STANDARD OPERATING PROCEDURE (SOP) FOR THE URG-3000N SEQUENTIAL PARTICULATE SPECIATION SYSTEM VERSION 2.0

$PM_{2.5}$ Chemical Speciation Network (CSN)
Office of Air Quality Planning and Standards
U.S. Environmental Protection Agency
Research Triangle Park, NC 27709

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1.0 Purpose and Applicability

In April 2005, the Clean Air Scientific Advisory Committee gave strong general support for making changes to the EPA $PM_{2.5}$ Chemical Speciation Network (CSN) to improve comparability with the rural Interagency Monitoring of Protected Visual Environments (IMPROVE) $PM_{2.5}$ carbon concentration data. The CSN currently includes about 185 sites and monitors $PM_{2.5}$ 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; when applicable, these differences will be highlighted in this standard operating procedure (SOP). 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, field operations, and quality control checks 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 $PM_{2.5}$ Carbon using the URG 3000N, specifically for data generated by the National $PM_{2.5}$ 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).

2.0 Safety Precautions, General Instructions, and Siting

2.1 Safety Precautions

2.1.1 To avoid electrical hazards, all sampler installation procedures should be conducted with the sampler disconnected from the AC power source.

2.1.2 Observe proper lifting procedures when unpacking and moving sampler components.

2.1.3 Read, understand, and follow all safety precautions for the sampler outlined in the sampler's operations manual.

2.1.4 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.

2.1.5 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.

2.1.6 Care must be taken when operating or calibrating the units in inclement weather. Safety is paramount.

2.1.7 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.

2.2 General Instructions

2.2.1 Read and thoroughly understand the operations manual before beginning field sampling operations. The ambient temperature, barometric pressure and flow rate calibrations of the sampler must be checked and, if necessary, adjusted to specifications prior to taking the first sample. Prior to any flow rate calibration or verification, a leak check must be performed. Consult the operations manual for calibration instructions.

2.2.2 Use only the sampling cartridges, sent to you from the laboratory, for the designated sampler and location.

2.2.3 Exercise great care in placement and handling of sampling cartridges to avoid contamination. Figure 2.1 below demonstrates the proper handling of sampling cartridge.

Figure 2.1 Handling of Sampling Cartridge

A red cap cover should be placed on the bottom of each of the four cassettes while the cartridge is in this position. Avoid touching the filter media while performing this task.

2.3 Siting

2.3.1 Ensure the sampler is level using a spirit level.

2.3.2 Ensure the sampler inlet is separated by at least 1 meter, but no more than 4 meter, from other $PM_{2.5}$ samplers and that the sampler has an unobstructed air flow of a minimum of 2 meter 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.

2.3.3 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.

3.0 Personnel Qualifications

Field technicians should be trained on all sampler operations prior to initiating the field procedures on their own. General knowledge of $PM_{2.5}$ Chemical Speciation sampling is recommended. Appendix C has information regarding the sampler assembly and installation procedure at the site.

4.0 Equipment and Supplies for Routine Sampling and Sampler Performance Verifications

Prior to conducting verification or routine sampling, the field scientist must gather the necessary equipment and supplies for the specified procedures.

4.1 Obtain a CSN Custody and Field Data Form (CAFDF) for the URG-3000N Sampler. The CAFDF (see Figure 6.1 in Section 6.0 Sampler Operating Procedures for Filters

Change-out and Setting up Sampling Events) and sampling supplies (filter cartridge and memory card) will be shipped to the site by the support laboratory for the upcoming sample day. If you are conducting quality control checks also bring a CSN QA/QC Spreadsheet (see Figure 8.1 in Section 8.0 Sampler QA/QC Procedures).

4.2 URG-3000N sampler operations manual and field notebook.

4.3 URG-3000N speciation sampler, accessories, and any tools needed.

4.4 When conducting verifications or calibrations, bring the "AUDIT" cartridge with four cassettes supplied by URG. Place a quartz filter in each of the four cassettes prior to going to the site. The filter in the cassettes will be replaced each year by the laboratory service contractor. Filters should be visually inspected before each use. Contaminated or damaged filters should be replaced by rotating (see text box below) the respective cassette with another cassette containing a fresh filter from the cartridge. The site operator should identify contaminated or damaged filter cassettes to avoid placing a contaminated or damaged filter back into service.

Rotating a cassette: When conducting verifications, calibrations, or leak checks, the filter in the number "1" position is used. The Number "1" position is located to the right of the pin used to position the cartridge in the sampler when installed. To remove the filter cassette, pop off the retaining ring that holds the cassette in the cartridge. Replace the contaminated or damaged filter cassette with one of the other three cassettes containing a fresh filter. Mark the contaminated or damaged filter with a colored dot to identify the filter is unusable.

4.5 For routine sample runs, the cartridge with cassettes and quartz sampling filters will be supplied by the support laboratory.

4.6 Bring the corrugated plastic shipping boxes, frozen ice substitutes, and UPS labels for shipment of sampling modules and reports to the support laboratory. These will be supplied by the support laboratory.

4.7 Independent NIST-traceable standards for quality control checks of sampler operation. All reference standards must be recertified as NIST-traceable annually.

- 4.7.1 Date and time. Use a calendar as a check for date. Atomic watch or cell phone is recommended.
- 4.7.2 Leak check. Bring the leak check assembly provided by URG.
  - a. Downtube reducer (1.5"ID to 1.25"OD)
  - b. Leak check adaptor (1.25" to brass hose barb with shutoff valve)
  - c. Pump shutoff valve assembly (This assembly was hard-plumbed into the Phase II and Phase III models of the URG 3000N)
- 4.7.3 Temperature. Use a thermocouple or thermistor-based digital thermometer transfer standard, with current NIST traceability.
- 4.7.4 Pressure. Use an aneroid barometer or equivalent transfer standard with current NIST traceability.
- 4.7.5 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.

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.

5.0 Sampler Verification

5.1 Introduction

Prior to the first use of the sampler and every month thereafter, conduct verifications of ambient temperature, barometric pressure, and flow rate. **Perform a leak check prior to conducting the flow rate verification.** Always use verification standards that are NIST-traceable with current certificates of traceability. Do not try to circumvent pump and mass flow controller warm-ups to "save time". These short-cuts will cause erroneous performance and therefore erroneous sampling results.

Use a CSN QA/QC Spreadsheet and field notebook to record and report results of the verification. Also, have a copy on hand of the latest version of the URG 3000N Operations Manual. For assistance in performing the verification refer to the Calibration, Maintenance, and Audit Menu Trees in Appendix A of this SOP.

With the older models in ambient conditions that are extremely cold or hot, a 60-minute equilibration is imperative. Usually operators or auditors find some way to minimize the implications like doing other work, or storing the device in a place that tracks the ambient temperature. There are other ways to save time as well. For example: taking another thermometer; if the "Tamb" is close to the thermometer and the "Tfil" is within one degree of "Tamb," the Trical is probably equilibrated. The new Tricals have a "Tamb" sensor that is outside of the box, which according to BGI provides a shorter equilibration time. We don't have experience with the new version yet, but it and all other Standards require some equilibration time, and the larger the temperature extremes the longer the equilibration period.

