

# **Particulate Matter 2.5 Speciation QA Plan**

## **Section I**

### **Electronic Calibrations Branch**

#### **(ECB)**

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**AMBIENT PM 2.5 CHEMICAL SPECIATION  
SAMPLER  
MET ONE MODEL SUPERSASS**

**1.0 General Information**

**1.1 Introduction**

Met One Instruments developed the SuperSASS (Speciation Air Sampler System) chemical sampler under contract from the United States Environmental Protection Agency (USEPA) for the purpose of collecting samples for the chemical and gravimetric analysis of ambient air PM<sub>2.5</sub> particles (airborne particles with diameters smaller than 2.5 micrometers ( $\mu\text{m}$ )). These particles are comprised of sulfates, nitrates, organic carbon, soot-like carbon and metals.

**1.2 Specifications**

The SuperSASS can accommodate eight (8) sampling canisters used in groups of up to four, each with active flow control. Each individual canister has its own PM<sub>2.5</sub> sharp cut cyclone (SCC) inlet, denuder ring and tandem 47 mm FRM filter holders. As such, each canister contains all necessary components for excluding particles above 2.5  $\mu\text{m}$ , for removing interfering gases, and for collecting ambient fine particles.

The canisters are mounted in a wind aspirated radiation shield that maintains sampler temperature close to ambient. Inlets are approximately 72 inches above the ground. The sample flow rate is controlled at 6.7 L/min per canister depending on filter media and denuder material pressures.

The PM<sub>2.5</sub> separation is produced by the SCC, which removes both solid and liquid coarse particles with equal efficiency without the use of impaction grease or oil. The denuders are multi-cell configured, 25mm in length, and are housed in a 47mm O.D. aluminum sleeve. The nitric acid denuder is made of aluminum with 350 parallel, hexagonal channels, and is coated with Magnesium Oxide. Empty sleeves are used when sampling doesn't require the use of a denuder.

The filter size used in the sample canister is 47 mm O.D. Each canister can hold either one or two filters in tandem. The collection media used for each canister varies, depending on the types of analysis to be performed. The FRM designed cassettes are used with the speciation filters.

The SuperSASS contains a solar and heat radiation shield that is designed to maintain the samples at near ambient temperature. The temperatures for both the sample filter and the ambient air are logged throughout the sampling period. The filter temperature is measured immediately downstream of the filter media in each canister.

The SuperSASS is standard with four active volumetric flow controllers. Each sampling line has a check valve to shut off the flow if the sampling line is not used, or for performing a dynamic field leak check. Volumetric flow rate measurement is made independently for each of the active flow channels, displayed instantaneously and logged with five-minute averages. Flow rate errors are flagged both on the display and in the data logger. Volumetric flows are measured and recorded with four independent electronic mass flow sensors. The mass flow sensors in conjunction with ambient temperature and barometric pressure readings are used by the control unit microprocessor to calculate the actual volumetric flow. This provides site-specific flow measurements so no correction is needed for true volumetric readings.

All routine maintenance can be done in the field. Sampling canisters are transported to the EPA contract laboratory for inspection, cleaning and changing of sampling substrates. Every element of the sampler that is contacted by the sampled air stream ahead of the filter, including the inlet can be cleaned with each sample change. This approach eliminates possible contamination problems.

### **1.3 Technical Description**

The SuperSASS sampler is shown in Figure 1. 1. There are eight possible canister positions mounted within the solar radiation shield, each being selectively controlled to collect particles 2.5 $\mu$ m or less. Canisters may be equipped with a diffusion denuder ahead of the filter to remove selected gaseous compounds. The SuperSASS has individual SCC inlets.

A set of eight (8) solenoid valves is used to select which of the canisters are used during each test sequence. Vacuum lines for each orifice leads to an electronic mass flow monitor. The lines are then connected to a common manifold. A vacuum line from the manifold leads to the pump, which is housed in a fan-ventilated box.



Figure 1.1 Assembled SuperSASS Sampler

## **2.0 ASSEMBLY**

### **2.1 Unpacking, Inspection and Parts Inventory**

The SuperSASS is shipped in five (5) cardboard boxes. The contents of each individual box are listed in Attachment 1. Each box should be opened and its contents visually inspected for obvious damage from shipping. If items are missing or damaged, Met One Instruments, Inc. should be notified immediately so as to assure that the proper parts are received for installation.

