.10 DC Weekly Maintenance

- Check liquid lines for crimping or discoloration. Relocate any pinched lines. Replace damaged lines.
- Check for excess condensation inside the DC. Condensation may build up when the DC is operated in a highly humid environment and the majority of the applications are run at cold temperatures. To remove condensation, run the DC at its maximum temperature for at least 48 hours.

8.11 DC Periodic Maintenance

- Inspect the door seal for signs of damage. A defective seal impairs the performance of the instrument. If the seal is defective, contact Technical Support for Dionex products.

8.12 DC Annual Maintenance

Thermo Fisher Scientific recommends performing preventive maintenance annually. The DC preventive maintenance procedure consists of rebuilding each high-pressure valve installed in the module. The following kits are available:

- 0.1 µL Internal Loop High-Pressure Valve Maintenance Kit (P/N 22181-62026)
- 0.2 µL Internal Loop High-Pressure Valve Maintenance Kit (P/N 22181-62027)
- 0.4 µL Internal Loop High-Pressure Valve Maintenance Kit (P/N 075040)
- 6-Port High-Pressure Valve Maintenance Kit (P/N 075974)
- 10-Port High-Pressure Valve Maintenance Kit (P/N 079053)

9 • Troubleshooting

This chapter is a guide to troubleshooting minor issues that may arise during operation of the Dionex ICS-6000 system. 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 Technical Support for Dionex products. In the U.S. and Canada, call 1-800-532-4752. Outside the U.S. and Canada, call the nearest Thermo Fisher Scientific office. Please have this chapter at hand when talking with Technical Support personnel.

9.1 Audit Trail Error Messages

The instrument control firmware installed in each Dionex ICS-6000 module periodically checks the status of certain parameters. If a problem is detected, it is 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). For most modules, you can change the severity level assigned to a problem whenever appropriate.

Icon	Default Severity Level	Description
	Warning	A message is displayed in the audit trail, but the current run is not interrupted. The instrument can be started or continue running; however,Thermo Fisher Scientific recommends that you take appropriate action to remedy the situation.

Icon	Default Severity Level	Description
	Error	A message is displayed in the audit trail or the Ready Check Results, and the system attempts to correct the problem (sometimes by using an alternative parameter), but the current run is not interrupted. If an error occurs during the Ready Check, the queue will not be started until the error is resolved.
	Abort	A message is displayed in the audit trail and the running queue is aborted.

9.1.1 DP/SP Error Messages

Table 9-1 lists the most frequently observed DP/SP-related error messages and their default severity levels. For troubleshooting assistance, see the page indicated in the table.

DP/SP-Related Audit Trail Error Message	Default Severity Level	See
Abnormal drive current for x.x seconds.	**Warning**	**page 247**
Adjust pump upper limit.	**Warning**	**page 247**
An instrument method with this name already exists.	**Abort**	**page 248**
Camshaft index too early.	**Abort**	**page 248**
Camshaft index too late.	**Abort**	**page 248**
Camshaft sensor always alight.	**Abort**	**page 248**
Camshaft sensor missing or dark.	**Abort**	**page 248**
Degasser malfunction.	**Warning**	**page 249**
Excessive drive current. Camshaft x.x.	**Abort**	**page 249**
Force motor off.	**Warning**	**page 249**
Invalid flow value.	**Abort**	**page 250**
Leak detected.	**Abort**	**page 250**

Table 9-1. *DP/SP Error Messages*

DP/SP-Related Audit Trail Error Message	Default Severity Level	See
Left-hand pump block carryover pressure is too high.	Abort	page 250
Right-hand pump block carryover pressure is too high.	Abort	page 250
Motor malfunction.	Abort	page 251
Motor position error. The motor is overloaded.	Abort	page 251
Pressure fallen below lower limit.	Abort	page 251
Relay 4 is configured for inject synchronization. Please change pump configuration.	Abort	page 252
The maximum purge pressure was exceeded.	Abort	page 252
The pressure in the left-hand working cylinder exceeded the safety limit.	Abort	page 253
The pressure in the right-hand working cylinder exceeded the safety limit.	Abort	page 253
The system pressure exceeded the safety limit.	Abort	page 253
This function cannot be adjusted by the user.	Abort	page 254
Upper pressure limit exceeded.	Abort	page 254

Table 9-1. *DP/SP Error Messages (Continued)*

9.1.2 EG Error Messages

Table 9-2 lists the EG-related error messages and their default severity levels. For troubleshooting assistance, see the page indicated in the table.

EG-Related Audit Trail Error Message	Default Severity Level	See
Command not executed because a calibration command is already running.	Warning	page 259
Command not executed because a diagnostic command is already running.	Warning	page 259

Table 9-2. *EG Error Messages*

EG-Related Audit Trail Error Message	Default Severity Level	See
Concentration out of range! The maximum value at time %1 is %2.	Error	page 259
Concentration out of range! The maximum value is %1.	Error	page 259
CR-TC1 open circuit. CR-TC2 open circuit.	Abort	page 260
CR-TC1 over current. CR-TC2 over current.	Abort	page 260
CR-TC1 stopped because EGC1 OFF. CR-TC2 stopped because EGC2 OFF.	Abort	page 261
CR-TC1 stopped due to zero flow. CR-TC2 stopped due to zero flow.	Abort	page 261
CR-TC mode will be turned off for invalid flow. Flow range for analytical EGC: 0.100 – 3.000 mL/min, capillary EGC: 0.001 – 0.100 mL/min.	Abort	page 262
Current linked pump is analytical. Please install an analytical EGC.	Abort	page 262
Current linked pump is capillary. Please install a capillary EGC.	Abort	page 262
EG1 cartridge disconnected. EG2 cartridge disconnected.	Abort	page 262
EG1 invalid activation date. EG2 invalid activation date.	Abort	page 263
EG1 invalid concentration. EG2 invalid concentration.	Abort	page 263
EG1 invalid flow. EG2 invalid flow.	Abort	page 264
EG1 invalid flow rate-concentration. EG2 invalid flow rate-concentration.	Abort	page 264

Table 9-2. *EG Error Messages (Continued)*

EG-Related Audit Trail Error Message	Default Severity Level	See
EG1 invalid ion count. EG2 invalid ion count.	Abort	page 264
EG1 invalid serial number. EG2 invalid serial number.	Abort	page 265
EG1 over current. EG2 over current.	Abort	page 265
EG1 over power. EG2 over power.	Abort	page 266
EG1 over voltage. EG2 over voltage.	Abort	page 266
EG1 wrong cartridge error. EG2 wrong cartridge error.	Warning	page 267
EGC cannot be used due to invalid ion count.	Abort	page 268
EGC is either not installed or not supported. Please install a capillary EGC.	Abort	page 268
EGC is either not installed or not supported. Please install an analytical EGC.	Abort	page 268
EGC-1 is not linked to a compatible pump. EGC-2 is not linked to a compatible pump.	Warning	page 267
Flash memory reset to defaults.	Abort	page 269
Hardware is not installed.	Abort	page 269
Leak sensor wet.	Abort	page 269
pH modifier must be used with a different type of cartridge.	Error	page 270
Pump is disconnected. The EG and CR-TC modes are turned off.	Warning	page 270
The CR-TC mode is off for a virtual pump.	Abort	page 270
The EG mode is off due to pump pressure alarm or leak.	Abort	page 270
The EG mode is off for a virtual pump.	Warning	page 270

Table 9-2. *EG Error Messages (Continued)*

9.1.3 DC Error Messages

Table 9-3 lists the DC-related error messages and their default severity levels. For troubleshooting assistance, see the page indicated in the table.

DC-Related Audit Trail Error Message	Default Severity Level	See
CD cell option disconnected.	Abort	page 277
CD cell over safe temperature.	Abort	page 278
Column over safe temperature.	Abort	page 278
Column temperature calibration error.	Warning	page 278
Column temperature open circuit.	Abort	page 279
Compartment over safe temperature.	Abort	page 279
Compartment temperature calibration error.	Warning	page 279
Compartment temperature open circuit.	Abort	page 279
ED cell current exceeds limits error.	Warning	page 280
ED cell option disconnected.	Abort	page 280
ED cell working electrode disconnected.	Abort	page 281
ED pH offset calibration failed.	Warning	page 281
ED pH slope calibration failed.	Warning	page 282
ED reference electrode disconnected.	Warning	page 282
Flash memory reset to defaults.	Warning	page 283
High-pressure valve 1 error. High-pressure valve 2 error. High-pressure valve 3 error. High-pressure valve 4 error.	Abort	page 283
I2C bus serious problem.	Error	page 285
IC Cube 1 heater over safe temperature. IC Cube 2 heater over safe temperature.	Error	page 285
Local memory allocation for flash is too small.	Error	page 285
Lower door opened.	Warning	page 286

Table 9-3. *DC Error Messages*

DC-Related Audit Trail Error Message	Default Severity Level	See
Lower leak sensor wet.	Warning	page 286
Module is in direct control.	Warning	page 286
Reaction coil open circuit error.	Abort	page 287
Reaction coil over safe temperature.	Abort	page 287
RFID command sent when not ready.	Warning	page 287
RFID reader initialization failed.	Warning	page 287
Suppressor over-current.	Abort	page 289
Suppressor over-power.	Abort	page 289
Suppressor over-voltage.	Abort	page 290
Suppressor stopped for flow rate.	Warning	page 290
Temperature below range error.	Warning	page 290
Too many errors; device will be disconnected.	Abort	page 291
Upper door opened.	Warning	page 291

Table 9-3. *DC Error Messages (Continued)*

9.2 Noisy Baseline

- **Eluent is contaminated**

  1. Clean all eluent reservoirs thoroughly (inside and out) with ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6. Dry with clean, particulate-free air. If a reservoir still appears dirty, or if there is a slimy film on the interior, follow the cleaning instructions in Section 10.2.1.
  2. Flush the system with ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6.
  3. Replace all end-line filters (P/N 045987). See Section 4.5 for instructions.
  4. Prepare new stock solution.
  5. Prepare fresh eluent. To ensure eluent purity, prepare all eluents with spectro-grade eluents, reagent-grade chemicals, and ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6.

- **DP/SP not properly primed**

  Prime the pump (see Section 10.3).

- **Piston seal is damaged**

  If the piston seal is damaged, it allows liquid leaks. Leaks are usually visible, and thus easily detected. If necessary, replace the piston seal (see Section 10.5).

- **Inadequate system or cell backpressure**

  Add backpressure tubing to the cell outlet (see Section 10.26.4) or to the pump (if no column is installed).

Analytical IC

- **(Analytical EG only) System backpressure is below 14 MPa (2000 psi)**

  The optimal system backpressure is 16 MPa (2300 psi) in an analytical IC system with an EG installed. Low system backpressure may cause high baseline noise as the eluent concentration increases in the gradient. To correct this, install a backpressure coil in the EG after the Dionex RFIC^{+} Eluent Degasser (see Section 10.15).

- **Flow system leak ahead of cell**

  Check all fittings and liquid lines for leaks. Tighten or, if necessary, replace all liquid line connections (see Section 10.17).

- **Rapid changes in ambient temperature**

  Make sure the column is installed in a thermostatically controlled compartment and the compartment 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.

Noisy Baseline: CD Only

- **Incorrect suppressor operating conditions**

  Refer to the suppressor manual for troubleshooting information.

- **Cell above or below temperature**

  Contact Technical Support for Dionex products for assistance.

- **Detector electronics not functioning correctly**

  Run the detector dummy cell diagnostics from the Chromeleon Wellness panel (see Section 10.26.1).

- **Inappropriate suppressor operating conditions**

  Refer to the suppressor manual for the correct operating conditions.

- **Temperature compensation setting not optimized**

  Optimize the selected setting (see Section 2.14).

Analytical IC

- **Trapped gases in cell**

  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.

Analytical IC

- **Inadequate system backpressure**

  In an analytical IC system, add backpressure tubing to the cell outlet (see Section 10.26.4).

Noisy Baseline: ED Only

- **(DC Amperometry and Integrated Amperometry modes) Air bubbles trapped inside cell**

  While wearing gloves and eye protection and with the pump running and all plumbing connected, generate a slight temporary backpressure by putting your finger over the end of the cell outlet tubing for 2 to 3 seconds. Repeat two or three times. If the baseline does not improve, check the other causes of baseline instability described in this section.

IMPORTANT **Do not block the end of the cell outlet tubing for longer than the recommended 2 to 3 seconds. Doing so creates high backpressure, which can break the pH-Ag/AgCl reference electrode glass membrane.**

NOTE To prevent air from becoming trapped in the cell in the future, increase the backpressure on the cell by connecting backpressure tubing to the cell outlet. The backpressure limit for the ED cell is 690 kPa (100 psi). Do not exceed this limit.

- **(DC Amperometry and Integrated Amperometry modes) Frequent, random spikes in the baseline**

  The pH-Ag/AgCl reference electrode diaphragm is plugged. First, try regenerating the pH-Ag/AgCl reference electrode frit by soaking the electrode in a solution of 1 M KCl plus 1 M HCl. If this does not eliminate the spiking, replace the electrode (P/N 061879).

- **(DC Amperometry and Integrated Amperometry modes) Regular baseline oscillation on high-sensitivity ranges**

  Analytical IC

  Reconnect the short length of titanium tubing to the cell inlet (see Figure 2-31).

- **(DC Amperometry and Integrated Amperometry modes) Dirty or pitted conventional (nondisposable) working electrode**

  Polish the working electrode (see Section 10.27.4). If you are using a disposable electrode, replace it.

- **(Integrated Amperometry mode) Regular baseline oscillations**

  1. Check the pump pressure plot to verify that the pump is working properly.
  2. Air bubbles may be trapped inside the cell. While wearing gloves and eye protection, generate a slight temporary backpressure by putting your finger over the end of the cell outlet tubing for 2 to 3 seconds. Repeat two or three times. If the baseline does not improve, check the other causes of baseline instability described in this section.

IMPORTANT **Do not block the end of the cell outlet tubing for longer than the recommended 2 to 3 seconds. Doing so creates high backpressure, which can break the pH-Ag/AgCl reference electrode glass membrane.**

NOTE To prevent air from becoming trapped in the cell in the future, increase the backpressure on the cell by connecting backpressure tubing to the cell outlet. The backpressure limit for the ED cell is 690 kPa (100 psi). Do not exceed this limit.

  3. The water used to prepare the eluent may contain trace contaminants. Remake the eluent, using ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6.

9.3 Poor Retention Time Reproducibility

- **Liquid leaks**

  1. Check for leaks from the piston seals. Replace the piston seal on any head with a leak (see Section 10.5).
  2. Check for leaks throughout the remainder of the system, including the check valves, injection valve, and columns. Tighten or replace fittings as needed.

- **DP/SP not primed**

  Prime the pump (see Section 10.3).

- **Liquid lines incompletely flushed after an eluent change**

  Attach a 10 cc syringe (P/N 079803) to the waste port on the priming valve. Open the priming valve (turn the knob one-half turn counterclockwise). Draw at least 20 mL of the new eluent through the liquid lines before operation.

- **Inoperative eluent proportioning valve (gradient pump only)**

  The proportioning valve assembly should be replaced. Contact Technical Support for Dionex products for assistance.

- **Inoperative check valves**

  Replace the check valve cartridges (see Section 10.4).

- **Insufficient mixing (gradient pump only)**

  The static mixer may be dirty or contaminated. Flush with IPA (isopropyl alcohol). If this does not eliminate the problem, install a new GM-4 mixer (P/N 049135).

- **Eluent is contaminated**

  1. Clean all eluent reservoirs thoroughly (inside and out) with ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6. Dry with clean, particulate-free air. If a reservoir still appears dirty, or if there is a slimy film on the interior, follow the cleaning instructions in Section 10.2.1.
  2. Flush the system with ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6.
  3. Replace all end-line filters (P/N 045987). See Section 4.5 for instructions.
  4. Prepare new stock solution.
  5. Prepare fresh eluent. To ensure eluent purity, prepare all eluents with electrochemical-grade chemicals, and ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6.

- **Problem unrelated to the pump**

  1. The eluent concentration may be wrong, or the eluent may have been prepared with impure chemicals/eluents or water. To ensure eluent purity, prepare all eluents with spectro-grade eluents, reagent-grade chemicals, and ASTM Type I (or better) filtered and deionized water that meets the specifications listed in Section 1.6.

2. The column may be the source of the problem. Refer to the column manual for troubleshooting assistance.
3. The injection valve may be the source of the problem. Rebuild the injection valve (see Section 10.20).

9.4 Peak Retention Times Are Too Early

- **Eluent concentration setting is too high**

  The correct eluent concentration setting depends on several factors (the flow rate, Dionex EGC type, etc.). See Section 4.8 for a list of valid concentration ranges for the cartridges, and then edit the Chromeleon instrument method as required.

- **DP/SP flow rate is too low**

  Increase the DP/SP flow rate.

- **Inoperative eluent proportioning valve (gradient pump only)**

  The proportioning valve assembly should be replaced. Contact Technical Support for Dionex products for assistance.

9.5 Peak Retention Times Are Too Late

- **Eluent concentration setting is too low**

  The correct eluent concentration setting depends on several factors (the flow rate, Dionex EGC type, etc.). See Section 4.8 for a list of valid concentration ranges for the cartridges, and then edit the Chromeleon instrument method as required.

- **DP/SP flow rate is too high**

  Decrease the DP/SP flow rate.

- **Inoperative eluent proportioning valve (gradient pump only)**

  The proportioning valve assembly should be replaced. Contact Technical Support for Dionex products for assistance.

9.6 No Peaks

- **EG power is not turned on**

  1. Check that the **POWER** button on the front of the EG is turned on.
  2. Check that the EG main power switch (on the rear panel) is turned on.
  3. Check that the main power cord is plugged into both the EG rear panel connector and the power source. Check that the wall outlet has power.

- **Injection valve is not actuating or the sample loop is plugged**

  1. Test the valve by manually switching the position from the DC ePanel in Chromeleon.
  2. Check the sample loop for blockage. Clean or replace the loop if needed.

- **Detector not properly installed**

  CD: An electronics connector on the back of the detector plugs into a receptacle on the detector compartment. Push on the detector to make certain the connector is securely connected (see Figure 9-1).

- **ED:** Verify that the signal cables from the cell are connected to the detector block. In addition, an electronics connector on the back of the detector plugs into a receptacle on the detector compartment. Push on the detector to make certain the connector is securely connected (see Figure 9-1).

Figure 9-1. *Detector Connection*

ED Only

- **Cell is off**

  Turn on the cell from the detector ePanel in Chromeleon.

9.7 Tailing Peaks

- **Excess tubing void volumes**

  Check tubing connections for void volumes.

Analytical IC

- **(CD) Long tubing lengths connecting**

  Minimize all tubing lengths between the injection valve and the detector.

- **(DC Amperometry and Integrated Amperometry modes) Dirty or pitted conventional (nondisposable) working electrode**

  Clean the working electrode with water and dry with pressurized air or nitrogen.

  Polish the working electrode (see Section 10.27.4). If you are using a disposable electrode, replace it.

Capillary IC

- **Capillary tubing fittings incorrectly installed**

  Incorrectly installed fittings on capillary tubing can increase void volumes, causing chromatograms with tailing peaks (see Figure 9-2).

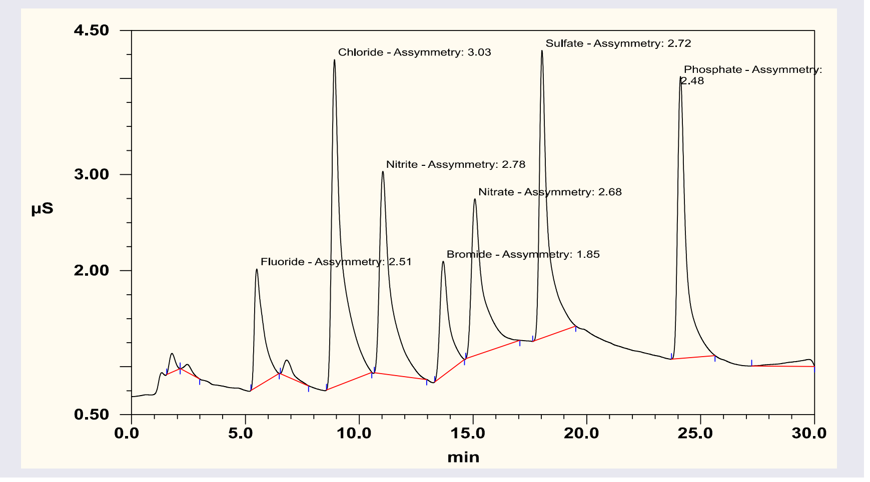


***Figure 9-2.** Tailing Peaks Caused by Incorrectly Installed Capillary Tubing Fittings*

To correctly install fittings on capillary tubing, follow the instructions in Section 10.1.

9.8 Low System Backpressure

- **Loose fitting**

  Make sure there are no liquid leaks in the flow system. Check tubing connections throughout the system (including the check valves, injection valves, and columns) and tighten or replace fittings as needed.

Analytical IC

- **RFIC+ Eluent Degasser tubing is ruptured**

  If flow from the EG waste line is normal but there is no flow through the columns, the tubing assembly inside the Dionex RFIC+ Eluent Degasser has ruptured. Replace the degasser (see Section 10.14).

- **Internal EGC leak (from membrane barrier)**

  Leakage from the membrane barrier may trip the DP/SP low pressure limit and shut down the pump. If all other causes of the low system pressure have been eliminated, replace the Dionex EGC (see Section 10.12).

NOTE The EG leak sensor cannot immediately detect leakage from the membrane barrier because these leaks exit the EG through the vent line.

9.9 High System Backpressure

- **Restriction in the system plumbing**

  1. Begin pumping eluent through the system (including the columns) at the flow rate normally used.
  2. Work backward through the system, beginning at the flow cell exit. One at a time, loosen each fitting and observe the pressure. The connection at which the pressure drops abnormally indicates the point of restriction. If the Dionex EGC is the source of the high backpressure, replace the outlet frit as instructed in the Dionex EGC manual.
  3. If the restriction has caused such high pressure that the system cannot be operated, you must work forward through the system, adding parts one at a time until an abnormal pressure increase (and hence, the restriction) is found.

9.10 Low Detector Output

- **Insufficient sample injected**

  Increase the injection size or concentration.

ED Only

- **Working electrode fouled**

  1. If a disposable working electrode is being used, replace the electrode.

2. For conventional (nondisposable) electrodes, clean the working electrode with ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6. Dry with pressurized air or nitrogen. If the electrode is pitted, polish the electrode (see Section 10.27.4).

3. Check the value of the reference potential shift (see “Using a Digital Voltmeter to Determine Reference Potential Shift” on page 301). If the value fluctuates by more than 30 mV, electrode passivation may occur because potentials that are too high are being applied. Recalibrate the pH-Ag/AgCl reference electrode (see Section 10.27.6). If the problem persists, replace the pH-Ag/AgCl reference electrode (see Section 10.27.5).

Analog Output Option

- **Analog output range set too high**

  Select a more sensitive analog output range.

9.11 High Background

- **Dionex CR-TC 600 is contaminated**

  Clean the trap column as instructed in the Dionex CR-TC 600 manual.

- **Wrong eluent**

  Check that you are using the correct eluent for your application. For ED detectors, verify that the pH readout is correct for your eluent.

- **Background signal not offset from detector signal**

  Before injecting sample, allow the background signal to equilibrate, and then press **Autozero** on the detector ePanel in Chromeleon.

CD Only

- **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.

- **Regenerant fails to suppress background**

  Use a higher regenerant flow rate. Refer to the suppressor manual for the suggested regenerant flow rate for your application.

ED Only

- **(Integrated Amperometry mode) Excessive number or length of integration intervals and/or incorrect potential for the integration**

  Verify that the length and potential of the integration interval is correct (refer to the column manual for the settings required for your application).

- **(DC Amperometry and Integrated Amperometry modes) Amperometric detection cell working electrode shorted to counter electrode**

  Clean the working electrode with water and dry with pressurized air or nitrogen.

  Remove any precipitate on the counter electrode by cleaning the spot directly opposite the working electrode with a lint-free tissue.

- **(DC Amperometry and Integrated Amperometry modes)—Leak between gasket and electrode, or between gasket and cell body**

  Remove any precipitate with water and a lint-free tissue and then install a new gasket (see Section 10.27.3).

  Turn the yoke knob (see Figure 10-60) a full 360 degrees to completely engage the knob.

9.12 External Device Stops Unexpectedly

- **Fuse has blown**

  The power to an external device is controlled by one of the switched AC sockets on the DC rear panel (see Figure 2-32). The sockets are protected by internal fuses. The fuses cannot be replaced by the user. Contact Technical Support for Dionex products for assistance.

9.13 Troubleshooting DP/SP Error Messages

If any of the following alarm conditions occurs, a message is displayed in the Chromeleon audit trail.

Abnormal drive current for x.x seconds.

If this error occurs, the tubing between the pump heads may be blocked or the fitting may be overtightened.

There could be a pump problem, such as high friction on the seal, causing piston binding, or the motor may be bad.

To troubleshoot:

- Inspect the tubing for blockage or crimping, and replace it as needed (see Section 10.2). Be careful not to over-tighten fittings. If the message appears again, contact Technical Support for Dionex products for assistance.
- Lower the flow rate to see if the error goes away. This would be an indication of a bad motor, seal friction, or faulty electronics.

Adjust pump upper limit.

This error occurs when Chromeleon adjusts the pump upper pressure limit to %1 MPa (%1 psi) in response to a request from a linked module.

To troubleshoot:

Accept the upper pressure limit set by Chromeleon.

An instrument method with this name already exists.

This error occurs if you attempt to save a modified Chromeleon instrument method under the name of an existing instrument method.

To troubleshoot:

Enter a new name for the modified instrument method.

–or–

Select **Save** to save your changes under the existing instrument method name.

Camshaft index too early.

-or-

Camshaft sensor too late.

This error is caused by a malfunction or interference in the camshaft sensor.

To troubleshoot:

Turn off the DP/SP power for 30 seconds and then turn it on again. If the error message appears again, contact Technical Support for Dionex products for assistance.

Camshaft sensor always alight.

-or-

Camshaft sensor missing or dark.

This error is caused by an internal error in the pump drive mechanism.

To troubleshoot:

Turn off the DP/SP power for 30 seconds and then turn it on again. If the error message appears again, contact Technical Support for Dionex products for assistance.

Degasser malfunction.

The vacuum degassing module monitors the vacuum system continuously. If a problem is detected, this error occurs.

To troubleshoot:

1. Check all tubing connections to the vacuum degassing module for leakage; tighten loose fitting connections. Be careful not to overtighten fittings.
2. Turn off the DP/SP power for 30 seconds and then restart the pump.

   If the message appears again, the vacuum degassing module should be replaced. Contact Technical Support for Dionex products for assistance.

Excessive drive current. Camshaft x.x.

This error occurs if the drive current is above the allowed value. When this message appears, the DP/SP stops running.

To troubleshoot:

One or more tubing connections may be plugged, blocked, or crimped. Check all tubing connections and replace as needed (see Section 10.2). Be careful not to overtighten fittings.

Force motor off.

This error occurs when the DP/SP motor is turned off in response to an issue related to a linked suppressor.

To troubleshoot:

1. Follow the troubleshooting instructions for the “Suppressor Over-Current” error message (see page 289).
2. Follow the troubleshooting instructions for the “Suppressor Over-Voltage” error message (see page 290).
3. Follow the troubleshooting instructions for the “Suppressor Over-Power” error message (see page 289).

Invalid flow value.

This error occurs if you enter an invalid value for the DP/SP flow rate in Chromeleon.

To troubleshoot:

Select a flow rate within the DP/SP flow rate range. For the flow rate range for each type of DP/SP, see the pump specifications in Appendix A.

Leak detected.

This error occurs if the DP/SP leak sensor detects a liquid leak inside the enclosure. When this error occurs, the pump stops running.

To troubleshoot:

To find and eliminate the source of the leak, see Section 9.16.

Left-hand pump block carryover pressure is too high.

-or-

Right-hand pump block carryover pressure is too high.

This error occurs if the pressure in the primary pump head exceeds the maximum allowed. ("Right-hand" refers to the bottom pump; "left-hand" refers to the top pump in a dual-pump module.)

To troubleshoot:

1. Make sure that the tubing between the pump heads and the tubing leading to the priming/outlet block is not plugged or blocked. Replace tubing connections as needed (see Section 10.2). Be careful not to overtighten fittings.
2. Inspect the outlet check valve for blockage. Replace the check valve cartridge, if needed (see Section 10.4).

Motor malfunction.

This error occurs if an internal error in the pump drive mechanism occurs.

To troubleshoot:

Turn off the DP/SP power for 30 seconds, and then turn on the power again. If the error message appears again, contact Technical Support for Dionex products for assistance.

Motor position error. The motor is overloaded.

This error occurs if the pump motor is overloaded.

To troubleshoot:

1. One or more tubing connections may be plugged or blocked. Check all tubing connections and replace as needed (see Section 10.2). Be careful not to overtighten fittings.
2. If the “Upper pressure limit exceeded message” is also displayed, see page 254 for additional troubleshooting steps.

Pressure fallen below lower limit.

This error occurs if the DP/SP pressure falls below the low pressure limit specified in Chromeleon.

To troubleshoot:

1. The eluent supply may be depleted. Check the **Eluent Level Display** on the Chromeleon ePanel Set to verify that eluent is present in the selected channel. If the eluent reservoir is empty, refill it (or select a channel that does have eluent). Prime the pump before resuming operation (see Section 10.3).
2. Check all eluent lines for air bubbles. If air is trapped in a line, replace the end-line filter (P/N 045987) as instructed in Section 4.5. Verify that the end of each filter extends to the bottom of the reservoir and is submerged in eluent. Prime the pump (see Section 10.3).

3. Eluents may be insufficiently degassed. Check the vacuum degassing module.
4. Check all tubing connections for leaks; tighten loose fitting connections. Be careful not to overtighten fittings.
5. Make sure the priming valve is closed (see Figure 2-3). To close the valve, turn the knob clockwise until closed. Tighten no more than fingertight.

IMPORTANT **Do not use any tools to tighten the priming valve! Overtightening may destroy the cap seal. Open or close the priming valve only when the system pressure is down.**

6. A check valve may be defective. Replace the check valve cartridges (see Section 10.4) and then prime the pump (see Section 10.3).

Relay 4 is configured for inject synchronization. Please change pump configuration.

This error occurs if you attempt to use relay 4 as a standard relay in a Chromeleon instrument method when the relay has been set to synchronize the gradient with the autosampler sample injection.

To troubleshoot:

Define the relay as a standard relay *or* specify a different relay for use in the instrument method.

The maximum purge pressure was exceeded.

If the DP/SP pressure exceeds 5 MPa (725 psi) during priming, this error occurs and the priming process is aborted.

To troubleshoot:

1. Verify that the priming valve is open. (To open the valve, turn the knob one-half turn counterclockwise.)
2. Check fittings for overtightening. Check tubing for crimping, and replace it as needed (see Section 10.2). Be careful not to overtighten fittings.

The pressure in the left-hand working cylinder exceeded the safety limit.

-or-

The pressure in the right-hand working cylinder exceeded the safety limit.

-or-

The system pressure exceeded the safety limit.

This error may be caused by a blockage in the system or by a problem with the column. (“Right-hand” refers to the bottom pump; “left-hand” refers to the top pump in a dual-pump module.)

To troubleshoot:

1. Check all tubing connections for signs of blockage; replace as needed (see Section 10.2). Be careful not to overtighten fittings.
2. To determine the source of the high backpressure, isolate segments of the flow path:
   a. Remove the pump outlet tubing at the injection valve.
   b. Press the **POWER** button on the front of the DP/SP to turn on the pump.
   c. On the Chromeleon ePanel Set, set the **Flow** rate to 0.01 mL/min for a capillary IC system or 1.0 mL/min for an analytical IC system. Record the backpressure.
   d. Disconnect all components after the injection valve.
   e. One at a time, reconnect each component of the flow path. If reconnecting a component causes an abnormal increase in backpressure, replace the component. Replace as many components as necessary to resume operation at the standard operating backpressure.
3. As columns age, their backpressure increases. If the column is the source of the high backpressure, clean the column as instructed in the column manual. If this does not eliminate the problem, replace the column.
4. Observe a run to see whether the high pressure limit is triggered when injection occurs; if it is, the injection valve may be the source of the

blockage (indicating that the rotor seal or stator may need to be replaced). Contact Technical Support for Dionex products for assistance.

This function cannot be adjusted by the user.

This error occurs if you attempt to change a parameter that users are not allowed to adjust.

To troubleshoot:

Only qualified personnel can change this parameter. For assistance, contact Technical Support for Dionex products.

Upper pressure limit exceeded.

This error occurs if the upper pressure limit specified in the Chromeleon instrument method is exceeded. The running queue is aborted (default) and this message appears.

To troubleshoot:

1. Inspect the tubing for blockage or crimping, and replace it as needed (see Section 10.2). Be careful not to overtighten fittings.
2. To determine the source of the high backpressure, isolate segments of the flow path:
    a. Remove the pump outlet tubing at the injection valve.
    b. Press the **POWER** button on the front of the DP/SP to turn on the pump.
    c. On the Chromeleon ePanel Set, set the **Flow** rate to 0.01 mL/min for a capillary IC system or 1.0 mL/min for an analytical IC system. Record the backpressure.
    d. Disconnect all components after the injection valve.
    e. One at a time, reconnect each component of the flow path. If reconnecting a component causes an abnormal increase in backpressure, replace the component. Replace as many components as necessary to resume operation at the standard operating backpressure.

3. As columns age, their backpressure increases. If the column is the source of the high backpressure, clean the column as instructed in the column manual. If this does not eliminate the problem, replace the column.

4. Observe a run to see whether the high pressure limit is triggered when injection occurs; if it is, the injection valve may be the source of the blockage (i.e., the rotor seal or stator may need to be replaced). Contact Technical Support for Dionex products for assistance.

9.14 DP/SP Does Not Start

- **Power is off**

  1. Check that the main power switch on the DP/SP rear panel is turned on.

  2. Press the **POWER** button on the front of the DP/SP to turn on the pump.

- **Flow rate is set to zero**

  Select a **Flow** rate on the Chromeleon ePanel Set.

- **While being primed, pump starts briefly and an alarm sounds**

  If the high pressure limit was tripped:

  1. Check that the priming valve on the secondary pump head is opened (see Figure 2-3). To open the valve, turn the knob one-half turn counterclockwise.

  2. Check fittings for overtightening. Check tubing for crimping and replace it as needed (see Section 10.2). Be careful not to overtighten fittings.

  If the low pressure limit was tripped:

  1. Verify that the **Minimum Pressure** setting is set to the correct value.

  2. Make sure there are no liquid leaks in the flow system. To find and eliminate the source of a leak, see Section 9.16.

  If an audit trail error message is displayed, see the troubleshooting steps listed for the particular message.

9.15 DP/SP Stops Unexpectedly

- **Instrument method (or other remote input) instructed the pump to stop**

  If no error message is displayed in the audit trail, the DP/SP was probably instructed to stop by the Chromeleon instrument method or other remote signal source. If you do not want the pump to stop, take the appropriate preventive action (edit the instrument method or the settings of the other remote signal source).

- **Low pressure limit was tripped**

  See the troubleshooting steps on page 251 for this audit trail message: "Pressure fallen below lower limit."

- **High pressure limit was tripped**

  See the troubleshooting steps on page 253 for this audit trail message: "The system pressure exceeded the safety limit."

- **Electrical connections incorrectly installed**

  The electrical cables may not be properly installed. For assistance, contact Technical Support for Dionex products.

  NOTE The Dionex ICS-6000 IC system electronics components cannot be serviced by the user.

9.16 DP/SP Liquid Leaks/Leak Alarm

NOTE After eliminating the source of a leak, always dry the leak sensor thoroughly. If the leak sensor is not dry, it will remain activated and will continue to report a leak to the Chromeleon audit trail.

- **Defective piston seal**

  Check the pump heads for leaks. If there is any leakage, tighten the fitting connections just enough to stop the leak. Dry the components. If the pump head continues to leak, replace the piston seal (see Section 10.5).

- **Leaking check valve**

  If the leaking check valve is securely tightened but allows leaks despite this, the valve is defective. Replace both check valve cartridges (see Section 10.4).

  If the leaking check valve is loose, follow these steps to tighten it:

  1. Turn off the pump.
  2. Loosen the check valve enough to allow it to turn freely.
  3. Tighten the check valve fingertight, and then tighten it one-quarter turn with a 1/2-inch wrench.
  4. If the check valve continues to leak, tighten it an additional one-quarter turn with the 1/2-inch wrench.
  5. If the check valve continues to leak, it is defective. Replace both check valve cartridges (see Section 10.4).

- **Eluent proportioning valve leaks (gradient pump only)**

  Tighten loose fittings. If there are no loose fittings, the proportioning valve assembly should be replaced. For assistance, contact Technical Support for Dionex products.

- **Priming valve knob leaks**

  If leaks occur when the priming valve knob is open, close the knob *completely* and then open it one-half to three-quarters turn. If this does not stop the leakage, replace the seal in the priming valve knob (see Section 10.8).

  If leaks occurs when the priming valve knob is closed, either the pump head or the knob is damaged and should be replaced. For assistance, contact Technical Support for Dionex products.

- **Excessive system backpressure**

  If system backpressure is substantially higher than the normal operating backpressure for the currently configured system (including the column), tubing may be plugged or overtightened. See the troubleshooting steps on page 253 for this audit trail message: “The system pressure exceeded the safety limit.”

9.17 Vacuum Degassing Module Low Vacuum

- **Leak in the vacuum degassing module**

  Check all tubing connections for leakage; tighten loose fitting connections.

9.18 Vacuum Degassing Module Does Not Run

- **Electrical connections incorrectly installed**

  There may be a problem with the connections from the vacuum degassing module to the CPU board. For assistance, contact Technical Support for Dionex products.

  NOTE The Dionex ICS-6000 IC system electronics components cannot be serviced by the user.