5.2 NIST-traceable Calibration Standards

Turn on the NIST-traceable calibration standard(s) and allow the standard to equilibrate to ambient conditions. Follow the procedures provided by standard's manufacturer regarding the length of time for the standard to reach stable conditions.

5.3 AUTO MODE to AUDIT Menu Screens

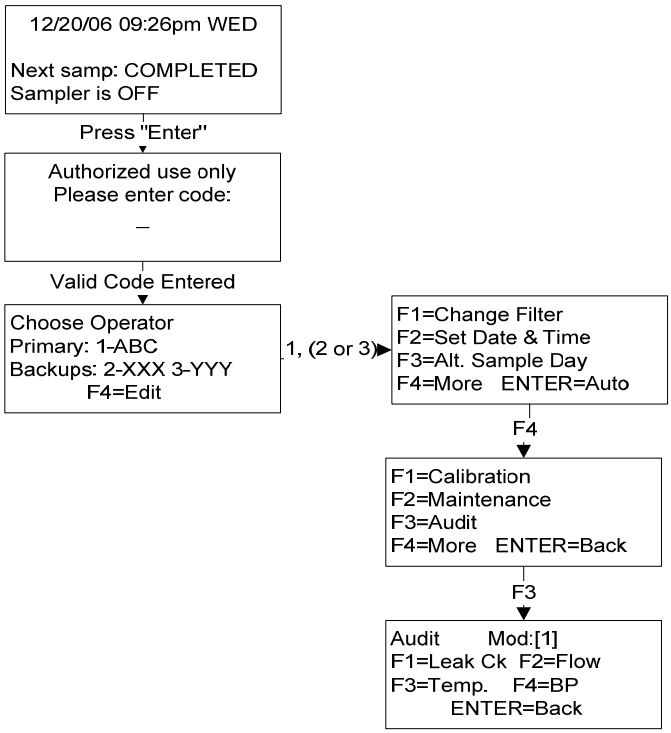
Figure 5.1 below displays the menu screens from the AUTO MODE screen to the Audit Menu. The first displayed in Figure 5.1 is the AUTO MODE screen. From this

screen, press the "**ENTER**" key to move to the Authentication screen. Then enter "**1123**" to proceed to Choose Operator screen (for samplers deployed during Phases II and III, pressing "ENTER" also allows the operator to proceed). Select the appropriate operator by their initials; the primary operator is "**1**", the backup operator is "**2"**, and the auditor is "**3**".

The initial of each operator is important for tracking issues on the memory card. See Appendix C for instructions on entering operator's initials.

The **F4** key will allow the operator to change the initials for the operator, backup, or auditor. Selecting "**1**, **2**, or **3**" or "**F4**" keys will automatically proceed to the next screen, the Main Menu. Skip the "**F1**", "**F2**", and "**F3**" keys unless the date and time or sampling schedule needs corrected. Select the "**F4**" key to proceed to the next screen, the second Main Menu. At the second Main Menu, press the "**F3**" key for the Audit Menu.

Figure 5.1 Menu Tree from AUTO MODE Screen to Audit Menu Screen

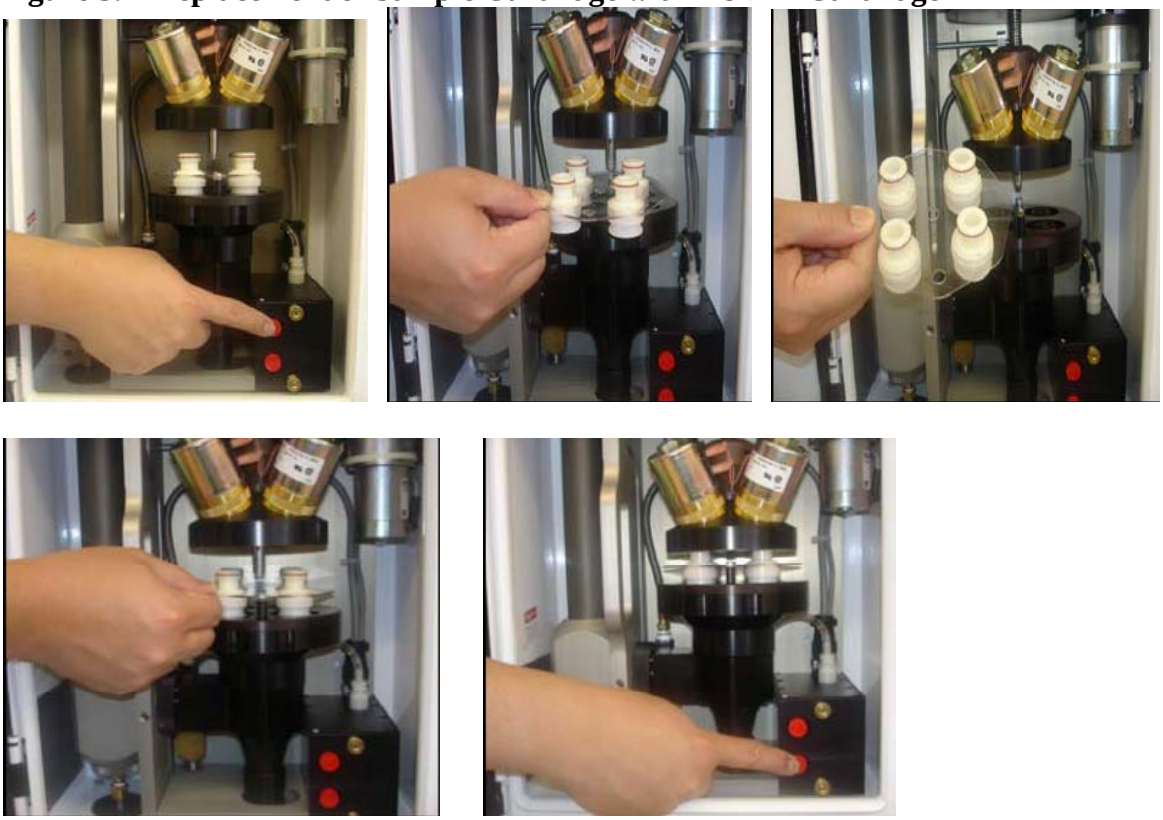


5.4 Audit Cartridge

Refer to Figure 5.2 illustrations of five steps to remove existing cartridge and inserting the "AUDIT" cartridge. Open the Sample Module door and raise the solenoid manifold by pressing the red "up" button on the electronic box. Remove any filter cartridge on the cassette manifold and place red caps on the bottom of the four filter cassette inlets. Remove the red caps from the "AUDIT" cartridge and place the

cartridge on the cassette manifold. Lower the solenoid manifold by pressing and holding the red "down" button. Release the "down" button when the solenoid manifold has stopped moving to close the filter cassettes against the cassette manifold.

Figure 5.2 Replacement of Sample Cartridge with AUDIT Cartridge



5.5 Ambient Temperature Verification

5.5.1 At the base of the inlet tee, locate the ambient temperature probe (see Figure 5.3).

5.5.2 While holding the ambient temperature probe cable, gently push the black plastic disc through the bottom of the Sample Module (see Figure 5.4).

