



# **ASUREX-A100**

Automatic Suppressor Regenerator

# Instructions for Use

**Xenoic®**

## **ASUREX-A100 Automatic Suppressor Regenerator**

with **XAMS** Anion Membrane Suppressor

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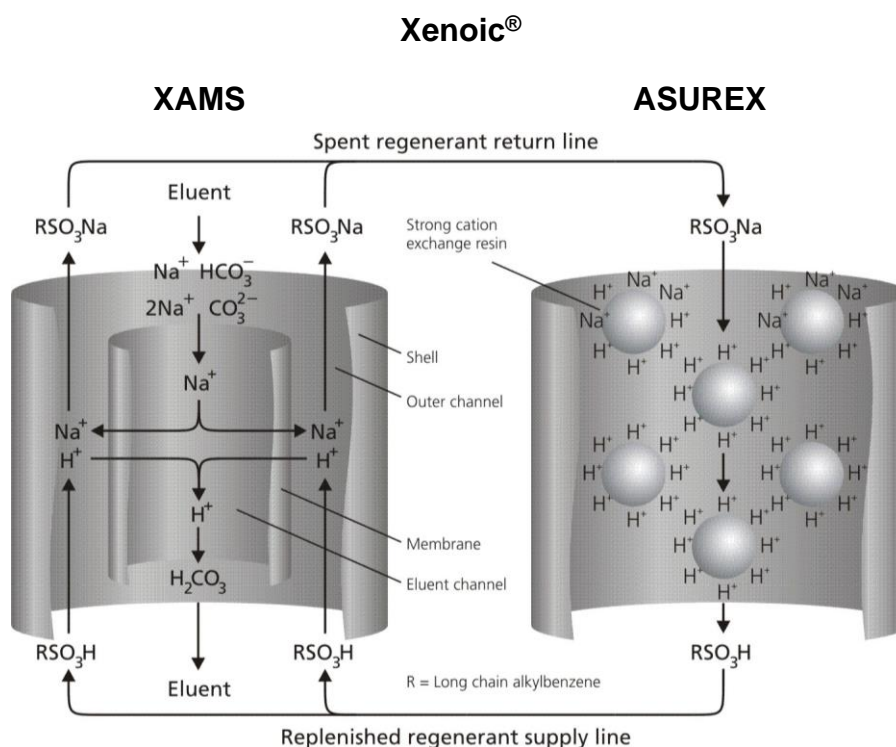
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## General Information

The Xenoic® XAMS membrane suppressor and the Xenoic® ASUREX automatic regenerator are designed to maximize detectability in anion chromatography by increasing the signal intensity while simultaneously minimizing the eluent background conductivity and noise. The robust and flexible design of ASUREX and XAMS ensures stable routine operation together with many different brands of ion chromatography systems and conductivity detectors.

The purpose of ASUREX is to maintain a constant acidic environment in the XAMS suppressor, where the ion chromatography eluent background conductivity is suppressed. Protons continuously supplied from the ASUREX-AR1 cartridge to the XAMS suppressor are transported across the suppressor ion exchange membrane into the eluent. There protons replace the cationic counter ions in the eluent (often sodium or potassium), thereby neutralizing the eluent ions to their corresponding acids (often carbonic acid or water) which have very low conductivity. The replaced eluent cations are transported out from the XAMS suppressor and deposited on the ASUREX cartridge. Anions on the other hand, cannot cross the suppressor membrane due to ion exclusion. The ASUREX-AS1 regeneration solution circulating in the ASUREX system is an ultra-pure organic acid that act as a vehicle for transport of protons between the ASUREX cartridge and the XAMS suppressor.

The ASUREX regenerator with XAMS suppressor is particularly well suited for applications requiring long, unattended routine operation, and exceptionally low and stable background conductivity. Gradient elution may also be carried out with minimal baseline drift, and the background level is unaffected if the user decides to change the mobile phase flow rate or ion strength to reduce the chromatographic run time. While convenient and cost-saving in laboratory applications, the ASUREX will really excel in applications such as environmental sampling in pristine areas, and for continuous industrial monitoring of high purity water.



