Particulate Matter 2.5 Speciation QA Plan

for URG 3000N

Section 1

Electronic Calibration Branch

(ECB)

Responsibilities

QAPP Approval Sign-Off Sheet

I certify that I have read and approve of the contents of the QAPP/SOP 2.45 with an effective date of October 1, 2013

Document Preparer
Roy Colleton, Environmental Chemist Roy H Colleton

ECB Lead
Christian Burge, Electronic Technician Christian Burge

Electronics Branch Supervisor
Justin Davis Justin L Davis

Projects and Procedures Branch Supervisor
Joette Steger Joette Steger 9/17/2013

Ambient Monitoring Section Chief
Donnie Redmond 9/25/13

Table of Contents

List of Figures

2.44.1.1 Scope, Application & Purpose

2.44.1.1.1 Purpose and Applicability

In April 2005, the Clean Air Scientific Advisory Committee gave strong general support for making changes to the EPA PM2.5 Chemical Speciation Network (CSN) to improve comparability with the rural Interagency Monitoring of Protected Visual Environments (IMPROVE) PM2.5 carbon concentration data. The CSN currently includes about 185 sites and monitors PM2.5 including mass, ions, elements, and carbon species. The program's objectives are to:

- Provide data to support the development of modeling tools.
- Assess the effectiveness of emission reduction strategies.
- Support other air quality programs and the National Ambient Air Quality Standards **(**NAAQS).
- Support research studies.

The EPA process, designed to achieve this comparability, included replacing the CSN carbon sampling channel with an IMPROVE-like sampler and using the IMPROVE carbon Thermal Optical Reflectance (TOR) analysis method, instead of the Thermal Optical Transmittance (TOT) method. In addition, the EPA requested the manufacturer of the IMPROVE sampler, URG (Chapel Hill, NC) to modify the IMPROVE sampler to incorporate mass flow control versus fixed-orifice flow control. The result is a new instrument, the URG-3000N Sequential Particulate Speciation System.

The carbon sampler replacement project occurred in three phases – Phase I in May 2007; Phase II in April 2009; and Phase III in October 2009. Between Phases I and II, design changes were made to the URG-3000N. As a result, there are minor differences in the operation of the sampler. The NC Division of Air Quality received all of its URG samplers during Phase III. One important distinction between the Phase I and Phases II and III samplers is the firmware upgrade. Although there was an upgrade in the firmware, all versions of the firmware are applicable for the operation of the sampler.

This SOP outlines procedures for field installation and setup, troubleshooting, maintenance and repair of the URG-3000N speciation sampler. For more detailed information regarding field installation, setup and operation of this sampler, refer to the URG-3000N Operations Manual or contact URG at (919) 942-2753, http://www.urgcorp.com/index.php/email-form or info@urgcorp.com.

This SOP is applicable to the collection of PM2.5 Carbon using the URG 3000N, specifically for data generated by the National PM2.5 CSN. This SOP will not necessarily apply to other monitoring activities for which the URG 3000N may be capable and operated. Any such use will be described by the applicable Quality Assurance Project Plan(s).

2.44.1.1.2 Safety Precautions

- To avoid electrical hazards, all sampler installation procedures should be conducted with the sampler disconnected from the AC power source.
- Observe proper lifting procedures when unpacking and moving sampler components.

- Read, understand, and follow all safety precautions for the sampler outlined in the sampler's operations manual.
- Once sampler installation is complete, secure the sampler to the field sampling platform to ensure that it does not tip over during high wind speed events.
- The sampler weighs 135 pounds when completely installed. If a move is necessary, dissemble and remove the sample and controller modules and rain shield assembly from the lower stand (pump enclosure) so they can be moved separately.
- Care must be taken when installing or repairing the units in inclement weather. Safety is paramount.
- If you are planning to dismantle and reconstruct the sampler for any reason, ensure that all electrical connections, both cords and sockets, are color-coded with tape prior to disconnecting.

2.44.1.2 Installation

This section discusses monitor selection and initial laboratory monitor check-out, providing exact procedures, schedule, acceptance criteria, etc.

2.44.1.2.1 Sampler Selection

The only monitor acceptable for measuring carbon fine particulate species in the Speciation Trend Network (STN) and Chemical Speciation Network (CSN) is the URG 3000N. The monitor can be ordered from URG at (919) 942-2753, http://www.urgcorp.com/index.php/email-form or info@urgcorp.com. When ordering be sure to specify that you are ordering a monitor for the STN or CSN network so that you will receive the correct monitor. After the monitor is received, conduct an inventory of the parts as described in Section 2.44.1.2.2 Sampler Parts by Shipping Boxes. Do not accept the shipment if any boxes or parts are missing.

2.44.1.2.2 Sampler Parts by Shipping Boxes

The URG-3000N sampler is shipped in six boxes. If an optional collocation module is setup, there will be five extra boxes for the sample module, stand, stand rain shield, pump, and inlet pump. The collocated sample module runs off the same controller module as the Routine sample module. The following sections identify the contents of each box. Use this to inventory parts needed for sampler installation.

2.44.1.2.2.1 Module Box

- Sample Module
- One 20" length 12-pin standard control cable for attaching Sample Module to Controller Module and Mass Flow Controller (MFC)
- Temperature probe (partially installed in inlet tee)
- Leak check (Flow Audit) assembly: downtube reducer (1.B"ID to 1.25"OD), Leak check (Flow Audit) adaptor (1.25" to brass hose barb with shutoff valve), pump shutoff valve assembly, and an audit cartridge with four cassettes

- Inlet cap
- Roof flashing for inlet
- Quick Filter Change Guide (attached to enclosure door)
- Copy of inspection and status checklist

2.44.1.2.2.2 Controller Module Box

- Controller Module
- One 72” length 115VAC power cable
- Compact Flash memory card

2.44.1.2.2.3 Stand Box

- Lower stand components
- Pump enclosure: MFC, snap thermostat, fan, power terminal
- 30” length standard pump relay cable

2.44.1.2.2.4 Stand Rain Shield Box

- Rain shield
- Two upright supports
- Two roof supports
- Two lower stand supports
- Two module supports

2.44.1.2.2.5 Pump Box

- One 120V pump
- Assorted mounting hardware
- Exhaust tube
- Rubber feet

2.44.1.2.2.6 Inlet Box

- One 36” length downtube

Figure 1 shows the major components of the stand assembly for the URG-3000N sampler.

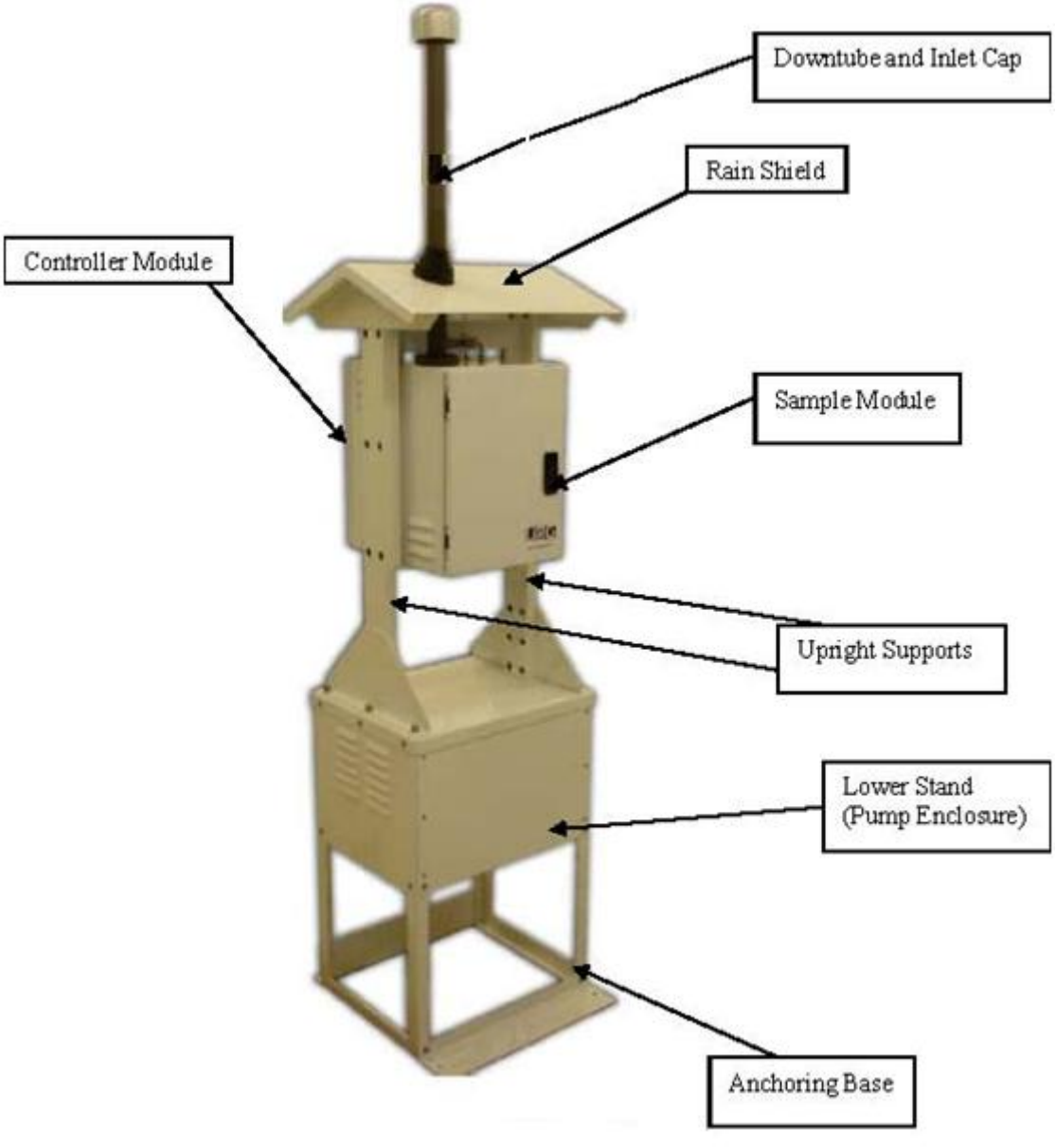


Figure 1. URG-3000N Sampler

Figure 2 displays the interior components of the Sample Module. Figure 3 shows the major components of the Controller Module. The lower portion of the Figure 3 points out the locations for connections on the bottom of the Controller Module.