5.5.3 With one hand reach into the sample module box. Carefully wiggle the probe plug free with your thumb and forefinger while holding temperature probe cable on the bottom side of the sample module box with your other hand. Glide the probe through the opening at the bottom of the sample module. Set the temperature probe plug inside the sample module away from direct sunlight (exposing the probe to ambient conditions).

5.5.4 Place the reference temperature probe ½ inch from the sampler's ambient temperature probe and allow both temperature probes to equilibrate (see Figure 5.5). If it is windy place the probes in the module for reading. This will minimize interference from wind effects.

Figure 5.3 Interior of the Sample Module Supporting

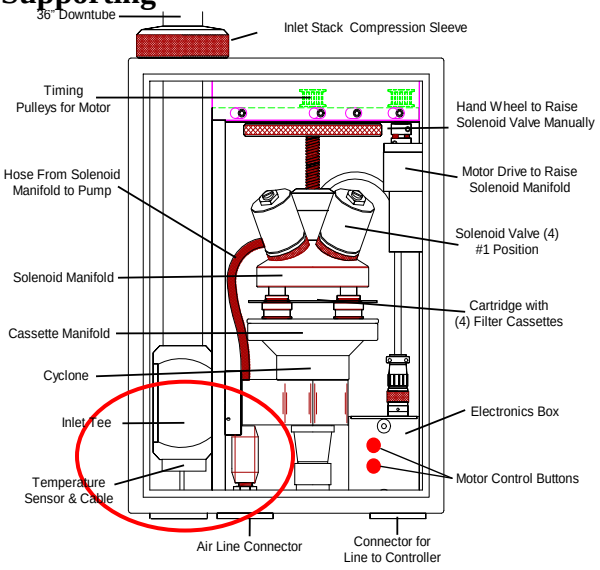


Figure 5.4 Black Plastic Disc the Ambient Temperature Probe

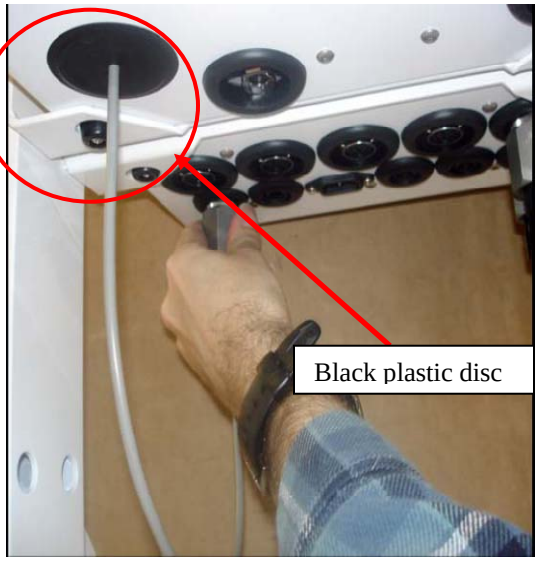
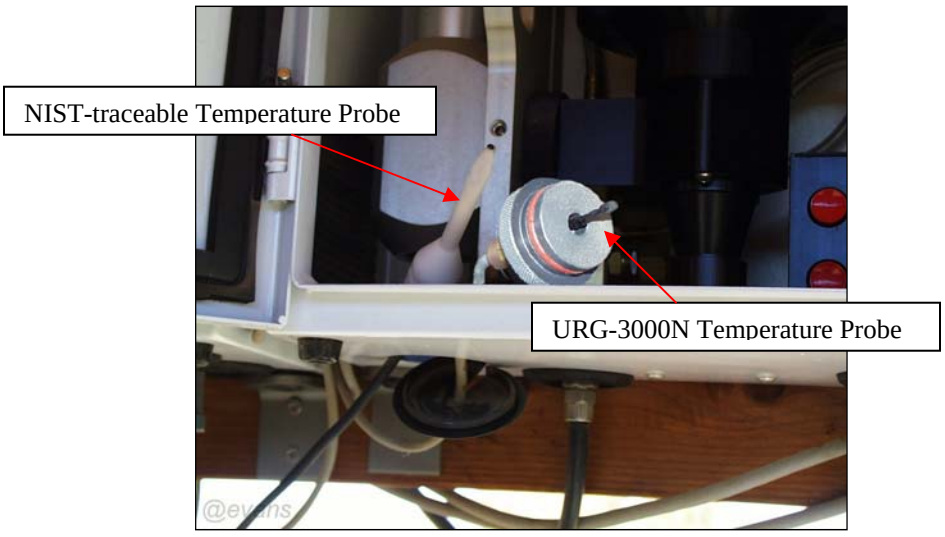
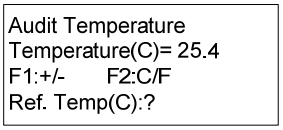


Figure 5.5 Ambient Temperature Probe and NIST-traceable Temperature Probe



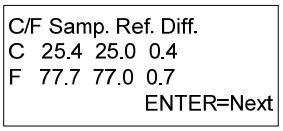
5.5.5 At the Audit Menu, press the "**F3**" key to proceed to the ambient temperature verification (audit) screen (see screen below).



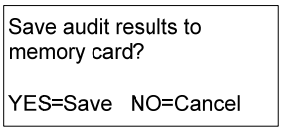
5.5.6 After the two probes equilibrate, enter in the reference standard temperature value in degrees Celsius. Press the "**F1"** key to toggle between positive and negative values; press the "**F2"** key to toggle between Celsius and Fahrenheit. (Example: for 25.2 ºC; enter "**252**". The decimal place is fixed for a tenth degree.)

5.5.7 Record the sampler and reference standard values in degrees Celsius on the CSN QA/QC Spreadsheet and the field notebook. **The agreement should be within ±2 ºC**. If values do not agree within acceptance criteria, perform an ambient temperature calibration (see Section 7.1).

5.5.8 After entering the reference standard's temperature, the next screen shows the sampler's temperature, reference standard's temperature, and the difference between the two values in Fahrenheit and Celsius (see screen below).



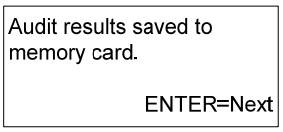
5.5.9 Press the "**ENTER**" key to proceed to the next screen (see below).



5.5.10 Press the "**YES**" key to save audit results to the memory card. If the operator selects the "**NO**" key, no data will be saved and the sampler software will return to the Audit Menu screen.

When reviewing the memory card, all files beginning with an "a" are audit files.

By selecting "**YES**", the next screen appears. (This screen could take a couple of minutes to appear.)



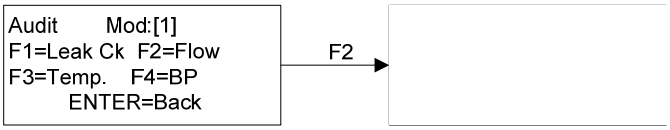
5.5.11 Press the "**ENTER**" key to return to the Audit Menu.

5.5.12 Remove the temperature reference standard and securely replace the sampler's temperature probe in the bottom of the inlet tee. Replace the black plastic disc.