### **2.2 Assemble the Unit**

#### **2.2.1 Tripod**

The SuperSASS tripod comes as an assembled item. Upon removal from the shipping container, the 3 ringed pins from the tripod leg brackets are removed and the legs folded down. The pins are then reinserted to hold the legs in position. Holes are provided in the tripod feet and commercial hardware can be used to anchor the tripod to the sampling site. It is recommended to use spikes driven through the tripod mounting feet. Due to lack of cable length, running from the pump box to the tripod, it will be necessary to place the tripod as close to the FRM platform as possible. The sampler must be installed at a minimum distance of 1 meter from intake to intake from the FRM sampler and 2 meters from the PM10 sampler.

#### **2.2.2 Head Assembly**

Locate the complete head assembly (Box 5) and remove from shipping container. Place the head assembly on the floor with the solar shield down. Remove the bottom shield by pulling up. Inside is the canister mounting of the upper shield. There is a gray PVC shipping tube that needs to be removed from the center of the sampling head assembly. It is used only during shipping, and is no longer required as part of the installation of the sample head. Once PVC tube is removed, place the detached portion of the bottom shield onto the tripod mast, sides pointing upward. Allow the bottom shield to rest on the mast. Unwind the cable of the upper shield. Using the assistance of a second person feed the cable and electrical wires into the mast until all has been pulled through to the bottom. As the cable reaches the bottom of the mast place the upper shield onto the top of the mast. Use the 8-32 x 3/16" long socket-head screws to secure the upper shield in place, as shown in Figure 2.1. These screws provide upper and lower shield orientation. Next, tighten the setscrews of the upper shield to secure to the mast. Raise the bottom shield while aligning the slot with

screw head in mast and pin in place. Leave head assembly in this position (Figure 2.2) while installing the next portion of the unit.



Figure 2.1 Head Assembly Mounting Screws



Figure 2.2 Head Assembly

### 2.2.3 Control Unit

Locate the control unit (Box 1), and remove from the shipping container. Locate the two metal U-Bolt hardware clamps that have been provided. Using a wrench or a 7/16" socket, connect the control unit to the lower portion of the mast, just above the top of the tripod legs. Proper orientation of the control box is with the hinged side of the box facing the left (from the front) and in the middle of two legs of the tripod. Once the unit is positioned, tighten the U-Bolt clamps. See Figure 2.3 for mounting details.



Figure 2.3 Control Unit and Temperature Sensor Assembly

### **2.2.4 Temperature Sensor**

Locate the temperature sensor (Box 1) and remove from shipping container. The sensor is mounted just above the control box, about 3 inches above the lower control unit U-Bolt, facing the opposite direction (see Figure 2.3). The sensor is mounted using the one U-Bolt and two 7/16" nuts with washers that have been provided. The sensor should be mounted on the mast with the flat top plate facing up and the cable connector facing the ground. The top of the shield should be about the same level as the top of the control box. This will allow the bottom shield of the sampling head to be lowered without hitting the top of the temperature shield.

Attach the cable and connector to the ambient temperature sensor from the pump control box. The cable is labeled Amb. Temp. (8838-6). It is impossible to misconnect the cable since the connections are keyed.

### **2.2.5 Pump Box**

Locate the pump box (Box 3) and remove from shipping container. The dual diaphragm AC vacuum pump is contained in its own environmental shelter isolated from the SuperSASS to prevent vibration, noise, heat and any potential of exhaust contamination. The vacuum pump is a dual head Thomas Co.<sup>TM</sup> diaphragm vacuum pump mounted with four bolts through the bottom of the cabinet.

The pump box contains a filter screen under the pump and an aspiration fan on the side. Heat is exhausted from the box by pulling ambient air in the base and through the fan and exhausting on the right. The pump will be located in a position that is close to the base of the tripod. The pump box ideally will be secured to the existing FRM platform, given there is ample room to keep the minimum 1-meter distance intake to intake from the FRM sampler. If securing to the existing platform is not possible, a smaller version of the platform will be constructed specifically for the pump box alone. The platform should be a minimum of 12" x 18", and should be approximately 1.5 to 2 feet high. This will increase the accessibility of the pump box by the technicians to perform routine maintenance. The pump box can be mounted using ¼" bolts or lag screws to the platform. The pump box will ultimately be located as close to the tripod as possible.

The pump box contains three cables. One is the 110VAC 60 HZ power cable, which is connected to the AC grounded service. The second is a signal cable with a screw type connector that attaches to the ambient temperature sensor. The third cable from the bottom of the pump box (labeled 8833) connects to the center connector on the bottom of the control

unit. Once this cable is inserted rotate the outer ring on the front of the connector to lock it in place on the control unit. A multi-pin connector on the side of the pump box connects to a multi-conductor cable that runs down the center of the mast from the sampling head assembly (gray cable, 8896).