9.19 DP/SP Digital I/O Port Inoperative

- **TTL input-related error**

  1. The TTL input mode must match the signal type output by the device connected to the pump. Check the user's manual for the device to verify that the correct signal type is selected.
  2. A programming error occurred in the device sending the signal. Refer to the user's manual for the device for troubleshooting assistance.

- **TTL/Relay output-related error**

  1. A programming error occurred in the device sending the signal. Refer to the user's manual for the device for troubleshooting assistance.
  2. The device being triggered may require a TTL, not a relay. Connect the device to a pump TTL output.

9.20 Troubleshooting EG Error Messages

If any of the following alarm conditions occurs, a message is displayed in the Chromeleon audit trail.

Command not executed because a calibration command is already running.

This error occurs if you enter a command (of any type) while Chromeleon is executing a calibration command.

To troubleshoot:

Wait for the calibration command to finish running before entering a new command.

Command not executed because a diagnostic command is already running.

This error occurs if you enter a command (of any type) while Chromeleon is executing a diagnostic command.

To troubleshoot:

Wait for the diagnostic command to finish running before entering a new command.

Concentration out of range! The maximum value at time %1 is %2.

-or-

Concentration out of range! The maximum value is %1.

The allowable eluent concentration depends on the flow rate and the Dionex EGC type. This message appears if the selected eluent concentration is out of range for the flow rate. The time indicated in the message refers to the time specified in the Chromeleon instrument method.

To troubleshoot:

Check the information in Section 4.9 to verify that the selected concentration is within the accepted range for the cartridge type and flow rate. Adjust the flow rate or concentration as needed.

CR-TC1 open circuit.

-or-

CR-TC2 open circuit.

To troubleshoot:

1. Check that the Dionex CR-TC 600 is correctly plugged into the EG. Push the Dionex CR-TC 600 electrical cable firmly into the **CR-TC 1** (or **CR-TC 2**) bulkhead connector. Twist the ring on the cable connector fingertight to secure it.
2. If the error persists, the Dionex CR-TC 600 may be faulty. Replace the Dionex CR-TC 600 (see Section 10.13).

CR-TC1 over current.

-or-

CR-TC2 over current.

This error occurs when the current applied to the Dionex CR-TC 600 exceeds the maximum current allowed. (The Dionex CR-TC 600 current will be turned off automatically to prevent damage to the column.) This error may also occur if liquid flow to the Dionex CR-TC 600 is interrupted.

To troubleshoot:

1. Check the Dionex CR-TC 600 cable connection to the electrical bulkhead (see Figure 2-10).
2. See Section 9.24 to determine why liquid flow stopped.

3. If the error message appears again, contact Technical Support for Dionex products for assistance. The Dionex CR-TC 600 control electronics may have malfunctioned.

NOTE The Dionex ICS-6000 IC system electronics components cannot be serviced by the user.

CR-TC1 stopped because EGC1 OFF.

-or-

CR-TC2 stopped because EGC2 OFF.

This error occurs if you attempt to turn on the Dionex CR-TC 600 when the Dionex EGC is turned off. The Dionex CR-TC 600 current will be turned off automatically to prevent damage to the Dionex CR-TC 600.

To troubleshoot:

Verify that the pump flow and the Dionex EGC are on before turning on the Dionex CR-TC 600.

CR-TC1 stopped due to zero flow.

-or-

CR-TC2 stopped due to zero flow.

This error occurs if you turn off the pump flow while the Dionex EGC current (and Dionex CR-TC 600) are on. (The Dionex CR-TC 600 current will be automatically turned off to prevent damage to the column.)

To troubleshoot:

If the pump stopped unexpectedly, follow the troubleshooting steps in Section 9.24.

CR-TC mode will be turned off for invalid flow. Flow range for analytical EGC: 0.100 – 3.000 mL/min, capillary EGC: 0.001 – 0.100 mL/min.

This error occurs when the flow to the Dionex CR-TC 600 is out of range or the Dionex EGC is not linked to a pump.

To troubleshoot:

1. Set the flow rate to a value within the allowed range. See Appendix A for flow rate specifications.
2. Check the Dionex EGC configuration properties in the Chromeleon Instrument Configuration Manager to verify that the pump and Dionex EGC are linked.

Current linked pump is analytical. Please install an analytical EGC.

-or-

Current linked pump is capillary. Please install a capillary EGC.

This error occurs if the type of pump linked to the Dionex EGC does not match the Dionex EGC type. A capillary Dionex EGC must be used only with a capillary pump; an analytical Dionex EGC must be used only with an analytical pump.

To troubleshoot:

1. Install the correct type of Dionex EGC for the pump type.
2. For a hybrid system (a dual system with both an analytical and a capillary pump), check the Dionex EGC configuration properties in the Chromeleon Instrument Configuration Manager to verify that the correct pump is linked to the Dionex EGC.

EG1 cartridge disconnected.

-or-

EG2 cartridge disconnected.

This error occurs if Chromeleon sends a command to set an EG parameter when the Dionex EGC is disconnected.

To troubleshoot:

1. Make sure the Dionex EGC cable is securely plugged into the EG (see Figure 2-10) and the locking ring is tightened.
2. If the error message appears again, contact Technical Support for Dionex products for assistance. The Dionex EGC control electronics may have malfunctioned.

NOTE The Dionex ICS-6000 IC system electronics components cannot be serviced by the user.

EG1 invalid activation date.

-or-

EG2 invalid activation date.

This error occurs if the activation date for the Dionex EGC is not a valid date. This may indicate a problem with the memory chip in the Dionex EGC.

To troubleshoot:

1. Make sure the Dionex EGC cable is securely plugged into the EG (see Figure 2-10) and the locking ring is tightened.
2. If the error message appears again, contact Technical Support for Dionex products for assistance.

EG1 invalid concentration.

-or-

EG2 invalid concentration.

This error occurs if the eluent concentration is outside the range allowed by the EG. This may indicate corrupted memory or a problem in the EG instrument control firmware.

To troubleshoot:

Contact Technical Support for Dionex products for assistance.

NOTE The Dionex ICS-6000 IC system electronics components and instrument control firmware cannot be serviced by the user.

EG1 invalid flow.

-or-

EG2 invalid flow.

This error occurs if the flow rate is set to a value the EG does not support.

To troubleshoot:

Set the flow rate to a value within the allowed range. See Appendix A for flow rate specifications.

EG1 invalid flow rate-concentration.

-or-

EG2 invalid flow rate-concentration.

This error occurs if the selected concentration is too high for the current flow rate.

To troubleshoot:

Set the flow rate to a value within the allowed range. The allowable eluent concentration for a particular application depends on several factors: the flow rate, suppressor type, Dionex EGC type, and cartridge configuration. For details, see Section 4.8.

EG1 invalid ion count.

-or-

EG2 invalid ion count.

This error occurs if the ion count reported by the Dionex EGC is invalid. This may indicate a problem with the memory chip in the Dionex EGC.

To troubleshoot:

1. Make sure the Dionex EGC cable is securely plugged into the EG (see Figure 2-10) and the locking ring is tightened.
2. If the error message appears again, contact Technical Support for Dionex products for assistance.

EG1 invalid serial number.

-or-

EG2 invalid serial number.

This error occurs if the serial number reported by the Dionex EGC is invalid. This may indicate a problem with the memory chip in the Dionex EGC.

To troubleshoot:

1. Make sure the Dionex EGC cable is securely plugged into the EG (see Figure 2-10) and the locking ring is tightened.
2. If the error message appears again, contact Technical Support for Dionex products for assistance.

EG1 over current.

-or-

EG2 over current.

This error occurs when the current applied to the Dionex EGC exceeds the maximum current allowed. The Dionex EGC current will be automatically turned off to prevent damage to the cartridge.

This error may also occur if the liquid flow to the cartridge is interrupted.

To troubleshoot:

1. Make sure the Dionex EGC cable is securely plugged into the EG (see Figure 2-10) and the locking ring is tightened.
2. See Section 9.24 to determine why there is no flow.
3. If the error message appears again, contact Technical Support for Dionex products for assistance. The cartridge control electronics may have malfunctioned.

NOTE The Dionex ICS-6000 IC system electronics components cannot be serviced by the user.

EG1 over power.

-or-

EG2 over power.

This error occurs when, in order to maintain the selected current, the power supply is required to supply a higher voltage than the Dionex EGC can support.

To troubleshoot:

Replace the Dionex EGC (see Section 10.12).

EG1 over voltage.

-or-

EG2 over voltage.

This error occurs when the voltage applied to the Dionex EGC exceeds the maximum voltage allowed. The Dionex EGC will be automatically turned off to prevent damage to the cartridge.

This error may also occur if the liquid flow to the cartridge is interrupted.

To troubleshoot:

1. See Section 9.24 to determine why there is no flow.

2. If the error message appears again, contact Technical Support for Dionex products for assistance. The Dionex EGC control electronics may have malfunctioned.

   NOTE The Dionex ICS-6000 IC system electronics components cannot be serviced by the user.

EGC-1 is not linked to a compatible pump.

-or-

EGC-2 is not linked to a compatible pump.

This error occurs if the type of pump linked to the Dionex EGC does not match the Dionex EGC type. A capillary Dionex EGC can only be used with a capillary pump; an analytical Dionex EGC can only be used with an analytical pump.

To troubleshoot:

1. Install the correct type of Dionex EGC for the pump type.
2. For a hybrid system (a dual system with both an analytical and a capillary pump), check the Dionex EGC configuration properties in the Chromeleon Instrument Configuration Manager to verify that the correct pump is linked to the Dionex EGC.

EG1 wrong cartridge error.

-or-

EG2 wrong cartridge error.

This error occurs when the Dionex EGC plugged into an EG is not supported for use with your system.

To troubleshoot:

See Table 2-3 for a list of the supported Dionex EGC types for capillary and analytical IC systems.

EGC cannot be used due to invalid ion count.

This error occurs if the ion count reported by the Dionex EGC is invalid. This may indicate a problem with the memory chip in the Dionex EGC.

To troubleshoot:

1. Make sure the Dionex EGC cable is securely plugged into the EG (see Figure 2-10) and the locking ring is tightened.
2. If the error message appears again, contact Technical Support for Dionex products for assistance.

EGC is either not installed or not supported. Please install a capillary EGC.

-or-

EGC is either not installed or not supported. Please install an analytical EGC.

This error occurs if no Dionex EGC cartridge is connected to the EG, or if the cartridge is the wrong type. A capillary Dionex EGC can only be used with a capillary pump; an analytical Dionex EGC can only be used with an analytical pump.

To troubleshoot:

1. Install the correct type of Dionex EGC for the pump type.
2. For a hybrid system (a dual system with both an analytical and a capillary pump), check the Dionex EGC configuration properties in the Chromeleon Instrument Configuration Manager to verify that the correct pump is linked to the Dionex EGC.

Flash memory reset to defaults.

This error indicates a malfunction in the system electronics.

To troubleshoot:

Contact Technical Support for Dionex products for assistance.

NOTE The Dionex ICS-6000 IC system electronics components cannot be serviced by the user.

Hardware is not installed.

This error occurs if the hardware required for a Chromeleon instrument method is not installed in the system.

To troubleshoot:

Install the required hardware.

Leak sensor wet.

This error occurs when liquid accumulates in the drip tray in the bottom of the EG.

To troubleshoot:

1. Locate the source of the leak by visually inspecting the tubing, fittings, and components in the EG.
2. Tighten fittings (or replace tubing and fittings) as required (see Section 10.10). See Section 9.23 for detailed troubleshooting of various types of leaks.
3. After fixing the leak, dry the drip tray and leak sensor thoroughly to prevent the leak sensor from triggering additional error messages.

pH modifier must be used with a different type of cartridge.

This error occurs if you attempt to configure a Dionex EPM 500 Electrolytic pH Modifier with an incompatible Dionex EGC.

To troubleshoot:

Verify that the Dionex EPM 500 is paired with a Dionex EGC 500 K_2CO_3. The Dionex EPM 500 cannot be used with any other cartridge type.

Pump is disconnected. The EG and CR-TC modes are turned off.

This error occurs if the pump linked to the EG is disconnected from Chromeleon. To prevent damage to the Dionex EGC and CR-TC 600, the respective mode is automatically turned off to prevent operation of the EG when there is no flow.

The CR-TC mode is off for a virtual pump.

This error occurs if you try to turn on the Dionex CR-TC 600 when a "live" EG is linked to a virtual pump. The mode is turned off automatically to ensure that the EG does not operate when there is no flow.

The EG mode is off due to pump pressure alarm or leak.

This error occurs if the pump flow is turned off because of a pump pressure alarm or leak. The EG is automatically turned off to prevent damage to the Dionex EGC.

To troubleshoot:

Check the troubleshooting information for the pump in Section 9.15 and Section 9.16.

The EG mode is off for a virtual pump.

This error occurs if you try to turn on the Dionex EGC when a "live" EG is linked to a virtual pump. To prevent damage to the Dionex EGC, the mode is automatically turned off to ensure that the EG does not operate when there is no flow.

9.21 EG ALARM LED Is Lighted

- **Leaking fitting**

  Locate the source of the leak. Tighten or replace liquid line connections as needed (see Section 10.10).

- **Blocked or improperly installed waste line**

  Check the EG waste lines to be sure they are not crimped or otherwise blocked. Make sure the lines are not elevated at any point after they exit the EG.

- **EGC leaks**

  Replace the Dionex EGC (see Section 10.12).

- **RFIC$^+$ Eluent Degasser leaks**

  Replace the Dionex RFIC$^+$ Eluent Degasser (see Section 10.14).

- **EGC electrical connection is open**

  1. Tug gently on the Dionex EGC electrical cable; the locking connector should hold the cable in place (see Figure 2-10).
  2. If the electrical cable is fully seated but the problem persists, the cartridge is defective and must be replaced (see Section 10.12).

- **EGC input electrical connection has shorted out**

  Replace the Dionex EGC (see Section 10.12).

- **Electrical error**

  The EG current and/or voltage may have become unstable. Contact Technical Support for Dionex products for assistance.

NOTE The Dionex ICS-6000 IC system electronics components cannot be serviced by the user.

9.22 EG POWER LED Fails to Light

- **No power**

  Check that the **POWER** button on the front of the EG is turned on.

  Check that the EG main power switch (on the rear panel) is turned on.

  Check that the main power cord is plugged into both the EG rear panel connector and the power source. Check that the wall outlet has power.

  If the **POWER** LED still fails to light, contact Technical Support for Dionex products for assistance.

9.23 Liquid Leaks in the EG

- **Leaking fitting**

  Locate the source of the leak. Tighten or replace liquid line connections as needed (see Section 10.10).

- **Blocked or improperly installed waste line**

  Check the EG waste lines to be sure they are not crimped or otherwise blocked. Make sure the lines are not elevated at any point after they exit the EG.

- **EGC leaks**

  Replace the Dionex EGC (see Section 10.12).

Analytical IC

- **(Analytical IC only) RFIC$^+$ Eluent Degasser leaks**

  Replace the analytical IC system Dionex RFIC$^+$ Eluent Degasser (see Section 10.14).

9.24 No Flow

- **DP/SP power is off**

  Turning off the DP/SP automatically turns off the EG and the suppressor. Current to the Dionex CR-TC 600 is automatically turned on and off when the EG power is turned on and off.

  Check that the power to the DP/SP is turned on. Prime the pump (see Section 10.3) and resume operation.

- **DP/SP pressure limit tripped**

  Verify that the **Current Pressure** reading on the Chromeleon ePanel Set is between the high and low limits displayed on the panel. For details, see Section 4.7.

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

Analytical IC

- **(Analytical IC only) RFIC$^+$ Eluent Degasser tubing is ruptured**

  If flow from the EG waste line is normal but there is no flow through the columns, the tubing assembly inside the analytical IC system Dionex RFIC$^+$ Eluent Degasser has ruptured. Replace the degasser (see Section 10.14).

9.25 EG Stops Operation

- **DP/SP power is off**

  Turning off the DP/SP automatically turns off the EG and the suppressor. Current to the Dionex CR-TC 600 is automatically turned on and off when the EG power is turned on and off.

  Check that the power to the DP/SP is turned on. Prime the pump (see Section 10.3) and resume operation.

- **DP/SP pressure limit tripped**

  Verify that the **Current Pressure** reading on the Chromeleon ePanel Set is between the high and low limits displayed on the panel. For details, see Section 4.7.

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

- **DP/SP flow rate is too low or too high**

  For a capillary IC system, select a flow rate between 0.001 and 0.100 mL/min. For an analytical IC system, select a flow rate between 0.100 and 3.000 mL/min.

- **Electrical error detected (ALARM LED is lighted)**

  To prevent damage to the Dionex EGCs, the DP/SP automatically turns off electrical power to the cartridge when excessive current or voltage is detected. Contact Technical Support for Dionex products for assistance.

  NOTE The Dionex ICS-6000 IC system electronics components cannot be serviced by the user.

- **EGC is expended**

  Replace the cartridge (see Section 10.12).

- **No communication with Chromeleon**

  1. Check that the **POWER** button on the front of the EG is turned on.
  2. Check that the EG main power switch (on the rear panel) is turned on.
  3. Check that the main power cord is plugged into both the EG rear panel connector and the power source. Check that the wall outlet has power.
  4. Check the USB connections:
     - The EG should be connected to the DP/SP (or other Dionex ICS-6000 module) via a USB cable (P/N 960777).

- In addition, one module in the system must be connected to the PC on which Chromeleon is installed.

5. Check that the EG is configured in Chromeleon and is assigned to an instrument in Chromeleon.

9.26 Troubleshooting DC Error Messages

If any of the following alarm conditions occurs, a message is displayed in the Chromeleon audit trail.

CD cell option disconnected.

To troubleshoot:

1. Check the detector connection: An electronics connector on the back of the detector plugs into a receptacle on the detector compartment. Push on the upper part of the detector (see Figure 9-3) to ensure that the connector is securely connected.

Figure 9-3. *Conductivity Detector Connection*

2. If the error persists, there may be a problem in the detector electronics. Contact Technical Support for Dionex products for assistance.

NOTE The Dionex ICS-6000 IC system electronics components cannot be serviced by the user.

CD cell over safe temperature.

This error occurs when the temperature of the conductivity detector is higher than the maximum allowed. This error may occur if the Dionex ICS-6000 IC system is operating in an environment in which the temperature is greater than 40 °C (104 °F).

To troubleshoot:

1. See Appendix A for environmental specifications.
2. Verify that the compartment set point is at least 5 °C less than the CD cell set point.
3. Check the suppressor current setting. Running the suppressor at a higher current than is recommended for the application can cause heat up of the CD cell.

Column over safe temperature.

This error occurs when the temperature of the column compartment exceeds the maximum allowed. This error may occur if the Dionex ICS-6000 IC system is operating in an environment in which the temperature is greater than 40 °C (104 °F).

To troubleshoot:

See Appendix A for environmental specifications.

Column temperature calibration error.

To troubleshoot:

Repeat the calibration procedure. Follow the instructions provided in the DC Temperature Calibration Kit (P/N 063782). If the error persists, contact Technical Support for Dionex products for assistance.

Column temperature open circuit.

This error may indicate a problem in the detector electronics. Contact Technical Support for Dionex products for assistance.

NOTE The Dionex ICS-6000 IC system electronics components cannot be serviced by the user.

Compartment over safe temperature.

This error occurs when the temperature of the DC lower compartment is higher than the maximum allowed. This error may occur if the Dionex ICS-6000 IC system is operating in an environment in which the temperature is greater than 40 °C (104 °F).

To troubleshoot:

See Appendix A for environmental specifications.

Compartment temperature calibration error.

To troubleshoot:

Repeat the calibration procedure, following the instructions provided in the DC Temperature Calibration Kit (P/N 063782). If the error persists, contact Technical Support for Dionex products for assistance.

Compartment temperature open circuit.

This error may indicate a problem in the detector electronics. Contact Technical Support for Dionex products for assistance.

NOTE The Dionex ICS-6000 IC system electronics components cannot be serviced by the user.

ED cell current exceeds limits error.

This error can have multiple causes (for example, a cell potential that is too high for a given salt concentration, a cell potential that is too high because the reference mode is incorrect, injection of excessive amounts of electroactive analytes, a damaged or incorrectly installed cell gasket, or an electrical short between two of the three electrodes).

To troubleshoot:

1. Turn off the cell voltage. Excessive currents can change or even damage the working electrode.
2. Turn off the pump flow.
3. Disassemble the cell (see Section 10.27.3) and check for evidence of liquid and salt bridges that can cause shorts. Rinse the cell surface and dry it with a clean, lint-free towel. Replace the cell gasket.
4. Verify that the correct electrode material, waveform potentials, and reference mode are selected for the application being run.
5. Restart the flow and select DC amperometry mode. Apply cell potential in steps increasing toward the detection potential (the potential of the integration period in integrated amperometric detection). If the current becomes excessive again, try a new working electrode or another cell, if available.

ED cell option disconnected.

To troubleshoot:

1. Check the detector connections: Verify that the signal cable from the cell is connected to the appropriate connector on the detector block (see Figure 9-4). Also, push firmly on the detector to ensure that the

electronics connector on the back of the detector is securely connected to the receptacle on the detector compartment.

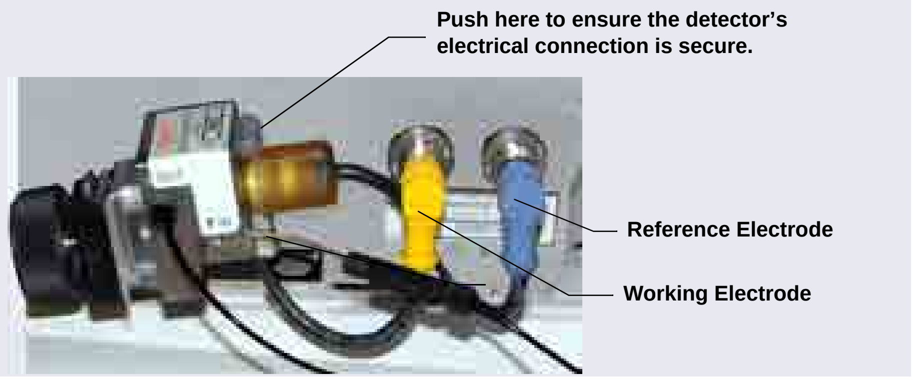


Figure 9-4. *Electrochemical Detector Connection (Analytical Cell Shown)*

If the error persists, contact Technical Support for Dionex products for assistance. The detector electronics may have malfunctioned.

NOTE The Dionex ICS-6000 IC system electronics components cannot be serviced by the user.

ED cell working electrode disconnected.

This error occurs when the cable on the working electrode is disconnected from the cell electronics.

To troubleshoot:

Check the cable connection: Verify that the signal cable from the working electrode is connected to the detector block (see Figure 9-4).

ED pH offset calibration failed.

This error occurs when the pH reading differs by more than 1.0 pH unit from 7.0, which is the value specified for offset calibration. This can be caused by too large a change in the Ag/AgCl reference potential or by a damaged glass membrane in the pH sensing part of the reference electrode

To troubleshoot:

1. Check the buffer selection.
2. Verify that the electrode is properly immersed in the calibration buffer.
3. Repeat the calibration procedure (see Section 10.27.6). If the error recurs, repeat the calibration at least one more time.
4. If the error recurs after repeating the calibration at least two times, replace the Ag/AgCl reference electrode (see Section 10.27.5).

ED pH slope calibration failed.

This error occurs when the pH sensing glass membrane of the Ag/AgCl reference electrode is broken or otherwise affected causing the calibration slope to deviate by more than ±10% from the theoretical slope of 59 mV/pH unit at 25 °C.

To troubleshoot:

1. Make sure the calibration temperature is as close as possible to 25 °C.
2. Verify that the correct buffer is being used and that the electrode is properly immersed in the calibration buffer.
3. Repeat the calibration procedure (see Section 10.27.6). If the error recurs, repeat the calibration at least one more time.
4. If the error recurs after repeating the calibration at least two times, replace the Ag/AgCl reference electrode (see Section 10.27.5).

ED reference electrode disconnected.

This error occurs when the reference electrode is disconnected from the cell electronics.

To troubleshoot:

Verify that the signal cable from the reference electrode is connected to the detector block (see Figure 9-4).

Flash memory reset to defaults.

This error indicates a malfunction in the system electronics.

To troubleshoot:

Contact Technical Support for Dionex products for assistance.

NOTE The Dionex ICS-6000 IC system electronics components cannot be serviced by the user.

High-pressure valve 1 error.

-or-

High-pressure valve 2 error.

-or-

High-pressure valve 3 error.

-or-

High-pressure valve 4 error.

This error occurs if a high-pressure valve fails to switch position within 1 second of being toggled. High-pressure valves 1 and 2 are installed in the DC lower compartment (see Figure 9-5). High-pressure valves 3 and 4 are installed either in the IC Cubes or on the AM in the upper compartment (see Figure 9-6).

Figure 9-5. *High-Pressure Valves #1 and #2 (in DC Lower Compartment)*

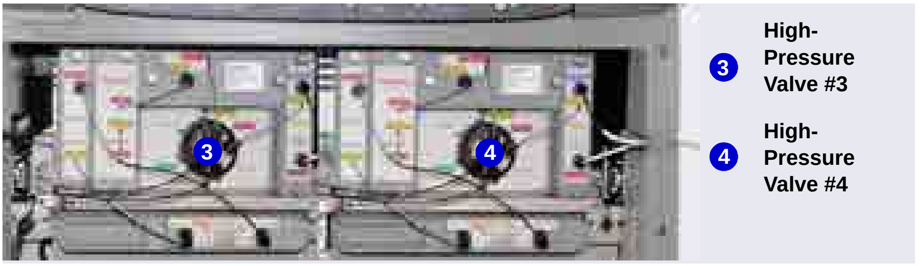


Figure 9-6. *High-Pressure Valves #3 and #4 (in IC Cubes)*

Figure 9-7. *High-Pressure Valves #3 and #4 (on AM)*

To troubleshoot:

1. If a sequence is being executed, terminate the sequence by selecting **Stop** on the Chromeleon ePanel.
2. Turn off the Dionex ICS-6000 IC system power briefly by pressing the **POWER** button on the front of each module. Then, press the **POWER** button again to restart the system.
3. From the Chromeleon ePanel, toggle each valve from Load to Inject.
4. If the problem persists, contact Technical Support for Dionex products for assistance.

I2C bus serious problem.

This error occurs if the I2C bus loses control of the real-time lock. Although consumables tracking is disabled, RFID tags can still be read and scanned.

To troubleshoot:

1. Check the orientation of all the RFID tags on the installed consumable products. Tags should be free in the air (not wrapped around a column or caught behind something).
2. If the error occurs again, contact Technical Support for Dionex products for assistance.

IC Cube 1 heater over safe temperature.

-or-

IC Cube 2 heater over safe temperature.

This error occurs when the temperature of the IC Cube heater exceeds the maximum allowed. This error may occur if the Dionex ICS-6000 IC system is operating in an environment in which the temperature is greater than 40 °C (104 °F).

To troubleshoot:

See Appendix A for environmental specifications.

Local memory allocation for flash is too small.

This error occurs if the DC loses communication with Chromeleon.

To troubleshoot:

1. Press the **POWER** button on the front of the DC to turn off the power for 30 seconds and then turn it on again.
2. If the error message appears again, contact Technical Support for Dionex products for assistance.

Lower door opened.

This error occurs when the door to the lower compartment is opened during a run.

To troubleshoot:

1. Verify that the door is fully closed.
2. Check for—and remove—any obstruction.
3. Reconnect to Chromeleon.
4. If the error persists, even when the door is fully closed, contact Technical Support for Dionex products for assistance.

Lower leak sensor wet.

The leak sensor is installed in the drip tray at the bottom of the column compartment (see Figure 10-35). 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.
2. Tighten fittings or replace tubing and fittings as required. See Section 9.27 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.

Module is in direct control.

This error occurs if you try to issue a direct control command while a direct control command is already being executed.

To troubleshoot:

Wait until the direct control command in progress is finished before issuing a another direct control command.

Reaction coil open circuit error.

This error occurs when the reaction coil heater is unplugged from the DC.

To troubleshoot:

1. Check that the reaction coil heater is correctly plugged into the component panel.
2. If the error persists, the heater may be faulty. Replace the heater (P/N 079849).

Reaction coil over safe temperature.

This error occurs when the temperature of the DC upper compartment is higher than the maximum allowed. This can occur if the Dionex ICS-6000 is operated in an environment in which the temperature exceeds 40 °C (104 °F).

To troubleshoot:

See Appendix A for environmental specifications.

RFID command sent when not ready.

This error occurs when an RFID command cannot be sent because an RFID operation is already in progress.

To troubleshoot:

Wait until the operation in progress is completed.

RFID reader initialization failed.

This error occurs if the Dionex Consumable Device Monitor is unable to start the RFID reader.

To troubleshoot:

1. Press the **POWER** button on the front of the DC to turn off the power for 30 seconds and then turn it on again.

2. If the error message appears again, contact Technical Support for Dionex products for assistance.

RFID tag 1–tag 25 error reading the user data.

–or–

RFID 1–tag 25 error writing the user data.

This error occurs if data on the corresponding RFID tag cannot be read, or if data cannot be written to the tag. The RFID tag number corresponds to the number of the consumable product listed in the Consumables Inventory window in Chromeleon or on the Consumables page in the ICS-6000 App.

To troubleshoot:

1. Check the orientation of the RFID tag on the corresponding consumable product. The tag should be free in the air (not wrapped around a column or caught behind something).
2. If the error message appears again, contact Technical Support for Dionex products for assistance.

RFID 1–tag 25 type is not recognized.

The error occurs if the consumable type is not recognized. The RFID tag number corresponds to the number of the consumable product listed in the Consumables Inventory window in Chromeleon or on the Consumables page in the ICS-6000 App.

To troubleshoot:

1. Check the orientation of the RFID tag on the corresponding consumable product. The tag should be free in the air (not wrapped around a column or caught behind something).
2. If the error message appears again, contact Technical Support for Dionex products for assistance.

Suppressor offset self-calibration error.

–or–

Suppressor slope self-calibration error.

This error occurs when an offset or slope calibration error occurs. It indicates faulty hardware.

To troubleshoot:

Contact Technical Support for Dionex products for assistance.

NOTE The Dionex ICS-6000 IC system electronics components cannot be serviced by the user.

Suppressor over-current.

This error may be caused by a depleted 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.
2. Follow the instructions in the suppressor manual to clean the suppressor.
3. If you suspect a malfunction in the suppressor controller, contact Technical Support for Dionex products for assistance.

   NOTE The Dionex ICS-6000 IC system electronics components cannot be serviced by the user.

Suppressor over-power.

This error occurs when, in order to maintain the selected current, the Dionex ICS-6000 IC system 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.
3. If the error persists, replace the suppressor (see Section 10.26.2).

Suppressor over-voltage.

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

To troubleshoot:

1. Check the suppressor cable connection.
2. If the error persists, replace the suppressor (see Section 10.26.2).

Suppressor stopped for flow rate.

This error occurs if the pump flow stops 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 9.15 for pump troubleshooting information.

Temperature below range error.

This error occurs when the temperature of the compartment, column, CD cell, reaction coil, or IC Cube is below the normal range. This may indicate a failing temperature sensor.

To troubleshoot:

1. Press the **POWER** button on the front of the DC to turn off the power; after 30 seconds, press the button again to turn on the power.
2. If the error occurs again, check the temperature sensor connection to see if it is loose or broken.

3. If the error persists, contact Technical Support for Dionex products for assistance.

Too many errors; device will be disconnected.

This error occurs if the computer on which Chromeleon is installed stops responding to commands from Chromeleon.

To troubleshoot:

Contact Technical Support for Dionex products for assistance.

NOTE The Dionex ICS-6000 IC system electronics components cannot be serviced by the user.

Upper door opened.

This error occurs when the door to the DC upper compartment is opened during a run.

To troubleshoot:

1. Verify that the door is fully closed.
2. Check for—and remove—any obstruction.
3. If the door is fully closed but the error persists, contact Technical Support for Dionex products for assistance.

9.27 Liquid Leaks from DC Components

- **Leaking fitting**

  Locate the source of the leak. Tighten or, if necessary, replace the liquid line connection (see Section 10.17).

- **Broken liquid line**

  Replace the line and fittings with tubing of the same length and internal diameter (see Section 10.17).

- **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 DC. If a line is blocked, replace it (see Section 10.17).

- **Leaking injection valve**

  1. Make sure the liquid line connections to the valve are tight. Replace any damaged fittings (see Section 10.17).
  2. If the leak is from behind the valve stator, the rotor seal may be scratched. Rebuild the injection valve (see Section 10.20).

- **Leaking cell**

  1. Check the waste lines for blockage; trapped particles can plug the lines and cause a restriction and/or leak. If necessary, clear the waste lines by reversing the direction of flow.
  2. Make sure the plumbing downstream from the cell is clear; a blockage may overpressurize the cell and cause it to leak. If the problem continues, contact Technical Support for Dionex products for assistance.

- **Leaking suppressor**

  Refer to the suppressor manual for troubleshooting procedures.

9.28 VALVE Button Not Working

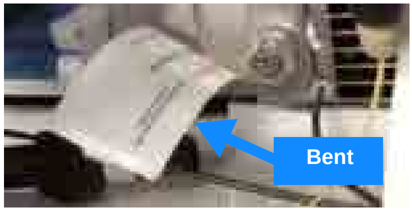
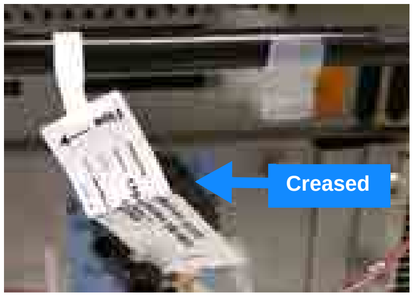
If you want to use the **VALVE 1** and **VALVE 2** buttons on the front of the DC to manually switch the inject valves, you must enable this function in Chromeleon.

To enable a button, open the Command window in Chromeleon and select the **Valve1Button** (or **Valve2Button**) command in the list of commands for the DC.

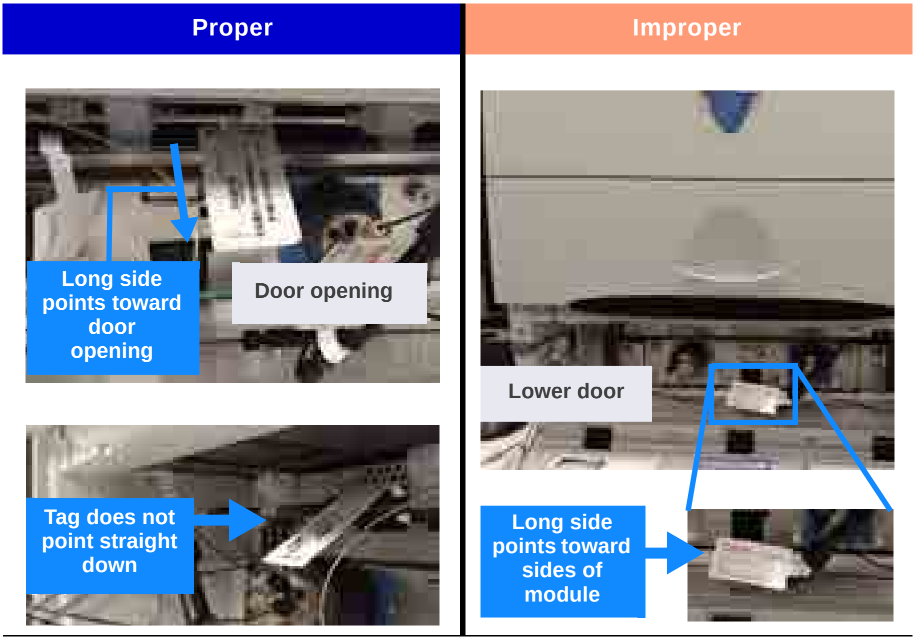
9.29 RFID Communication Error

RFID tag location and orientation are critical to ensuring reliable communication with RFID-enabled consumables. If a communication error occurs, review the guidelines below and adjust the tags as needed.

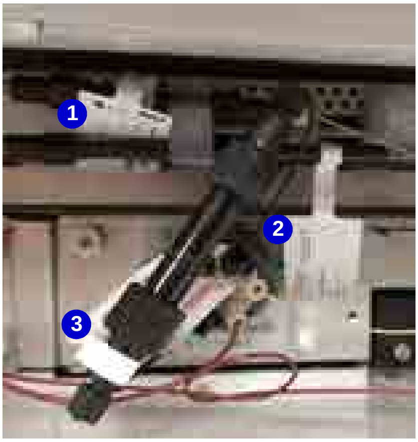
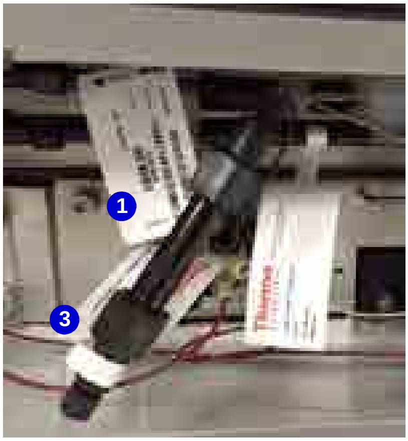
Form: Tags should not be deformed. Avoid bending or creasing tags.

Proper	Improper
	 

Rotation: Tags should be oriented so that the long side points simultaneously toward the door opening and the rear of the DC. The long side should not point toward the sides of the module. Also, tags should not point straight down.