5.5.13 If the operator wishes to return to the AUTO MODE, press the "**ENTER**" key twice. See Sections 5.6 to 5.8 to continue with the barometric pressure verification, leak check, and flow rate verification,

5.6 Barometric Pressure Verification

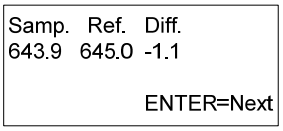
5.6.1 At the Audit Menu, press the "**F4**" key to proceed to the barometric pressure verification (audit) screen (see screens below).



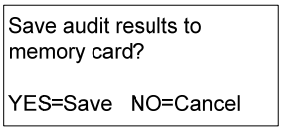
5.6.2 Enter the barometric pressure (in mm Hg) of an equilibrated NIST-traceable reference standard using the keypad. (Example: for 754 mm Hg; enter 7540, the display screen will show 754.0 mm Hg. The decimal place is fixed for a tenth degree. If you entered "**754**", the display screen will show 75.4 mm Hg which is incorrect.)

5.6.3 Record the sampler and reference standard values in mm Hg on the CSN QA/QC Spreadsheet and the field notebook. **The agreement should be within ±10 mm Hg**. If values do not agree within acceptance criteria, perform a barometric pressure calibration (see Section 7.2).

5.6.4 After entering the reference standard's barometric pressure, the next screen shows the sampler's barometric pressure, the reference standard's barometric pressure, and the difference between the two values in mm Hg (see screen below).



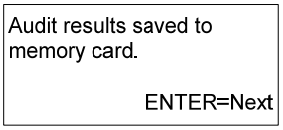
5.6.5 Press the "**ENTER**" key to proceed to the next screen (see below).



5.6.6 Press the "**YES**" key to save audit results to the memory card. If the operator selects the "**NO**" key, no data will be saved and the sampler software will return to the Audit Menu screen.

When reviewing the memory card, all files beginning with an "a" are audit files.

By selecting "**YES**", the next screen appears. (This screen could take a couple of minutes to appear.)



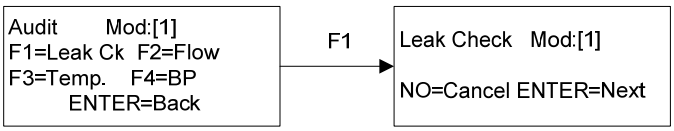
5.6.7 Press the "**ENTER**" key to return to the Audit Menu.

5.6.8 If the operator wishes to return to the AUTO MODE, press the "**ENTER**" key twice. To continue with a leak check and flow rate verification, see Sections 5.7 to 5.8.

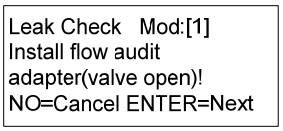
5.7 Leak Check

Suggestion: While there is no reason to anticipate widespread performance problems, it would be advisable to perform a leak check several times during the first month or two of operation. Issues with flow rates and other parameters are more self-evident and are recorded by the sampler controller when they occur.

5.7.1 At the Audit Menu, press the "**F1**" key to proceed to the leak check (see screens below).



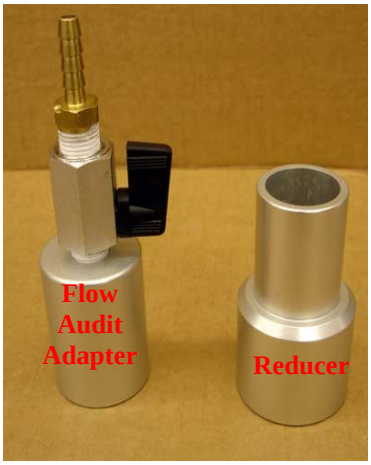
5.7.2 Press the "**ENTER**" key to begin the leak check. The screen below requests the operator install the flow audit adapter in the open position.



5.7.3 Ensure that the flow audit adapter is in the open position. If not, open it, and then remove the inlet cap at the top of the downtube (see Figure 5.6). Place the reducer on the downtube and then the flow audit adapter on the reducer (see Figure 5.7).

Figure 5.6 Removal of Ambient Air Inlet Cap

Figure 5.7 Placing the Reducer and the Flow Audit Adapter on the Downtube



5.7.4 Press the "**ENTER**" key to continue with the leak check. The screen below requests that the operator install the pump shutoff valve in the open position.

```
Leak Check   Mod:[1]
Install pump shutoff
valve (valve open)!
NO=Cancel ENTER=Next
```

Phases II and III o f the URG 3000N sampler have the pump shut-off valve plumbed into the pump box. There is an "OPEN/CLOSED" valve on the side of the box.

5.7.5 Inspect and assure the pump shutoff valve is in the open position. For Phase I samplers, it will be necessary to disconnect the vacuum line from the side of the pump enclosure (see Figure 5.8). Connect the pump shutoff valve to the vacuum (air) line and reconnect to the side of the pump enclosure (see Figures 5.9 and 5.10).

Figure 5.8 Vacuum (air) Line Disconnect

Figure 5.9 Pump Shutoff Valve Connection

Figure 5.10 Connection of Air Line to Pump Shutoff Valve

5.7.6 Press the "**ENTER**" key to continue with the leak check. The software screen will now display that both valves are open, the pump is warming up, and a vacuum and time value, which will count down from 15 to 0 seconds. (See screens below).

```
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
```

5.7.7 Press the "**ENTER**" key to continue to the next screen. This screen below requests the operator close the flow audit adapter at the top of the downtube.

```
Leak Check   Mod:[1]
Close valve on flow audit
adapter!
NO=Cancel ENTER=Next
```

5.7.8 Rotate the lever on the flow audit adapter 90º to close the **flow audit adapter** (see Figure 5.11 below). This will begin creating a vacuum in the downtube,

through the sampler, to the pump. The pump should begin to sound a little louder representing more stress on the pump.

5.7.9 Press the "**ENTER**" key to continue to the next screen. The vacuum will begin to increase and at a point near 680 mm Hg, the time will begin to count down from 15 to 0.

```
Leak Check   Mod:[1]
  <Valve Closed>
Vac=655  Time=15
NO=Cancel ENTER=Next
```

5.7.10 After countdown reaches zero, press the "**ENTER**" key to continue to the next screen.

```
Leak Check   Mod:[1]
        Close pump
        shutoff valve!
NO=Cancel ENTER=Next
```

5.7.11 Promptly rotate the lever on the pump shutoff valve 90º to close the valve (see Figure 5.11 below).

Figure 5.11 Flow Audit Adapter and Shutoff Pump Valve in the Closed Position

5.7.12 Press the "**ENTER**" key to begin the leak check. The pump will stop automatically. The vacuum will begin to drop and when it reaches 380 mm Hg, a timer will count for a maximum of 35 seconds. For Phases II and III models, the overall leak capability of the sampler has been improved. Thus, it may take longer for the vacuum drop to reach 380 mm Hg. As a result, the software has been programmed to begin the 35-second count if it takes 70 seconds for the vacuum drop to reach 380 mm Hg.

```
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
```

5.7.13 After the countdown from 35 seconds, the results will be displayed as either PASSED or FAILED. The acceptance criterion is a vacuum drop of less than 225 mm Hg in 35 seconds. The timer will stop if the leak is large enough for the vacuum pressure to drop more than 225 mm Hg within 35 seconds.