Although the SuperSASS allows for eight (8) sampling channels, only the first three will be used. The upper shield of the assembly head has labeled channels, 1 through 8. Channels 1, 2 and 3 will be used primarily for sampling. Although the remaining five channels will not be used on a regular basis, they may be used during long holiday seasons such as Thanksgiving and Christmas, or any other special circumstances which may arise. Regardless, all eight channels will be calibrated upon setup and then annually. Only the 1, 2 and 3 channels will be verified monthly and audited quarterly. In the event it becomes necessary to use any of the other channels, a verification of temperature, pressure and flow should be performed prior to sampling.

There are only four flow controllers for the SuperSASS. The same four are used for all eight channels. The sampler will run channels 1 through 4 simultaneously or channels 5 through 8 simultaneously. This means that, if for some reason one channel in the first group of four are not functioning properly, then the corresponding channel in the last group of four will also not function properly. For example, if channel 3 is not functioning properly, neither will channel 7.

### **2.2.6 Channel Cables**

Each channel has its own individually identified cable that runs down the center of the mast. Connect all eight cables to the corresponding position on the pump box (cable #1 connects to valve #1, etc.). A Quick-Disconnect valve on the side of the pump box connects each cable. Secure the cables to the tripod leg with tie wraps or electrical tape.

### **2.2.7 System Ground**

The SuperSASS is equipped with a heavy green/yellow ground cable that should be connected to a nearby earth ground rod. It is recommended that one leg of the tripod also be grounded to the same earth ground used to ground the pump box. For maximum effectiveness, a copper cable of AWG # 6 or larger should be used to ground the tripod. The AWG cable is not provided.

### **3.0 Initial Setup and Operation of the SuperSASS Sampler**

#### **3.1 Canister Assembly and SCC Installation**

In order to check the operation of the SuperSASS, blank filters must be loaded into the canisters that will be used for the system check. Remove the two yellow caps from both ends of the canister. The canisters are secured with three socket head cap screws, ¼" -20 x 5/9" lg. Unscrew all three using a long Allen wrench. Once the screws have been removed, lift the upper portion of the canister to expose the two filter cassettes and the denuder sleeve. Place 47mm Teflon filters into each cassette and place back onto the canister bottom. Referring to Figure 3.1, replace the contents of the canister in the appropriate order, with filter surfaces facing away from the screws. After all contents have been replaced, lower the upper portion of the canister back onto the bottom portion, and secure with the three screws.

The fixed shoulder screw at the top of the sample canister will hold the SCC in place. Do not loosen or remove this screw. Referring to Figure 3.1, insert the SCC into the sample canister and twist so that the bracket slides under the shoulder screw. A light coating of silicone grease can be applied to the two O-rings on the SCC for easier installation. The sample canister is now complete and ready to be used in the systems check.