**Figure 1:** Ion exchange in a Xenoic® XAMS suppressor connected to Xenoic® ASUREX regenerator

## Unpacking

The ASUREX A100 box contains the following items:

- ASUREX-A100 Pump (reorder number 1810-101)
- ASUREX-A100 Fitting kit (reorder number 1810-111)
- ASUREX-AR1 Cartridge, 0.5 L (reorder number 1810-911)
- ASUREX-AS1 Solution, 100 mL (reorder number 1810-921)
- XAMS Suppressor installation kit (reorder number 1125-711)
- Instructions for Use

Optional items supplied if ordered:

- XAMS Suppressor (reorder number 1125-100)
- XAMS-HC High-capacity suppressor (reorder number 1125-200)
- XAMS Pressure Relief Valve kit (reorder number 1125-721)
- XAMS Pressure Optimizer kit (reorder number 1125-731)

Please confirm the delivery against the lists above.

## Installation

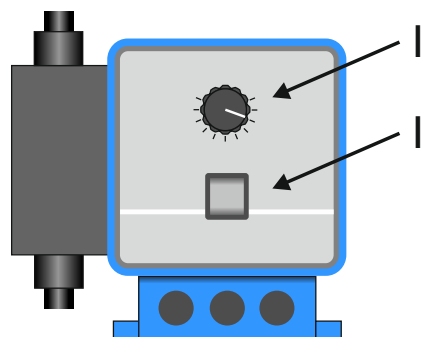
### *Operating the Pump*



*To avoid damaging the ASUREX Pump, only change the flow rate during operation.*

There are two controls on the pump front:

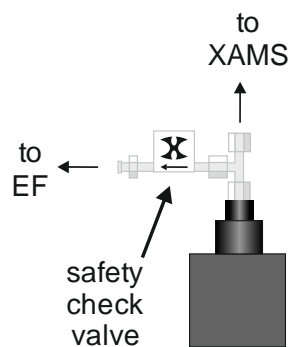
- The top button mechanically adjusts the volume delivered per pump stroke and should only be used when the pump is operating. This button is used to alter the flow rate of AS1 solution and is normally set to a value of 80.
- The lower button is the power switch. Use this switch to turn the pump on and off.



**Figure 2:** Control buttons on the ASUREX Pump.

## Safety Check Valve

Install the three-way luer connector and the Safety Check Valve (2 bar, 30 psi) at the top of the Pump outlet. This will protect the user against overpressure that could occur if the tubing in the system is accidentally blocked or squeezed. Connect the outlet of the Safety Check Valve to the Expansion Flask (EF), which should be large enough able to hold all the AS1 solution in the system (about 150 mL) plus some additional volume. The spring-loaded Safety Check Valve will automatically reseal after opening and continue to protect from overpressure.



**Figure 3:** Install the Safety Check Valve and connect its outlet to the Expansion Flask (EF).

## Diluting the ASUREX AS1 Solution



*Wear protective glasses and gloves during handling of the ASUREX-AS1 Solution.*

The ASUREX-AS1 Solution contains an ultra-pure, high-molecular weight, polymeric sulfonic acid in water, which may be corrosive and irritate skin. Spills should therefore be avoided. The use of eye protective glasses and gloves during handling is strongly recommended.

The ASUREX-AS1 Solution is shipped as a concentrate and must be diluted with Reagent Grade Laboratory Water before use. A 1+4 dilution is recommended for eluent strengths up to 30 mM. Stronger and less diluted AS1 Solution should be used for gradients and strong eluents. For eluents 30-50 mM a 1+1 dilution of the AS1 Solution is recommended with the standard XAMS Suppressor. For stronger eluents (up to 100 mM) the XAMS-HC High-capacity suppressor is recommended with a 1+4 dilution of the AS1 Solution.