PASSED

```
Leak Check   Mod:[1]
Max  Min  Diff  Time
380  250   130    35
PASSED    ENTER=Done
```

FAILED

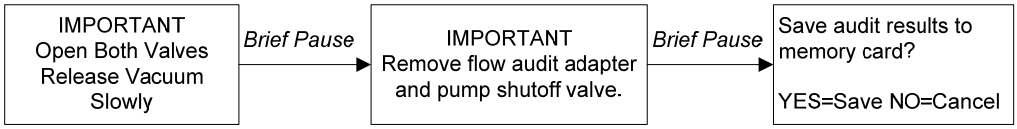
```
Leak Check   Mod:[1]
Max  Min  Diff  Time
380   81   299    15
FAILED    ENTER=Done
```

5.7.14 Record the pressure drop in mm Hg on the CSN QA/QC Spreadsheet and in the field notebook. If the sampler fails the leak check, attempt another leak check. If the sampler fails both times, refer to Section 10.0 Troubleshooting or to the Operations Manual. If you are still unable to solve the leak problem, contact URG at (919) 942-2753, http://www.urgcorp.com/index.php/email-form or info@urgcorp.com.

5.7.15 Press the "**ENTER**" key to advance to the next screen shown below. Slowly release the pressure in the sampler by **FIRST** slowly turning the lever on the flow audit adapter.

> ***Releasing the vacuum quickly may rupture the filter or pop it loose from the cassette.***

The next screen will request the operator remove the flow audit adapter and pump shutoff valve. If the operator is going to perform a flow rate verification or calibration, the flow audit adapter can remain in place. If the operator is not going to perform a flow rate check, remove the flow audit adapter and then the pump shutoff valve. Reconnect the vacuum (air) line and store the flow audit adapter and pump shutoff valve in a safe place for further service.



5.7.16 Press the "**YES**" key to save audit results to the memory card. When reviewing the memory card, all files beginning with an "a" are audit files. By selecting "**YES**", the next screen appears.

```
Audit results saved to
memory card.

                ENTER=Next
```

5.7.17 Press the "**ENTER**" key to return to the Audit Menu.

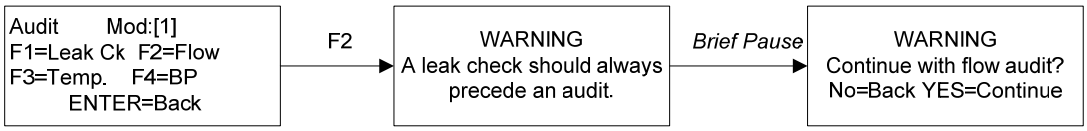
5.7.18 If the operator wishes to return to the AUTO MODE, press the "**ENTER**" key twice. To continue with flow rate verification, see Sections 5.8.

5.8 Flow Rate Verification

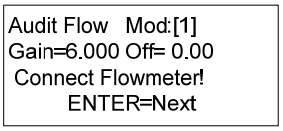
Prior to conducting flow rate verification, a successful leak check must be completed (see Section 5.7). The operator should use a NIST-traceable flow rate calibration

standard that has been equilibrated to ambient conditions. Follow the procedures provided by standard's manufacturer regarding the length of time for the standard to obtain stable conditions. The flow rate verification must be conducted with the "AUDIT" cartridge. See Section 5.4 regarding proper procedure for inserting the "AUDIT" cartridge. If the flow audit adapter is not connected to the top of the downtube, remove the inlet cap and place the flow audit adapter on the top of the downtube. Connect tubing from reference standard to the flow audit adapter and begin the flow rate verification.

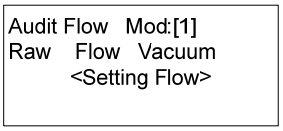
5.8.1 At the Audit Menu, press the "**F2**" key to proceed to the flow rate verification (audit) screen (see screens below).



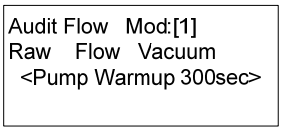
5.8.2 Press the "**YES**" key to continue with the flow verification (audit). The values for the Gain and Offset should be near 6.00 and 0.00, respectively.



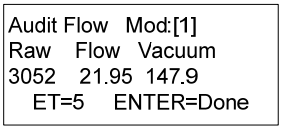
5.8.3 Check connections to reference flow meter, and press the "**ENTER**" key to continue.



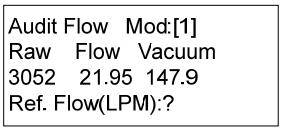
5.8.4 The Mass Flow Controller (MCF) initiates after a brief pause and the following screen appears.



5.8.5 The MFC will run for 5 minutes (300 seconds) at the samplers design flow rate of 22.0 L/min. At the end of the 5-minute warm up period, the screen below will appear showing the sampler's flow rate and vacuum at that time.

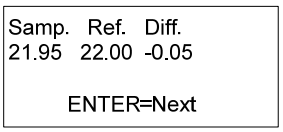


5.8.6 Press the "**ENTER**" key to continue to the next screen. In the screen below, the operator is prompted to enter the reference standard's flow rate in L/min. Use the keypad to enter the reference standard's flow rate value. The decimal place is fixed at two decimal places, so for a flow rate of 21.95 L/min., enter "**2195**".



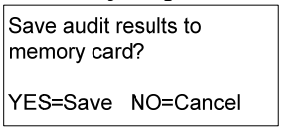
Note the pump will not shutdown until all the reference flow rates have been recorded.

5.8.7 After entering the reference standard's flow rate, the screen below appears showing the sampler's flow rate, the reference standard's flow rate, and the difference (sampler – reference standard) between the two values (all in L/min).



5.8.8 Record the sampler and reference standard values in L/min on the CSN QA/QC Spreadsheet and in the field notebook. **The agreement should be within ±10 %**. If values do not agree within acceptance criteria, perform a flow rate calibration (see Section 7.3).

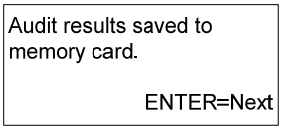
5.8.9 Press the "**ENTER**" key to proceed to the next screen (see below).



5.8.10 Press the "**YES**" key to save audit results to memory card. If the operator selects "**NO**" no data will be saved and the sampler software will return to the Audit Menu screen.

When reviewing the memory card, all files beginning with an "a" are audit files.

By selecting "**YES**", the next screen appears. (This screen could take a couple of minutes to appear.



5.8.11 Press the "**ENTER**" key will return to the Audit Menu.

5.8.12 If the operator wishes to return to the AUTO MODE, press the "**ENTER**" key twice. This concludes the verification of the routine URG-3000N sampler. If any parameter failed the verification check, refer to Section 7.0 Calibration of Sampler, for assistance.