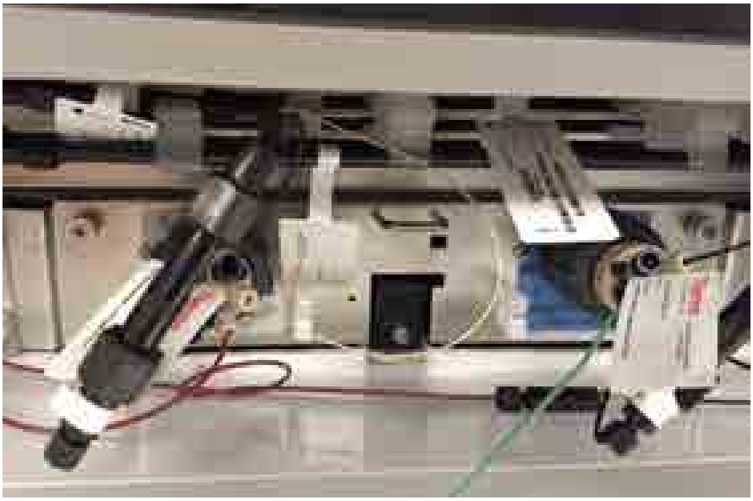
Grouping: Proper tag spacing should be maintained. Tags should not overlap or be stacked together.

<table>
<tr><th>Proper</th><th>Improper</th></tr>
<tr><td>
Proper spacing of tags is maintained.
1 Guard column tag
2 Separator column tag
3 Concentrator column tag</td><td>
The guard column tag (item 1) and the concentrator column tag (item 3) overlap each other.</td></tr>
</table>

Location: Tags should be located and oriented so that they hang freely. Tags should not be placed:

- Flat on a surface
- At the far left or far right side of the compartment
- Flat against the compartment ceiling

Proper



Improper

Tags placed flat on a surface

Improper

Tags should not be placed in the areas shown in red (the far left or far right side of the compartment)

Tag placed flat against the compartment ceiling

9.30 ED Cell Troubleshooting

9.30.1 ED Cell pH Readout Always 7.0

The pH reading of the pH-Ag/AgCl reference electrode is displayed on the Chromeleon ED ePanel.

- **Disconnected pH-Ag/AgCl reference electrode**

  Verify that the reference electrode cable is securely connected (see Figure 9-8).

Figure 9-8. *ED Cell Electrical Connections*

- **Reference electrode short circuit**

  Replace the reference electrode (see Section 10.27.5).

- **pH-Ag/AgCl reference electrode glass membrane broken or cracked**

  Replace the pH-Ag/AgCl reference electrode (see Section 10.27.5).

9.30.2 Cannot Set ED Cell pH Readout to 7.0

The pH reading of the pH-Ag/AgCl reference electrode is displayed on the ED ePanel in Chromeleon.

- **Inaccurate calibration buffer**

  Use a pH meter to check the pH of the buffer.

- **Dry pH-Ag/AgCl reference electrode**

  1. Soak the pH-Ag/AgCl reference electrode in a solution containing 1 M KCl and 1 M HCl for long enough to restore the electrode potential to within 30 mV when compared to an unexposed Ag/AgCl reference electrode. To test the pH-Ag/AgCl reference electrode potential, see “Using a Digital Voltmeter to Determine Reference Potential Shift” on page 301.
  2. Replace the pH-Ag/AgCl reference electrode (see Section 10.27.5).

  NOTE See Section 4.1.2 for instructions on how to prevent a pH-Ag/AgCl reference electrode from drying out.

9.30.3 Shift in ED Cell pH Readout

The pH readout is considered to have shifted if it is 0.5 pH units or more different from the value observed when the pH-Ag/AgCl reference electrode was new.

- **Faulty pH-Ag/AgCl reference electrode**

  1. Check the electrode by following the instructions in Section 9.30.6.
  2. Regenerate the electrode by soaking in a solution containing 1 M KCl and 1 M HCl for long enough to restore the electrode potential to within 30 mV when compared to an unexposed Ag/AgCl reference electrode. To test the pH-Ag/AgCl reference electrode potential, see “Using a Digital Voltmeter to Determine Reference Potential Shift” on page 301.
  3. If soaking does not fix the problem, replace the electrode (see Section 10.27.5).

9.30.4 No ED Cell pH Readout (or Intermittent Readout)

The pH reading is displayed on the ED ePanel in Chromeleon.

Capillary IC

- **PdH reference electrode selected**

  Select the AgCl reference electrode mode on the ED ePanel (or in the instrument method).

- **Disconnected reference electrode**

  Verify that the reference electrode cable is securely connected (see Figure 9-8).

- **Uncalibrated pH-Ag/AgCl reference electrode**

  Calibrate the pH-Ag/AgCl reference electrode (see Section 10.27.6).

- **Dry pH-Ag/AgCl reference electrode**

  1. Soak the pH-Ag/AgCl reference electrode in a solution containing 1 M KCl and 1 M HCl for long enough to restore the electrode potential to <30 mV when compared to an unexposed Ag/AgCl reference electrode. To test the electrode potential, see "Using a Digital Voltmeter to Determine Reference Potential Shift" on page 301.
  2. If soaking the pH-Ag/AgCl reference electrode does not fix the problem, replace the electrode (see Section 10.27.5).

  NOTE See Section 4.1.2 for instructions on how to prevent a pH-Ag/AgCl reference electrode from drying out.

- **Contaminated pH-Ag/AgCl reference electrode**

  Replace the pH-Ag/AgCl reference electrode (see Section 10.27.5).

9.30.5 Leak in pH-Ag/AgCl Reference Electrode Compartment

- **Defective pH-Ag/AgCl reference electrode O-ring**

  Replace the pH-Ag/AgCl reference electrode O-ring (see Section 10.27.7).

9.30.6 Shift in Ag/AgCl Reference Potential

- **Faulty pH-Ag/AgCl reference electrode**

  A shift in reference potential causes a shift in the effective potential applied to the working electrode. For example, when using an electrode with a shift of 50 mV, an applied potential of 0.1 V is equivalent to an applied potential of 0.15 V for a new pH-Ag/AgCl reference electrode with no shift.

Following the steps below, measure the pH-Ag/AgCl reference electrode potential shift by comparing it to the potential shift of an unexposed electrode. A spare pH-Ag/AgCl reference electrode (P/N 061879) stored in 3 M KCl can be kept on hand for this purpose.

Using a Digital Voltmeter to Determine Reference Potential Shift

1. For each pH-Ag/AgCl reference electrode (the unexposed electrode and the electrode being tested), use a straightened paper clip or short piece of wire of a suitable diameter to connect the voltmeter's voltage inputs to pin 1 on the reference electrode's cable connector.

   To identify the cable connector pins, refer to *Product Information Update for the Electrochemical Detector Consumables* (PIU_ED_1).

2. Immerse both electrodes in a solution of 0.1 M KCl.

3. Read the potential difference (in mV) between the unexposed electrode and the electrode being tested. If it is greater than 30 mV, try regenerating the electrode by soaking it in a solution containing 1 M KCl and 1 M HCl. If this does not reduce the potential shift, replace the electrode (see Section 10.27.7).

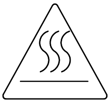
10 • Service

This chapter describes Dionex ICS-6000 service and repair procedures that users can perform. All procedures not included here, including electronics-related repair procedures, must be performed by Thermo Fisher Scientific personnel. For assistance, contact Technical Support for Dionex products. In the U.S. and Canada, call 1-800-532-4752. Outside the U.S. and Canada, call the nearest Thermo Fisher Scientific office.

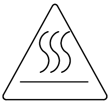
Before replacing any part, see the troubleshooting information in Chapter 9 to correctly identify the cause of the problem.

IMPORTANT

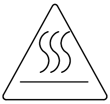
Substituting non-Dionex/Thermo Scientific parts may impair a module's performance, thereby voiding the product warranty. Refer to the warranty statement in the Dionex Terms and Conditions for more information.



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



MISE EN GARDE: Permettre aux composants chauffés de refroidir avant tout intervention.



VORSICHT: Warten Sie erhitzte Komponenten erst nachdem diese sich abgekühlt haben.

10.1 Fitting and Tube Connection Guidelines

The Dionex ICS-6000 is plumbed with two types of high-pressure fittings: IC PEEK Viper fittings, and 10-32 fitting bolts (P/N 22000-98001) with 10-32 double-cone ferrules (P/N 043276).

Installation and tightening requirements are different for each fitting type. To ensure a correct seal and avoid damage to fittings and tubing, carefully follow the installation and tightening instructions provided here.

10.1.1 Installing and Tightening Ferrule Fittings

High-pressure 10-32 fitting bolts (P/N 22000-98001) and high-pressure 10-32 double-cone ferrules (P/N 043276) are used for most Dionex ICS-6000 tubing connections, even in low-pressure systems. When connecting tubing to a port, make sure the 10-32 ferrule and fitting bolt are at least 2 mm (0.1 in) from the end of the tubing before you insert the tubing into the port. *Do not* position the ferrule and fitting bolt flush with the end of the tubing. Figure 10-1 shows the correct and incorrect placement of the ferrule and fitting bolt on the tubing,

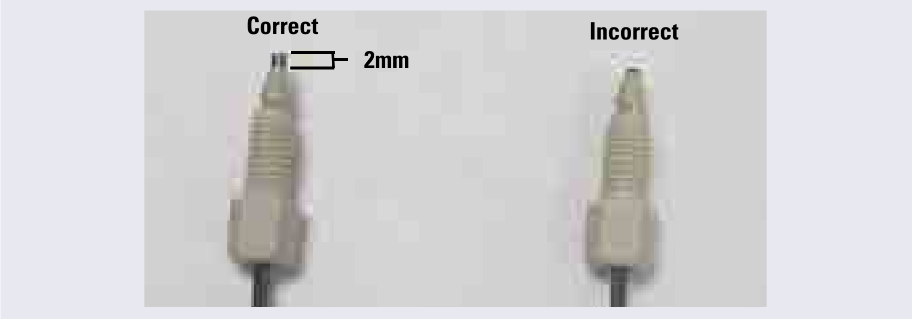
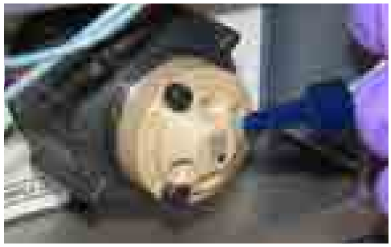


Figure 10-1. *Correct and Incorrect Ferrule and Fitting Bolt Placement for Tubing Connections (High-Pressure Fitting and Ferrule Shown)*

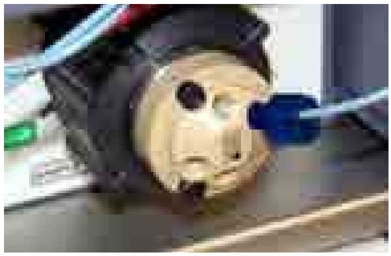
Installing a 10-32 Ferrule Fitting

1. Install the fitting bolt and ferrule onto the tubing. Position the ferrule at least 2 mm (0.1 in) from the end of the tubing (see Figure 10-1).

2. Insert the tubing into the port until it stops.



3. While maintaining pressure on the tubing to keep it in place in the port, tighten the fitting bolt fingertight.
4. Follow the instructions in the next section to tighten the fitting.



Tightening a 10-32 Ferrule Fitting

Follow these guidelines when tightening a high-pressure 10-32 fitting bolt (P/N 22000-98001) and high-pressure 10-32 double-cone ferrule (P/N 043276):

1. Use your fingers to tighten the fitting bolt as tight as you can. Then, use a wrench to tighten the fitting an additional three-quarter turn (270 degrees).
2. If leaks occur, replace the fitting bolt, ferrule, and tubing.

10.1.2 Installing and Tightening IC PEEK Viper Fittings

IC PEEK Viper fittings require much less torque to tighten than other types of PEEK fittings (although they may look similar to other fittings). The effort required to create a seal for 34 MPa (5000 psi) of pressure is similar to the effort needed to turn a dial on a combination lock. Overtightening will damage the fitting and the port. To avoid damaging the fitting and port, please follow the tightening procedure provided below.

IMPORTANT

DO NOT OVERTIGHTEN THE FITTING. Do not use any tools to tighten the fitting. IC PEEK Viper fittings require very little torque to seal.

To extend the life of IC PEEK Viper fittings, do not connect or disconnect a fitting under pressure.

When using IC PEEK Viper fittings with columns, ensure that the columns have the Viper Fittings Ready label.

Installing an IC PEEK Viper Fitting

1. IC PEEK Viper fittings are pre-installed on tubing. Specific tubing assemblies are required for the various system plumbing connections. Verify that you have the correct tubing and fitting assembly for the connection (see Section 10.2, Section 10.10, and Section 10.17).
2. Insert the tubing and fitting into the port until it stops.
3. Tighten the fitting by following the instructions in the next section.

Tightening an IC PEEK Viper Fitting

1. If the pump is on, stop the pump and allow the system to reach zero pressure.
2. Slide the Viper fitting into the port and use your fingers to gently tighten the bolt until you feel the first contact or resistance. This is the "0" mark. Then, tighten the bolt according to the following guidelines:
   - For the initial installation of the fitting: Use your fingers to tighten the bolt one-eighth of a turn from the "0" mark (45° or between 1 and 2 on a clock face) (see Figure 10-2, View A).

- For subsequent installations: Use your fingers to tighten the bolt one-sixteenth of a turn from the “0” mark (22° or 4 minutes past 12 on a clock face) (see Figure 10-2, View B).

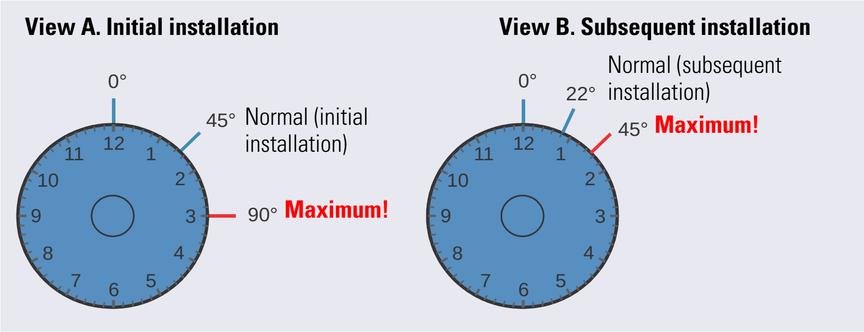


Figure 10-2. *IC PEEK Viper Fitting Installation*

3. Turn on the pump and begin operating the system at the regular operating pressure.
4. Check for leaks. If a leak is present, follow the instructions in the next section.

Fixing a Leaking IC PEEK Viper Fitting

1. Gently tighten the fitting a little more:
    - For initial installation of the fitting: Fingertighten the bolt another one-eighth turn only.
    - For subsequent installations: Fingertighten the bolt another one-sixteenth turn only.
2. If the leak continues, stop the pump and wait for the system to reach zero pressure before continuing.
3. Remove the fitting and clean it thoroughly with deionized water. Also, clean the port with deionized water and inspect it for any foreign objects or damage to the bottom of the port (for example, deformations or scratches).
4. Reinstall the fitting. If the leak continues, replace the entire Viper assembly.

10.2 Replacing DP/SP Tubing and Fittings

The DP/SP is plumbed with the tubing and fittings listed below.

NOTE IC PEEK Viper tubing assemblies are available individually or in Tubing Kits. For details, see Appendix B.

Tubing Size and Type	Color	P/N	Used to connect…
Pump outlet tubing assembly: 0.25 mm (0.010 in) ID PEEK, 86 cm (34 in)	Black	068568	Pulse damper outlet (capillary pumps) or static valve outlet (standard bore analytical pumps) to Dionex EGC inlet or injection valve
0.125 mm (0.005 in) ID PEEK, 86 cm (34 in)	Red	044221 (1 in)	Microbore analytical pumps only: Static valve outlet to Dionex EGC inlet or injection valve
0.25 mm (0.010 in) ID PEEK, 10 cm (4 in)	Black	082647 (1 in) (capillary) 042690 (1 in) (analytical)	Primary and secondary pump heads
0.51 mm (0.020 in) ID PEEK, 13 cm (5 in)	Orange	042855 (1 in)	Microbore systems only: Proportioning/eluent valve to inlet check valve
1.02 mm (0.040 in) ID PEEK, 13 cm (5 in)	Tan	054410 (1 in)	Standard bore systems only: Proportioning/eluent valve to inlet check valve
0.159 cm (0.0625 in) ID PharMed™	Yellow	063268 (1 in)	Peristaltic pump to primary pump head
0.15 cm (0.060 in) ID Tygon™ 2075	Colorless	064079 (1 in)	• Peristaltic pump to seal wash reservoir • Between pump heads for seal wash

Table 10-1. *DP/SP Tubing and Fittings*

Tubing Size and Type	Color	P/N	Used to connect…
1.58 mm (0.062 in) ID PTFE	Colorless	082645 (1 in) (capillary) 014157 (1 in) (analytical)	• Eluent reservoirs • Vacuum degassing assembly
1.58 mm (0.062 in) ID polyurethane	Colorless	047203 (1 in)	Secondary pump head to waste
10 mm (0.39 in) ID polyethylene	Colorless	055075	Drip tray drain hose
IC PEEK Viper assembly, 0.18 mm (0.007 in) ID, 864 mm (34 in)	Tan	088916	Pump output to Dionex EGC inlet
1/16 in fitting bolt 1/16 in ferrule	Tan Tan	052230 062511	Inlet check valve fitting
1/8 in fitting bolt 1/8 in ferrule	Tan Yellow	052267 048949	Eluent reservoir fittings
High-pressure 10-32 fitting bolt	Blue	22000-98001	Capillary pumps only: Pulse damper to Dionex EGC or injection valve
High-pressure 10-32 ferrule, double-cone	Tan	043276	Use with high-pressure fitting bolts
10-32 fitting bolt 10-32 ferrule, double-cone	Tan Tan	22000-98001 043276	All other tubing fittings

Table 10-1. *DP/SP Tubing and Fittings (Continued)*

Notes

- For tightening requirements for the 10-32 fitting bolt (P/N 22000-98001) and 10-32 double-cone ferrule (P/N 043276), see Section 10.1.1.
- When a 10-32 fitting bolt and 10-32 double-cone ferrule are installed, a tubing cutter can be used (except on capillary tubing) to cut tubing to the required length. Be sure the cut is at a right angle to the length of the tubing, and that there are no nicks or burrs on the end. A tubing cutter

(P/N 049584) is included in the DC Ship Kit (P/N 072011, standard DC; P/N 22171-62000, low-temperature DC). Refer to the instructions provided with the cutter for details.

- For tightening requirements for IC PEEK Viper fittings, see Section 10.1.2.
- Do not cut tubing on which IC PEEK Viper fittings are installed.

10.2.1 Cleaning Eluent Reservoirs

Before preparing new eluent, all eluent reservoirs should be rinsed thoroughly (inside and out) with ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6. If a reservoir still appears dirty, or has a slimy film on the inside, clean it as instructed below.

Capillary IC

Clean the reservoirs in a capillary IC system every 3 months, as instructed below.

1. Dispose of any remaining chemicals according to municipal regulations.
2. Rinse the reservoir (inside and out) with ASTM Type I (18 megohm-cm) filtered and deionized water.
3. Rinse the inside of the reservoir with isopropyl alcohol or methanol.
4. If algae or bacteria have left a slimy film on the reservoir, use an algicide or disinfectant (dilute hydrogen peroxide, etc.).
5. Rinse cleaning chemicals out of the reservoir with ASTM Type I (18 megohm-cm) filtered and deionized water.
6. Dry the reservoir with clean, particulate-free air.

10.3 Priming the DP/SP

Prime the pump if the eluent has been changed, the eluent line is new (empty), or the eluent line contains air. This section describes two different priming procedures:

- To prime the pump with the **PUMP PRIME** button, see Section 10.3.1.
- To prime the pump from the pump ePanel in Chromeleon, see Section 10.3.2.

Although a 10 cc syringe (P/N 079803) can be used with either priming procedure, Thermo Fisher Scientific recommends using a syringe only if eluent lines are 100% empty or if the pump is dry.

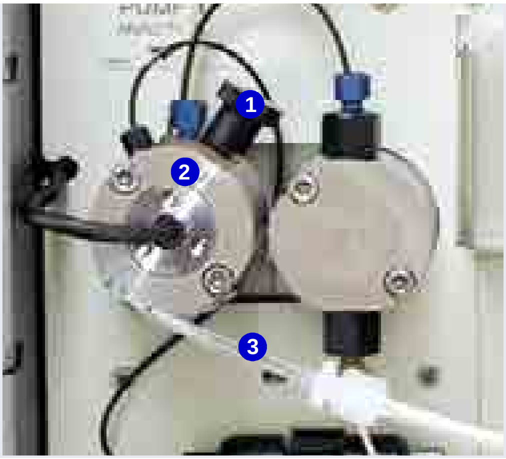
10.3.1 Priming with the PUMP PRIME Button

1. On the Chromeleon ePanel Set, click the pump tab.
2. **Gradient pump only:** Enter 100% for the channel (A, B, C, or D) to be primed.
3. Select the priming flow rate. The default rate for a capillary IC pump is 3.0 mL/min. The default rate for an analytical IC pump is 6.0 mL/min.
4. Disconnect the DP/SP from Chromeleon by clicking **Connected** on the pump ePanel.

   NOTE When the pump is connected to Chromeleon, the **PUMP PRIME** buttons are disabled.

5. Open the priming valve on the secondary pump head (see Figure 10-3) by turning it one-half turn counterclockwise.

   NOTE If the priming valve is opened too much, air is drawn through the valve and air bubbles can be seen exiting the waste line.



1 Priming Valve
2 Secondary Pump Head
3 Priming Waste Line

Figure 10-3. *DP/SP Priming Valve*

6. Press **PUMP PRIME 1** (or **PUMP PRIME 2**) on the front of the DP/SP. The pump will begin pumping at the priming flow rate selected on the Chromeleon panel.
7. Prime the pump until all air is purged and no air bubbles can be seen exiting the waste line.
8. **Gradient pump only:** To prime additional eluent lines, select another eluent channel and repeat the priming procedure.
9. After priming all eluent lines, press **PUMP PRIME 1** (or **PUMP PRIME 2**) to stop priming and return to the flow rate last selected.
10. Close the priming valve by turning it clockwise. **Do not overtighten the priming valve.**

IMPORTANT **Do not use any tools to tighten the priming valve! Overtightening may destroy the cap seal. Open or close the priming valve only when the system pressure is down.**

11. Reconnect the pump to Chromeleon by clicking **Connected** on the pump ePanel.

10.3.2 Priming from the Chromeleon ePanel

1. Open the priming valve on the secondary pump head (see Figure 10-3) by turning it one-half turn counterclockwise.

   NOTE If the priming valve is opened too much, air is drawn through the valve and air bubbles can be seen exiting the waste line.

2. On the Chromeleon ePanel Set, click the pump tab.
3. **Gradient pump only:** Enter 100% for the channel (A, B, C, or D) to be primed.
4. Select the priming flow rate. The default rate for a capillary IC pump is 3.0 mL/min. The default rate for an analytical IC pump is 6.0 mL/min.
5. Click the **Prime** button on the pump ePanel. A warning message asks you to verify that the purge (priming) valve is open. Click **Execute despite warnings**. Priming starts.

6. Prime the pump until all air is purged and no air bubbles can be seen exiting the waste line. Click the **Prime** button to stop priming.

   NOTE Priming will stop automatically after the time specified (in seconds) in the **Duration** box has elapsed. You can set the duration to a preferred value.

7. **Gradient pump only:** To prime additional eluent lines, select another eluent channel and repeat the priming procedure.

8. Close the priming valve by turning it clockwise. **Do not overtighten the priming valve.**

IMPORTANT **Do not use any tools to tighten the priming valve! Overtightening may destroy the cap seal. Open or close the priming valve only when the system pressure is down.**

9. Enter the flow rate required for your application.

10. **Gradient pump only:** Enter the required proportions of eluents A, B, C, and D on the pump ePanel.

11. Turn on the pump flow.

    NOTE After starting the pump, wait at least 5 minutes (longer for flow rates below 1.0 mL/min) before beginning an analysis. This allows the DP/SP to stabilize the flow rate.

10.4 Replacing the 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 a check valve leaks or is dirty, it should be replaced.

Capillary IC pumps and analytical IC pumps use different check valves. Before proceeding, verify that you have the correct check valve assembly for your pump type (see Table 10-2).

Pump Type	Check Valve Assembly	Part Number
Capillary IC	Inlet	044541
	Outlet	044540
Analytical IC	Inlet	045722
	Outlet	045721

Table 10-2. *DP/SP Check Valve Assemblies*

Additional items:

- Cleanroom gloves (lint-free, particle-free, and oil-free)
- 1/2-inch open-end wrench
- 0.2 micron filtered, Class 10, isopropyl alcohol (IPA)

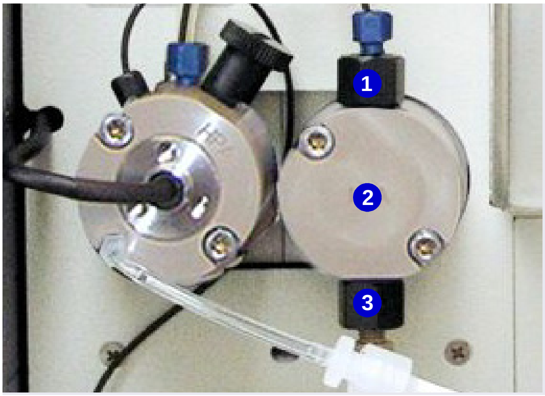
10.4.1 Removing the Check Valves

1. Turn off the pump flow.
2. Begin monitoring the **Current Pressure** reading. When the system pressure reaches zero, disconnect the pump from the software and turn off the pump.
    - For Chromeleon operation: Click **Connected** on the pump ePanel. Press the **POWER** button on the front of the DP/SP for 2 seconds to turn off the pump.
    - For ICS-6000 App operation: On the Home page, tap the pump **ON/OFF** button to turn off the pump.
3. Open the DP/SP door to access the mechanical components.

4. Five red Phillips screws are installed on the component mounting panel before shipment from the factory. Remove these screws, if present.
5. Use the handles on the component mounting panel to pull the panel forward until it reaches the stop.
6. To prevent contamination of pump parts, wear cleanroom gloves while disassembling the pump head.

IMPORTANT **Never disassemble the pump head with bare hands. Even minute particles of dust, dirt, etc. on the check valves or piston can contaminate the inside of the pump head and result in poor pump performance.**

7. The check valves are installed in the primary pump head (see Figure 10-4).



1 **Outlet Check Valve**
2 **Primary Pump Head**
3 **Inlet Check Valve**

Figure 10-4. *DP/SP Check Valves*

8. Disconnect the tubing connections from the inlet and outlet check valves.
9. Using a 1/2-inch open-end wrench, loosen both check valve assemblies.
10. Remove both check valve assemblies from the pump head.

10.4.2 Installing the New Check Valves

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

   Inspect the new inlet check valve assembly to verify that the double-hole end of the cartridge (see Figure 10-5) is visible.

   If the double-hole end is not visible, remove the cartridge from the housing and install it correctly.

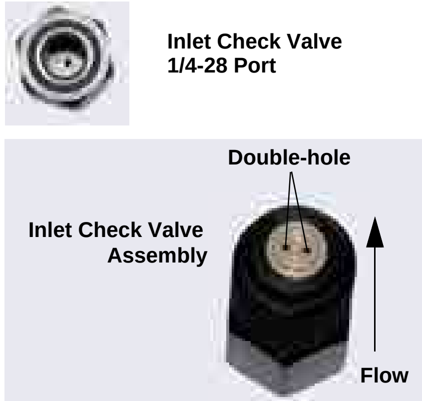


Figure 10-5. *Inlet Check Valve Assembly*

2. The *outlet* check valve assembly housing has a smaller, 10-32 port.

   Inspect the new outlet check valve assembly to verify that the single-hole end of the cartridge is visible (see Figure 10-6).

   If the single-hole end is not visible, remove the cartridge from the housing and install it correctly.

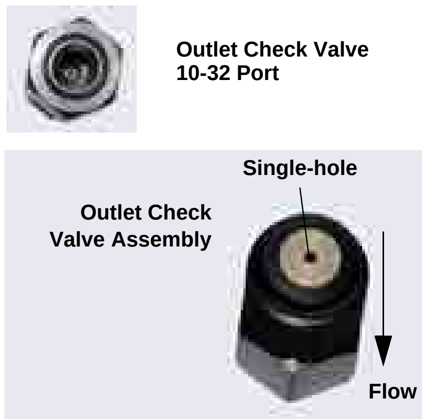


Figure 10-6. *Outlet Check Valve Assembly*

NOTE The pump cannot operate properly unless the cartridges are installed in their respective housings in the correct orientation. Liquid enters the check valve through the large single hole and exits through the small double holes.

3. Rinse the bottom of the check valve ports in each pump with isopropyl alcohol and air-dry the ports. Inspect the bottom of each port for any particulate matter. If necessary, rinse and dry again, until the ports are clean.

4. Screw the inlet check valve assembly into the port on the *bottom* of the primary pump head until contact is made. Tighten the check valve fingertight, and then use the 1/2-inch open-end wrench to tighten an additional one-quarter turn.
5. Screw the outlet check valve assembly into the port on the *top* of the primary pump head until contact is made. Tighten the check valve fingertight, and then use the 1/2-inch open-end wrench to tighten an additional one-quarter turn.
6. Tighten the check valves fingertight, and then use the 1/2-inch 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.**

7. Push the component mounting panel back into the enclosure. Close the DP/SP door.
8. Press the **POWER** button on the front of the DP/SP to turn on the pump.
9. Reconnect the pump to the software.
   - For Chromeleon operation: Click **Connected** on the pump ePanel.
   - For ICS-6000 App operation: On the Home page, tap the pump **ON/OFF** button.

10.5 Replacing Piston Seals

A defective piston seal allows leakage past the piston. This may cause unstable flow rates and baseline noise; in addition, it may make it difficult to prime the pump.

The piston seal replacement procedure consists of:

- Removing the pump head and piston (Section 10.5.1)
- Cleaning the piston (Section 10.5.2)
- Removing the main piston seal (Section 10.5.3)
- Removing the piston seal wash seal (Section 10.5.4)
- Installing new seals (Section 10.5.5)
- Reinstalling the piston and pump head (Section 10.5.6)

NOTE Capillary IC pumps and analytical IC pumps use different main piston seals and piston seal wash seals. Before continuing, verify that you have the correct seal for your pump type. Part numbers are shown in Figure 10-7 and Figure 10-8.

Before proceeding, locate the following items in your pump ship kit:

- 3.0 mm hex key (P/N 062338)
- 10-32 fitting plugs (P/N 042772)
- 10 cc syringe (P/N 079803)
- Seal insertion tool (P/N 063675)

Pump Ship Kit	Part Number
DP Ship Kit Dual Capillary	072112
DP Ship Kit Dual Analytical	062463
DP Ship Kit Capillary and Analytical	072111
SP Ship Kit Capillary or Analytical	063342

Additional items:

- Cleanroom gloves (lint-free, particle-free, and oil-free)
- Small beaker
- ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6
- Methanol (optional)
- 0.2 micron filtered, Class 10, isopropyl alcohol (IPA)
- Lint-free paper towels (KIMWIPES™ or equivalent)
- Large flat-blade screwdriver

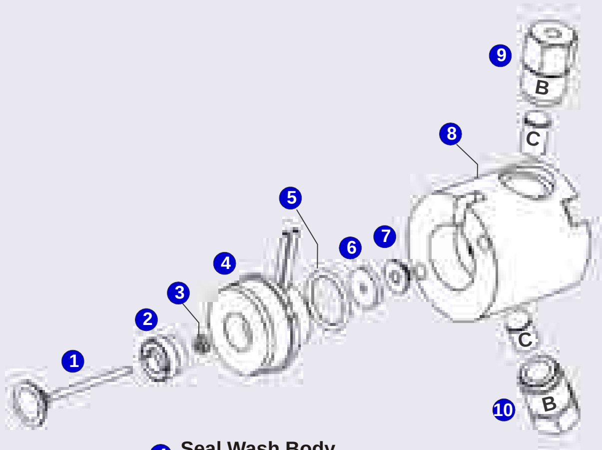
10.5.1 Removing the Pump Head and Piston

1. Turn off the pump flow.
2. Begin monitoring the **Current Pressure** reading on the pump ePanel on the Chromeleon ePanel Set. When the system pressure reaches zero:
   a. Disconnect the pump from Chromeleon by clicking **Connected** on the pump ePanel.
   b. Press the **POWER** button on the front of the DP/SP for 2 seconds to turn off the pump.
3. Open the DP/SP door to access the mechanical components.
4. Five red Phillips screws are installed on the component mounting panel before shipment from the factory. Remove these screws, if present.
5. Use the handles on the component mounting panel to pull the panel forward until it reaches the stop.
6. To prevent contamination of pump parts, wear cleanroom gloves while disassembling and reassembling the pump head.

IMPORTANT **Never disassemble the pump head with bare hands. Even minute particles of dust, dirt, etc., on the check valves or piston can contaminate the inside of the pump head and result in poor pump performance.**

7. Disconnect all tubing connections to the pump head with the defective piston seal.

8. The primary and secondary pump heads have different components. When disassembling a pump head, see Figure 10-7 for a primary pump head or Figure 10-8 for a secondary pump head.



Note: Each check valve assembly includes a valve body (**B**) and a cartridge (**C**).

1 **Piston**
P/N 068646 (Capillary)
P/N 079857 (Analytical)

2 **Seal Retainer**
P/N 068627 (Capillary)
P/N 062092 (Analytical)

3 **Piston Seal Wash Seal**
P/N 068628 (Capillary)
P/N 063382 (Analytical)

4 **Seal Wash Body**
P/N 074446 (Capillary)
P/N 075767 (Analytical)

5 **O-Ring**
P/N 040695
(Capillary and Analytical)

6 **Backup Ring**
P/N 074371 (Capillary)
P/N 074370 (Analytical)

7 **Main Piston Seal**
P/N 075493 (Capillary)
P/N 075768 (Analytical)

8 **Primary Pump Head**
P/N 082602 (Capillary)
P/N 075047 (Analytical)

9 **Outlet Check Valve Assembly**
P/N 044540 (Capillary)
P/N 045721 (Analytical)

10 **Inlet Check Valve Assembly**
P/N 044541 (Capillary)
P/N 045722 (Analytical)

Figure 10-7. *DP/SP Pump: Primary Pump Head Assembly*

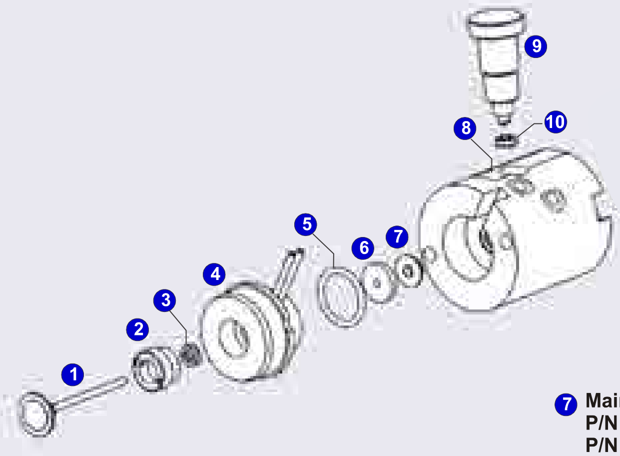


Figure 10-8. *DP/SP: Secondary Pump Head Assembly*

9. Using the 3.0 mm hex key (P/N 062338), loosen the two screws on the pump head with the defective seal. Remove the screws, and then carefully remove the head and place it on a clean surface.

10. Remove the seal wash body from the pump head. Or, if the seal wash body was not removed with the pump head in Step 9, pull it straight out of the pump mechanism now.

11. Pull the piston out of the pump mechanism.

NOTE A magnet secures the piston in place. If the magnetic force makes the piston difficult to remove, tilt the piston to one side and then pull it out of the pump mechanism.

10.5.2 Cleaning the Piston

1. Place the piston in a beaker containing either ASTM Type I (18 megohm-cm) filtered and deionized water or methanol. Sonicate for several minutes.
2. After cleaning, rinse the piston thoroughly with ASTM Type I (18 megohm-cm) filtered and deionized water. Dry it with a lint-free paper towel.
3. Inspect the piston for signs of damage. If the piston is scratched or scored, replace it (see Section 10.6).

IMPORTANT **Even minute scratches or particles of dust, dirt, etc. on the check valves or piston can contaminate the inside of the pump head and result in poor pump performance.**

10.5.3 Removing the Main Piston Seal

1. If this is the *primary* pump head, insert a 10-32 fitting plug (P/N 042772) into the 10-32 outlet hole of the check valve nut.

   If this is the *secondary* pump head, insert a 10-32 fitting plug (P/N 042772) into both the 10-32 inlet and outlet holes.
2. Using a 10 cc syringe (P/N 079803), inject a few drops of ASTM Type I (18 megohm-cm) filtered and deionized water through the main piston seal and into the piston cavity in the pump head.
3. Reinsert the piston approximately 3 mm (0.125 in) into the piston seal and press gently. The seal should pop out of the head and onto the piston.

IMPORTANT **Do not use a sharp tool (such as tweezers) to remove the piston seal. This will scratch the inside of the pump housing; these scratches will prevent a proper seal and cause leakage.**

4. If the piston seal was not removed in Step 3, follow these steps:
   a. Verify that the 10-32 fitting plugs in the inlet and outlet holes are tightened enough to prevent any leaks from the pump head.
   b. Fill the piston cavity with water and check for bubbles.
   c. If there are no bubbles, repeat Step 3.

10.5.4 Removing the Piston Seal Wash Seal

1. Remove the O-ring (P/N 040695) and the backup ring (capillary pump: P/N 074371; analytical pump: P/N 074370) from the seal wash body.
2. Follow these steps to remove the piston seal wash seal from the seal wash body:
    a. Using a large flat-blade screwdriver, remove the retainer (P/N 062092) for the seal from the seal wash body.
    b. Insert the piston into the seal wash body *from the O-ring side* and gently push the seal out of the retainer.