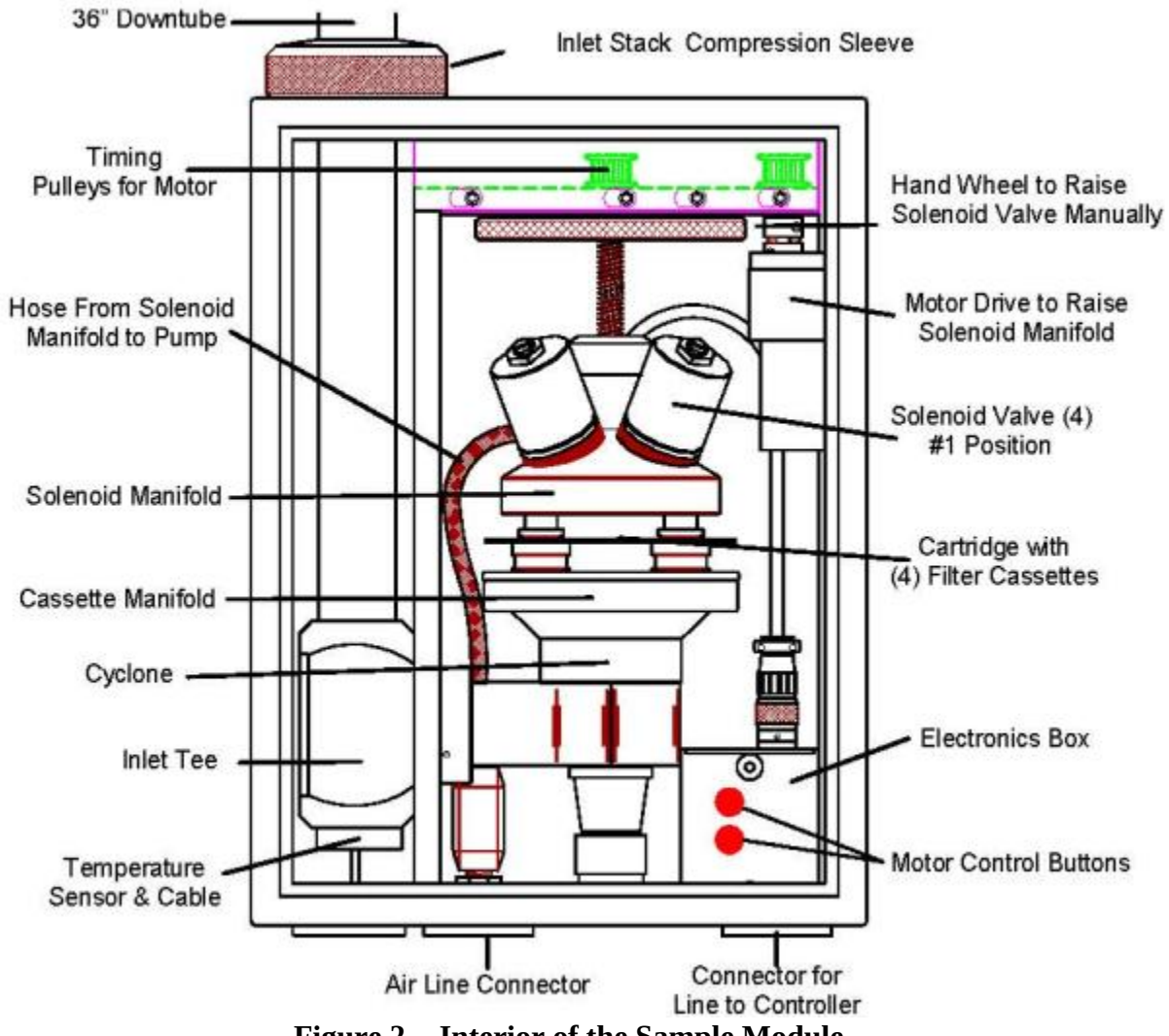


Figure 2. Interior of the Sample Module

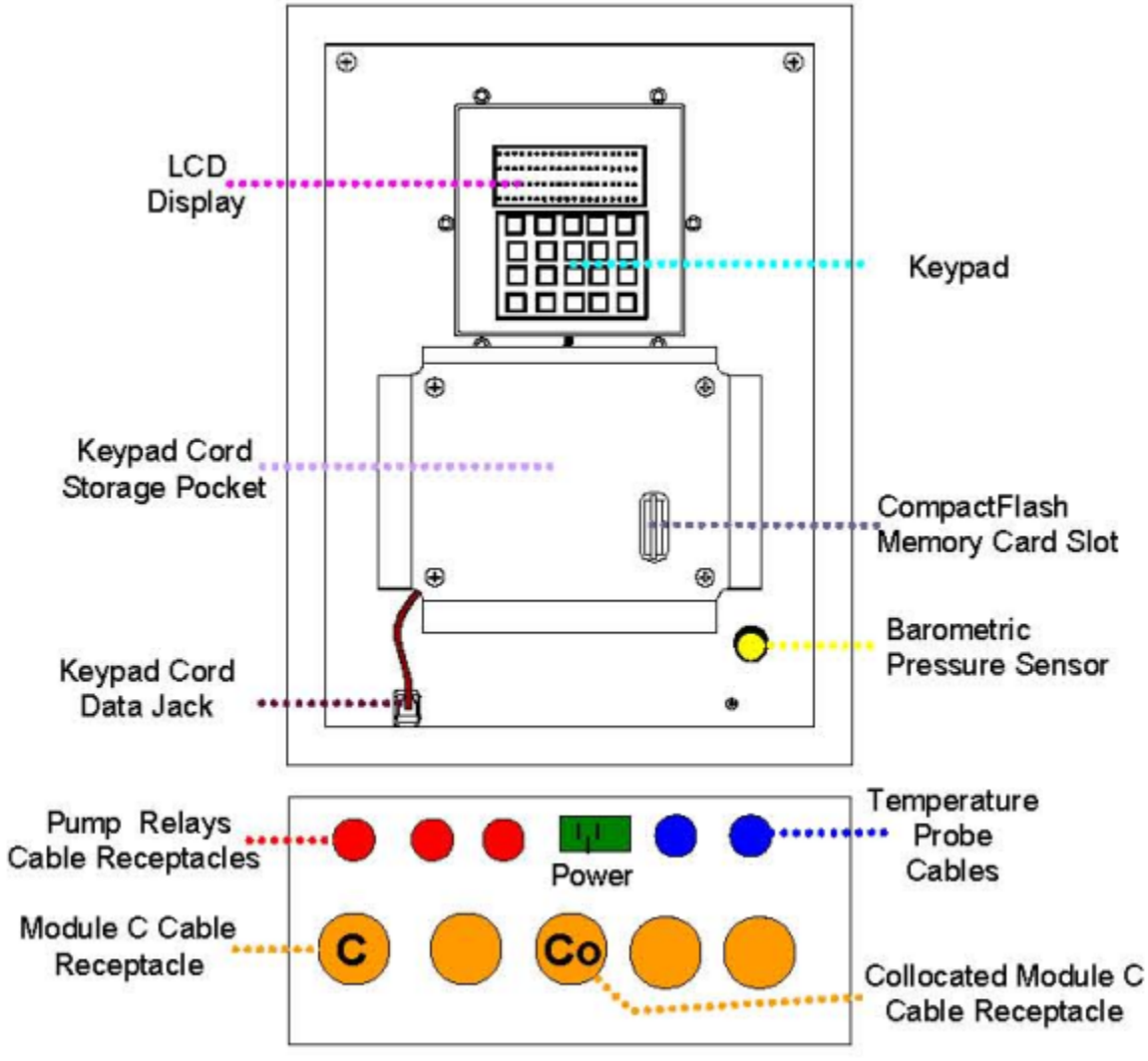


Figure 3. Controller Module

2.44.1.3 Operational Set-up & Start-up

2.44.1.3.1 Appropriate Siting Considerations in Locating a Monitor at a Site

- Ensure the sampler is level using a spirit level.
- Ensure the sampler inlet is separated by at least 1 meter, but no more than 4 meters, from other $PM_{2.5}$ samplers, especially collocated SASS samplers, and that the sampler has an unobstructed air flow of a minimum of 2 meters in all directions. The sampler is likely to be sited in proximity to another speciation sampler and should therefore meet criteria for a collocated sampler.
- For collocated samples, the inlets are ideally positioned exactly 1 meter apart. If located near a high volume sampler, the minimum distance is 2 meters and the maximum allowable distance for any collocation is 4 meters.

- The monitor should have its own dedicated outlet when possible but if that is not possible, it should share an outlet with the collocated SASS monitor.

2.44.1.3.2 Sampler Assembly and Installation Procedure at Site

2.44.1.3.2.1 Upright Supports and Rain Shield Assembly

- Install one roof support to the roof with six (6) S.S. nuts with integrated lock washers and tighten (see Figure 4).
- Install both H-body base supports with twelve (12) S.S. washers and nuts. Turn the H-body on its side, using a thin screwdriver, slide one washer on the screwdriver. Align the screwdriver with the stud and let the washer slide down onto the stud (see Figure 5).
- Turn the H-body over far enough that the washer does not slide off and the S.S. nut in a nut-driver will stay in the driver. Tighten the nut. Repeat the washer/nut installation until all twelve (12) studs have been secured (see Figure 6).

Figure 4. Installing the Roof Support to the H-Body, Step 1

Figure 5. Installing the Roof Support to the H-Body, Step 2

Figure 6. Installing the Roof Support to the H-Body, Step 3

- Install the second roof support on the H-body. H-Body should look like the Figure 7 below on the left.
- Install the roof assembly as shown in the center Figure 8 below. Line up all the studs with the holes and press fit everything together.
- Assembly should look like the Figure 9 below on right.
- Install and tighten all connectors. The roof connector nuts require an 11/32" open end wrench to access the studs at the peak.

Figure 7. Installing the Second Roof Support to the H-Body, Step 1

Figure 8. Installing the Second Roof Support to the H-Body, Step 2

Figure 9. Installing the Second Roof Support to the H-Body, Step 3

2.44.1.3.2.2 Upright Support Assembly to Lower Stand

A. Place the completed upright support assembly from Section 2.44.1.3.2.1 Upright Supports and Rain Shield Assembly on the top surface of the lower stand (pump enclosure).