6.0 Sampler Operating Procedures for Routine Filters Change-out and Setting Up Sampling Events

The URG-3000N sampler is designed to sample on a 1-in-3 day or a 1-in-6 day schedule. After the correct date and time are programmed (see Appendix C), the software default is set at a 1-in-3 schedule. If you are sampling on a 1-in-6 day schedule, please see Appendix C for steps to change the program to run the 1-in-6 schedule. The sample also can be programmed to run an alternative sample date (see Appendix C). For any other programming issues please see the URG-3000N Operations Manual.

The sampler software identifies two types of filters, Exposed Filter and New Filter. The Exposed Filter is the filter in the sampler from the previous sample run. The New Filter is the filter for the next sample run. See the two display screens below to understand where the designation (in bold) is on the screen. The Mod:[1] represents sampling from Module 1.

Exp. Filter Mod:[1]
Flow Vacuum ET
22.2 147.1 5
ENTER=Next

New Filter Mod:[1]
Flow Vacuum ET
21.8 140.6 1
ENTER=Next

When the CSN operator goes to the site to recover exposed filter and set-up new sampling events, they should bring the following equipment and supplies.

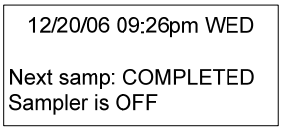
1. Operations Manual or this SOP with Menu Trees for operating the sampler
2. Field notebook
3. Marker (indelible ink)
4. Quartz filter(s) in a filter cassette mounted on a filter cartridge in a 9" x 12" sealable plastic shipping bag (provided by the support laboratory)
5. Compact Flash memory card in a 3" x 4" anti-static sealable plastic shipping bag (provided by the support laboratory)
6. $PM_{2.5}$ CSN Custody and Field Data Form (CAFDF) provide by the support laboratory (Figure 6.1 shows an example of this form.)
7. "AUDIT" filter cartridge (provided by manufacturer)
8. NIST-traceable calibration standard(s) for ambient temperature, barometric pressure, and flow rate with connecting tubing
9. Leak check assembly (flow audit adaptor and shutoff pump valve provided by the manufacturer)
10. Laboratory tissue

It is highly recommended that the exposed filter be recovered from the sampler as soon as practical, but no later than 120 hours.

6.1 Filter Changing

6.1.1 Prior to opening the Controller or Sample Module doors, check for moisture buildup from rain or snow on the sample housing; remove as necessary. Report the findings on the CAFDF and field notebook.

6.1.2 Open the Controller Module and confirm that the sampler has power by viewing the display screen. The AUTO MODE screen (see below) should be visible.



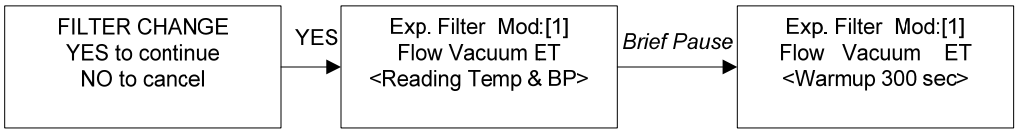
6.1.3 The keypad has an extension cord and magnetic strips. Remove the keypad from its holder and move it with attached extension cord to the front of the Sample Module. Open the Sample Module door and attach the keypad (magnetic strips) to the inside of the Sample Module door.

6.1.4 Inspect the Sample Module for moisture and wipe out with a laboratory tissue if necessary. Inspect the seating around the filter manifold and filter cassette. Report the findings on the CAFDF and field notebook.

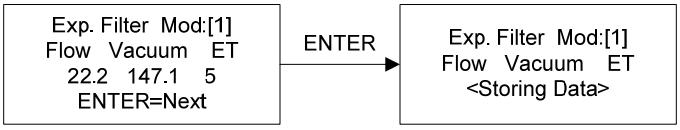
6.1.5 From the AUTO MODE display screen, record the sample cartridge removal date and time on the Exposed Filter CAFDF in the Retrieval Date and Retrieval Time columns.

6.1.6 Use the Filter Change and Scheduling Menu Tree (see Appendix) to assist in applying the proper keystrokes for the software program. Begin by pressing the "**ENTER**" key. The display screen below should appear.

6.1.7 Press the "**F1**" key and then the "**YES**" key to proceed to the filter change menu. The sampler will read the ambient temperature and barometric pressure for the Exposed Filter and record the information on the Compact Flash memory card. After a brief pause, the MFC will initiate (see the screens below).

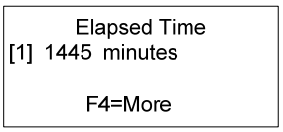


6.1.8 After five minutes, the program will show the final flow rate and vacuum pressure. Press the "**ENTER**" key, and the final flow rate values will be stored for the Exposed Filter on the memory card (see screens below).



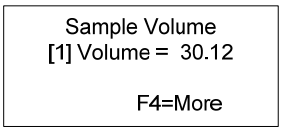
6.1.9 After a brief pause, the program will display the results for the Exposed Filter. These results are stored on the memory card and should be transcribed to the CAFDF assigned to the Exposed Filter.

6.1.10 The first screen (below) shows the elapsed time for the Exposed Filter sampling event. Record this value (*1445 minutes*) in the Run Time column on the CAFDF. An accepted sample run is 24 hours ± 1 hour (1440 minutes ± 60 minutes). If the elapsed time was less than 1380 minutes or more than 1500 minutes, record "YES" in the Run Time Flag column. Remember the sampler performed a final flow rate and vacuum check for 5 minutes (see Step 6.1.7).

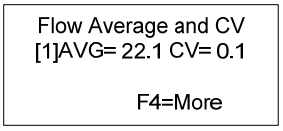


6.1.11 The sampler is designed to start at midnight and run until midnight the following day. Since the URG-3000N does not display the Start Date, Start Time, End Date, or End Time on the display screens, the operator need to determine the Stop Time and Stop Date based on the elapsed time. The Start Date was recorded on the CAFDF when the sample run was initially programmed and if the sampler ran as programmed; the Start Time would be 0:00.

6.1.12 Press the "**F4**" key to advance to the next screen below shows the sample volume in m^3 (*30.12*). Report the volume on the CAFDF under the Sample Volume column.



6.1.13 Press the "**F4**" key to view the flow average in L/min (*22.1*) and the coefficient of variation (CV) in percent (*0.1*). Report the flow average and CV on the CAFDF under the Average Flow and Average CV columns.



6.1.14 Press the "**F4**" key to view the average (*25.0*), maximum (*26.1*), and minimum (*24.3*) ambient temperatures during the sample run in ºC. Report these results on the CAFDF under the Average Ambient Temperature, Maximum Ambient Temperature, and Minimum Ambient Temperature columns.

Temperature
AVG= 25.0 (C)
MIN= 24.3 MAX= 26.1
F4=More

6.1.15 Press the "**F4**" key to view the average (*738.8*), maximum (*739.0*), and minimum (*734.5*) barometric pressure during the sample run in mm Hg. Report these results on the CAFDF under the Average Barometric Pressure, Maximum Barometric Pressure, and Minimum Barometric Pressure columns.