IMPORTANT **Do not use a sharp tool (such as tweezers) to remove the piston seal wash seal. This may scratch the seal and the inside of the pump housing; scratches will prevent a proper seal and cause leakage.**

10.5.5 Installing the Piston Seals and O-Ring

1. Follow these steps to reassemble the seal wash body:
    a. Place the seal wash body on a clean work surface.
    b. Slide the new seal wash seal, with the open side of the seal facing upward, onto the seal insertion tool (P/N 063675) (see Figure 10-9).

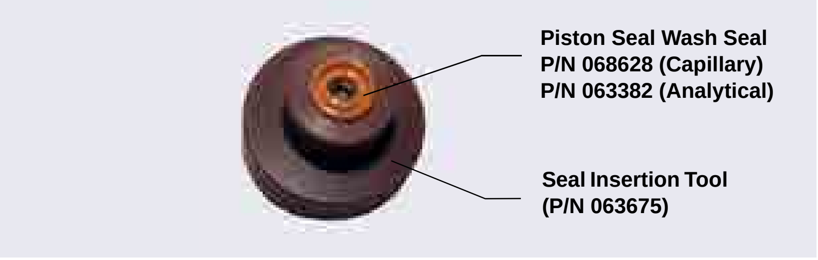


Figure 10-9. *Piston Seal Wash Seal and Seal Insertion Tool*

    c. Insert this end of the tool partway into the seal wash body. Make sure the tool is centered and does not rock back and forth. Then, press firmly on the tool and the seal wash body until they snap together.
    d. Remove the seal insertion tool from the seal wash body.

e. The seal wash seal is now partially installed. To complete the seal installation, place the retainer in the seal wash body and use the large flat-blade screwdriver to tighten the retainer.

f. Place the new O-ring (P/N 040695) on the seal wash body.

NOTE When replacing a piston seal, always replace the O-ring, also. This will prevent leaks.

g. Place the new backup ring (capillary pump: P/N 074371; analytical pump: P/N 074370) on the seal wash body.

2. Rinse the new main piston seal (capillary pump: P/N 075493; analytical pump: P/N 075768) with isopropyl alcohol (IPA) or dip it into a container of IPA. (The seal is easier to install when it is moist.)
3. Insert the piston through the seal wash assembly, and then through the new main piston seal.
4. Make sure the piston seal is centered.

IMPORTANT **If the piston seal is not centered, applying pressure to it in Step 7 will damage the seal and make it unusable.**

5. Place the front of the pump head, flat side down, on a clean work surface.

   Make sure the open side of the piston seal faces away from the retainer for the seal wash seal.

6. Using IPA, rinse inside the pump head cavity where the seal will be installed. Air-dry the cavity, and then inspect it for any particulate matter. If necessary, rinse and dry again, until the cavity is clean. Fill the cavity with ASTM Type I (18 megohm-cm) filtered and deionized water.
7. Place the components on the pump head and *gently* press the housing until the piston seal snaps into place.

   When pressing the seal in place, ensure that the piston is free to move out, to relieve the pressure in the pump head during seal installation.

IMPORTANT **Do not use a sharp tool (such as tweezers) to install the piston seal. This will scratch the seal and the inside of the pump housing; these scratches will prevent a proper seal and cause leakage.**

8. Remove the 10-32 fitting plugs from the pump head.

10.5.6 Reinstalling the Piston and Pump Head

1. Slide the piston *partway* into the pump head; approximately 6 mm (1/4 in) of the sapphire part of the piston should extend from the head.
2. Place the pump head back on the pump.
3. Reinstall the screws in the pump head. Using the 3.0 mm hex key (P/N 062338), tighten the screws just until they come into contact with the pump head. Then, tighten the screws another one-quarter to one-half turn, one-eighth of a turn at a time.
4. Reconnect all tubing connections to the pump head. Tighten connections fingertight, and then tighten an additional one-quarter turn only.
5. Push the component mounting panel back into the enclosure. Close the DP/SP door.
6. Press the **POWER** button on the front of the DP/SP to turn on the pump.
7. Reconnect the pump to Chromeleon by clicking **Connected** on the pump ePanel.
8. Turn on the pump flow.

10.6 Replacing the Piston

If a new piston seal leaks (assuming that the pump head is tight), it indicates that the piston is dirty, scratched, or broken, and should be replaced.

The piston replacement procedure consists of

- Removing the pump head and the old piston (see Section 10.6.1)
- Reinstalling a new piston (see Section 10.6.2)
- Reinstalling the pump head (see Section 10.6.3)

NOTE Capillary IC pumps and analytical IC pumps use different pistons. Before continuing, verify that you have the correct piston for your pump type (for capillary pump: P/N 068646; for analytical pump: P/N 079857).

Before proceeding, locate the 3.0 mm hex key (P/N 062338) in your pump ship kit.

Pump Ship Kit	Part Number
DP Ship Kit Dual Capillary	072112
DP Ship Kit Dual Analytical	062463
DP Ship Kit Capillary and Analytical	072111
SP Ship Kit Capillary or Analytical	063342

Additional items:

- Cleanroom gloves (lint-free, particle-free, and oil-free)
- ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6.

10.6.1 Removing the Pump Head and Piston

When disassembling and reassembling the pump head, see Figure 10-7 (primary pump head) or Figure 10-8 (secondary pump head).

1. Turn off the pump flow.
2. Begin monitoring the **Current Pressure** reading on the pump ePanel on the Chromeleon ePanel Set. When the system pressure reaches zero:
   a. Disconnect the pump from Chromeleon by clicking **Connected** on the pump ePanel.
   b. Press the **POWER** button on the front of the DP/SP for 2 seconds to turn off the pump.
3. Open the DP/SP door to access the mechanical components.
4. Five red Phillips screws are installed on the component mounting panel before shipment from the factory. Remove these screws, if present.
5. Use the handles on the component mounting panel to pull the panel forward until it reaches the stop.

6. To prevent contamination of pump parts, wear cleanroom gloves while disassembling the pump head.

IMPORTANT **Never disassemble the pump head with bare hands. Even minute particles of dust, dirt, etc., on the check valves or piston can contaminate the inside of the pump head and result in poor pump performance.**

7. Disconnect all tubing connections to the pump head with the damaged piston.
8. Using the 3.0 mm hex key (P/N 062338), loosen the Allen screws on the pump head with the damaged piston. Remove the Allen screws, and then carefully remove the head and place it on a clean surface.
9. If the piston was not removed with the pump head in Step 8, remove the piston now by pulling it straight out of the pump mechanism.

   NOTE A magnet secures the piston in place. If the magnetic force makes the piston difficult to remove, tilt the piston to one side and then pull it out of the pump mechanism.

10. If the piston is broken, be sure to remove all broken pieces. If necessary, flush the pump head with ASTM Type I (18 megohm-cm) filtered and deionized water.

10.6.2 Installing the New Piston

Slide the new piston (for capillary pump: P/N 068646; for analytical pump: P/N 079857) *partway* into the pump head; approximately 6 mm (1/4 in) of the sapphire part of the piston should extend from the head.

10.6.3 Reinstalling the Pump Head

1. Place the pump head back on the pump.
2. Reinstall the screws in the pump head. Using the 3.0 mm hex key (P/N 062338), tighten the screws just until they come into contact with the pump head. Then, tighten the screws another one-quarter to one-half turn, one-eighth of a turn at a time.

3. Reconnect all tubing connections to the pump head. Tighten connections fingertight, and then tighten an additional one-quarter turn only.
4. Push the component mounting panel back into the enclosure, using the handle in the center of the panel. Close the DP/SP door.
5. Press the **POWER** button on the front of the DP/SP to turn on the pump.
6. Reconnect the pump to Chromeleon by clicking **Connected** on the pump ePanel.
7. Turn on the pump flow.

10.7 Replacing the Piston Seal Wash Tubing

Check the piston seal wash tubing weekly for crimping or blockage, and replace as needed.

1. Turn off the pump flow.
2. Five red Phillips screws are installed on the component mounting panel before shipment from the factory. Remove these screws, if present.
3. Open the DP/SP door and then use the handles on the component mounting panel to pull the panel forward until it reaches the stop.
4. Remove the old tubing from the peristaltic pump (see Figure 10-10) as follows:
    a. Lift the lever up and to the right and hold it in that position with one hand.
    b. With your other hand, pull the PharMed tubing away from the rotor and out of the lower notch on the left side of the mounting plate.
    c. Release the lever.

d. Pull on the fitting slightly to remove the PharMed tubing from the upper notch on the pump mounting plate.

1. PharMed Tubing (P/N 063268)
2. Rotor
3. Lever
4. Mounting Plate
5. Tygon 2075 Tubing (P/N 064079)
6. Fitting

Figure 10-10. *Peristaltic Pump for Seal Wash System*

5. Pull off the PharMed and Tygon 2075 tubing from the fitting. Save the fitting.
6. Pull off all seal wash tubing from the seal wash reservoir and the primary and secondary pump heads (see Figure 10-11).
7. Cut three new pieces of Tygon 2075 tubing (0.15 cm (0.060 in) ID; P/N 064079) and one piece of PharMed tubing (0.159 cm (0.0625 in) ID; P/N 063268) to the same lengths as the tubing just removed. The tubing is included in the pump ship kit:

Pump Ship Kit	Part Number
DP Ship Kit Dual Capillary	072112
DP Ship Kit Dual Analytical	062463
DP Ship Kit Capillary and Analytical	072111
SP Ship Kit Capillary or Analytical	063342

8. Connect the new tubing pieces to the seal wash reservoir and pump heads (see Figure 10-11).
9. Push the tubing onto the fitting that was removed in Step 5.

10. Connect the PharMed tubing to the peristaltic pump as follows:
    a. Push the tubing into the lower notch on the pump mounting plate.
    b. Lift the lever to the right and hold it in that position with one hand.
    c. With your other hand, wind the tubing around the rotor.
    d. Release the lever.
    e. Pull on the fitting slightly to slide the tubing into the upper notch.
    f. Make sure there is no slack in the tubing. If necessary, lift the lever again, adjust the tubing around the rotor and through the lower notch to remove any slack, and release the lever.

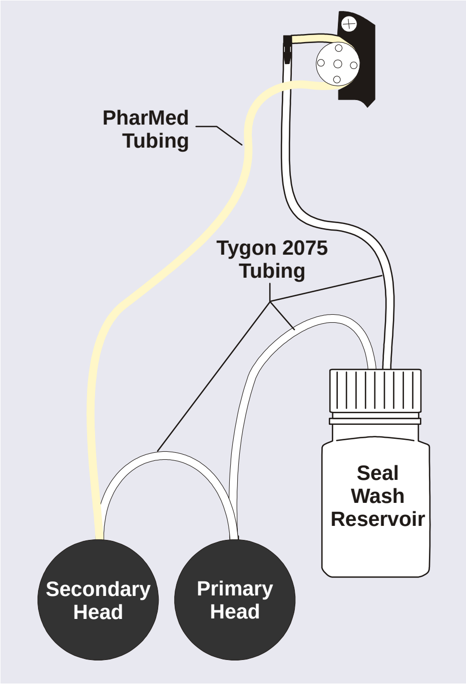


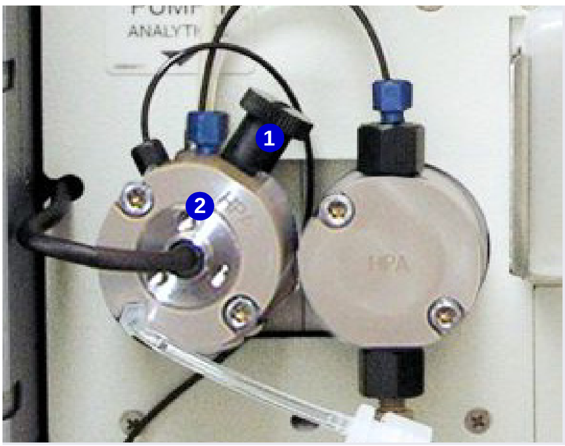
Figure 10-11. *Piston Seal Wash Tubing Connections*

11. Push the component mounting panel back into the enclosure. Close the DP/SP door.
12. Turn on the pump flow.

10.8 Replacing the DP/SP Priming Valve Knob Seal

Replace the seal in the priming valve knob if there is leakage around the valve threads when the valve is open or if the waste port leaks when the valve is closed.

1. Turn off the pump flow.
2. Begin monitoring the **Current Pressure** reading on the pump ePanel on the Chromeleon ePanel Set. When the system pressure reaches zero:
    a. Disconnect the pump from Chromeleon by clicking **Connected** on the pump ePanel.
    b. Press the **POWER** button on the front of the DP/SP for 2 seconds to turn off the pump.
3. Open the front door of the DP/SP.
4. Five red Phillips screws are installed on the component mounting panel before shipment from the factory. Remove these screws, if present.
5. Use the handles on the component mounting panel to pull the panel forward until it reaches the stop.
6. The priming valve knob is located on the secondary pump head (see Figure 10-12). To remove the knob, turn it counterclockwise all the way and then pull it straight off the pump head.



1 Priming Valve
2 Secondary Pump Head

Figure 10-12. DP/SP Priming Valve

7. Pull the old seal off the end of the priming valve knob.
8. Hold the new seal (P/N 063382) with the groove in the priming valve seal facing away from the knob (see Figure 10-13). Carefully slide the seal onto the knob; avoid scratching or nicking the sides.

IMPORTANT **Do not use a sharp tool (such as tweezers) to install the seal. This may scratch the seal and the surface of the priming valve knob. These scratches will prevent a proper seal and cause leakage.**

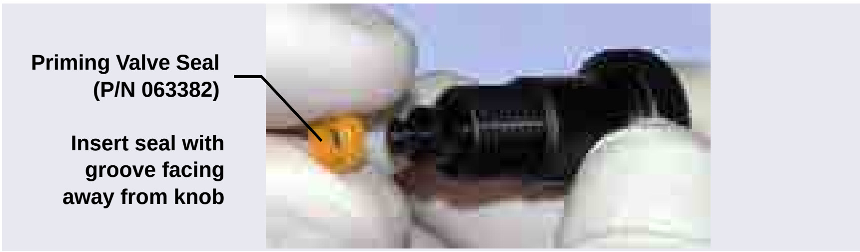


Figure 10-13. *Replacing the Priming Valve Seal*

9. Insert the priming valve knob into the secondary pump head, turn the knob clockwise, and tighten fingertight.
10. Push the component mounting panel back into the enclosure. Close the DP/SP door.
11. Press the **POWER** button on the front of the DP/SP to turn on the pump.
12. Reconnect the pump to Chromeleon by clicking **Connected** on the pump ePanel.
13. Turn on the pump flow.

10.9 Changing the DP/SP Main Power Fuses

1. Turn off the pump flow.
2. Begin monitoring the **Current Pressure** reading on the pump ePanel on the Chromeleon ePanel Set. When the system pressure reaches zero:
    a. Disconnect the pump from Chromeleon by clicking **Connected** on the pump ePanel.

b. Press the **POWER** button on the front of the DP/SP for 2 seconds to turn off the pump.

3. Turn off the main power switch on the rear panel of the pump (see Figure 2-7).

4. Disconnect the main power cord from both its source and from the rear panel of the pump.

DANGER

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

DANGER

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

ACHTUNG

HOCHSPANNUNG—Ziehen Sie das Netzkabel aus der Steckdose und der Netzbuchse auf der Rückseite der Pumpe.

5. The fuse cartridge is located next to the main power switch (see Figure 10-14). Use a small screwdriver to remove the fuse cartridge.

6. Replace the two fuses with new 2 A IEC 60127-2 slow-blow fuses (P/N 954773). Thermo Fisher Scientific recommends always replacing *both* fuses.

7. Reinstall the fuse cartridge.

8. Reconnect the main power cord to its source and to the DP/SP.

Figure 10-14. *DP/SP Fuse Cartridge*

9. Turn on the main power switch.

10. Press the **POWER** button on the front of the DP/SP to turn on the pump.

11. Reconnect the pump to Chromeleon by clicking **Connected** on the pump ePanel.

12. Turn on the pump flow.

10.10 Replacing EG Tubing and Fittings

Capillary IC

10.10.1 Tubing and Fittings for Capillary IC EG Channels

Table 10-4 lists the tubing and fittings used to plumb an EG channel for capillary IC.

NOTE IC PEEK Viper tubing assemblies are available individually or in Tubing Kits. For details, see Appendix B.

Tubing/Fitting Size and Type	Color	P/N	Use to connect...
Tubing assembly, precision cut, 0.062 mm (0.0025 in) ID PEEK, 61 cm (24 in)	Blue	072203	Dionex CR-TC 600 **ELUENT OUT** to EG degas **ELUENT IN**
Tubing assembly, precision cut, 0.062 mm (0.0025 in) ID PEEK, 18 cm (7 in)	Blue	072204	Dionex CR-TC 600 **ELUENT IN** to Dionex EGC **OUT**
Tubing assembly, 0.25 m (0.010 in) ID PEEK, 64 cm (25 in)	Black	072224	EG degas **REGEN OUT** to Dionex CR-TC 600 **REGEN IN**
Tubing assembly, 1.58 mm (0.062 in) ID ETFE (ethylene tetrafluoroethylene), 2.1 m (7 ft)	Clear	072225	Dionex CR-TC 600 **REGEN OUT** to waste
10 mm (0.39 in) ID polyethylene	Colorless	055075	Drip tray drain hose
IC PEEK Viper assembly, 0.18 mm (0.007 in) ID, 178 mm (7.0 in)	Tan	088907	Dionex EGC outlet to Dionex CR-TC 600 inlet

Table 10-3. *Tubing and Fittings for a Capillary IC EG Channel*

Tubing/Fitting Size and Type	Color	P/N	Use to connect...
IC PEEK Viper assembly, 0.18 mm (0.007 in) ID, 864 mm (34.0 in)	Tan	088908	Trap column outlet to Dionex EGC inlet
High-pressure 10-32 fitting bolt	Blue	22000-98001	Use high-pressure fittings for all other tubing connections, including: • Pump outlet to Dionex EGC **IN** • Dionex EGC **OUT** to Dionex CR-TC 600 **ELUENT IN** • Dionex CR-TC **ELUENT OUT** to EG degas **ELUENT IN**
High-pressure 10-32 ferrule, double-cone	Tan	043276	Use with high-pressure fitting bolts

Table 10-3. *Tubing and Fittings for a Capillary IC EG Channel (Continued)*

Capillary IC

Notes for capillary IC channels:

- For tightening requirements for the 10-32 fitting bolt (P/N 22000-98001) and 10-32 double-cone ferrule (P/N 043276), see Section 10.1.1.
- Do not cut the 0.062 mm (0.0025 in) ID blue PEEK tubing used for capillary IC connections. To ensure good chromatographic results, this tubing must be cut at the factory, using a specialized precision cutter. If you need to replace any tubing of this type, order the appropriate precision cut tubing assembly listed in Table 10-3.
- For tightening requirements for IC PEEK Viper fittings, see Section 10.1.2.
- Do not cut tubing on which IC PEEK Viper fittings are installed.

Analytical IC

10.10.2 Tubing and Fittings for Analytical IC EG Channels

Table 10-4 lists the tubing and fittings used to plumb an EG channel for analytical IC.

NOTE IC PEEK Viper tubing assemblies are available individually or in Tubing Kits. For details, see Appendix B.

Tubing/Fitting Size and Type	Color	P/N	Used to connect...
0.25 mm (0.010 in) ID PEEK tubing	Black	042690 (1 in)	• Dionex EGC to pump • Dionex EGC to Dionex CR-TC 600 • Dionex RFIC+ Eluent Degasser to injection valve • Dionex RFIC+ Eluent Degasser to eluent reservoir
1.58 mm (0.062 in) ID polyurethane tubing	Colorless	047203	Dionex EGC gas vent line and Dionex RFIC+ Eluent Degasser vent line
10 mm (0.39 in) ID polyethylene tubing	Colorless	055075	Drip tray drain hose
IC PEEK Viper assembly, 0.18 mm (0.007 in) ID, 864 mm (34.0 in)	Tan	088916	Pump output to Dionex EGC inlet
IC PEEK Viper assembly, 0.18 mm (0.007 in) ID, 178 mm (7.0 in)	Tan	088917	Dionex EGC outlet to Dionex CR-TC 600 inlet
1/8 in fitting bolt 1/8 in ferrule	Tan Yellow	052267 048949	Suppressor **REGEN OUT** port and eluent reservoirs

Table 10-4. *Tubing and Fittings for an Analytical IC EG Channel*

Analytical IC

Notes for analytical IC channels:

- For tightening requirements for the 10-32 fitting bolt (P/N 22000-98001) and 10-32 double-cone ferrule (P/N 043276), see Section 10.1.1.

- When a 10-32 fitting bolt and 10-32 double-cone ferrule are installed, a tubing cutter can be used to cut tubing to the required length. Be sure the cut is at a right angle to the length of the tubing, and that there are no nicks or burrs on the end. A tubing cutter (P/N 049584) is included in the DC Ship Kit (P/N 072011, standard DC; P/N 22171-62000, low-temperature DC). Refer to the instructions provided with the cutter for details.
- For tightening requirements for IC PEEK Viper fittings, see Section 10.1.2.
- Do not cut tubing on which IC PEEK Viper fittings are installed.

10.11 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) at the flow rate normally used.
2. Work backward through the system, beginning at the flow cell exit. One at a time, loosen each fitting and observe the pressure. The connection at which the pressure drops abnormally indicates the point of restriction. If the Dionex EGC is the source of the high backpressure, replace the outlet frit as instructed in the Dionex EGC manual.
3. If the restriction has caused such high pressure that the system cannot be operated, you must work forward through the system, adding parts one at a time, until an abnormal pressure increase (and hence, the restriction) is found.

10.12 Replacing the EGC

Replace the Dionex EGC when the cartridge is expended or when it leaks. See Table 2-3 for a list of the Dionex EGC models that can be used with the Dionex ICS-6000 EG.

Analytical IC

Standard-pressure analytical IC systems require Dionex EGC III cartridges. Operation with high-pressure analytical IC systems typically requires Dionex EGC 500 cartridges.

NOTE Although it is possible to operate a high-pressure analytical system with a Dionex EGC III cartridge, this will limit the operating pressure to 35 MPa (5000 psi).

The Dionex EGC replacement procedure consists of:

- Removing the old Dionex EGC (see Section 10.12.1)
- Disposing of the old Dionex EGC (see Section 10.12.2)
- Installing and conditioning a new capillary Dionex EGC (see Section 10.12.4)

  –or–

- Installing and conditioning a new analytical Dionex EGC (see Section 10.12.5)

CAUTION

The Dionex EGC 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 de Dionex EGC 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 Dionex EGC-Kartusche enthält eine korrodierende Base (KOH, LiOH oder NaOH), eine korrodierende Säure (MSA) oder eine konzentrierte K_2CO_3-Lösung. Tragen Sie daher beim Umgang mit Kartusche eine Schutzbrille und Handschuhe.

10.12.1 Removing the Old EGC

1. Turn off the pump flow. (This turns off the power to the Dionex EGC and the suppressor, also.)
2. Open the front door of the EG.
3. Pull the tray forward until it reaches the stop.
4. Twist the ring on the Dionex EGC electrical cable counter-clockwise to loosen it, and then pull the cable straight out of the **EGC 1** (or **EGC 2**) bulkhead connector (see Figure 10-15).

Figure 10-15. *Dionex EGC Cables*

5. Close or cap the Dionex EGC vent opening to prevent leakage when you turn over the cartridge in Step 7.

Capillary IC

If you are removing a capillary Dionex EGC, tighten the vent fitting on the top of the Dionex EGC (see Figure 10-16).

Figure 10-16. *Capillary Dionex EGC Vent Fitting*

Analytical IC

If you are removing a *standard-pressure* analytical Dionex EGC:

a. Remove the **VENT** line from the Dionex EGC by unscrewing the 10-32 luer adapter (see Figure 10-17).

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

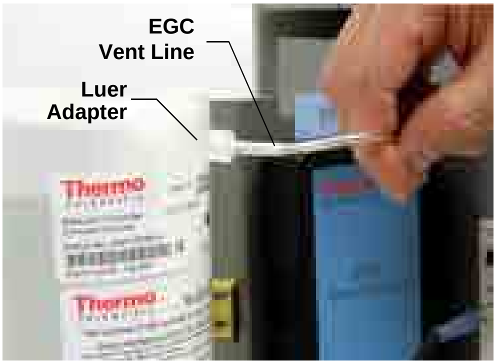


Figure 10-17. *Analytical Dionex EGC Vent Line (Standard-Pressure Cartridge Shown)*

b. Locate the 10-32 plug (P/N 053981) removed from the Dionex EGC vent opening during installation. Install the plug in the vent opening.

If you are removing a *high-pressure* analytical Dionex EGC, tighten the vent fitting in the top of the Dionex EGC.

6. Lift the Dionex EGC straight up and off the cartridge holder.

7. Turn the Dionex EGC upside down and place it on the EG drip tray (see Figure 10-18). This is the "service position" for the cartridge.

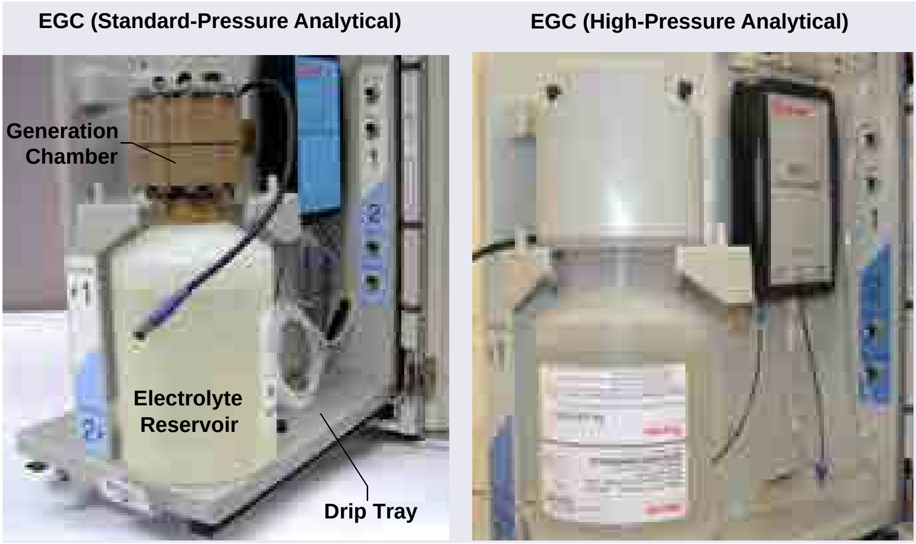


Figure 10-18. *Dionex EGC Service Position*

8. Disconnect the **EGC IN** and **EGC OUT** lines from the **INLET** and **OUTLET** ports on the Dionex EGC.

10.12.2 Disposing of the Old EGC

Follow the procedure here to dispose of an expended Dionex EGC. If the cartridge is not expended, ignore this section and go on to Section 10.12.3.

1. Hold the cartridge with the eluent generation chamber (see Figure 10-18) on top. Unscrew the eluent generation chamber from the electrolyte reservoir and pour the remaining electrolyte solution into an appropriate hazardous waste container.

   NOTE Refer to the Material Safety Data Sheet (MSDS) shipped with the Dionex EGC for the chemical description.

2. Rinse the electrolyte reservoir and membranes *three times* with ASTM Type I (18 megohm-cm) filtered and deionized water that meets the

specifications listed in Section 1.6. Rinsing should render the reservoir and membranes nonhazardous; however, check your local, state, and federal regulatory agency regulations for proper disposal.

10.12.3 Storing the Old EGC

If the old Dionex EGC is not expended, follow the procedure here to prepare the cartridge for storage.

1. Plug all fittings. Tighten the vent fitting (capillary Dionex EGC or high-pressure analytical Dionex EGC) or cap the vent port (standard-pressure analytical Dionex EGC). This will prevent the evaporation of water in the electrolyte reservoir.
2. Store the cartridge in an upright position (with the electrolyte reservoir at top) at 4 to 40°C (39 to 104°F) until its next use. The original shipping container is ideal for storage. Before resuming operation, condition the cartridge. For instructions, see Section 10.12.4 (for a capillary Dionex EGC) or Section 10.12.5 (for an analytical Dionex EGC).

Capillary IC If you are replacing a capillary Dionex EGC, go on to Section 10.12.4.

Analytical IC If you are replacing an analytical Dionex EGC, go on to Section 10.12.5.

Capillary IC

10.12.4 Installing and Conditioning a New Capillary EGC

Figure 10-19 shows the EG flow schematic for a capillary IC system. Refer to this figure when performing Dionex EGC and Dionex CR-TC 600 service procedures for a capillary IC system.

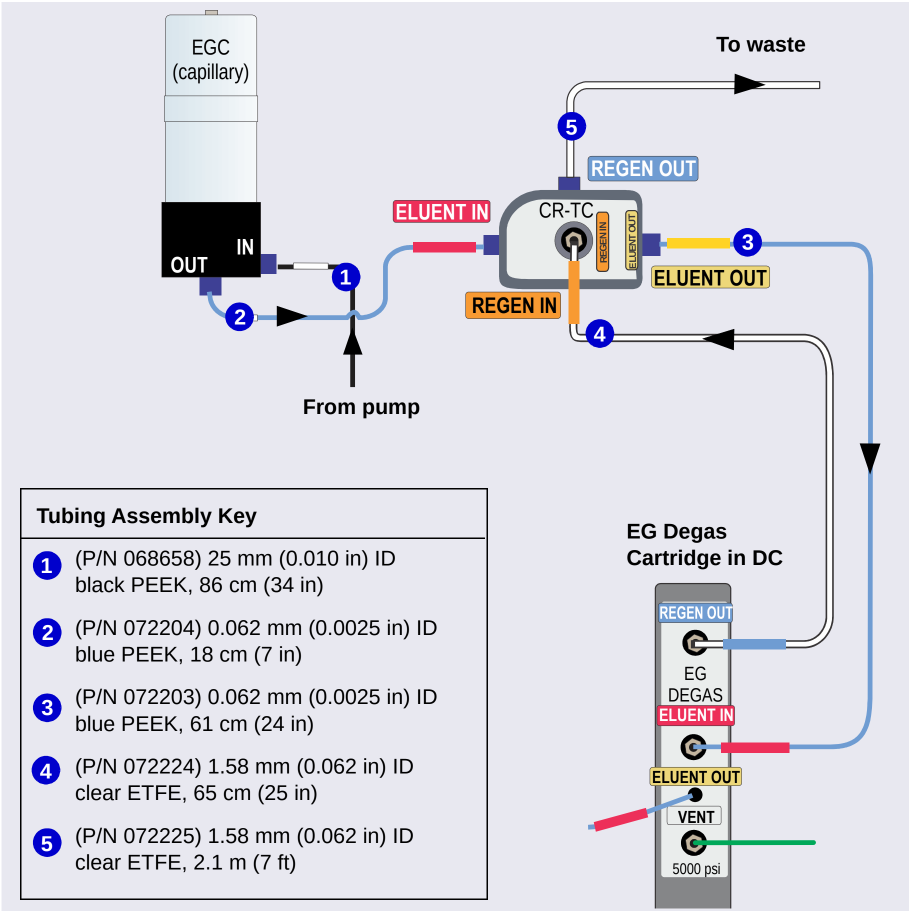


***Figure 10-19.** EG Flow Schematic Example for Capillary IC Systems*

Capillary IC

Preparing the Capillary EGC

1. Remove the new Dionex EGC from the shipping container.

NOTE Save the shipping container; it may be required for storage or disposal of the Dionex EGC.

2. The Dionex EGC cable is attached to the vent fitting on the top of the cartridge with a cable tie. Cut the cable tie to release the cable.
3. Verify that the vent fitting on top of the Dionex EGC is tightened.
4. Turn the cartridge upside down and place it on the EG drip tray.
5. Remove the plugs from the **INLET** and **OUTLET** ports on the eluent generation chamber.
6. While holding the EGC with the ports on the bottom, shake the EGC vigorously and tap it with the palm of your hand 10 to 15 times to dislodge air bubbles that may be trapped in the chamber.
7. Unscrew the vent fitting from the top of the cartridge and install the luer fitting shipped with the Dionex EGC. Save the vent fitting.

Luer Fitting

IMPORTANT **To ensure proper ventilation, always install the luer fitting before operation. If you need to remove the Dionex EGC from the system, re-install the vent fitting to prevent leaks.**

8. Slide the Dionex EGC (with the electrolyte reservoir on top) into the cartridge holder (see Figure 10-20).

Figure 10-20. *Capillary Dionex EGC Installed on Holder*

9. Align the pins inside the Dionex EGC cable connector with the holes in the **EGC 1** (or **EGC 2**) bulkhead connector. Push the cable connector firmly onto the bulkhead connector and twist the ring on the cable connector fingertight to secure it.

Capillary IC

Flushing the Capillary EGC

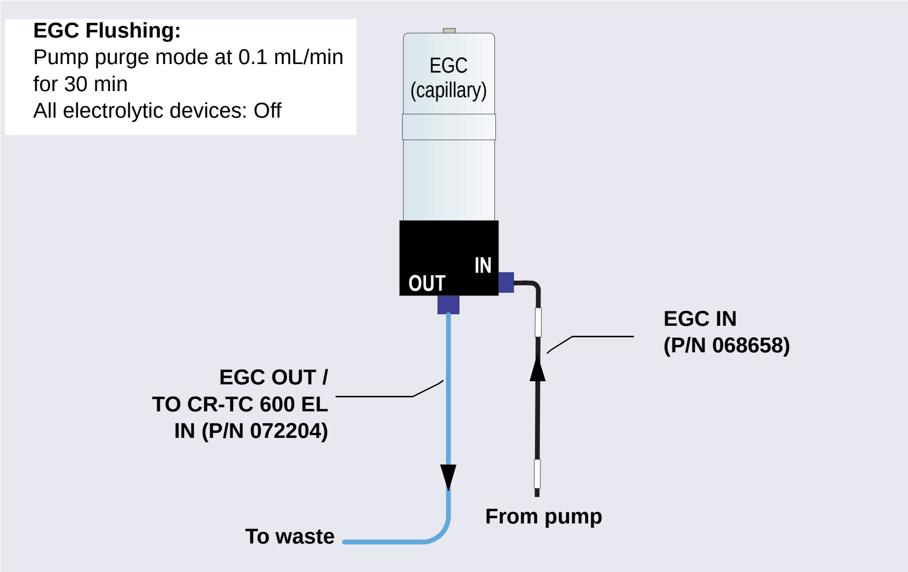


Figure 10-21. *Flow Schematic for Flushing the Dionex EGC (Capillary)*

1. Connect the **EGC IN** line to the **EGC IN** port.
2. Verify that the Dionex EGC, Dionex CR-TC 600, and the suppressor are all off.

IMPORTANT **To avoid damaging the Dionex CR-TC 600 and suppressor, always turn them off before flushing the Dionex EGC. The pump flow is on during flushing; however, no flow reaches the Dionex CR-TC 600 or suppressor.**

3. Set the pump **Purge** rate to 0.1 mL/min and the **Duration** to 1800 s. Click **Prime**. Wait for fluid to flow from the **EGC OUT** port on the bottom of the Dionex EGC.
4. Connect the **EGC OUT** line to the **EGC OUT** port. Temporarily disconnect the other end of this line from the Dionex CR-TC 600 **EGC OUT** port. Direct the open end of the tubing to waste.

   The Dionex EGC will be flushed for 30 minutes.

Conditioning the Dionex EGC

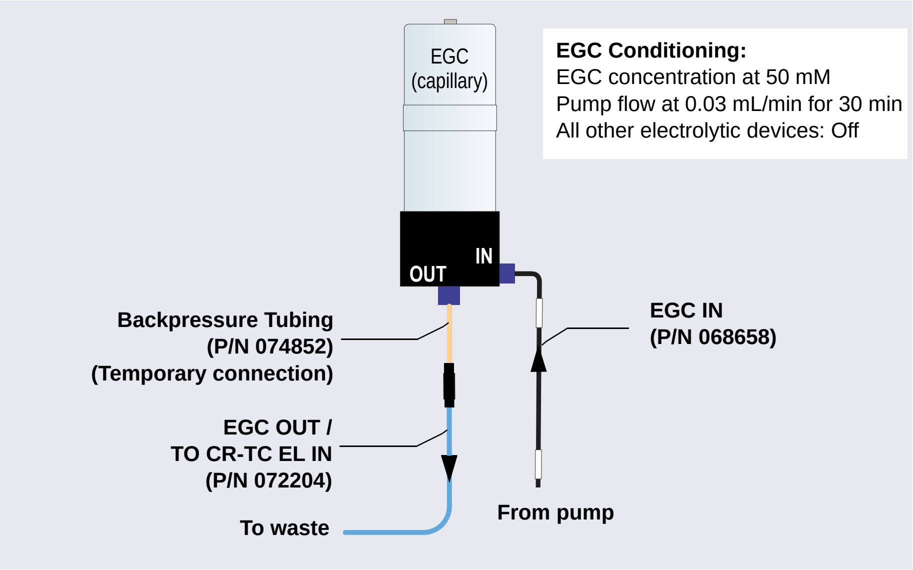


Figure 10-22. *Flow Schematic for Conditioning the Dionex EGC (Capillary)*

1. Locate the backpressure tubing (P/N 074582) in the IC Cube Ship Kit (P/N 072003) and connect it between the **EGC OUT** line and the **EGC OUT** port.
2. Verify that the luer adapter is installed on the top of the Dionex EGC to allow venting of the Dionex EGC.

IMPORTANT **To ensure proper ventilation, always install the luer fitting on the top of the Dionex EGC before operation. If you need to remove the Dionex EGC from the system, install the vent fitting plug to prevent leaks.**

3. Set the pump **Flow** rate to 0.03 mL/min and turn on the pump.
4. Set the EG concentration to 50 mM and turn on the Dionex EGC power. Verify that the Dionex CR-TC 600 voltage is off and the suppressor current is off.