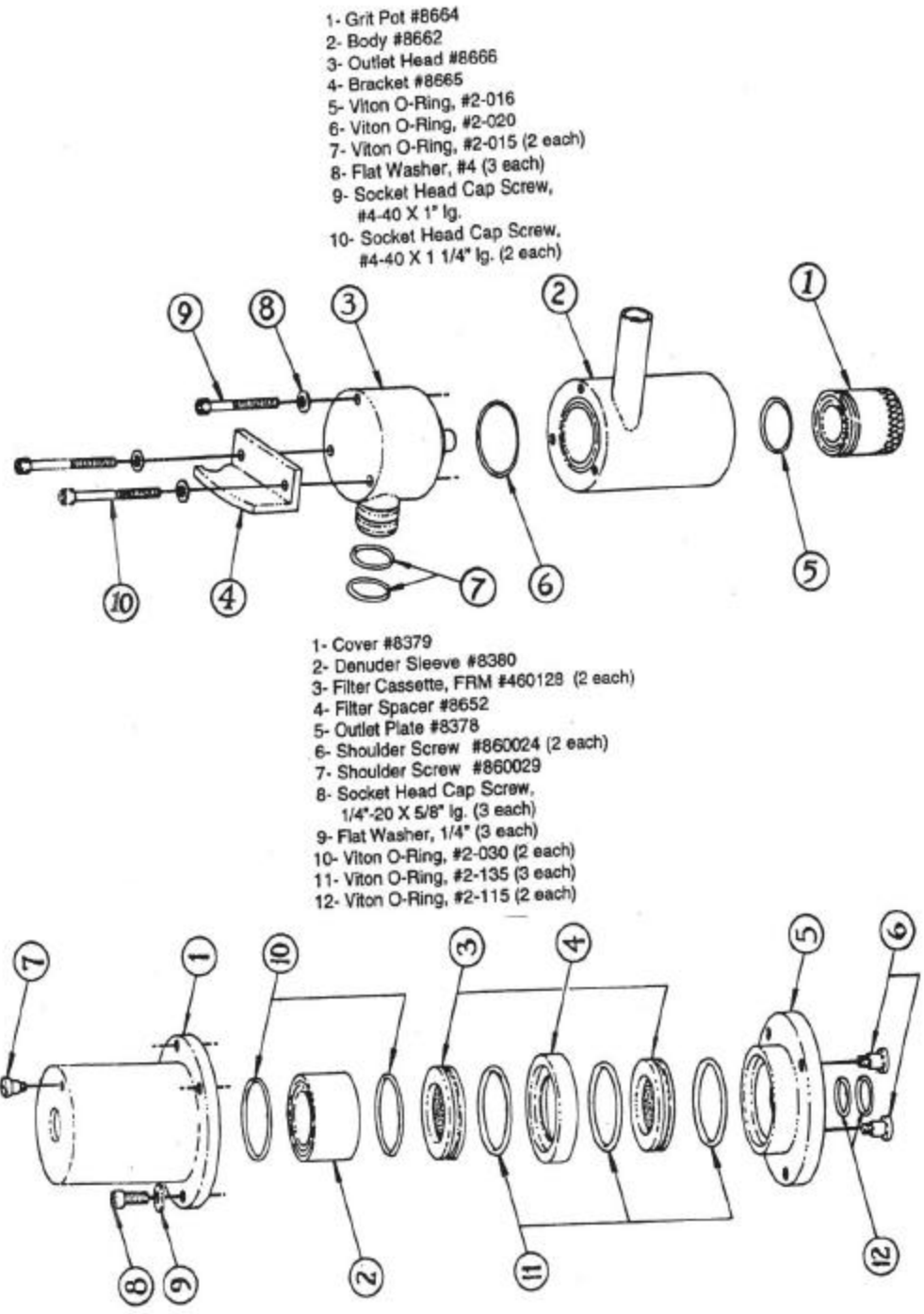


Figure 3.1 Sharp Cut Cyclone (SCC) and Canister Assembly

### 3.2 Operational Checkout of System

Before the system check can begin, sample canisters must be loaded into each sampling channel to be used. Each operator will have three canisters for use in verifications, audits and calibrations. For yearly calibrations, it will be necessary to calibrate each channel. Therefore, the procedures will have to be performed three different times. Channels 1-3, channels 4-6, and finally channels 7 and 8. For monthly and quarterly checks, only channels 1-3 will be checked. Each canister has a pair of mounting shoulder bolt posts and a vacuum connection with O-rings. Insert the posts into the inlet assembly and twist to the right until locked into position. Each canister has an alignment mark that should be pointing out and away from the tripod mast. The mark should approximately align with the channel number above the canister. A light coating of silicone grease can be used on the canister O-rings for easier installation.

Once the SuperSASS has been powered, the pump fan in the pump box should be detected operating and the LCD display of the Control unit should illuminate. There is no on/off switch. The Control unit's main screen menu will be displayed as below in Figure 3.2. The LCD display can be adjusted according to brightness by pressing the \* key on the Control Unit keypad. Continued pressure on the key will lighten or darken the LCD display.

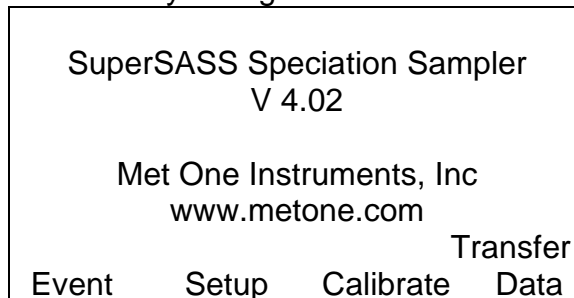


Figure 3.2 Main Screen Display

As part of the preliminary setup and checkout of the SuperSASS, the following process can be used to verify the operation of the unit. To insure that the system has been correctly assembled, there are no leaks, and that there has been no damage to the unit use the following procedure.

#### 3.2.1 Temperature, Pressure and Flow Test

From the main menu, select the "Calibrate" function at the bottom of the screen. From the next screen menu, select the "System Test" by pressing the FI key. The System Test menu will be displayed on the LCD as shown in Figure 3.3.