To make a 1+4 dilution, transfer all 100 mL of the supplied ASUREX-AS1 Solution to a 500 mL flask. Add and dilute with 400 mL Reagent Grade Laboratory Water. Mix the solution properly. Diluted AS1 Solution that is not used immediately should be stored in a plastic bottle in a cool place (ca 5-10 °C), but not below freezing.

Reagent Grade Laboratory Water is ultra-pure deionized water, free of organics, microorganisms and particulate, with a specific resistance of 18 Mohm cm<sup>-1</sup>. Do not use water on bottle unless this is optimized for ion chromatography and is specified to contain very low levels of ions. Contamination of the AS1 Solution with ions will deteriorate the low background capability of the AS1 Solution and decrease the performance of the XAMS Suppressor.

Avoid using laboratory glassware when handling Reagent Grade Laboratory Water or any solutions (including eluents and diluents) prepared for use in suppressed ion chromatography, since they will release ions and increase the background level. Instead use plastic bottles which have been washed without use of detergents and rinsed in Reagent Grade Laboratory Water before use.

## ASUREX-AR1 Cartridge

The AR1 Cartridge have three connections. The central one is used as outlet during operation. The connectors on the edge (which are identical) are used for inlet and vent, respectively. The vent is connected to an Expansion Flask to avoid pressure buildup of the circulating AS1 solution.



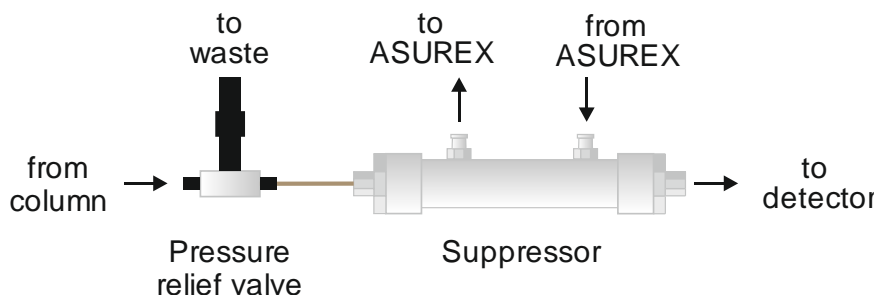
**Figure 4:** Connectors on the ASUREX AR1 Cartridge.

Since the XAMS Suppressor is a membrane device, it is not entirely impermeable to water. Due to osmotic transfer of water between the AS1 Solution and the eluent taking place over the long lifespan of the AR1 Cartridge, the volume of the AS1 Solution may decrease, or more typically, increase. This means that some solution may leave the AR1 Cartridge through the waste tubing, but this has no effect on the performance of the system. Failure to install the Vent Tubing may cause build-up of pressure in the ASUREX Regenerator. This will affect the performance and constitutes a risk for leakage and damage to equipment and is a health hazard for laboratory staff.

## XAMS Suppressor



*Always disconnect the XAMS if the separation column is being washed with solutions containing high concentrations of salt or organic solvents. The ASUREX Cartridge lifetime will otherwise be reduced and the XAMS Suppressor risks being poisoned by released contaminants.*



**Figure 5:** Connectors on the XAMS membrane suppressor and how to fit it to a pressure relief valve.

For best results, the XAMS Suppressor should be installed close to the ion chromatography column. Extensive tubing between the column and suppressor or between the suppressor and detector will lead to band-broadening of the chromatographic peaks and loss of resolution. Optimum low level of background conductivity, noise and reproducibility are achieved when the XAMS is placed in a column oven or similar compartment with controlled temperature.






If your XAMS previously has been used with sulfuric acid or other low molecular-weight acids for regeneration, it must be flushed with minimum 50 mL of ultra-pure water to avoid contaminating the AS1 solution. A contaminated AS1 solution will result in a higher background level and more noise. For further information regarding handling of XAMS, please consult its separate Instructions for Use.

## Pressure Relief Valve

It is recommended to install a 100 psi (7 bar) Pressure Relief Valve between your column and the XAMS to protect the suppressor against back-pressures.

