

# Thermo Scientific Dionex Eluent Suppressors for Ion Chromatography

Suppression was introduced in 1975, thereby bringing ion chromatography (IC) to the forefront of modern analytical techniques for inorganic analysis. Suppression greatly enhances signal-to-noise ratio in two ways by:

- Decreasing background eluent conductivity and noise
- Increasing analyte conductivity



We currently offer five suppressors for continuous suppression of the eluent in a broad range of IC applications. Suppressor choice depends on the eluent used, whether organic solvents are used, analyte and matrix concentration, and the type of chromatography being practiced:

- The Thermo Scientific™ Dionex™ ERS™ 500 Electrolytically Regenerated Suppressor is used for electrolytically regenerated suppression of IC applications requiring high-capacity, low noise, high backpressure resiliency and fast startup. The Dionex ERS 500 suppressor is recommended for isocratic or gradient use with hydroxide eluents or methanesulfonic acid and sulfuric acid eluents in both the standard bore (4 mm) and microbore (2 mm) format of operation. This suppressor is a fundamental component of a Reagent-Free™ IC (RFIC™) system.
- Thermo Scientific™ Dionex™ CES™ 300 Capillary Electrolytic Suppressor is used for electrolytically regenerated suppression of IC applications at a capillary scale (5–30 µL/min). The Dionex CES 300 suppressor is recommended for

isocratic or gradient use with hydroxide or methanesulfonic acid eluents. This suppressor is a fundamental part of a RFIC systems with Eluent Generation (RFIC-EG™) capillary system.

- The Thermo Scientific™ Dionex™ MicroMembrane™ MMS 300 Suppressor is used for chemically regenerated suppression of IC eluents requiring high-capacity, solvents, and/or very low noise.
- The Thermo Scientific™ Dionex™ AMMS™ ICE 300 Anion Ion-Exchange Suppressor is used for chemically regenerated suppression of ion-exclusion chromatography.
- The Thermo Scientific™ Dionex™ AES™ Atlas™ Electrolytic Suppressor is recommended for isocratic anion-exchange separations with carbonate eluents, or isocratic cation-exchange separations with low concentrations of methanesulfonic acid or sulfuric acid eluents.

## IC Separation Technology

A typical ion chromatograph consists of several components as shown in Figure 1. The eluent, which is conductive, is delivered to the system using a high-pressure pump. The sample is introduced, then flows through the guard, and into the analytical ion-exchange columns where the ion-exchange separation occurs. After separation, the suppressor reduces the conductivity of the eluent and typically increases the conductivity of the analytes so they are delivered to the conductivity cell in a form that increases response. A computer and software are used to control the system, acquire and process the data.

We have continuously worked to improve suppressor technology to provide better sensitivity and consistency for the analysis of a wide variety of compounds.

### The Suppressor Advantage

Figure 2 shows an example of suppression used for anion chromatography. Thermo Scientific Dionex AERS 500 Anion Electrolytically Regenerated Suppressor, Thermo Scientific Dionex AAES Anion Atlas Electrolytic Suppressor, or the Dionex ACES 300 Anion Capillary Electrolytic Suppressor removes potassium or sodium ions (and other sample cations) from the eluent and replaces them with hydronium ions formed by electrolysis of the water regenerant. These hydronium ions combine with the hydroxyl or carbonate ions from the eluent to form water or carbonic acid, which have very low conductivity and associated noise compared with the hydroxide or carbonate eluent. Analyte conductivity is generally enhanced because the analyte anions associate with the highly conductive hydronium ions. Overall improved detection limits are feasible due to the net gain in signal-to-noise ratio using suppressed IC relative to non-suppressed IC.

### Performance Comparison

The Dionex ERS 500 and Dionex MMS 300 suppressors are high-capacity, continuously regenerated suppressors capable of suppressing eluents for all IC separations, including gradients in the standard bore and microbore scale of operation. The Dionex CES 300 suppressor is a capillary scale suppressor capable of suppressing all eluents at a capillary scale. The Dionex AES Atlas suppressor provides very low noise for applications using carbonate/bicarbonate eluents for anion-exchange in the standard bore and microbore formats, but has a lower suppression capacity. The Dionex AES Atlas suppressor can also be used with low concentrations of methanesulfonic acid and sulfuric acid eluents for cation-exchange.

The Dionex MMS 300 suppressor is recommended for the best long-term performance when using solvent in the eluent. When using the Dionex ERS 500 or Dionex CES 300 suppressors, low levels of oxidizable solvent in the eluent are acceptable only in the external water mode. These suppressors can operate in the recycle mode with a relatively non-oxidizable solvent such as isopropyl alcohol. Higher levels of solvents (> 40%) in the eluent require the Dionex 300 MMS suppressor. The Dionex AES Atlas suppressor is designed for aqueous eluents only.

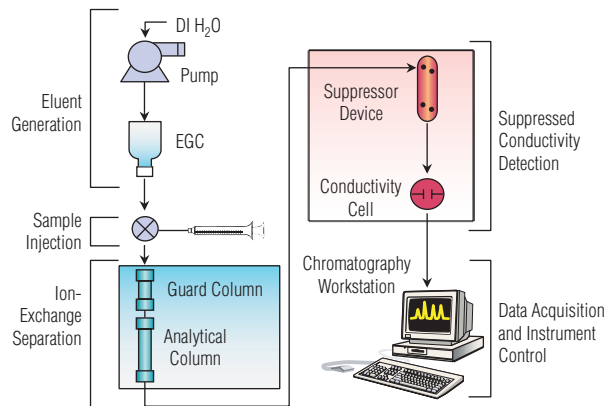


Figure 1. Ion chromatograph using suppressed conductivity detection.

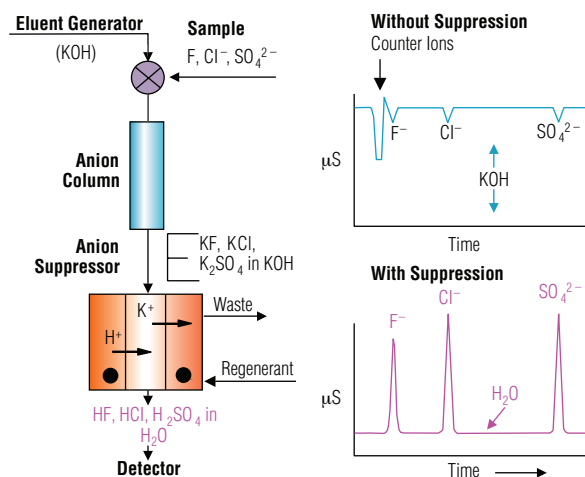


Figure 2. Diagram of eluent suppression for anion chromatography.

The Dionex ERS 500 and Dionex MMS 300 suppressors are available in two formats, 4 and 2 mm. The 4 mm suppressors are used with 5 and 4 mm columns. The 2 mm suppressors are used with 1, 2 and 3 mm columns. The Dionex AES Atlas suppressor is available in one format that is used for all column formats (5, 4, 3, and 2 mm). The Dionex CES 300 suppressor is available in one format that is used for all capillary scale formats (0.2–0.5 mm)

The internal void volume of the suppressor can affect the efficiency of a separation. Although the void volume of the Dionex AES Atlas suppressor has been reduced to provide excellent peak efficiency for 4 and 3 mm columns, a slight decrease in efficiency, compared to the 2 mm Dionex ERS 500 or Dionex MMS 300 suppressor, may be noticed for early-eluting peaks with 2 mm columns. To maintain maximum peak efficiencies when using 2 mm columns, the 2 mm Dionex ERS 500 or 2 mm Dionex MMS 300 suppressors should be used.

Suppressor	Regeneration Requirements	Operational Requirements	Suppressor Capacity [mN] × [mL/min]	Benefits	Applications	
					Anions	Cations
<b>Dionex ERS 500</b> 2 and 4 mm formats < 15 and < 50 µL void volume	Electrolytic	All existing systems, except Thermo Scientific Dionex ICS-600 and Dionex ICS-900	Anion (Dionex AERS): 4 mm: 200 µeq/min 2 mm: 50 µeq/min  Cation (Dionex CSRS): 4 mm: 110 µeq/min 2 mm: 37.5 µeq/min	<ul style="list-style-type: none"> <li>- High-capacity</li> <li>- Versatility</li> <li>- Ease-of-use</li> <li>- High-pressure operation</li> <li>- Low noise</li> <li>- Electrolytic regeneration</li> <li>- Limited solvent compatibility</li> </ul>	<ul style="list-style-type: none"> <li>- Hydroxide and carbonate/bicarbonate eluents</li> <li>- For low-level solvent applications use external water</li> <li>- Columns: all anion-exchange columns</li> </ul>	<ul style="list-style-type: none"> <li>- Methanesulfonic acid and sulfuric acid eluents</li> <li>- For low-level solvent applications, external water</li> <li>- For eluents containing chloride or nitrate use the Dionex MMS 300 suppressor.</li> <li>- Columns: all cation-exchange columns except Thermo Scientific™ Dionex™ IonPac™ SCS 1</li> </ul>
<b>Dionex CES 300</b> < 1.5 µL void volume	Electrolytic	Requires Capillary IC system (Dionex ICS-5000+)	Anion (Dionex ACES): 2 µeq/min  Cation (Dionex CCES): 1.5 µeq/min	<ul style="list-style-type: none"> <li>- Compatible with capillary flow rates</li> <li>- Versatility</li> <li>- Ease-of-use</li> <li>- Low noise</li> <li>- Electrolytic regeneration</li> <li>- Limited solvent compatibility</li> </ul>	<ul style="list-style-type: none"> <li>- Hydroxide eluents</li> <li>- For low-level solvent applications use external water or chemical regeneration</li> <li>- All capillary anion-exchange columns</li> <li>- Isocratic and gradient eluents</li> </ul>	<ul style="list-style-type: none"> <li>- Methanesulfonic acid eluents</li> <li>- For low-level solvent applications, use external water or chemical regeneration</li> <li>- All capillary cation-exchange columns</li> <li>- Isocratic and gradient eluents</li> </ul>
<b>Dionex MMS 300</b> 2 and 4 mm formats < 15 and < 50 µL void volume	Chemical	All existing systems Required for Dionex ICS-900	Anion (Dionex AMMS): 4 mm: 150 µeq/min 2 mm: 37.5 µeq/min  Cation (Dionex CMMS): 4 mm: 150 µeq/min 2 mm: 37.5 µeq/min	<ul style="list-style-type: none"> <li>- Solvent compatibility</li> <li>- Lowest noise</li> <li>- Fastest startup</li> </ul>	<ul style="list-style-type: none"> <li>- Carbonate/bicarbonate and hydroxide eluents and eluents containing solvents</li> <li>- Columns: all anion-exchange columns</li> </ul>	<ul style="list-style-type: none"> <li>- Methanesulfonic acid and sulfuric acid eluents and eluents containing solvents, chloride, or nitrate</li> <li>- Columns: all cation-exchange columns</li> </ul>
<b>Dionex AMMS-ICE 300</b> 2 and 4 mm formats < 15 and < 50 µL void volume	Chemical	All existing systems		<ul style="list-style-type: none"> <li>- Recommended for ion-exclusion chromatography</li> </ul>	<ul style="list-style-type: none"> <li>- Any Dionex IonPac ICE column set with suppressed conductivity detection</li> <li>- Useful for IC of weak acids</li> </ul>	
<b>Dionex AES Atlas</b> One format for 2, 3, and 4 mm columns < 35 µL void volume	Electrolytic	Requires Thermo Scientific™ Dionex™ Chromeleon™ Chromatography Data System (CDS) software, version 6.2 and above and Series “A” detectors; Thermo Scientific Dionex RFC-10 or RFC-30 Reagent-Free Controllers for other systems	Anion: Dionex AAES: 25 µeq/min  Cation: Dionex CAES: 25 µeq/min	<ul style="list-style-type: none"> <li>- Ease-of-use</li> <li>- Low noise for carbonate/bicarbonate</li> </ul>	<ul style="list-style-type: none"> <li>- Carbonate/bicarbonate eluents</li> <li>- No solvents</li> <li>- Dionex IonPac Columns: AS4, AS4A, AS4A-SC, AS9-SC, AS9-HC, AS12A, AS14, AS14A, AS22, AS23</li> </ul>	<ul style="list-style-type: none"> <li>- Use with methanesulfonic acid and sulfuric acid eluents</li> <li>- No solvents</li> <li>- Dionex IonPac Columns: CS12, CS12A, CS14, CS17, CS18</li> </ul>