B. Align the six (6) screw studs on the lower stand with the opening on the upright support assembly and fasten with lock washers and carriage nuts.

C. The mounting feet are installed in the wrong direction to allow for easier shipping. Figure 11 below in center shows how the feet are installed when you receive the stand. You will have to remove the support feet and install them correctly before operating the URG-3000N

D. Remove the two (2) S.S. screws that hold the feet onto the base and re-install them with the larger flat surface facing down onto the ground like shown in Figure 12 below on the right. There are four (4) holes in the part of the feet that face the ground. The two (2) larger holes are to allow the stand to be bolted to a sampling platform.

Figure 10. Installing of the Upright Support to the Base

Figure 11. Feet Installed in Wrong Direction for Shipping

Figure 12. Support Feet Installed Correctly with Larger Flat Surface Facing Down on the Ground

2.44.1.3.2.3 Pump Enclosure

A. Connect the Tygon exhaust tubing to the brass L-shaped fitting and screw into the pump as shown in Figure 13.

B. Unscrew the six (6) screws in the side panel of the lower stand and place the pump in the pump enclosure.

C. Screw the four (4) rubber feet into the bottom of the pump.

D. Align the four (4) rubber feet from the pump with the four (4) openings in the lower stand to secure the pump to the lower stand. Attach four (4) lock washers and four (4) nuts and tighten.

E. Align the exhaust tubing through the opening in the bottom of the lower stand (pump enclosure).

F. Connect a vacuum hose with "Colder" fittings from the pump to the Mass Flow Controller (MFC) (see Figure 13).

G. Connect electrical line from pump to gray power box in the pump enclosure (see Figure 14).

H. After powering up the sampler and determining it is operational, re-assemble the side panel to the lower stand (pump enclosure) using the six screws and washers.

Figure 13. Interior of the Pump Enclosure

Figure 14. Mass Flow Controller and Power Box

- **Fan:** The Pump Enclosure Fan is used to regulate the temperature within the enclosure. It is regulated by the Snap Thermostat.
- **Snap Thermostat:** The Snap Thermostat regulates the Pump Enclosure Fan. When the enclosure temperature rises above 85 degrees Fahrenheit, the fan is turned on. When the enclosure temperature drops below 65 degrees Fahrenheit, the enclosure fan is disabled.
- **Mass Flow Controller:** The Mass Flow Controller is located on a bracket within the pump enclosure.
- **Power Terminal:** Underneath the door shown in the photo are two power outlets. The top outlet is the correct outlet for usage with the Pump. This outlet is controlled to power on and off the pump. The bottom outlet is to be used for the optional Enclosure Heater. Note that the red lever is a dummy lever and does not perform any function.
- **Pump:** The URG-3000N utilizes a 120V pump that is seated in the pump enclosure as shown. It mounts with four nuts from the bottom.
- **Enclosure Heater:** This heater is available for usage with the URG-3000N in colder environments. For Phase I units, this was an optional feature.

2.44.1.3.2.4 Connecting Modules to Upright Support Assembly

A. Unscrew one of the set screws on the module support (assembled in 2.44.1.3.2.1 Upright Supports and Rain Shield Assembly).

B. Align and place the rubber feet on the base of the Controller Module with the opening in the lower module support. The Controller Module is placed on the side marked "Controller" and **does not** have an opening protruding through the roof rain shield. (The opening is for inserting the 36" downtube.) (see Figure 1)

C. Direct the handle at the top of the Controller Module through the opening behind the set screw.

D. Tighten the set screw to secure the top of the Controller Module (see Figure 16).

E. Repeat Steps A through D with the Sample Module.

F. Open the door of the Sample Module.

G. Take rubber roof flashing boot and slide 1/3 down the downtube.

H. Loosen the nut at the top of the Sample Module for inserting the downtube.

I. Insert the downtube through opening in the roof rain shield and Sample Module until it reaches the inlet tee inside the Sample Module.

J. With a turning motion, insert the downtube into the inlet tee until it seats. (*Be careful not to tear the silicon-coated Teflon O-ring at the base of the inlet tee*.)

K. Tighten the large lock-nut that secures the downtube into the T-fitting inside the module box; the lock-nut is located on the top of the Sample Module box.

L. Slide the rubber roof flashing boot on top of the roof boot mounted in the roof rain shield.

M. Attach the inlet cap at the top of the downtube.

Figure 15. Inserting the Module Boxes and the Downtube

Figure 16. Inserting the Module Boxes and the Downtube

Figure 17. Inserting the Module Boxes and the Downtube

2.44.1.3.2.5 Connecting the Pump Relay Cable

A. Connect the pump relay cable from the side of the lower stand as shown in Figure 18 to the controller module as shown in Figure 19.
B. Align the prongs on the pump relay cable plug with the receiver end of the controller module.
C. Turn plug until locked into place.

Figure 18. Side View of Pump Relay Cable Connection

Figure 19. Connection of the Pump Relay Cable to bottom of Controller Module

2.44.1.3.2.6 Connecting the Controller Cable

A. Connect the *single end* of the 20" 12-pin data cable (without the MFC connector) to the Controller Module as shown in Figure 20.

B. Connect the other 12-pin data cable to Sample Module as shown in Figure 21.

C. Connect the breakout cable on that end to the Mass Flow Controller, which is the central port on the side of the lower stand (pump enclosure), as shown in Figure 22.

Figure 20. Connection of the Controller Cable to Controller Module

Figure 21. Connection of the Controller Cable to Sample Module

Figure 22. Connection of the Controller Cable to Mass Flow Controller Connection on Lower Stand (Pump Enclosure)

2.44.1.3.2.7 Connecting the Vacuum (Air) Line

Connect the 30" Air line with "Colder" fittings to the Sample Module and the side of the lower stand (pump enclosure) as shown in Figure 23 and Figure 24.

Figure 23. Connection of Air Line to the Sample Module

Figure 24. Connection of Air Line to the Lower Stand (Pump Enclosure)

2.44.1.3.2.8 Connecting the Ambient Temperature Probe

A. Mount the ambient temperature probe at the base of the inlet tee as shown in Figure 25.

B. Drop the cable out of the bottom of the Sample Module and secure the plastic disc in the hole.

C. Plug the connector into the base of the Controller Module as shown in Figure 25.

Figure 25. Connection of the Ambient Temperature Probe to the Sample Module and Controller Module

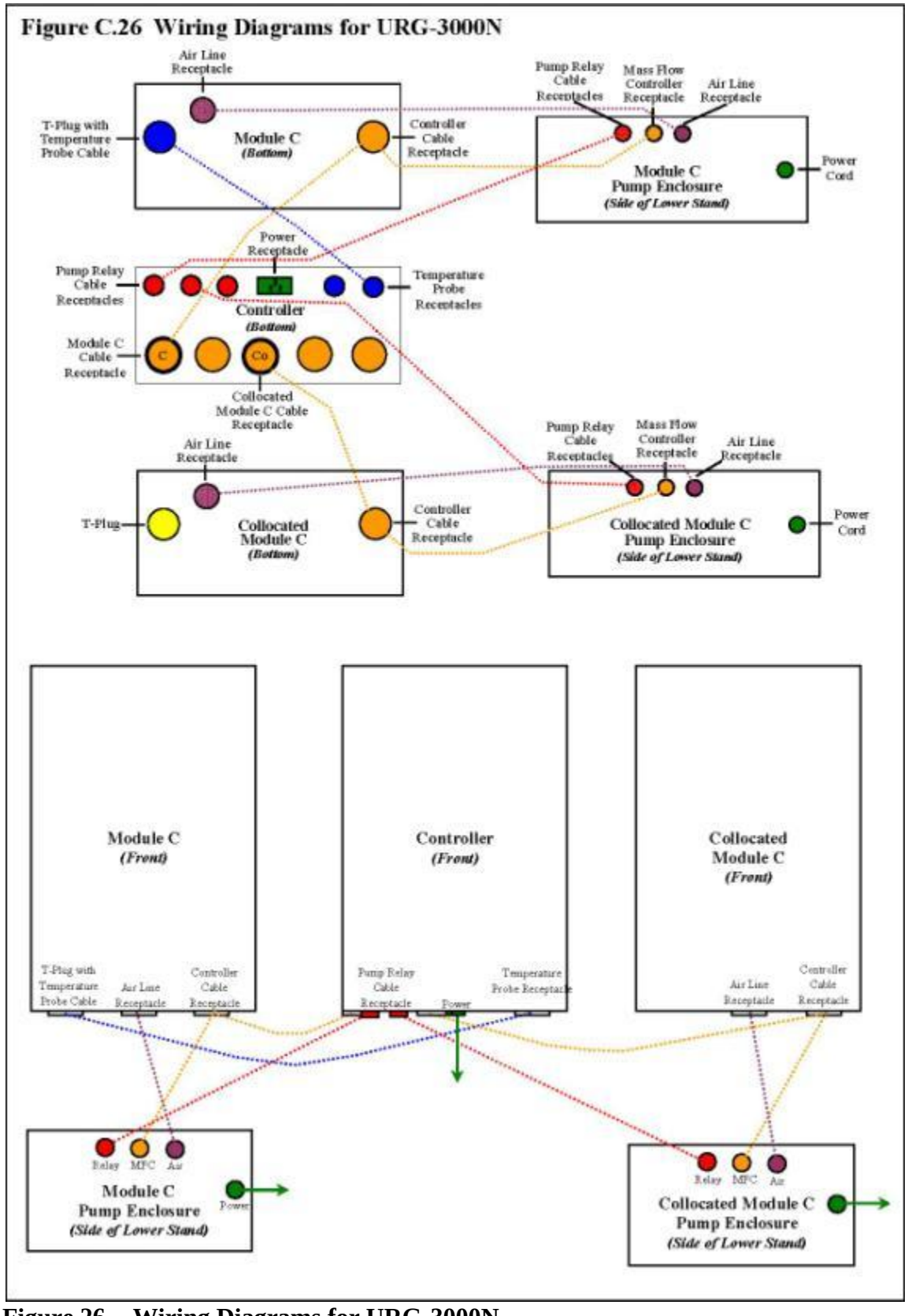


Figure 26. Wiring Diagrams for URG-3000N

2.44.1.3.2.9 Installing Keypad and Memory Card

A. The Keypad has magnetic strips on the back, which allow it to sit in a holder as shown below in Figure 27. Directly below the Keypad holder is a cord storage area and memory card slot.