Barometric Pressure
AVG=738.8 (mmHg)
MIN=734.5 MAX=739.0
ENTER=Done

6.1.16 After displaying the Exposed Filter data, the controller will prompt the operator to replace the memory card (see screen below). Replace the old memory card by pulling lightly (see below) and placing a new memory card provided by the support laboratory. The memory card will only fit in the memory card slot one way. Do not force it into the slot. Place the old memory card in a 3" x 4" anti-static sealable plastic shipping bag provided by the support laboratory. The file name for the sample run on the memory card will begin with "r".

Replace controller's flash card.
ENTER=Done

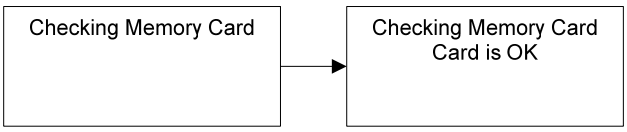
6.1.17 Press the "**ENTER**" key and the system will reset briefly showing the URG-3000N boot screen (below).

URG-3000N
Sequential Particle
Speciation System
YYYY.MM.DD

6.1.18 After a brief pause, the screen below appears.

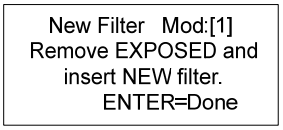
Checking Memory Card

The system is checking the new memory card. If the card is found to be OK, it will continue to the New Filter Menu after a brief pause (see screens below).



If the card is not found, the operator will have the option to run the sampler with no card (not recommended in CSN program) or test card again. If the sampler still does not recognize the card, use the old memory card and report issue on the CAFDF and report in the field notebook. Return the malfunctioned memory card to the support laboratory.

6.1.19 The first screen in the New Filter Menu below request for the operator to replace the Exposed Filter with the New Filter.



6.1.20 To remove the Exposed Filter cartridge, press the top "**up**" button on the electronic box to raise the solenoid manifold until the cartridge is released.

In cold weather, the motor may not move the manifold initially. In this case, first try to move the large knurled wheel above the solenoids. If the does not work, disengage the motor (see Section 9.1) to allow for manually moving the manifold up and down.

Grasp the filter cartridge with the bottom side down and place the red caps on all of the filter inlets. Place the cartridge in the 9" x 12" sealable plastic shipping bag provided by the support laboratory. See demonstration of filter cartridge removal below.

Place the white and pink copies of the Exposed Filter CAFDF in the 9" x 12" sealable plastic shipping bag. The site operator will maintain the yellow copy for their records. Place the 3" x 4" anti-static sealable plastic containing the Exposed Filter memory card in the larger 9" x 12" bag. This larger bag will be shipped to the support laboratory (see Section 6.2).

6.1.21 Prior to removing the New Filter cartridge from the sealable plastic shipping bag, check that all four filter inlets are covered with red caps. If any of these caps came off during shipping, please note on the CAFDF for the New Filter. Now remove the New Filter cartridge from the sealable plastic shipping bag provided by the support laboratory. Align with the hole forward as below to

the left. Insert the cartridge into the cassette manifold and press the bottom "**down**" button on the electronic box to lower the solenoid manifold until it stops.



6.1.22 Press the "**ENTER**" key to advance to the next screen below. This screen identifies the Q Number for the New Filter. The Q Number for the New Filter can be found at the top left of the CAFDF. Using the keypad, enter the Q Number. The cursor on the display screen indicates where you are entering information. Some of the Q Numbers include both alpha and numeric characters. You can enter letters via the Controller Keypad by pressing the F1 key several times. F1 will step forward through number 0-9 and then continue to step through letters A-Z. You can use the F2 key to go back to previous numbers and/or letters already pressed when using F1. Double-check entry before continuing.

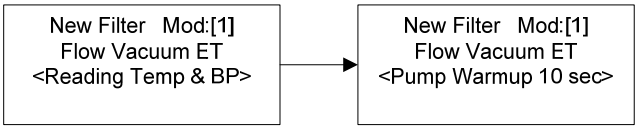
```
Q Number (New)
Q_

ENTER=Done
```

6.1.23 Press the "**ENTER**" key to advance to the next screen below. This screen identifies the Comp ID Number for the New Filter. The CAFDF identifies two Comp ID Numbers; the operator is to use the keypad to enter the Comp ID Number for the Quartz cartridge. The cursor on the display screen indicates where you are entering information. As with the Q Number, some of the Comp ID Numbers include both alpha and numeric characters. You can enter letters via the Controller Keypad by pressing the F1 key several times. F1 will step forward through number 0-9 and then continue to step through letters A-Z. You can use the F2 key to go back to previous numbers and/or letters already pressed when using F1. Double-check entry before continuing.

```
Comp.ID Number (New)
I_
ENTER=Done
```

6.1.24 Press the "**ENTER**" key to advance to the next screen below. The sampler will read the ambient temperature and barometric pressure for the New Filter and record the information on the Compact Flash memory card. The MFC will

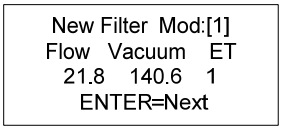
warm up for 10 seconds to conduct an initial vacuum check (see the screens below).



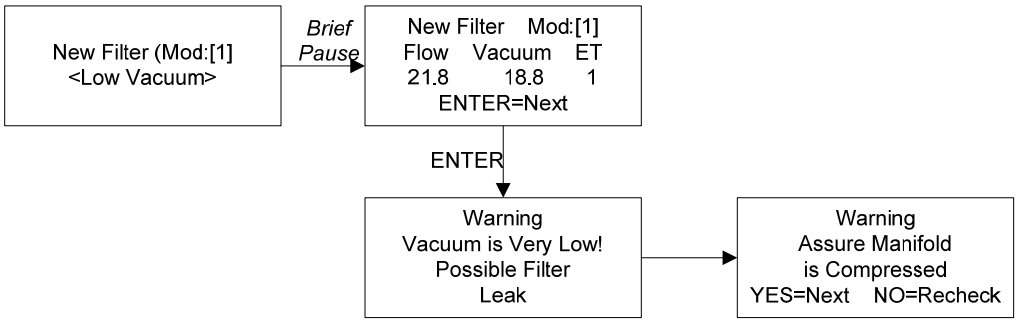
6.1.25 After a brief pause, the program will show the final flow rate and vacuum pressure.

If you do not press "ENTER", the pump may continue to run. Consequently, press the "ENTER" to stop the pump and air flow after the disposition of the vacuum is ascertained so that the filter is not exposed unnecessarily to the "wrong-sampling-day" air.

Press the "**ENTER**" key, and the final flow rate values will be stored for the Exposed Filter on the memory card (see screens below).

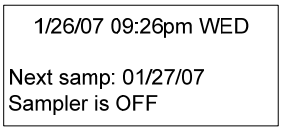


If the measured vacuum pressure is less than 50 mm Hg, the following screens will appear.



If the compression (vacuum pressure) is too low, review the leak check issue under Section 10.0 Troubleshooting (possible O-ring issue or the seating between solenoid manifold, filter cassettes, and cassette manifold). When the leak issue is resolved, press the "**NO"** key to recheck. Report leak issue in the field notebook and CAFDF.

