

ELEMENTAL SCIENTIFIC INC.



Apex E Quick Installation Guide

Apex E Quick Installation Guide

© Elemental Scientific Inc.
2440 Cuming Street
Omaha, NE 68131 USA
Phone 402.991.7800 • Fax 402.991.7799

Table of Contents

1			
Introduction	4		
		5	
		Maintenance	12
		Cleaning the Apex E Flow Path	12
		Optional Acid Vapor Cleaning	15
2			
Preparing for Installation	5		
Power Requirements	5	APPENDIX 1	
Power Cord Set Requirements	5	Areo Accessory	1
Space Requirements	5	Attaching Areo Dryer to Apex E	1
ICP Requirements	5	Areo Completion Kit	1
		Interfacing to the ICP	2
		Cleaning the Areo Membrane	3
3			
Installing the Apex E	6	APPENDIX 2	
Hookup Diagram	6	ACM Accessory	1
Interfacing to the ICP	7	Power Requirements	1
Connecting the Drainage System	7	Power Cord Set Requirements	1
Controlling the Pump Speed	8	Space Requirements	1
Pressure Shoe Adjustment	8	Hookup Diagram	1
Power Supply Connections	8	Attaching ACM Module to the Apex E	2
Apex E Power Connector	8	How to Install ACM	3
Installing the Nebulizer	9	ACM Completion Kit	4
		Interfacing to the ICP	5
		ACM Power Connector	5
		Cleaning the ACM Membrane	6
4			
Using the Apex E	10		
About the Switch and Lights	10		
Start-up Procedure	11		
Shut-down Procedure	11		

1

Introduction

The Apex E is a fully-integrated inlet system for ICP that connects directly to the torch injector and incorporates ESI's industry standard MicroFlow PFA-ST or PolyPro-ST nebulizer technology. This allows the Apex E system to be configured for self-aspiration at rates from 20 $\mu\text{L}/\text{min}$ to 700 $\mu\text{L}/\text{min}$, or the sample can be pumped at flow rates over 1 mL/min for ICP-AES applications. The standard Apex E configuration is a MicroFlow ST nebulizer operating at 700 $\mu\text{L}/\text{min}$. The uniform aerosol produced by the MicroFlow ST nebulizer is conditioned by the Apex E to deliver analytes to the plasma in optimum usable form by minimizing interferences and stabilizing the signal. The Apex E's patent pending geometry and reduced memory effects produce faster rinse-out times and also allows the inlet system to be cleaned quickly and easily between applications.

The Apex E system allows analysis of corrosive samples, organic solvents and high-TDS samples while delivering a substantial increase in raw sensitivity due to a nearly 100% sample transport efficiency.

2

Preparing for Installation

Power Requirements

The Apex E is powered by a desktop power supply delivering 12VDC, 10A. This power supply, in turn, needs to be plugged into the mains supply with a requirement of 100-240VAC +/- 10%, 47-63Hz, 3.2A.

Power Cord Set Requirements

The power cord supplied with the Apex E is 2m long and meets the requirements of the country where you purchased the system. Always use approved power cords to prevent possible injury or electric shock.

Space Requirements

The Apex E can be connected directly to the injector of the ICP or by means of a length of transfer tubing. Whichever method is used there must be a 5" area surrounding the Apex E footprint that is free of any obstacles. This is needed to facilitate adequate air movement around the Apex E. The total area needed is 10"W x 20"D (25cmW x 51cmD).

ICP Requirements

Ensure the operating performance of the ICP has been observed prior to using the Apex E for the first time.

3

Installing the Apex E

Connection Diagram

The Apex E is very simple to install and can be completed in just a few minutes. Figure 1 shows a quick reference connection diagram.