B. To attach the Keypad, drop the cable through the cord storage area and pull the data jack through the slot in the bottom left as shown.

C. Plug this data jack into the designated jack on the controller, also shown below in Figure 27.

D. Insert a compatible Compact Flash memory card into the slot as shown in Figure 28. (For routine sampling, the card for each sampling event will be provided with the filter cartridge by the contract service laboratory.)

E. Close up view of the keypad is shown in Figure 29.

Figure 27. Front View of Controller Module

Figure 28. Inserting the Compact Flash Memory Card

Figure 29. Close Up View of Keypad

2.44.1.3.2.10 Powering Up the Sampler

A. Connect the 72” 115VAC power cable to the Controller Module and grounded receptacle.

B. Connect the pump power cable to a ground receptacle.

C. The LCD display screen on the controller keypad should illuminate and display, in sequence, the following four screens:

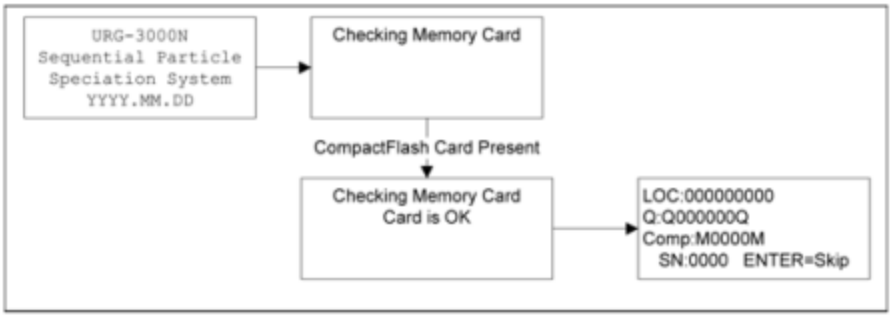


Figure 30. Display Screen Sequence

2.44.1.3.3 Completing the Installation

2.44.1.3.3.1 Leveling the sampler

A. Adjust the URG-3000N Sampler so that the top surface of each module is horizontal as indicated by a bubble level. Final leveling of the unit is done only after the major installation tasks described in Section 2.44.1.3.2 Sampler Assembly and Installation Procedure at Site have been completed.

B. Inspect the sampler to be sure that the inlet is not out of alignment due to an improperly mounted downtube. The downtube should be perpendicular to the modules. Make any necessary adjustments to the downtube mounting.

C. The sampler's horizontal angle can be adjusted by placing thin shims of wood under the anchoring base. Be sure to observe safety precautions; it may require two people to safely place the shims. Verify that the sampler remains secure after the shims are put into place.

D. Secure the anchoring base to the platform with screws and washers.

2.44.1.3.3.2 Setting Time and Date

NOTE: The operating area for the sampler may include more than one time zone. The field scientists in the PM2.5 Chemical Speciation Network (CSN) need to be aware of time zone changes and set samplers up based on the local time.

After the sampler has been successfully installed and powered up, the date and time should be checked and, if necessary, adjusted to local time. All CSN samplers at a site should be synchronized to within 1 minute of a time standard. Use the following procedure to set or adjust the URG-3000N sampler's date and time.

After powering up the sampler, the program is initiated and the display screens shown in Figure 30 are displayed. At the last screen, ID Codes, the operator is asked to press the "**ENTER**" key to proceed to the next screen shown in Figure 31. This screen is the default AUTO MODE screen. All operations begin at this screen.

Figure 31. AUTO MODE screen

- Press the "**ENTER**" key to move from the AUTO MODE to the MENU MODE.
- The Authentication screen appears (see Figure 32). Press enter to proceed to Choose Operator screen.

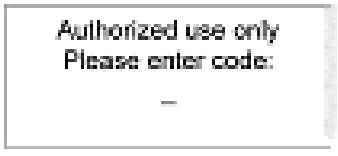


Figure 32. Authorization Screen

- Choose "**1**, **2**, or **3**" from the Choose Operator screen (see Figure 33) to proceed to the Main Menu screen.

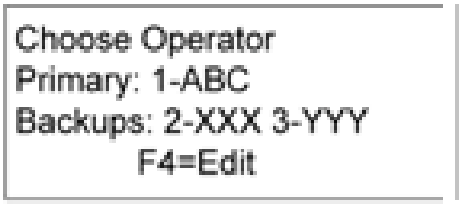


Figure 33. Operator Screen

- At the Main Menu screen (see Figure 34), press the "F2" key to advance to the next screen to set date and time.

Figure 34. Main Menu Screen

- The screen shown in Figure 35 shows the menu for changing the date and time. By pressing the "**F3"** and "**F4"** keys, the operator can move the cursor to select the month, day, year, hour or minute. Pressing "**F1"** or "**F2"** will alter values. The day of the week changes based on the month, day, and year. If you enter an invalid date, a screen will appear and prompt you to re-enter the proper date.

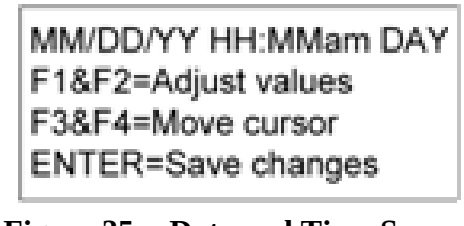


Figure 35. Date and Time Screen

- Press the "**ENTER**" key to save changes. The sampler software will return the operator to the Main Menu screen (see Figure 34).
- Press the "**ENTER**" key to return to the AUTO MODE screen (see Figure 31). The EPROM chip defaults to the 1-in-3 day CSN sampling schedule when the sampler is set to the correct date and time.

2.44.1.3.3.3 Setting the Alternative Sample Day

During special studies, the operator may wish to operate the sampler on schedules other than a 1-in-3 or 1-in-6. The Alternative Sample Day menu will permit the operator to change the sampling day.

- Press the "**ENTER**" key to move from the AUTO MODE to the MENU MODE.
- The Authentication screen appears (see Figure 36). Press enter to proceed to Choose Operator screen.

Figure 36. Authentication Screen

- Choose "**1**, **2**, or **3**" (see Figure 37) to proceed to the Main Menu screen.

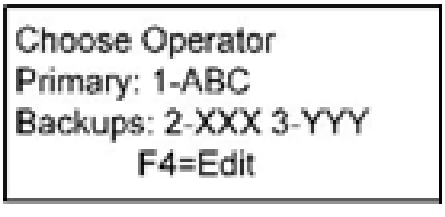


Figure 37. Choose Operator Screen

- At the Main Menu screen (see Figure 38), press the "**F3**" key to set an alternative date and time.

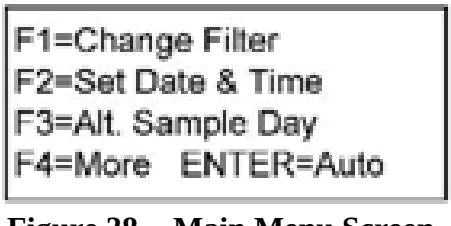


Figure 38. Main Menu Screen

- The screen below shows the menu for changing the date and time. By pressing the "**F3"** and "**F4"** keys, the operator can move the cursor to select the month, day, year, hour or minute. Pressing "**F1"** or "**F2"** will alter values. The day of the week changes based on the month, day, and year. If you enter an invalid date, the screen will prompt you to re-enter the proper date.

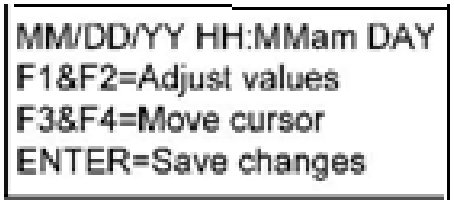


Figure 39. Alternate Sample Date Screen

- Press the "**ENTER**" key to save changes. The sampler software will return the operator to the Main Menu screen.
- Press the "**ENTER**" key will return to the AUTO MODE screen.

2.44.1.3.3.4 Setting the Site Configuration Information

The operator should set up the site configuration using the following menu tree (see Figure 40). All steps from the AUTO MODE screen to the Site Configuration Menu are identified.

A. At the Location Code screen, use the keypad to enter the AQS Number assigned to the site. Press the "**ENTER**" key to proceed to the Controller Module Serial Number screen. Use the keypad and enter the last four digits of the Controller Module's serial number (located on the inside of the Controller Module door). Press the "**ENTER**" key to proceed to the Number of Modules screen.

B. The remaining screens in the Site Configuration Menu are set at the factory default for running the sampler in the CSN. *If the site is using this sampler for collocation, enter "**2**" using the keypad for Number of Modules. This only needs to be done prior to running collocated samplers. In the event that the site returns back to only running the routine sampler, the operator must return to Site Configuration Menu and select "**1**" for one module.*

C. After reviewing the remaining screens (Select Schedule, Sampling Interval, Sample Time per Hour, and Filter Configuration), press the "ENTER" key six times to return to the AUTO MODE screen.

D. Collect the installation tools and shipping material and put them in a place where they will be safe and out of the way.

E. Installation of the URG-3000N sampler is complete. The site operator must perform a leak check on the sampler before doing the flow rate verification. The site operator must complete an ambient temperature, barometric pressure, and flow rate verificationbefore beginning sampling (see Section 2.44.2 for these procedures).

