Thermo Scientific

Dionex ERS 500 Suppressor

Product Manual

P/N: 031956-08 April 2013

Thermo SCIENTIFIC

Product Manual

for

Dionex Anion Electrolytically Regenerated Suppressor 500

(Dionex AERS 500 (4 mm), P/N 082540)
(Dionex AERS 500 (2 mm), P/N 082541)

Dionex Cation Electrolytically Regenerated Suppressor 500

(Dionex CERS 500 (4 mm), P/N 082542)
(Dionex CERS 500 (2 mm), P/N 082543)

Revision History:

Revision 08, April 24, 2013, Rebranded for Thermo Scientific. Product name changed from Dionex SRS-300 to Dionex ERS-300.

Safety and Special Notices

Make sure you follow the precautionary statements presented in this guide. The safety and other special notices appear in boxes.

Safety and special notices include the following:

 **SAFETY**	***Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.***
 **WARNING**	***Indicates a potentially hazardous situation which, if not avoided, could result in damage to equipment.***
 **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.***
 **NOTE**	***Indicates information of general interest.***
IMPORTANT	***Highlights information necessary to prevent damage to software, loss of data, or invalid test results; or might contain information that is critical for optimal performance of the system.***
Tip	***Highlights helpful information that can make a task easier.***

Contents

1. Introduction

Suppressor: The role of a suppressor in Ion Chromatography is to remove the eluent and sample counterions and replace this with regenerant ions thereby converting the eluent to a weakly dissociated form prior to detection. Detection of analyte ions particularly with conductivity detection is therefore feasible against a low background. The suppressor not only reduces the background signal but also the noise associated with the signal. Furthermore, the analytes are converted to the more conductive acid or base form, which enhances the signal, particularly for fully dissociated species. Thus overall improvement in detection limits as observed from the signal to noise ratio is achieved. When compared to single column ion chromatography, i.e., applications that do not use a suppressor, the improvement in noise with suppressed ion chromatography far exceeds the noise performance of single column chromatography applications. Hence the suppressor has become an integral part of the ion chromatography instrument.

The suppressors from Thermo Fisher Scientific are designed for continuous operation and do not require any switching or offline regeneration. Furthermore, the standards and the samples are always exposed to the same suppressor device when pursuing ion analysis, thus ensuring that the analytical parameters are consistent between calibration and analysis. From a simplistic perspective there are two types of suppressors offered for continuous operation, namely, electrolytically regenerated suppressors and chemically regenerated suppressors. The electrolytic suppressors operate continuously with a water source as a regenerant. In the recycle mode of operation the water source is derived from the suppressed eluent, thereby making the suppressor operation facile. The chemical suppressors operate continuously with an external regenerant source.

The electrolytic suppressor also is a device that permits recycle of the eluent when installed in a system with Eluent Recycle (ER) system.

1.1 Electrolytically Regenerated Suppressor

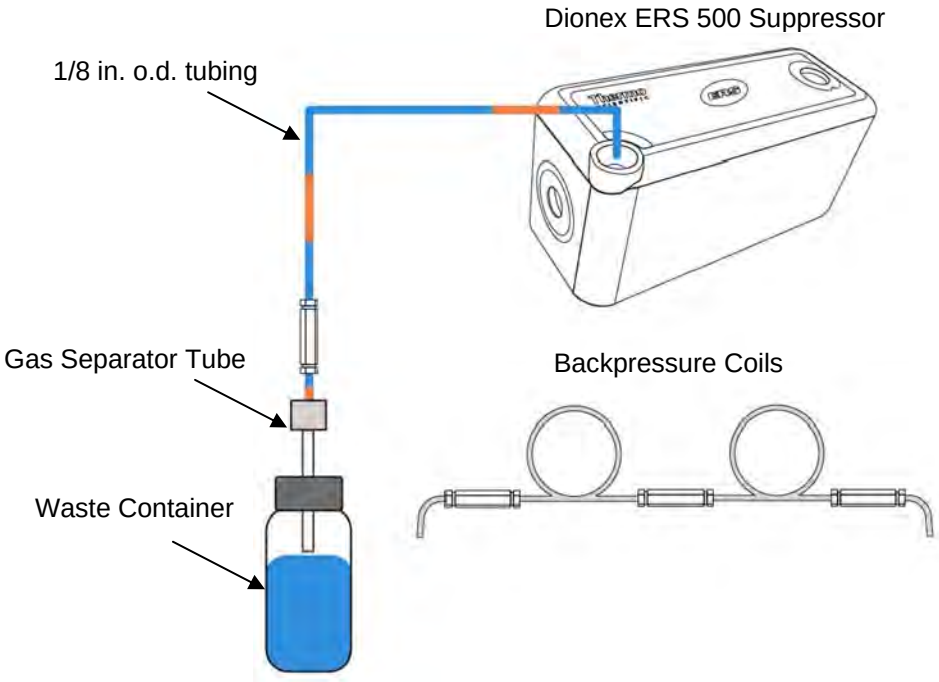
The Thermo Scientific™ Dionex™ Electrolytically Regenerated Suppressor (Dionex ERS™ 500 Suppressor) replaces the Thermo Scientific Dionex Self-Regenerating Suppressor (Dionex SRS™ 300 Suppressor) product line. The Dionex ERS 500 is an electrolytic suppressor with a new hardware design that allows the suppressor to be more pressure tolerant than previous generation suppressor devices. The suppressor flow pathway has been redesigned to optimize band dispersion, improve the flow and sealing properties. The Dionex ERS 500 continues to use the same cleaned ion exchange components (screens and membranes) as the Dionex SRS 300 suppressor devices; however the Dionex ERS 500 eluent channel uses an ion exchange resin bed as opposed to a gasketed screen.

The Electrolytically Regenerated Suppressor (ERS 500) is available in two versions: the Anion Electrolytically Regenerated Suppressor (Dionex AERS™ 500) or Cation Electrolytically Regenerated Suppressor (Dionex CERS™ 500) to support anion and cation analysis applications. The Dionex ERS 500 system consists of an Electrolytically Regenerated Suppressor, the Suppressor Control, the back pressure coils, and the Gas Separator Waste Tube, see Figure 1. This high performance, low maintenance AutoSuppression system provides a reliable solution for Ion Chromatography.

Additionally, the Dionex ERS 500 offers high capacity suppression while adding minimal delay volume to the analytical system. The Dionex AERS 500 provides continuous suppression of traditional eluents, and more concentrated eluents up to 200 mM NaOH. The Dionex CERS 500 offers continuous suppression of concentrated eluents up to 100 mN H2SO4 or MSA. This high capacity significantly expands the capabilities and simplifies the operation of Ion Chromatography.

The Dionex ERS 500 is available in both 2 mm and 4 mm formats for use with 2, 3, 4, or 5 mm Ion Chromatography columns and systems. The 2 mm Dionex ERS 500 is specially designed with reduced internal volume to ensure optimum performance with 2 mm columns and systems.

Figure 1 The Electrolytically Regenerated Suppressor and Accessories



Tip ***For assistance, contact Technical Support for Dionex Products. In the U.S., call 1-800-346-6390. Outside the U.S., call the nearest Thermo Fisher Scientific office.***

The ERS 500 design comprises of three channels defined by two ion exchange membranes. The central channel is the eluent channel and the two side channels are regenerant channels. Two PEEK plates form the outer wall of the regenerant channels and have the ¼-24 ports for bringing in the regenerant liquid in and out of the device. The eluent channel is physically defined by a PEEK plate that seals against the ion exchange membrane and a thin elastomeric O=ring installed in the regenerant channel. The eluent in and out ports are independent ports that define the fluidic pathway which is similar to a column. The regenerant flow is arranged to be counter-current to the eluent flow. This orientation ensures complete regeneration of the device

Electrodes are placed along the length of the regenerant channels to completely cover the eluent channel. In operation, when a DC voltage is applied across the electrodes and the voltage exceeds the standard potential for the electrolysis of water (approximately 1.5 V), water is electrolytically split to form electrolysis ions.

At the anode $H_2O \rightarrow 2H^+ + 1/2O_2 + 2e^-$

At the cathode $H_2O + 2e^- \rightarrow 2OH^- + H_2$

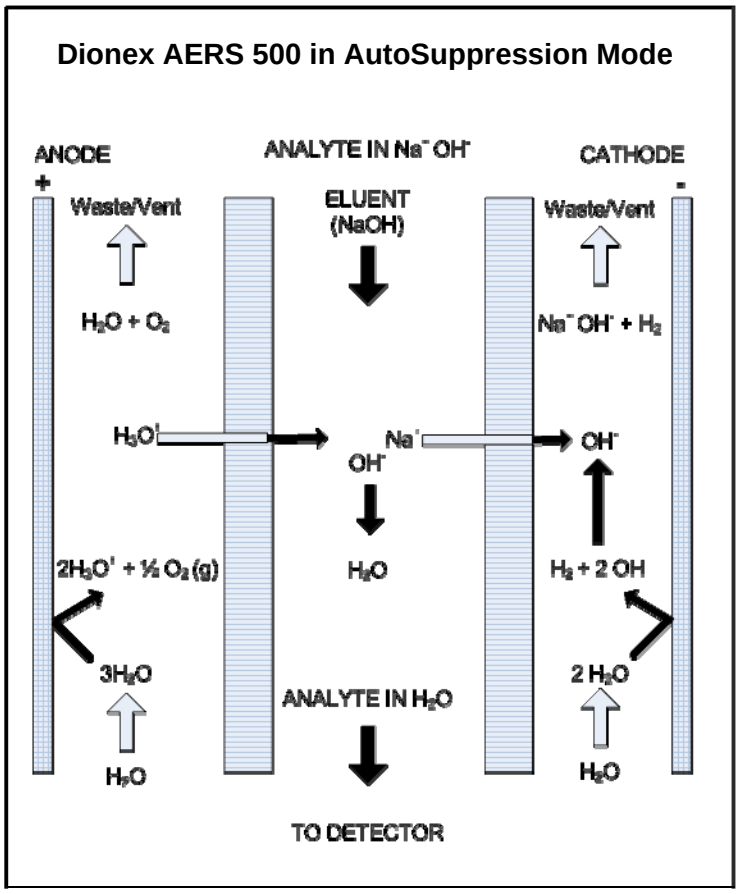
The electrolysis ions are available for the suppression reactions. The Dionex ERS 500 suppressor design allows facile transport of cations or anions depending on which type of suppressor is used for the application. For example, when pursuing anion analysis with an Dionex AERS 500, cation exchange functionality extends across the electrodes. The function of the ion exchange functionality in the regenerant channels is to lower the resistance and aid in the transport of ions in and out of the eluent channel. In the Dionex ERS 500 the eluent channel is filled with ion exchange resin and provides a static capacity which is particularly useful when eluent is pumped into the device with the power off.

In operation the electrolytically generated hydronium ions in the Dionex AERS are driven towards the cathode along with eluent cations by the applied voltage. The membrane allows hydronium ions to pass into the eluent chamber resulting in the conversion of the electrolyte of the eluent to a weakly ionized form. For each hydronium ion entering the eluent channel one hydronium or a cation exits the device and is driven towards the cathode. At the cathode the cations combine with the electrolytically generated hydroxide ions to form water or base. Overall the current dictates the concentration of hydronium and hydroxide ions.

The eluent suppression process is illustrated for Anion Suppressor in Figure 2 and for Cation Suppressor in Figure 3.

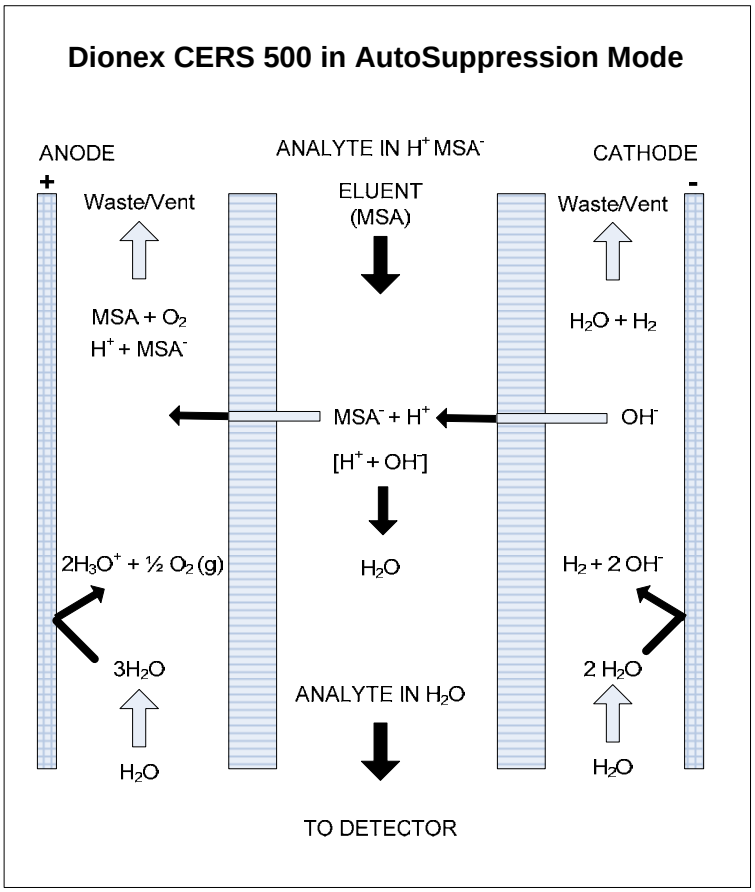
As shown in Figure 2, the water regenerant undergoes electrolysis to form hydroxide ions on the cathode surface along with hydrogen gas while hydronium ions are formed in the anode surface along with oxygen gas.. In the Anion Suppressor, cation exchange materials such as screens, membranes and resins allow hydronium ions to move from the anode chamber into the eluent chamber to neutralize the hydroxide eluent. Sodium ions or eluent or sample counter-ions in the eluent are driven by the applied electric potential towards the cathode and combine with the hydroxide ions generated at the cathode to form sodium hydroxide waste. Hydronium ions can also travel all the way to the cathode to form water. Thus effecting suppression of the eluent and conversion of the analyte to typically a more conductive acid form.

Figure 2 AutoSuppression with the Dionex AERS 500



As shown in Figure 3, the water regenerant undergoes electrolysis to form hydroxide ions in the cathode surface along with hydrogen gas while hydronium ions are formed in the anode surface along with oxygen gas. In the cation suppressor, anion exchange materials such as screens, membranes and resins allow hydroxide ions to move from the cathode chamber into the eluent chamber to neutralize the acid eluent. MSA ions or eluent or sample counter-ions in the eluent, are driven by the applied electric potential towards the anode and combine with the hydronium ions generated at the anode to form methane sulfonic acid waste. Hydroxide ions can also travel all the way from the cathode and combine with hydronium ions at the anode to form water. Thus effecting suppression of the eluent and conversion of the analyte to typically a more conductive base form.

Figure 2 AutoSuppression with the Dionex CERS 500



The Dionex AERS 500 (2 mm) suppressor is compatible with MS detection; the suppressor has been designed to have minimal sulfate interference for MS applications. The 2 mm suppressor is recommended for applications that use MS detection due to the improved efficiency, and since less eluent enters the MSD at the relatively lower operational flow rate.

1.2 Overview of Suppression Modes

Three basic modes of suppression can be performed with the Dionex Electrolytically Regenerated Suppressor (Dionex ERS 500):

- AutoSuppression Recycle Mode
- AutoSuppression External Water Mode
- MPIC Suppression Mode

NOTE

The Dionex ERS 500 is not compatible with the Chemical Suppression Mode. The Dionex MMS 300 or equivalent should be used when Chemical Suppression Mode is required.

AutoSuppression Recycle Mode: The Dionex ERS 500 uses water as the regenerant for eluent suppression. There are two modes of electrolytic operation. The simplest mode of operation is the AutoSuppression Recycle Mode. In this mode of operation, eluent flows from the eluent outlet of the suppressor into the conductivity cell and is then recycled through the Dionex ERS 500 regenerant chambers to supply the water required for electrolysis. This eliminates the need for an external source of regenerant water but limits the regenerant flow rate to the eluent flow rate. The AutoSuppression Recycle Mode is the most common mode of operation and is recommended for aqueous eluents and relatively simple sample matrices. From an ease of use perspective the AutoSuppression Recycle Mode is the best mode of operation.