## CHEMICAL SPECIFICATIONS

Suppressor	Temperature Range <sup>1</sup>	Recommended Backpressure	Maximum Eluent Flow Rate	Eluent Solvent Restrictions <sup>2</sup>	Maximum Regenerant EWM <sup>3</sup> Flow Rate	Modes of Operation Supported	Maximum Current
Dionex AERS 500	15–40 °C	30–60 psi	3 mL/min (4 mm), 1 mL/min (2 mm)	< 40% oxidizable solvents in EWM <sup>3</sup>	5 mL/min (4 mm) 2 mL/min (2 mm)	Recycle, EWM <sup>3</sup>	500 mA for 4 mm, (recommended for use with Chromeleon CDS) 100 mA for 2 mm
Dionex CERS 500	15–40 °C	30–60 psi	3 mL/min (4 mm), 0.75 mL/min (2 mm)	< 40% oxidizable solvents in EWM <sup>3</sup>	5 mL/min (4 mm) 2 mL/min (2 mm)	Recycle, EWM <sup>3</sup>	500 mA for 4 mm, (recommended for use with Chromeleon CDS) 100 mA for 2 mm
Dionex ACES 300	15 °C <sup>6</sup>	20–100 psi	0.030 mL/min	< 40% solvent in EWM <sup>3</sup>	0.100 mL/min	Recycle, EWM <sup>3</sup> (recycle recommended) <sup>4</sup>	25 mA
Dionex CCES 300	15 °C <sup>6</sup>	20–100 psi	0.030 mL/min	< 40% solvent in EWM <sup>3</sup>	0.100 mL/min	Recycle, EWM <sup>3</sup> (recycle recommended) <sup>4</sup>	25 mA
Dionex CMMS 300	15–40 °C	40 psi	3 mL/min (4 mm), 0.75 mL/min (2 mm)	100% solvent compatible	10 mL/min (4 mm) 5 mL/min 2 mm	Chemical, DCR mode	n/a
Dionex AMMS 300	15–40 °C	40 psi	3 mL/min (4 mm), 0.75 mL/min (2 mm)	100% solvent compatible	10 mL/min (4 mm) 5 mL/min (2 mm)	Chemical, DCR mode	n/a
Dionex AMMS-ICE 300	15–40 °C	40 psi	3 mL/min	90% solvent	10 mL/min compatible <sup>6</sup>	Chemical, DCR mode	n/a
Dionex AAES	15–40 °C	20–100 psi	3 mL/min	0% solvents (no solvents)	5 mL/min	Recycle and external water	150 mA
Dionex CAES	15–40 °C	20–100 psi	3 mL/min	0% solvents (no solvents)	5 mL/min	Recycle and external water	150 mA

<sup>1</sup>When installed outside the heated column enclosure, all suppressors excluding Dionex CES 300 suppressor can support applications up to 60 °C.

<sup>2</sup>Solvents for anion eluents include methanol. Solvents for cation eluents include acetonitrile and dioxane.

<sup>3</sup>EWM = external water mode; for eluents containing >40% solvent, use the chemical regeneration mode.

<sup>4</sup>Recycle recommended for aqueous applications without solvent.

<sup>5</sup>Do not use THF solvent in the eluent.

<sup>6</sup>Dionex ACES 300 and Dionex CCES 300 suppressors require 15 °C for recycled eluent mode of operation.

## Noise Comparison

The Dionex ERS 500 suppressor offers very low noise for hydroxide, carbonate, and MSA eluents, whereas the anion Dionex AES Atlas suppressor provides the lowest noise for carbonate eluent suppression. The Dionex MMS 300 suppressor produces the lowest overall noise because it uses non-electrolytic chemical regeneration. The Dionex ERS 500 suppressor provides low noise for carbonate eluents when used in conjunction with the Dionex CRD 300 Carbonate Removal Device. Low noise levels translate into lower method detection limits.

The Dionex CES 300 suppressors offers similar noise levels as the Dionex ERS 500 suppressor.

## Electrolytically Regenerated Suppressor (Dionex ERS 500) for IC Analysis

The Dionex ERS 500 suppressor enhances analyte conductivity while suppressing eluent conductivity. The Thermo Scientific™ Dionex™ AutoSuppression™ device provides significant improvement in analyte detection limits. The ions required for eluent suppression are generated by the continuous electrolysis of water. Therefore, the Dionex ERS 500 suppressor delivers low backgrounds and low noise levels without the need for manually prepared regenerant solutions or off-line regeneration of the suppressor.

## Dionex ERS 500 Versatility

The Dionex ERS 500 suppressor is designed to operate with the entire line of Thermo Scientific Dionex IC equipment and a very broad range of applications, including anion-exchange, cation-exchange, anion ion-pairing and ion suppression, or cation ion-pairing and ion suppression. The combination of a revolutionary eluent generator and the Dionex ERS 500 suppressor is the basis of a RFIC-EG system technology. The combination of Dionex ERS 500 eluent regeneration with eluent purification columns is the basis of RFC systems with Eluent Regeneration (RFIC-ER™) system technology.

## PHYSICAL SPECIFICATIONS

Suppressor	Dimensions	Void Volume	Weight
Dionex ERS 500	12.1 × 4.5 × 4.8 cm (4.25 × 1.8 × 1.9 in.)	4 mm: < 50 µL 2 mm: < 15 µL	295 g (1.4 lb)
Dionex MMS 300	16.8 × 4.5 × 5.2 cm (6.6 × 1.8 × 2.1 in.)	4 mm: < 50 µL 2 mm: < 15 µL	630 g (1.4 lb)
Dionex AMMS-ICE 300	16.8 × 4.5 × 5.2 cm (6.6 × 1.8 × 2.1 in.)	< 50 µL	630 g (1.4 lb)
Dionex AES Atlas	4.9 × 4.4 × 10.2 cm (1.9 × 1.8 × 4.0 in.)	< 35 µL	120 g (0.3 lb)
Dionex CES 300	10.3 × 3.1 × 10.3 cm	< 1.5 µL	150 g (0.3 lb)

Table 1. Dionex ERS 500 suppressor modes of operation.

Mode	Benefit	Application
Recycle	Easy-to-use	Aqueous eluents, limited solvents
Gas-Assisted Recycle*	Easy-to-use, low noise	Aqueous eluents, limited solvents, low level analysis
External Water	Low noise, solvent compatible	Eluents containing < 40% solvent trace-level analysis, interface with MS and postcolumn reactions
Gas-Assisted External Water*	Low noise, solvent compatible, reduces water requirement	Eluents containing < 40% solvent, trace-level analysis
Intermittent Mode	Low noise, easy-to-use	Carbonate chemistries
Thermo Scientific™ Dionex™ MPIC™ Mobile Phase IC	Low noise	Anion ion-pairing and ion suppression Cation ion-pairing and ion suppression

\*Requires P/N 056886.

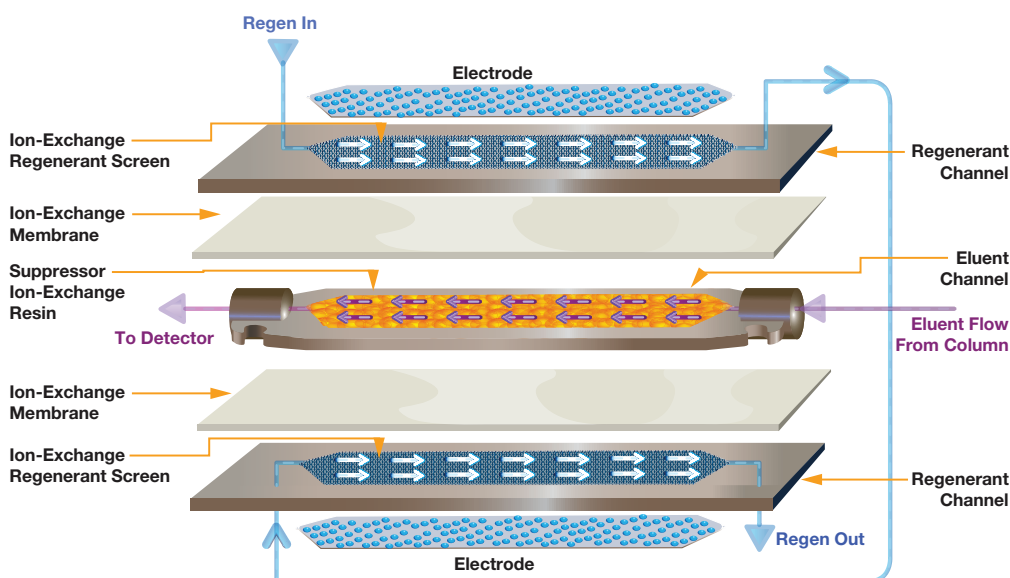


Figure 3. Internal construction of the Dionex ERS 500 suppressor.