System Test		MM/DD/YY HH:MM:SS	
Ambient P	745 mmHg	Ambient T	24.4 C
Flow 1	.0 LPM	Filter 1	24.2 C
Flow 2	.0 LPM	Filter 2	24.3 C
Flow 3	.0 LPM	Filter 3	24.2 C
Flow 4	.0 LPM	Filter 4	24.2 C
Pump: ON			
Cans		Pump	Exit

Figure 3.3 System Test Screen

This screen displays the current ambient temperature, the current temperature of the filters in the sample head, and the current absolute barometric pressure in mmHg. The filter temperatures and the individual channel flow values are displayed in two groups of four. Temperature and pressure will be displayed simultaneously for channels 1 through 4. Pressing the "Cans" in the bottom left hand corner of the screen will change the display to read the temperatures and flow values of channels 5 through 8. These screens will toggle back and forth by pressing the "Cans" button. The values for flow should read 0.0 LPM for all channels. If the values displayed for temperature or barometric pressure are obviously incorrect, check to verify that all connections have been made and the connectors from the pump box are installed.

Press the "Pump" button. This will bring up a caution screen that reads "Press 'Continue' to STOP the sample event and control the pump". Pressing the "Continue" button will activate the pump and you should immediately hear the pump start inside of the pump box. (The pump will activate automatically if the temperature inside the pump box reaches below 35° F, so that there is no possibility of the pump not starting correctly in cold weather). Once the pump has started, allow several seconds for the flow readings to stabilize. The values for all canisters should be between 6.6 and 6.8 LPM of flow. Channels with no canisters installed will have flow values of 0.0 LPM. If flow values are far outside this range, check the trouble shooting and maintenance information contained in section 6.0 of this QA plan.

### 3.2.2 Leak Check of System

Allow pump to run for a few minutes, or until a stable flow reading is obtained. Press the Leak button to put the unit in leak test mode. This turns OFF the motor control to the flow control valves. While pump is operating and flow values are being displayed on the screen of the control unit, use a yellow plastic cap and block off the inlet tube of the SCC of canister # 1. The flow value for canister #1 should drop to 0.0 or 0.1 LPM, indicating that there are no leaks in the components of the first canister. Continue this procedure

for each of the eight channels, using the "Cans" button to toggle the screen of the control unit between the first four channels and the last four channels. Any channel reading higher than 0.1 LPM indicates that there is a leak in that portion of the system. Refer to the troubleshooting and maintenance information in section 6.0 of this QA plan.

#### 4.0 System Verification and Calibration

Using a set of NIST traceable standards for volumetric flow, barometric pressure and temperature, the SuperSASS can be easily calibrated using the calibration screens in the control unit. From the main menu, select the "Calibrate" key. The following utility menu will be displayed.

Calibrate Menu
F1: System Test
F2: Flow Calibration
F3: Temperature Calibration
F4: Pressure Calibration
F5:
F6:
Exit

Calibrate Menu

It is necessary to perform the temperature and pressure checks and calibrations before performing the flow calibration.

#### 4.1 Temperature

Select the F3 key from the calibration menu. This will bring up the Temperature Calibration screen. Use the arrow keys to select the correct temperature in the upper left-hand corner of the screen. The screen should be in the "Ambient Temperature Calibration" mode.

(0) Ambient Temperature Calibration				
SASS	Pt	Save	Reference	
23.6	1	-30.0	-30.0	Save (F1)
	2	50.0	50.0	Save (F4)
Calibrate			Default	Exit

Display Screen for Temperature Calibration Menu

The number in parenthesis in the upper left-hand corner of the screen represents the current temperature being displayed. (0) represents ambient

temperature while the filter temperatures are denoted 1 through 8, depending on which channel is being viewed at the time. By placing the cursor in the parenthesis position, you can scroll through all temperature options.

Compare the SuperSASS temperature reading to that of a NIST traceable reference temperature device. Place the reference device near the temperature sensor of the SuperSASS, and allow time to stabilize. The readings should compare at  $\pm 2^{\circ}$  C of one another to satisfy verification limits. If readings do not compare within this tolerance, follow the instructions to perform the one-point calibration. After calibrating, recheck to see that the values now fall within the tolerance.

#### **4.1.1 One-Point Temperature Calibration**

Using a NIST traceable reference temperature device, obtain a stable temperature reading next to the SuperSASS temperature sensor. Place the cursor in the position of the "Reference" value for Pt 1. Using the arrow keys, enter the value measured by the reference device. Press F1 to save the value. After saving the value press the "Calibrate" key. The ambient temperature has now been calibrated.

Using the arrow keys, move the cursor back to the parenthesis position and change to "Filter Temperature Calibration". Perform the same one-point calibration on all eight channels. These calibrations will be performed yearly, unless values fall outside of the tolerance during any monthly verification. In that instance, calibration will be required.