AutoSuppression External Water Mode: This mode incorporates an external source of deionized water flowing through the regenerant chambers. The detector cell effluent is typically directed to waste. This requires the installation of a pressurized reservoir system or an additional pump to pump the external source of water (in most cases a peristaltic pump provides satisfactory results). With this configuration the regenerant flow rate is not limited to the eluent flow rate. The AutoSuppression External Water mode is primarily recommended with solvent containing eluents (up to 40%, compared to 25% maximum for RFIC-EG KOH systems) and for samples with complex matrices such as samples containing high levels of precipitating ions, i.e., transition metals, calcium or magnesium.

MPIC Suppression Mode: The MPIC Suppression Mode uses an external regenerant source such as sulfuric acid (Dionex AERS 500) or boric acid (Dionex CERS 500). When the Dionex ERS 500 is operating in this mode, it uses an applied current and a constant source of dilute regenerant solution from a pressurized bottle delivery system or additional pump. The following sections explain how each mode works and help to determine which mode to use for an application. Once the mode of operation is determined, more detailed plumbing configuration and operating instructions can be found in Section 3, “Operation.”

1.2.1 Mode of Operation Selection

The Dionex ERS 500 mode of operation depends mainly on the eluent composition, the analysis sensitivity requirements and the sample matrix. The compatibilities are shown in Table 1. For example, eluents containing organic solvents that tend to oxidize easily are not compatible with the AutoSuppression Recycle Mode. The AutoSuppression External Water Mode should be used instead, or a Dionex MMS suppressor employed in Chemical Suppression Mode. The MPIC Suppression Mode is specifically designed for applications where ion-pair reagents and solvents are present in the eluent.

Table 1 Eluent Composition and Suppression Mode Compatibility

Eluent Composition	Suppression Recycle	Suppression External Water	Chemical Suppression[(1)]	MPIC Suppression
Aqueous Eluents (excluding borate)	Yes	Yes	Yes	N/A
Borate Eluents	No	Yes	Yes	N/A
Eluents Containing Organic Solvents that tend to oxidize	No	Yes (Up to 40%)	Yes (Up to 100%)	N/A
Eluents containing Organic Solvents that are not easily oxidized	Yes	Yes	Yes	Yes
Eluents Containing Ion Pair Reagents with or without Solvents	No	No	No	Yes
Simple Aqueous Samples	Yes	Yes	Yes	Yes (assuming Ion Pairing Reagent)
Complex Samples or Samples containing Solvents	No	Yes	Yes	Yes (assuming Ion Pairing Reagent)

[(1)]The ERS 500 does not support Chemical Suppression Mode. Use of a Micro-Membrane Suppressor such as the MMS 300 or equivalent is recommended.

1.2.2 The AutoSuppression Recycle Mode

The AutoSuppression Recycle Mode uses the suppressed conductivity cell effluent as the source of water for the regenerant. This is the preferred method of operation for the ERS 500. The advantage of this mode of operation is simplicity and ease of use. This mode reliably provides AutoSuppression for most suppressed conductivity applications using solvent-free eluents. For solvents that are not easily oxidized such as iso-propyl alcohol the Autosuppression recycle mode is preferred. As the eluent passes through the Dionex ERS 500 eluent channel it is converted to a weakly ionized form. After detection such as with conductivity detection the cell effluent can be routed back to the regenerant channel to provide the water required for the electrolysis reactions. The amount of water flowing through the regenerant chambers is therefore limited to the eluent flow rate. See Section 3 for complete operating instructions.

NOTE

The AutoSuppression Recycle Mode is not compatible with eluents containing Borate or Organic Solvents that tend to oxidize easily such as methanol.

1.2.3 The AutoSuppression External Water Mode

The AutoSuppression External Water Mode is used for any application requiring organic solvents in the eluent or sample, or for applications using borate as the eluent ion. This mode uses a constant source of deionized water from a pressurized bottle or other source of deionized water that delivers 1 to 2 mL/min for 2 mm applications and 3 to 5 mL/min for 4 mm applications. The amount of water flowing through the regenerant chambers is therefore independent of the eluent flow rate. The AutoSuppression External Water Mode eliminates the potential for build-up of contaminating ions resulting from the oxidation of solvents. It also reliably provides AutoSuppression for high sensitivity analysis, maximizing signal-to-noise ratios for suppressed conductivity applications. Any analysis performed using the AutoSuppression Recycle Mode can also be performed using the AutoSuppression External Water Mode. See Section 3 for complete operating instructions.

1.2.4 The Chemical Suppression Mode

The ERS 500 cannot be used in the Chemical Suppression Mode. The reason for this stems from the fact that the regenerant flow is sequential which makes it incompatible with the chemical mode of operation. The peak response will not be maintained to a constant level in this mode since a mixture of the suppressed and salt form of the analyte will be detected

Thermo Scientific Dionex recommends the use of a MicroMembrane Suppressor (Dionex MMS 300) or equivalent for chemical suppression applications. Please refer to the Dionex MMS Manual Document No. 031727 and the DCR Kit Manual Document No. 031664.

1.2.5 The MPIC Suppression Mode

1.2.5.1 Anion MPIC

The Dionex AERS 500 is used for eluent suppression of Mobile Phase Ion Chromatography (MPIC or ion-pairing) eluents by using the MPIC Suppression Mode. The MPIC Suppression Mode is a combination of the AutoSuppression External Water Mode augmented with a chemical regenerant such as sulfuric acid (H_2SO_4). The MPIC Suppression Mode uses an applied current and a constant source of dilute sulfuric acid solution from a pressurized bottle delivery system. This mode must be used for MPIC applications requiring an ion pair reagent and organic solvents in the eluent. The MPIC Suppression Mode reliably provides suppression of typical eluents for MPIC applications using suppressed conductivity detection. The ion pair reagents, such as tetrabutylammonium hydroxide (TBAOH), are used in concentrations typically ranging from 1.0 to 5.0 mM. See Section 3 for complete operating instructions.

1.2.5.2 Cation MPIC

The Dionex CERS 500 is used for eluent suppression of MPIC eluents by using the AutoSuppression External Water Mode or the MPIC Suppression Mode depending on the specific MPIC application. The MPIC Suppression Mode uses an applied current and a constant source of dilute boric acid regenerant solution from a pressurized bottle delivery system. Dilute boric acid is added to the water regenerant to enhance detection and improve linearity of weak bases such as ammonia and amines. This mode is used for MPIC applications requiring an ion pair reagent and organic solvents in the eluent. The MPIC Suppression Mode reliably provides suppression of typical eluents for MPIC applications using suppressed conductivity detection. The ion pair reagents, such as octanesulfonic acid (OSA), are used in concentrations typically ranging from 1.0 to 5.0 mM. Organic solvent concentrations should not exceed 40%. See Section 3 for complete operating instructions.

1.3 Shipment and Storage

1.3.1 Shipment

CAUTION

The Electrolytically Regenerated Suppressors (Dionex AERS 500 and Dionex CERS 500) should not be subjected to temperatures above 50°C for long durations during shipment, storage or operation, or for short durations above 80°C.

1.3.2 Storage

CAUTION

Ensure the suppressor is stored in a temperature controlled environment away from direct exposure to sunlight or other sources of heat. Do not store the suppressor in an environment where temperatures in excess of 50°C may be experienced, such as a parked car.

2. Installation

2.1 System Requirements

The Dionex ERS 500 is designed to be a direct replacement for the Dionex SRS series of suppressors, such as the Dionex SRS I, Dionex SRS II, Dionex SRS ULTRA, Dionex SRS ULTRA II and Dionex SRS 300. The Dionex ERS 500 can be used in place of any of these suppressors, except where these suppressors are being used in Chemical Suppression Mode. If Chemical Suppression Mode is being used the Micro-Membrane Suppressor (Dionex MMS 300) or equivalent is recommended.

The Dionex ERS 500 is designed to be run on any Dionex Ion Chromatography System (ICS) equipped with an analytical Anion or Cation exchange column set and an electrolytic suppressor controller, such as the ICS-5000$^+$, ICS-2100, ICS-1600 or ICS-1100. It is not designed to be run on a Dionex Capillary Ion Chromatography System such as the ICS-4000, or on Dionex Ion Chromatography Systems that do not have an electrolytic suppressor controller, such as the Dionex ICS-90A, Dionex ICS-600 or Dionex ICS-900. Some legacy systems require a standalone controller such as the Dionex SRC-1, Dionex SC20, Dionex RFC-10, or Dionex RFC-30 Controller for installation of the Dionex ERS 500. See Table 2, “Electrolytically Regenerated Suppressor Requirements for Selected IC Modules.”

For optimal suppressor performance it is important to operate the suppressor at the recommended current settings as recommended by Chromeleon or as calculated from section 2.5.1.

The older Dionex SRC-1 controller has been discontinued. The replacement product is either the Dionex RFC-10 controller or the Dionex RFC-30 controller. The Dionex RFC-10 controller provides 1 mA graduated control of an electrolytic suppressor. The Dionex RFC-30 controller also provides 1 mA graduated control and, in addition, provides control of an Eluent Generator Cartridge (Dionex EGC) and a Continuously Regenerated Trap Column (Dionex CR-TC). The Dionex SCC-10 suppressor current controller can be used in conjunction with the Dionex SRC-1 controller to provide a current output of twelve settings.

It is highly recommended to set the current setting for the Dionex ERS 500 to the exact calculated current (within 1 mA). Older power supplies do not have the 1 mA graduated control. For older systems it is recommended to upgrade to a newer power supply such as the Dionex RFC-10 or Dionex RFC-30 or use the power supply with a Dionex SCC-10 suppressor current controller. Failure to set the current accurately could reduce suppressor performance and life-time.

Table 2 Self-Regenerating Suppressor Requirements for Selected Ion Chromatographs

Dionex Ion Chromatograph Series Module	Dionex RFC-10, Dionex RFC-30 or Dionex SCC-10 Controller Requirement
2000i	YES
QIC	YES
2000 SP	YES
4000i	YES
4500i	YES
8000	YES
8100	N/A
8200	N/A
DX-100	YES
Model DX 1-03	RECOMMENDED
DX-120	RECOMMENDED
DX-300	N/A
CDM-2, PED	YES
CDM-3, PED-2	RECOMMENDED
DX-320 with IC20 or IC25	RECOMMENDED
DX-320 with IC25A	NO
DX-500	RECOMMENDED
DX-600 with CD25A or ED50A	NO
DX-600 with CD25 or ED50	RECOMMENDED
DX-800	RECOMMENDED

The Dionex ERS 500 is installed in the column compartment or detector compartment of the chromatography module immediately after the analytical column and before the conductivity detector cell. All components required for installation of the Dionex ERS 500 are included with the system.

- Gas Separator Waste Tube (P/N 045460)
- Backpressure coil(s)
  - 4 mm (P/N 045877)
  - 2 mm (P/N 045878)
- Microbore Tubing (2 mm only) (P/N 052324)
- Mounting clip (P/N 045612)

Options:

- Dionex MMS/ERS Installation Kit (P/N 038018)
  (Pressurized Water Delivery System used with AutoSuppression External Water Mode, Chemical Suppression Mode, or MPIC Suppression Mode).
- Peristallic Pump Kit (P/N: 064508). (Water delivery system used with AutoSuppression External Water Mode, Chemical Suppression Mode or MPIC Mode).

CAUTION

The Dionex ERS 500 must be operated with the Gas Separator Waste Tube (P/N 045460)

NOTE

The use of 1/4-28 or 10-32 ferrule/bolt style liquid lines may be required for installation and use of ERS 500. See "Dionex Liquid Line Fittings" for complete details.

2.2 Electrolytically Regenerated Suppressor Control

The Dionex ERS control is provided by discrete (50,100,300 and 500mA) and non discrete (0 to 500 mA in 1mA increment) power supplies. Discrete Dionex SRS Control is integrated into older systems such as the CDM-3 and PED-2 of the Dionex DX-300, the Dionex DX-100 (Model 1-03), Dionex DX-120, Dionex DX-320 (IC20 and IC25 models), Dionex DX-500 (CD20 and ED40 detectors), and Dionex DX-600 (CD25 and ED50 detectors). The use of discrete power supplies may not be suitable for optimal suppressor performance and may affect the suppressor noise performance and life time. It is therefore recommended the use of a non-discrete power supply, such as the Dionex RFC-10 or Dionex RFC-30. It is also possible to use the discrete power supplies with an Dionex SCC-10 controller that provides twelve discrete current settings. Non-discrete Dionex SRS Control is integrated into modern instruments including the Dionex ICS series (excluding Dionex ICS-90, Dionex ICS-90A, Dionex ICS-600 and Dionex ICS-900).

CAUTION

Always turn the pump and the Dionex ***ERS Control on and off at the same time. Eluent flow through the*** Dionex ***ERS 500 is required for proper operation. However, without current, the membranes and screens in the*** Dionex ***ERS 500 will become exhausted by the flowing eluent resulting in small analyte peak areas. If this should occur, perform the procedure in Section 4.***

NOTE

Select the equivalent SRS Mode on the power supply to support the Dionex ***ERS 500 suppressor if ERS modes are not available. The*** Dionex ***ERS 500 is fully compatible with SRS settings.***

2.2.1 Dionex Reagent-Free Controller (Dionex RFC)

The Dionex Reagent-Free Controller (Dionex RFC) is an external power supply available in two versions.

- The Dionex RFC-10 controls the Dionex ERS 500 Electrolytically Regenerated Suppressor. Current is delivered at 1 mA resolution.
- The Dionex RFC-30 controls an Dionex ERS 500 Electrolytically Regenerated Suppressor, as well as a Dionex Eluent Generator Cartridge (Dionex EGC) and a Dionex CR-TC Continuously Regenerated Trap Column. Current is delivered at 1 mA resolution.

NOTE

Select the equivalent SRS Mode on the power supply to support the Dionex ***ERS 500 suppressor. The*** Dionex ***ERS 500 is fully compatible with SRS settings.***

The Dionex RFC controls these devices by supplying current to the suppressor and for the Dionex RFC-30, current to the eluent generator and voltage (to the Dionex CR-TC). Please see the Dionex RFC Operator's Manual for suppressor operating and installation instructions with the following Dionex products:

- Dionex DX-320/320J
- Dionex DX-500, Dionex DX-600, or Dionex ICS-2500
- Dionex DX-120

2.3 Dionex SCC-10 Suppressor current controller (P/N 074053)

The Dionex SCC-10 is an external controller designed for use with legacy instruments that only offer four settings for suppressor current and is recommended for optimal performance.. The Dionex SCC-10 is powered from the existing suppressor current supply, and can output twelve discrete current settings from 10 mA to 250 mA.

2.4 Back Pressure Coils for the Dionex ERS 500

All detector cells require enough back pressure to prevent eluent in the cell from out-gassing due to abrupt volume changes between the small inner diameter of the connecting tube and the relatively larger volume of the cell. Out-gassing creates bubbles in the cell and disrupts detector responsiveness. Back pressure coils help to prevent gases, generated during AutoSuppression, from out-gassing and formation of bubbles in the detector cell. For example, carbonate eluent is suppressed to carbonic acid which is CO_2 gas in equilibrium with DI water and CO_2 gas can come out of solution if adequate pressure is not applied. The above out-gassing can trap bubbles in the cell causing high noise. Therefore Thermo Scientific Dionex recommends addition of 30-40 psi of backpressure. It should be noted that for RFIC hydroxide or MSA applications it may be possible to operate the cell without backpressure. However for carbonate and/or bicarbonate applications it is highly recommended to install backpressure coils.

Back pressure coil components are shipped with your system. For 4 mm systems, locate assembly P/N 045877. For 2 mm systems, the backpressure coils are also available in the microbore tubing kit, P/N 052324. For 2 mm systems, locate assembly P/N 045878. Alternatively, lengths and diameters of tubing necessary for proper back pressure are given in Table 3, "Coils for ERS 500 Back Pressure Requirements." Adjust the tubing length to achieve a backpressure of approximately 40 psi.