## Dionex ERS 500 System Control

The software and hardware control options for the Dionex ERS 500 suppressor allow use of the optimum current for specific applications, extending suppressor life and improving recoveries of certain analytes, such as magnesium.

The Dionex ICS-1000, ICS-1100, ICS-1500, ICS-1600, ICS-2000, ICS-2100, ICS-2500, ICS-3000, ICS-5000 and ICS-5000+ series systems include software and hardware to control the Dionex ERS 500 suppressor.

For other systems, the Thermo Scientific Dionex ED50A Electrochemical Detector or Thermo Scientific Dionex CD25A Conductivity Detector with Chromeleon CDS software, version 6.2 or higher can control the current to the Dionex ERS 500 suppressor in 1 mA increments. For older units, the Dionex RFC-10 Reagent-Free Controller can also control the current to the Dionex ERS 500 suppressor in 1 mA increments. (See Table 2). The Dionex ERS 500 Suppressors Current Controller, Dionex SCC-10 can be used in conjunction with the older current controllers provide a current output of twelve settings.

## Dionex ERS 500 for Maximum Flexibility

The Dionex ERS 500 suppressor is designed for maximum flexibility. The Dionex ERS 500 suppressor does not restrict the user to one or two columns and eluents. This suppressor is compatible with the full range of ion-exchange columns and isocratic or gradient eluents.

Most applications for anion or cation-exchange use the economical and easy-to-use AutoSuppression recycle mode (Figure 4). The AutoSuppression recycle mode can be enhanced with the use of the Gas-Assisted Regeneration Kit. This optional mode reduces the noise for trace-level analysis without the need for external water regenerant. In this mode, gas is added to the conductivity cell effluent before it flows into the "Regen In" port of the Dionex ERS 500 suppressor. The gas-assisted mode significantly reduces noise, allowing trace-level analysis.

Eluents or samples containing up to 40% oxidizable organic solvent can be suppressed using the AutoSuppression external water mode. In external water mode, the water for electrolysis is supplied from an external source (see Figure 5). This mode also can be enhanced with the use of the gas-assisted mode, which reduces the regenerant consumption and lowers noise.

Installation kits are available for each of these modes of operation, see the Ordering Information section.

Table 2. System control of Dionex ERS 500 electrolytic suppressors.

IC System	SRS Hardware Control Requirements	SRS Software Control Requirements
Dionex ICS-1000, 1100, 1500, 1600, 2000, 2100, 2500, 3000, -5000, and -5000+	Integrated, no additional hardware required	Chromeleon CDS, version 6.2 or higher
Dionex DX-600 or BioLC with ED50A or CD25A detector	Integrated, no additional hardware required	Chromeleon CDS, version 6.2 or higher
Dionex DX-320 with IC25A detector	Integrated, no additional hardware required	Chromeleon CDS, version 6.2 6.2 or higher
Dionex DX-600 or BioLC with ED50	Dionex RFC-10 or RFC 30 Reagent-Free Controller <sup>1</sup> or Dionex SSC-10	No software required for Dionex RFC <sup>2</sup> control
Dionex DX-500 with ED40/50 or CD20/25 detector	Dionex RFC-10 or RFC 30 Reagent-Free Controller <sup>1</sup> or Dionex SSC-10	No software required for Dionex RFC <sup>2</sup> control
Dionex DX-320 with IC25 detector	Dionex RFC-10 or RFC 30 Reagent-Free Controller <sup>1</sup> or Dionex SSC-10	No software required for Dionex RFC <sup>2</sup> control

<sup>1</sup> Needed for optimal current control in 1-mA increments

<sup>2</sup> Chromeleon CDS can be used to control the Dionex DX system.

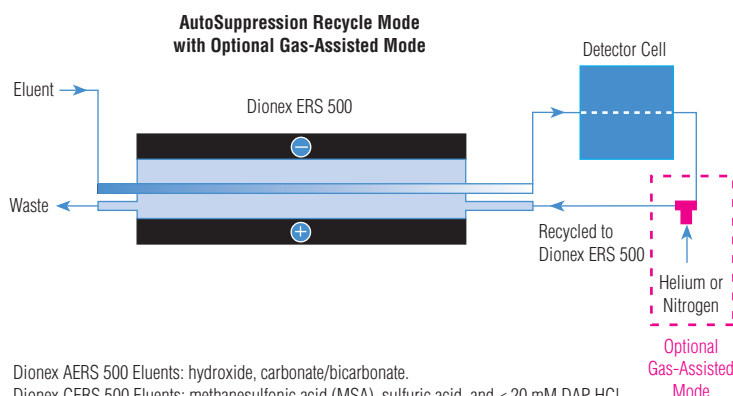


Figure 4. Eluent flow in the AutoSuppression recycle mode with optional gas-assisted mode. In AutoSuppression recycle mode, after the eluent passes through the detector flow cell, it is recycled back to the suppressor to be used as regenerant. With the optional gas-assisted mode, gas is added to the conductivity cell effluent before it flows into the "Regen In" port of the Dionex ERS 500 suppressor. The gas-assisted mode significantly reduces noise, allowing trace-level analysis.

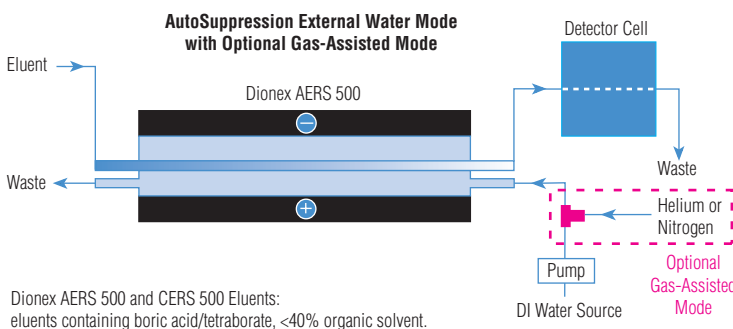


Figure 5. Eluent flow in the AutoSuppression external water mode with optional gas-assisted mode. The deionized water used for the electrolysis process is supplied from a constant pressure source or pump. This mode is ideal for operation with eluents and samples containing up to 40% organic solvent. With the optional gas-assisted mode, gas is added to the external water, which is pumped through the Dionex ERS 500 suppressor at a consistent flow rate between 1–2 mL/min. This mode decreases the amount of water required for the external water mode.



The Dionex ERS 500 suppressor should not be used with eluents or samples containing more than 40% organic solvent. The Dionex MMS 300 suppressor is recommended for eluents and samples containing high levels of organic solvents.

The Dionex ERS 500 suppressor can also be used to suppress eluents for Dionex MPIC Mobile Phase IC when the organic solvent content of the eluent remains below 40%.

## Dionex AERS 500 Suppressor for Anion-Exchange Chromatography

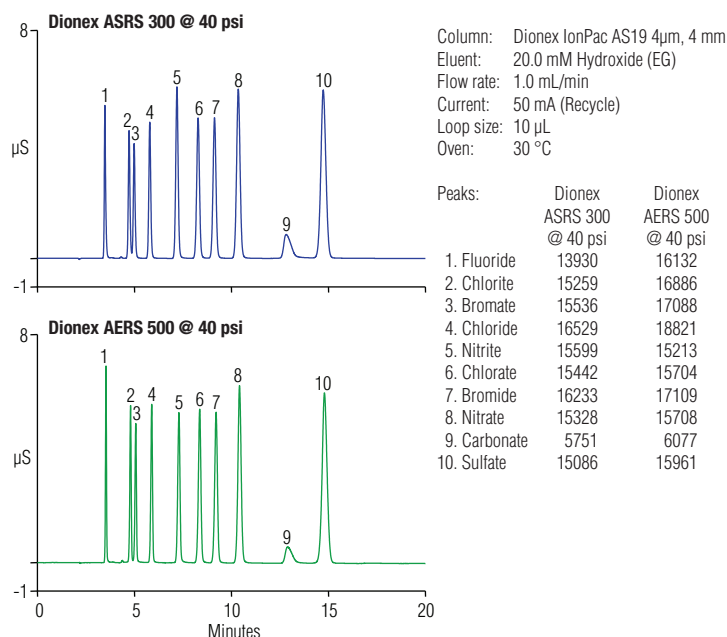


Figure 6. Comparison of the Dionex AERS 500 suppressor to the Dionex ASRS 300 suppressor using an inorganic anion standard. The Dionex AERS 500 suppressor outperforms the Dionex ASRS 300 suppressor even at elevated pressures, as shown by the peak efficiency.

## Dionex CERS 500 Suppressor for Cation-Exchange Chromatography

Column: Dionex IonPac AG16/AS16 Peaks: 1. Chloride 3.0 mg/L  
(0.4 × 250 mm) 2. Carbonate —  
Eluent Source: Dionex EGC KOH (Capillary) 3. Sulfate 5.0  
Eluent: Potassium hydroxide 4. Phosphate 10.0  
25 mM from 0 to 0.5 min, 5. Pyrophosphate 10.0  
25 mM to 65 mM 6. Trimetaphosphate 10.0  
from 0.5 to 3 min 7. Tripolyphosphate 10.0  
Flow Rate: 0.015 mL/min 8. Tetrametaphosphate 10.0  
Inj. Volume: 0.4 µL 9. Tetrapolyphosphate 10.0  
Temperature: 30 °C  
Detection: Suppressed conductivity, Dionex ACES 300 suppressor, recycle mode

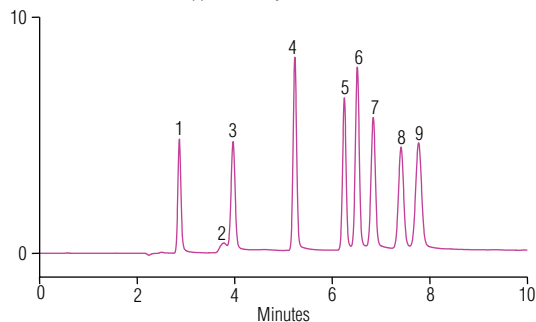
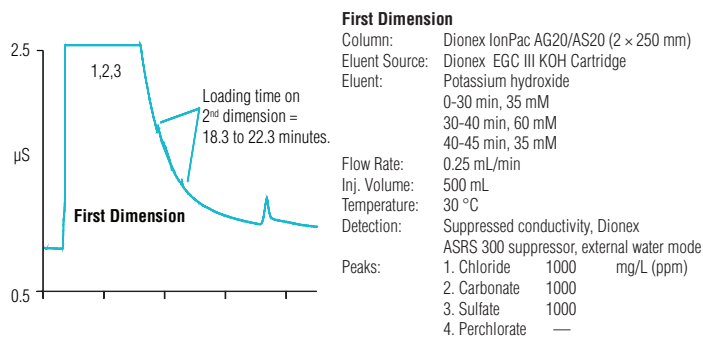


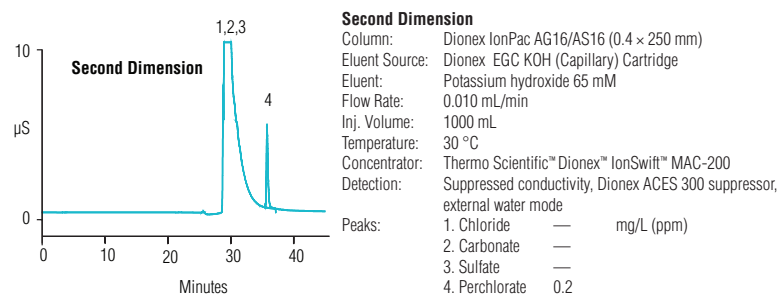
Figure 7. The Dionex CSRS is used in external water mode to suppress an eluent containing < 40% organic solvent. This separation permits the determination of trace-level ammonium in a wastewater sample containing a high concentration of sodium.