## **4.2 Pressure**

Select F4 from the "Calibrate Menu". This screen shows the current barometric pressure observed by the SuperSASS. It is necessary to have a NIST traceable reference device. The reading from the reference and the SuperSASS should be within  $\pm 10$  mmHg of the reference pressure device to satisfy verification requirements. If at any time the value should fall outside of this tolerance, a two-point calibration will be required.

### **4.2.1 Two-Point Pressure Calibration**

From the Utility Menu press F4 for the Pressure Calibration Menu. Comparing the SuperSASS pressure measurement with a reference barometer can make a preliminary check. If the SuperSASS does not compare to within  $\pm 10$  mmHg, calibration is necessary.

Pressure Calibration				
SASS	Pt	Save	Reference	
760	1	600	600 mmHg	Save (F1)
	2	800	800 mmHg	Save (F4)
Calibrate			Default	Exit

Display Screen for Pressure Calibration Menu

A pressure calibration requires a NIST traceable reference pressure device, a syringe, some tubing and a tee. Refer to Figure 4.1 for the pressure test setup. Refer to Figure 4.2 for location of the pressure test port. The cover of the pump box must be removed to reach the pressure test port.



Figure 4.1 Pressure Test Setup

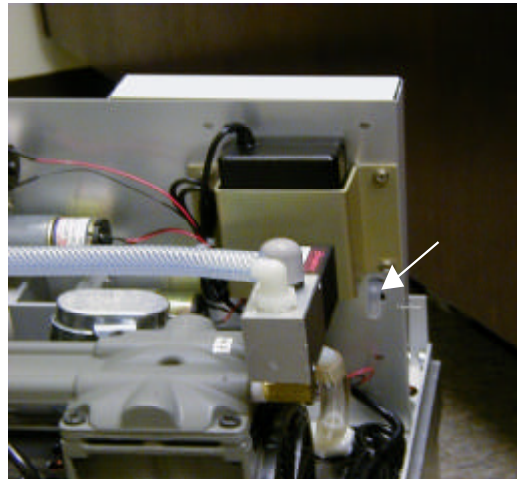


Figure 4.2 Pressure Test Port  
inside of pump box

Connect the syringe to the tubing shortest in length and the long tubing to the pressure test port of the SuperSASS. The syringe is used to change the pressure inside the tubing from below ambient to above ambient. Verify that the syringe is able to adjust the pressure to 600 and 800 mmHg. Adjust the length of tubing to provide the necessary adjustment.

Follow the procedure outlined below to calibrate for pressure.

- Set the simulated pressure value to 600 mmHg as measured from the reference pressure sensor. When the measurement is stable, enter the value measured from the reference by moving the cursor to the top reference window position and entering the value. When completed press F1 to save value.

- Now set the simulated pressure value to 800 mmHg as measured from the reference sensor. When the measurement is stable, enter the value measured from the reference by moving the cursor to the second reference window position and entering the value. When completed press F4 to save value.
- Now press the "Calibrate" key and the new values will be saved in the memory of the control unit.
- Re-check the pressure to the reference pressure device and verify that the values are within the  $\pm 10$  mmHg tolerance. If test fails after two times, a new pressure sensor may be required. If a new sensor is installed set the replacement sensor using the "Default" menu selection. This will return to the original measurement factors.

Remove the test setup and log results in the on site maintenance log.

### 4.3 Flow Verification and Calibration

Press F2 from the calibration menu. This will display the "Volumetric Flow Calibration" screen. It is necessary to have a NIST traceable reference flow device, along with the adapter for the SCC inlet. Follow the sequence below to verify and/or calibrate. If only verification is required, then no values will be entered into the SuperSASS. Calibration will be performed yearly, unless values fall outside of tolerance. Only the first four channels will be calibrated (1 through 4). This calibration reflects the last four channels as well. There are only four flow controllers on the SuperSASS.

- Attach the reference device to the inlet of the SCC on canister #1 and turn on the pump by pressing "Pump".
- Select channel #1 on the menu screen (only one channel can be calibrated at a time), using the up/down arrow keys. Allow the flow to reach a stable reading, and record the measurement from the reference flow standard.
- Use the following equation, along with the calibrated values for the low flow standard from AirMetrics, to calculate the volumetric flow of the SuperSASS. Note: the  $b_{flo}$  is not included in the square root function.

$$Q_{act} = m_{flo} \times \sqrt{\frac{\Delta H \times T_{act}}{P_{act}}} + b_{flo}$$

- Compare the calculated value of the reference standard with that of the SuperSASS. All measured flows should be within  $\pm 0.67$  LPM of the reference standard. If any value is in excess of this tolerance, entering the value of the reference in the "Reference" position and then hitting

the "Calibrate" key can calibrate the channel. This will enter in the correctly measured value for that channel.