IMPORTANT **To avoid damaging the suppressor and Dionex CR-TC 600, always turn them off before conditioning the Dionex EGC. The pump flow is on during conditioning; however, no flow reaches the suppressor or Dionex CR-TC 600.**

5. Condition the Dionex EGC for 30 minutes and then turn off the Dionex EGC and the pump flow.
6. Remove the backpressure tubing and reconnect the **EGC OUT** line.
7. Reconnect the other end of the line to the Dionex CR-TC 600 **EGC OUT** port.

10.12.5 Installing and Conditioning a New Analytical EGC

Analytical IC

For an EG flow schematic for an analytical IC system, see Figure 10-23 (standard-pressure version) or Figure 10-24 (high-pressure version). Refer to the appropriate figure when performing Dionex EGC and Dionex CR-TC 600 service procedures for an analytical IC system.

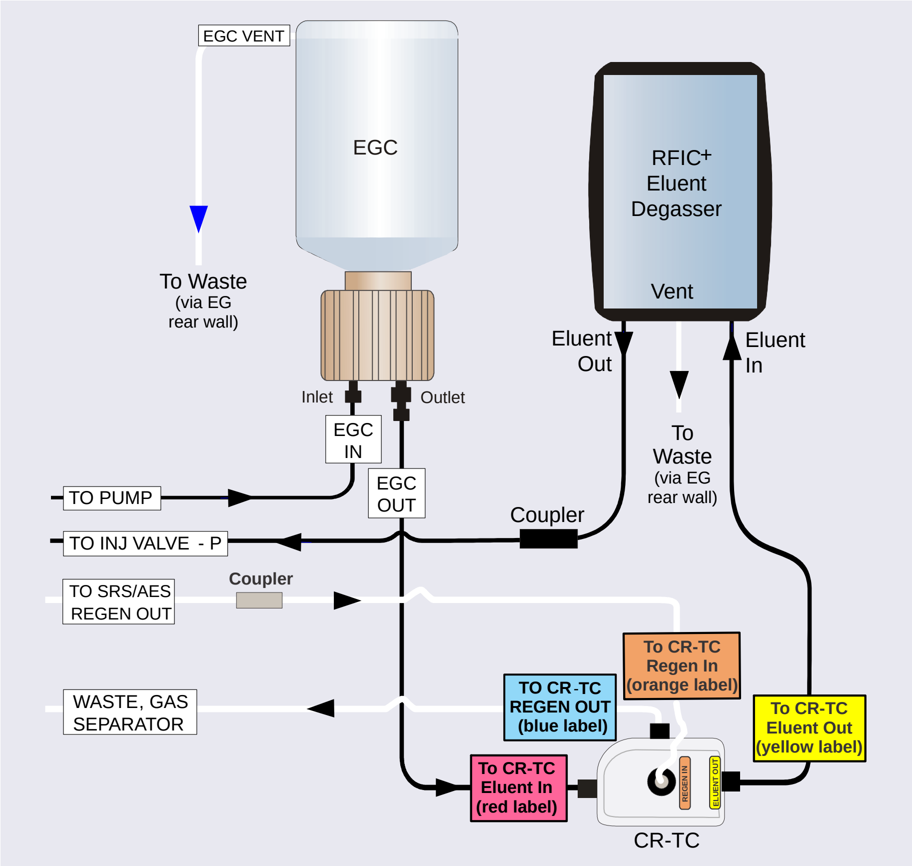


Figure 10-23. *EG Flow Schematic Example for Analytical (Standard-Pressure) IC Systems*

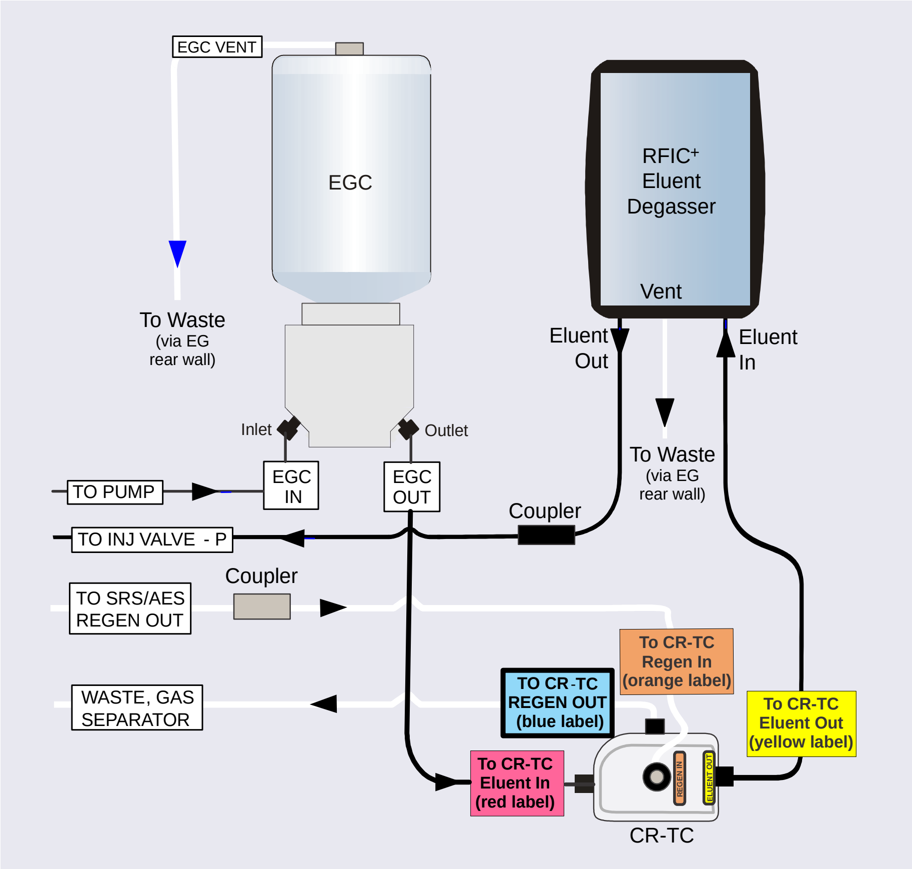


Figure 10-24. *EG Flow Schematic Example for Analytical (High-Pressure) IC Systems*

Installing the Analytical EGC

1. Remove the new Dionex EGC from the shipping container.

   NOTE Save the shipping container; it may be required for storage or disposal of the Dionex EGC.

2. Verify that a 10-32 plug (standard-pressure Dionex EGC) or a fitting (high-pressure Dionex EGC) is installed in the Dionex EGC vent opening. This prevents leakage from the vent opening when you turn over the cartridge (in Step 3).

3. Turn the cartridge upside down and place it on the EG drip tray in the service position (see Figure 10-17).
4. Remove the plugs from the **INLET** and **OUTLET** fittings on the eluent generation chamber.
5. Connect the **EGC IN** line from the pump to the Dionex EGC **INLET** port.
6. Locate the yellow 0.5 mL/min, 7 MPa (1000 psi) backpressure coil (P/N 053765) in the EG Ship Kit (P/N 072047).
7. Connect one end of the backpressure coil to the Dionex EGC **OUTLET** port; leave the other end of the coil unconnected (see Figure 10-25). (This is a temporary connection.)

Figure 10-25. *Dionex EGC Outlet Connection for Cartridge Conditioning (Standard-Pressure Analytical Cartridge Shown)*

8. While holding the Dionex EGC right-side up (with the electrolyte reservoir on top), shake the cartridge vigorously and tap it with the palm of your hand 10 to 15 times. Make sure any bubbles trapped in the eluent generation chamber are dislodged.

9. Slide the Dionex EGC (with the electrolyte reservoir on top) into the holder in the EG (see Figure 10-26).

EGC (Standard-Pressure Analytical) **EGC (High-Pressure Analytical)**

Figure 10-26. *Analytical Dionex EGC Installed in Holder*

10. Remove the 10-32 plug (standard-pressure analytical Dionex EGC) or fitting (high-pressure analytical Dionex EGC) from the vent opening and install a 10-32 luer adapter (P/N 063517) in the vent opening. (The luer adapter is shipped with the cartridge.) Remove the luer cap.

    NOTE Store the 10-32 plug or fitting in a safe place. The plug or fitting is required when shipping or storing the cartridge.

11. Push the Dionex EGC electrical cable firmly into the **EGC 1** (or **EGC 2**) bulkhead connector (see Figure 10-15). Twist the ring on the cable connector fingertight to secure it.

12. Connect the **VENT** line removed from the old cartridge to the vent opening in the new cartridge (see Figure 10-17).

Analytical IC

Conditioning the Analytical EGC

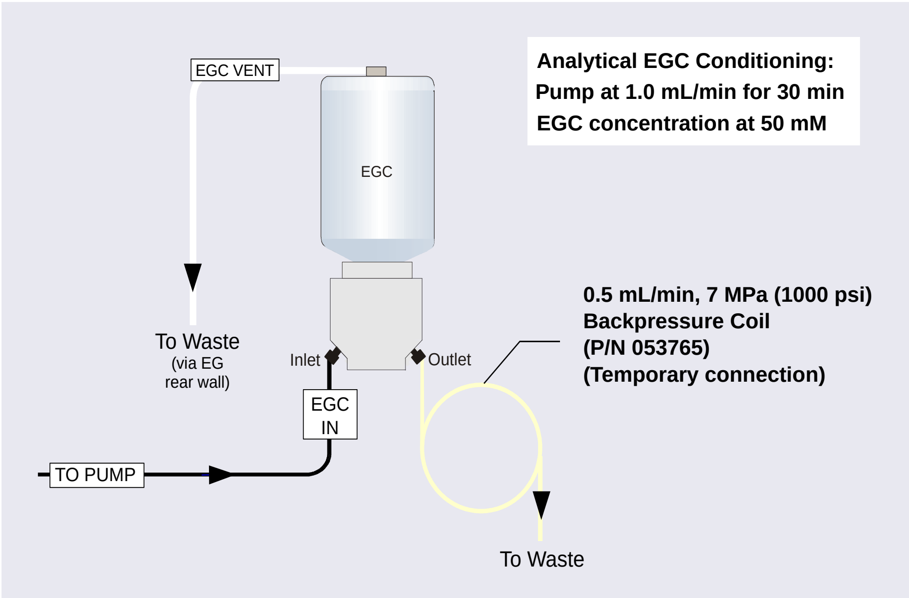


Figure 10-27. Flow Schematic for Conditioning an Analytical Dionex EGC (High-Pressure Version Shown)

1. Set a small temporary waste container (for example, a beaker) next to the EG. Direct the yellow backpressure coil from the Dionex EGC **OUT** port to the waste container. The backpressure must be at least 1.4 MPa (200 psi).
2. On the Chromeleon ePanel Set, select the following settings:
   a. DC ePanel: Verify that the suppressor **Mode** is off.
   b. Eluent Generator panel: Verify that the Dionex CR-TC 600 is off.

IMPORTANT **To avoid damaging the suppressor and Dionex CR-TC 600, always turn them off before conditioning the Dionex EGC. The pump flow is on during conditioning; however, no flow reaches the suppressor or Dionex CR-TC 600.**

c. Pump panel:

- **Gradient pump only:** Select the correct eluent channel (A, B, C, or D).
- **All pumps:** Set the flow rate to 1.0 mL/min. This turns on the pump flow, also.

d. Eluent Generator panel: Enter 50 mM in the **Target Concentration** field. This turns on the power to the Dionex EGC, also.

e. Condition the analytical Dionex EGC for 30 minutes.

3. Turn off the Dionex EGC and Dionex CR-TC 600 power.
4. Turn off the pump flow.

Analytical IC

Completing the Analytical EGC Installation

1. Twist the ring on the Dionex EGC electrical cable counterclockwise to loosen it, and then pull the cable straight out of the **EGC 1** (or **EGC 2**) bulkhead connector.
2. Remove the backpressure tubing from the waste container and remove the waste container.
3. For a standard-pressure analytical Dionex EGC: Replace the 10-32 plug in the Dionex EGC vent opening.

   For a high-pressure analytical Dionex EGC: Verify that a fitting is installed in the Dionex EGC vent opening.
4. Lift the Dionex EGC out of the holder, turn it upside down, and place it on the drip tray in the service position (see Figure 10-18).
5. Disconnect the backpressure coil from the Dionex EGC **OUTLET** port.
6. Connect the **EGC OUT** line to the **OUTLET** port.
7. Turn the Dionex EGC right-side up, and check for bubbles in the eluent generation chamber. If necessary, shake and tap the cartridge to remove bubbles.
8. Install the Dionex EGC in the holder.

9. For a standard-pressure analytical Dionex EGC: Remove the 10-32 plug from the vent opening and reinstall the luer adapter and vent line.

   For a high-pressure analytical Dionex EGC: Reinstall the vent line. Unscrew the fitting on the top of the Dionex EGC a few turns to allow venting of the EG.

IMPORTANT **To ensure proper ventilation, always loosen the fitting on the top of the high-pressure analytical Dionex EGC before operation.**

10. Reconnect the Dionex EGC electrical cable.
11. Before beginning operation, check the Consumables Inventory window in Chromeleon to verify that all consumables installed in the system are compatible. Refer to the Chromeleon Help for details.

10.13 Replacing the Dionex CR-TC 600

The Dionex CR-TC 600 replacement procedure consists of:

- Removing the old Dionex CR-TC 600 (see Section 10.12.1)
- Installing and hydrating the new Dionex CR-TC 600 (see Section 10.13.2)
- Completing the plumbing for the new Dionex CR-TC 600 Section 10.13.4

See Figure 10-19 for a flow schematic of the EG and Dionex CR-TC 600 for capillary IC. See Figure 10-23 or Figure 10-24 for a flow schematic for standard-pressure or high-pressure analytical IC, respectively.

10.13.1 Removing the Old Dionex CR-TC 600

1. Turn off the pump flow. (This turns off the power to the Dionex EGC and the suppressor, also.)
2. Open the front door of the EG.
3. Push down on the slide release latch and pull the tray forward until it reaches the stop.
4. Pull the Dionex CR-TC 600 off the ball studs on the component mounting panel.

5. Disconnect the liquid lines from the four ports on the Dionex CR-TC 600.
6. Twist the ring on the Dionex CR-TC 600 electrical cable counterclockwise to loosen it, and then pull the cable straight out of the **CR-TC 1** (or **CR-TC 2**) bulkhead connector.
7. Remove the Dionex CR-TC 600 from the EG.

Capillary IC

If you are replacing a capillary Dionex CR-TC 600, go on to Section 10.13.2.

Analytical IC

If you are replacing an analytical Dionex CR-TC 600, go on to Section 10.13.3.

Capillary IC

10.13.2 Installing and Flushing a New Capillary Dionex CR-TC 600

Flushing the New Capillary Dionex CR-TC 600

1. Remove the plugs from the ports on the new Dionex CR-TC 600.
2. Locate the backpressure tubing (P/N 074582) in the IC Cube Ship Kit (P/N 072003).

3. Connect the plumbing for flushing the Dionex CR-TC 600 as shown in Figure 10-28. The same plumbing is also used for conditioning the Dionex CR-TC 600.

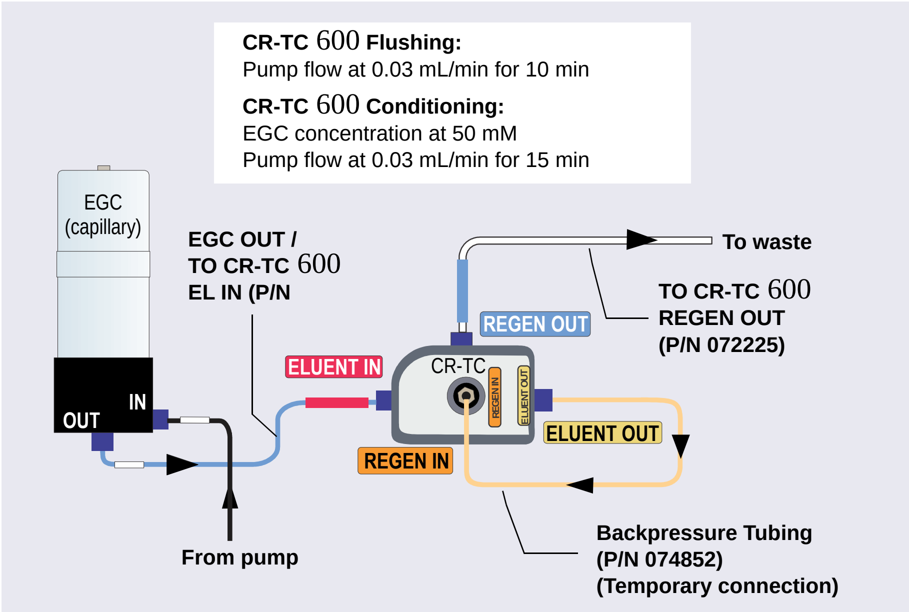


Figure 10-28. Flow Schematic for Flushing and Conditioning the Dionex CR-TC 600 (Capillary)

4. In Chromeleon, on the EG ePanel, verify that the Dionex EGC current is off and the Dionex CR-TC 600 voltage is off.
5. Set the pump **Flow** rate to 0.03 mL/min and turn on the pump. Flush the Dionex CR-TC 600 for 10 minutes. Verify that liquid is flowing steadily from the Dionex CR-TC 600 **REGEN OUT** line.

Conditioning the New Capillary Dionex CR-TC 600

1. Verify that the pump **Flow** rate is 0.03 mL/min.
2. Set the EG concentration to 50 mM. Turn on the Dionex EGC current and the Dionex CR-TC 600 voltage. Condition the Dionex CR-TC 600 for 15 minutes. Bubbles will be present in the Dionex CR-TC 600 **REGEN OUT** line.

3. Turn off the Dionex EGC current, the Dionex CR-TC 600 voltage, and the pump flow. Remove the backpressure tubing.
4. Connect the regen out and eluent in lines from the EG degas cartridge to their respective ports on the Dionex CR-TC 600 (see Figure 10-29).

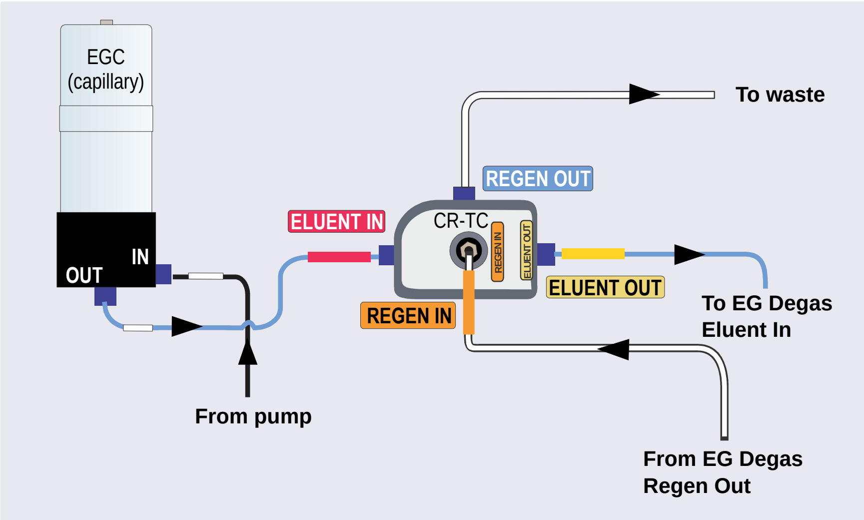


Figure 10-29. *Capillary Dionex CR-TC 600 Plumbing Diagram: Installation Completed*

5. Check that no liquid lines are caught under the Dionex CR-TC 600.
6. Align the two mounting holes on the Dionex CR-TC 600 back plate with the ball studs on the mounting plate, and then push the Dionex CR-TC 600 firmly onto the mounting ball studs. The Dionex CR-TC 600 clicks into place when properly installed.
7. Align the pins inside the Dionex EGC cable connector with the holes in the **CR-TC 1** (or **CR-TC 2**) bulkhead connector. Push the cable connector firmly onto the bulkhead connector. Twist the ring on the cable connector fingertight to secure it.
8. Push the tray into the module until it locks into place. Close the EG door.
9. Before beginning operation, check the Consumables Inventory window in Chromeleon to verify that all consumables installed in the system are compatible. Refer to the Chromeleon Help for details.

Analytical IC

10.13.3 Installing and Flushing a New Analytical Dionex CR-TC 600

1. Locate the Dionex CR-TC 600 Hydration Tubing Kit (P/N 063487) provided in the EG Ship Kit.
2. Refer to Figure 10-30 to plumb the four ports on the Dionex CR-TC 600.

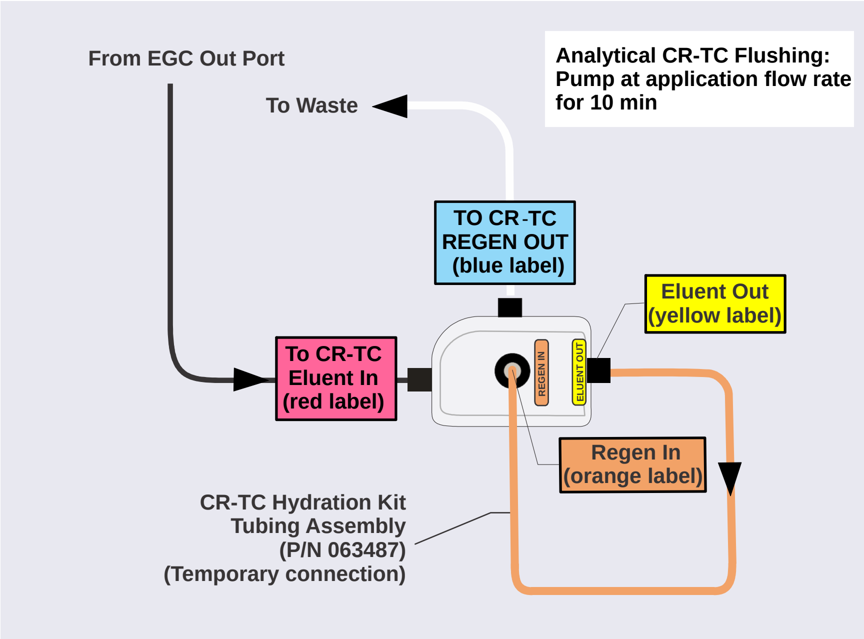


Figure 10-30. *Plumbing for Hydrating an Analytical Dionex CR-TC 600*

3. On the Chromeleon ePanel Set, select the following settings:
   a. DC ePanel: Verify that the suppressor **Mode** is off.

IMPORTANT **To avoid damaging the suppressor, always turn off the suppressor before hydrating the Dionex CR-TC 600. The pump flow is on during conditioning; however, no flow reaches the suppressor.**

   b. Pump ePanel:
      - **Gradient pump only:** Select the correct eluent channel (A, B, C, or D).

- **Analytical pumps:** Set the flow rate recommended for your application. This turns on the pump flow, also. Allow the pump to run for at least 10 minutes.
- **Capillary pumps:** Set the flow rate to 0.02 mL/min. This turns on the pump flow, also. Allow the pump to run for 15 minutes.

4. Turn off the pump flow.
5. Disconnect the temporary tubing from the **ELUENT OUT** and **REGEN IN** ports on the Dionex CR-TC 600.

10.13.4 Completing the Dionex CR-TC 600 Plumbing

Refer to Figure 10-31 and the following steps to complete the Dionex CR-TC 600 plumbing.

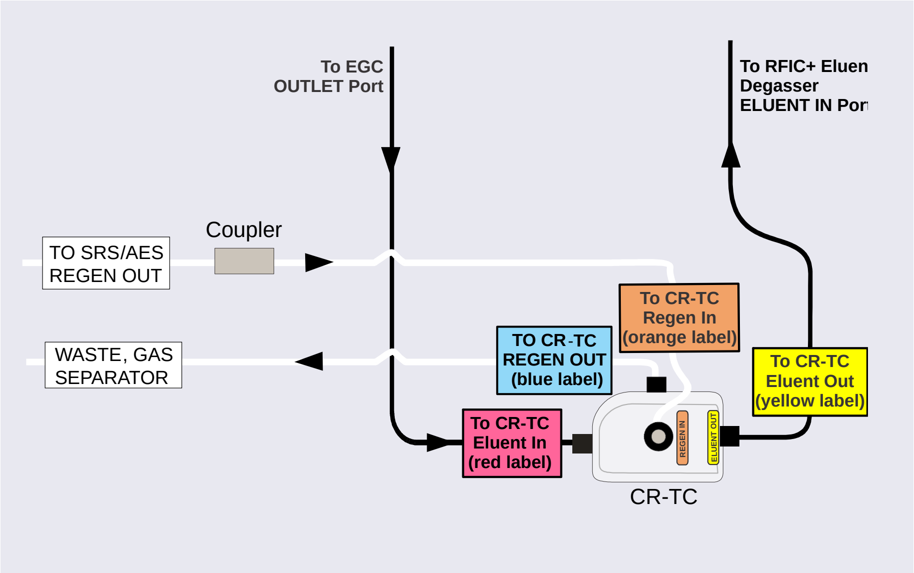


Figure 10-31. *Dionex CR-TC 600 Plumbing Diagram: Analytical Flow Version Installation Completed*

1. Check that no liquid lines are caught under the Dionex CR-TC 600.
2. Align the two mounting holes on the Dionex CR-TC 600 back plate with the ball studs on the mounting plate, and then push the Dionex CR-TC

600 firmly onto the mounting ball studs. The Dionex CR-TC 600 clicks into place when properly installed.

3. Align the pins inside the Dionex EGC cable connector with the holes in the **CR-TC 1** (or **CR-TC 2**) bulkhead connector. Push the cable connector firmly onto the bulkhead connector. Twist the ring on the cable connector fingertight to secure it.
4. Push the tray into the module until it locks into place. Close the EG door.
5. Before beginning operation, check the Consumables Inventory window in Chromeleon to verify that all consumables installed in the system are compatible. Refer to the Chromeleon Help for details.

Analytical IC

10.14 Replacing the RFIC+ Eluent Degasser

1. Turn off the pump flow.
2. Open the front door of the EG.
3. Push down on the slide release latch and pull the tray forward until it reaches the stop.
4. Grasp the old Dionex RFIC+ Eluent Degasser by the sides and pull it straight off the ball studs that secure it to the component mounting panel.
5. Disconnect the three lines connected to the degasser fittings (**ELUENT OUT**, **ELUENT IN**, and **VENT**). Connect these lines to the new Dionex RFIC+ Eluent Degasser (P/N 075522).
6. Align the two mounting holes on the back plate of the new Dionex RFIC+ Eluent Degasser with the ball studs on the component mounting panel. Push the degasser firmly onto the mounting ball studs. The degasser clicks into place when properly installed.
7. Push the tray into the module until it locks into place. Close the EG door.
8. Dispose of the old degasser.

Analytical IC

10.15 Installing a Backpressure Coil

In an analytical IC system, the Dionex EGC requires at least 14 MPa (2000 psi) of system backpressure to ensure optimal removal of electrolysis gas from the eluent produced by the cartridge.

During system equilibration, monitor the pressure and verify that it is between 14 and 21 MPa (2000 and 3000 psi). A system backpressure of 16 MPa (2300 psi) is optimal.

If the backpressure is too low, install a backpressure coil (see Table 10-5) between the injection valve and the **OUTLET** port on the Dionex EGC. 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.

The EG Ship Kit (P/N 072047) includes four backpressure coils (see Table 10-5).

Part Number	Backpressure Coil Description	Flow Rate	Approximate Backpressure Added
AAA-053762	4 mm ID	2.0 mL/min	3.5 MPa (500 psi)
		1.0 mL/min	1.75 MPa (250 psi)
AAA-053763	4 mm ID	2.0 mL/min	7 MPa (1000 psi)
		1.0 mL/min	3.5 MPa (500 psi)
053764	2 mm ID	0.50 mL/min	3.5 MPa (500 psi)
		0.25 mL/min	1.75 MPa (250 psi)
053765	2 mm ID	0.50 mL/min	7 MPa (1000 psi)
		0.25 mL/min	3.5 MPa (500 psi)

Table 10-5. *EG Backpressure Coils*

10.16 Changing the EG Main Power Fuses

1. Press the **POWER** button on the front of the EG for 2 seconds to turn off the power.
2. Turn off the main power switch on the EG rear panel (see Figure 2-12).
3. Disconnect the main power cord from both its source and from the EG rear panel.

DANGER

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

DANGER

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

ACHTUNG

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

4. The fuse drawer is located above the main power switch (see Figure 10-32). A small tab locks the fuse drawer in place. Using a small screwdriver, press the tab *in* and *then up* to release the fuse drawer.
5. Pull the fuse drawer out of the rear panel and remove the old fuses.
6. Replace the two fuses with new 2 A IEC 60127-2 slow-blow fuses (P/N 954773). Thermo Fisher Scientific recommends always replacing *both* fuses.

Figure 10-32. *EG Fuse Drawer*

7. Insert the fuse drawer into the rear panel and press until the drawer snaps into place.
8. Reconnect the main power cord and turn on the power.

10.17 Replacing DC Tubing and Fittings

Capillary IC

10.17.1 Tubing and Fittings for Capillary IC Systems

Table 10-6 lists tubing and fittings used to plumb a DC system for capillary IC.

NOTE IC PEEK Viper tubing assemblies are available individually or in Tubing Kits. For details, see Appendix B.

Tubing Size and Type	Color	P/N	Used to connect...
IC Cube Tubing Kit	N/A	072186	See Table 10-7
0.33 mm (0.013 in) ID PEEK tubing	Blue	049714 (1 in)	Dionex AS-AP sample transfer line to injection valve or diverter valve
ED Cell Inlet Tubing Kit	N/A	074221	ED cell inlet to column outlet
IC PEEK Viper assembly, 0.635 mm (0.0025 in) ID, 216 mm (8.5 in)	Tan	088841	Valve port 3 to column inlet (no guard column)
IC PEEK Viper assembly, 0.635 mm (0.0025 in) ID, 635 mm (25.0 in)	Tan	088847	Dionex CR-TC 600 outlet to EG degas inlet
IC PEEK Viper assembly, 0.18 mm (0.007 in) ID, 178 mm (7.0 in)	Tan	088907	EG outlet to Dionex CR-TC 600 inlet
IC PEEK Viper assembly, 0.18 mm (0.007 in) ID, 864 mm (34.0 in)	Tan	088908	Trap column outlet to EG inlet

Table 10-6. *Tubing and Fittings for a Capillary IC DC System*

Tubing Size and Type	Color	P/N	Used to connect...
IC PEEK Viper assembly, 0.635 mm (0.0025 in) ID, 114 mm (4.5 in)	Tan	088909	Valve port 3 to guard column inlet
IC PEEK Viper assembly, 0.635 mm (0.0025 in) ID, 63.5 mm (2.5 in)	Tan	088910	Guard column outlet to separator column inlet
IC PEEK Viper assembly, 0.635 mm (0.0025 in) ID, 229 mm (9.0 in)	Tan	088911	Guard column outlet to ED cell inlet
High-pressure 10-32 fitting bolt High-pressure 10-32 ferrule, double-cone	Blue Tan	22000-98001 043276	Dionex AS-AP sample transfer line to injection valve or diverter valve
10-32 fitting bolt Split-cone ferrule	Black Black	062980 062978	Dionex AS-AP sample transfer line to injection port (push modes)
1/16 in flangeless fitting bolt Two-piece ferrule	Tan Clear cone, tan flat	052230 062511	Dionex AS-AP sample transfer line to needle (pull modes)
High-pressure 10-32 fitting bolt High-pressure 10-32 ferrule, double-cone	Tan Tan	22000-98001 043276	• Suppressor eluent out Dionex CRD eluent in • CD cell inlet and outlet • ED cell outlet • Injection valve sample in and sample out

Table 10-6. *Tubing and Fittings for a Capillary IC DC System (Continued)*

Capillary IC

Table 10-7 lists tubing and fittings in the IC Cube Tubing Kit (P/N 072186).

Part	Length/ Quantity	Part Number	Used to connect...
Precision cut 0.062 mm (0.0025 in) ID PEEK tubing, blue	65 mm (2.56 in)	072188	50 mm guard column outlet to 250 mm separator column inlet
Precision cut 0.062 mm (0.0025 in) ID PEEK tubing, blue, labeled **VALVE PORT 3**	115 mm (4.53 in)	072189	Guard column inlet to injection valve
Precision cut 0.062 mm (0.0025 in) ID PEEK tubing, blue	75 mm (2.93 in)	074603	35 mm guard column outlet to 150 mm separator column inlet
Precision cut 0.062 mm (0.0025 in) ID PEEK tubing, blue, labeled **VALVE PORT 3**	210 mm (8.27 in)	072187	Separator column inlet to injection valve (if a guard column is not present)
0.25 mm (0.010 in) ID PEEK tubing, black	610 mm (24 in) 914 mm (36 in)	082647	• EG degas cartridge **REGEN OUT** to waste (if an EG is not present) • Inject valve waste to Dionex AS-AP waste port (located near the injection port)
High-pressure 10-32 fitting bolt, blue	7	22000-98001	• EG degas cartridge **ELUENT OUT** to injection valve • Injection valve to guard or separator column • Guard column to separator column • Separator column to suppressor
High-pressure 10-32 ferrule, double-cone	7	043276	Use with high-pressure fitting bolts

Table 10-7. *Contents of the IC Cube Tubing Kit (P/N 072186)*

Capillary IC

Notes for capillary IC systems:

- For tightening requirements for the 10-32 fitting bolt (P/N 22000-98001) and 10-32 double-cone ferrule (P/N 043276), see Section 10.1.1.
- When a 10-32 fitting bolt and 10-32 double-cone ferrule are installed, a tubing cutter can be used to cut tubing (except capillary tubing) to the required length. Be sure the cut is at a right angle to the length of the tubing, and that there are no nicks or burrs on the end. A tubing cutter (P/N 049584) is included in the DC Ship Kit (P/N 072011, standard DC; P/N 22171-62000, low-temperature DC). Refer to the instructions provided with the cutter for details.
- Do not cut the 0.062 mm (0.0025 in) ID blue PEEK tubing used for capillary IC connections. To ensure good chromatographic results, this tubing must be cut at the factory, using a specialized precision cutter. If you need to replace any tubing of this type, order the appropriate precision cut tubing assembly listed in Table 10-7.
- For tightening requirements for IC PEEK Viper fittings, see Section 10.1.2.
- Do not cut tubing on which IC PEEK Viper fittings are installed.

Analytical IC

10.17.2 Tubing and Fittings for Analytical IC Systems

Table 10-8 lists the tubing and fittings used to plumb a DC system for analytical IC.

NOTE IC PEEK Viper tubing assemblies are available individually or in Tubing Kits. For details, see Appendix B.

Tubing Size and Type	Color	P/N	Used to connect...
0.75 mm (0.030 in) ID PEEK	Green	044777 (1 in)	Injection valve to Dionex AS-AP waste port (located near the injection port)
0.33 mm (0.013 in) ID PEEK tubing	Blue	049714 (1 in)	Dionex AS-AP sample transfer line to injection valve or diverter valve

Table 10-8. *Tubing and Fittings for an Analytical IC DC System*

Tubing Size and Type	Color	P/N	Used to connect…
IC PEEK Viper assembly, 0.18 mm (0.007 in) ID, 114 mm (4.5 in)	Tan	088813	Eluent outlet to CRD inlet
IC PEEK Viper assembly, 0.18 mm (0.007 in) ID, 406 mm (16.0 in)	Tan	088832	Trap column outlet to ED cell inlet
IC PEEK Viper assembly, 0.18 mm (0.007 in) ID, 229 mm (9.0 in)	Tan	088835	Guard column outlet to ED column inlet right
IC PEEK Viper assembly, 0.18 mm (0.007 in) ID, 127 mm (5.0 in)	Tan	088836	Dionex CRD eluent outlet to cell inlet
IC PEEK Viper assembly, 0.18 mm (0.007 in) ID, 89 mm (3.5 in)	Tan	088892	Guard column outlet to column inlet
IC PEEK Viper assembly, 0.18 mm (0.007 in) ID, 356 mm (14.0 in)	Tan	088893	Column outlet to CD eluent inlet right
IC PEEK Viper assembly, 0.18 mm (0.007 in) ID, 254 mm (10.0 in)	Tan	088894	Column outlet to CD eluent inlet left
IC PEEK Viper assembly, 0.18 mm (0.007 in) ID, 178 mm (7.0 in)	Tan	088915	Eluent outlet to cell inlet
IC PEEK Viper assembly, 0.18 mm (0.007 in) ID, 864 mm (34.0 in)	Tan	088916	Pump outlet to EG inlet
IC PEEK Viper assembly, 0.18 mm (0.007 in) ID, 178 mm (7.0 in)	Tan	088917	EG outlet to Dionex CR-TC 600 inlet
IC PEEK Viper assembly, 0.18 mm (0.007 in) ID, 203 mm (8.0 in)	Tan	302959	Port 3 to CD guard column inlet

Table 10-8. *Tubing and Fittings for an Analytical IC DC System (Continued)*

Tubing Size and Type	Color	P/N	Used to connect...
IC PEEK Viper assembly, 0.18 mm (0.007 in) ID, 406 mm (16.0 in)	Tan	302960	Degas outlet to port 2
10-32 fitting bolt 10-32 ferrule, double-cone	Blue Tan	22000-98001 043276	Dionex AS-AP sample transfer line to injection valve or diverter valve
10-32 fitting bolt Split-cone ferrule	Black Black	062980 062978	Dionex AS-AP sample transfer line to injection port (push modes)
1/16 in flangeless fitting bolt Two-piece ferrule	Tan Clear cone, tan flat	052230 062511	Dionex AS-AP sample transfer line to needle (pull modes)
1.58 mm (0.062 in) ID PTFE	Colorless	014157 (1 in)	Suppressor **REGEN OUT**
0.125 mm (0.005 in) ID PEEK	Red	044221 (1 in)	Microbore systems: Connections between other system components
0.25 mm (0.010 in) ID PEEK	Black	042690 (1 in)	Standard bore systems: Connections between other system components
1/8 in fitting bolt 1/8 in ferrule	Tan Yellow	052267 048949	Suppressor **REGEN OUT** fitting
10-32 fitting bolt 10-32 ferrule, double-cone	Black Tan	22000-98001 043276	All other tubing fittings

Table 10-8. *Tubing and Fittings for an Analytical IC DC System (Continued)*

Analytical IC

Notes for analytical IC systems:

- For tightening requirements for the 10-32 fitting bolt (P/N 22000-98001) and 10-32 double-cone ferrule (P/N 043276), see Section 10.1.1.
- When a 10-32 fitting bolt (P/N 22000-98001) and 10-32 double-cone ferrule (P/N 043276) are installed, you can use a tubing cutter to cut

tubing to the required length. Make sure the cut is at a right angle to the length of the tubing, and that there are no nicks or burrs on the end. A tubing cutter (P/N 049584) is included in the DC Ship Kit (P/N 072011, standard DC; P/N 22171-62000, low-temperature DC). Refer to the instructions provided with the cutter for details.