CAUTION

If back pressure coils become damaged or plugged, they may cause irreversible damage to the suppressor.

2.4.1 Assembly

A. Slip PEEK liquid line bolts and ferrules onto the ends of the tubing. Refer to Table 3, "Coils for ERS 500 Back Pressure Requirements," and determine the correct number of coils required for your application based on the eluent flow rate.

B. After assembly of the coils, see Figure 7, "The AutoSuppression Recycle Mode Plumbing Diagram," for the proper placement of the completed coils and couplers between the ERS 500 and the Gas Separator Waste Tube.

Table 3 Coils for Dionex ERS 500 Back Pressure Requirements

ERS 500 Type	P/N	Flow Rate	I.D. of Tubing	Length of Each Coil	Number of Coils
4 mm	045877	0.5–1.5 mL/min	0.010" (Black)	2.5 ft.	2
4 mm	045877	1.5–3.0 mL/min	0.010" (Black)	2.5 ft.	1
2 mm	045878	0.12–0.25 mL/min	0.005" (Red)	1.0 ft.	2
2 mm	045878	0.25–0.75 mL/min	0.005" (Red)	1.0 ft.	1

CAUTION

The correct amount of back pressure for optimum operation is 40 psi. Back pressure over 450 psi after the Dionex ***ERS 500 can cause irreversible damage.***

2.5 Gas Separator Waste Tube for the Dionex ERS 500

The Gas Separator Waste Tube (P/N 045460) is an integral part of the ERS 500 system. It separates any electrolytic gases (such as hydrogen and oxygen gas) generated in the Dionex AERS 500 or Dionex CERS 500 during electrolysis. The Gas Separator Waste Tube is used to avoid concentrating the gas (particularly hydrogen gas) in the waste container. The Gas Separator Waste Tube is shipped in one of the Ship Kits of your system.

CAUTION

Do not cap the waste reservoir.

SAFETY

Minimal hydrogen gas generated by the Dionex ***ERS 500 is not dangerous unless the gas is trapped in a closed container and allowed to concentrate. The Gas Separator Waste Tube must be open to the atmosphere, and not in a confined space, to operate properly.***

2.5.1 Assembly

A. Assemble and install the Gas Separator Waste Tube and waste line following the steps below. See Figure 5, "The AutoSuppression Recycle Mode Plumbing Diagram," or Figure 7, "Configuration of the Pressurized Water Reservoir and the Gas Separator Waste Tube with the Self-Regenerating Suppressor."

B. Use one or two couplers (P/N 045463) to connect two or three lengths of 1/2" i.d. black polyethylene tubing (P/N 045462) depending on the waste container depth. Extend the top of the Waste Separator Tube above the top of the Waste container.

C. Place the Gas Separator Waste Tube with the 1/8" o.d. tubing attached into the waste container. Ensure the bottom of the Gas Separator Waste Tube is resting on the floor of the waste container, the top of the device (where the white 1/8" o.d. tubing meets the black 1/2" o.d. tubing) is above the top of the container, and that both the Gas Separator Waste Tube and the waste container are open to the atmosphere.

2.6 Electrolytically Regenerated Suppressor Current Selection

Lower current is better for the performance of both the Dionex ERS 500 and Dionex Atlas suppressors. Excess current through the suppressor devices causes excess heat generation and over time will cause the ion exchange materials to degrade, thus shortening suppressor lifetime. Excess current can also cause poor recoveries of certain analytes, particularly magnesium, manganese and phosphate. The optimum current setting produces just enough hydronium or hydroxide ions to displace the eluent counter ions and neutralize the eluent and is the recommended setting. No more than 10% above the optimum current setting is recommended for extended periods of time. Cooling the suppressor would provide improved noise and lifetime performance. A temperature setting of 20 ˚C for the thermal compartment such as the DC is recommended.

2.6.1 Calculating the Optimum Current Setting

The optimum current setting depends on the eluent concentration, sample counterion concentration and flow rate. If the sample counterion concentration exceeds the eluent concentration then use the sample counterion concentration in the calculation discussed below. A concentrated eluent at a high flow rate requires a higher current setting than a diluted eluent at a low flow rate. These calculations are specific for the type of suppressor and vary for Dionex AERS 500 and Dionex CERS 500. These settings are also applicable in the presence of standard solvents such as methanol or isopropyl alcohol for anion applications and acetonitrile for cation applications.

Current (mA) = [flow rate (mL/min)] × [eluent concentration (mN)] × [a suppressor specific factor]

The factors are listed in the table below. The unit for eluent concentration is mN (not mM).

Table 4 Optimum Suppressor Settings

Suppressor Type	Suppressor Specific Factor
Dionex AERS 500	2.47
Dionex CERS 500	2.94
Dionex Atlas (Anion and Cation)	3.34

NOTE

Always round the calculated optimum current up to the nearest whole integer.

All modern Thermo Scientific Dionex detectors and suppressor power supplies can be used to set the current at the calculated value with a minimum current resolution of 1 mA. A Dionex RFC-10 or Dionex RFC-30 or Dionex SCC-10 Controller is recommended for older systems that only set the current in discrete values of 50, 100, 300 or 500 mA.

NOTE

The lower flow rates require a lower current. A 2 mm Dionex ***ERS 500 should NEVER be operated at a current above 100 mA.***

A. Maximum Suppression Capacity

The Maximum Suppression Capacity (MSC) depends on the eluent concentration and flow rate. The MSC can be calculated using the following equation.

MSC (mN * mL/min) = flow rate (mL/min) * sum of eluent concentration (mN)

Table 5 Maximum Suppression Capacity for Dionex ERS 500

Suppressor	Flow Rate (mL/min)	Maximum Suppression Capacity
Dionex AERS 500 4 mm	0.5 - 3.0	≤ 200 µ equivalents
Dionex AERS 500 2 mm	0.25 - 0.75	< 50 µ equivalents
Dionex AERS 500 2 mm	0.10 - 0.25	< 30 µ equivalents
Dionex CERS 500 4 mm	0.5 - 3.0	< 100 µ equivalents
Dionex CERS 500 2 mm	0.25 - 0.75	< 35 µ equivalents
Dionex CERS 500 2 mm	0.10 - 0.25	≤ 20 µ equivalents

B. Sum of Eluent Concentration Calculation

The sum of the eluent concentration can be calculated from the equations below.

Dionex **AERS 500 (4 mm)**

Sum of eluent concentration (mN) = {2* Carbonate (mM) + Bicarbonate (mM) + hydroxide (mM) + 2 * Tetraborate (mM) + custom eluent cation (mN)}

where Tetraborate is <= 50 mM

Dionex **AERS 500 (2 mm)**

Sum of eluent concentration (mN) = {2 * Carbonate (mM) + Bicarbonate (mM) + hydroxide (mM) + 2 * Tetraborate (mM) + custom eluent cation (mN)}

where Tetraborate is <= 75 mM

Custom eluent cation (mN) can be calculated from the normality of the eluent concentration.

NOTE

Normality is Equivalents/L of solution. For example, 20.0 mM sodium acetate (CH_3COONa) has 20.0 mN sodium as the cation and 20.0 mM sodium sulfate (Na_2SO_4) has 40.0 mN sodium as the cation.

When using the Dionex CERS 500 (4 mm) and Dionex CERS 500 (2 mm), the sum of the eluent concentration can be calculated using the equations below.

Dionex **CERS 500**

Sum of eluent concentration (mN) ={2 * Sulfuric Acid (mM) + MSA (mM) + custom eluent anion (mN)}

Custom eluent anion (mN) can be calculated from the normality of the eluent concentration.

NOTE

Normality is Equivalents/L of solution. For example, 20.0 mM sodium sulfate (Na_2SO_4) has 40.0 mN sulfate as the anion.

3. Operation

This section provides instructions for the start-up and operation of the Dionex ERS 500 including the selection process and suppression modes of operation.

3.1 Chemical Purity Requirements

Precise and accurate results require eluents free of ionic impurities. Chemicals and deionized water used to prepare eluents must be pure as described below. Low trace impurities and low particulate levels in eluents and regenerants also help protect the Dionex ERS 500 and system components from contamination. Dionex ERS 500 performance is not guaranteed when the quality of the chemicals and water used to prepare eluents has been compromised.

3.1.1 Inorganic Chemicals

Reagent Grade inorganic chemicals should always be used to prepare ionic eluents. Preferably, a lot analysis on each label will certify each chemical as meeting or surpassing the latest American Chemical Society standard for purity, a universally accepted standard for reagents.

3.1.2 Solvents

Since solvents used with the Dionex ERS 500 are added to ionic eluents to modify the ion exchange process or improve sample solubility, the solvents used must be free of ionic impurities. However, since most solvent manufacturers do not test for ionic impurities, the highest grade of solvents available should be used. Currently, several manufacturers are making ultra-high purity solvents that are compatible for HPLC and spectrophotometric applications. These ultra-high purity solvents will usually ensure that your chromatography is not affected by ionic impurities in the solvent. Dionex has obtained consistent results using High Purity Solvents manufactured by Burdick and Jackson and Optima® Solvents by Thermo Fisher Scientific.

3.1.3 Deionized Water

The deionized water used to prepare eluents should be degassed Type I Reagent Grade Water with a specific resistance of 18.2 megohm-cm. The water used for the AutoSuppression External Water Mode should have a specific resistance of 18.2 megohm-cm or greater. The deionized water should be free of ionized impurities, organics, microorganisms and particulate matter larger than 0.2 µm. It is good practice to filter eluents through a 0.2 µm filter whenever possible. Bottled HPLC-Grade Water should not be used since most bottled water contains an unacceptable level of ionic impurities. Finally, thoroughly degas all deionized water prior to preparing any eluents or regenerants.

3.2 Start-up

The Dionex ERS 500 is installed in the column or detector chamber of the chromatography module right after the analytical column and before the conductivity detector cell. On the Dionex ICS-5000$^+$, the suppressor mounts on the conductivity detector module in the DC. On the Dionex ICS-2100, 1600 and 1100, the suppressor mounts on the component panel behind the Dionex ICS front door. Refer to the Dionex ICS Operator's Manual for further details. Orient the Dionex ERS 500 with the ELUENT IN port and the cable at the top if installed vertically; align the slots on the back of the Dionex ERS 500 with the tabs on the panel. Press in, and then down, to lock the Dionex ERS 500 in place. Lift up and pull out to remove the Dionex ERS 500. Ensure the Dionex ERS 500 is plumbed properly according to the selected mode of operation. Refer to Section 2, “Installation,” for complete installation instructions.

WARNING

Keep the regenerant chambers full with the appropriate regenerant solution or water. The membranes and screens in the Dionex ***ERS 500 must be completely hydrated to maintain liquid seals and chromatographic performance.***

CAUTION

The correct amount of back pressure on the conductivity detector for optimum operation is 40 psi. Connect the back pressure coil(s) appropriate for your column i.d. and flow rate. Back pressures over 450 psi after the Dionex ***ERS 500 can cause irreversible damage.***

CAUTION

Do not cap the waste reservoir.

SAFETY

Hydrogen gas generated by the Dionex ***ERS 500 is not dangerous unless the gas is trapped in a closed container and allowed to accumulate. The Gas Separator Waste Tube must be open to the atmosphere, and not in a confined space, to operate properly.***

3.2.1 Hydration

1. Hydrating the suppressor ensures that the ion exchange membranes are in a swollen form for proper operation.

   A 20 minute static step is recommended during first time installation to ensure complete hydration.

2. Using a disposable plastic syringe and the 10-32 Luer adapter (P/N 046888), push approximately 3 mL (Dionex ERS 500 4 mm) or 0.75 mL (Dionex ERS 500 2 mm) of degassed DI water through the ELUENT OUT port. Using a disposable syringe and the

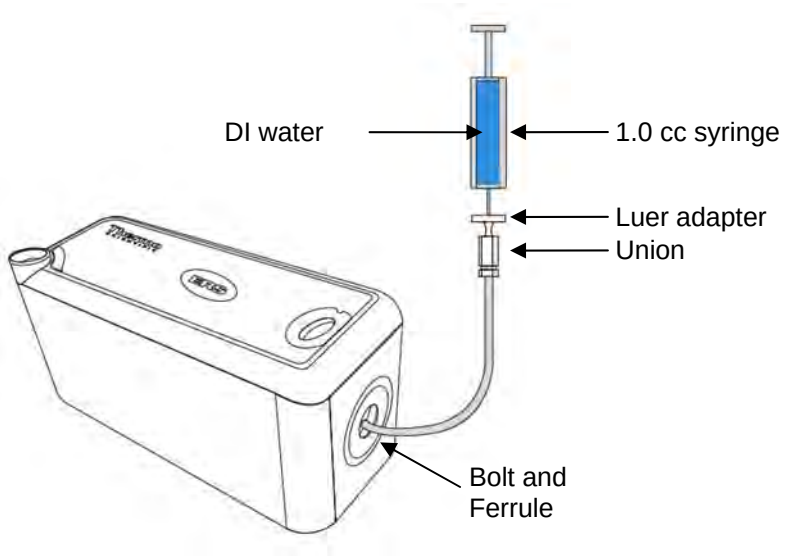
   1/4-28 Luer adapter (P/N 024305), push 5 mL (Dionex ERS 500 4 mm) or 2 mL (Dionex ERS 500 2 mm) of degassed DI water through the **REGEN IN** port, according to Figure 6.

NOTE

Step 1 can be accomplished by installing the suppressor in the system in the recycle mode, bypassing the guard and analytical columns, and pumping 5 mL (Dionex ***ERS 500 4 mm) or 2 mL (***Dionex ***ERS 500 2 mm) of deionized water through the suppressor. Care should be taken with this procedure not to exceed 100 psi of backpressure on the ERS suppressor.***

P/N	Description
016388	1 cc plastic syringe
024305	1/4-28 Luer adapter
046888	10-32 Luer adapter
042627	10-32 Union
043275	10-32 Bolt
043276	10-32 Double Cone Ferrule

Figure 3 Hydrating the Suppressor



3. Allow the suppressor to sit for approximately 20 minutes to fully hydrate the suppressor screens and membranes.

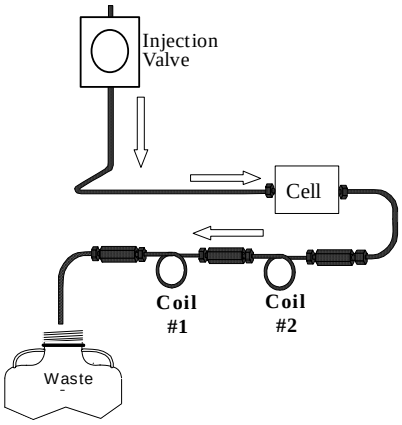
WARNING

Do not install a luer adapter directly into an Dionex ***ERS 500 port. Connect a luer adapter to a union and use two 10-32 bolt and ferrules with a few centimeters of tubing to connect to the*** Dionex ***ERS 500 ports.***

NOTE

A short piece of waste tubing should be installed in the Eluent In port during this procedure to ensure that liquid exiting the suppressor does not well up and flow back into the cover. This can give a false impression of an internal leak.

3.2.2 Back Pressure Coil Pressure Test



1. Disconnect the eluent line from the injection valve to the column at the column inlet.
2. Connect the eluent line from the injection valve directly to the detector cell inlet with the recommended number of back pressure coils attached for your application (see the table below). Turn the pump on at your application flow rate. After 2 to 3 minutes of equilibration record pressure P_1.
3. Disconnect the back pressure coils and with the pump on measure the system pressure P_2.

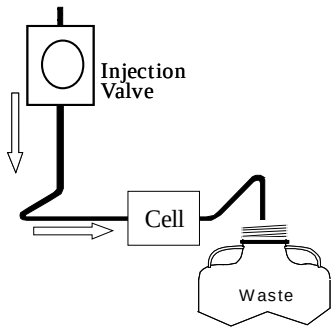
4-mm Chromatography	**2-mm Chromatography**
1.0 mL/min. = 2 black backpressure coils (P/N 045877)	0.25 mL/min. = 2 red backpressure coils (P/N 045878)
2.0 mL/min. = 1 black backpressure coil (P/N 045877)	0.50 mL/min. = 1 red backpressure coil (P/N 045878)

4. The correct operating pressure range for the backpressure coil being tested is

   Dionex ERS 500 $P_1 - P_2 = 30–40$ psi

   If the pressure is greater than 40 psi, then trim the back pressure coil and repeat step 2 and 3 to achieve 30-40 psi in step 4.