Use this same procedure for any other channels that may require calibration.

Record all changes to the system in the site logbook.

## **5.0 Programming of System**

### **5.1 Setting Date and Time**

From the main menu, select the "Setup" button. Once selected the "Setup Menu" will be displayed. From this menu press F3. Using the left and right arrow keys, move the cursor to the MM/DD/YY or the HH:mm:ss position. Using the up and down arrow keys, enter the correct date and time. Once completed, press the "Set" key and the newly entered values will be saved. Press "Exit" to return to Setup Menu. Samplers will not be using daylight savings time. Use Eastern Standard Time.

#### **5.1.1 Setting Default Elapsed Time for Tests**

From the Setup Menu press the F2 key to advance to the "Sample Event Defaults" screen. This is used to set up the default value that is used for the total elapsed time for each run during the operation and collection of sample material. This also allows for a default set of canisters to be selected.

From the "Sample Event Defaults" screen use the left and right arrow keys to move the cursor to the HH or mm position that needs to be changed. Use the up and down arrow keys to change the value. Each sample run will total 24 hours. Once completed press the "Save" key.

The factory default setting for the canister set is {1, 2, 3}. These are the three channels that will be used for sampling on a routine basis. In the event these are not the current canisters selected, use the up and down arrow keys to correct. Once completed press the "Save" key. Press "Exit".

#### **5.1.2 Event Manager**

From the Setup Menu press F1 to display the "Event Manager" screen. This screen allows for sequential programming of the SuperSASS. Although sequential sampling is available the system will only be using the first three channels for testing.

Event Manager	MM/DD/YY	HH:mm:ss	
Start Date/Time	Length	Canisters	
MM/DD/YY HH:mm:ss	HH:mm	{1,2,3}	
MM/DD/YY HH:mm:ss	HH:mm	{5,6,7}	
Add	Modify	Delete	Exit

Event Manager Display Screen

### 5.1.3 Setting the Site ID Value

From the "Setup Menu" press the F4 key to display the "ID Setup" screen. The value displayed is the serial number for the control unit. This value should be changed to reflect the county code for the site on which it is located. There will be one sampler at each of the following six sites. Enter the corresponding three digit county code followed by a zero to fill the fourth position. After entering the correct code, press "Save". Press "Exit" to get back to the main menu.

Cherry Grove-**0330**  
Greensboro EB-**0810**

Hickory-**0350**  
Lenoir CC-**1070**

Raleigh-**1830**  
Fayetteville-**0510**

### 5.1.4 Software Installation

The software will be loaded onto the laptop PC's of the operators. There are two disks containing the SassCommAQ software. To install, insert Disk #1 into the disk drive. Click on the Windows <Start> button and then <Run>. Type in A:\Setup, then press <Enter>. Follow the instructions on the screen.

## 6.0 Troubleshooting and Maintenance

Very little maintenance is required for the operation of the SuperSASS Sampler System. Most maintenance involves inspection and cleaning of components for damage or wear, as well as the regularly performed checks and calibrations by the operators. All maintenance and troubleshooting activities should be recorded in the site log.

In the event a sampler fails to operate properly after repeated attempts, the ECB should collect the sampler from the site for further troubleshooting. Operators will inform the ECB of such occasions.

## **6.1 System Cleaning**

Each time the system canisters are replaced, or as deemed necessary, the solar radiation shield of the sampler head should be cleaned with a wet cloth. Buildup on the shield can reduce the effectiveness of the reflective surface and cause the temperature to rise inside the shield.

The pump housing should be inspected and cleaned at least every quarter by removing the four screws on the corners and lifting the cover up and out of the way. Using a brush, or a compressed air source, clean the insides of the enclosure, particularly the screen located below the pump assembly. When completed, reattach the pump box cover and re-secure the four screws.

The control box and cables should be inspected for damage or dirt/dust accumulation. The control panel should only be cleaned with a damp cloth, and no liquids should be allowed to enter the electronic package.

### **6.1.1 Denuder Replacement**

The MgO denuder will need replacement approximately every three months of operation, or as required by the US-EPA. The third party contract laboratory performing the chemical analysis of the filters replaces the denuders. The third party vendor is replacing filters and denuders in each canister.

### **6.1.2 System Inspection**

The various components of the system should be inspected for wear, damage, and changes in previous operation. Most inspections rely on visual checks during normal operation of the system.