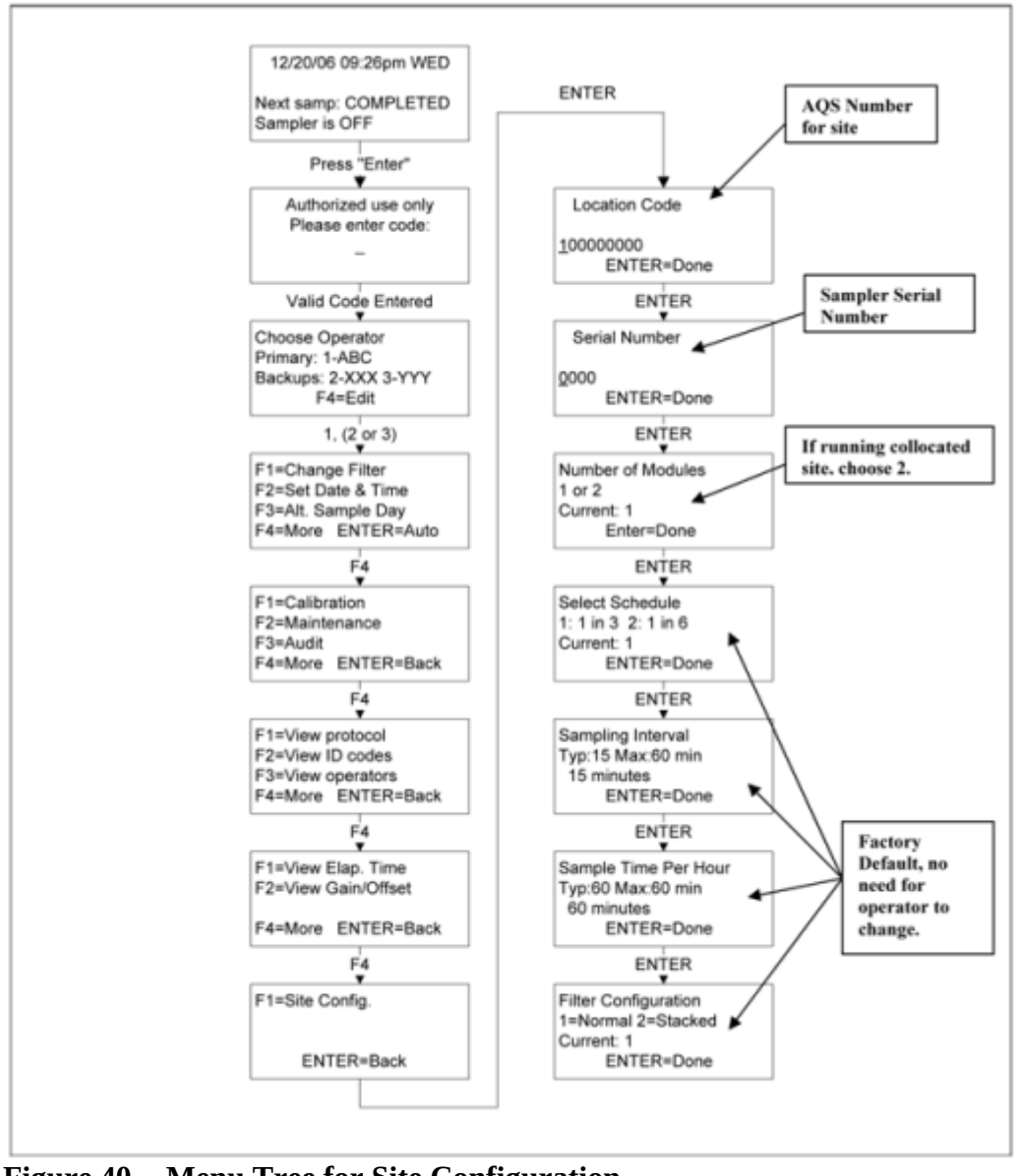


Figure 40. Menu Tree for Site Configuration

2.44.1.4 Site Documentation & Data Handling

All visits to sites with site logbooks should be documented in the site logbook. Documentation in the site log should include who was at the site, when they were there, why they were there and what they did at the site. All maintenance to the samplers should be documented in the sampler logbook. Any data stored in the sampler's memory should be retrieved and returned to the region, if for some reason the sampler is removed before the region has an opportunity to download the data.

2.44.1.5 Site Support

2.44.1.5.1 Sampler Service and Maintenance

If any electrical connections are disconnected, make sure cables and sockets are color-coded or otherwise labeled for subsequent reconstruction.

2.44.1.5.1.1 Sampler Service

Manually Moving the Solenoid Manifold

To manually move the solenoid manifold, follow the steps below. Note that you can remove the solenoid manifold completely for servicing by lowering it fully using the wheel.

A. Grasp the motor to the right of the solenoid manifold firmly and pull downwards (see Figure 41).

B. Next, grasp the motor and swing it to the left (see Figure 42).

C. You can now use the large wheel located above the solenoid manifold to manually raise and lower the solenoid manifold (see Figure 43).

Figure 41. Moving the Motor

Figure 42. Rotating the Motor

Figure 43. Use the Wheel to Raise and Lower Solenoid Manifold

Electronic Box

The black box located at the bottom-right of the Sample Module is known as the electronic box. This box contains the electronics that control the solenoid module. To remove it for servicing, follow the steps below.

A. First, remove the vacuum sensor tube by pressing in the quick-release adaptor and lifting at the same time. Next, reach behind it to remove the motor control cable by twisting the metal nut counter-clockwise (see Figure 44).

B. Then remove the 12-pin controller cable from the bottom of the Sample Module which is connected through to the electronic box (see Figure 45).

C. Unscrew the two brass-headed bolts in the front of the electronic box (see Figure 46).

D. Now remove the electronic box (see Figure 47).

Figure 44. Removing the Vacuum Sensor Tube

Figure 45. Removing the Controller Cable

Figure 46. Unscrew Bolts

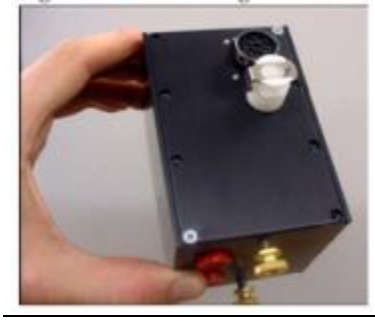


Figure 47. Removing the Electronic Box

Mass Flow Controller

The Mass Flow Controller (MFC) can be removed from the pump enclosure by following the directions below.

A. Remove the six (6) small screws from the front panel of the pump enclosure (see Figure 48). The door will slide down and off.

B. Remove the hose that connects to the front of the MFC and runs to the air line on the enclosure wall (see Figure 49).

C. Remove the hose that connects to the rear of the MFC and runs to the pump outlet (see Figure 50).

D. Unscrew the two (2) flathead screws holding the MFC data cable and remove the cable (see Figure 51).

E. Unscrew the two (2) Philip screws on the MFC base plate. The MFC and the base plate can now be removed (see Figure 52). Save the mounting plate and send the MFC for repair or replacement.

Figure 48. Removing the Panel Pump Enclosure

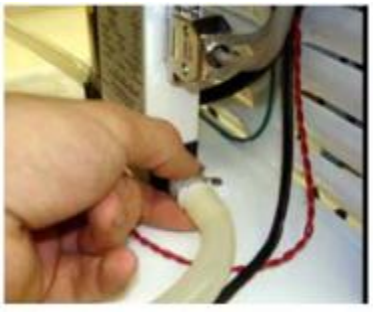


Figure 49. Removing Front Hose on the MFC

Figure 50. Removing Rear Hose to MFC

Figure 51. Removing MFC Data Cable

Figure 52. Removing MFC and Base Plate

Pump Removal

A. Unplug the power from the top outlet of the power terminal inside the pump enclosure (see Figure 53).

B. Remove the four (4) nuts on the bottom of the pump enclosure (see Figure 54).

C. Disconnect the hose the runs from the MFC to the pump (see Figure 55).

D. Disconnect the outlet hose that runs from the pump through the bottom of the pump enclosure. Pull the hose out of the hole, bend slightly, and gently twist the connector and hose until removed (see Figure 56.)

E. Carefully lift the pump out of the base of the pump enclosure. Be aware that the pump is quite heavy and may take two hands to hold firmly (see Figure 57).

Figure 53. Unplug Power from Power Terminal

Figure 54. Remove Nuts from Bottom of Pump Enclosure

Figure 55. Disconnect Hose from MFC to Pump

Figure 56. Disconnect Outlet Hose

Figure 57. Removing Pump

Replacing Fuses/MOVs

In the Controller Module near the keypad/display (see Figure 58), there are two Metal Oxide Varistors (MOVs). The top MOV is a P18Z3 for the 12-volt power supply as noted by the red and black wires that lead to it. The bottom MOV is a P33Z5 for the 24-volt power supply as noted by the yellow and black wires that lead to it. If these become damaged, it may be necessary to replace them. Additionally, inside the controller panel, behind the protective plate, each board shown below in Figure 59 has a 4A 250VAC fuse on the top left that may need to be replaced.

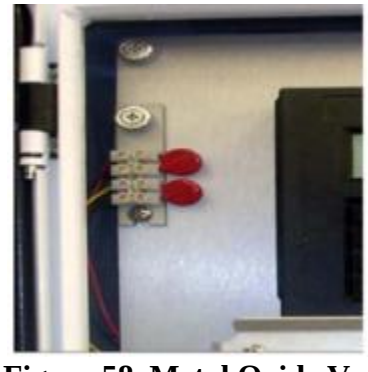


Figure 58. Metal Oxide Varistors

Figure 59. Boards with Fuses

Cyclone Removal

To remove the cyclone, you must first release the filter cartridge by pressing the red "up" button on the electronic box. After removing the filter cartridge, follow the instructions under the heading "***Electronic Box***" in Section 2.44.1.5.1.1 Sampler Service to remove the electronic box. Note that the box does not have to be completely removed, but it is recommended for ease of cyclone removal. Proceed by unscrewing the ring that connects the cyclone to the inlet tee (see Figure 60). Then lift up and carefully remove the cyclone and cassette manifold body (see Figure 61).

Figure 60. Unscrewing the Cyclone Ring

Figure 61. Removing the Cyclone

Pump Enclosure Heater

The installation of a pump enclosure heater is recommended for cold-weather environments. Shown in Figure 62 and Figure 63 are the four mounting brackets on the wall of the pump enclosure that the heater mounts on to and an example of an available heater that can be installed in the URG-3000N. If a heater was not included with the sampler, contact URG for more information about obtaining a heater.

Figure 62. Four Mounting Brackets for Heater

Figure 63. Available Heater

2.44.1.5.1.2 Operation Maintenance Performed by Regions

The operator should record all maintenance activities in the monitor logbook..