## Tubing for the AS1 Solution

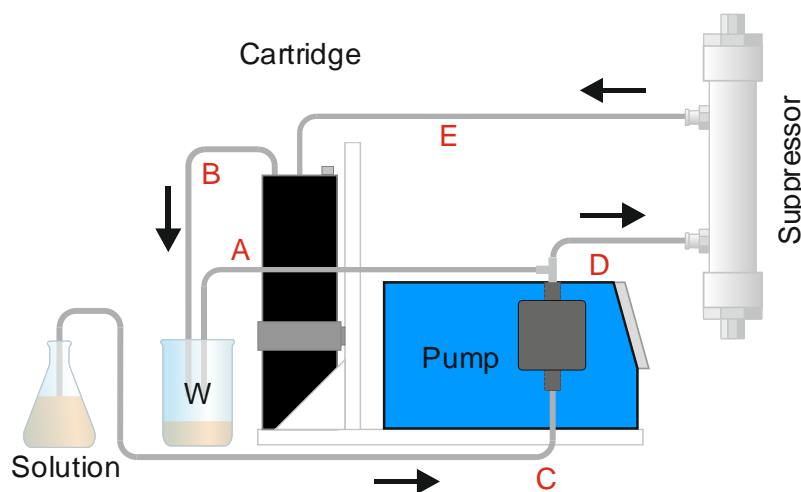
The ASUREX regenerator is supplied with pre-cut flexible tubing. Two pieces with open ends are included in the ASUREX fitting kit and three pieces with connectors in both ends are included in the XAMS installation kit.

A		0.5 m	ASUREX Fitting kit
B		0.5 m	
C		0.5 m	XAMS Installation kit
D		1.5 m	
E		1.5 m	

**Figure 6:** Flexible pre-cut tubing included with the ASUREX automatic suppressor regenerator.

## Installing and Filling the AR1 Cartridge

ASUREX-AR1 Cartridges are delivered empty and must first be filled with diluted AS1 solution. The ASUREX Pump is used for this procedure and it involves some temporary plumbing, according to the steps listed below and as shown in Figure 7. Wear protective gloves and glasses when performing the filling procedure.



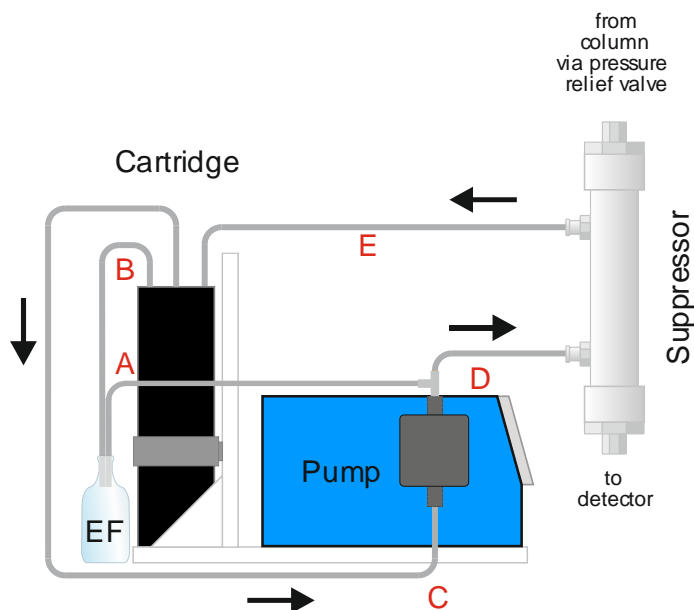
**Figure 7:** Tubing connections for filling the ASUREX AR1 Cartridge.  
Tubing A is connected from the exit of the Safety Check Valve.