   If it is less than 30 psi, then add more tubing to achieve 30 - 40 psi.



3.2.3 Quick Back Pressure Check

This section describes how to measure the backpressure to the suppressor. Install the system for the application of choice.

1. Measure the system pressure P1 with the suppressor powered
2. Unplug the line from the “Eluent Out” port on the suppressor and measure system pressure P_2

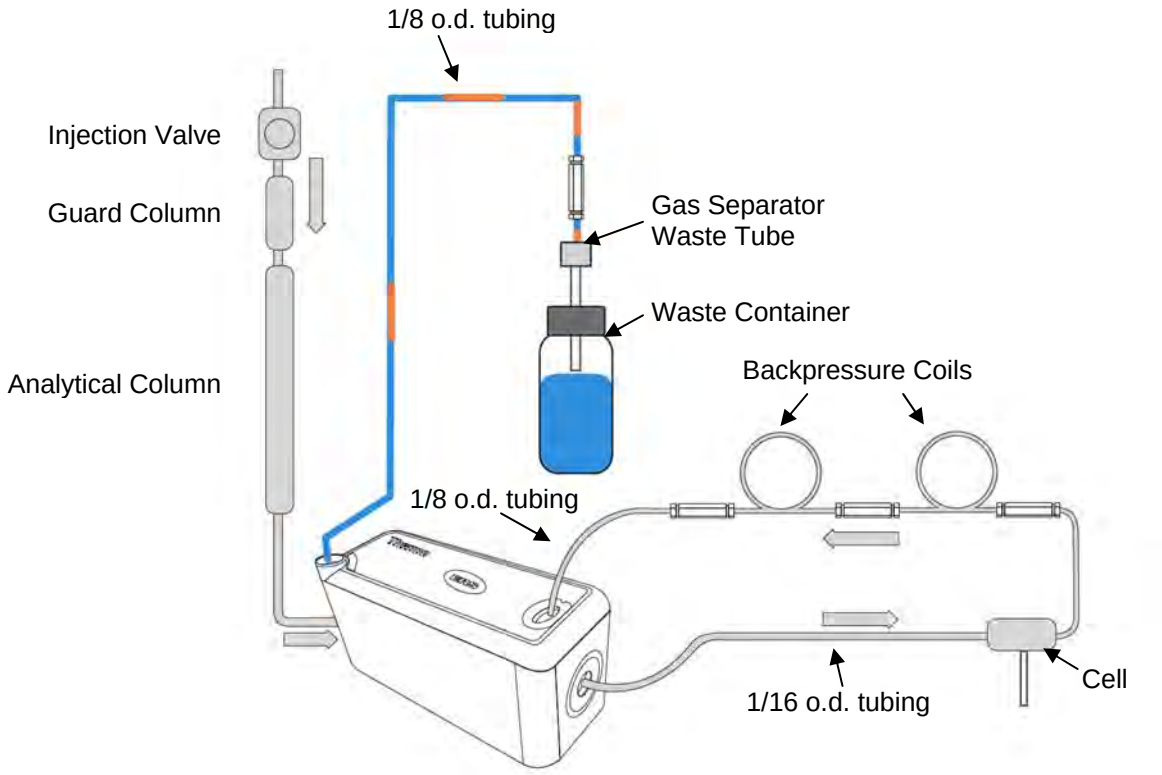
CAUTION

Do not leave the port open for more than 2 minutes.

3. $P_1-P_2 < 100$ psi.
4. Adjust the backpressure coils if needed to achieve the < 100 psi value. Refer to 3.2.2 to measure the back pressure contribution from the back pressure coil.

3.3 Plumbing for the AutoSuppression Recycle Mode Operation

Figure 4 The Auto Suppression Recycle Mode Plumbing Diagram



The AutoSuppression Recycle Mode is the easiest method of operation. As the eluent passes through the suppressor, it is neutralized to produce its weakly ionized form. After passing through the conductivity cell, this effluent can be redirected to the regenerant inlet on the suppressor, thus supplying it with a source of water containing a small amount of diluted analyte (see Figure 7). The main advantage of this mode is its simplicity and ease of use. It is not necessary to have an external supply of water available for the suppressor.

CAUTION

Only use the AutoSuppression Recycle Mode for eluents and samples without organic solvents or metallic contaminants such as iron in ground water.

3.3.1 Eluent Flow Path Connections in the AutoSuppression Recycle Mode

Depending on the specific components (analytical column, conductivity cell, back pressure coils) in the system, 1/4-28 or 10-32 ferrule/bolt liquid lines may be required. All necessary tubing and fittings are supplied in the detector or Dionex RFC-10 or Dionex RFC-30 Ship Kits. To purchase or assemble 1/4-28 or 10-32 ferrule/bolt liquid lines, refer to, "Dionex Liquid Line Fittings." Always use 0.005" i.d. PEEK tubing with 10-32 ferrule/bolt fittings on 2 mm systems. Use 0.010" i.d. PEEK tubing with 10-32 ferrule/bolt fittings on 4 mm systems when possible. Avoid adding dead volume to the system by keeping all eluent lines as short as possible.

A. Install the Dionex ERS 500 inside the Dionex ICS Module.

B. Connect the outlet of the analytical column to the ELUENT IN of the Dionex ERS 500 (Figure 5).

C. Connect the ELUENT OUT port of the Dionex ERS 500 to the inlet of the conductivity cell (Figure 5).

3.3.2 Regenerant Flow Path Connections in the AutoSuppression Recycle Mode

Connect the back pressure coil(s) between the CELL OUTLET port and the REGEN IN port (see Figure 5 and Section 2). The back pressure coils are provided in the Gas Separator Waste Tube Components Assembly (P/N 045825) for 4 mm systems. The backpressure coils for 2 mm systems are provided in the microbore tubing kit (P/N 052324).

CAUTION

The Dionex ***ERS 500 must be operated with the Gas Separator Waste Tube (P/N 045460).***

3.3.3 Installation in Thermal Chamber

A. Installation instructions for Dionex ICS-3000/5000/5000+ DC.

1. Install the suppressor using the suppressor holder on the CD in the upper compartment. Ensure the upper compartment temperature is set to a value no greater than 40°C and temperature control is turned on. It is recommended that the upper compartment is kept cooler than the lower compartment. The lower compartment (column oven) can be set to temperatures up to 70°C. If using a single zone DC, do not set the temperature above 40°C. For best noise performance the upper compartment can be set to 20° C.

B. Installation instructions for Dionex ICS 1100/1600/2100, AS50 thermal chamber TC and CC:

1. Install the suppressor using the suppressor holder. The suppressor is installed outside the heated column enclosure. It can support all high temperature applications up to 60° C. Add a length of tubing (up to 20", 50 cm) between the column outlet and the suppressor inlet to allow time for the eluent to cool to room temperature if operating the column above 35°C.

C. Installation instructions for LC30 and LC25 ovens:

1. For all ANION applications up to 40 ° C, install the suppressor in the oven using the SRS holder.

2. For operation above 40 ° C and up to 60° C, it is recommended that the Dionex AERS 500 suppressor be installed outside the oven. This would ensure optimal performance of the suppressor in terms of noise and background.

3. For all CATION applications up to 40° C, install the suppressor in the oven using the SRS holder.

4. For operation above 40° C and up to 60° C, it is recommended that the Dionex CERS 500 suppressor be installed outside the oven. This would ensure optimal performance of the suppressor in terms of background and noise. The Dionex CERS 500 suppressor however is fully compatible with operation up to 60° C. The noise performance would be slightly inferior at 60° C versus 30° C.

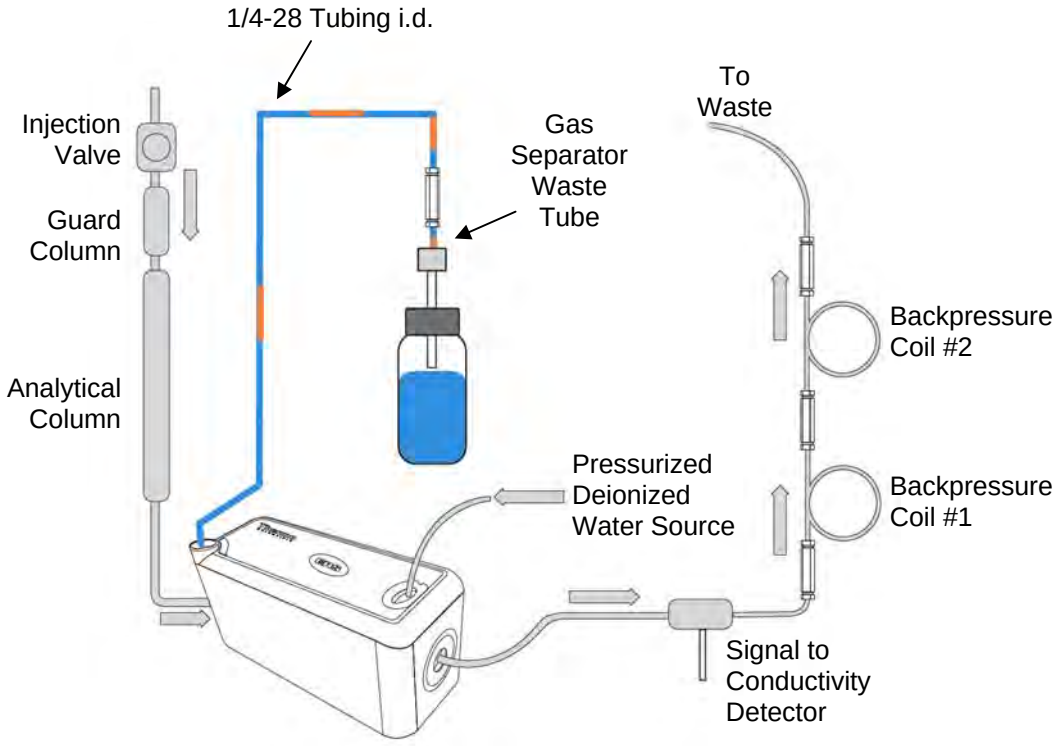
NOTE

For best performance and suppressor longevity, the suppressor should be kept as cool as possible; 20°C is ideal.

Set the required current based on your specific application requirements for column flow rate and temperature in addition to eluent concentration. If using Chromeleon software, the Wizards can greatly assist you in determining the correct requirements. Refer to Section 2 for suppressor current calculations and Appendix A for examples.

3.4 Plumbing for the AutoSuppression External Water Mode Operation

Figure 5 The AutoSuppression External Water Mode Plumbing Diagram



Any analysis that can be performed using the AutoSuppression Recycle Mode can be done using the AutoSuppression External Water Mode. A constant source of deionized water having a specific resistance of 18.2 megohm, or greater, is supplied to the regenerant chambers to generate hydronium or hydroxide ions for neutralization.

NOTE

AutoSuppression External Water Mode is used when organic solvents or metallic contaminants are present in the eluent or sample, or borate is used as eluent.

When the Dionex ERS 500 is operating in the AutoSuppression External Water Mode, the background noise may be lower than in the AutoSuppression Recycle Mode because the external water flow rate is not limited to the eluent flow rate. The independent source of external water allows for higher water flow rates and better sweep out of bubbles from the Regen chamber resulting in lower background noise.

3.4.1 Eluent Flow Path Connections for the AutoSuppression External Water Mode

Depending on the specific components in the system (such as analytical column, conductivity cell, back pressure coils), 1/4-28 or 10-32 ferrule/bolt liquid lines may be required. All necessary tubing and fittings are supplied in the detector or Dionex RFC-10 or Dionex RFC-30 Ship Kits. To purchase or assemble 1/4-28 or 10-32 ferrule/bolt liquid lines, refer to, “Dionex Liquid Line Fittings.” Always use 0.005" i.d. PEEK tubing with 10-32 ferrule/bolt fittings on 2 mm systems. When possible, use 0.010" i.d. PEEK tubing with 10-32 ferrule/bolt fittings on 4 mm systems. Avoid adding dead volume to the system by keeping all eluent lines as short as possible.

A. Install the Dionex ERS 500 in the first slot inside the Chromatography Module.

B. Connect the outlet of the analytical column to the ELUENT IN of the ERS 500 (Figure 6).

C. Connect the ELUENT OUT port of the Dionex ERS 500 to the inlet of the conductivity cell (see Figure 6).

D. Install a waste line from the conductivity cell that generates 40 psi back pressure at the flow rate required by the application. Use the appropriate i.d. tubing depending on your application requirements. Refer to Section 2 and see Figure 7 for the correct back pressure tubing requirements.

Install and adjust the flow rate of water from the pressurized water delivery system to the regenerant chambers of the Dionex ERS 500 (see Section 3).

3.4.2 Regenerant Flow Path Connections in the AutoSuppression External Water Mode

The Dionex ERS 500 Pressurized Bottle Installation Kit (P/N 038018) contains all of the components needed to install and operate the Dionex ERS 500 with a pressurized water reservoir. The kit contains the Dionex ERS Installation Parts Kit (P/N 039055), a 25 psi regulator (P/N 038201) and a 4 liter water reservoir (P/N 039164).

A. Make the following air line connections:

   1. Locate the pieces of tinted 1/8" o.d. plastic tubing (P/N 030089) supplied in the Installation Parts Kit.

   2. Push the end of one piece of 1/8" o.d. tubing over the barbed fitting of the regulator. Connect the other end of the tubing to the source of air pressure.

   3. Push one end of the second piece of 1/8" o.d. tubing over the other barbed fitting of the regulator. Push the other end of this tubing over the barbed fitting (P/N 030077) in the pressure inlet of the plastic reservoir (see Figure 13).

B. Make the following water line connection.

   1. Use a coupler (P/N 039056) to connect one end of the 30" tubing assembly (P/N 035727) that comes in the Installation Kit to the water reservoir. Connect the other end of this tubing to the REGEN IN port of the Dionex ERS 500 Suppressor.

   2. Using a coupler (P/N 039056) and a 1/8" o.d. piece of tubing (P/N 035728) from the Installation Kit, connect one end of this line to the REGEN OUT port of the Dionex ERS 500 Suppressor and then connect the other end of the line to the Gas Separator Waste Tube.

C. Fill the water source reservoir. Make sure that the O-ring is inside the cap of the reservoir before screwing the cap onto the reservoir. Screw the cap onto the reservoir tightly and place the reservoir near the Chromatography Module.

With no current applied, adjust the external water flow rate to approximately 3–5 mL/min for the Dionex ERS 500 (4 mm) and 1–3 mL/min for the Dionex ERS 500 (2 mm) by using a graduated cylinder and measuring the flow from the REGEN OUT waste line. The pressure applied to the reservoir can vary from 0–25 psi (the lower and upper pressure limits of the water reservoir) but the typical operating pressure is between 10–15 psi. Please note that this value is highly system dependent. After turning on the current, the external water flow rate will be less because the electrolysis of water will generate a small amount of hydrogen and oxygen gases that will be seen as bubbles from the REGEN OUT waste line. In summary, the final external water flow rate is dependent on two factors: the pressure applied to the water reservoir and the current setting. It is best to measure it with the current off since the formation of bubbles will decrease the accuracy of the overall measurement.

SAFETY

A safety relief valve on the reservoir regulator prevents pressure greater than 25 psi from being applied to the water reservoir.

3.4.3 Regenerant Flow Path Connections in the AutoSuppression External Water Mode with Peristaltic Pump.

For peristaltic pump plumbing refer to the "MASTERFLEX® C/L® Peristaltic Pump Quick Start Guide" (P/N 065203). For the Dionex ERS 500 plumbing refer to Figure 8, The AutoSuppression External Water Mode Plumbing Diagram and pump the Deionized water into the "Regen in" port of the Dionex ERS 500 using the peristaltic pump.