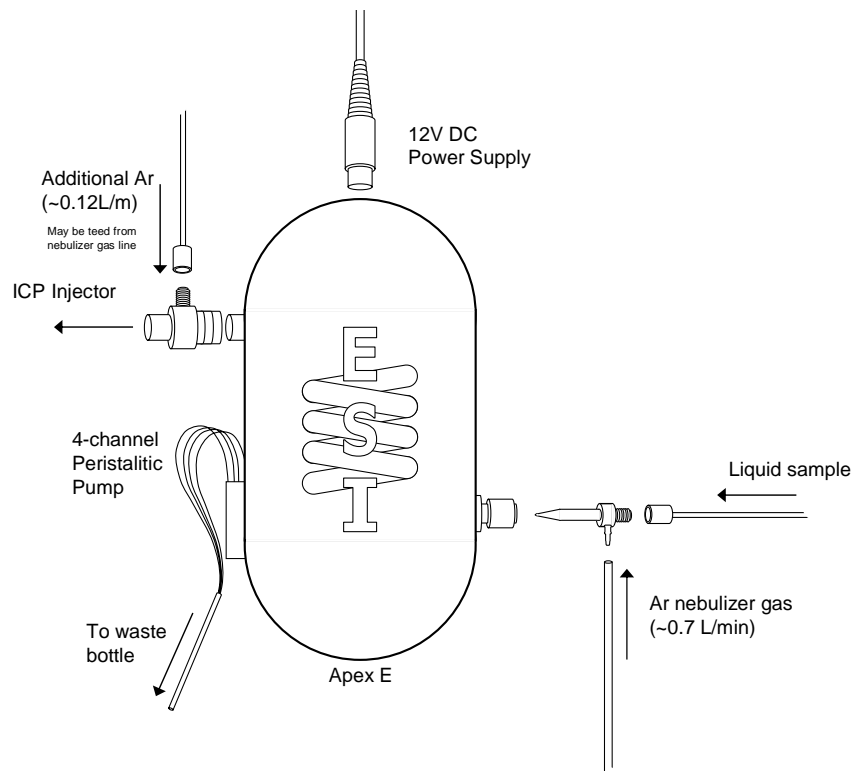


Figure 1. Apex E Connection Diagram

Interfacing to the ICP

The Apex E can either be connected directly to the torch injector or via a length of transfer tubing as shown below in Figure 2.

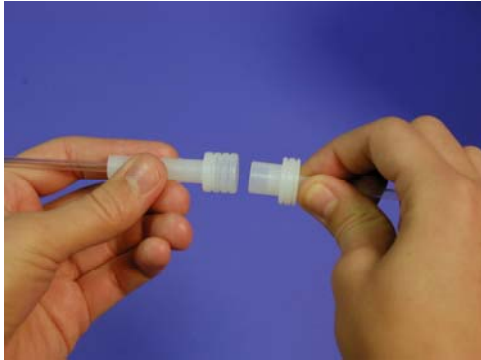


Figure 2. Connection to Injector and Apex E

Connecting the Drainage System



Figure 3. Waste Pump and Waste Lines

The Apex E system has four drain lines located on the back of the unit that connect to the pump. These lines are pressed into the barbed fittings on the peristaltic pump and can easily be removed, if needed, by pulling. During operation, observe the pump fittings to make sure there are no leaks. The tubing needs to be pushed through the barbed fittings and into the pump tubing to make a reliable connection. Place the other ends of the waste lines into an approved waste container.

Controlling the Pump Speed

The speed of the peristaltic pump can be controlled by turning the knob located just above the pump on the back of the unit. Use a slower speed during normal operation (knob should be in the half way position) and use a higher speed to quickly drain the system after a flushing rinse.

Pressure Shoe Adjustment

The pressure shoe on the pump squeezes the pump tubing together which allows the peristaltic pumping action to occur. Too little pressure on the tubing will lead to poor analytical results, while too much pressure will cause undue strain on the pump tubing causing premature wear and the need to replace pump tubing often.

Adjust the amount of pressure on the shoe by turning the adjustment screw/locking mechanism located on the lower side of the pump. Proper adjustment is achieved by tightening the screw one more turn after all channels have started to pump.

Power Supply Connections

Apex E Power Connector

Plug the 12VDC power supply into the Apex E using the 8-pin round DIN connector from the power supply. There is a locating indentation on the 8-pin connector that should be oriented upwards when trying to press the plug into the socket on the Apex E. Plug the AC power cord into the power supply and the other end into the mains power supply.