1. Install the Cartridge in the holder at the rear of the Pump.
2. Connect a short open-end tubing (A) from the exit of the Safety Check Valve to a Waste bottle (W).
3. Remove the Luer Plugs on the Cartridge from the central connector and one of the edge connectors.
4. Connect a short open-end tubing (B) to the inlet (edge) of the Cartridge and place the other end in a suitable waste bottle.
5. Connect a short tubing (C) to the Pump inlet (bottom) and place the other end of the tube in the flask containing the diluted AS1 solution.
6. Connect a long tubing (D) between the Pump outlet (top) and the XAMS suppressor inlet (lower).
7. Connect a long tubing (E) between the XAMS suppressor outlet (upper) and the Cartridge outlet (centre).
8. If no XAMS is present, use a luer union to connect the two pieces of long tubing (D & E).
9. Start the Pump and let it operate until about 200 mL of the diluted AS1 solution has emerged to waste. Save the remaining approx 200 mL of diluted AS1 solution for future refilling needs. Store it in a plastic bottle cold, but not below freezing.
10. Stop the Pump.

## Starting the ASUREX Regenerator with a XAMS Suppressor



*Before you start the ASUREX Pump for normal operation, ensure that the connecting tubing are assembled correctly.*



**Figure 8:** Tubing connections during normal operation the ASUREX System. Tubing A and B are connected to the Expansion Flask (EF) from the exit of the Safety Check Valve and from the Cartridge Vent, respectively.

1. Connect the tubing according to the filling procedure if this has not been performed recently.
2. Replace the Waste bottle (W) with an Expansion Flask (EF).
3. Remove the last Luer Plug on the Cartridge from the edge connector.
4. Move the long return tubing (E) which was connected to the suppressor, from the outlet (central) connector, to the inlet (edge) connector on the cartridge.
5. Move the short tubing (C) from the bottle with AS1 solution and connect this to the outlet (central) connector on the cartridge.
6. Start the Pump and ensure the flow rate is set at a value of 80. This gives an expected flow rate of about 20 mL/min and a back-pressure in the regeneration channel below 1 bar (14 psi).
7. Flush your ion chromatography eluent pump system thoroughly with purified water if it has not recently been used for suppressed anion chromatography. Use fresh eluents and wash solutions free from organic solvents.
8. Connect the XAMS eluent inlet (top) to the tee union with a pressure relief valve (100 psi, ordered separately) and then to your separation column outlet using the supplied 0.25 mm ID PEEK tubing. The exit from the Pressure Relief Valve is connected to your eluent waste.
9. Connect the XAMS eluent outlet (bottom) to your detector.
10. Start your eluent pump and let the system equilibrate for at least 30 minutes. Monitor the baseline of your chromatography system to determine when the suppression is stable.



*Failure to install the Vent Tubing and the Safety Check Valve constitutes a risk for leakage, damage to equipment and health hazard for laboratory staff.*



## Operation

The level and stability of the background conductivity will improve during the first operating hours of a new cartridge. This baseline is monitored through your conductivity detector and ion chromatography system.

### *Air Bubbles*

During operation of the ASUREX System, air bubbles may sometimes appear within the circulating AS1 solution. This does not affect the performance of the ASUREX unless air is accumulating in the XAMS. To avoid this, the XAMS regeneration channel outlet should be positioned slightly higher than the inlet.

### *Optimum Performance*

To get the most stable background, the ASUREX System should be operated also when the eluent flow has been stopped, such as during nights. When eluent is not pumped through the suppressor, protons in the AR1 cartridge and AS1 solution are not “consumed”. The cartridge lifetime will therefore not be negatively affected by continuous recirculation.

The most optimal performance is obtained when the Cartridge is placed within the ion chromatography system compartment (column oven or similar), avoiding exposure to direct sunlight and other major temperature variations. The ASUREX-AR1 Cartridge should always be kept in an upright position during operation.

### *Temporary Storage*



*Store diluted ASUREX-AS1 solution and filled ASUREX Cartridges plugged in a refrigerator at 5-10 °C.*

Keep the ASUREX System in continuous operation during analysis even if the eluent flow is temporary stopped. However, if the ion chromatography system will not be used for a couple of days, it is recommended that the regeneration flow is stopped.