### First Dimension

Column: Dionex IonPac AG20/AS20 (2 × 250 mm)  
Eluent Source: Dionex EGC III KOH Cartridge  
Eluent: Potassium hydroxide  
0-30 min, 35 mM  
30-40 min, 60 mM  
40-45 min, 35 mM  
Flow Rate: 0.25 mL/min  
Inj. Volume: 500 µL  
Temperature: 30 °C  
Detection: Suppressed conductivity, Dionex ASRS 300 suppressor, external water mode

Peaks:	1. Chloride	1000	mg/L (ppm)
	2. Carbonate	1000	
	3. Sulfate	1000	
	4. Perchlorate	—	



### Second Dimension

Column: Dionex IonPac AG16/AS16 (0.4 × 250 mm)  
Eluent Source: Dionex EGC KOH (Capillary) Cartridge  
Eluent: Potassium hydroxide 65 mM  
Flow Rate: 0.010 mL/min  
Inj. Volume: 1000 µL  
Temperature: 30 °C  
Concentrator: Thermo Scientific™ Dionex™ IonSwift™ MAC-200  
Detection: Suppressed conductivity, Dionex ACES 300 suppressor, external water mode

Peaks:	1. Chloride	—	mg/L (ppm)
	2. Carbonate	—	
	3. Sulfate	—	
	4. Perchlorate	0.2	

Figure 8. 2D-IC Analysis of Trace Perchlorate Using the Dionex IonPac AS20 microbore column and the Dionex IonPac AS16 Capillary column.

## Dionex ERS 500 for Mobile Phase Ion Chromatography

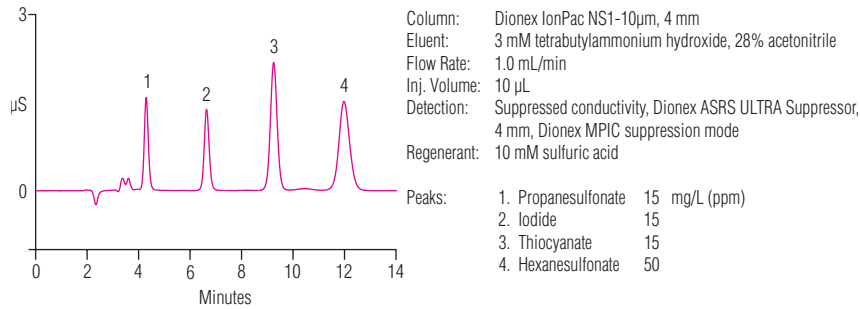


Figure 9. The Dionex ASRS 300 or Dionex CSRS ULTRA AERS 500 or Dionex CERS 500 suppressors can suppress eluents used for Dionex MPIC Mobile Phase IC. In this example, the anion Dionex MPIC Mobile Phase IC suppression mode uses electrolysis augmented by sulfuric acid regenerant to supply the hydronium ions for suppression. Similarly, the Dionex CSRS CERS 500 suppressor can be used for cation Dionex MPIC Mobile Phase IC ion-pairing separations.

### MicroMembrane Suppressor (Dionex MMS 300) for Chemically Regenerated Eluent Suppression

The Dionex MMS 300 suppressor uses continuous chemical suppression to enhance analyte conductivities while decreasing eluent conductivity. While using continuous chemical regeneration, the Dionex MMS 300 suppressor enables direct conductivity detection with ion-exchange applications using isocratic or gradient elution over wide concentration ranges (Figure 10).

The Dionex MMS suppressor membranes are optimized for low background and noise. New regenerant screens were introduced with the Dionex MMS 300 suppressor, improving regenerant flow, decreasing startup times, and improving background noise. Figure 11 illustrates the internal design of the Dionex MMS 300 suppressor.

### Dionex MMS 300 Suppressor for Sensitive Ion-Exchange Chromatography

When compared to non-suppressed IC, chemical suppression increases the linear working range of analytes by several orders of magnitude and improves detection limits for analytes 20–100 times. The Dionex MMS 300 suppressor is designed with minimal internal dead volume to provide high suppression capacity with minimal peak dispersion. The net result of chemical suppression is a dramatic improvement in signal-to-noise compared to non-suppressed applications.

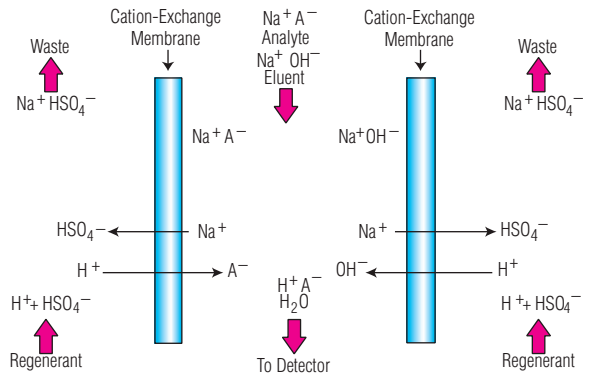


Figure 10. The Dionex MMS 300 suppressor enables direct conductivity detection with ion-exchange applications using isocratic or gradient elution over wide concentration ranges.

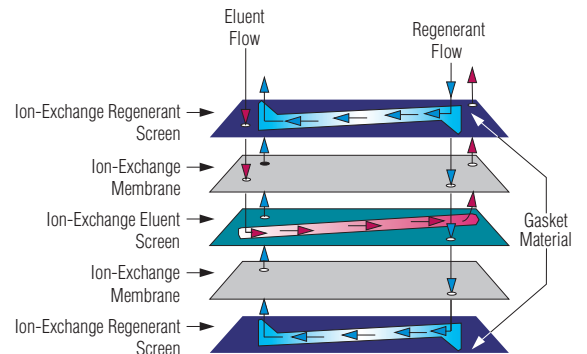


Figure 11. Internal construction of the Dionex MMS 300 suppressor. The Dionex MMS 300 suppressor is a high-capacity suppressor.



Table 3. Dionex MMS 300 suppressor modes of operation.

Mode	Benefit	Application
Displacement chemical regeneration (DCR)	Low noise and ease-of-use with extended unattended operation	Chemical regeneration with Displacement Chemical Regeneration Kit
Pressurized bottle	Lowest noise	Chemical regeneration with External Regeneration Kit
Peristaltic Pump	Low noise and ease-of-use	Peristaltic Pump Kit

Table 4. Dionex MMS 300 suppressor.

Anions	Cations
Use with carbonate/bicarbonate and hydroxide eluents and for eluents containing solvents Columns: All anion-exchange columns	Use with methanesulfonic acid and sulfuric acid eluents and eluents containing solvents, chloride, or nitrate Columns: All cation-exchange columns except for the Dionex IonPac SCS-1 column

### Dionex MMS Operational Modes

The Dionex MMS 300 suppressor can be used in the conventional pressurized bottle mode, the displacement chemical regeneration (DCR) mode, or the new peristaltic pump mode. Convenient concentrated regenerant solutions are available for each mode of operation.

The DCR mode is a convenient and economical mode of operation for chemical suppressors in which the regenerant is displaced by using conductivity cell effluent, delivering regenerant to the suppressor at a flow rate equal to the eluent flow rate (Figure 12). In this mode, the regenerant bottle is completely filled with regenerant upon start-up. As the cell effluent is pumped into the regenerant bottle, the regenerant is forced out into the suppressor regen chambers. No additional pump or pressure is required. Eluent and regenerant bottles are of equivalent volumes and new regenerant is prepared when new eluent is installed. The low regenerant flow rate minimizes waste and allows unattended operation, offering an economical option to the AutoRegen or pressurized bottle mode.

The conventional pressurized bottle mode uses a pressurized reservoir to deliver the chemical regenerant to the Dionex MMS 300 suppressor (Figure 13). The pressure is set at 5–10 psi, which delivers the regenerant to the Dionex MMS 300 suppressor at approximately 5–10 mL/min for 4 mm (5–8 mL/min for 2 mm). The spent regenerant is then diverted to waste.

The new peristaltic pump mode uses a peristaltic pump to deliver the regenerant to the Dionex MMS 300 suppressor at a controlled flow rate. A two-channel pump is available, and can be used to deliver Dionex MMS 300 regenerant and Thermo Scientific Dionex CRD 300 Carbonate Removal Device regenerant simultaneously.

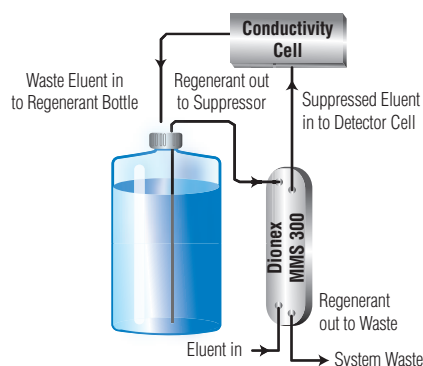


Figure 12. In the DCR mode, the regenerant is displaced by the eluent flow into the regenerant bottle. The regenerant flow is directed to the suppressor's Regen In port. This mode of operation is convenient and economical because the regenerant flow rate is reduced to and controlled by the eluent flow rate.