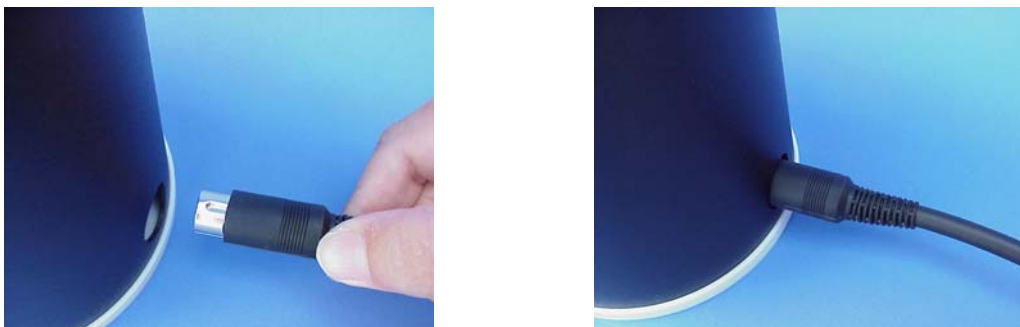


Figure 4. Connecting 12 VDC Power to the Apex E

Installing the Nebulizer

Insert the nebulizer into the inlet port nut and securely tighten. **BEWARE: Over tightening can damage the nebulizer.**

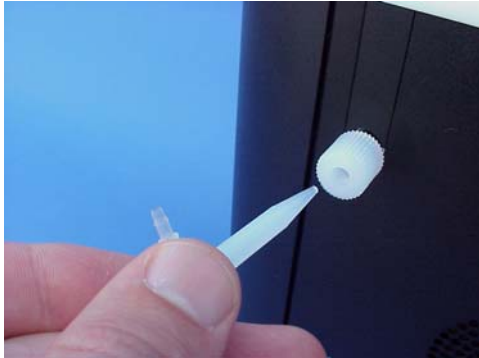


Figure 5. Attaching Nebulizer to Apex E

Attach one end of the gas line to nebulizer fitting as shown in Figure 6. Attach the other end of the nebulizer gas line to the instrument supply. Attach the ST uptake capillary to the nebulizer by firmly tightening the capillary nut onto the threaded end of the nebulizer to ensure a leak-free connection.



Figure 6. Attaching Nebulizer Gas Line and Capillary to ST Nebulizer

Using the Apex E

About the Switch and Lights

The power switch located on the front panel beside three LED lights.

I/O illuminates when the power switch is turned on.

 illuminates when the heater temperature has reached the set point.


 illuminates when the chiller temperature has reached the selected set point.



Figure 7. Front Panel of Apex E

Start-up Procedure

1. Turn the Apex E on.
2. Wait until the LED's on the Apex E are illuminated, this should be no longer than approximately 20 minutes.
3. Ignite the ICP plasma as normal.
4. Adjust the ICP operating parameters to optimize.
5. You may begin routine analysis.

Shut-down Procedure

1. Change the sample type to deionized water and nebulize for three minutes to rinse the system.
2. Turn off plasma.
3. Turn off Apex E.

Maintenance

Cleaning the Apex Flow Path

Everything needed to clean the Apex is included with your unit in the Apex cleaning kit. The kit includes (1) Apex / ACM rinse bottle, (2) solvent rinse line, (3) outlet drain tube and (4) luer adapter nut.



Figure 11. Apex cleaning kit

Important: The ACM or Spiro membrane module, if installed, must be removed prior to performing this cleaning step. Failure to do this will cause permanent damage to the ACM or Spiro.

1. Switch off the Apex and disconnect the power cord from the unit
2. Remove the MicroFlow nebulizer and close the nitrogen valve.
3. Fill the 500mL rinse bottle (1) with the desired cleaning solution.

4. Attach the drain tube (2) to the outlet port on the back of the Apex and direct the other end of the drain tube to an appropriate drain or waste container.
5. Replace the nebulizer nut with the luer adapter nut and tighten securely.



Figure 12. Preparing the Apex for cleaning the flow path

6. Attach one end of the solvent rinse line (3) to the luer adapter nut and attach the other end of the solvent rinse line to the luer fitting on the rinse bottle.



Figure 13. Attaching Rinsing Bottle to Apex

7. Turn the Apex upside down, this ensures there will be no air gaps when the unit is filled with cleaning solution.
8. Hold the rinse bottle upside down and squeeze the cleaning solution into the Apex until liquid starts to exit through the outlet port. Let the cleaning solution stand in the flow path for a brief period of time.