- Do not cut tubing on which IC PEEK Viper fittings are installed.
- For tightening requirements for IC PEEK Viper fittings, see Section 10.1.2.

10.18 Connecting a Sample Loading Port to the Injection Valve

1. For each sample loading port to be connected, locate the following items in the DC Ship Kit (P/N 072011, standard DC; P/N 22171-62000, low-temperature DC):
   - One 1/4-28 fitting (P/N 052230) and ferrule (P/N 052231)
   - One 10-32 fitting (P/N 22000-98001) and 10-32 double-cone ferrule (P/N 043276)
   - 0.75 mm (0.030 in) ID green PEEK tubing (P/N 052304)
   - One luer adapter fitting (P/N 024305)
2. Locate the metal release tab under the sample loading port on the front of the DC (see Figure 10-33). Press up on the tab to release the port and pull the port out the front of the DC.

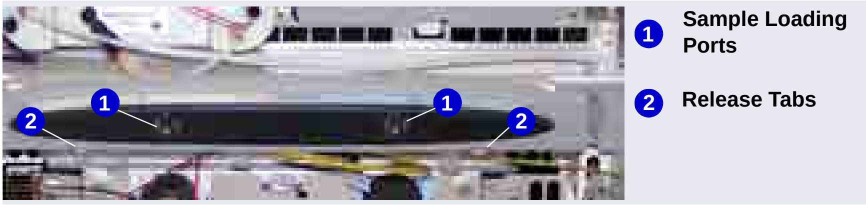


Figure 10-33. *DC Sample Loading Ports and Release Tabs*

3. Remove the fitting plug from the rear of the port.

4. Attach the luer adapter fitting to the front of the port (see Figure 10-34).

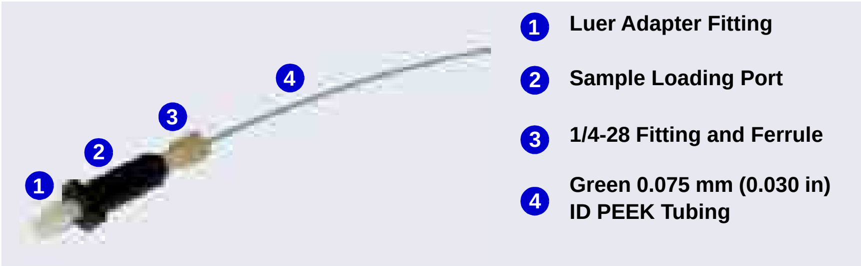


Figure 10-34. *Sample Loading Port Connection*

5. Cut a length of green 0.75 mm (0.030 in) ID PEEK tubing. The tubing will be used to connect the sample loading port and the sample port on the valve.
6. Attach a 1/4-28 fitting and ferrule to one end of this tubing and connect it to the rear of the sample loading port.
7. Thread the free end of the tubing through the sample loading port opening on the DC. Insert the port into the opening and turn it until it snaps into place.
8. Attach a 10-32 fitting and ferrule to the free end of the tubing and connect it to sample port **S (5)** on the injection valve.

10.19 Replacing the Leak Sensor

1. Turn off the pump flow from the ePanel in Chromeleon, or press **PUMP FLOW** on the front of the pump.
2. Press the **POWER** button on the front of the DC to turn off the DC.

CAUTION

To avoid injury, wait for the DC to cool down before opening the door or performing any maintenance or service procedures.

MISE EN GARDE

Afin d'éviter toute brûlure, laisser refroidir le DC avant d'ouvrir la porte ou d'effectuer des opérations de maintenance.

Um Verletzungen zu vermeiden, warten Sie bitte, bis der DC abgekühlt ist, ehe Sie die Tür öffnen bzw. Wartungs oder Servicearbeiten durchführen.

3. Open the DC lower door.
4. Loosen the screw on the front of the leak sensor (P/N 062437) (see Figure 10-35). **Note:** The screw remains attached to the sensor.

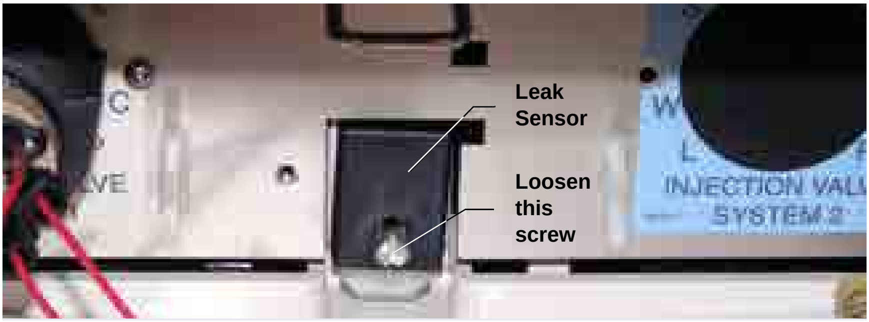


Figure 10-35. *Leak Sensor*

5. Start pulling the leak sensor out of the component panel; continue pulling until both the sensor and the attached cable are out of the opening.
6. The cable attached to the leak sensor connects to a cable inside the DC. Continue pulling the cable until the connectors for the two cables are outside the panel (see Figure 10-36).

Figure 10-36. *Leak Sensor Cable*

7. Disconnect the two cables.
8. Connect the cable from the new leak sensor to the DC cable.
9. Feed the cables back inside the DC. Align the leak sensor with the component panel opening and fingertighten the screw.

10. Make sure the leak sensor does not touch the bottom of the drip tray.

10.20 Rebuilding a High-Pressure (Injection) Valve

Thermo Fisher Scientific recommends rebuilding the injection valve annually. The Injection Valve Rebuild Kit contains all required replacement parts.

Injection Valve Rebuild Kit	Part Number
For 4-port valve with 0.1 µL internal loop	00110-03-00043
For 4-port valve with 0.2 µL internal loop	00110-03-00044
For 4-port valve with 0.4 µL internal loop	074698
For 6-port valve	075973
For 10-port valve	079054

To obtain a Valve Rebuild Kit, order the appropriate Maintenance Kit.

Injection Valve Maintenance Kit	Part Number
For 4-port valve with 0.1 µL internal loop	22181-62026
For 4-port valve with 0.2 µL internal loop	22181-62027
For 4-port valve with 0.4 µL internal loop	075040
For 6-port valve	075974
For 10-port valve	079053

The injection valve rebuild procedure also applies to high-pressure valves installed in a Dionex ICS-6000 Automation Manager.

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

NOTE Replacing the high-pressure valve “pod” is an alternative to rebuilding the valve. Replacing the pod is easier and faster than rebuilding the valve. For instructions, see Section 10.21.

1. Turn off the pump flow.

2. Press the **POWER** button on the front of the DC for 2 seconds to turn off the DC.

CAUTION

To avoid injury, wait for the DC to cool down before opening the door or performing any maintenance or service procedures.

MISE EN GARDE

Afin d'éviter toute brûlure, laisser refroidir le DC avant d'ouvrir la porte ou d'effectuer des opérations de maintenance.

VORSICHT

Um Verletzungen zu vermeiden, warten Sie bitte, bis der DC abgekühlt ist, ehe Sie die Tür öffnen bzw. Wartungs oder Servicearbeiten durchführen.

3. Open the DC door.
4. Disconnect each liquid line connected to the valve.
5. Follow the instructions provided in the Rebuild Kit to replace the rotor seal and stator face.
6. Reconnect all liquid lines to the injection valve.
7. Turn on the power to the DC.
8. Turn on the pump flow. Check for leaks from the valve. Tighten fittings as required.
9. Close the door.

10.21 Replacing a High-Pressure (Injection) Valve Pod

This procedure describes how to replace the mechanical parts (the “pod”) of a high-pressure valve.

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

NOTE Electronics-related repair procedures must be performed by Technical Support for Dionex products.

1. Turn off the pump flow.

CAUTION

To avoid injury, wait for the DC to cool down before opening the door or performing any maintenance or service procedures.

MISE EN GARDE

Afin d'éviter toute brûlure, laisser refroidir le DC avant d'ouvrir la porte ou d'effectuer des opérations de maintenance.

VORSICHT

Um Verletzungen zu vermeiden, warten Sie bitte, bis der DC abgekühlt ist, ehe Sie die Tür öffnen bzw. Wartungs oder Servicearbeiten durchführen.

2. Press the **POWER** button on the front of the DC for 2 seconds to turn off the DC.
3. Open the DC door.
4. Disconnect each liquid line connected to the valve.
5. Unscrew the locking ring on the outside of the valve (see Figure 10-37) and remove the ring.

Figure 10-37. *Unscrew the Locking Ring (Valve in IC Cube Shown)*

6. Grasp the front of the valve pod and pull out firmly to remove it from the DC or AM.
7. Align the slots in the new pod (4-port, P/N 074699; 6-port, P/N 075971; 10-port, P/N 075972) with the runner in the valve holder on the DC or AM (see Figure 10-38). 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.

8. Also verify that the two splines on the pod align with the matching splines inside the valve holder (see Figure 10-38). If necessary, twist the end of the pod to adjust the position of the splines.

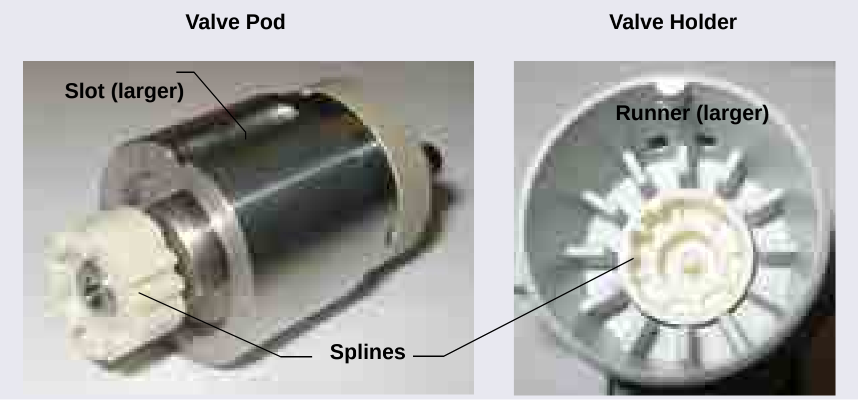


Figure 10-38. *High-Pressure Valve Pod and Pod Holder*

9. Push the pod into the holder until it clicks into place. Replace the black locking ring.
10. Reconnect all liquid lines to the valve.
11. Turn on the power to the DC.
12. Turn on the pump flow. Check for leaks from the valve. Tighten fittings as required.
13. Close the door.

10.22 Installing or Replacing an I/O Option Board

The I/O option board and the Dionex Consumable Device Monitor (see Section 10.23) are installed in the same opening in the DC rear panel. Therefore, only one of these options can be installed.

1. Press the **POWER** button on the front of the DC for 2 seconds to turn off the power.
2. Turn off the main power switch on the DC rear panel (see Figure 2-32).

3. Disconnect the main power cord from both its source and from the DC rear panel.

DANGER

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

DANGER

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

ACHTUNG

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

4. On the DC rear panel, remove the two screws that attach the I/O option cover plate or the existing I/O option board to the rear panel (see Figure 10-39). Save the screws.

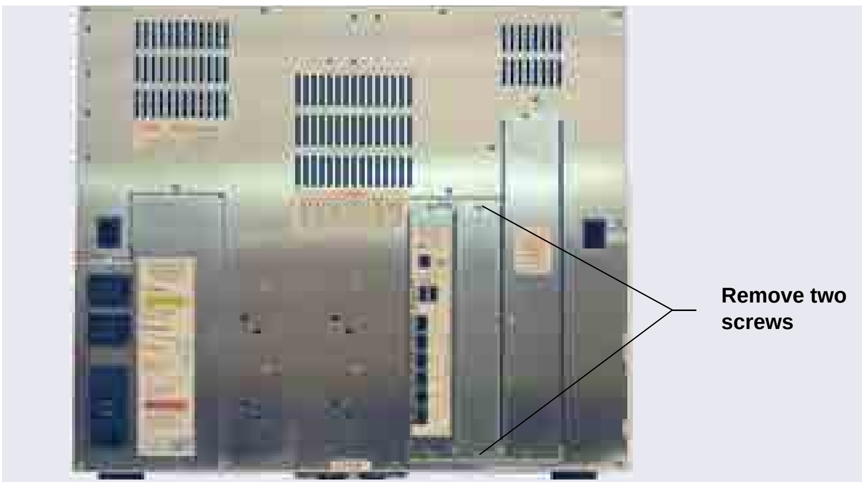


Figure 10-39. *DC Rear Panel: Removing the I/O Option Cover Plate*

5. Slide the new I/O option board (P/N 062201) into the rear panel opening and press firmly to connect the board to the DC motherboard.

6. Replace the two screws.

   Figure 10-40 shows the I/O option installed.

Figure 10-40. DC Rear Panel: I/O Option Installed

7. Reconnect the main power cord and turn on the power.

10.23 Installing or Replacing a Dionex Consumable Device Monitor

The Dionex Consumable Device Monitor and the I/O option board (see Section 10.22) are installed in the same opening in the DC rear panel. Therefore, only one of these options can be installed.

The Dionex Consumable Device Monitor Kit (P/N 22181-60031) contains all the parts needed to install the monitor.

NOTE Do not remove the Dionex Consumable Device Monitor (P/N 22181-60030) from its package until instructed to do so.

To install the Dionex Consumable Device Monitor

1. Press the **POWER** button on the front of the DC for 2 seconds to turn off the power.
2. Turn off the main power switch on the DC rear panel (see Figure 2-32).

3. Disconnect the main power cord from both its source and from the DC rear panel.

DANGER

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

DANGER

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

ACHTUNG

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

4. Remove the two screws that attach the cover plate or the existing board to the DC slot (see Figure 10-41). Save the screws.
5. If an I/O board or Dionex Consumable Device Monitor is already installed, carefully disconnect any TTL or USB cable from the existing device. Disconnect the other end of the cable. Store the cable for future use.
6. Installation of the Dionex Consumable Device Monitor involves handling static-sensitive devices. Before proceeding, put on a wrist (grounding) strap and be sure both feet are grounded.
7. Remove the existing cover plate or board and set it aside.
8. Touch a metal surface to discharge any static electricity.

9. Remove the Dionex Consumable Device Monitor from its package, being careful not to touch any of the connectors on the rear.

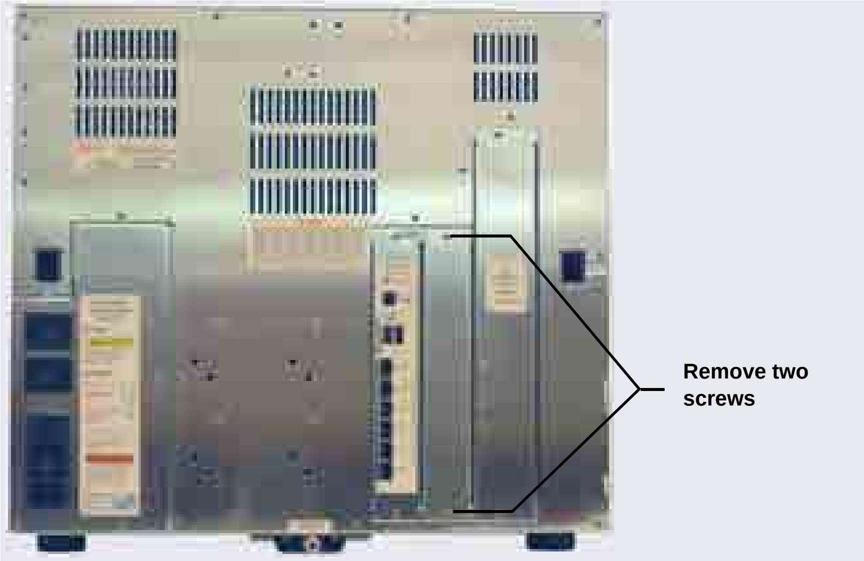


Figure 10-41. *DC Rear Panel: Removing the Cover Plate*

10. While still being careful not to touch the connectors on the rear of the Dionex Consumable Device Monitor, orient the monitor so that the four

antenna connectors are on top and the pin connectors are below (see Figure 10-42).

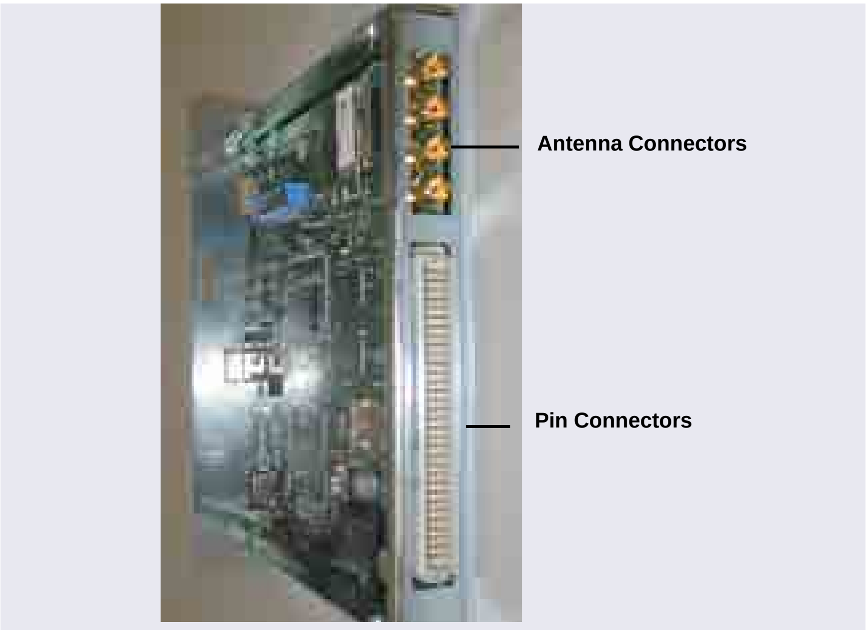


Figure 10-42. *Dionex Consumable Device Monitor Connectors*

11. Align the rails (or wings) on the top and bottom of the Dionex Consumable Device Monitor with the card guides in the rear of the DC, and then *firmly* push the monitor into place.

IMPORTANT **Failure to align the rails on the Dionex Consumable Device Monitor with the card guides may bend the pin connectors.**

12. Use the two screws removed previously (see Step 4) to secure the Dionex Consumable Device Monitor.

13. Locate the USB port on the Dionex Consumable Device Monitor and the two USB ports on the DC CPU board (see Figure 10-43).

14. Connect the USB cable (P/N 00302-99-00132) provided in the Dionex Consumable Device Monitor Kit to the monitor. Connect the other end to one of the USB ports on the DC CPU board.

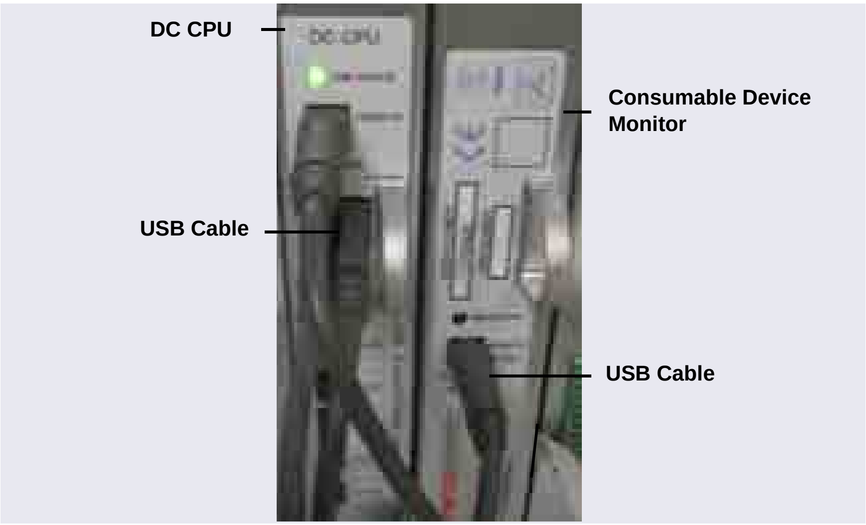


Figure 10-43. *Dionex Consumable Device Monitor Connected to CPU Board*

15. Reconnect the main power cord to the outlet and the DC rear panel.

16. Add the Dionex Consumable Device Monitor to the Dionex ICS-6000 instrument in the Chromeleon Instrument Configuration Manager.

10.24 Changing the DC Main Power Fuses

1. Press the **POWER** button on the front of the DC for 2 seconds to turn off the power.
2. Turn off the main power switch on the DC rear panel (see Figure 2-32).
3. Disconnect the main power cord from both its source and from the DC rear panel.

DANGER

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

DANGER

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

ACHTUNG

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

4. The fuse drawer is located above the main power switch (see Figure 10-44). A small tab locks the fuse drawer in place. Using a small screwdriver, press the tab *in* and *then up* to release the fuse drawer.
5. Pull the fuse drawer out of the rear panel and remove the old fuses.
6. Replace the two fuses with new 10 A IEC 60127-2 slow-blow fuses (P/N 954772). Thermo Fisher Scientific recommends always replacing *both* fuses.

Figure 10-44. *DC Fuse Drawer*

7. Insert the fuse drawer into the rear panel and press until the drawer snaps into place.
8. Reconnect the main power cord and turn on the power.

10.25 IC Cube Service Procedures

10.25.1 Replacing an IC Cube Cartridge

1. Turn off the pump flow.
2. Press the **POWER** button on the front of the DC for 2 seconds to turn off the DC power.

CAUTION

To avoid injury, wait for the DC to cool down before opening the door or performing any maintenance or service procedures.

MISE EN GARDE

Afin d'éviter toute brûlure, laisser refroidir le DC avant d'ouvrir la porte ou d'effectuer des opérations de maintenance.

VORSICHT

Um Verletzungen zu vermeiden, warten Sie bitte, bis der DC abgekühlt ist, ehe Sie die Tür öffnen bzw. Wartungs-oder Servicearbeiten durchführen.

3. Open the DC upper door.
4. Disconnect each liquid line connected to the IC Cube cartridge to be replaced.
5. Loosen the two thumbscrews on the cartridge (see Figure 10-45) and pull the cartridge out of the IC Cube.
6. Remove the caps from the regenerant ports on the rear of the cartridge. Slide the new cartridge into the IC Cube. Push the cartridge firmly into the IC Cube and then tighten the thumbscrews.

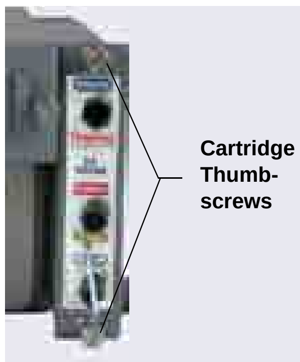


Figure 10-45. *Capillary Cartridge Thumbscrews (EG Degas Cartridge Shown)*

7. If you are installing a Dionex suppressor or CRD cartridge, hydrate it before use. If you are installing an EG degas cartridge, reconnect the liquid lines that were disconnected in Step 4.

8. Reconnect the liquid lines to the cartridge.

Hydrating the Suppressor

Suppressor hydration consists of two steps: flushing the regenerant path and hydrating the suppressor eluent chamber.

To flush the suppressor regenerant path:

1. Disconnect the line from the **ELUENT OUT** port of the injection valve and disconnect the line from the **IN** port of the CD cell.
2. In the IC Cube Tubing Kit (P/N 072186), locate either one or two precision cut tubing assemblies to use for the flushing procedure. The available tubing depends on which tubing from the kit is available:
   - 219 mm (8.27 in) (P/N 072187) *or*
   - 65 mm (2.56 in) (P/N 072188) and 125 mm (4.92 in) (P/N 072189) (use a union to connect these two tubing assemblies)
3. Connect the pump to the regenerant path as shown in Figure 10-46.

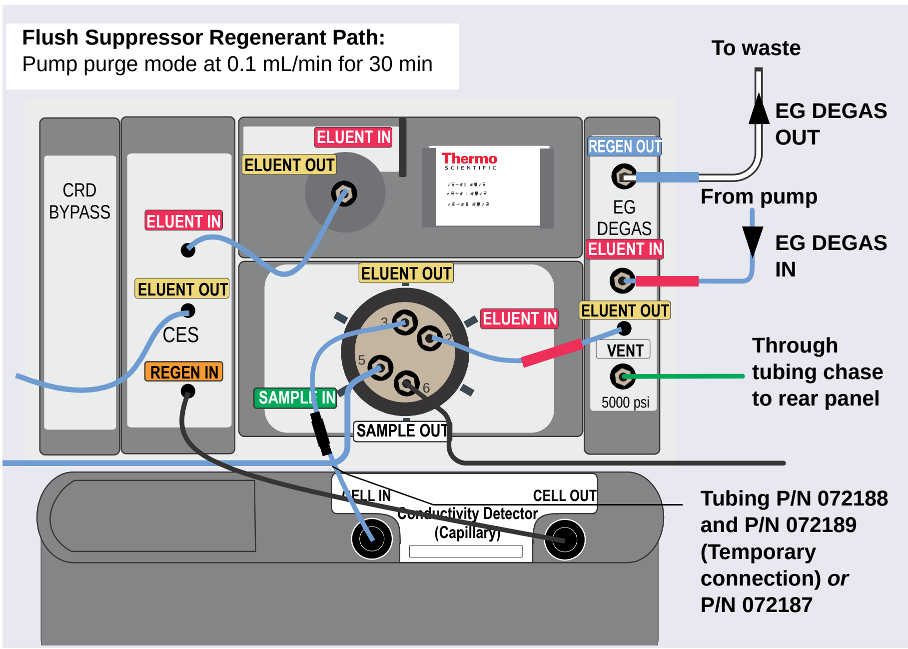


***Figure 10-46.** Flow Schematic for Filling and Flushing the Regenerant Path in a Capillary Suppressor*

4. Set the pump **Purge** rate to 0.1 mL/min and the **Duration** to 1800 s. Click **Prime**. Do not open the purge valve (you can cancel the Ready Check message that appears). The regenerant path is flushed for 30 minutes.

   NOTE The pump pressure is typically 3 to 5 MPa (400 to 700 psi) at 0.100 mL/min.

5. Monitor the waste flow from the EG degas. When no bubbles are present, the path is completely filled and flushed.

To hydrate the suppressor eluent chamber:

1. Connect the plumbing for suppressor hydration as shown in Figure 10-47.

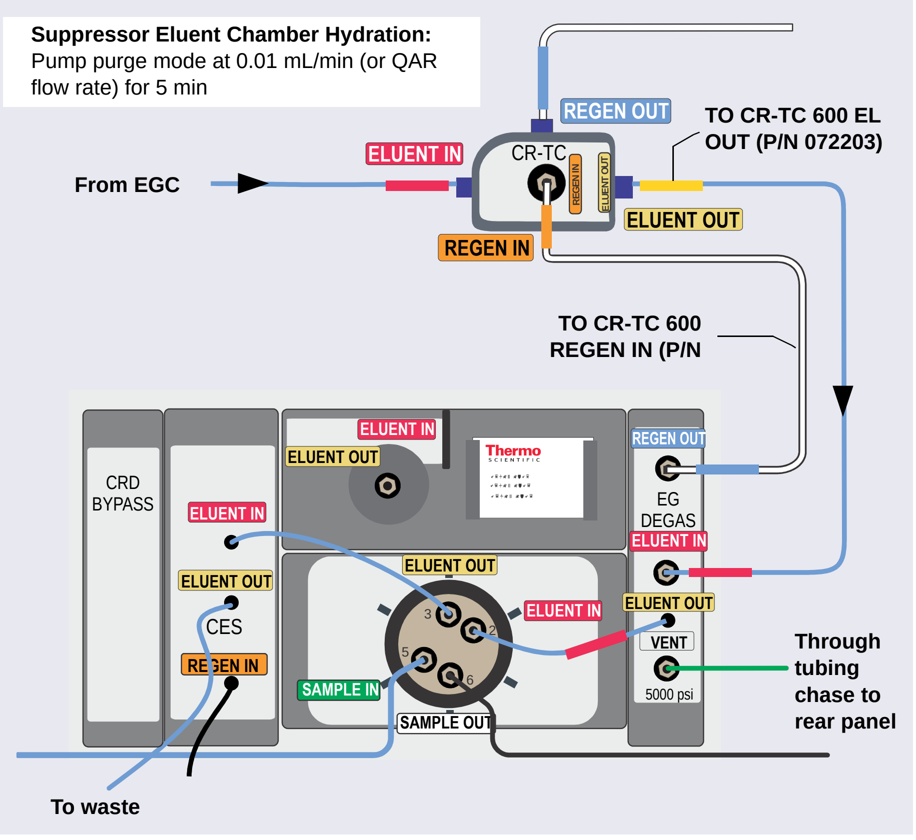


Figure 10-47. *Flow Schematic for Hydrating the Suppressor Eluent Chamber in a Capillary IC System*

NOTE If a CRD is installed, connect the **CES ELUENT OUT** line to the **CRD ELUENT IN** port and direct the **CRD ELUENT OUT** line to waste.

2. Set the **Duration** to 300 s and click **Prime**. Using purge mode prevents low-pressure alarms.
3. Reconnect the liquid lines that were disconnected from the old suppressor.

10.25.2 Replacing Capillary Columns

Removing the Old Columns

1. Turn off the pump flow.
2. Open the DC upper door.
3. Disconnect the line from the **ELUENT OUT** port of the injection valve and the line from the **ELUENT OUT** fitting on the column tray (see Figure 10-48).

Figure 10-48. *Disconnect Capillary Tray Eluent Lines (Conductivity System Plumbing Shown)*

4. Loosen the two thumbscrews on the column tray and pull the tray out of the IC Cube.
5. Raise the lid of the column tray to open it.

6. Remove the guard column (if present) and separator column from the column clips. Lift up the separator column outlet fitting (see Figure 10-49) slightly to free it from the clips, and then slide it out of the tray.
7. Remove the columns from the tray.
8. Disconnect the tubing from the columns. Save the tubing.

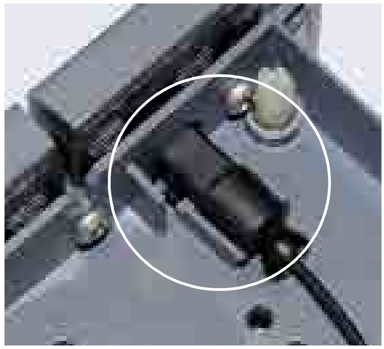


Figure 10-49. *Separator Column Outlet Fitting*

NOTE Do not cut the tubing that you removed from the columns and do not substitute different tubing. To ensure good chromatographic results, capillary tubing is cut at the factory, using a specialized precision cutter. If you need to replace the tubing or to install a different length tubing (to accommodate a new column configuration), order an IC Cube Tubing Kit (P/N 072186).

Flushing the New Capillary Columns

1. To flush the guard column (if included):
   a. Connect the 125 mm (4.92 in) precision cut tubing, labeled **VALVE PORT 3** (P/N 072189), to the **ELUENT OUT** port (3) of the injection valve. Connect the other end of the tubing to the guard column.
   b. Select the flow rate specified in the Quality Assurance Report (QAR) shipped with the column and turn on the pump.
   c. Set the Dionex EGC current to the setting specified in the QAR and turn on the Dionex EGC current. Verify that the CR-TC 600 is off.
   d. Flush the guard column to waste for 10 min.
   e. Connect the separator column to the guard column, using the 65 mm (2.56 in) precision cut tubing (P/N 072188).
2. To flush the separator column:
   a. If you did not install a guard column, connect the 210 mm (8.27 in) precision cut tubing, labeled **VALVE PORT 3** (P/N 072187), to the

ELUENT OUT port (3) of the injection valve. Connect the other end of the tubing to the separator column.

b. Verify that the CR-TC 600 is off and the pump flow and Dionex EGC are set to the conditions specified in the QAR.

c. Flush the separator column to waste for 20 min.

Installing the Columns in the Capillary Column Tray

1. Temporarily disconnect the column inlet tubing from the **ELUENT OUT** port (3) of the injection valve.
2. Cut off the label from the separator column along the dotted line and slide the label into the holder on the front of the tray (see Figure 10-50).

Figure 10-50. *Capillary Column Tray with Column Label*

3. Orient the separator column's outlet fitting with a flat side facing up and push the fitting into the opening at the front of the column tray until it stops. Press the fitting down into the clip (see Figure 10-51).

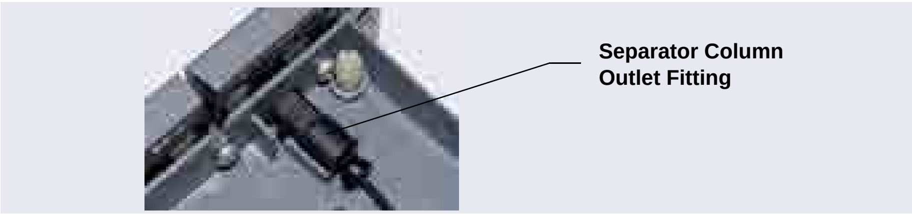


Figure 10-51. *Separator Column Outlet Fitting in Capillary Column Tray*

4. Coil the columns and precision cut tubing inside the tray as required for your configuration (refer to the following figures). Secure the tubing under the tubing clips and press the fittings onto the fitting clips.

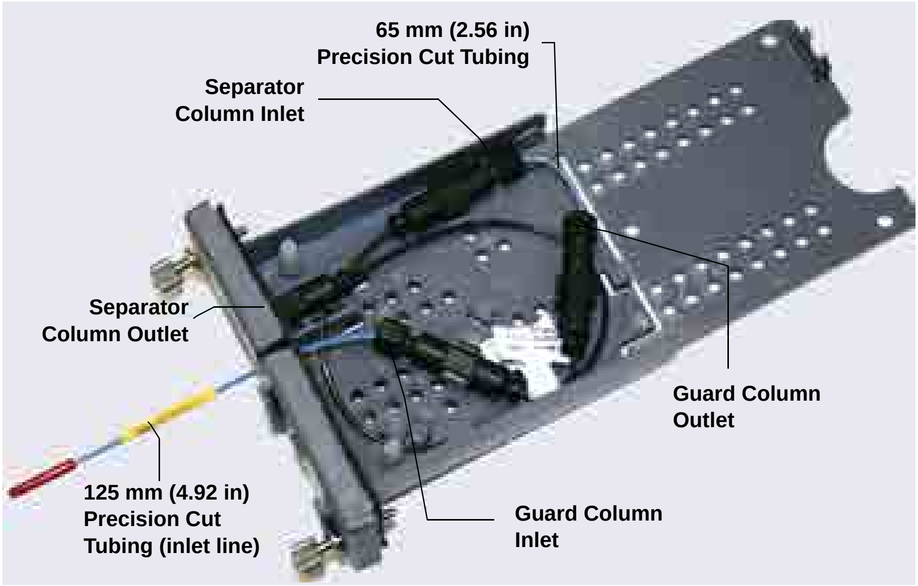


Figure 10-52. *250 mm Separator Column and 50 mm Guard Column Installed in Capillary Column Tray*

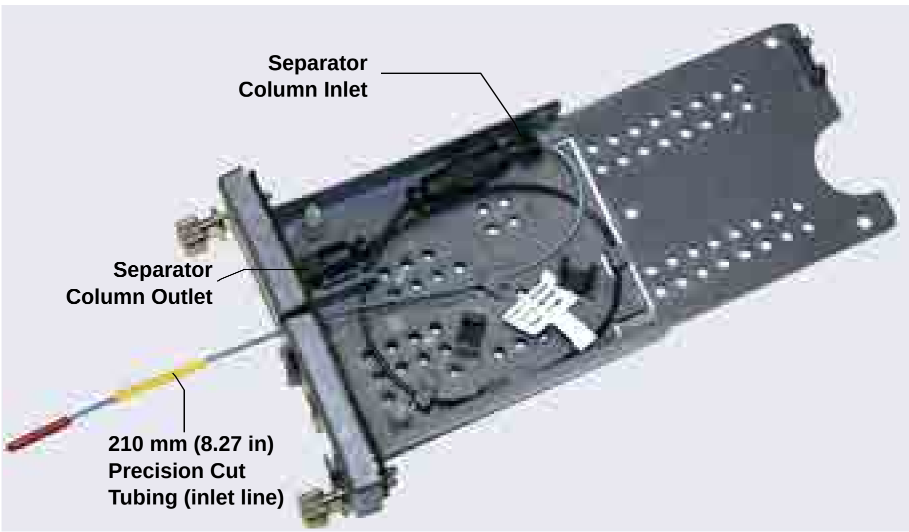


Figure 10-53. *250 mm Separator Column Installed in Capillary Column Tray*

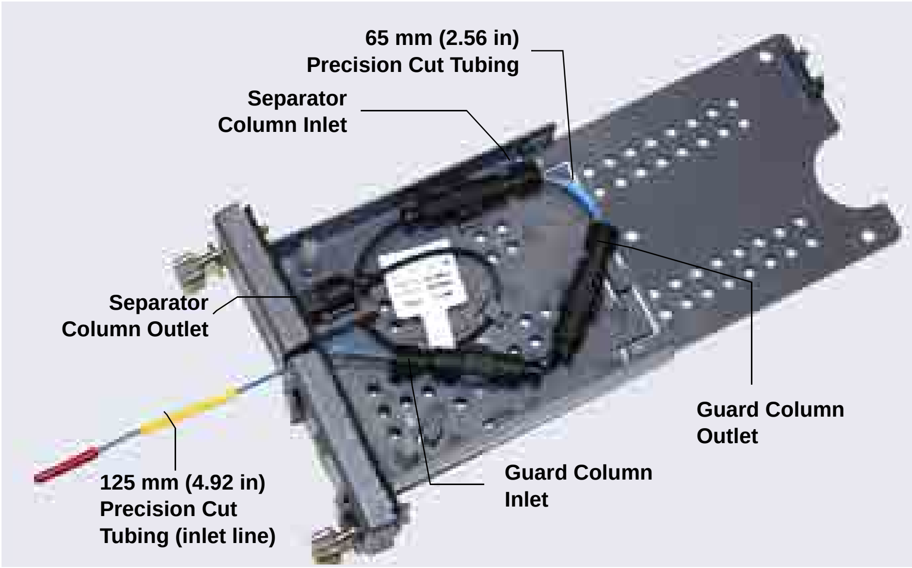


Figure 10-54. *150 mm Separator Column and 35 mm Guard Column Installed in Capillary Column Tray*

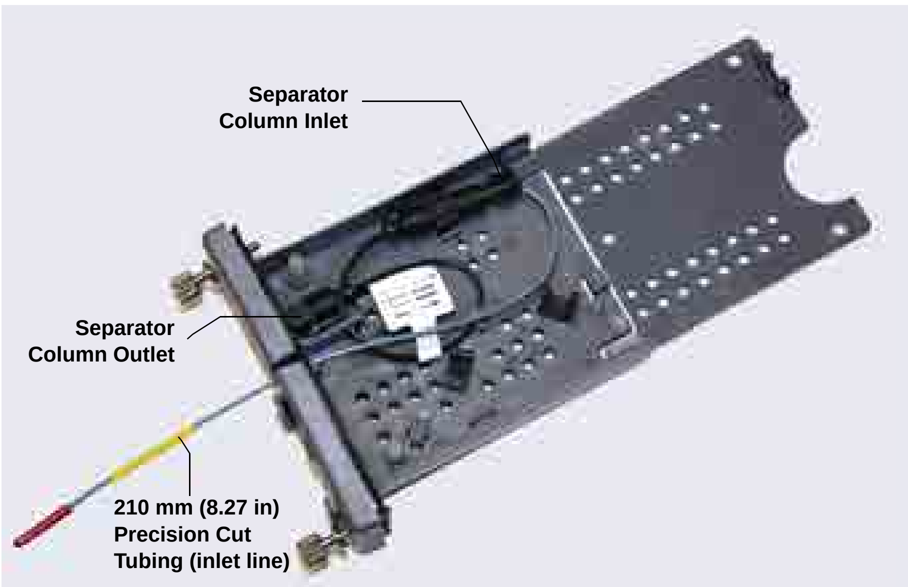


Figure 10-55. *150 mm Separator Column Installed in Capillary Column Tray*

5. Press the inlet line down into the slot on the front of the column tray and close the lid (you should hear a click).

   NOTE The column tray lid should close easily. If not, do not force it. Open the lid and verify that the columns and tubing are installed correctly and secured in the clips.