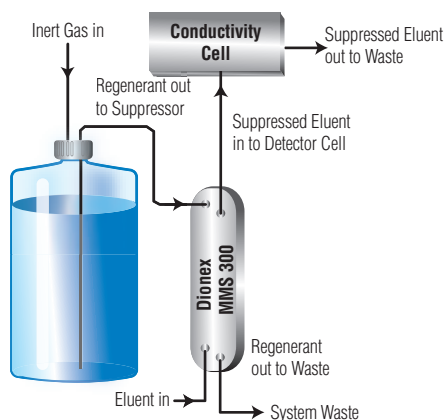


Figure 13. In pressurized bottle mode, the regenerant reservoir is pressurized to deliver the regenerant to the suppressor. The spent regenerant is then collected as waste.

## High Efficiency

The Dionex MMS 300 suppressor is available in both standardbore (5 and 4 mm) and microbore (2 and 3 mm) formats. The standardbore suppressors have a low void volume of less than 50  $\mu\text{L}$  to maintain the efficiency of ion-exchange separations using 4 or 5 mm columns. The microbore Dionex MMS 300 suppressor format is optimized to maintain the efficiency of ion-exchange separations when using either 2 or 3 mm columns (Figures 14 and 15).

## High Suppression Capacity

The Dionex MMS 300 suppressor is a direct replacement for older chemical suppressor devices, including the Dionex MMS III, MMS II, MMS I, and packed-bed suppressors. The Dionex MMS 300 suppressor accommodates both isocratic elution and rapidly increasing gradients to high eluent concentrations (above 100 mM hydroxide for the Dionex AMMS 300 4 mm suppressor) while maintaining low background conductance.

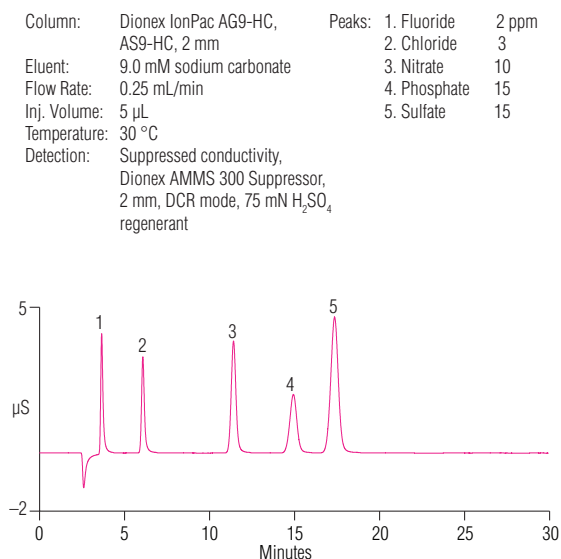


Figure 14. Anion separation using the Dionex IonPac AS9-HC column, 2 mm and the Dionex AMMS 300 suppressor (2 mm) in DCR mode.

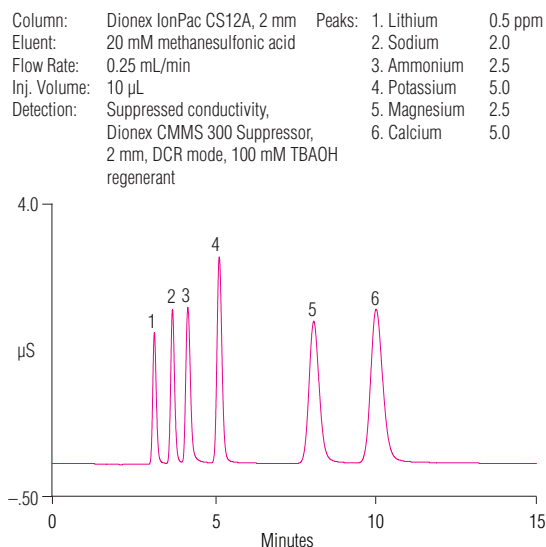


Figure 15. Cation separation using the Dionex IonPac CS12A column, 2 mm and the Dionex CMMS 300 suppressor (2 mm) in DCR mode.

## Compatible with HPLC Solvents

The Dionex MMS suppressor is compatible with typical HPLC solvents and are recommended for both anion and cation separations when solvents are used in the eluents (Figures 16 and 17). Solvent compatibility allows flexibility when optimizing eluent conditions for more demanding separations.

## Anion Ion-Exclusion MicroMembrane Suppressor (Dionex MMS 300) for Chemically Regenerated Eluent Suppression

The Dionex AMMS-ICE 300 is a high-capacity, low-void volume, membrane-based eluent suppressor designed for use with the ion-exclusion and ion-suppression separation modes of IC. The Dionex AMMS-ICE 300 uses chemical suppression to increase analyte ionization and therefore conductivity while decreasing eluent conductivity. The result is a significant improvement in analyte detection limits.

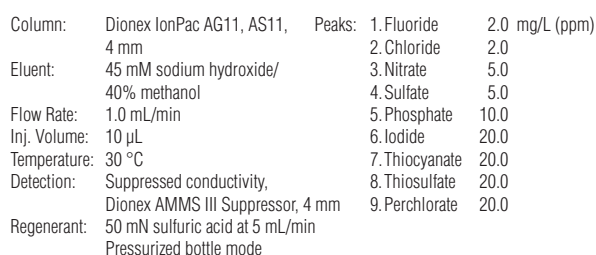


Figure 16. Anion separation with a sodium hydroxide and methanol eluent using the Dionex IonPac AS11 column and the Dionex AMMS 300 suppressor in pressurized bottle mode.

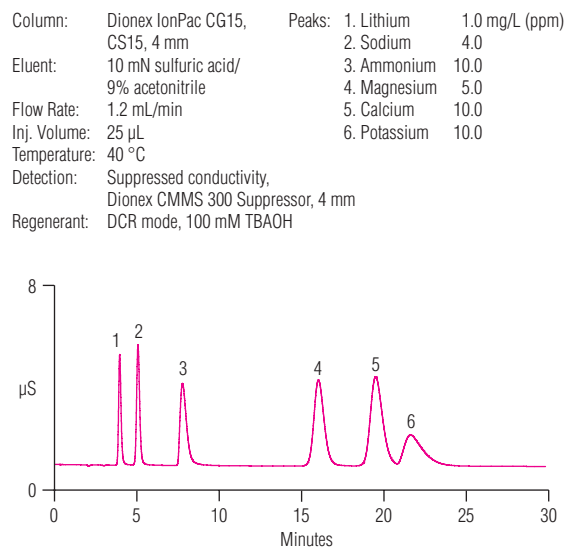


Figure 17. Cation separation with a sulfuric acid and acetonitrile eluent using the Dionex IonPac CS15 column and the Dionex CMMS 300 suppressor in Dionex DCR mode using tetrabutylammonium hydroxide regenerant.

## Increased Sensitivity with Suppressed Conductivity Detection

The Dionex AMMS-ICE 300 suppressor is used in chemical suppression mode with a tetrabutylammonium hydroxide (TBAOH) regenerant. The Dionex AMMS-ICE 300 suppressor decreases background eluent conductivity by displacing the highly conductive hydronium ions from the eluent into the regenerant chambers, followed by a neutralization step in the regenerant chambers. The resulting TBA<sup>+</sup> OSA<sup>-</sup> pair has low conductance. Figure 18 illustrates the suppression process for the Dionex AMMS-ICE suppressor. The cation-exchange membrane in the Dionex AMMS-ICE 300 suppressor allows the hydronium ions from the eluent to pass into the regenerant chambers where they are neutralized by hydroxide ions from the TBAOH regenerant.

Analyte conductivity is increased by forming the TBA salt of the weak acid analyte, which is more conductive than the partially ionized acid form of the analyte.

## Optimized for Ion-Exclusion Chromatography and Ion-Suppression Chromatography

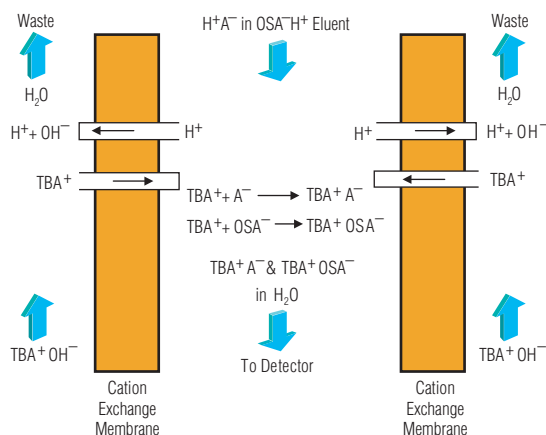
The Dionex AMMS-ICE 300 suppressor has been improved to allow use at temperatures up to 40 °C with eluents containing HPLC solvents. Elevated temperatures or solvents can be used to increase peak efficiency or alter column selectivity in ion-exclusion and ion-suppression separations. The suppressor can be placed outside a chromatography oven for operation at elevated temperatures above 40 °C.

The Dionex AMMS-ICE 300 suppressor is designed for use with either the ion-exclusion or ion-suppression separation modes of IC. Both modes use dilute eluents containing acids with low pKa values. Ion-exclusion chromatography uses a cation-exchange phase, typically in the hydronium form, to selectively exclude weak acids on the basis of differences in pKa (see Figures 19 and 20). In contrast, ion-suppression chromatography uses an acidic eluent that suppresses ionization of analytes, thus allowing the separation of weak acids using a hydrophobic reversed-phase column such as the Dionex IonPac NS1.

## Dionex AMMS-ICE 300 Applications

The Dionex AMMS-ICE 300 suppressor is ideally suited to ion-exclusion chromatography of:

- Organic acids and alcohols in complex or high-ionic-strength samples, including food and beverage products, biological samples, fermentation processes, industrial process liquors, and treated wastewaters.
- Organic acids in high-ionic-strength matrices.



A<sup>-</sup> = Weak Acid Anion    TBA<sup>+</sup> = Tetrabutylammonium Ion    H<sup>+</sup> OSA<sup>-</sup> = Octanesulfonic acid

Figure 18. Dionex AMMS-ICE suppression process for ion-exclusion chromatography.

Column:	Dionex IonPac ICE-AS6, 9 mm	Peaks:	1. Citric	0.5 mg/L (ppm)
Eluent:	10 mM heptafluorobutyric acid		2. Malic	1.0
Flow Rate:	1.0 mL/min		3. Glycolic	1.0
Inj. Volume:	50 µL		4. Lactic	1.0
Detection:	Suppressed conductivity, Dionex AMMS-ICE Suppressor, 4 mm		5. Acetic	1.0
			6. Succinic	1.0
Sample:	0.25% sulfuric acid			

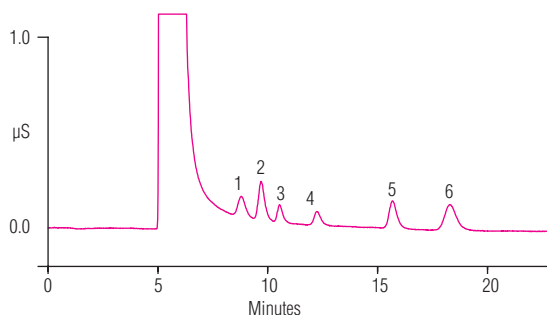


Figure 19. Determination of aliphatic acids in an acidic matrix using ion-exclusion.