Figure 13. Rinsing the Apex

9. Turn the Apex back to its correct position, remove the rinse inlet line & allow unit to drain out by gravity. Drain or dispose of the cleaning solution accordingly.
10. Flush the Apex with deionized water in the same way described in steps 3 –9.
11. Restore power to the Apex, turn on the heater and turn the peristaltic pump to maximum speed to remove the remaining water through the drain lines.

Optional Acid Vapor Cleaning

From time to time it may be necessary to perform a more aggressive cleaning procedure to obtain low blank levels. This is described here.

1. Place the Apex upside down and attach the solvent drain tube to the outlet port of the Apex, direct the other end of the solvent drain tube to an appropriate drain or waste container. Attach the rinse line to the inlet.
2. Inject 10mL strong acid into the spray chamber inlet port.

CAUTION: Ensure unit is placed in a fume hood to prevent acid vapors entering the laboratory atmosphere

3. Cap (4) the inlet port to prevent leaking and turn the heater on (Setting 1) with the peristaltic pump at the lowest setting.



Figure 14. Inlet port cap

4. Allow the Apex to heat overnight.
5. Taking care, return the Apex to its correct position, remove the inlet cap, and allow the unit to drain out via the peristaltic drain pump.
6. Rinse the Apex with deionized water following steps 3 - 11 in Cleaning Apex Flow Path described earlier.

APPENDIX 1

Areo Accessory

The Areo microporous Nafion membrane dryer accessory for the Apex E performs on-line removal of residual water vapor from the sample aerosol stream exiting the Apex E inlet system. The Areo may also be useful for removing certain hydrocarbon solvent vapors, such as methanol, from the sample aerosol stream. Solvent vapors pass into the Nafion membrane, are transported through the membrane wall, and are removed by a counter current sweep flow of a dry gas such as nitrogen or argon. The sweep gas does not pass through the membrane or enter the sample aerosol stream, it simply serves to receive solvent vapor molecules that pass through the membrane. A wide range of sweep gas flows may be used, but typically a flow of 2 to 3 L/min will be adequate.

Attaching Areo Dryer to Apex E

Attach the Areo membrane dryer unit to the Apex E by pressing the inlet connector of the Areo onto the outlet tube of the Apex E.



Figure 13. Attaching Areo Dryer to Apex E

Areo Completion Kit

The Areo completion kit includes everything needed to tie into the existing gas line. Included is a pressure regulator, shut-off valve, tee, and custom flow restrictor that when connected as shown will deliver the proper flow of sweep gas. Adjust the pressure regulator to approximately 2 Bar to achieve a flow of about 3 L/min. See figure 11 for flow rates vs. pressure to adjust to other flow rates. Once set you can tighten the locking ring to prevent changes in flow rates and simply use the shut-off valve to turn the flow off when not in use.

Connect the “Sweep Gas In” line from the Areo to the pressure regulator that is supplied with the unit. There are a couple of ways to connect the other end of the pressure regulator: one is to connect directly to a gas bottle; and the other is to tee into an existing gas line.

Next route the “Sweep Gas Out” from the Areo to an appropriate vent.

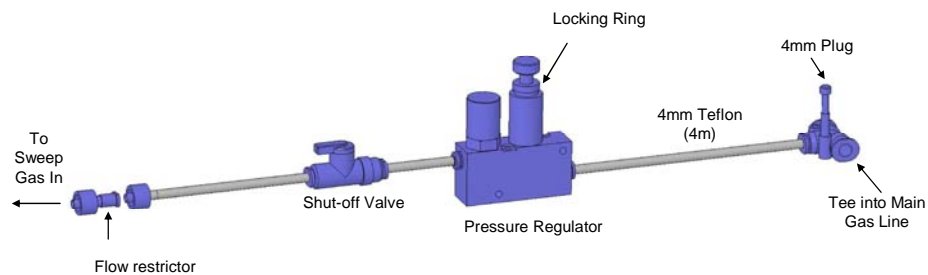


Figure 14. Areo Completion Kit

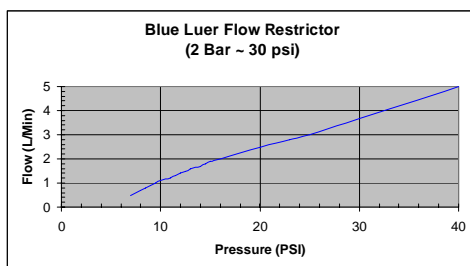


Figure 15. Flow Rate vs. Pressure

Interfacing to the ICP

The Areo can be interfaced to the injector by a length of transfer tubing or directly connected to the ICP injector should the configuration of the ICP allow.