3.4.4 Installation in Thermal Chamber

Refer to Section 3.3.3.

3.4.5 Dionex SRD-10 Suppressor Regenerant Detector

The Dionex SRD-10 Suppressor Regenerant Detector is a stand-alone device that monitors liquid flow to a suppressor. If the flow is restricted or stops, the Dionex SRD-10 automatically disables the eluent pump via a TTL command, thus preventing irreversible damage being done to the suppressor. In the external water mode if the water runs out in the source reservoir then the suppressor would be still powered without any regenerant flow and this condition results in irreversible damage to the suppressor. Installing the Dionex SRD-10 suppressor regenerant detector avoids this issue and the system is turned off if the regenerant flow is interrupted either due to a plumbing leakage or due to the source reservoir getting empty.

3.5 Plumbing for Chemical Suppression Mode Operation

Since the Dionex ERS 500 plumbing in the regenerant side has sequential flow, this arrangement is not compatible with the chemical suppression mode. Therefore Thermo Scientific Dionex recommends the Dionex MMS 300 or equivalent for chemical suppression mode applications.

NOTE

The Dionex ERS 500 is not compatible with the Chemical Suppression Mode. The Dionex MMS 300 or equivalent should be used when Chemical Suppression Mode is required.

3.6 Plumbing for MPIC Suppression Mode Operation

The Dionex AERS 500 can be used with current applied to the suppressor augmented by dilute sulfuric acid in the regenerant solution. If you intend to use an AutoRegen Accessory, configure the system as described in Section 3.5, "Plumbing for the Chemical Suppression Mode Operation," and use the appropriate sulfuric acid concentration. The Dionex CERS 500 can be used with current applied to the suppressor augmented by diluted boric acid in the regenerant solution.

NOTE

The following installation instructions are based on a system configured with a pressurized water delivery system.

3.6.1 Eluent Flow Path Connections in MPIC Suppression Mode

To operate a system in the MPIC Suppression Mode, configure the system as described in Section 3.4.1, “Eluent Flow Path Connections in the AutoSuppression External Water Mode.”

3.6.2 Regenerant Flow Path Connections in MPIC Suppression Mode Using Pressurized Water Delivery System

The Dionex Electrolytically Regenerated Suppressor (Dionex ERS) Installation Kit (P/N 038018) contains all of the components needed to install and operate the Dionex ERS 500 with a pressurized regenerant reservoir. The kit contains the Dionex ERS Installation Parts Kit (P/N 039055), a 25 psi regulator (P/N 038201) and a 4-liter regenerant reservoir (P/N 039164).

To operate a system in the MPIC Suppression Mode, configure the system and use the appropriate sulfuric acid concentration as described in Section 3.6.3.

3.6.3 MPIC Suppression Mode Operation

A. Anion MPIC

The Dionex AERS 500 can be used for suppression of MPIC (ion-pairing) eluents by using the MPIC Suppression Mode. The MPIC Suppression Mode is a combination of the AutoSuppression External Water Mode augmented with a chemical regenerant such as sulfuric acid (H_2SO_4). When the Dionex AERS 500 is operating in this mode, it uses an applied current and a constant source of dilute sulfuric acid solution from a pressurized bottle delivery system or additional pump.

Table 6, “ Matching the Current Setting and Regenerant Flow Rate to the Eluent Concentration and Flow Rate,” lists the eluent concentrations and flow rates of standard eluents used in Anion MPIC separations and the current level and regenerant flow rate required to suppress them.

Table 6 Matching the Current Setting and Regenerant Flow Rate to the Eluent Concentration and Flow Rate for the Dionex AERS 500 (4 mm) in the MPIC Suppression Mode

Eluent	Eluent Flow Rate (mL/min)	Current (mA)	Regenerant Flow Rate (mL/min)*	Regenerant Concentration (mN)
0.1–2.0 mM TBAOH	0.5–2.0	50/100	3–5	5–10
2.0–5.0 mM TBAOH	0.5–1.0	100/300	3–5	10
	1.1–1.5	300/500	3–5	10

*Measured with power ON using a graduated cylinder

NOTE

For lower eluent concentration in a given range, choose lower corresponding current; for higher eluent concentration, choose higher current setting. Higher current settings require higher pressures applied to the pressurized regenerant delivery bottle to maintain adequate regenerant flow.

B. Cation MPIC

The Dionex CERS 500 can be used for suppression of MPIC (ion-pairing) eluents by using the AutoSuppression External Water Mode or the MPIC Suppression Mode depending on the specific MPIC application. The MPIC Suppression Mode is a combination of the AutoSuppression External Water Mode augmented with a chemical regenerant if necessary, such as boric acid (H_3BO_3). When the Dionex CERS 500 is operating in this mode, it uses an applied current and a constant source of dilute boric acid solution from a pressurized bottle delivery system.

The separation of alkanolamines by ion-pairing using the Dionex CERS 500 requires adding 10 mM boric acid to the regenerant to increase the ionization of the ethanolamines, thereby increasing the conductivity of the alkanolamines. Boric acid regenerant should not be used for the separations of the fully ionized alkali and alkaline earth metals as the borate will displace the hydroxide counter ion and reduce the conductance of these ions. Table 7, " Matching the Current Setting and Regenerant Flow Rate to the Eluent Concentration and Flow Rate ," lists the eluent concentrations and flow rates of standard eluents used in cation MPIC separations and the current level and regenerant flow rate required to suppress them.

Table 7 Matching the Current Setting and Regenerant Flow Rate to the Eluent Concentration and Flow Rate Dionex CERS 500 (4 mm)

Eluent	Eluent Flow Rate (mL/min)	Current (mA) [1]	Regenerant Flow Rate (mL/min) [2]
0.1–2.0 mM Hexane sulfonic acid (HSA)	0.5–1.0	50/100	3–5
2.0–5.0 mM HSA	0.5–1.0	100/300	3–5
0.1–2.0 mM Octane sulfonic acid (OSA)	0.5–1.0	50/100	3–5
2.0–5.0 mM OSA	0.5–1.0	100/300	3–5
0.1–2.0 mM Nonafluoropentanoic acid	0.5–1.0	50/100	3–5
2.0–5.0 mM Nonafluoropentanoic acid	0.5–1.0	100/300	3–5

1. CERS 500 applications will operate best at current settings of 300 mA or lower.
   Operating the CERS 500 at current settings over 300 mA can reduce the life of the suppressor and produce unnecessary baseline noise.
2. Measured with power ON using a graduated cylinder

NOTE

For lower eluent concentration, in a given range, choose lower corresponding current; for higher eluent concentration, choose higher current setting. Higher current settings require higher pressures applied to the pressurized regenerant delivery bottle to maintain adequate regenerant flow. Organic eluent solvents levels should be kept below 40%.

3.7 Dionex Electrolytically Regenerated Suppressor (Dionex ERS 500) Storage

The Dionex ERS 500 is shipped with deionized water as the storage solution. If the suppressor will not be used for more than three days, prepare it for storage. The resin, screens and membranes in the Dionex ERS 500 must be completely hydrated to maintain liquid seal and chromatographic performance. Plug all the ports after hydration.

3.7.1 Short Term Storage (3 to 7 days)

A. Using a plastic syringe, push 5 mL of deionized water through the REGEN IN port, and 3 mL of Deionized Water through the ELUENT IN port until all bubbles are removed. Plug all the ports (both REGEN and ELUENT ports).

B. To resume operation, connect the suppressor to the system. Allow the system to equilibrate before starting analysis.

NOTE

If the eluent last used contained organic solvents, flush the Dionex ***ERS 500 with deionized water for 10 minutes through both chambers before plugging the fitting ports.***

3.7.2 Long Term Storage (More than 7 days)

A. Connect the eluent and regenerant chambers in series and flush the Dionex ERS 500 with deionized water for 10 minutes at 1.0 mL/min (Dionex ERS 500 (4 mm)) or 0.25 mL/min (Dionex ERS 500 (2 mm)).

B. Plug all Dionex ERS 500 ELUENT ports and REGEN ports.

C. To resume operation, complete the hydration steps and connect the suppressor to the system. Allow the system to equilibrate before starting analysis.

D. If small or increasing analyte peak areas are observed, perform steps A–G as outlined in Section 4.2, “Small or increasing Analyte Peak Area or Regeneration.”

4. Troubleshooting Guide

The purpose of the Troubleshooting Guide is to help you solve operating problems that may arise while using the Dionex ERS 500. For more information on problems that originate with the Ion Chromatograph System or the specific exchange column set in use, refer to the Troubleshooting Guide in the appropriate Product Manual. If you cannot solve the problem on your own, contact the Dionex Regional Office nearest you (see Dionex Worldwide Offices on the Reference Library CD-ROM).

CAUTION

Do not allow eluent to flow through the Dionex ***ERS 500 without the power turned on for more than a few minutes. Doing so will cause noticeable reduction of analyte peak areas. If this should occur, perform the procedure outlined in Section 4.2, "Small or increasing Analyte Peak Areas."***

4.1 Electrolytically Regenerated Suppressor Operational Status Displays Alarm State

ERS or SRS Alarm:

Alarm state indicates that there is high resistance in the suppressor device typically in the regenerant channel or there is an issue with connectivity of the suppressor to a power supply.

High resistance occurs when:

1. The suppressor is not connected to the power supply or has a defective cable. In this state the only indicator from the system is a high voltage alarm. In this state no current is applied to the suppressor.

   The suppressor is operated with higher currents than the recommended currents.

   Refer to the current settings section to determine the correct current and lower the current.

2. The suppressor is exposed to contaminants such as iron, other metals or organics.

   Refer to the appropriate cleanup procedure and implement the recommended cleanup. In cases when the contamination is continuous, a routine cleanup step on a weekly basis is recommended as part of preventive maintenance.

NOTE

If the above problem is encountered on a routine basis particularly with samples containing high levels of metals or solvents, the chemical mode of operation is recommended. The Dionex ***MMS 300 is recommended for the chemical mode of operation; the*** Dionex ***ERS 500 cannot be operated in the chemical mode.***

Refer to Appendix C for alarm state information on discontinued models.

4.2 Small or Increasing Analyte Peak Areas

This problem is caused by running eluent through the Dionex ERS 500 with the power off while using the AutoSuppression Recycle Mode or the AutoSuppression External Water Mode. A regeneration protocol is needed to ensure good operation.

4.2.1 Suppressor Chemical Regeneration Steps

For fast regeneration it is recommended to follow the steps below for Chemical Regeneration of the suppressor.

A. Disconnect the eluent line from the analytical column attached to the ELUENT IN port of the Dionex ERS 500 at the analytical column end of the line. Direct this line to a separate waste beaker.

B. Disconnect the eluent line from the ELUENT OUT port of the Dionex ERS 500.

C. For the Dionex AERS 500:

   Using a plastic syringe push approximately 3 mL of 200 mN H_2SO_4 through the ELUENT OUT port and approximately 5 mL of 200 mN H_2SO_4 through the REGEN IN port. Flush with 3 mL degassed, deionized water through the ELUENT OUT port and 5 mL degassed, deionized water through the REGEN IN port.

D. For the Dionex CERS 500:

   Using a plastic syringe slowly push approximately 3 mL of freshly prepared 200 mN NaOH (made up using degassed, deionized water) through the ELUENT OUT port and approximately 5 mL of 200 mN NaOH through the REGEN IN port. Flush with 3 mL degassed, deionized water through the ELUENT OUT port and 5 mL degassed, deionized water through the REGEN IN port.

E. Reconnect the eluent line from the ELUENT IN port of the ERS 500 to the analytical column and the eluent line from the eluent out port of the ERS 500 to the conductivity detector cell.

F. If you are in the Auto Suppression Recycle mode of operation, begin pumping eluent and immediately turn on the power. DO NOT LET THE ELUENT FLOW THROUGH THE ERS 500 FOR MORE THAN A FEW MINUTES WITHOUT TURNING ON THE POWER.

   If you are in the Auto Suppression External water mode of operation, establish water flow through the regenerant chambers, begin pumping eluent and immediately turn on the power. DO NOT LET THE ELUENT FLOW THROUGH THE ERS 500 FOR MORE THAN A FEW MINUTES WITHOUT TURNING ON THE POWER.

4.2.2 Suppressor Electrolytic Regeneration Steps

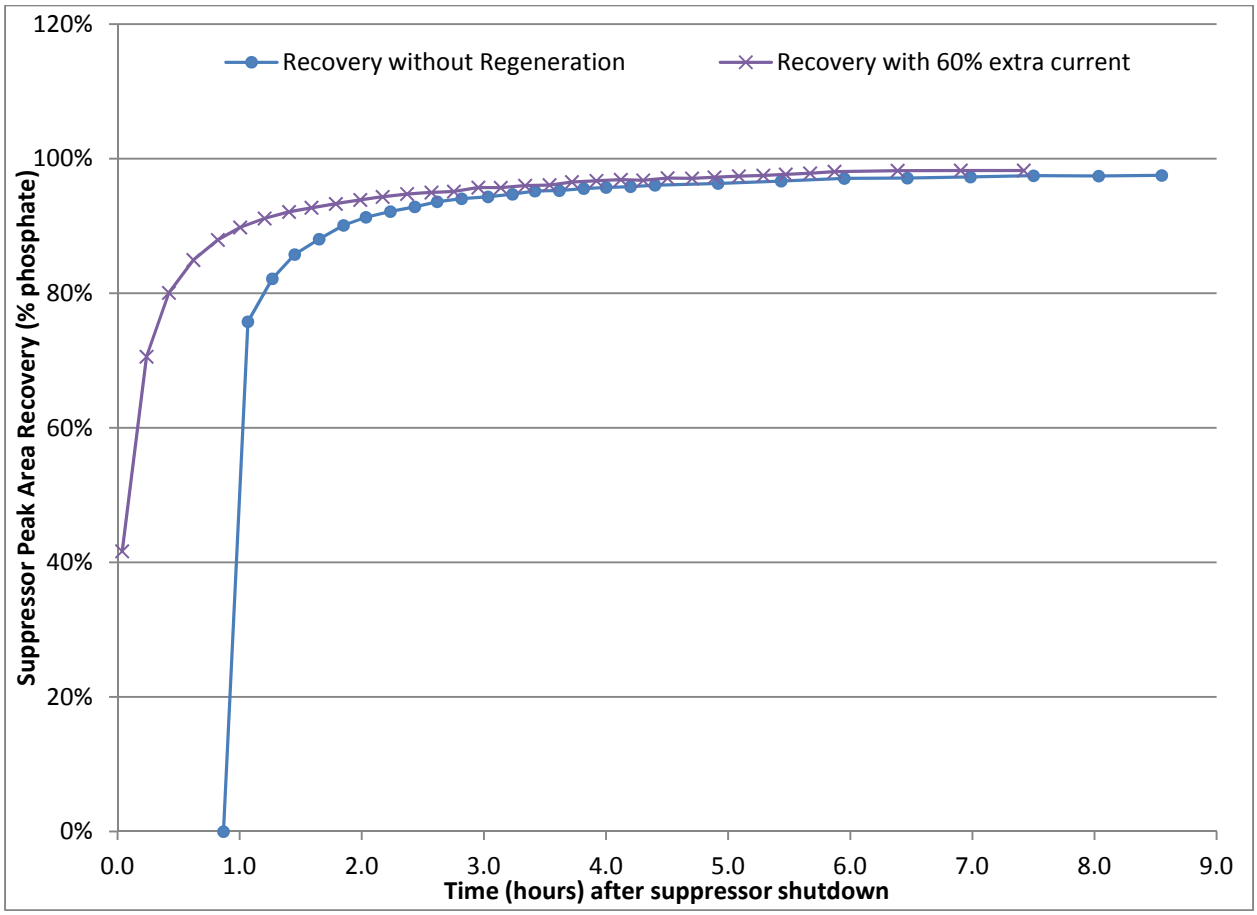
1. The Dionex ERS 500 is unique that it can be regenerated electrolytically. Although this is slower than Chemical Regeneration, it does not require the suppressor to be disconnected or the use of any reagents.
2. Turn on the system with the normal application settings, if using gradient elution, set the eluent concentration to the maximum value usually seen in the gradient.
3. Set the current of the suppressor to 60% higher than the optimal current. e.g., if the optimal current is 50 mA, set the current to 80 mA. This is the maximum suppressor current reported by Chromeleon in the Instrument Program settings.
4. Leave the system running with the suppressor set to the higher current for a minimum of 3 hours, up to 6 hours.
5. Set the current back to the optimal current.