Column:	Dionex IonPac ICE-AS6, 9 mm	Peaks:	1. Oxalic	5.0 mg/L (ppm)
Eluent:	10 mM heptafluorobutyric acid		2. Tartaric	10.0
Flow Rate:	1.0 mL/min		3. Citric	15.0
Inj. Volume:	50 µL		4. Malic	20.0
Detection:	Suppressed conductivity, Dionex AMMS-ICE Suppressor, 4 mm		5. Glycolic	10.0
			6. Formic	10.0
Sample:	0.25% sulfuric acid		7. Lactic	10.0
			8. 2-Hydroxyisobutyric	30.0
			9. Acetic	25.0
			10. Succinic	25.0
			11. Fumaric	35.0
			12. Propionic	50.0
			13. Glutaric	40.0

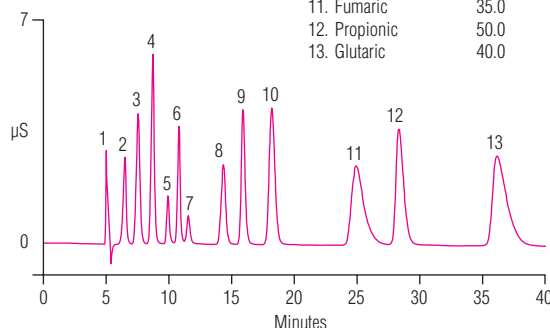


Figure 20. Separation of organic acids using the Dionex IonPac ICE-AS6 column.

## Capillary Electrolytic Suppressor (Dionex CES 300) for Capillary IC Analysis

The Dionex CES 300 suppressors are optimized for eluent flow rates typically seen in capillary systems (5–30  $\mu\text{L}/\text{min}$ ). When used for anion analysis, the Dionex ACES 300 suppressor converts highly conductive hydroxide-based eluents into pure water, thus reducing the baseline on a conductivity detector. While suppressing the eluent, the Dionex ACES 300 suppressor also converts the analytes into their more conductive hydronium (acid) form, thus increasing their sensitivity under conductivity detection. Likewise, when used for cation analysis, the Dionex CCES 300 suppressor converts highly conductive methanesulfonic acid (MSA) eluents into pure water; simultaneously, the analytes are converted to their more conductive hydroxide form, increasing their sensitivity.

### Dionex CES Suppressor Technology

The Dionex CES 300 suppressor uses a three-chamber design to minimize dead volume while maximizing suppression capacity and reducing noise.

The eluent chamber is comprised of an ion-exchange capillary membrane that facilitates the efficient exchange of the eluent counterions for regenerant ions.

The regenerant chambers are divided into the ion-exchange chamber and the electrode chambers. The regenerant first passes through the ion-exchange chamber, which is filled with a bed of ion-exchange resin; the ion-exchange capillary membrane is coiled in this bed. The regenerant bed is an ion-exchange resin in the opposite form as the eluent. It is this bed of resin that provides the regenerant ions for the capillary membrane eluent chamber.

There are two electrode chambers that are separated from the ion-exchange chamber by a pair of ion-exchange membranes. The regenerant, after passing through the ion-exchange chamber, passes through the cathode and anode chambers serially. When current is passed through the electrodes, the regenerant ions are generated in the first electrode chamber; these ions are pushed into the ion-exchange chamber via an electric field, maintaining the ion-exchange chamber in the regenerant form. After co-ions exchange from the eluent ion-exchange capillary membrane, the co-ions are pushed out of the ion-exchange chamber via the electric field into the second electrode chamber. Finally, these co-ions are neutralized by the ions generated in the second electrode chamber.

### Dionex CES 300 System Control

The unique design of the Dionex CES 300 suppressor simplifies software and hardware control options. For most applications, the Dionex CES 300 suppressor can be set to a single current setting of 10 mA. For applications requiring very high eluent concentrations, the Dionex CES 300 suppressor must be set to 20 mA. The Dionex ICS-5000+ system includes software and hardware to control the Dionex CES 300 suppressor. Chromeleon CDS software, version 6.8 or 7.0 is required.

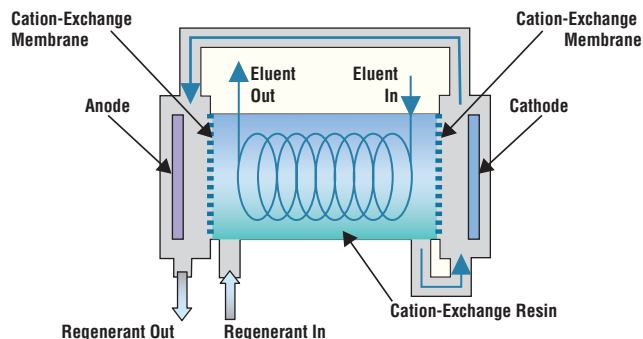


Figure 21. Anion Capillary Electrolytic Suppressor (Dionex ACES 300).

### Key Applications Using a Dionex CES 300 Suppressor

Column:	Dionex IonPac CS12A column (0.4 × 250 mm)	Peaks:	1. Lithium	0.5 mg/L
Eluent:	20 mM Methanesulfonic acid		2. Sodium	2.0
Eluent Source:	Thermo Scientific Dionex EGC-MSA (Capillary) Cartridge		3. Ammonium	2.5
Temperature:	30 °C		4. Potassium	5.0
Flow Rate:	10 $\mu\text{L}/\text{min}$		5. Magnesium	2.5
Inj. Volume:	0.4 $\mu\text{L}$		6. Calcium	5.0
Detection:	Suppressed conductivity, Dionex CCES 300 Suppressor, Dionex AutoSuppression device, recycle mode			

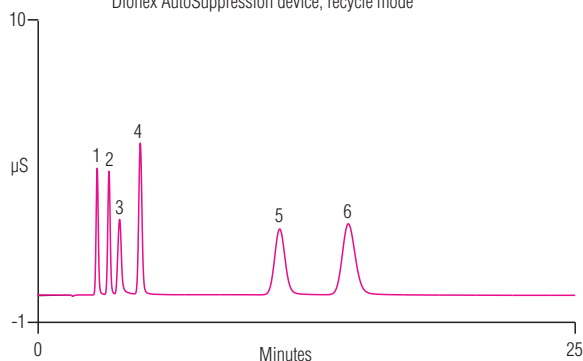


Figure 22. Separation of six common cations using a Dionex IonPac CS12A Capillary column.

Column:	Dionex IonPac AS19 column (0.4 mm × 250 mm)	Peaks:	1. Fluoride	12. Malonate
Eluent:	10 mM KOH (0 to 10 min), 10 to 52 mM KOH (10 to 42 min), 52 to 70 mM (42 to 45 min), 10 mM (45 to 50 min)		2. Acetate	13. Selenate
Eluent Source:	Dionex EGC-KOH (Capillary) Cartridge		3. Formate	14. Oxalate
Temperature:	30 °C		4. Chlorite	15. Iodide
Flow Rate:	10 $\mu\text{L}/\text{min}$		5. Bromate	16. Thiosulfate
Inj. Volume:	0.4 $\mu\text{L}$		6. Chloride	17. Chromate
Detection:	Suppressed conductivity, Dionex ACES 300 Suppressor recycle mode		7. Nitrite	18. Chromate
			8. Chlorate	19. Fumarate
			9. Bromide	20. Arsenate
			10. Nitrate	21. Thiocyanate
			11. Sulfate	22. Perchlorate

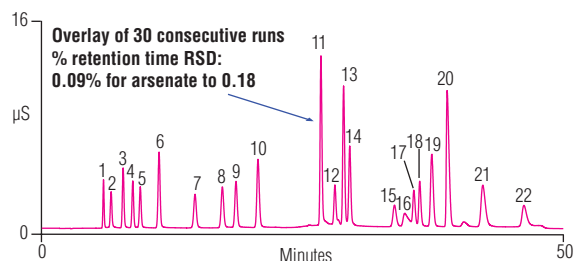


Figure 23. Separation of 22 anions on a Dionex IonPac AS19 Capillary column.

## Atlas Electrolytic Suppressor (Dionex AES Atlas) for Routine IC Analysis

The Dionex AES Atlas suppressor is designed for optimal performance when using routine carbonate/bicarbonate, MSA, or sulfuric acid eluents. The patented design of the Dionex AES Atlas suppressor results in much faster daily start-up times to improve the throughput of routine sample analysis. The Dionex AES Atlas suppressor improves the analysis of standard anions and cations by lowering the noise. For routine analysis, the peak response and efficiencies are equivalent to the performance of a Dionex ERS 500 suppressor.

### Dionex AES Atlas Suppressor Technology

The Thermo Scientific™ Dionex™ MonoDisc™ suppression bed of the Dionex AES Atlas suppressor is composed of ion-exchange monolith and flow distribution discs (patented technology). This configuration, illustrated in Figure 24, facilitates efficient exchange of the eluent counter ions for regenerant ions, resulting in eluent suppression and analyte response enhancement.

### Dionex AES Atlas Suppressor System Control

Dionex ICS-1000, ICS-1100, ICS-1500, ICS-1600, ICS-2000, ICS-2100, ICS-2500, ICS-3000, ICS-5000, and ICS-5000+ series systems include software and hardware to control the Dionex AES Atlas suppressor. Dionex DX-600 or DX-320 systems must be configured with Chromeleon CDS, version 6.2/PeakNet 6.2 or higher, and an ED50A, CD25A, or IC25A detector. Dionex DX-600, DX-500, or DX-320 systems using earlier versions of PeakNet software require the Dionex RFC-10 or RFC-30 Reagent-Free Controller. The Dionex RFC-10 or RFC-30 is required for the Dionex DX-120, along with a Dionex DX-120 adapter cable.