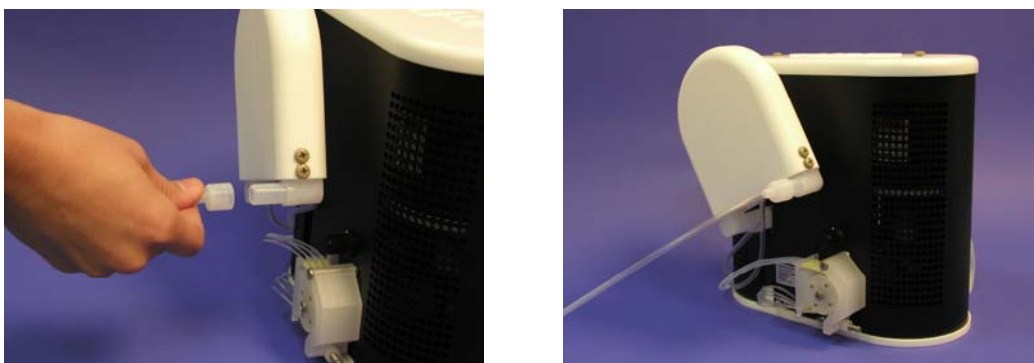


Figure 16. Connecting the Areo

Cleaning the Areo Membrane

Should the Areo membrane require a more thorough cleaning, perform the steps listed below:

1. Disconnect power from the Apex E unit.
2. Remove Areo from Apex E.
3. Attach the Areo rinse connector to the rinse bottle.
4. Fill the 500mL rinse bottle with a cleaning solution, i.e. 10% HNO₃.
5. Connect the rinse bottle to the Areo membrane unit by pressing the Areo rinse connector into the Areo membrane unit.
6. Place the exit of the Areo over a sink and transfer the cleaning solution into the Areo membrane by squeezing the bottle.
7. Drain the cleaning solution.
8. Attach the Areo membrane unit back onto the Apex E and connect all tubing and drain lines.
9. Power on the Apex E and turn on the sweep gas to allow the membrane to dry.
10. The unit will be ready for use in about 10 minutes.

APPENDIX 2

ACM Accessory

The Actively Cooled Membrane module (ACM) uses a Nafion membrane, which is Peltier-cooled, to increase the ability to further remove water vapor from the sample aerosol stream exiting the Apex E system. Because of the Peltier-cooling, the ACM performs better than the Areo providing oxide ratios of .05% or less.

Power Requirements

The ACM is powered by a desktop power supply delivering 12VDC, 6.6A. This power supply, in turn, needs to be plugged into the mains supply with a requirement of 100-240VAC +/- 10%, 47-63Hz, 1.9A.

Power Cord Set Requirements

The power cord supplied with the Apex E is 2m long and meets the requirements of the country where you purchased the system. Always use approved power cords to prevent possible injury or electric shock.

Space Requirements

The addition of the ACM requires the system to be connected to the injector by a length of transfer tubing. The total area needed for the addition of the ACM is 15"Wx20"D (38cm x 51cmD).

Connection Diagram

Figure 13 below shows a quick reference connection diagram.