4.2.3 Full or Extended Regeneration:

Depending on the extent of capacity loss of the suppressor, the regeneration procedure as outlined above may be inadequate to fully regenerate the suppressor. In order to fully regenerate the suppressor an extended rinse (for at least two hours) with 200 mN sulfuric acid (for Dionex AERS 500) or 200 mN NaOH (for Dionex CERS 500) at the application flow rate is needed. Pump the acid or base (as the case may be) through the eluent out port of the suppressor, with a line connecting the eluent in port to the regen in port. Divert a line from the Regen out port to waste. A standalone pump or a trap column/suppressor clean-up kit (P/N 059659) could be used for the above regeneration. Another option is to pursue the regeneration as outlined in steps 4.2.1. C or D above and then allow the acid or base to soak in the suppressor overnight. In the morning repeat the regeneration as outlined in steps 4.2.1. C or D and then displace the acid or base with DI water.

If the correct peak areas are not observed following two injections of a standard test solution, contact the nearest Dionex Regional Office (see Dionex Worldwide Offices on the Reference Library CD-ROM).

Figure 6 Trend plot showing Increasing Peak Areas after a suppressor was operated with the power off for 40 minutes. Blue trace shows recovery without following the Regeneration steps, Purple trace show recovery during Suppressor Electrolytic Regeneration process.



NOTE

The sulfuric acid in the above steps could be replaced with a non oxidizing strong acid such as Methanesulfonic acid (MSA) which is recommended when pursuing MS applications.

NOTE

Do not use the Analytical pump for regeneration purpose as this would contaminate the pump

4.3 High Background Conductivity

A. Check the Dionex ERS 500 current settings.
Refer to the Dionex ERS 500 current settings section.

B. Check for eluent flow out of the Dionex ERS 500 ELUENT OUT port.

1. If there is no flow out of the ERS 500 ELUENT OUT port, make sure that eluent is entering the Dionex ERS 500 at the ELUENT IN port. If there is no flow at this point, trace the eluent flow path backward through the system to find and remove the blockage.

2. If there is flow into the Dionex ERS 500 but not out, and there are no visible leaks from the rear seam of the suppressor, a break in the suppressor seal is probably allowing eluent to leak into the regenerant chambers. If this is the case, then the Dionex ERS 500 should be replaced. The Dionex ERS 500 is sealed during manufacture; attempting to open it will destroy it.

SAFETY

Do NOT attempt to disassemble the Dionex ***ERS 500.***

3. If there is flow from the ELUENT OUT port, but no eluent suppression, the membrane may have been contaminated. Try to restore system performance by cleaning the membrane (see Section 5, “Electrolytically Regenerated Suppressor Cleanup”).

C. Remake the eluent to be sure that the concentration is correct. Be sure that chemicals of the required purity were used to make the eluent (see Section 3.1, “Chemical Purity Requirements”). If the eluent concentration is high, the ERS 500 may not be set up to suppress the high concentration resulting in high background conductivity. Refer to Tables 11–14 in Appendix A, “Matching the Current Setting to the Eluent Concentration and Flow Rate,” for Dionex AERS 500 suppressors and the Tables 15–17 in Appendix A for the Dionex CERS 500.

D. Contact the nearest Dionex Regional Office (see, “Dionex Worldwide Offices”) if you cannot solve the problem on your own.

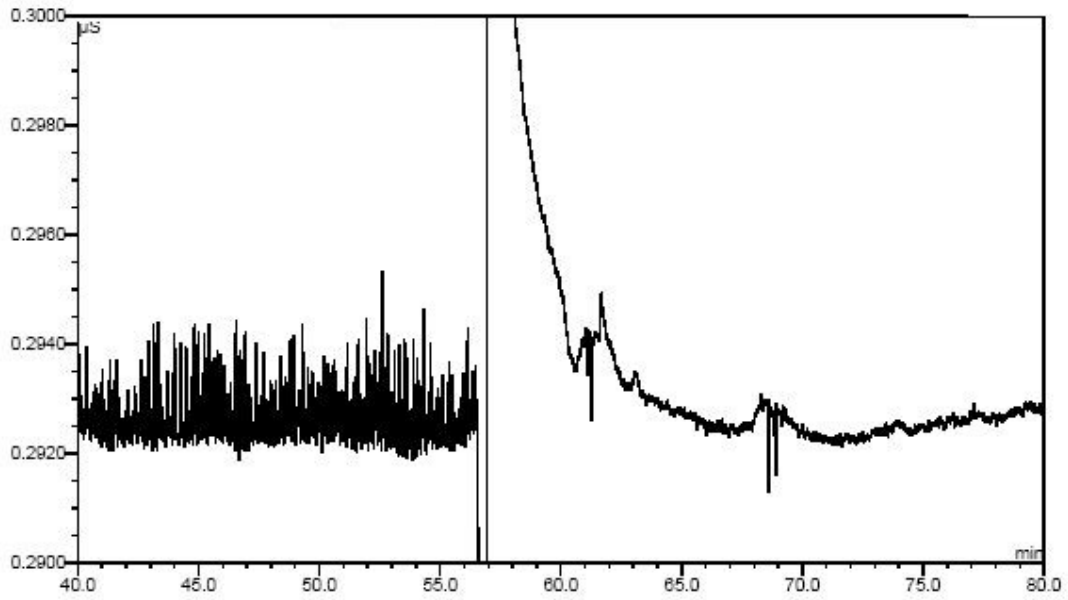
4.4 Drifting Baseline

If the baseline drifts steadily upward, increase the current setting by 5-10% to reduce the background conductivity. As the background conductivity decreases, the baseline drift should decrease.

4.5 Noisy Baseline

If the baseline is noisy (> 3 nS with hydroxide or MSA eluents, > 10 nS with carbonate or borate eluents), it could be caused by trapped air bubbles in the cell or tubing. Burp or release the trapped bubbles by gently tapping on the cell while the fittings are slightly loosened or bleeding the tubing. Below is an example:

Figure 7 Effect of Air Bubbles on Baseline
Dionex AERS 500 (4 mm), Recycle Eluent Mode



In the above figure, a bubble is released from ELUENT IN line by loosening and tightening the fitting at 56.6 minutes into the run.

Noise:

~2.5 nS	before
< 0.5 nS	after

4.6 Decreased Sensitivity

A. Check for leaks throughout the system. If a fitting is leaking, tighten it carefully until the leak stops. Do not over tighten. If the Dionex ERS 500 is observed to be leaking from the center or bottom seam, see Section 4.8, “Liquid Leaks.” If you cannot cure the problem yourself, call the nearest Dionex Regional Office (see, “Dionex Regional Offices”) for assistance.

B. Ensure that the injection valve is operating correctly. Refer to the valve manuals that accompany the chromatography module for troubleshooting assistance. For slider valves, be sure to check the slider port faces for damage.

C. Pursue regeneration of the suppressor as outlined in section 4.2

D. If sensitivity remains low, clean the suppressor membrane (see Section 5, “Dionex ERS 500 Suppressor Cleanup”).

E. Check the backpressure coils. Verify that they are not exceeding 40 psi in the current plumbing configuration and flow rate.

F. Replace the Dionex ERS 500 if cleaning the suppressor membrane does not restore sensitivity.

G. Contact the nearest Dionex Regional Office (see, “Dionex Worldwide Offices”) if you cannot solve the problem on your own.

4.7 System Back Pressure Increases Over Time

If the increased back pressure does not affect system performance, no maintenance is necessary.

A. Check the inlet frits on the guard and analytical column and replace them if necessary. The most common cause of increasing system back pressure is a contaminated frit in the analytical or guard column inlet end fitting. The complete instructions for replacing column bed support assemblies are in Document No. 032285. Recheck the system back pressure. If it remains high, go on to the next step.

B. Check the backpressure coils. If removing the backpressure coils lowers the pressure by more than 40 psi, replace the coils or remove the blockage causing the increased pressure. Backpressure over 450 psi after the suppressor can cause irreversible damage.

C. Find and eliminate any system blockage. Bypass the Dionex ERS 500 by coupling the lines attached to the ELUENT IN and ELUENT OUT ports. If the back pressure decreases by less than 150 psi with the ERS 500 out of line, a blockage in the system rather then in the Dionex ERS 500 is causing the high pressure.

D. Remove a blockage from Dionex ERS 500 by reversing the eluent flow. If the back pressure decreases by more than 150 psi with the Dionex ERS 500 out of line, the high pressure may be caused by a blockage in the Dionex ERS 500. Reverse the direction of flow of both the eluent and the external water through the Dionex ERS 500. After the pressure drops, allow eluent, or eluent and regenerant, to flow to waste for several minutes after the pressure drops. Perform step A of Section 3.2, “Startup” and reinstall the ERS 500 in the appropriate configuration.

E. Clean the suppressor membranes if reversing the flow through the Dionex ERS 500 does not decrease the pressure. (See Section 5, “Anion Self-Regenerating Suppressor Cleanup”).

F. Replace the Dionex ERS 500 if cleaning the suppressor membrane does not reduce the pressure.

G. Contact the nearest Dionex Regional Office (see, “Dionex Regional Offices”) if you cannot solve the problem on your own.

4.8 Liquid Leaks

A. If there is leakage from the rear seam of the Dionex ERS 500, check the back pressure after the Dionex ERS 500.

B. If the system back pressure is greater than 450 psi, the leaks are caused by excessive back pressure downstream from the Dionex ERS 500. Find and eliminate the source of the pressure. The Dionex ERS 500 will usually recover from momentary overpressure conditions if allowed to stand approximately 20 minutes with the membranes fully hydrated. See the Caution Note in Section 3.2, “Start-Up” If the Dionex ERS 500 continues to leak when operated within the proper back pressure range, it must be replaced.

4.9 Poor or unstable recovery of certain peaks.

If one or two peaks are experiencing poor or unstable recoveries while the other peaks are stable, it could be that the current to the suppressor is set too high. Recalculate the correct time setting (see section 2.5, or use the “signal parameters“ tool in Chromeleon). Do not exceed the recommended current setting unless necessary to stabilize a drifting baseline.

Alternatively the system may be contaminated with a transition metal that is binding to the analyte of interest (See Section 5.1, “Metal Contaminants or Precipitates”).

4.10 Peaks and spikes in the absence of an injection

A. Excessive current applied to the suppressor (over-currenting): Recalculate the optimum current and apply; never apply more than 10% above the optimum current except when executing the Electrolytic Regeneration Steps. When operating with gradient eluents, apply the minimum current setting for the maximum eluent concentration at the eluent flow rate. During a low flow method (stand-by mode), ensure that the current is lowered to the optimal value based on the reduced flow rate and/or eluent concentration.

B. Precipitation on the suppressor membrane or screens (calcium, magnesium and other metals): Follow the Metal Contaminants or Precipitates procedure from section 5.1. To prevent contaminants from reaching the suppressor, a CP1 cation polisher column (P/N 064930) can be used during anion analysis to strip cationic contaminants from the sample. Refer to the CP1 Operator's Manual for detailed instructions.

C. Outgassing or trapped bubbles in the suppressor regenerant chambers: Ensure that the external water (if used) is degassed before use; do not pressurize the external water with air, use nitrogen or helium. Eliminate causes of excessive backpressure between the cell outlet and the regenerant inlet if recycled eluent mode is used.

D. Excess suppressor temperature: Ensure liquid entering the Dionex ERS 500 is at or less than 35°C. Ensure the Dionex ERS 500 is operated in an environment that does not exceed 35°C during operation. Refer to section 3.3.3 Installation in thermal chamber. 20°C is the optimum temperature for Dionex ERS 500 operation.

E. Large changes to the flow rate or applied current of the suppressor: When changing eluent concentration or flow rate, recalculate the optimum current using the attached calculator; do not allow the suppressor to operate for more than 5 minutes with excessive or insufficient current. If the current is changed, allow the suppressor a few hours to reestablish baseline stability. Ensure that shut-down, stand-by and start-up methods are applying the correct suppressor current.

F. Operating the suppressor with power but no eluent or regenerant flow: Operation of the suppressor without flow may irreversibly damage the suppressor, depending on amount of applied current and duration. Ensure that the regenerant lines are connected and flow is established when powering on the suppressor at all times. Ensure that during external water operation that the suppressor is never operated without regenerant flow. When operating properly, bubbles interspersed with liquid exiting the regenerant chamber indicates good flow. Replace the suppressor if operation without flow is known to have occurred. Confirm that the minimum pressure limit on the pump is set to a non-zero value to ensure that the system turns off in the event of a leak.

G. Incorrect current setting during shutdown, stand-by or startup method: Shut-down methods should shut the pump flow off at the same time as the suppressor current. Stand-by methods should reset the suppressor current to the optimum level for the reduced flow rate and/or concentration. Do not reduce the flow rate on RFIC-EG systems; this will lower the backpressure on the degasser below 2,000 psi and cause out-gassing. Stand-by methods for RFIC-EG systems should reduce eluent concentration to preserve Dionex EGC ion count; reset the suppressor current accordingly. Do not turn the Dionex EGC concentration to zero with flow; use a low setting. Consider using the smart-shutdown and smart-startup feature of Chromeleon instead of standby conditions and configure the system for smart-startup two hours before use is anticipated so the system is equilibrated and ready to run. Consider using RFIC-ER; no shut-down, stand-by or start-up procedure is needed with an Always On, Always Ready system. Start-up settings should turn on the pump flow and suppressor current simultaneously.

5. ERS Cleanup

This section describes routine cleanup procedures for the Dionex Electrolytically Regenerated Suppressors (Dionex ERS 500) in the case of contamination. Consult the Troubleshooting Guide (see Section 4, "Troubleshooting Guide") to first determine that the system is operating properly. If the Dionex ERS 500 is determined to be the source of higher than normal back pressure, higher than anticipated conductivity, decreased suppression capacity or decreased sensitivity, cleaning the membrane may restore the performance of the system. Use the following procedures to clean the membrane.

5.1 Metal Contaminants or Precipitates

Note: The suppressor voltage is a good indicator of the resistance across the suppressor. Higher resistance may indicate contamination of the suppressor. For more information regarding monitoring the voltage, see Document No. 031841-02 "Removal of Iron Contamination from Electrolytic Suppressors."

A. Turn off the Dionex ERS Control unit and system pump.

B. Disconnect the analytical (and guard) column(s) from the injection valve and the Dionex ERS 500. Refer to the specific analytical column Product Manual for column cleanup procedures.

C. If you are running in the AutoSuppression External Water Mode, turn off the external water and disconnect the external water line from the Dionex ERS 500 REGEN IN port.

D. Disconnect the liquid line from the Dionex ERS 500 ELUENT OUT port to the cell at the cell fitting and reconnect it to the REGEN IN port.

E. If iron is present then connect a temporary line from the priming block or the low-pressure tee on the isocratic or gradient pump to a container with a solution of 0.2 M oxalic acid. Pump this solution through the Dionex ERS 500 (4 mm) at 1 – 2 mL/min for 30 minutes. For 2 mm systems pump this solution through the Dionex ERS 500 (2 mm) at 0.25–0.50 mL/min for 30 minutes. Proceed to step G.

F. If iron is not present then proceed to step G.

NOTE

Bypassing internal pump manifolds when temporarily pumping high concentration cleaning solutions significantly reduces the time required to reequilibrate the system to low concentration eluents.

G. Pursue an extended regeneration as outlined in 4.2.2.

H. Reinstall the analytical (and guard) column(s). Begin pumping eluent through the system at the flow rate required for your analysis and equilibrate the system and resume normal operation.