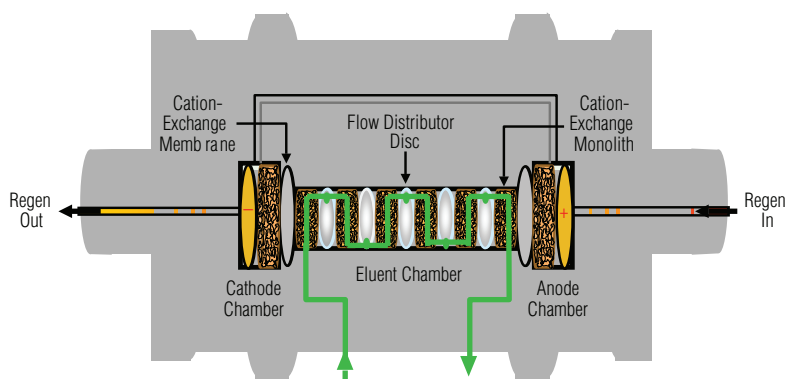


Figure 24. Dionex AES Atlas Anion Electrolytic Suppressor using electrolytic regeneration of the Dionex MonoDisc eluent chamber.

Table 5. Applications using the Dionex AES Atlas suppressor.

Anion Analysis Using Carbonate/Bicarbonate Eluents	Dionex IonPac Anion Columns
One Dionex AES suppressor format is used for all column formats.	4 mm: AS23, AS22, AS14A, AS14, AS9-SC, AS9-HC, AS12A, AS4A-SC, AS4A, AS4
Eluent concentrations up to 25 mN at 1.0 mL/min can be suppressed.	3 mm: AS14A, 5µm
Eluents containing solvents should not be used.	2 mm: AS23, AS22, AS14, AS12A, AS9-HC, AS9-SC, AS4A-SC
	1 mm: Dionex IonSwift MAX-100
Cation Analysis Using MSA or Sulfuric Acid Eluents	Dionex IonPac Cation Columns
One Dionex CAES suppressor format is used for all column formats.	4 mm: CS12, CS12A, CS14, CS17, CS18
Eluent concentrations up to 25 mN at 1.0 mL/min can be suppressed.	3 mm: CS12A-5µm
Eluents containing solvents should not be used.	2 mm: CS12, CS12A, CS14, CS17, CS18

Table 6. System control of the Dionex AES Atlas Suppressor.

IC System	Hardware Control Requirements	Software Control Requirements
Dionex ICS-1000, 1100, 1500, 1600, 2000, 2100, Integrated Dionex ICS-2500, 3000, 5000 and 5000+ Modular. No additional hardware required Chromeleon 6.2 or higher	Integrated into system, no additional hardware required	Chromeleon CDS, versions 6.2 or higher
Dionex DX-600 with ED50A or CD25A detector	Integrated, no additional hardware required	Chromeleon CDS, versions 6.2 or higher
Dionex DX-320 with IC25A detector	Integrated, no additional hardware required	Chromeleon CDS, versions 6.2 or higher
Dionex DX-600 or with ED50 or CD25 detector	Dionex RFC-10 or RFC 30 Reagent-Free Controller	No software required for RFC <sup>1</sup>
Dionex DX-500 with ED40/50 or CD20/25 detector	Dionex RFC-10 or RFC 30 Reagent-Free Controller	No software required for RFC <sup>1</sup>
Dionex DX-320 with IC25 detector	Dionex RFC-10 or RFC 30 Reagent-Free Controller	No software required for RFC <sup>1</sup>
Dionex DX-120	Dionex RFC-10 or RFC 30 Reagent-Free Controller	No software required for RFC <sup>1</sup>

## Key Applications Using a Dionex AES Atlas Suppressor

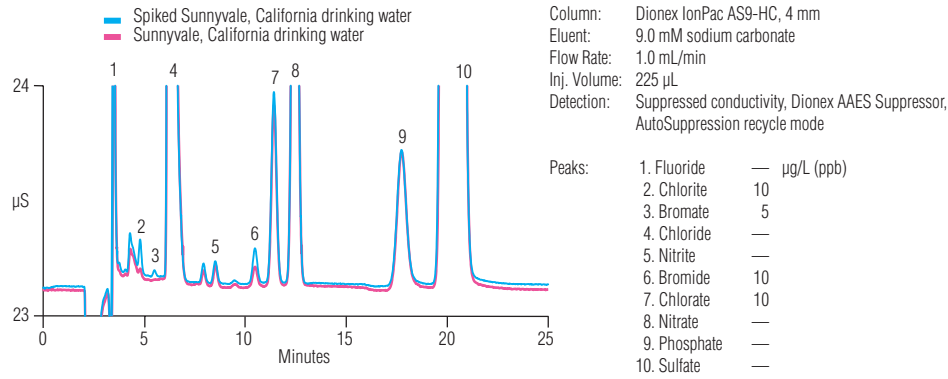


Figure 25. Separation of target analytes using the Dionex IonPac AS9-HC column offers an ideal method for determination of oxyhalides and bromide in drinking water samples. This figure illustrates the use of a Dionex AAES suppressor for the analysis of spiked (blue trace) and unspiked (red trace) drinking water samples. The drinking water sample was spiked with chlorite, chlorate, and bromide at 10 µg/L and bromate at 5 µg/L. Because of the low baseline noise that can be achieved when using the Dionex AAES suppressor, 5 µg/L bromate is detected easily.

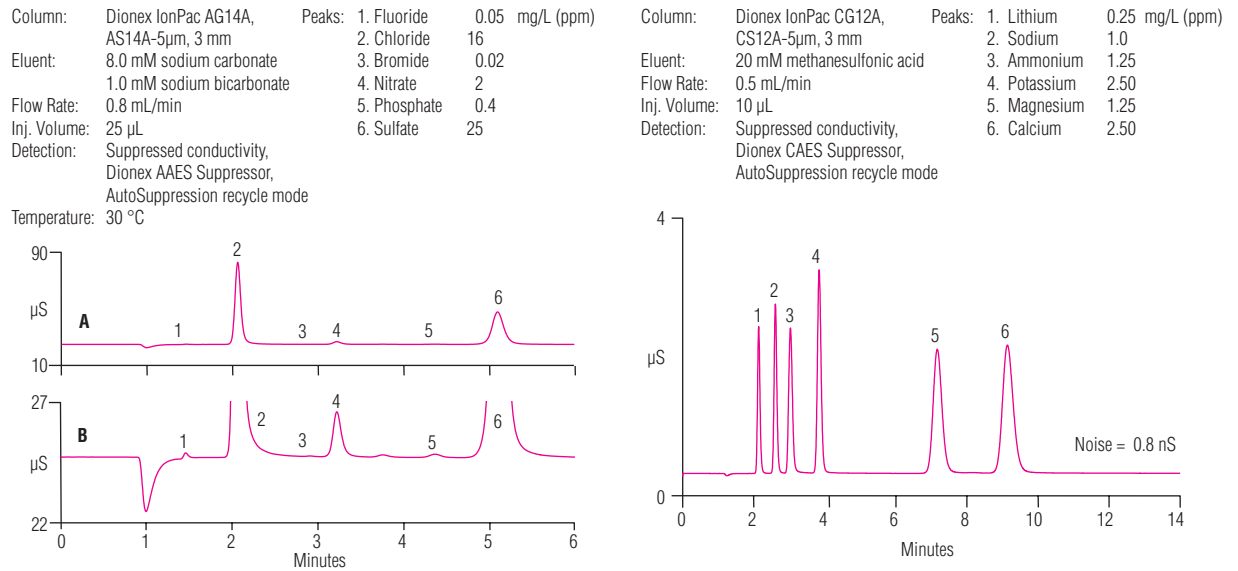


Figure 26. Routine analysis of anions in drinking water using the Dionex IonPac AS14A-5µm column and the Dionex AAES suppressor. A) Full scale. B) Magnification of baseline to show resolution of low-concentration analytes

Figure 27. Analysis of common cations plus ammonium using the Dionex IonPac CS12A-4µm column and the Dionex CAES suppressor.



## Ordering Information

In the U.S., call (800) 346-6390 or contact the Thermo Fisher Scientific Regional Office nearest you. Outside the U.S., order through your local Thermo Fisher Scientific office or distributor. Refer to the following part numbers.

### Dionex ERS 500 Suppressors

Dionex ERS 500 Electrolytically Regenerated Suppressors	Part Number
Dionex AERS 500 (2 mm) Anion Electrolytically Regenerated Suppressor For use with 2 and 3 mm microbore anion-exchange columns. Replaces the Dionex ASRS 300 (P/N 064555), ASRS ULTRA II (P/N 061562), ASRS ULTRA (P/N 053947), ASRS I (P/N 043187), and the ASRS II (P/N 046078) suppressors.	082541
Dionex AERS 500 (4 mm) Anion Electrolytically Regenerated Suppressor For use with 4 and 5 mm anion-exchange columns. Replaces the Dionex ASRS 300 (P/N 064554), ASRS ULTRA II (P/N 061561), ASRS ULTRA (P/N 053946), ASRS I (P/N 043189), and the ASRS II (P/N 046081) suppressors.	082540
Dionex CERS 500 (2 mm) Cation Electrolytically Regenerated Suppressor For use with 2 and 3 mm microbore cation-exchange columns. Replaces the Dionex CSRS 300 (P/N 046557), CSRS ULTRA II (P/N 061564), CSRS ULTRA (P/N 053949), CSRS I (P/N 043188), and the CSRS II (P/N 046080) suppressors.	082543
Dionex CERS 500 (4 mm) Cation Electrolytically Regenerated Suppressor For use with 4 mm cation-exchange columns. Replaces the Dionex CSRS 300 (P/N 064556), CSRS ULTRA II (P/N 061563), CSRS ULTRA (P/N 053948), CSRS I (P/N 043190), and the CSRS II (P/N 046079) suppressors.	082542
Dionex ERS 500 Suppressors for Mobile Phase Ion Chromatography (MPIC) For ASRS MPIC (NS1 ion-pairing suppressor): Order the Dionex AERS 500 suppressor. Note: The AMMS-ICE 300 Anion MicroMembrane Suppressor cannot be used for anion Dionex MPIC Mobile Phase IC. For Dionex CERS MPIC (NS1 ion-pairing suppressor): Order the Dionex CERS 500 suppressor.	
Dionex ERS 500 Suppressor Spare Parts	Part Number
Backpressure loop, 1 each For 5 and 4 mm columns	045877
For 2 and 3 mm columns	045878
Syringe, 1.0 mL, disposable For flushing the Dionex ERS 500 suppressor at startup.	016388
Syringe adapter, female Luer lock, 1/4-28 threads (for regenerant chamber)	024305
10–32 threads (for eluent chamber)	046888
Optional Kits	Part Number
External Regenerant Installation Kit For Dionex ERS 500 suppressor operation in the external water mode, chemical regeneration mode, and MPIC chemical regeneration mode. Kit contains a 4 L bottle, one pressure regulator (0–30 psi/0–210 kPa), and appropriate tubing and fittings for installation of one Dionex ERS 500 suppressor with pneumatic delivery of regenerant.	038018
Dionex ERS Gas-Assisted Regeneration Kit Required for the initial installation of the gas-assisted recycle mode or the gas-assisted external water mode. Contains one pressure regulator (0–30 psi/0–210 kPa), 1/4-28 mixing tee, one check valve, and all tubing and fittings required to install the Dionex ERS 500 suppressor for operation in these modes.	056886
Dionex SRD-10 Suppressor Regenerant Detector The Dionex SRD-10 is a stand-alone device that monitors liquid flow to a suppressor's regenerant chambers and automatically disables the eluent pump if flow is disrupted.	074395
Dionex SCC-10 Suppressor Current Controller The Dionex SCC-10 is an external adapter designed for use with legacy instruments that only offer four settings for current. The Dionex SCC-10 is powered from the existing suppressor current supply, and can output 12 discreet current settings from 10 mA to 250 mA.	074053