6. Slide the column tray into the Dionex ICS-6000 IC Cube column heater and tighten the two thumbscrews.
7. Reconnect the column inlet tubing to the **Eluent Out** port (3) of the injection valve.
8. Reconnect the line to the **Eluent Out** fitting on the column tray.
9. Close the DC upper door.

10.26 CD Service Procedures

10.26.1 Calibrating the CD Cell

NOTE Do not use this procedure to calibrate a new cell. New cells are calibrated at the factory.

Items Needed	Description
1.0 mM KCl solution	Prepare by dissolving 0.07456 g of reagent-grade KCl in 1 liter of 18 megohm-cm DI water.
Backpressure tubing to provide at least 7 MPa (1000 psi)	Use 0.25 mm (0.010 in) ID black PEEK tubing (capillary system, P/N 082647; analytical system, P/N 042690).

1. Click the **CD** tab on the Chromeleon ePanel Set.

2. Under **Detector Settings**, click **Calibration**. The Wellness panel opens (see Figure 10-56).

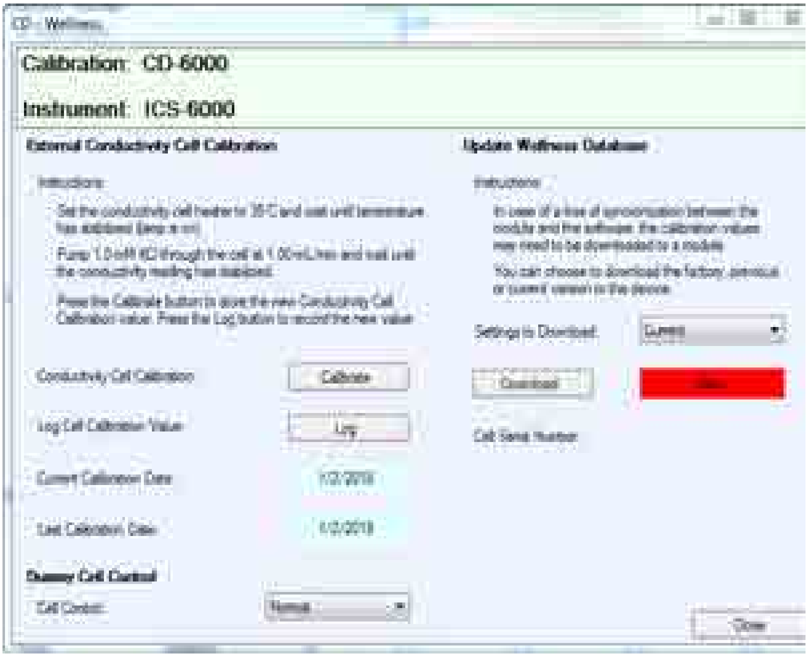


Figure 10-56. *Wellness Panel: Dionex ICS-6000 Conductivity Detector*

3. On the Wellness panel, under **External Conductivity Cell Calibration**, click **Instructions** for a summary of the procedure (described in detail in this section).
4. Disconnect the pump output line from the injection valve.
5. Disconnect the line from the suppressor **ELUENT OUT** port to the cell inlet and connect the pump output line directly to the cell inlet.
6. Verify that backpressure at the pump is at least 7 MPa (1000 psi) at 0.01 mL/min (for a capillary pump) or 1.00 mL/min (for an analytical pump).
7. Set the cell heater to 35 °C. Allow the cell to reach this temperature (when it does, the LED stops blinking).
8. Begin pumping 1.0 mM KCl through the cell at 0.01 mL/min (for a capillary pump) or 1.0 mL/min (for an analytical pump).

9. Wait until the total conductivity reading stabilizes (15 to 30 minutes).
10. On the Wellness panel, click **Calibrate**.

    After calibration, the conductivity reading should be 147.00 ± 2 µS. If this is not the case, repeat the calibration.
11. To record the new calibration value in the audit trail, click **Log**.
12. Flush the KCl solution from the system by pumping ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications in Section 1.6 through the cell. When the conductivity drops to less than 1 µS/cm, stop the pump.
13. Reconnect the pump to the injection valve and reconnect the line from the suppressor to the cell inlet.

Analytical IC

10.26.2 Replacing an Analytical Suppressor

Refer to the suppressor manual for guidance about when to replace a suppressor and for instructions on how to prepare a new suppressor before initial use.

1. Stop the pump flow.
2. Press the **POWER** button on the front of the DC for 2 seconds to turn off the DC.

CAUTION

To avoid injury, wait for the DC to cool down before opening the door or performing any maintenance or service procedures.

MISE EN GARDE

Afin d'éviter toute brûlure, laisser refroidir le DC avant d'ouvrir la porte ou d'effectuer des opérations de maintenance.

VORSICHT

Um Verletzungen zu vermeiden, warten Sie bitte, bis der DC abgekühlt ist, ehe Sie die Tür öffnen bzw. Wartungs oder Servicearbeiten durchführen.

3. Open the DC upper door.
4. Disconnect the four liquid lines from the suppressor (see Figure 10-57).

5. Unplug the suppressor cable from the detector.

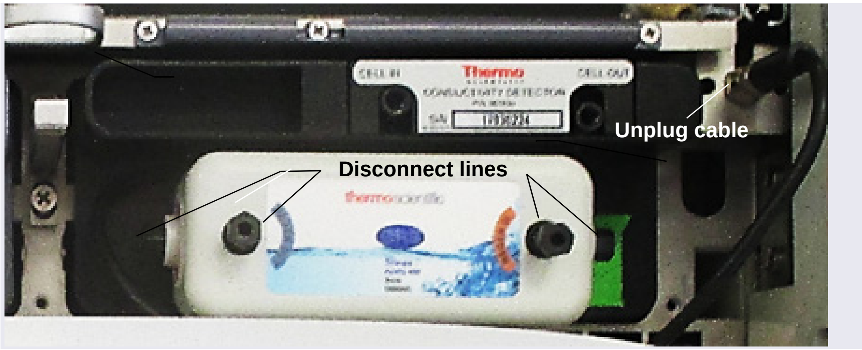


Figure 10-57. *Disconnecting the Suppressor Liquid Lines and Cable*

6. Remove the suppressor from the detector by sliding it to the left a few millimeters to detach it from the mounting tabs on the detector. Then, pull the suppressor toward you.
7. Orient the new suppressor with the **ELUENT IN** and **REGEN OUT** ports on the bottom (see Figure 10-57). Press the suppressor against the back of the detector and then slide it to the right to secure it onto the mounting tabs. Pull out slightly on the center of the suppressor to verify that it is securely fastened.
8. Reconnect the four liquid lines to the new suppressor.
9. Plug in the suppressor cable.
10. Close the DC door.
11. Turn on the DC power and restart the pump flow.
12. Before beginning operation, check the Consumables Inventory window in Chromeleon to verify that all consumables installed in the system are compatible. Refer to the Chromeleon Help for details.

10.26.3 Replacing a CD

1. Stop the pump flow.
2. Press the **POWER** button on the front of the DC for 2 seconds to turn off the DC.

3. Open the DC upper door and disconnect the tubing from the CD **CELL IN** and **CELL OUT** ports (see Figure 10-58).

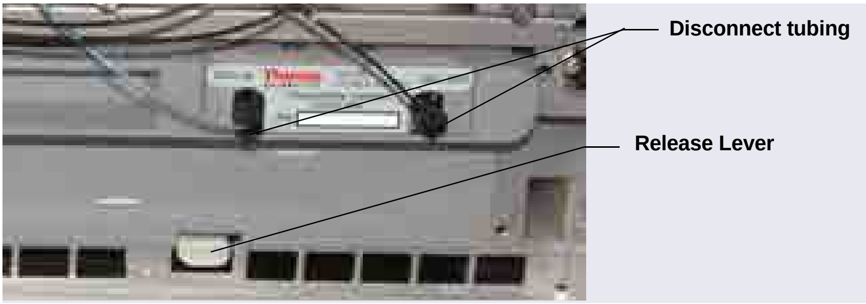


Figure 10-58. *Disconnecting the CD Liquid Lines (Capillary CD Shown)*

Analytical IC

4. For an analytical CD, remove the suppressor from the detector. For instructions, see Section 10.26.2.
5. Press the release lever located below the detector (see Figure 10-58). The detector pops out slightly from the DC compartment. Grasp the top of the detector and pull outward to remove the detector from the compartment. **Do not pull from the CELL IN and CELL OUT fittings**.
6. Note the electrical plug on the back of the detector and the receptacle on the inside of the DC.
7. Push the new detector into the opening in the DC and press firmly to ensure the electrical connection is secure.
8. Reconnect the cell inlet and outlet lines.
9. Reinstall the suppressor (see Section 10.26.2).
10. Turn on the DC power and restart the pump flow.

Analytical IC

10.26.4 Removing Trapped Air from the Conductivity Cell

Air bubbles in the cell can cause pulsations of the baseline, random noise, and low readings. Air may result from outgassing of the eluent. In an analytical IC system, follow the steps below to remove trapped air from the cell. These steps are not required for a conductivity cell in a capillary IC system.

1. Connect enough backpressure tubing to the cell outlet to shrink bubbles and allow them to pass more easily through the cell. See Table 10-9 for the appropriate type and number of backpressure tubing coils required.

Column Format	Flow Rate	Number of Coils (Carbonate EGC)	Number of Coils (KOH/ MSA EGCs)
2 mm	0.12–0.25 mL/min	2 red*	1 red
2 mm	0.25–0.75 mL/min	1 red	0
4 mm	0.5–1.5 mL/min	2 black	1 black
4 mm	1.5–3.0 mL/min	1 black	0
*The red coil (P/N 045878) consists of 0.125 mm (0.005 in) ID PEEK tubing with fittings.			

Table 10-9. *Backpressure Coil Requirements*

Table 10-10 lists the correct pressure range for each type of suppressor.

Dionex Suppressor Type	Pressure Range
DRS 600 and ERS 500e	0.21 to 0.70 MPa (30 to 100 psi)
AERS 500 Carbonate	0.28 to 0.70 MPa (40 to 100 psi)

Table 10-10. *Suppressor Operating Pressure Ranges*

2. To verify that the required amount of backpressure is being generated, follow the instructions in the suppressor manual.
3. If a bubble is still trapped in the cell, try these techniques to remove it:
   - Loosen and then tighten the cell outlet fitting.

- Temporarily disconnect the backpressure coil from the suppressor **REGEN IN** port and then plug and unplug the end of the tubing with your fingertip two or three times to create a pressure difference.

10.27 ED Service Procedures

10.27.1 Disconnecting the ED Cell

Before performing an ED cell service procedure, follow these instructions to disconnect the cell.

1. Turn off the cell voltage from the Chromeleon ePanel Set.
2. Stop the pump flow.
3. Disconnect the cell inlet and outlet lines from the ED cell and disconnect the two electrical cables (see Figure 10-59).

NOTE For a capillary IC system, disconnect the cell inlet line from the **ELUENT OUT** port of the IC Cube column tray.

Figure 10-59. *Disconnecting the ED Cell (Cell Configured for Analytical IC Shown)*

4. Grasp the cell by the cell body and pull straight out to remove it from the detector.

10.27.2 Replacing an ED Cell Disposable Working Electrode Gasket

For installation instructions for disposable working electrodes, refer to the installation guide shipped with the electrodes (see below) or to *Product Manual for Disposable Electrodes* (Document No. 065040).

- *Disposable Silver Electrode Installation Guide for ED* (Document No. 065137)
- *Disposable Platinum Electrode Installation Guide for ED* (Document No. 065139)
- *Disposable Gold Electrode Installation Guide* (Document No. 065191)

IMPORTANT **When you install a disposable electrode, be sure to install the correct gasket for your system:**

- **For a capillary system, use a 0.001 in PTFE gasket (P/N 072117, Pkg. of 2).**
- **For an analytical system with a gold, silver, or platinum disposable electrode, use a 0.002 in PTFE gasket (P/N 060141, Pkg. of 4).**
- **For an analytical system with a carbon disposable electrode, use a 0.001 in Ultem gasket (P/N 069339).**

10.27.3 Replacing an ED Cell Conventional Working Electrode Gasket

When to Replace the Gasket

Replace the gasket if there is a leak between the gasket and electrode, or between the gasket and cell body.

Items Needed

- ED cell gasket for conventional working electrodes (P/N 045972)
- Gloves
- Blunt-end tweezers

ED Cell Gasket Replacement Procedure

NOTE Always wear gloves when handling the ED cell. Never touch the electrode surface.

1. Follow the instructions in Section 10.27.1 to turn off the cell voltage, stop the pump flow, and disconnect the cell from the detector.
2. Loosen the yoke knob on the yoke block by unscrewing it two to three turns (see Figure 10-60).

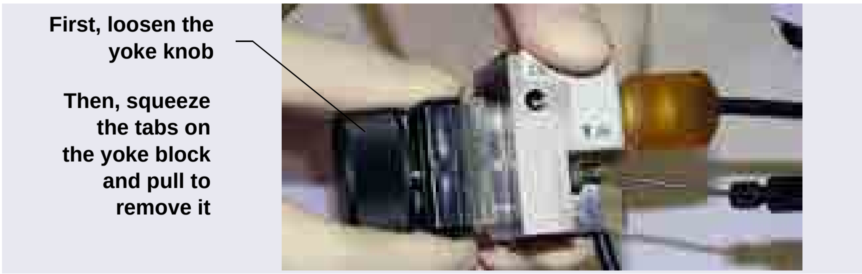


Figure 10-60. *Disassembling the ED Cell (Cell Configured for Analytical IC Shown)*

3. Squeeze the tabs on the sides of the yoke block, and then pull the block and knob off the working electrode (see Figure 10-60).

   NOTE Handle the cell gasket and the inside surfaces of the cell carefully to prevent scratches which may subsequently cause leakage.

4. Carefully separate the parts (see Figure 10-61).

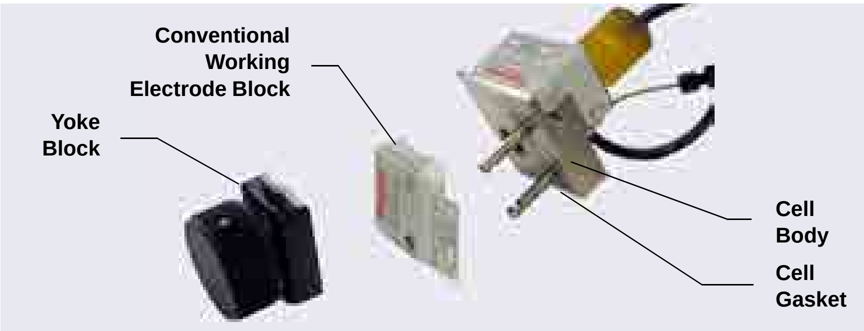


Figure 10-61. *ED Cell Components*

5. Use tweezers to remove the old cell gasket from the cell body (see Figure 10-62).

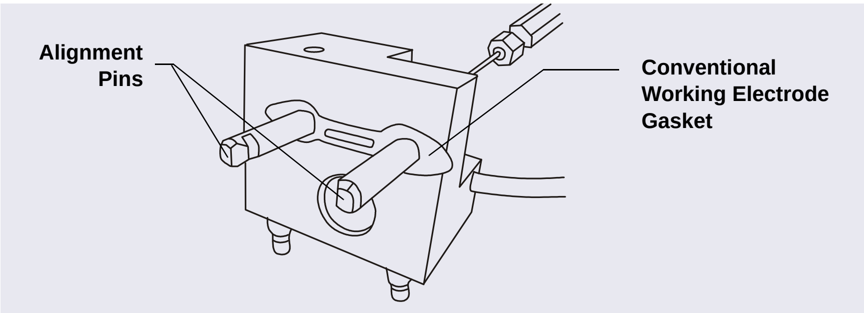


Figure 10-62. *ED Cell Gasket for Conventional Working Electrodes*

6. Rinse the surface of the cell with ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6.
7. Clean the polished surface of the cell with a clean, damp lint-free tissue.
8. Install the new gasket over the alignment pins on the cell body. When correctly installed, one end of the gasket extends beyond the cell body, to facilitate gasket installation and removal.
9. Verify that the gasket is flat against the cell body and is not wrinkled.

10. Reinstall the working electrode block and the yoke knob and block. Fingertighten the yoke knob by turning it a full 360 degrees.

    NOTE It is not possible to overtighten the yoke knob. Once the knob clicks into place, it does not tighten any further. The yoke knob ensures constant pressure is applied to the cell.

11. Orient the cell assembly with the yoke knob on the left and push the cell onto its mounting location in the DC compartment.
12. Reconnect the cell's inlet and outlet lines.
13. Reconnect the electrical cables.
14. Start the pump flow.
15. Wait until the pump pressure has stabilized (30 to 60 seconds) and then turn on the cell voltage.

10.27.4 Polishing an ED Cell Conventional Working Electrode

These instructions are for conventional (nondisposable) working electrodes only. **Do not polish disposable electrodes**.

When to Polish the Working Electrode

- **Do not polish new conventional working electrodes before installation.**
- After an electrode has been used for a period of time, a layer of contamination may build up. When this occurs, the electrode must be polished.
- After the working electrode is polished and installed, background signal and analyte sensitivity require several hours to stabilize. Once these have stabilized, do not polish the electrode unless you observe a loss of signal or severe electrode recession.

Items Needed

- Polishing kit (P/N 036313) shipped with the electrode

  The polishing kit contains polishing pads (P/N 036321), a bottle of fine polishing compound (P/N 036318), and a bottle of coarse polishing compound (P/N 036319).

- Gloves
- Tweezers

Working Electrode Polishing Procedure

NOTE To avoid electrode fouling, always wear gloves when handling electrodes.

1. Follow the instructions in Section 10.27.3, Step 1 through Step 4, to remove the working electrode from the cell.
2. Prepare the polishing pads:
   a. Designate a pad for use with the coarse polishing compound.
   b. Designate another pad for fine polishing compound; also designate the working electrode type with which it will be used.

   NOTE Do not use the same fine polishing pad to polish more than one type of working electrode; this can contaminate the electrode surface with microparticles from the other working electrodes.

   c. Designate a pad that will not be used with polishing compound. This pad is for removal of particles after polishing (see Step 5).
   d. Moisten the suede side of the polishing pad slightly with water and place the pad on a smooth, flat surface, with the suede side facing up.
3. Polish the electrode:

   NOTE If you are polishing the electrode before initial installation, use only the fine polishing compound.

   NOTE If you are polishing the electrode because of degradation of performance, such as increased baseline noise or tailing peaks, first use the coarse polishing compound. Then, repeat with the fine compound.

a. Sprinkle about one-half gram of polishing compound in the center of the suede side of the polishing pad. Add enough ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6 to make a thick paste.

b. Using the working electrode block, spread the paste evenly over the pad. Then, applying firm pressure in a figure eight motion, polish the surface of the electrode block for about 1 minute. If the pad dries out while polishing, add water sparingly. However, **never** allow the polishing compound to dry on the electrode.

c. Use ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6 to rinse off all traces of polishing compound from the electrode block. An ultrasonic cleaner is effective for thoroughly cleaning the electrode block. Carefully rinse the surface of the block with ASTM Type I (18 megohm-cm) filtered and deionized water.

4. If you used the coarse polishing compound in Step 3, repeat the step with the fine compound.

5. Using a moist piece of polishing cloth (with no polishing compound added), rub the polished surface free of residual polishing compound particles.

6. Inspect the surface of the working electrode to make sure that it is clean. Repeat Step 5, if necessary.

NOTE The polishing pads are reusable. Do not rinse the polishing compound from the pads. After initial use, add only enough polishing compound to maintain the coating on the pad.

7. Replace the working electrode block and yoke knob. Fingertighten the knob by turning it a full 360 degrees.

NOTE It is not possible to overtighten the yoke knob. Once the knob clicks into place, it does not tighten any further. The yoke knob ensures constant pressure is applied to the cell.

8. Orient the cell assembly with the yoke knob on the left and push the cell onto its mounting location in the DC compartment.
9. Reconnect the cell's inlet and outlet lines.
10. Reconnect the electrical cables.
11. Start the pump flow.
12. Wait until the pump pressure has stabilized (30 to 60 seconds) and then turn on the cell voltage.
13. Reapply the electrode potential. The baseline will drift for more than 1 hour as the cell re-equilibrates. Peak area values may require up to 12 hours to stabilize.

10.27.5 Replacing a pH-Ag/AgCl Reference Electrode

When to Replace a pH-Ag/AgCl Reference Electrode

Replace the pH-Ag/AgCl reference electrode if performance problems occur that are not corrected by regenerating the electrode. Performance problems can include no pH readouts, a shift in Ag/AgCl reference potential or incorrect readouts, baseline spikes, or a decreased response even with a freshly polished working electrode. The pH-Ag/AgCl reference electrode typically lasts from 3 months to 1 year, depending on use.

NOTE To regenerate a pH-Ag/AgCl reference electrode, soak it in a solution of 1 M KCl and 1 M HCl.

Items Needed

- pH-Ag/AgCl reference electrode (P/N 061879)

pH-Ag/AgCl Reference Electrode Replacement Procedure

1. Follow the instructions in Section 10.27.1 to turn off the cell voltage, stop the pump flow, and disconnect the cell from the detector.

2. Unscrew the pH-Ag/AgCl reference electrode and remove it from the cell body (see Figure 10-63).

Figure 10-63. *Removing the pH-Ag/AgCl Reference Electrode (Cell Configured for Analytical IC Shown)*

3. Unscrew the storage cap from the new pH-Ag/AgCl reference electrode (see Figure 10-64). Save the cap.

IMPORTANT **Always store the electrode in the storage cap (filled with saturated KCl solution) when the cell is not in use. This prevents the pH-Ag/AgCl reference electrode membrane from drying out and damaging the electrode. See Section 7.4 for storage instructions.**

Figure 10-64. *pH-Ag/AgCl Reference Electrode in Storage Cap*

4. To remove any precipitated salt, rinse the new electrode thoroughly in ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6.

5. Calibrate the pH-Ag/AgCl reference electrode (see Section 10.27.6).

10.27.6 Calibrating a pH-Ag/AgCl Reference Electrode

When to Calibrate

- Calibrate after installing a new pH-Ag/AgCl reference electrode.

Items Needed

- A buffer solution with a pH of 7.00
- A second buffer solution with a different pH (typically one that matches the pH of the eluent used in your application; either pH 10 or pH 4 in most cases)

pH-Ag/AgCl Reference Electrode Calibration Procedure

1. Complete the following if you are calibrating an electrode that is currently in use:
   a. Follow the instructions in Section 10.27.1 to turn off the cell voltage, stop the pump flow, and disconnect the cell from the detector.
   b. Unscrew the pH-Ag/AgCl reference electrode and remove it from the cell body (see Figure 10-63).
   c. To remove any precipitated salt, rinse the pH-Ag/AgCl reference electrode thoroughly in ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6.
2. With the pH-Ag/AgCl reference electrode removed from the cell, connect the cell and electrode electrical cables to the detector.
3. Click the **ED** tab on the Chromeleon ePanel Set.
4. Click the **Calibration** button. The Wellness panel opens.
5. Follow the instructions on the Wellness panel to calibrate the electrode.
6. Disconnect the pH-Ag/AgCl reference electrode cable and the cell cable.
7. Grasp the cell body and pull straight out to remove the cell from the detector.

Capillary IC If you are installing the pH-Ag/AgCl reference electrode in a capillary IC system, go on to page 409.

Analytical IC If you are installing the pH-Ag/AgCl reference electrode in an analytical IC system, go on to page 411.

Capillary IC

Installing the pH-Ag/AgCl Reference Electrode in the Cell for a Capillary IC System

1. To avoid any hydraulic pressure buildup when inserting the pH-Ag/AgCl reference electrode into the cell, make sure that fitting plugs are not installed on the cell inlet and outlet fittings.
2. Using tweezers, install the reference electrode gasket for capillary IC (P/N 072162) into the bottom of the reference electrode well (see Figure 10-65).

Figure 10-65. *Reference Electrode Gasket for Capillary IC*

3. Make sure the gasket is centered in the bottom of the well, and that it does not block the inlet and outlet of the well. The inlet and outlet are small round openings in the bottom of the well (see Figure 10-66).

Figure 10-66. *Reference Electrode Well with Reference Electrode Gasket for Capillary IC Installed*

4. Verify that the reference electrode gasket is correctly installed in the bottom of the well.
5. Screw the pH-Ag/AgCl reference electrode into the reference electrode well and tighten it fingertight (see Figure 10-67).

Figure 10-67. *Installing the pH-Ag/AgCl Reference Electrode In the Reference Electrode Well*

6. Orient the cell assembly with the yoke knob on the left and then push the cell onto its mounting location on the ED.
7. Connect the reference electrode cable and the cell cable.
8. Reconnect the cell inlet and outlet lines.

9. Start the pump flow.
10. Turn on the DC power.
11. Wait until the pump pressure has stabilized (30 to 60 seconds) and then turn on the cell voltage.

Analytical IC

Installing the pH-Ag/AgCl Reference Electrode in the Cell for an Analytical IC System

1. To avoid any hydraulic pressure buildup when inserting the reference electrode into the cell, make sure that fitting plugs are not installed on the cell inlet and outlet fittings.
2. Verify that the pH-Ag/AgCl reference electrode O-ring is present (see Figure 10-68) and then screw the pH-Ag/AgCl reference electrode into the reference electrode well and tighten it fingertight (see Figure 10-67).

Figure 10-68. *pH-Ag/AgCl reference electrode O-Ring*

3. Orient the cell assembly with the yoke knob on the left (see Figure 10-59) and push the cell onto its mounting location in the DC compartment.
4. Reconnect the cell inlet and outlet lines.
5. Start the pump flow.
6. Turn on the DC power.
7. Wait until the pump pressure has stabilized (30 to 60 seconds) and then turn on the cell voltage.

10.27.7 Replacing a pH-Ag/AgCl Reference Electrode O-Ring

1. Follow the instructions in Section 10.27.1 to turn off the cell voltage, stop the pump flow, and disconnect the cell from the detector.
2. Unscrew the pH-Ag/AgCl reference electrode and remove it from the cell body (see Figure 10-69).

Figure 10-69. *Removing the pH-Ag/AgCl Reference Electrode (Cell Configured for Analytical IC Shown)*

3. To remove any precipitated salt, rinse the pH-Ag/AgCl reference electrode thoroughly with ASTM Type I (18 megohm-cm) filtered and deionized water that meets the specifications listed in Section 1.6.
4. Use a sharp tool (for example, the tip of a safety pin or a straight pin) to remove the pH-Ag/AgCl reference electrode O-ring (see Figure 10-70).

Figure 10-70. *Removing the pH-Ag/AgCl Reference Electrode O-Ring*

5. Slide the new O-ring (P/N 014067) onto the electrode.

6. To avoid any hydraulic pressure buildup when inserting the pH-Ag/AgCl reference electrode, make sure that fitting plugs are not installed on the cell inlet and outlet fittings.
7. Screw the pH-Ag/AgCl reference electrode into the cell body and tighten fingertight.
8. Orient the cell assembly with the yoke knob on the left and push the cell onto its mounting location in the DC compartment (see Figure 10-59).
9. Reconnect the two cables and the liquid lines.
10. Start the pump flow.
11. Wait until the pump pressure has stabilized (30 to 60 seconds) and then turn on the cell voltage.

Capillary IC

10.27.8 Replacing a PdH Reference Electrode

When to Replace a PdH Reference Electrode

Replace the PdH reference electrode if its sensing surface is damaged or if the electrode no longer seals properly. Replace the PdH electrode if performance has degraded; for example, you observe lower response, higher background, or spikes.

The PdH reference electrode typically lasts several years, depending on use.

Items Needed

- PdH reference electrode (P/N 072075)
- Tweezers
- Wrench

PdH Reference Electrode Replacement Procedure

1. Follow the instructions in Section 10.27.1 to turn off the cell voltage, stop the pump flow, and disconnect the cell from the detector.

2. Use a wrench to unscrew the PdH reference electrode nut and then remove the nut from the reference electrode well (see Figure 10-71).

Figure 10-71. *Unscrewing the PdH Reference Electrode Nut*

3. Pull the reference electrode out of the well (see Figure 10-72).

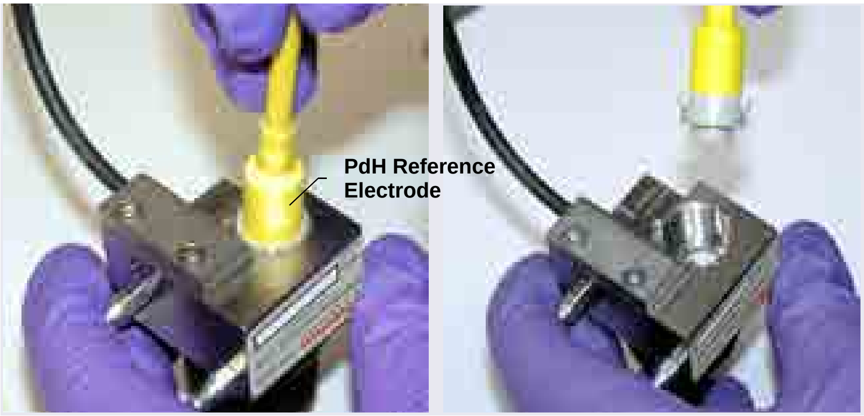


Figure 10-72. *Removing the PdH Reference Electrode from the Reference Electrode Well*

4. Using tweezers, remove the PdH reference electrode gasket from the well (see Figure 10-73).

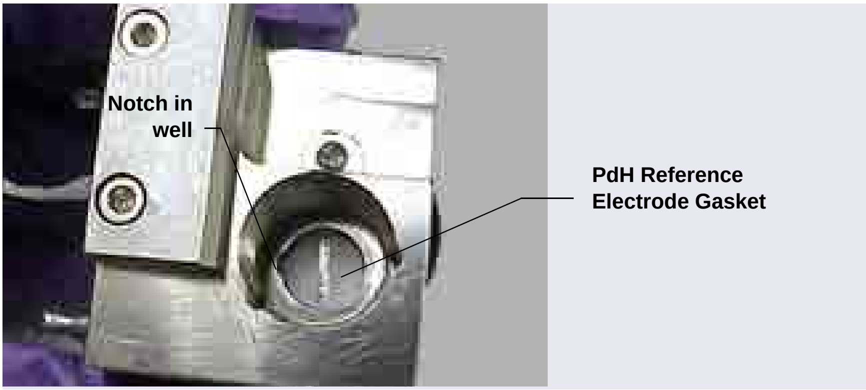


Figure 10-73. *Removing the PdH Reference Electrode Gasket*

5. To avoid any hydraulic pressure buildup when inserting the reference electrode into the cell, verify that fitting plugs are not installed on the cell inlet and outlet fittings.
6. Remove the PdH reference electrode (P/N 072075) from its box.
7. Install the O-ring (P/N 030839) on the end of the PdH reference electrode (see Figure 10-74).

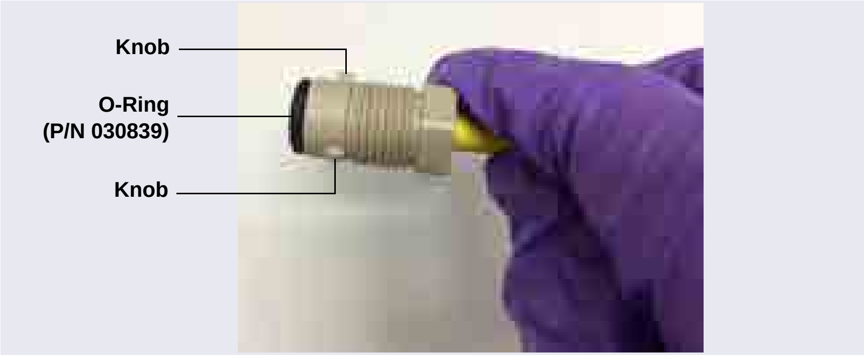


Figure 10-74. *PdH Reference Electrode with O-Ring*

8. Align the fitting on the end of the PdH reference electrode so that the knobs on the fitting align with the grooves in the reference electrode well (see Figure 10-75).

9. Insert the fitting into the well.

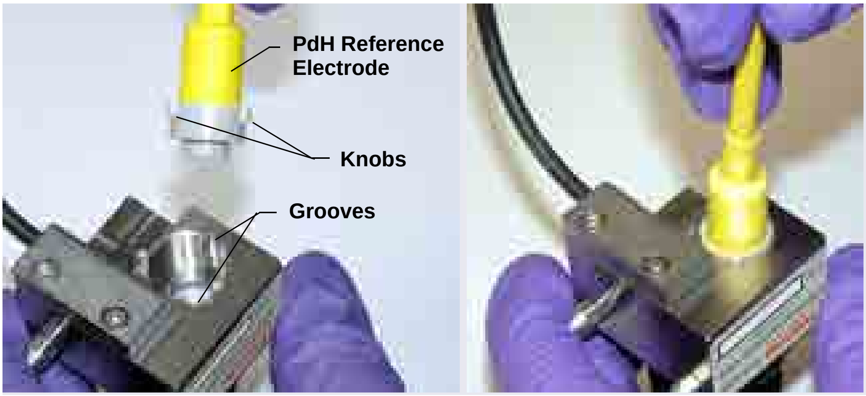


Figure 10-75. *Inserting the PdH Reference Electrode Fitting into the Reference Electrode Well*

10. Screw the nut on the PdH reference electrode into the reference electrode well and tighten it fingertight (see Figure 10-76). After fingertightening, use a wrench to tighten the nut an additional 20 to 30 degrees.

Figure 10-76. *Installing the PdH Reference Electrode Nut*

11. Orient the cell assembly with the yoke knob on the left and then push the cell onto its mounting location on the ED.

12. Connect the reference electrode cable and the cell cable.
13. Reconnect the cell inlet and outlet fittings.
14. Condition the PdH reference electrode (see the instructions below).

Conditioning the PdH Reference Electrode

The PdH reference electrode conditioning procedure varies slightly, depending on your application. After plumbing the cell, follow the appropriate instructions below to condition the electrode.

To condition the PdH reference electrode for alkaline (carbohydrate) applications

Alkaline applications include the Au working electrode under hydroxide eluent for a Dionex ICS-6000 RFIC-EG system.

1. On the Chromeleon Home ePanel, set the pump flow rate to the recommended value for the column (for example, **0.50 mL/min** for a Thermo Scientific™ Dionex™ CarboPac® PA20 column [3 x 150 mm]) and click the slider to turn on the pump.
2. Under **Eluent Generator**, enter **100 mM**. The eluent generator will turn on automatically.
3. Under **CR-TC**, if **Mode Off** is displayed, click the slider to turn on the power.
4. Verify that eluent is exiting the cell.
5. On the ED ePanel, set the ED reference electrode type to **PdH** and turn on the PdH power.