NOTE

Chromeleon 6.5 and later includes a feature to Trend various parameters. Trend plotting the suppressor voltage will reveal if there is a build-up of metal contaminants or precipitates in the suppressor. A slow but steady increase in voltage indicates such a contamination build-up

5.2 Organic Contaminants

A. Turn off the ERS Control unit and system pump.

B. Disconnect the analytical (and guard) column(s) from the injection valve and the Dionex ERS 500. Refer to the specific analytical column Product Manual for column cleanup procedures.

C. If you are running in the AutoSuppression External Water Mode, turn off the external water and disconnect the external water line from the Dionex ERS 500 REGEN IN port. If you are running in the AutoSuppression Recycle Mode, proceed to D.

D. Disconnect the liquid line from the Dionex ERS 500 ELUENT OUT port to the cell at the cell fitting and reconnect it to the REGEN IN port.

E. Connect a temporary line from the priming block or the low-pressure tee on the isocratic or gradient pump to a container with a solution of freshly prepared 10% 1 N methane sulfonic acid or sulfuric acid and 90% acetonitrile or methanol. Acid/acetonitrile solutions are not stable during long term storage so this cleanup solution must be made immediately before each column cleanup. Alternatively, it can be proportioned from 1 bottle containing 1.0 N acid and another bottle containing 100% acetonitrile. Pump this solution through the Dionex ERS 500 (4 mm) at 1–2 mL/min for 30 minutes. For 2 mm systems, pump this solution through the ERS 500 (2 mm) at 0.25–0.50 mL/min for 30 minutes.

NOTE

Bypassing internal pump manifolds when temporarily pumping high concentration cleaning solutions significantly reduces the time required to re-equilibrate the system to low concentration eluents.

F. Flush the Dionex ERS 500 with deionized water for 10 minutes.

G. Reinstall the analytical (and guard) column(s). Begin pumping eluent through the system at the flow rate required for your analysis and equilibrate the system and resume normal operation.

Appendix A – Current Settings

A.1. Optimum Current Settings for Common Eluents; Dionex AERS 500 (4 and 2 mm)

The Dionex Anion Electrolytically Regenerated Suppressor (Dionex AERS 500) uses water as the regenerant and has the ability to provide continuous suppression. Table 8 and 9 list the eluent concentrations and flow rates of commonly used mobile phases used in anion separations and the optimum / recommended current level to suppress the eluent. The operation of the Dionex AERS 500 requires a constant flow of water over the electrodes in a direction that is countercurrent to the flow of the eluent.

In the AutoSuppression Recycle Mode, the eluent leaving the conductivity cell is recycled through the regenerant chambers as the water supply. This eliminates the need for an external regenerant water supply and delivery system. When the Dionex AERS 500 is operating in this mode, the amount of water flowing through the regenerant chambers is limited to the eluent flow rate. The AutoSuppression Recycle Mode cannot be used with eluents containing any organic solvents.

The AutoSuppression External Water Mode requires an external source of deionized water for the regenerant chambers. When the Dionex AERS 500 is operating in this mode, the amount of water flowing through the regenerant chambers is independent of the eluent flow rate. Because of this, higher regenerant flow rates are achievable, see Table 10. Higher regenerant flow rates translate in improved signal-to-noise ratios compared to the AutoSuppression Recycle Mode. The AutoSuppression External Water Mode is the mode used if organic solvents (up to 40%) are present in the eluent. It eliminates the potential for buildup of contaminating ions resulting from the oxidation of solvents.

Table 8 Optimum Current Settings for the Dionex AERS 500 in the AutoSuppression Recycle and External Water Modes

Column	Eluent	Eluent Flow Rate (mL/min) (2 mm)	Eluent Flow Rate (mL/min) (4 mm)	Optimum Current (mA) (2 mm)	Optimum Current (mA) (4 mm)
AS4A-SC	1.8 mM CO_3^{2-} / 1.7 mM HCO_3^-	0.5	2.0	7	27
AS9-HC	9.0 mM CO_3^{2-}	0.25	1.0	12	45
AS12A	2.7 mM CO_3^{2-} / 0.3 mM HCO_3^-	0.38	1.5	6	22
AS14	3.5 mM CO_3^{2-} / 1.0 mM HCO_3^-	0.3	1.2	6	24
AS14A	8.0 mM CO_3^{2-} / 1.0 mM HCO_3^-	0.5[(1)]	1.0	21	42
AS22	4.5 mM CO_3^{2-} / 1.4 mM HCO_3^-	0.3	1.2	8	31
AS23	4.5 mM CO_3^{2-} / 0.8 mM HCO_3^-	0.25	1.0	7	25
AS10	80 mM OH^-	0.25	1.0	50	198
AS11	12 mM OH^-	0.25	1.0	8	30
	38.3 mM OH^-	0.5	2.0	48	190
AS11-HC	30 mM OH^-	0.38	1.5	29	112
	60 mM OH^-	0.38	1.5	57	223
AS15	38 mM OH^-	0.3	1.2	29	113
	40 mM OH^-	0.5[(1)]		50	
AS16	35 mM OH^-	0.25	1.0	22	87
	55 mM OH^-	0.38	1.5	52	204
AS17-C	15 mM OH^-	0.25	1.0	10	38
	40 mM OH^-	0.5	2.0	50	198
AS18	23 mM OH^-	0.25	1.0	15	57
	39 mM OH^-	0.25	1.0	25	97
AS19	20 mM OH^-	0.25	1.0	13	50
	45 mM OH^-	0.25	1.0	28	112
AS20	35 mM OH^-	0.25	1.0	22	87
	55 mM OH^-	0.25	1.0	34	136
AS21	15 mM OH^-	0.35		13	
AS24	55 mM OH^-	0.30		41	
AS25	36 mM OH^-	0.25	1.0	23	92
AS26	55 mM OH^-	0.30	1.2	41	164

[(1)] 3 mm format

The Dionex AERS 500 can be used with legacy systems that only provide discrete (50, 100, 300 and 500 mA) current settings, see Table 9; note that some compromise in performance and product life-expectancy may be observed. For optimum performance it is recommended to use an Dionex RFC-10 or Dionex RFC-30 power supply to provide fine current control with the optimum setting.

Table 9 Recommended Current Settings for the Dionex AERS 500 in the AutoSuppression Recycle and External Water Modes with legacy discrete power supplies

Column	Eluent	Eluent Flow Rate (mL/min) (4 mm)	(2 mm)	Recommended Current (mA)(2 mm)	(4 mm)
AS4A-SC	1.8 mM CO_3^{2-} / 1.7 mM HCO_3^-	0.5	2.0	50	50
AS9-HC	9.0 mM CO_3^{2-}	0.25	1.0	50	50
AS12A	2.7 mM CO_3^{2-} / 0.3 mM HCO_3^-	0.38	1.5	50	50
AS14	3.5 mM CO_3^{2-} / 1.0 mM HCO_3^-	0.3	1.2	50	50
AS14A	8.0 mM CO_3^{2-} / 1.0 mM HCO_3^-	0.5[(1)]	1.0	50	50
AS22	4.5 mM CO_3^{2-} / 1.4 mM HCO_3^-	0.3	1.2	50	50
AS23	4.5 mM CO_3^{2-} / 0.8 mM HCO_3^-	0.25	1.0	50	50
AS10	80 mM OH^-	0.25	1.0	50	300
AS11	12 mM OH^-	0.25	1.0	50	50
	38.3 mM OH^-	0.5	2.0	50	300
AS11-HC	30 mM OH^-	0.38	1.5	50	300
	60 mM OH^-	0.38	1.5	100	300
AS15	38 mM OH^-	0.3	1.2	50	300
	40 mM OH^-	0.5[(1)]		50	
AS16	35 mM OH^-	0.25	1.0	50	100
	55 mM OH^-	0.38	1.5	100	300
AS17-C	15 mM OH^-	0.25	1.0	50	50
	40 mM OH^-	0.5	2.0	50	300
AS18	23 mM OH^-	0.25	1.0	50	100
	39 mM OH^-	0.25	1.0	50	100
AS19	20 mM OH^-	0.25	1.0	50	50
	45 mM OH^-	0.25	1.0	50	300
AS20	35 mM OH^-	0.25	1.0	50	100
	55 mM OH^-	0.25	1.0	50	300
AS21	15 mM OH^-	0.35		50	
AS24	55 mM OH^-	0.30		50	
AS25	36 mM OH^-	0.25	1.0	50	100
AS26	55 mM OH^-	0.30	1.2	50	300

[(1)] 3 mm format

Table 10 External Water Flow Rates for Dionex AERS 500 (4 and 2 mm)

Dionex AERS 300 Format	Regenerant Flow Rate (mL/min)[1]
4 mm	2 – 5
2 mm	1 – 2

[1] Measured with power ON using a graduated cylinder

Refer to Section 3.3.3 and 3.4.3, of this manual for recommended Current Switch settings required for the chromatographic conditions required in the specific application being performed.

The Dionex Cation Electrolytically Regenerated Suppressor (Dionex CERS 500) uses water as the regenerant and has the ability to provide continuous suppression. Table 11 and 12 list the eluent concentrations and flow rates of commonly used mobile phases used in cation separations and the optimum / recommended current level to suppress the eluent. The operation of the Dionex CERS 500 requires a constant flow of water over the electrodes in a direction that is countercurrent to the flow of the eluent.

In the AutoSuppression Recycle Mode, the eluent leaving the conductivity cell is recycled through the regenerant chambers as the water supply. This eliminates the need for an external regenerant water supply and delivery system. When the Dionex CERS 500 is operating in this mode, the amount of water flowing through the regenerant chambers is limited to the eluent flow rate. The AutoSuppression Recycle Mode cannot be used with eluents containing any organic solvents.

The AutoSuppression External Water Mode requires an external source of deionized water for the regenerant chambers. When the Dionex CERS 500 is operating in this mode, the amount of water flowing through the regenerant chambers is independent of the eluent flow rate. Because of this, higher regenerant flow rates are achievable, see Table 13. Higher regenerant flow rates translate in improved signal-to-noise ratios compared to the AutoSuppression Recycle Mode. The AutoSuppression External Water Mode is the mode used if organic solvents (up to 40%) are present in the eluent. It eliminates the potential for buildup of contaminating ions resulting from the oxidation of solvents.

Table 11 Optimum Current Settings for the Dionex CERS 500 in the AutoSuppression Recycle and External Water Modes

Column	Eluent	Eluent Flow Rate (mL/min) (2 mm)	(4 mm)	Optimum Current (mA) (2 mm)	(4 mm)
CS12A	20 mM MSA	0.25	1.0	15	59
	33 mM MSA	0.25	1.0	25	98
CS12A-5µm	20 mM MSA	0.5[1]		30	
	33 mM MSA	0.5[1]		49	
CS14	10 mM MSA	0.25	1.0	8	30
CS15	10 mM H_2SO_4/9% AcN[2]	0.3	1.2	18	71
	14 mM H_2SO_4	0.3	1.2	25	99
CS16	30 mM MSA	0.36[1]	1.0[3]	32	89
	48 mM MSA	0.36[1]	1.0[3]	51	142
CS17	6 mM MSA	0.25	1.0	5	18
	40 mM MSA	0.25	1.0	30	118
CS18	5 mM MSA	0.25		4	
CS19	8 mM MSA	0.25	1.0	6	24
	60 mM	0.3	1.2	53	212

[1] 3 mm format
[2] Compatible with External Water Mode only
[3] 5 mm format

The Dionex CERS 500 can be used with legacy systems that only provide discrete (50, 100, 300 and 500 mA) current settings, see Table 12; note that some compromise in performance may be observed. For optimum performance it is recommended to use an Dionex RFC-10 or Dionex RFC-30 power supply to provide graduated current control with the optimum setting.

Table 12 Recommended Current Settings for the Dionex CERS 500 in the AutoSuppression Recycle and External Water Modes with legacy discrete power supplies

Column	Eluent	Eluent Flow Rate (mL/min) (2 mm)	(4 mm)	Recommended Current (mA) (2 mm)	(4 mm)
CS12A	20 mM MSA	0.25	1.0	50	100
	33 mM MSA	0.25	1.0	50	100
CS12A-5µm	20 mM MSA	0.5[1]		50	
	33 mM MSA	0.5[1]		50	
CS14	10 mM MSA	0.25	1.0	50	50
CS15	10 mM H_2SO_4/9% AcN[2]	0.3	1.2	50	100
	14 mM H_2SO_4	0.3	1.2	50	100
CS16	30 mM MSA	0.36[1]	1.0[3]	50	100
	48 mM MSA	0.36[1]	1.0[3]	100	300
CS17	6 mM MSA	0.25	1.0	50	50
	40 mM MSA	0.25	1.0	50	300
CS18	5 mM MSA	0.25		50	
CS19	8 mM MSA	0.25	1.0	50	50
	60 mM	0.3	1.2	100	300

[1] 3 mm format
[2] Compatible with External Water Mode only
[3] 5 mm format

Table 13 External Water Flow Rates for Dionex CERS 500 (4 and 2 mm)

CSRS 300 Format	Regenerant Flow Rate (mL/min)[1]
4 mm	2 – 5
2 mm	1 – 2

[1] Measured with power ON using a graduated cylinder

A.2 Current Settings for Older Detectors

On CD20 and ED40 detectors in Dionex DX-500 instruments, the correct current is set by navigating to the SRS field in the “Main” menu and using the “Select” keys to change the setting. The readout is the approximate current level.

The Current Switch on the CDM-3, PED-2 and Dionex SRC-1 Control Units, along with the SW5 switch on the Dionex DX-100 (Model DX 1-03), selects the amount of current sent to the suppressor. See Table 14, “Current Settings for CDM-3 PED-2/DX-100 (DX 1-03) SRC-I.

The current Switch SW2 on the Dionex DX-120 selects the amount of current sent to the suppressor. Note that the setting number and corresponding current (mA) are different. See Table 15, "Current Settings for the Dionex DX-120”. For optimal performance the use of a Dionex SCC-10 suppressor current controller is recommended in conjunction with the four setting power supplies listed above to provide a current output of twelve settings.

Table 14 CDM-3/PED-2/DX-100 (DX 1-03)/SRC-I

Setting	Approximate Current (mA)
1	50
2	100
3	300
4	500

Table 15 Current Settings for the Dionex DX-120

Setting	Approximate Current (mA)
1	500
2	300
3	100
4	50

Refer to Section 3.3.3 and 3.4.3, of this manual for recommended Current Switch settings required for the chromatographic conditions required in the specific application being performed.

NOTE

For optimal performance Dionex recommends the use of a Dionex RFC10 or Dionex RFC 30 power supply.

Appendix B – Suppressor Controller

B.1 Dionex ERS 300 Control for the CD20/CD25/CD25A and ED40/ED50/ED50A (Dionex DX-500 instruments)

Dionex ERS 500 control for these instruments is accessible from the detector front panel or Chromeleon software. For information on operation from Chromeleon, please see the Help file in the Run or Method files.

NOTE

If using the ED40, first select Conductivity Mode from the Main Screen.

NOTE

There will not be an "ERS" setting on older instruments, use the SRS setting. The Dionex ERS 500 is fully backwards compatible with all SRS power adapters and settings.

To operate the Dionex ERS 500 from the front panel of these detectors:

A. Make sure the detector is in one of the main conductivity screens by choosing "Main Screen" or "Detail Screen." Press the "Menu" button until you see this as an option. Press the appropriate number.

B. Make sure you are in the "Local" mode. If you are in the "Remote" mode use the arrow keys to select "Local" and press "Enter."

C. In the "Main" or "Detail" screens, navigate, using the arrow keys, to the field labeled "SRS." Set the current output level. Increase or decrease the levels by using the select keys. These are labeled 50, 100, 300 and 500 mA. Remember to hit "Enter" after choosing a setting.

1. Dionex ERS 500 Control Connections for the CD20/ED40 (Dionex DX-500 instruments):
   For these instruments, connect one end of the ERS control cable to slot 2, plug J3 behind the instrument front panel. Route the cable through the chase beneath the electronics to the back. Route the female ERS plug end to the chromatography module that you are using. Place the cable close to the ERS and attach.

2. Dionex ERS 500 Line Voltage for the CD20/ED40 (DX-500 instruments):
   These detectors have automatic switching power supplies to adjust to the line voltage. No user settings are required.