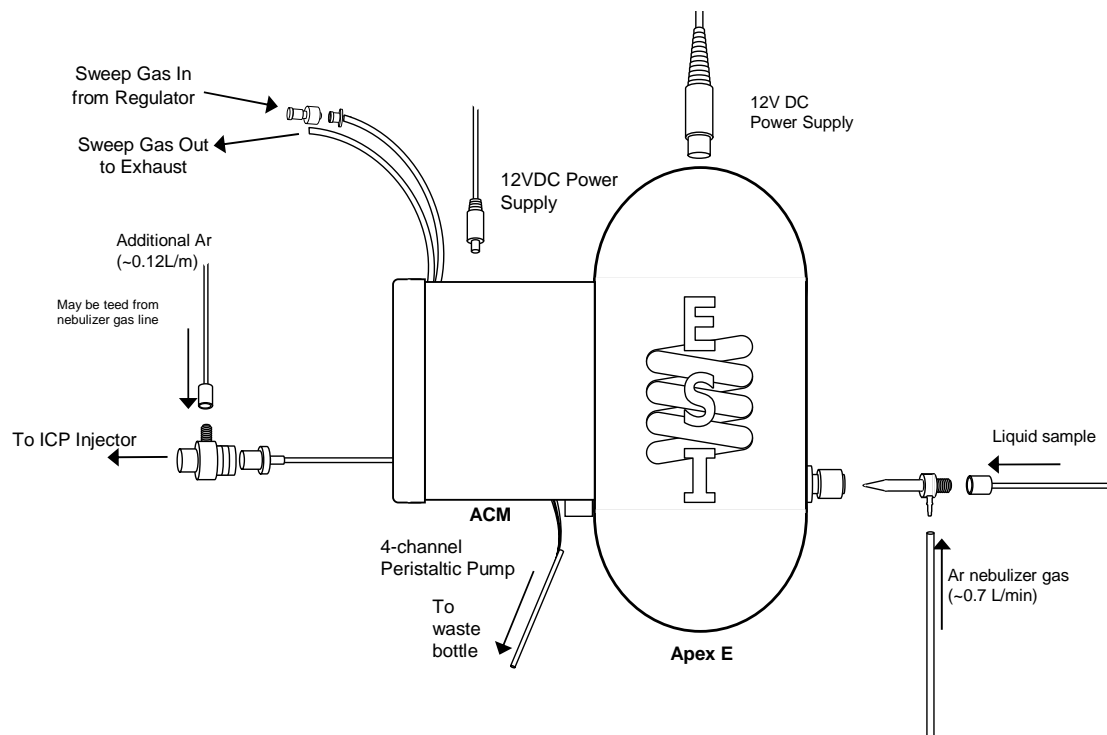


Figure 17. Apex E with ACM Connection Diagram

Attaching ACM Module to the Apex E

The ACM attaches to the Apex E by mating the Teflon fitting on the back of the ACM to the chiller inside the Apex E, aligning the mounting pins with the keyhole openings on the ACM, and pushing the ACM downward onto the Apex E. The completed assembly is shown below in Figure 14.



Figure 18. ACM Attached to the Apex E

How to Install ACM

To attach the ACM to the Apex E, first insert the right angle Teflon fitting, located on the back of the ACM, into the slot on the back of the Apex E. At the same time align the two keyhole openings on the back of the ACM with the two mounting pins on the back of the Apex E.



Figure 19. Aligning ACM with Apex E and Pushing Downward



Figure 20. Keyhole Slot on the Back of ACM and the Mating Connector on the Apex E

Hold the Apex E steady with one hand and use the other to push the ACM downward approximately .4" (10mm)

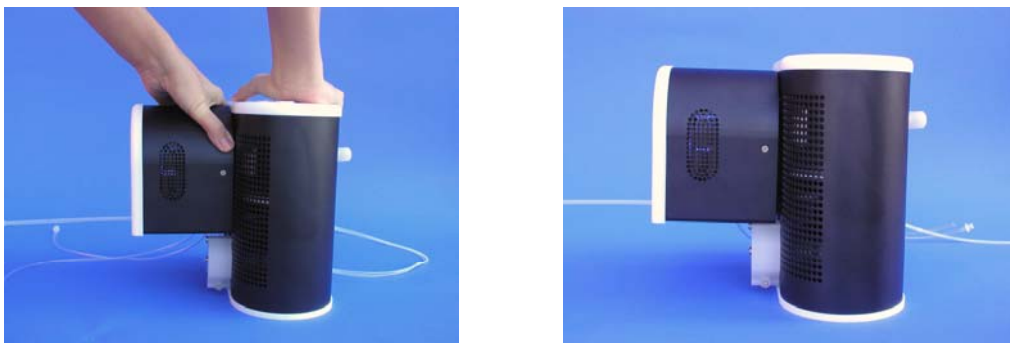


Figure 21. Pushing Downward to Attach ACM to Apex E

ACM Completion Kit

The ACM completion kit includes everything needed to tie into the existing gas line. Included is a pressure regulator, shut-off valve, tee, and custom flow restrictor that when connected as shown below will deliver the proper flow of sweep gas. Adjust the pressure regulator to approximately 2 Bar to achieve a flow of about 3 L/min. See Figure 19 for flow rates vs. pressure to adjust to other flow rates. Once set you can tighten the locking ring to prevent changes in flow rates and simply use the shut-off valve to turn the flow off when not in use.