Each time a canister is removed, check the O-rings of the canisters and those on the SCC. Each time the cyclones are removed, unscrew the grit cap and dump out any dirt that may have collected as part of a routine maintenance program.

**ATTACHMENT 1**

**Shipping List**

- Box 1: (CONTROL UNIT)      Size 20"L x 20"W x 12"H      Wt = 20 Lbs  
    Contains:      Control unit (PN 8863) & mounting hardware  
                    Ambient Temperature Sensor (PN 064-1)  
                    Temperature Shield (PN 5980) and mounting hardware  
                    Five (4) Sharp Cut Cyclones (PN 8670)  
                    One (1) MgO Denuder (PN 8382)  
                    RS-232 Cable (PN 3159)
- Tools:      Kit (PN 8629) Poly bagged together  
                            One (1) ¼ x 20 Allen Wrench  
                            One (1) Allen Wrench Kit  
                            One (1) O-ring lubricant  
                            Three (3) Hex Head Screws  
                            One (1) Wrench  
                            One (1) Cassette Laboratory Assembly Block  
                            Two (2) Black Tie Wraps
- Manuals:  
                            One (1) SuperSASS Operators Manual  
                            One (1) SASSComm Operators Manual and Software
- Box 2: (TRIPOD)              Size 8" x 8" x 52"      Wt = 15 Lbs  
    Contains:      One (1) Tripod (PN 8864)
- Box 3: (PUMP BOX)          Size 20"L x 20"W x 24"H      Wt = 45 Lbs  
    Contains:      One (1) Pump Box and Flow Management System  
                    (PN 8862-2)
- Box 4: (TRANSPORT CASE)      Size 18"L x 16"W x 12"H      Wt = 18 Lbs  
    Contains:      One (1) Canister Transport Case (PN 8460)  
                    Four (4) Sample Canisters (PN 8370) with cap  
                    Plugs for inlet and outlet of cassettes
- Box 5: (SAMPLING HEAD)      Size 25"L x 25"W x 20"H      Wt = 15 Lbs  
    Contains:      One (1) Sampling Head and Canister Mounting  
                    Platform (PN 8861-2)

**ATTACHMENT 2**

**Troubleshooting Guide**

<p>Out of specification (<math>\pm 10\%</math> of transfer standard)</p>	<ol style="list-style-type: none"> <li>1. Completely remove flow rate measurement adapter; reconnect and perform flow rate check again.</li> <li>2. Perform Leak test</li> <li>3. Check flow rate at three points to determine if flow rate problem with slope.</li> <li>4. Recalibrate flow rate</li> </ol>
<p>Leak outside acceptable tolerance</p>	<ol style="list-style-type: none"> <li>1. Completely remove flow rate measurement adapter; reconnect and perform leak test again.</li> <li>2. Inspect all seals and O-rings; replace as necessary and perform leak test again.</li> <li>3. Check sampler with different leak test device.</li> </ol>
<p>Consistently low flows during sample runs</p>	<ol style="list-style-type: none"> <li>1. Check programming of sampler flow rate.</li> <li>2. Check flow with a flow rate verification filter and determine if actual flow is low.</li> </ol>
<p>Out of specification (<math>\pm 4^\circ\text{C}</math> of standard)</p>	<ol style="list-style-type: none"> <li>1. Recalibrate sensor; replace sensor.</li> </ol>
<p>Out of specification (<math>\pm 10\text{ mmHg}</math> of standard)</p>	<ol style="list-style-type: none"> <li>1. Make certain pressure sensors are exposed to ambient air and are not in direct sunlight.</li> <li>2. Call local airport or other source of ambient pressure data and compare that pressure to pressure data from monitors sensor; pressure correction may be required.</li> <li>3. Connect new pressure sensor.</li> </ol>
<p>Out of specification (<math>\pm 5\text{ min}</math>)</p>	<ol style="list-style-type: none"> <li>1. Check programming; verify power outages</li> <li>2. Reset</li> </ol>

Sample did not run	<ol style="list-style-type: none"><li>1. Check programming</li><li>2. Try programming sample run to start while operator is at site; ensure the transport filter is in the unit.</li></ol>
Power Interruptions	<ol style="list-style-type: none"><li>1. Check line voltage</li></ol>
Liquid-crystal display pen on, but sample not working.	<ol style="list-style-type: none"><li>1. Check to see that plugs are in place and there are no loose connections.</li></ol>
Data did not transfer to laptop computer	<ol style="list-style-type: none"><li>1. Document key information on sample data sheet. Make sure problem is resolved before data may be overwritten.</li></ol>