If the ion chromatography system will not be used for several weeks, it is recommended that the Cartridge is removed and plugged and that the Pump flow path is flushed with deionized water for about 10 minutes. The Pump should finally be drained by pumping air for one minute. Prolonged operation without liquid in the Pump may lead to increased wear of the internal parts and is not recommended. Failure to flush the Pump when disconnected might result in precipitation of AS1 solution and clogging of the system. Prolonged storage of filled and plugged Cartridges and diluted AS1 solution should be performed at cold temperatures (ca 5-10 °C), but not below freezing.

### *Pump Maintenance*

The ASUREX-A100 Pump is very robust and can operate many months without significant maintenance. Parts that might need to be replaced are the inlet and outlet check valves and the mechanical membrane in the pump head. Both these operations are rather straightforward and can be performed in the laboratory.

An internal glass fuse (5x20 mm, T315 mA) located behind the front panel protects the ASUREX-A100 Pump, and this fuse might thus need to be replaced if the equipment has been exposed to external power surges from the power grid.

Please contact Diduco AB or your local Xenoic® distributor for more information.

## Expected Cartridge Lifetime

Eluent cations will break through the Cartridge before it is completely exhausted and a slight increase in background conductivity and noise indicates that a new Cartridge soon need to be installed. The practically useful capacity of the ASUREX-AR1 Cartridge (0.5 L) is about 0.8 eq. Table 1 shows the expected practical Cartridge lifetime when used with some typical anion chromatography eluents.

**Table 1:** Expected practical lifetime of the ASUREX Cartridge (0.5 L) when used with some typical eluents for anion chromatography. Lifetimes at other eluent concentrations or flow rates may be extrapolated from the tabulated estimates.

Eluent Type and Concentration			Flow Rate	Estimated useful lifetime
NaOH <i>mM</i>	Na <sub>2</sub> CO <sub>3</sub> <i>mM</i>	NaHCO <sub>3</sub> <i>mM</i>	<i>mL min<sup>-1</sup></i>	Full eight-hour working days <i>ea</i>
5.0	-	-	1.0	330
10.0	-	-	1.0	165
-	1.8	1.7	1.0	320
-	1.8	1.7	2.0	160

## Disposal of ASUREX-AR1 Cartridges

The ASUREX-AR1 Cartridge housing is made from polyvinyl chloride (PVC) and the interior filling is a sulfonated polystyrene cation exchange resin. Unless you are required to recycle different types of plastics separately, we recommend that the AR1 Cartridge is thoroughly washed with water and recycled as an all-plastic waste.

## Disposal of ASUREX-AS1 Solution

The chemical composition of the ASUREX-AS1 Solution is quite similar to dishwashing detergents. This means that the solution can be safely disposed in the drain if flushed with plenty of water.

## Disposal of XAMS Suppressors

The XAMS housing is made from polyvinylidene-fluoride (PVDF) and polyether-ether-ketone (PEEK). After being thoroughly flushed with water, XAMS can be recycled as an all-plastic waste unless you are required to recycle different types of plastics separately.

## Reference

### *Reordering Information*

Please contact Diduco AB or your local Xenoic® distributor for placing your order.

Ord. No.	Description
1125-100	Xenoic® XAMS Anion membrane suppressor
1125-200	Xenoic® XAMS-HC High-capacity anion membrane suppressor
1125-711	Xenoic® XAMS Installation kit
1125-721	Xenoic® Pressure Relief Valve kit (100 psi)
1125-731	Xenoic® Pressure Optimizer kit
1810-100	Xenoic® ASUREX-A100 Automatic suppressor regenerator
1810-106	Xenoic® ASUREX-A100 Service kit for pump valve
1810-107	Xenoic® ASUREX-A100 Service kit for pump house
1810-111	Xenoic® ASUREX-A100 Fitting kit
1810-911	Xenoic® ASUREX-AR1 Cartridge (0.5 L, capacity 0.9 eq)
1810-921	Xenoic® ASUREX-AS1 Solution (100 mL to be diluted 1+4)

Instructions for Use, Xenoic® ASUREX-A100, version 1.3, 2021-07-21.