3. ERS Power Control for The CD20/ED40 (DX-500 instruments): The CD20 and ED40 are controlled from the instrument front panel on DX-500 instruments. Navigate to the SRS field and use the "Select" keys to scroll the current settings to "Off." Press "Enter."

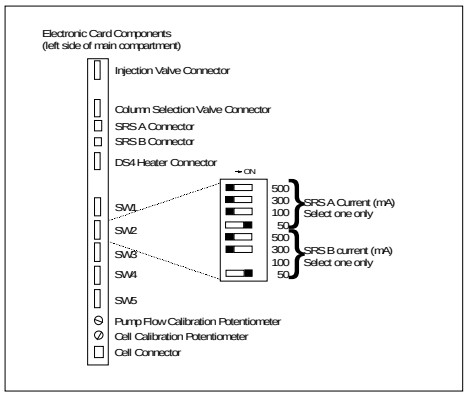
CAUTION

As a general operating precaution, never apply current to the Dionex ERS 500 without eluent or water regenerant flowing through the Dionex ERS 500 at the same time. Always apply current whenever eluent is running through the suppressor.

B.1.1 Dionex ERS 500 Control for the Dionex DX-120

Dionex ERS 500 control for this instrument is accessible from the instrument control panel or PeakNet / Chromeleon software. For information on operation from PeakNet or Chromeleon, please see the Help file in the Run or Method files.

Figure B1 Dionex DX-120 Control



NOTE

There will not be an "ERS" setting on older instruments, use the SRS setting. The Dionex ERS 500 is fully backwards compatible with all SRS power adapters and settings.

To operate the Dionex ERS 500 from the instrument control panel:

A. Select the Dionex ERS 500 current setting(s) with SW2. Figure B1 shows the default settings.

B. Press SRS to turn on the ERS power using the front control panel. When on, the LED on the button is illuminated.

C. ERS CONTROL CONNECTIONS FOR THE DX-120

D. For the DX-120 ERS Control, attach the Dionex ERS 500 current input connector directly to the SRS Control output connector, located inside the DX-120 enclosure door. For a dual-column system, also plug the current input connector of the second suppressor into the matching output connector extending from the SRS B Control.

E. ERS Line Voltage for the Dionex DX-120
The Dionex DX-120 is factory set for the proper voltage and frequency. No adjustments are necessary. If your line voltage or frequency does not match the specifications on the back of the Dionex DX-120, consult the nearest Thermo Scientific Office (see, “Thermo Scientific Worldwide Offices”). The Dionex DX-120 input line voltage cannot be modified by the user.

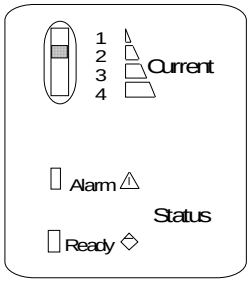
F. ERS Power Control for the Dionex DX-120
The SRS button on the Control Panel turns the ERS Control on and off. When on, the LED on the button is illuminated. Switch SW2 on the electronics card connections of the Dionex DX-120 toggles the current selected from the Dionex DX-120 SRS Control to the Dionex ERS 500 (see Figure B1, “Dionex DX-120 Control”).

CAUTION

As a general operating precaution, never apply current to the Dionex ERS 500 without eluent or water regenerant flowing through the Dionex ERS 500 at the same time. Always apply current whenever eluent is running through the suppressor.

B.1.2 ERS Control for the CDM-3/PED-2 (Dionex DX-300 Instruments)

Figure B2 CDM-3/PED-2 ERS Control



ERS Control on the CDM-3 or PED-2 receives power when the Detector Power Switch, located on the rear panel of the CDM-3 or the PED-2, is turned On.

The Cell OFF/ON button, on the CDM-3 or the PED-2 front panel, turns current flow On or Off to both the cell and the Dionex ERS 500.

ERS Control Current Selector switch on the CDM-3 and PED-2 is located on the top panel of the detector.

NOTE

There will not be an "ERS" setting on older instruments, use the SRS setting. The Dionex ERS 500 is fully backwards compatible with all SRS power adapters and settings.

Figure B2 CDM-3/PED-2 ERS Control

A. ERS Control Connections for the CDM-3/PED-2 (Dionex DX-300 Instruments)
For CDM-3 and PED-2 ERS Control, use the SRS Control extension cable (P/N 045343) to connect the SRS Control output connector on the back of the detector chassis, to the Dionex ERS 500 current input connector.

B. ERS Line Voltage for the CDM-3/PED-2 (Dionex DX-300 Instruments)
The ERS control portion of the detector receives its power directly from the CDM-3 or PED-2 detector. If the detector's voltage control (CORCOM) is properly set (see the appropriate CDM-3 or PED-2 Operator's Manual), the control portion of the detector will receive the correct power without further adjustment.

C. ERS Power Control for The CDM-3/PED-2 (Dionex DX-300 Instruments)
The control and display panels on the CDM-3 and PED-2 detectors for the Dionex ERS 500 are located under the top cover, visible through an opening in the cover. LED indicators inform the operator of the system's operational status.
The CDM-3 and the PED-2 detector AC Power On/Off switch, located on the rear panel of the instrument, toggles the AC Line voltage to the CDM-3 or PED-2 detector and the internal ERS Control on and off. ERS Control is therefore powered whenever the detector is powered. To interrupt the current to the Dionex ERS 500 while the detector is On, use the detector cell On/Off control.

D. With the detector cell On, the detector conductivity cell is On and the detector ERS Control provides current to the Dionex ERS 500.

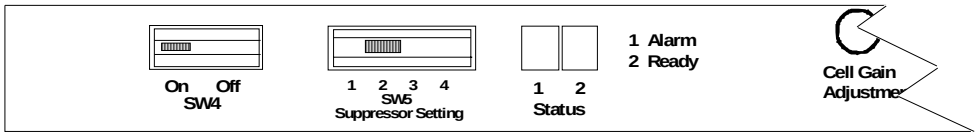
E. With the detector cell Off, the detector conductivity cell is Off and the detector ERS Control output current to the Dionex ERS 500 is Off although the detector ERS control still receives power.

CAUTION

As a general operating precaution, never apply current to the Dionex ERS 500 without eluent or water regenerant flowing through the Dionex ERS 500 at the same time. Always apply current whenever eluent is running through the suppressor.

B.1.3 ERS Control for the Dionex DX-100 (Model DX 1-03)

Figure B3 Dionex DX-100 (Model DX 1-03) ERS Control



NOTE

There will not be an "ERS" setting on older instruments, use the SRS setting. The Dionex ERS 500 is fully backwards compatible with all SRS power adapters and settings.

ERS Control on the Dionex DX-100 (Model DX 1-03) receives power only when both of the two following conditions are present:

A. The Dionex DX-100 (Model DX 1-03) Main On/Off Switch, located at the upper-rear right side of the Dionex DX-100 enclosure, is turned on.

B. The Dionex DX-100 (Model DX 1-03) Pump Switch is turned on.
The SW4 Switch on the Dip Switch Panel of the Dionex DX-100 toggles the current On or Off from ERS Control to the Dionex ERS 500.

C. ERS Control Connections for the Dionex DX-100 (Model DX 1-03)
For the Dionex DX-100 (Model DX 1-03) ERS Control, attach the Dionex ERS 500 current input connector directly to the ERS Control output connector, located inside the Dionex DX-100 enclosure door. This four-contact, female output connector is on the end of a cable located close to and below the Dionex ERS 300 mounting bracket.

D. ERS Line Voltage for the Dionex DX-100 (Model DX 1-03)
The Dionex DX-100 (Model DX 1-03) is factory set for the proper voltage and frequency. No adjustments are necessary. If your line voltage or frequency does not match the specifications on the back of the Dionex DX-100, consult the nearest Thermo Scientific Office (see, "Thermo Scientific Worldwide Offices"). The Dionex DX-100 input line voltage cannot be modified by the user.

E. ERS Power Control for The Dionex DX-100 (Model DX 1-03)
The control and display panel on the Dionex DX-100 for the Dionex ERS 500 is located behind the Dionex DX-100 main door. LED indicators inform the operator of the system's operational status.
The internal Dionex DX-100 (Model DX 1-03) ERS Control is powered in parallel with the pump. The ERS Control receives power when the Dionex DX-100 AC switch is On and Pump On is selected on the Dionex DX-100 front panel. Since the Dionex DX-100 has no Cell On/Off control, switch SW4 on the control panel of the Dionex

DX-100 toggles on and off the current from the Dionex DX-100 ERS Control to the Dionex ERS 500 (see Figure 8, “DX-100 (Model DX 1-03) ERS Control”).

F. With SW4 On and the pump On, the ERS Control provides current to the Dionex ERS 500. With SW4 Off, regardless of whether the pump is on or off, no current is supplied to the Dionex ERS 500.

CAUTION

As a general operating precaution, never apply current to the Dionex ERS 300 without eluent or water regenerant flowing through the Dionex ERS 300 at the same time. Always apply current whenever eluent is running through the suppressor.

B.1.4 SRC Controller

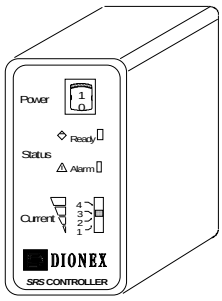
NOTE

Thermo Scientific Dionex recommends the Dionex RFC-10 (P/N 060335) for standalone control of the Dionex ERS 500 in older systems. The Dionex RFC-10 provides current at 1 mA intervals for exact current control.

This unit is intended to provide power and control to one Dionex ERS 500 when the associated detector does not have ERS control integrated into it.

The SRC-1 Power switch toggles On or Off AC line current to the SRC-1. Current is supplied to the Dionex ERS 500 only as long as the SRC-1 is powered on.

Figure B4 SRC-1 ERS Control



NOTE

There is no “ERS” setting on the Dionex SRC-1, use the SRS setting. The Dionex ERS 500 is fully backwards compatible with all SRS power adapters and settings. For optimal performance a Dionex SCC-10 suppressor current controller should be used in conjunction with the Dionex SRC-1 controller to provide a current output of twelve settings.

The control and display panel of the Dionex SRC-1 is located on the front of that module’s cabinet.

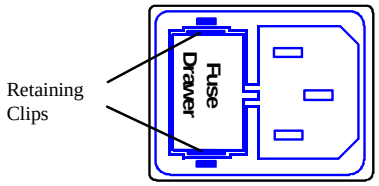
A. SRC-1 Controller Connections
For the Dionex SRC-1 Controller, connect the Dionex SRC-1 six-foot output cable directly to the Dionex ERS 500 current input connector.

B. SRC-1 Line Voltage
The 2-position rotary switch located on the back of the Dionex SRC-1 allows the selection of either 110 V or 220 V input line voltage. It can be adjusted with a large flat-bladed screwdriver or a small coin. The unit is not frequency sensitive and will work equally well on 50 or 60 Hz without adjustment. Each position accepts a wide range of input line voltages.

1. Use the 110 V position for all input line voltages between 85 V ac and 135 V ac.
2. Use the 220 V position for all input line voltages between 175 V ac and 265 V ac.

C. SRC-1 Power Control
The control and display panel on the Dionex SRC-1 is located on the front of that module's cabinet LED indicators inform the operator of the system's operational status.
The Dionex SRC-1 has its own AC Power On/Off switch to toggle the AC line current to the Dionex SRC-1 on and off (see Figure 9, "SRC-1 SRS Control"). This is the only way to turn the current output to the Dionex ERS 500 on and off on the Dionex SRC-1. Two line input fuses are located in the fuse drawer on the socket of the AC input connector on the back panel of the Dionex SRC-1.

Figure B5 The SRC-1 Fuse Holder



To replace fuses, first remove the AC line cord, and then remove the fuse drawer by squeezing the retaining clips located at the right and left of the drawer. Pull the drawer outward to replace both fuses. Spare fuses are found in the shipping kit. The fuses are 5 X 20 mm, 0.315A/250V, low breaking capty FSF type (P/N 954747).

CAUTION

As a general operating precaution, never apply current to the Dionex ERS 500 without eluent or water regenerant flowing through the Dionex ERS 500 at the same time. Always apply current whenever eluent is running through the suppressor.

Appendix C – Alarm States for Older Instruments

C.1 Alarm States for the CD20/ED40 (Dionex DX-500 Instruments)

When using these detectors, the power setting will be shown on the screen when the Dionex ERS 500 is on. The Dionex ERS 500 cable must be connected to the controller and conductive liquid must be flowing to prevent an alarm state.

When the ERS Control unit is in shutdown mode after detecting a malfunction in the system, an alarm message "SRS Alarm" will flash on the screen. To determine the cause, press "Menu" proceed to the "Diagnostic Menu" and press "Analog Status." On the left side of the screen, two fields give the ERS status as shown below:

SRS CONNECTED: Y (or N)

This indicates that the Dionex ERS 500 is connected. If it shows "N" connect the ERS cable.

SRS OVER VOLT: N (or Y)

This indicates whether the Dionex ERS 500 has a voltage higher than it can support (7.5 to 8 V). Try lowering the power setting on the front panel. Also, see Section 4.1.3.2, "The Alarm Red LED" for other causes.

C.1.1 Alarm States for the Dionex DX-120

The SRS Control LED is located on the Control Panel. This light remains on during normal operation. This light indicates that the power is on, current is being sent to the suppressor, and that the ERS Control unit can provide, within its voltage limits, the current selected by the SW2 Switch.

NOTE

This light does not indicate that the setting selected on the SW2 Switch is adequate to suppress the eluent, but only that the ERS Control unit is able to provide the current that has been selected.

The SRS Alarm indicates that the Dionex ERS 500 has exceeded the accepted current/voltage range.

C.1.2 Alarm States for The CDM-3 and PED-2 (DX-300 Instruments), DX-100 (Model 1-03) and SRC-1

A. The Ready Green LED
The ERS Control LED is located on the Control Panel. This light remains on during normal operation. This light indicates that the power is on, current is being sent to the suppressor, and that the ERS Control unit can provide, within its voltage limits, the current selected by the Current Switch.

NOTE

This light does notindicate that the setting selected on the Current switch is adequate to suppress the eluent, but only that the ERS Control unit is able to provide the current that has been selected.

The ***Ready Green LED*** glows only when **ALL** the following conditions are met:

1. The main power switch of the instrument (CDM-3, PED-2, Dionex DX-100 (Model DX 1-03) or Dionex SRC-1) is on.
2. The Dionex ERS 500 is connected to the ERS Control unit.
3. Cell On is selected on the CDM-3 or PED-2, or On is selected on the Dionex DX-100 (Model DX 1-03).
4. Conductive liquid flows in all chambers of the Dionex ERS 500.

The ***Alarm Red LED*** indicates that the ERS Control unit is in shutdown mode after detecting a malfunction in system operation. In this mode, the unit checks the system status every few seconds. When checking, the green light flashes for an instant; if the anomaly is still present, the red light glows again. If the status check no longer finds an anomaly, the green light remains on and the ERS Control unit resumes normal operation automatically.

Detection of the following malfunctions causes the Alarm Red LED to light:

A. **Overvoltage (oscillating green/red):** The ERS Control unit has detected a condition where in order to maintain the selected current, the ERS Control unit would have to apply a voltage higher than the suppressor could support (7.5 to 8 V). Try resetting the control unit to a lower power level or check to see if the Dionex ERS 500 is connected (see step D below).

B. **Low line voltage (oscillating green/red):** The line voltage from the lab AC power source is too low to allow the ERS Control unit to provide the requested current.

C. **The Dionex ERS 500 is not connected to the ERS Control Unit (oscillating green/red):** This may be caused by a broken cable, disconnected cable, bad contact, etc.

D. **The Dionex ERS 500 does not support electrolysis:** There is no conductive liquid in the eluent and/or the regenerant chamber(s). Causes of this malfunction may include the following:

1. Lack of eluent and regenerant flow.
2. Plugged or leaking tubing.
3. Plugged or leaking fittings.
4. Lack of pneumatic pressure on the eluent or water bottles in the AutoSuppression External Water Mode.
5. Empty eluent or water bottles.
6. Analytical pump is not operating.
7. Eluent is non-ionic liquid.