IMPORTANT **Do not turn on the ED cell. An incorrect reference electrode potential from the unconditioned PdH reference electrode can damage the working electrode.**

6. If an external vacuum pump is installed, turn off the pump before conditioning the electrode (see Step 7).

   NOTE If you condition the PdH reference electrode while the vacuum pump is on, the background reading during the run will be excessively high.

7. Condition the electrode for 2 hours at the selected settings.

8. Turn on the external vacuum pump, if installed.

To condition the PdH reference electrode for acidic applications

Acidic applications include the Pt working electrode under MSA (methanesulfonic acid) eluent.

1. On the Chromeleon Home ePanel, set the pump flow rate to the recommended value for the column (for example, **0.20 mL/min** for a Thermo Scientific™ Dionex™ IonPac® ICE-AS1 column [4 x 250 mm]) and click the slider to turn on the pump.
2. Under **Eluent Generator**, enter **100 mM**. The eluent generator will turn on automatically.
3. Under **CR-TC**, if **Mode Off** is displayed, click the slider to turn on the power.
4. On the ED ePanel, set the ED reference electrode type to **PdH** and turn on the PdH power.

IMPORTANT **Do not turn on the ED cell. An incorrect reference electrode potential from the unconditioned PdH reference electrode can damage the working electrode.**

5. Condition the electrode for 2 hours at these settings.

10.27.9 Replacing an ED Detector

1. Turn off the pump flow.
2. Press the **POWER** button on the front of the DC for 2 seconds to turn off the DC.

CAUTION **To avoid injury, wait for the DC to cool down before opening the door or performing any maintenance or service procedures.**

MISE EN GARDE **Afin d'éviter toute brûlure, laisser refroidir le DC avant d'ouvrir la porte ou d'effectuer des opérations de maintenance.**

VORSICHT

Um Verletzungen zu vermeiden, warten Sie bitte, bis der DC abgekühlt ist, ehe Sie die Tür öffnen bzw. Wartungs oder Servicearbeiten durchführen.

3. Open the DC upper door and disconnect the cell inlet and outlet lines.
4. Disconnect the reference electrode cable and the cell cable.
5. Grasp the cell body and pull straight out to remove the cell from the detector.
6. Press the release lever located below the detector. The detector pops out slightly from the DC compartment. Grasp the detector and pull outward to remove the detector from the compartment.
7. Note the electrical plug on the back of the detector and the receptacle on the inside of the DC.
8. Push the new detector into the opening in the DC and press firmly to ensure the electrical connection is secure.
9. Reinstall the cell and reconnect the cell inlet and outlet lines and the cables.

NOTE If you are installing an ED detector in a system that previously was set up for conductivity detection, remove the suppressor cartridge from the IC Cube and replace it with a suppressor bypass cartridge (P/N 072055). For IC Cube cartridge installation instructions, see Section 10.25.1.

ICS-6000 DP/SP

DP/SP Specifications

Dionex ICS-6000 Single Pump/Dual Pump Specifications	
Type	Dual-piston (in series), microprocessor-controlled, constant-stroke, variable-speed, patented Isokinetic Eluent Precompression
Construction	Chemically inert, metal-free PEEK pump heads and flow path; compatible with aqueous eluents from pH 0–14 and reversed-phase solvents
Pressure Range	0–41 MPa (0–6000 psi)
Flow Rate Range	Analytical: 0.000–10.000 mL/min with settable flow increments at 0.001 mL/min Capillary: 0.001–3.000 mL/min with settable flow increments at 0.0001 mL/min
Flow Rate Precision	<0.1%
Flow Rate Accuracy	<0.1% at 14 MPa (2000 psi)
Pressure Ripple	Analytical: <1.0% at 1.0 mL/min typical Capillary: <0.2% (with damper) or <1.0% (without damper) at 10 µL/min
Pressure	None required
Vacuum Degasser	Integrated degasser with 1 channel for isocratic pump or 4 channels for quaternary pump; optional
Piston Seal Wash	Automatic operation, standard
Gradient Formation	Quaternary low-pressure (Analytical only) or electrolytic eluent generation at high pressure (Analytical and Capillary)
RFIC-EG Gradients	Analytical: 0.1–100 mM Capillary: 0.1–200 mM
Gradient Profiles	Any combination of an unlimited number of linear, convex, and concave positive and negative gradient profiles

Dionex ICS-6000 Single Pump/Dual Pump Specifications (Continued)	
Gradient Proportioning Accuracy and Precision (Analytical only)	±0.5% at 2 mL/min
Gradient Mixing (Analytical only)	Passive mixers for 2 mm and 4 mm ID columns, optional
Eluent Generation	Eluent generation (RFIC-EG), optional
Eluent On/Off Valve	Electrically-actuated, standard
Leak Sensor	Optical, standard
System Software	
Chromeleon 7 Chromatography Data System	Operating system: Microsoft Windows 10 or later
ICS-6000 App	Operating system: Microsoft Windows 10 Pro
Electrical	
Main Power Requirements	90–264 VAC, 47–63 Hz (Auto-sensing power supply; no manual voltage or frequency adjustment required) Typical input power: 28 W Maximum line draw: 1.2 A at 110 VAC
Fuse Requirements	Two IEC 60127-2 slow-blow fuses (P/N 954773) rated at 2 A, 250 V
Physical	
Dimensions (h × w × d)	41 × 23 × 56 cm (16 × 8.75 × 21.5 in)
Weight	DP: 24.1 kg (55 lb) SP: 20.4 kg (45 lb)
Flow Path	All polymeric (PEEK), anion or cation configuration
Environmental	
Operating Temperature	4–40 °C (40–104 °F)
Operating Humidity	5–95% relative humidity (noncondensing)

EG Specifications

Dionex ICS-6000 Eluent Generator Specifications	
Minimum and Maximum Eluent Concentrations	Analytical: 0.1–100 mM Capillary: 0.1–200 mM
Flow Rates	Analytical: 0.100–3.000 mL/min Capillary: 0.001–0.030 mL/min
Eluent Types (Standard-Pressure Analytical)	KOH, LiOH, NaOH Carbonate Carbonate/Bicarbonate Carbonate with pH modifier MSA
Eluent Types (High-Pressure Analytical)	KOH MSA
Eluent Types (Capillary)	KOH MSA
Maximum Operating Pressure	35 MPa (5000 psi)
Maximum Solvent Concentration (Analytical and Capillary)	Cations: None Anions: 25% methanol
Gradient Profiles	Standard; any combination of an unlimited number of linear, convex, and concave positive and negative gradient profiles
Number of Cartridges Supported	Two–dual cartridge support
Dionex RFIC^{+} Eluent Degasser (Analytical)	Eluent degasser housed in the EG module
System Software	
Chromeleon 7 Chromatography Data System	Operating system: Microsoft Windows 10 or later
ICS-6000 App	Operating system: Microsoft Windows 10 Pro
Electrical	

Dionex ICS-6000 Eluent Generator Specifications	
Main Power Requirements	90–264 VAC, 47–63 Hz (Auto-sensing power supply; no manual voltage or frequency adjustment required) Typical input power: 18 W Maximum line draw: 1 A at 110 VAC
Fuse Requirements	Two IEC 60127-2 slow-blow fuses (P/N 954773) rated at 2 A, 250 V
Physical	
Dimensions (h × w × d)	41 × 23 × 56 cm (16 × 8.75 × 21.5 in)
Weight	18 kg (40 lb) (without optional items)
Flow Path	All polymeric (PEEK), anion or cation configurations
Environmental	
Operating Temperature	4–40 °C (40–104 °F)
Operating Humidity	5–95% relative humidity (noncondensing)

Dionex ICS-6000 Eluent Regeneration Specifications (Analytical IC Only)	
Eluents	Carbonate and carbonate/bicarbonate combinations up to 20 mM MSA up to 34 mM
Flow Rates	1.00–2.00 mL/min
Continuous Operation with 4 L of Eluent	Up to 28 days or 2000 samples, typically
Always On, Always Ready Capable	Standard feature
Remains Fully Calibrated for Extended Periods of Time (≲28 Days)	Standard feature; results are traceable to a single calibration
Maximum Operating Pressure	21 MPa (3000 psi)
Operating Temperature Range	4–40 °C (40–104 °F)

DC Specifications

Dionex ICS-6000 Detector/Chromatography Compartment Specifications	
Standard DC, Dual Temperature Zone Model: Independent Temperature Control of Each Zone	Upper Zone Temperature Range: 18–40 °C (minimum temperature: ambient – 15 °C) (maximum temperature: ambient + 20 °C) Lower Zone Temperature Range: 10–70 °C (minimum temperature: ambient – 15 °C) (maximum temperature: ambient + 50 °C) Temperature Accuracy: ±0.5 °C Temperature Stability: ±0.2 °C Temperature Precision: ±0.2 °C
Low-Temperature DC, Dual Temperature Zone Model: Independent Temperature Control of Each Zone	Upper Zone Temperature Range: 10–40 °C (minimum temperature: ambient – 17 °C) (maximum temperature: ambient + 20 °C) Lower Zone Temperature Range: 10–70 °C (minimum temperature: ambient – 15 °C or upper zone – 20 °C) (maximum temperature: ambient + 50 °C) Temperature Accuracy: ±0.5 °C Temperature Stability: ±0.2 °C Temperature Precision: ±0.2 °C
Standard DC and Low-Temperature DC: Lower Zone (Analytical)	Injection Valves: Up to two 6- or 10-port valves (upgradeable, field installable) Up to two column sets 1–9 mm diameter Maximum Column Length: 250 mm plus 50 mm guard column Precolumn Heat Exchangers: two (2 mm or 4 mm column ID version)
Automation Manager (Optional, Analytical only)	Injection Valves: Up to two high-pressure valves, either 6- or 10-port, 2-position Low-Pressure Valves: Up to two inert, 2- or 3-way Reaction Coil Heater (RCH): Holds two reaction coils RCH Temperature Range: 5 °C above upper zone, 80 °C maximum AutoPrep Kit: Dual loop for sample pre-concentration All valves and heater upgradeable and field installable

Dionex ICS-6000 Detector/Chromatography Compartment Specifications	
Capillary IC Cube (Optional, but required for capillary chemistries)	One or two IC Cube modules hold the following: Injection Valves: Up to two (one per IC Cube) high-pressure valves, 4-port, 2-position EG Degasser Separator column and guard Carbonate Removal Device Capillary suppressor (See Suppression section) IC Cubes and cartridges are customer-installable, with preformed tubing and color-coded labeling Capillary column heater, 15–80 °C
Flow Path	Plumbing configurations for 4 mm, 2 mm, and 0.4 mm columns; fully inert; PEEK
Detectors	Standard DC: Any combination of two conductivity or electrochemical detectors, upgradeable and field installable Low-Temperature DC: Up to two conductivity detectors, upgradeable and field installable All DC modules: Dual detectors can be operated simultaneously or independently. Optional remote operation up to 3 m from instrument.
Analog Signal Output	Two analog output channels, two 24 V relays, two TTL Out and eight TTL In lines, upgradeable and field installable, optional
Leak Detection	Optical leak sensor, standard
Application Control Automation	All DC modules are equipped with two built-in switched AC controllers to automate external devices and the ability to control up to six low-pressure 2-way or 3-way valves for fluidic automation
Suppression	
Nonsuppressed Conductivity	Supported
Suppressor Wear Parts	None; no valves, pumps, peristaltic pump tubing, or inline filters required
Chemical Suppression	2 mm and 4 mm anion and cation membrane suppression available

Dionex ICS-6000 Detector/Chromatography Compartment Specifications	
Displacement Chemical Suppression	2 mm and 4 mm anion and cation membrane suppression available
Electrolytic Suppression, Recycle Mode	0.4 mm (with optional IC Cube), 2 mm, and 4 mm anion and cation. Micro-membrane (2 mm and 4 mm) or capillary tube membrane (0.4 mm).
Electrolytic Suppression, External Water Mode	0.4 mm (with optional IC Cube), 2 mm, and 4 mm anion and cation. Micro-membrane (2 mm and 4 mm) or capillary tube membrane (0.4 mm).
Dionex AMMS-ICE	Available in 2 mm and 4 mm versions
Salt Converter	Available in 2 mm and 4 mm versions
Carbonic Acid Removal for Anions	Dionex AERS and Dionex AMMS plus Dionex CRD 200 or Dionex CRD 300 for 2 mm and 4 mm versions; Dionex ACES 300 plus Dionex CRD 200 (0.4 mm) for capillary suppressors
Suppression Capacities	Dionex ACES: 2 µeq/min Dionex CCES: 1.5 µeq/min Dionex ACES 300 (0.4 mm): 2 µeq/min Dionex CCES 300 (0.4 mm): 1.5 µeq/min Dionex ACRS (2 mm): 37.5 µeq/min Dionex ACRS (4 mm): 150 µeq/min Dionex CCRS (2 mm): 37.5 µeq/min Dionex CCRS (4 mm): 150 µeq/min Dionex ADRS 600 (2 mm): 50 µeq/min Dionex ADRS 600 (4 mm): 200 µeq/min Dionex AERS 500 Carbonate (2 mm): 7.5 µeq/min Dionex AERS 500 Carbonate (4 mm): 30 µeq/min Dionex AERS 500e (2 mm): 50 µeq/min Dionex AERS 500e (4 mm): 200 µeq/min Dionex CDRS 600 (2 mm): 35 µeq/min Dionex CDRS 600 (4 mm): 100 µeq/min Dionex CERS 500e (2 mm): 35 µeq/min Dionex CERS 500e (4 mm): 100 µeq/min

Dionex ICS-6000 Detector/Chromatography Compartment Specifications	
Suppressor Void Volumes	Dionex ACES: <1.5 µL Dionex CCES: <1.5 µL Dionex ACES 300 (0.4 mm): <1 µL Dionex CCES 300 (0.4 mm): <1 µL Dionex ACRS (2 mm): <15 µL Dionex CCRS (2 mm): <15 µL Dionex ACRS (4 mm): <50 µL Dionex CCRS (4 mm): <50 µL Dionex ADRS 600 (2 mm): <15 µL Dionex ADRS 600 (4 mm): <50 µL Dionex CDRS 600 (2 mm): <15 µL Dionex CDRS 600 (4 mm): <50 µL Dionex AERS 500 Carbonate (4 mm): <50 µL Dionex AERS 500 Carbonate (2 mm): <15 µL Dionex AERS 500e (2 mm): <15 µL Dionex CERS 500e (2 mm): <15 µL Dionex AERS 500e (4 mm): <50 µL Dionex CERS 500e (4 mm): <50 µL
System Software	
Chromeleon 7 Chromatography Data System	Operating system: Microsoft Windows 10 or later
ICS-6000 App	Operating system: Microsoft Windows 10 Pro
Electrical	
Main Power Requirements	90–265 VAC, 47–63 Hz (Auto-sensing power supply; no manual voltage or frequency adjustment required) Typical input power: 200 W Maximum line draw: 9.2 A at 110 VAC
Fuse Requirements	Two IEC 60127-2 slow-blow fuses (P/N 954772) rated at 10 A, 250 V
Physical Specifications	
Dimensions (h × w × d)	Standard DC: 44.5 × 42 × 57.5 cm (17.5 × 16 × 22.6 in) Low-Temperature DC: 44.5 × 42 × 59.7 cm (17.5 × 16 × 23.5 in)

Dionex ICS-6000 Detector/Chromatography Compartment Specifications	
Weight	Standard DC: 38 kg (84 lb) Low-Temperature DC: 43 kg (96 lb)
Flow Path	All polymeric (PEEK), anion or cation configurations
Environmental	
Operating Humidity	20–80% relative humidity (noncondensing)
Electronics Type	Microprocessor-controlled digital signal processing, autoranging
Cell Drive	8 kHz square wave
Linearity	1%
Resolution	0.00238 nS/cm
Output Range	Digital Signal Range: 0–15,000 µS/cm Analog Signal Range: 0–15,000 µS/cm
Noise, Wet	<0.2 nS at 23 µS/cm background <0.1 nS at 1 µS/cm background
Filter	Rise times 0 to 10 s, programmable
Sampling Rate	1 to 100 Hz, user-settable or automatic
Cell Temperature	5 °C above DC upper zone temperature to 60 °C maximum. User-settable; working range is identical to settable range.
Cell Temperature Stability	<0.001 °C
Cell Temperature Compensation	Default 1.7% per °C; programmable from 0–3% per °C
Flow Cell Maximum Pressure	10 MPa (1500 psi)
Flow Cell Volume	Analytical: 0.7 µL Capillary: 0.02 µL
Cell Electrodes	Passivated 316 stainless steel; compatible with MSA
Cell Body	Chemically inert polymeric material
Heat Exchanger	Inert, tortuous-path for low axial dispersion

Dionex ICS-6000 Conductivity Detector Specifications	
System Software	
Software	Operating system: Microsoft Windows 10 or later
Physical	
Dimensions (h × w × d)	6.9 × 16.7 × 9.9 cm (2.7 × 6.5 × 3.9 in)
Weight	400 g (1.6 lb)

Dionex ICS-6000 Electrochemical Detector Specifications	
Electronics Type	Microprocessor-controlled digital signal processing
Electronic Noise (Wet Noise) (Capillary and Analytical)	IPAD (Au electrode) <50 pC @ 10 mM KOH DC Amperometry (GC) <10 pA @ catecholamine eluent
Potential Range	–2.0 to 2.0 V in 0.001 V increments
Signal Range: Digital and Analog	Integrated amperometry: 50 pC to 200 µC DC amperometry: 5 pA to 74 µA
Filter	0–10 s response time, user-settable
Control Mode	Local or remote control using relay closures or TTL *or* control using Chromeleon via DC module
Cell Body	Titanium body with narrow bore PEEK inlet tubing for capillary format, titanium inlet tubing for analytical format. Compatible with 0.2 to 0.6 mm ID columns (PEEK inlet), 2 to 7 mm ID columns (titanium inlet).
Working Electrodes	Conventional: gold, glassy carbon, platinum, and silver Disposable: gold, platinum, carbon, and silver
Reference Electrode	pH-Ag/AgCl combination, one-piece design (Analytical and Capillary) PdH combination, one-piece design (Capillary only)
Autoranging	Yes
Analog Output	Full scale of 10, 100, or 1000 mV; user-selectable

Dionex ICS-6000 Electrochemical Detector Specifications (Continued)	
Cell Volume at Working Electrode	<0.2 µL
Maximum Cell Operating Pressure	0.7 MPa (100 psi)
System Software	
Chromeleon 7 Chromatography Data System	Operating system: Microsoft Windows 10 or later
ICS-6000 App	Operating system: Microsoft Windows 10 Pro
Physical	
Dimensions (h x w x d)	6.9 × 16.7 × 9.9 cm (2.7 × 6.5 × 3.9 in)
Weight	400 g (1.6 lb)

ICS-6000 DP/SP DP/SP Reordering Information

Part Number	Item
Pump Head Components	
082602 (capillary) 075047 (analytical)	Primary pump head
082661 (capillary) 083482 (analytical)	Secondary pump head
044451 (capillary) 045722 (analytical)	Inlet check valve assembly (for primary pump head); includes inlet nut and 1/8 in cartridge
044450 (capillary) 045721 (analytical)	Outlet check valve assembly (for primary pump head); includes outlet nut and 1/8 in cartridge
075493 (capillary) 075768 (analytical)	Main piston seal
074371 (capillary) 074370 (analytical)	Backup ring
040695	O-ring (for capillary or analytical pump)
074446 (capillary) 075767 (analytical)	Seal wash body
068628 (capillary) 063382 (analytical)	Piston seal wash seal
068627 (capillary) 062092 (analytical)	Retainer for piston seal wash seal
068646 (capillary) 079857 (analytical)	Piston
60-062087	Priming valve for secondary pump head (for capillary or analytical pump)
063382	Priming valve knob seal for secondary pump head (for capillary or analytical pump)

Part Number	Item
Piston Seal Wash System	
064155	Piston seal wash reservoir
063268	PharMed tubing, 0.159 cm (0.0625 in) ID **Note:** Order 12 in of tubing for replacement of piston seal wash tubing.
064079	Tygon 2075 tubing, 0.15 cm (0.060 in) ID **Note:** Order 12 in of tubing for replacement of piston seal wash tubing.
063518	Dual-Serial External Seal Wash Kit
068661	Dual-Parallel External Seal Wash Kit
Eluent Storage and Delivery	
072059	EO without reservoirs
072057	Dionex ICS-6000 Eluent Organizer with two 2-liter reservoirs
072058	Dionex ICS-6000 Eluent Organizer with four 2-liter reservoirs
063291	Eluent reservoir (plastic), 1-liter
062510	Eluent reservoir (plastic), 2-liter
063292	Eluent reservoir (plastic), 4-liter
AAA-074423	EO Regulator Accessory and Stand
074424	TC/VWD/PDA Regulator Bracket Kit
074422	Regulator
045987	Filter, end-line
044105	Filter, high-pressure inline
IC PEEK Viper Fittings and Tubing Assemblies	
088916	Viper assembly, 0.18 mm (0.007 in) ID, 864 mm (34.0 in)
088917	Viper assembly, 0.18 mm (0.007 in) ID, 178 mm (7.0 in)
Miscellaneous	
049135	GM-4 Static Mixer
043276	Ferrule fitting, 10-32 double-cone
22000-98001	Fitting bolt, 10-32 (for double-cone ferrule fitting)

Part Number	Item
062511	Ferrule fitting, 1/16 in
052230	Fitting bolt, 1/16 in
042772	Plug
079803	Syringe, 10 cc
954773	Fuse, IEC 60127-2 slow-blow; rated at 2A, 250V
063246	USB cable, 1 m (3 ft) long
005.9001A	Cinch connector, 2-pin
Maintenance Kits	
075039	DP/SP (Capillary) Annual Preventive Maintenance Kit
075970	DP/SP (Analytical) Annual Preventive Maintenance Kit

EG Reordering Information

Part Number	Item
Dionex Consumables for Capillary EG	
072076	EGC KOH (Capillary)
072077	EGC MSA (Capillary)
072078	CR-ATC (Capillary)
072079	CR-CTC (Capillary)
Dionex Consumables for Analytical EG (Standard-Pressure Systems)	
074532	EGC III KOH
074534	EGC III LiOH
074535	EGC III MSA
074533	EGC III NaOH
075550	CR-ATC 500
075551	CR-CTC 500
088471	EPM 500 Electrolytic pH Modifier
088468	EGC 500 CO_3 Mixer (4 mm)
088467	EGC 500 CO_3 Mixer (2 mm)
Dionex Consumables for Analytical EG (High-Pressure Systems with Consumable Monitoring Capability)	
075778	EGC 500 KOH
075779	EGC 500 MSA
088662	CR-ATC 600
088663	CR-CTC 600
088471	EPM 500 Electrolytic pH Modifier
088468	EGC 500 CO_3 Mixer (4 mm)
088467	EGC 500 CO_3 Mixer (2 mm)
IC PEEK Viper Fittings and Tubing Assemblies for Analytical EG	
088906	Viper assembly, 0.18 mm (0.007 in) ID, 178 mm (7.0 in)

Part Number	Item
Dionex ICS-6000 IC PEEK Viper Capillary CD Kit (P/N 088801) (Parts also available separately)	
088907	Viper assembly, 0.18 mm (0.007 in) ID, 178 mm (7.0 in)
088908	Viper assembly, 0.062 mm (0.0025 in) ID, 864 mm (34.0 in)
088909	Viper assembly, 0.062 mm (0.0025 in) ID, 114 mm (4.5 in)
088910	Viper assembly, 0.062 mm (0.0025 in) ID, 76 mm (3.0 in)
088841	Viper assembly, 0.062 mm (0.0025 in) ID, 216 mm (8.5 in)
088847	Viper assembly, 0.062 mm (0.0025 in) ID, 635 mm (25.0 in)
Dionex ICS-6000 IC PEEK Viper Capillary ED Kit (P/N 088802) (Parts also available separately)	
088907	Viper assembly, 0.18 mm (0.007 in) ID, 178 mm (7.0 in)
088908	Viper assembly, 0.062 mm (0.0025 in) ID, 864 mm (34.0 in)
088909	Viper assembly, 0.062 mm (0.0025 in) ID, 114 mm (4.5 in)
088910	Viper assembly, 0.062 mm (0.0025 in) ID, 76 mm (3.0 in)
088911	Viper assembly, 0.062 mm (0.0025 in) ID, 229 mm (9.0 in)
088841	Viper assembly, 0.062 mm (0.0025 in) ID, 216 mm (8.5 in)
088847	Viper assembly, 0.062 mm (0.0025 in) ID, 635 mm (25.0 in)
Dionex ICS-6000 IC PEEK Viper 2 mm CD Kit (P/N 302965) (Parts also available separately)	
302987	Viper assembly, 0.13 mm (0.005 in) ID, 89 mm (3.5 in)
302989	Viper assembly, 0.13 mm (0.005 in) ID, 356 mm (14.0 in)
302991	Viper assembly, 0.13 mm (0.005 in) ID, 254 mm (10.0 in)
302993	Viper assembly, 0.13 mm (0.005 in) ID, 178 mm (7.0 in)
302996	Viper assembly, 0.13 mm (0.005 in) ID, 864 mm (34.0 in)
302998	Viper assembly, 0.13 mm (0.005 in) ID, 178 mm (7.0 in)
303005	Viper assembly, 0.13 mm (0.005 in) ID, 203 mm (8.0 in)
302201	Viper assembly, 0.13 mm (0.005 in) ID, 406 mm (16.0 in)

Part Number	Item
Dionex ICS-6000 IC PEEK Viper 2 mm ED Kit (P/N 302966) (Parts also available separately)	
302996	Viper assembly, 0.13 mm (0.005 in) ID, 864 mm (34.0 in)
302998	Viper assembly, 0.13 mm (0.005 in) ID, 178 mm (7.0 in)
302987	Viper assembly, 0.13 mm (0.005 in) ID, 89 mm (3.5 in)
303007	Viper assembly, 0.13 mm (0.005 in) ID, 229 mm (9.0 in)
303009	Viper assembly, 0.13 mm (0.005 in) ID, 406 mm (16.0 in)
303005	Viper assembly, 0.13 mm (0.005 in) ID, 203 mm (8.0 in)
302201	Viper assembly, 0.13 mm (0.005 in) ID, 406 mm (16.0 in)
Dionex ICS-6000 IC PEEK Viper 4 mm CD Kit (P/N 088803) (Parts also available separately)	
088892	Viper assembly, 0.18 mm (0.007 in) ID, 89 mm (3.5 in)
088893	Viper assembly, 0.18 mm (0.007 in) ID, 356 mm (14.0 in)
088894	Viper assembly, 0.18 mm (0.007 in) ID, 254 mm (10.0 in)
088915	Viper assembly, 0.18 mm (0.007 in) ID, 178 mm (7.0 in)
088916	Viper assembly, 0.18 mm (0.007 in) ID, 864 mm (34.0 in)
088917	Viper assembly, 0.18 mm (0.007 in) ID, 178 mm (7.0 in)
302959	Viper assembly, 0.18 mm (0.007 in) ID, 203 mm (8.0 in)
302960	Viper assembly, 0.18 mm (0.007 in) ID, 406 mm (16.0 in)
Dionex ICS-6000 IC PEEK Viper 4 mm ED Kit (P/N 088804) (Parts also available separately)	
088916	Viper assembly, 0.18 mm (0.007 in) ID, 864 mm (34.0 in)
088917	Viper assembly, 0.18 mm (0.007 in) ID, 178 mm (7.0 in)
088892	Viper assembly, 0.18 mm (0.007 in) ID, 89 mm (3.5 in)
088835	Viper assembly, 0.18 mm (0.007 in) ID, 229 mm (9.0 in)
088832	Viper assembly, 0.18 mm (0.007 in) ID, 406 mm (16.0 in)
302959	Viper assembly, 0.18 mm (0.007 in) ID, 203 mm (8.0 in)
302960	Viper assembly, 0.18 mm (0.007 in) ID, 406 mm (16.0 in)

Part Number	Item
Precision Cut Tubing for Capillary EG	
072203	0.062 mm (0.0025 in) ID PEEK, 61 cm (24.0 in)
072204	0.062 mm (0.0025 in) ID PEEK, 18 cm (7.0 in)
Backpressure Coils	
AAA-053762	Backpressure coil, 2.0 mL/min, 500 psi, 4 mm
AAA-053763	Backpressure coil, 2.0 mL/min, 1000 psi, 4 mm
053764	Backpressure coil, 0.5 mL/min, 500 psi, 2 mm
053765	Backpressure coil, 0.5 mL/min, 1000 psi, 2 mm
Miscellaneous	
22000-98001	Fitting bolt, 10-32 (for double-cone ferrule fitting)
043276	Ferrule fitting, 10-32 double-cone
22181-60201	Dual EGC degasser (for analytical systems)
22181-60202	Dual EGC degasser (for capillary systems)
072133	Dionex EGC (Capillary) mounting adapter
075522	Dionex RFIC$^+$ Eluent Degasser (for standard-pressure and high-pressure analytical IC systems)
063246	USB cable, 1 m (3 ft) long
954773	Fuse, IEC 60127-2 slow-blow; rated at 2A, 250V
046985	Mini-screwdriver

DC Reordering Information

Part Number	Item
Valves and Accessories	
00110-03-00039	High-pressure (injection), 4-port, 0.1 µL
00110-03-00040	High-pressure (injection), 4-port, 0.2 µL
074525	High-pressure (injection), 4-port, 0.4 µL
075917	High-pressure (injection or switching valve), 6-port
075918	High-pressure (injection or switching valve), 10-port
061971	Low-pressure valve, 3-way
079848	Low-pressure valve, 2-way
042949	Sample loop, 10 µL
042857	Sample loop, 25 µL
044105	Filter, high-pressure inline (for sample filtering)
024305	Luer adapter fitting, 1/4-28 (for manual injections)
016388	Syringe, 1 cc (for manual injections)
00110-03-00043	Valve Rebuild Kit, 4-port, 0.1 µL
00110-03-00044	Valve Rebuild Kit, 4-port, 0.2 µL
074698	Valve Rebuild Kit, 4-port, 0.4 µL
075973	Valve Rebuild Kit, 6-port
079054	Valve Rebuild Kit, 10-port
IC Cube and Accessories for Capillary IC	
072000	Dionex ICS-6000 IC Cube
072186	IC Cube Tubing Kit (includes precision cut tubing for column connections)
088231	EG degas cartridge (for capillary)
072052	Dionex ACES 300 Anion Capillary Electrolytic Suppressor
072053	Dionex CCES 300 Cation Capillary Electrolytic Suppressor
072055	Suppressor bypass cartridge
072054	Dionex CRD 200 Carbonate Removal Device (Capillary)

Part Number	Item
064638	Dionex CRD 300 (2mm) Carbonate Removal Device (Capillary)
064637	Dionex CRD 300 (4 mm) Carbonate Removal Device (Capillary)
072056	Dionex CRD bypass cartridge
Conductivity Detector for Capillary IC	
072041	Dionex ICS-6000 Conductivity Detector (Capillary)
Conductivity Detector and Accessories for Analytical IC	
079829	Dionex ICS-6000 Conductivity Detector (Analytical)
085091	Dionex ACRS 500 (2 mm) Chemically Regenerated Suppressor
085090	Dionex ACRS 500 (4 mm) Chemically Regenerated Suppressor
085092	Dionex CCRS 500 (2 mm) Cation Chemically Regenerated Suppressor
085093	Dionex CCRS 500 (4 mm) Cation Chemically Regenerated Suppressor
085028	Dionex AERS 500 Carbonate (2 mm) Anion Electrolytically Regenerated Suppressor for Carbonate Eluents
085029	Dionex AERS 500 Carbonate (4 mm) Anion Electrolytically Regenerated Suppressor for Carbonate Eluents
302661	Dionex AERS 500e (2 mm) Anion Electrolytically Regenerated suppressor for External Water Mode
302662	Dionex AERS 500e (4 mm) Anion Electrolytically Regenerated suppressor for External Water Mode
088667	Dionex ADRS 600 (2 mm) Anion Dynamically Regenerated Suppressor
088666	Dionex ADRS 600 (4 mm) Anion Dynamically Regenerated Suppressor
088670	Dionex CDRS 600 (2 mm) Cation Dynamically Regenerated Suppressor

Part Number	Item
088668	Dionex CDRS 600 (4 mm) Cation Dynamically Regenerated Suppressor
045460	Suppressor gas separator waste tube
045878	Backpressure coil for 2 mm suppressor
045877	Backpressure coil for 4 mm suppressor
Electrochemical Detector and Accessories for Capillary and Analytical IC	
072042	Dionex ICS-6000 Electrochemical Detector (ED) (without cell)
072044	ED cell
061879	pH-Ag/AgCl reference electrode
014067	O-ring for pH-Ag/AgCl reference electrode (for analytical)
072162	Gasket for pH-Ag/AgCl reference electrode (for capillary)
072075	PdH reference electrode (for capillary)
072214	Gasket for PdH reference electrode (for capillary)
079850	ED gold conventional working electrode, with gasket and polishing kit
079851	ED platinum conventional working electrode, with gasket and polishing kit
079854	ED glassy carbon conventional working electrode, with gasket and polishing kit
079856	ED silver conventional working electrode, with gasket and polishing kit
045972	Gasket, PTFE, 0.001 in (for conventional working electrode)
063722	ED AAA gold working electrode, with gasket and polishing kit
060082	Gold AAA-Direct disposable working electrodes (6 electrodes, with 2 gaskets)
060139	Gold carbohydrate disposable working electrodes (polyester substrate) (6 electrodes, with 2 gaskets)
066480	Gold carbohydrate disposable working electrodes (PTFE substrate) (6 electrodes, with 2 gaskets)

Part Number	Item
064440	Platinum disposable working electrodes (6 electrodes, with 2 gaskets)
063003	Silver disposable working electrodes (6 electrodes, with 2 gaskets)
069336	Carbon disposable working electrodes (6 electrodes, with 2 gaskets)
060141	Gaskets for disposable working electrodes, PTFE, 0.002-in (4 gaskets) (for analytical systems)
069339	Gasket for carbon disposable working electrodes, ULTEM, 0.001-in (for analytical systems)
072117	Gasket for disposable working electrodes, PTFE, 0.001-in (2 gaskets) (for capillary systems)
062158	ED cell polypropylene support block (for use with disposable electrodes)
036313	Polishing kit
036319	Coarse polishing compound
036318	Fine polishing compound
036321	Polishing pads

Part Number	Item
Automation Manager	
075960	Dionex ICS-6000 Automation Manager, two 10-port high-pressure valves, two low-pressure 3-way valves
075951	Dionex ICS-6000 Automation Manager, one 10-port high-pressure valve, one low-pressure 3-way valve
075952	Dionex ICS-6000 Automation Manager, one 6-port high-pressure valve, one low-pressure 3-way valve
075953	Dionex ICS-6000 Automation Manager, AutoPrep configuration: one 10-port high-pressure valve, one AutoPrep sample loop, AutoPrep standard loops
079833	Dionex ICS-6000 Automation Manager, tray with no valves

Part Number	Item
079849	RCH-1 Reaction Coil Heater
062561	Temperature stabilizer, standard bore, 0.25 mm (0.010 in) ID
062562	Temperature stabilizer, microbore, 0.125 mm (0.005 in) ID
IC PEEK Viper Fittings and Tubing Assemblies for Capillary DC	
088908	Viper assembly, 0.18 mm (0.007 in) ID, 863 mm (34.0 in)
088909	Viper assembly, 0.18 mm (0.007 in) ID, 114 mm (4.5 in)
088910	Viper assembly, 0.635 mm (0.0025 in) ID, 63.5 mm (2.5 in)
088911	Viper assembly, 0.635 mm (0.0025 in) ID, 229 mm (9.0 in)
IC PEEK Viper Fittings and Tubing Assemblies for Analytical DC	
088832	Viper assembly, 0.18 mm (0.007 in) ID, 406 mm (16.0 in)
088834	Viper assembly, 0.18 mm (0.007 in) ID, 76 mm (3.0 in)
088835	Viper assembly, 0.18 mm (0.007 in) ID, 229 mm (9.0 in)
088836	Viper assembly, 0.18 mm (0.007 in) ID, 114 mm (4.5 in)
088892	Viper assembly, 0.18 mm (0.007 in) ID, 76 mm (3.0 in)
088893	Viper assembly, 0.18 mm (0.007 in) ID, 406 mm (16.0 in)
088894	Viper assembly, 0.18 mm (0.007 in) ID, 254 mm (10.0 in)
088915	Viper assembly, 0.18 mm (0.007 in) ID, 178 mm (7.0 in)
088916	Viper assembly, 0.18 mm (0.007 in) ID, 864 mm (34.0 in)
088917	Viper assembly, 0.18 mm (0.007 in) ID, 178 mm (7.0 in)
Analog Output/Relay/TTL	
062201	I/O option
923686	Connector plug, 12-position
043598	Twisted pair of wires
Dionex Consumable Device Monitor	
22181-60031	Consumable Device Monitor Kit
Tablet (for ICS-6000 App)	
22181-62020	Tablet (including power supply)
22181-62017	Tablet Connectivity Kit

Part Number	Item
22181-62016	Tablet arm/holder
Miscellaneous	
954772	Fuse, IEC 60127-2 slow-blow; rated at 10A, 250V
960777	USB cable, 1.8 m (6 ft) long
062437	Leak sensor
063782	DC Temperature Calibration Kit
043276	Ferrule fitting, 10-32 double-cone
22000-98001	Fitting bolt, 10-32 (for double-cone ferrule fitting)
044105	Filter, high-pressure inline
Maintenance Kits	
22181-62026	4-Port, 0.1 µL Internal Loop High-Pressure Valve Maintenance Kit
22181-62027	4-Port, 0.2 µL Internal Loop High-Pressure Valve Maintenance Kit
075040	4-Port, 0.4 µL Internal Loop High-Pressure Valve Maintenance Kit
075974	6-Port High-Pressure Valve Maintenance Kit
079053	10-Port High-Pressure Valve Maintenance Kit

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