Every Visit

- Check O-rings on each filter cassette for wear, damage, and proper seat.
- Clean off any moisture (rain or snow) around the outside of the Sampler and Controller Modules.
- Check for moisture inside Sample Module.

Monthly

- Examine O-rings.
- Clean the interior of the Sample and Controller Modules with Kimwipe tissues or paper towel to remove bugs, dirt, or water deposits.
- Clean sampler inlet surface.

Quarterly

- Inspect O-rings
- Clean the interior of the Sample and Controller Modules with Kimwipe tissues or paper towel to remove bugs, dirt, or water deposits.
- Check all Tygon tubing and vacuum lines; replace if necessary.
- Clean sampler inlet surfaces.
- Inspect electrical line connections.
- Clean sampler inlet tube by pushing a slightly moistened paper towel with a wooden dowel through the inlet tube. Allow to dry before using inlet tube.

- Rotate the quartz filter cassettes on the "AUDIT" cartridge provided by the manufacturer for conducting verification and calibration checks. The laboratory support contractor will periodically call for the AUDIT cartridge and send back a replacement cartridge with clean new filters in the cassettes. Cassettes that have been loaded with clean filters should be rotated to the Number "1" position once a quarter or as needed. Report and return to the laboratory support contractor any AUDIT cartridges on which all the filters become damaged or contaminated prematurely.

2.44.1.5.1.3 ECB Maintenance Activities

The ECB will perform the following annual and two year maintenance activities:

- Every two years the ECB will rebuild the pump manifolds; and
- Every two years the ECB will exchange the cyclones with URG to replace the cyclone o-rings.

The ECB should record all maintenance in the monitor logbook.

2.44.1.5.2 Troubleshooting

At this time, the manufacturer has identified the troubleshooting issues below that could develop when operating the URG-3000N sampler. When an issue develops, review Section 2.44.1.5.1 Sampler Service and Maintenance, and if you are still not able to solve the problem, refer to the Operations Manual or contact URG at (919) 942-2753, http://www.urgcorp.com/index.php/email-form or info@urgcorp.com.

2.44.1.5.2.1 Display Not Shown

When the sampler is first powered up or after completing a sample run and the display is blank, try to:

- Check the power as discussed in Section 2.44.1.5.2.2 No Power;
- Check the fuses as discussed earlier in ***Replacing Fuses/MOVs***; or
- Refer to the Operations Manual or contact URG.

2.44.1.5.2.2 No Power

When powering up the sampler and there is no power, try to:

- Check that the power cable running to the lower stand (pump enclosure) is properly plugged in an electrical outlet;
- Attempt to use another device in the outlet that the URG-3000N sampler is using to determine if AC power is available;
- Check inside the pump enclosure to ensure that the pump is plugged into the top outlet of the power terminal. If the heater is being used, it must be plugged into the bottom outlet of the power terminal; or
- Refer to the Operations Manual or contact URG.

2.44.1.5.2.3Leak Check Failed

If the leak check failed, try the following steps to determine where the leak is occurring.

- Re-seat the "AUDIT" cartridge and re-attempt leak check.
- Replace the Audit cartridge with an alternate cartridge or switch around the cassettes located on the AUDIT cartridge and re-attempt leak check.
- Inspect O-rings on cyclone manifold for tears or other damage. If found, contact URG.
- Inspect Temperature Probe plug O-rings for tears or other damage.
- Inspect O-rings in Inlet Tee for tears or other damage.
- Inspect all Tygon tubing and sample lines for cracks or other damage.
- Refer to the Operations Manual or contact URG.

2.44.1.5.2.4Removing Exposed Filter Cartridge without Installing a New One

There may be some instances that require the exposed filter cassette cartridge and the memory card to be removed without installing the new ones because they are not yet available.

After completing ONLY the exposed filter values retrieval, you can remove the memory card and the exposed filter cassette cartridge. Do not proceed any further until you return to the sampler with the new filter cartridge and memory card. Insert the memory card.

The software should pick up exactly where it left off. If it does not, turn the controller module off and then back on (using the OFF/ON switch on the side). This should allow you to complete the filter change procedure.

2.44.1.5.2.5 Prevent Sampler from Collecting on Previous Exposed Filter

There may be instances when the sampler is scheduled to collect a new sample before the site operator has removed the previous filter cassette cartridge and memory card.

After a sample has been collected, the sampler display will read "Sample Completed." The software contains a "lock out" feature that prevents the collection of another sample until the site operator performs and completes the filter change procedure. This prevents the sampler from collecting an additional sample onto the exposed filter from the previous sample run.

2.44.5.2.6 Pump Will NOT Start During Filter Change Procedure

The vacuum pump will occasionally contain some residual vacuum from the previous sample run. Even a small amount of residual vacuum can prevent the pump from starting. If this occurs, disconnect the black air line from the side of the sampler lower stand and then plug it back in. This procedure will release the residual vacuum and allow the pump to start again.

2.44.1.5.3 Site Support Equipment Provided by ECB

ECB is required to supply each region with a minimum of two sets of equipment for measuring temperatures, pressures, pressure drop, and flow rates. Each monitor was purchased with a BGI tetraCal. In addition to the tetraCal, the ECB should assign each region one to two flow transfer standards certified for a nominal flow rate of 22 liters per minute. The ECB must only purchase NIST-traceable equipment for the regions to use. All equipment must be recertified as NIST-traceable annually. NIST-traceable equipment supplied by the ECB include devices to measure the following:

- Temperature. Use a thermocouple or thermistor-based digital thermometer transfer standard, with current NIST traceability.
- Pressure. Use an aneroid barometer or equivalent transfer standard with current NIST traceability.
- Flow rate. Use a low pressure flow transfer standard with leak-tight connection tubing (flow rate range from 0 to 30 L/min). Examples: frictionless piston or soap film flow meter; orifice-type flow meter, either with current NIST traceability.
- Pressure drop. Use a water manometer or an aneroid manometer with current NIST traceability.

Note: The BGI triCal Model TC12 multi calibrator is an instrument that has all three NIST-traceable reference standards built in. This instrument is the reference standard used by EPA auditors.

The ECB may also need to supply the regions with expendable supplies such as lint free wipes.

2.44.1.6 Quality Control

2.44.1.6.1 Summary of Operator QA/QC Procedures

Certain quality control checks must be conducted at the time of sampler startup and at monthly or quarterly intervals thereafter. The monthly checks are to be conducted by the site operator, while the quarterly audits are to be conducted by an independent third party, usually another monitor technician in the regional office. The operator must carry out these checks before making any adjustments to the sampler. The operator must record information about the site, the sampler, and the results of scheduled or special (unscheduled) quality control checks on the PM2.5 CSN QA/QC Spreadsheet or site visit log. The information on the spreadsheet is to be returned to the support laboratory, who will then upload the results into AQS. Any actions taken to service or calibrate the speciation sampler after the check must be recorded in brief on the form and in detail in the site visit log or instrument logbook.

2.44.1.6.1.1 Date and Time Checks

Conduct these checks monthly or whenever daylight savings time changes occur.

2.44.1.6.1.2 Rotation of the filters in the AUDIT cartridge

The filter cassettes in the AUDIT cartridge should be rotated quarterly.

The filters in the AUDIT cartridge will be replaced annually. The contractor support laboratory will schedule a time to replace the filters in the AUDIT cartridge.

2.44.1.6.1.3 Monthly Leak Check

Perform leak check upon startup and then monthly.

2.44.1.6.1.4 Monthly Temperature Control Checks

Perform the temperature control checks upon startup and then monthly.

2.44.1.6.1.5 Quarterly Temperature Control Check

Perform the temperature control checks each calendar quarter, but use a temperature transfer standard that is independent of the one used for the monthly checks. Should a temperature sensor not maintain its calibration after the monthly or quarterly checks, maintenance and/or replacement of the faulty parts must occur. The ECB will be responsible for maintaining parts and making repairs.

2.44.1.6.1.6 Monthly Pressure Control Check

Perform pressure control checks on startup and then monthly.

2.44.1.6.1.7 Quarterly Pressure Control Check

Perform the pressure control checks each calendar quarter, but use a pressure standard that is independent of the one used for the monthly checks. Should the pressure sensor system not maintain its calibration after the monthly or quarterly checks, maintenance and/or replacement of the pressure sensor system must occur. The ECB will be responsible for maintaining parts and making repairs.

2.44.1.6.1.8 Monthly Flow Rate Control Check

Perform the flow rate check upon startup and then monthly.

2.44.1.6.1.9 Quarterly Flow Rate Control Check

Conduct a flow rate check each calendar quarter, but use a flow rate transfer standard that is independent of the one used for the monthly checks. Should the flow rate mechanism not maintain its calibration after the monthly or quarterly checks, maintenance and/or replacement of the flow controller system(s) must occur. The ECB will be responsible for maintaining parts and making repairs. Consult the manufacturer or the operator's manual for procedures for maintenance, adjustment, and calibration of sample flow rates.

2.44.1.6.1 Summary of ECB QA/QC Procedures

The ECB is responsible for ensuring that monitors that fail to run within the required quality assurance and quality control limits are expeditiously repaired so that they will meet the QA/QC criteria. The ECB is also responsible for maintaining all of the calibration and audit equipment used for measuring temperature, barometric pressure, pressure drop, and flow rate.