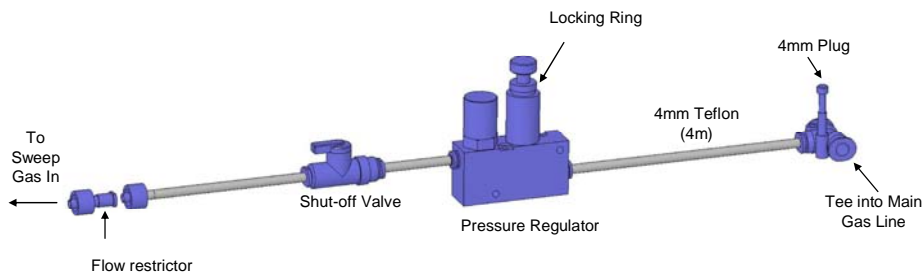


Figure 22. ACM Completion Kit

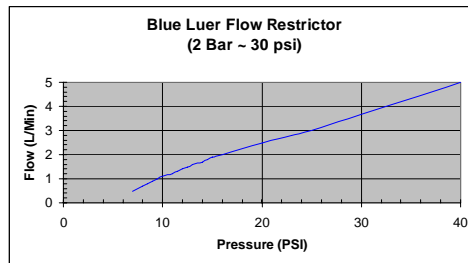


Figure 23. Flow Rate vs. Pressure

Connect the "Sweep Gas In" line from the ACM to the custom flow restrictor provided with the unit. Next route the "Sweep Gas Out" from the ACM to an appropriate exhaust.

Interfacing to the ICP

The ACM can be interfaced to the injector by a length of transfer tubing and connector that is supplied with the instrument.



Figure 24. ACM with Injector Connector

ACM Power Connector

Plug the 12VDC power supply into the ACM using the 2.5mm plug from the power supply. Plug the AC power cord into the power supply and the other end into the main power supply.

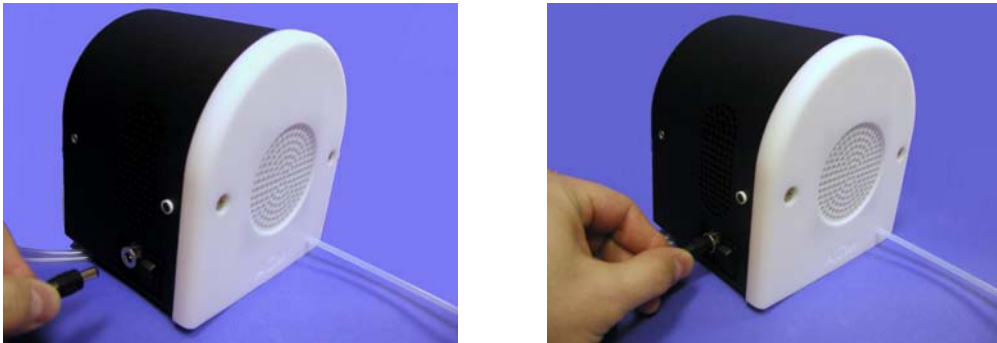


Figure 25. Connecting 12 VDC Power to the ACM

Cleaning the ACM Membrane

Should the ACM membrane require a more thorough cleaning, perform the steps listed below:

1. Disconnect power from the Apex E unit and ACM module.
2. Remove ACM from Apex E.
3. Attach the ACM rinse connector to the rinse bottle.
4. Fill the 500mL rinse bottle with a cleaning solution, i.e. 10% HNO₃.
5. Connect the rinse bottle to the ACM module by pressing the ACM rinse connector into the ACM membrane unit.
6. Place the exit of the ACM over a sink and transfer the cleaning solution into the ACM membrane by squeezing the bottle.
7. Drain the cleaning solution.
8. Attach the ACM module back onto the Apex E and connect all tubing and drain lines.
9. Power on the Apex E and ACM and turn on the sweep gas to allow the membrane to dry.
10. The unit will be ready for use in approximately 10 minutes