## Dionex MMS 300 Suppressors

<b>Dionex MicroMembrane MMS 300 Suppressors</b>	<b>Part Number</b>
Dionex AMMS 300 (2 mm) Anion MicroMembrane Suppressor For use with 2 and 3 mm anion-exchange columns. Replaces the 2 mm Dionex AMMS II (P/N 043106) and the AMMS III (P/N 056751) Suppressors.	064559
Dionex AMMS 300 (4 mm) Anion MicroMembrane Suppressor For use with 4 and 5 mm anion-exchange columns. Replaces the Dionex AMMS I (P/N 043189), AMMS II (P/N 043074), and the AMMS III (P/N 056750) Suppressors.	064558
Dionex CMMS 300 (2 mm) Cation MicroMembrane Suppressor For use with 2 and 3 mm cation-exchange columns. Replaces the 2 mm Dionex CMMS II (P/N 043107), and the CMMS III (P/N 056753) Suppressors.	064561
Dionex CMMS 300 (4 mm) Cation MicroMembrane Suppressor For use with 4 and 5 mm cation-exchange columns. Replaces the Dionex CMMS I (P/N 043190), CMMS II (P/N 043021) and the CMMS III (P/N 056752) Suppressors.	064560
<b>Chemical Regeneration Dionex MMS 300 Kits for Displacement</b>	<b>Part Number</b>
Installation Kit for Displacement Chemical Regeneration Operation	
2 L DCR Kit	056882
4 L DCR Kit	056884
Includes one regenerant reservoir, cap, and all tubing and fittings to install the Dionex MMS 300 in the DCR mode. Order the size that matches the system's eluent bottle size.	
2 L Eluent Bottle	044129
4 L Eluent Bottle	039164
Anion Regenerant Concentrate (75 mL of 2.0 N H <sub>2</sub> SO <sub>4</sub> )	057559
Anion Regenerant Concentrate, 4-pack (Four each of P/N 057559)	057555
Cation Regenerant Concentrate (100 mL of 2.06 M TBAOH)	057561
Cation Regenerant Concentrate, 4-pack (Four each of P/N 057561)	057556
<b>Chemical Regenerant Kits and Regenerant Concentrates</b>	<b>Part Number</b>
External Regenerant Installation Kit For Dionex MMS 300 operation in the chemical suppression mode. Includes one 4 L pressurizable regenerant reservoir, one pressure regulator (0–30 psi/0–210 kPa), and all tubing and fittings required to install the Dionex MMS 300 for operation in this mode.	038018
Anion Regenerant Concentrate (50 mL of 0.25 N H <sub>2</sub> SO <sub>4</sub> )	039601
Anion Regenerant Concentrate, 4-pack (Four each of P/N 039601)	037164
Cation Regenerant Concentrate (500 mL of 0.10 N TBAOH)	039602
<b>Dionex MMS 300 Suppressor Spare Parts</b>	<b>Part Number</b>
Backpressure loop, 1 each For 4 and 5 mm system	045877
For 2 and 3 mm systems	045878
Syringe, 1.0 mL, disposable For flushing the Dionex MMS 300 suppressor at startup.	016388
Syringe Adapter, female Luer lock, 1/4-28 threads	024305

## Dionex CES 300 Suppressors

<b>Dionex CES 300 Capillary Electrolytic Suppressors</b>	<b>Part Number</b>
Dionex ACES 300 Anion Capillary Electrolytic Suppressor For use with anion-exchange capillary columns.	072052
Dionex CCES 300 Cation Capillary Electrolytic Suppressor For use with cation-exchange capillary columns.	072053
<b>Optional Kits</b>	<b>Part Number</b>
Cation Regenerant Concentrate (100 mL of 2.06 M TBAOH)	057561
Cation Regenerant Concentrate, 4-pack (Four each of P/N 057561)	057556
<b>Chemical Regenerant Kits and Regenerant Concentrates</b>	<b>Part Number</b>
External Regenerant Installation Kit For Dionex CES 300 suppressor operation in the external water mode. Kit contains a 4 L bottle, one pressure regulator (0–30 psi/0–210 kPa), and appropriate tubing and fittings for installation of one Dionex CES 300 suppressor with pneumatic delivery of external water.	038018

## Dionex AES Atlas Suppressors

<b>Dionex AES Atlas Electrolytic Suppressors</b>	<b>Part Number</b>
Dionex AAES Atlas Anions Electrolytic Suppressor The Dionex AAES Atlas anion suppressor can be used for carbonate/bicarbonate eluents up to 25 mN at 1.0 mL/min. One dimension for 5, 4, 3, and 2 mm columns. Requires Chromeleon CDS, version 6.2 or higher with an ED50A, CD25A, or IC25A for direct control. Older systems (Dionex DX-500 with ED50 or CD25; DX-320 with IC25; and DX-120) require a Dionex RFC-10 or RFC-30 Reagent-Free Controller. The Dionex DX-120 also requires an DX-120 Adapter Cable listed below.	056116
Dionex CAES Atlas Cation Electrolytic Suppressor The Dionex CAES Atlas cation suppressor can be used for methanesulfonic acid or sulfuric acid eluents up to 25 mN at 1.0 mL/min. One dimension for 5, 4, 3, and 2 mm columns. Requires Chromeleon CDS, version 6.2 or higher with an ED50A, CD25A, or IC25A for direct control. Older systems (Dionex DX-500 with ED50 or CD25; DX-320 with IC25; and DX-120) require a Dionex RFC-10 or RFC-30 Reagent-Free Controller. The Dionex DX-120 also requires an DX-120 Adapter Cable listed below.	056118
<b>Dionex RFC-10, RFC-30 Suppressor Controllers</b>	<b>Part Number</b>
Dionex RFC-30 Reagent-Free Controller with Dionex EGC II KOH Cartridge and Dionex CR-ATC Continuously Regenerated Anion Trap Column	060667
Dionex RFC-30 Reagent-Free Controller with Dionex EGC II MSA Cartridge and Dionex CR-CTC II Continuously Regenerated Cation Trap Column	060668
Dionex RFC-10 Suppressor Controller	060335
Dionex DX-120 Adapter Cable for RFC-10 or RFC-30 This adapter cable is required to interface the Dionex RFC-10 or RFC-30 to the Dionex DX-120.	057861

<b>Dionex AES Atlas Suppressor Spare Parts</b>	<b>Part Number</b>
Backpressure loop, 1 ea. For 5 and 4 mm systems	045877
For 3 and 2 mm systems	045878
Syringe, 1.0 mL, disposable For flushing the Dionex AES Atlas suppressor at startup.	016388
Syringe adapter, female Luer lock, 1/4-28 threads (for regenerant chamber)	024305
Syringe adapter, female Luer lock, 10–32 threads (for eluent chamber)	046888
<b>Optional Kits</b>	<b>Part Number</b>
External Regenerant Installation Kit For Dionex AES Atlas suppressor operation in the external water mode. Kit contains a 4 L bottle, one pressure regulator (0–30 psi/0–210 kPa), and appropriate tubing and fittings for installation of one Dionex AES Atlas Suppressor with pneumatic delivery of regenerant.	038018
Trap Column and Suppressor Regeneration Kit The Trap Column and Suppressor Regeneration Kit allow off-line regeneration of trap columns and cleanup of suppressors. The kit includes a 1 L plastic bottle, pressure regulator, 2-way valve, and all of the fittings and tubing required for operation.	059659

## Dionex AMMS-ICE 300 Suppressor

Dionex AMMS-ICE Suppressor	Part Number
Dionex AMMS-ICE 300 Anion-ICE MicroMembrane Suppressor	067527
Regenerant Kits and Reagent	Part Number
External Regenerant Installation Kit Required for first time installation. Includes one 4 L pressurizable regenerant reservoir, one pressure regulator (0–30 psi/0–210 kPa), and all tubing and fittings required to install regenerant delivery to the Dionex AMMS-ICE 300 suppressor.	038018
Dionex AMMS-ICE Cation Regenerant Solution 500 mL of 0.1 M tetrabutylammonium hydroxide (TBAOH)	039602
Dionex AMMS-ICE 300 Suppressor Spare Parts	Part Number
Backpressure loop, 1 each for 4 mm system	045877
Syringe, 1.0 mL, disposable For flushing the Dionex AMMS-ICE 300 suppressor at startup.	016388
Syringe Adapter, female Luer lock, 1/4-28 threads	024305

## Dionex ERS 500 Suppressor Controller

Dionex ERS 500 Suppressor Controllers	Part Number
Dionex RFC-30 Reagent-Free Controller with Dionex EGC III KOH Cartridge and Dionex CR-ATC 500 Continuously Regenerated Anion Trap Column	060667
Dionex RFC-30 Reagent-Free Controller with Dionex EGC III MSA Cartridge and Dionex CR-CTC 500 Continuously Regenerated Cation Trap	060668
Dionex RFC-10 Suppressor Controller	060335
Dionex DX-120 Adapter Cable Note: Earlier Dionex systems can accommodate Dionex ERS 500 or Dionex AES Atlas suppressor operation with Dionex SCR-1 and SC-20 stand-alone controller modules. These modules are now discontinued and replaced by the Dionex RFC-10 or RFC-30.	057861

### Patent Numbers

6,650,546; 6,508,985; 6,495,371; 6,436,719; 6,425,284; 6,077,434; 6,328,885; 6,325,976; 5,597,734; 5,773,615; 5,622,171; 5,569,365; 5,352,360; 5,248,426; 4,999,098

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