References

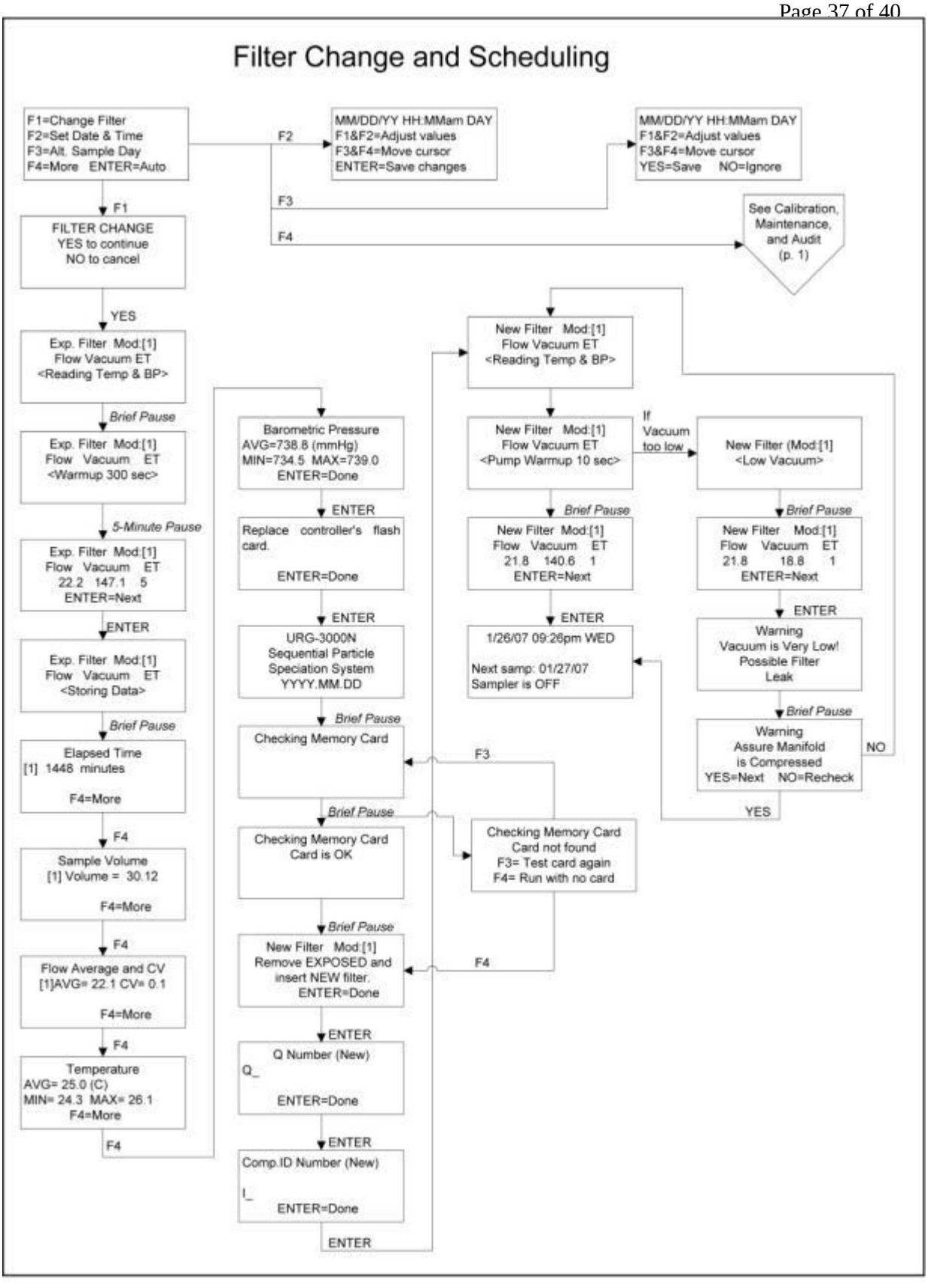
1. Standard Operating Procedure (Sop) For The Urg-3000N Sequential Particulate Speciation System Version 2.0. PM2.5 Chemical Speciation Network (CSN) Office of Air Quality Planning and Standards U.S. Environmental Protection Agency Research Triangle Park, NC 27709
2. Operation Manual (Revision 5.6). Sequential Particulate Speciation System URG-3000N. URG. October 2008.
3. EPA Guidance for Preparing Standard Operating Procedures (SOPs). EPA QA/G-6. Office of Environmental Information. Washington, D.C. April 2007.
4. IMPROVE Standard Operating Procedures, SOP 251 Sample Handling.

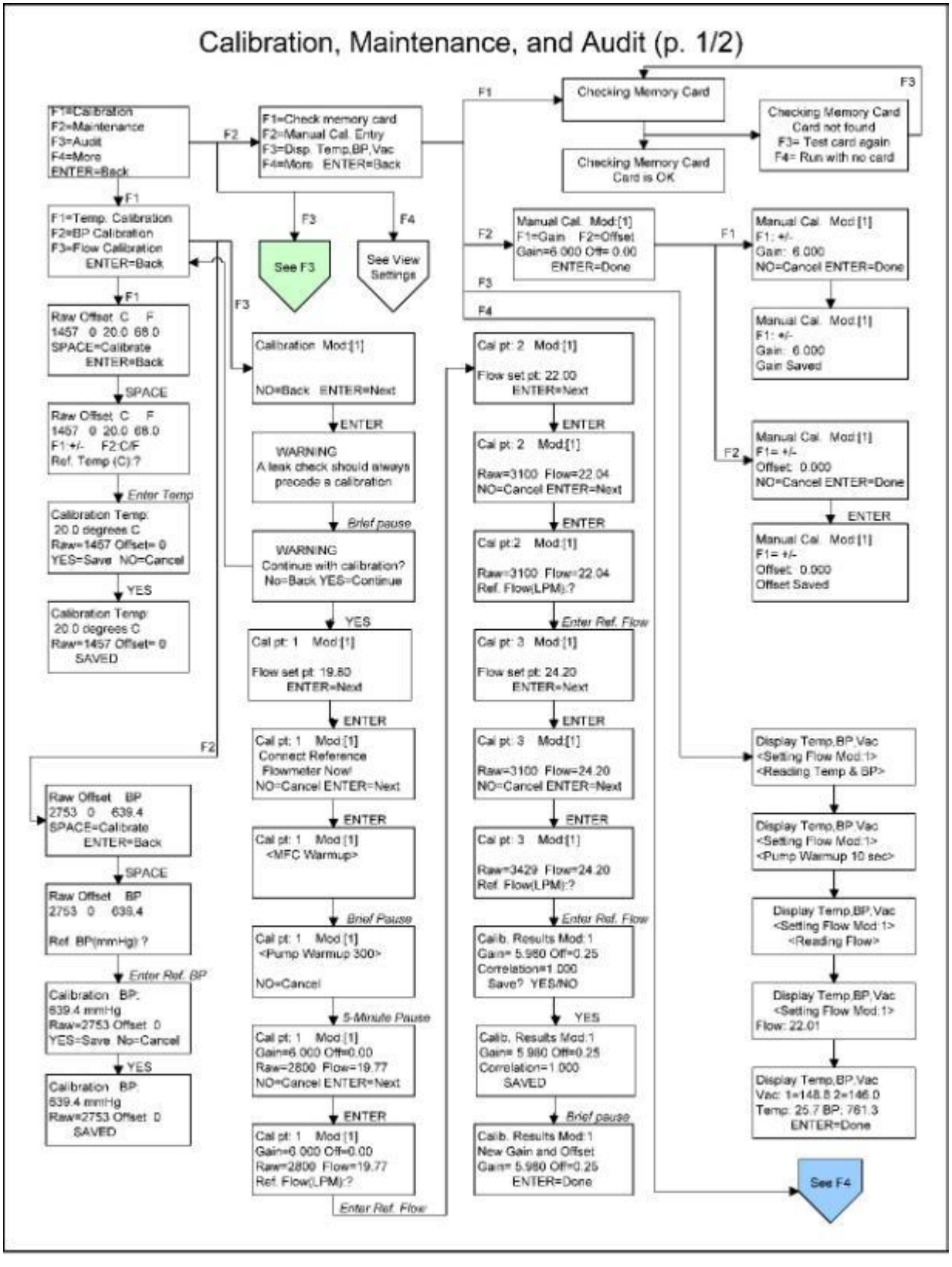
University of California. Davis, CA. September 12, 1996.

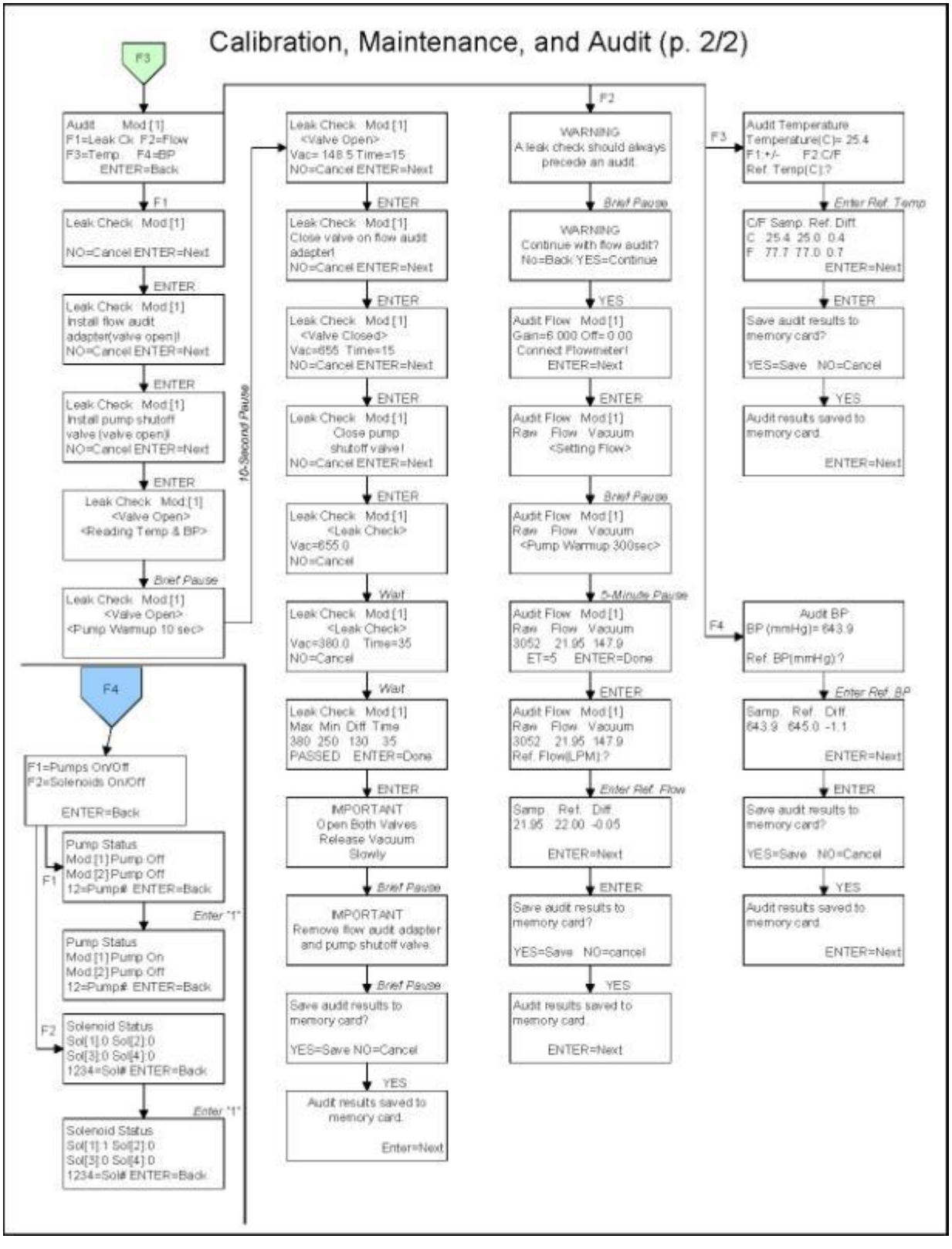
5. IMPROVE Standard Operating Procedures, SOP 226 Annual Site Maintenance. University of California. Davis, CA. September 12, 1996.
6. EPA Quality Assurance Guidance Document Method Compendium Addendum A. Andersen RAAS2.5-200 Audit Sampler. Field Standard Operating Procedures for the PM2.5 Performance Evaluation Program. Office of Air Quality Planning and Standards. Research Triangle Park, NC. December 1999.

Appendix A Menu Trees

Filter Change and Scheduling




Calibration, Maintenance, and Audit (p. 1/2)
F1=Calibration
F2=Maintenance
F3=Audit
F4=More
ENTER=Back
F2
F1=Check memory card
F2=Manual Cal. Entry
F3=Disp. Temp,BP,Vac
F4=More ENTER=Back
F1
Checking Memory Card
Checking Memory Card
Card is OK
Checking Memory Card
Card not found
F3= Test card again
F4= Run with no card
F3
F1
F1=Temp. Calibration
F2=BP Calibration
F3=Flow Calibration
ENTER=Back
F3
See F3
F4
See View Settings
F2
Manual Cal. Mod:[1]
F1=Gain F2=Offset
Gain=6.000 Off= 0.00
ENTER=Done
F1
Manual Cal. Mod:[1]
F1: +/-
Gain: 6.000
NO=Cancel ENTER=Done
Manual Cal. Mod:[1]
F1: +/-
Gain: 6.000
Gain Saved
F1
Raw Offset C F
1457 0 20.0 68.0
SPACE=Calibrate
ENTER=Back
SPACE
Raw Offset C F
1457 0 20.0 68.0
F1:+/- F2:C/F
Ref. Temp (C):?
Enter Temp
Calibration Temp:
20.0 degrees C
Raw=1457 Offset= 0
YES=Save NO=Cancel
YES
Calibration Temp:
20.0 degrees C
Raw=1457 Offset= 0
SAVED
F3
Calibration Mod:[1]
NO=Back ENTER=Next
ENTER
WARNING
A leak check should always
precede a calibration
Brief pause
WARNING
Continue with calibration?
No=Back YES=Continue
YES
Cal pt: 1 Mod:[1]
Flow set pt: 19.80
ENTER=Next
ENTER
Cal pt: 1 Mod:[1]
Connect Reference
Flowmeter Now!
NO=Cancel ENTER=Next
ENTER
Cal pt: 1 Mod:[1]
<MFC Warmup>
Brief Pause
Cal pt: 1 Mod:[1]
<Pump Warmup 300>
NO=Cancel
5-Minute Pause
Cal pt: 1 Mod:[1]
Gain=6.000 Off=0.00
Raw=2800 Flow=19.77
NO=Cancel ENTER=Next
ENTER
Cal pt: 1 Mod:[1]
Gain=6.000 Off=0.00
Raw=2800 Flow=19.77
Ref. Flow(LPM):?
Enter Ref. Flow
F4
Cal pt: 2 Mod:[1]
Flow set pt: 22.00
ENTER=Next
ENTER
Cal pt: 2 Mod:[1]
Raw=3100 Flow=22.04
NO=Cancel ENTER=Next
ENTER
Cal pt:2 Mod:[1]
Raw=3100 Flow=22.04
Ref. Flow(LPM):?
Enter Ref. Flow
Cal pt: 3 Mod:[1]
Flow set pt: 24.20
ENTER=Next
ENTER
Cal pt: 3 Mod:[1]
Raw=3100 Flow=24.20
NO=Cancel ENTER=Next
ENTER
Cal pt: 3 Mod:[1]
Raw=3429 Flow=24.20
Ref. Flow(LPM):?
Enter Ref. Flow
Calib. Results Mod:1
Gain= 5.980 Off=0.25
Correlation=1.000
Save? YES/NO
YES
Calib. Results Mod:1
Gain= 5.980 Off=0.25
Correlation=1.000
SAVED
Brief pause
Calib. Results Mod:1
New Gain and Offset
Gain= 5.980 Off=0.25
ENTER=Done
F2
Manual Cal. Mod:[1]
F1= +/-
Offset: 0.000
NO=Cancel ENTER=Done
ENTER
Manual Cal. Mod:[1]
F1= +/-
Offset: 0.000
Offset Saved
F2
Raw Offset BP
2753 0 639.4
SPACE=Calibrate
ENTER=Back
SPACE
Raw Offset BP
2753 0 639.4
Ref. BP(mmHg): ?
Enter Ref. BP
Calibration BP:
639.4 mmHg
Raw=2753 Offset 0
YES=Save No=Cancel
YES
Calibration BP:
639.4 mmHg
Raw=2753 Offset 0
SAVED
Display Temp,BP,Vac
<Setting Flow Mod:1>
<Reading Temp & BP>
Display Temp,BP,Vac
<Setting Flow Mod:1>
<Pump Warmup 10 sec>
Display Temp,BP,Vac
<Setting Flow Mod:1>
<Reading Flow>
Display Temp,BP,Vac
<Setting Flow Mod:1>
Flow: 22.01
Display Temp,BP,Vac
Vac: 1=148.8 2=146.0
Temp: 25.7 BP: 761.3
ENTER=Done
See F4


Calibration, Maintenance, and Audit (p. 2/2)
F3
Audit Mod [1]
F1=Leak Ck F2=Flow
F3=Temp F4=BP
ENTER=Back
F1
Leak Check Mod [1]
NO=Cancel ENTER=Next
ENTER
Leak Check Mod [1]
Install flow audit
adapter(valve open)!
NO=Cancel ENTER=Next
ENTER
Leak Check Mod [1]
Install pump shutoff
valve (valve open)!
NO=Cancel ENTER=Next
ENTER
Leak Check Mod [1]
<Valve Open>
<Reading Temp & BP>
Brief Pause
Leak Check Mod [1]
<Valve Open>
<Pump Warmup 10 sec>
10-Second Pause
Leak Check Mod [1]
<Valve Open>
Vac= 148.5 Time=15
NO=Cancel ENTER=Next
ENTER
Leak Check Mod [1]
Close valve on flow audit
adapter!
NO=Cancel ENTER=Next
ENTER
Leak Check Mod [1]
<Valve Closed>
Vac=655 Time=15
NO=Cancel ENTER=Next
ENTER
Leak Check Mod [1]
Close pump
shutoff valve!
NO=Cancel ENTER=Next
ENTER
Leak Check Mod [1]
<Leak Check>
Vac=655.0
NO=Cancel
Wait
Leak Check Mod [1]
<Leak Check>
Vac=380.0 Time=35
NO=Cancel
Wait
Leak Check Mod [1]
Max Min Diff Time
380 250 130 35
PASSED ENTER=Done
ENTER
IMPORTANT
Open Both Valves
Release Vacuum
Slowly
Brief Pause
IMPORTANT
Remove flow audit adapter
and pump shutoff valve
Brief Pause
Save audit results to
memory card?
YES=Save NO=Cancel
YES
Audit results saved to
memory card.
Enter=Next
F2
WARNING
A leak check should always
precede an audit
Brief Pause
WARNING
Continue with flow audit?
No=Back YES=Continue
YES
Audit Flow Mod [1]
Gain=6.000 Off= 0.00
Connect Flowmeter!
ENTER=Next
ENTER
Audit Flow Mod [1]
Raw Flow Vacuum
<Setting Flow>
Brief Pause
Audit Flow Mod [1]
Raw Flow Vacuum
<Pump Warmup 300sec>
5-Minute Pause
Audit Flow Mod [1]
Raw Flow Vacuum
3052 21.95 147.9
ET=5 ENTER=Done
ENTER
Audit Flow Mod [1]
Raw Flow Vacuum
3052 21.95 147.9
Ref. Flow(LPM)?
Enter Ref. Flow
Samp Ref Diff
21.95 22.00 -0.05
ENTER=Next
ENTER
Save audit results to
memory card?
YES=Save NO=cancel
YES
Audit results saved to
memory card.
ENTER=Next
F3
Audit Temperature
Temperature(C)= 25.4
F1:+/- F2:C/F
Ref. Temp(C)?
Enter Ref. Temp
C/F Samp Ref Diff
C 25.4 25.0 0.4
F 77.7 77.0 0.7
ENTER=Next
ENTER
Save audit results to
memory card?
YES=Save NO=Cancel
YES
Audit results saved to
memory card.
ENTER=Next
F4
Audit BP
BP (mmHg)= 643.9
Ref. BP(mmHg)?
Enter Ref. BP
Samp Ref Diff
643.9 645.0 -1.1
ENTER=Next
ENTER
Save audit results to
memory card?
YES=Save NO=Cancel
YES
Audit results saved to
memory card.
ENTER=Next
F4
F1=Pumps On/Off
F2=Solenoids On/Off
ENTER=Back
F1
Pump Status
Mod [1] Pump Off
Mod [2] Pump Off
12=Pump# ENTER=Back
Enter "1"
Pump Status
Mod [1] Pump On
Mod [2] Pump Off
12=Pump# ENTER=Back
F2
Solenoid Status
Sol[1]:0 Sol[2]:0
Sol[3]:0 Sol[4]:0
1234=Sol# ENTER=Back
Enter "1"
Solenoid Status
Sol[1]:1 Sol[2]:0
Sol[3]:0 Sol[4]:0
1234=Sol# ENTER=Back

View Settings, Site Configuration