6.1.26 After a satisfactory vacuum check has been obtained, press the "ENTER" key and the sampler will return to the AUTO MODE menu shown below.

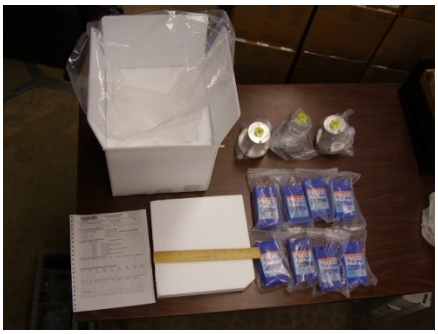


6.1.27 The filter changing procedure is completed at the site. Take all equipment, supplies, and shipping bags with filter cartridge and memory card back to the field office.

6.2 Shipping the Sample

6.2.1 Protect the sample from direct sunlight and extreme heat during transport from the site to the field office. Store them in a secure, air-conditioned area until just before packaging them in the cooler. *The filter cartridge, paperwork, and memory card must be properly packaged in a shipping container, ready for pickup by UPS, within 96 hours after the sampling cartridge has been recovered. The support laboratory will provide specific directions for packaging and shipment and days for shipment. Days of the week for shipment will be arranged in coordination with the DOPO and laboratory. Do not ship on Fridays unless prior arrangements are made with the DOPO and laboratory.*

6.2.2 In the CSN, the URG-3000N sampler will be assigned to locations that use the MetOne (SASS or Super SASS) sampler or other speciation samplers. These samplers use sample modules to collect samples. The two pictures below illustrate the packing of the MetOne sample modules.



6.2.3 After packing the MetOne sampler modules, place the 9” x 12” sealable plastic shipping bag containing the URG-3000N filter cartridge, completed CAFDF, and small anti-static plastic bag containing the memory card on top of the modules. The three pictures below show packing of the URG-3000N filter cartridge, paperwork, and memory card.

6.2.4 Place the insulated lid on, cover with plastic, and seal the shipping container.

6.2.5 Place the appropriate UPS shipping label and ship the support laboratory.

6.3 Generation of 24-hour Field Blanks

The procedure for sampling the field blanks has not been determined. When an approved procedure has been accepted, steps will be added to the SOP. The current plan is to place a "BLANK" filter in the Number 4 position on the filter cartridge. As a natural consequence of the procedure, the filter will remain in the Sampler for the 24-hour routine sampling, plus recovery time.

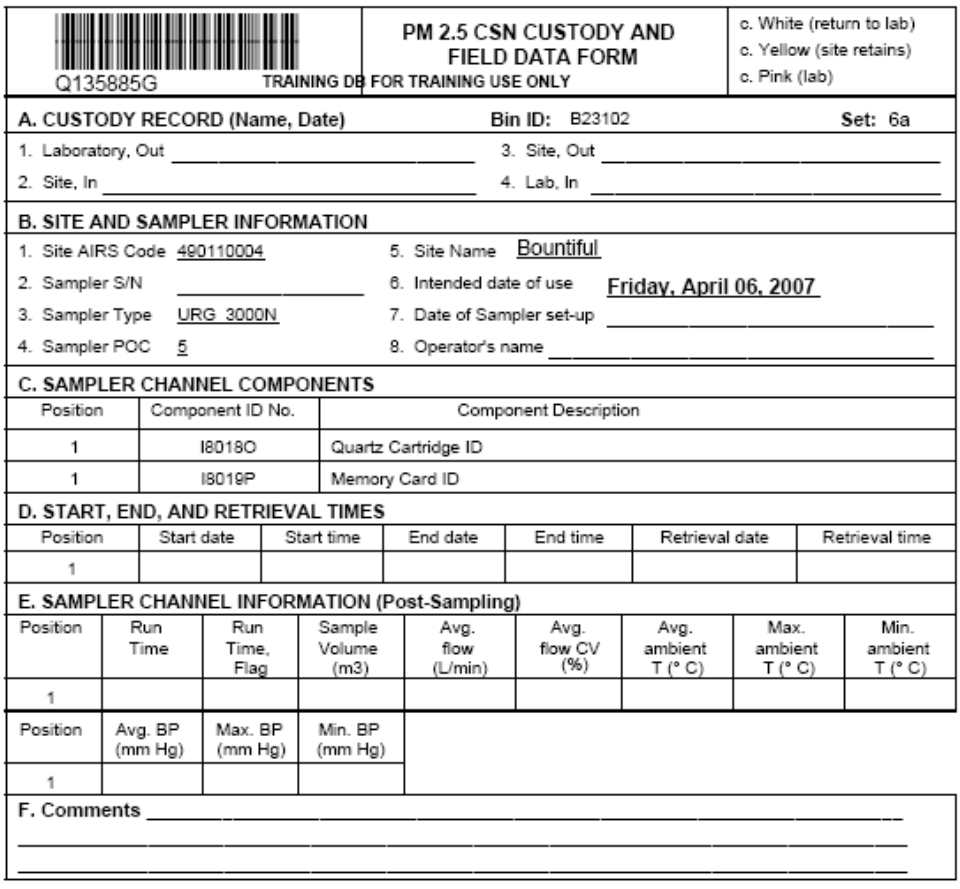
6.4 Generation of Trip Blanks

The frequency of Trip blanks will be recommended by the $PM_{2.5}$ Chemical Speciation Network Quality Assurance Project Plan. Trip blanks are used to measure possible contamination to filters during transportation to and from sampling locations. They provide a frame of reference in case field blanks exhibit mass gain higher than the tolerance levels. Trip blanks should remain inside their protective bags and never be exposed to sampling procedures. Trip Blanks are designated by the weighing laboratory and issued at random. However, trip blanks should be used in conjunction

with field blanks.

1. The trip blank should be treated in the same manner as all other sampling events PEP filters, with the exception of exposure. The filters should remain in their 9" x 11" anti-static, self-sealing plastic cassette bag at all times.
2. Transport the trip blank from the vehicle to the sampling location and return it to the transport container cooler. Do not leave the trip blank inside the sampler during the sampling event.
3. Make sure that the trip blank is properly indicated on the CAFDF.

Figure 6.1 PM2.5 CSN Custody and Field Data Form (CAFDF) for the URG-3000N Sampler



Q135885G TRAINING DB FOR TRAINING USE ONLY

PM 2.5 CSN CUSTODY AND FIELD DATA FORM

c. White (return to lab)
c. Yellow (site retains)
c. Pink (lab)

A. CUSTODY RECORD (Name, Date) Bin ID: B23102 Set: 6a

1. Laboratory, Out _____ 3. Site, Out _____
2. Site, In _____ 4. Lab, In _____

B. SITE AND SAMPLER INFORMATION

1. Site AIRS Code 490110004 5. Site Name Bountiful
2. Sampler S/N _____ 6. Intended date of use Friday, April 06, 2007
3. Sampler Type URG 3000N 7. Date of Sampler set-up _____
4. Sampler POC 5 8. Operator's name _____

C. SAMPLER CHANNEL COMPONENTS

Position	Component ID No.	Component Description
1	I8018O	Quartz Cartridge ID
1	I8019P	Memory Card ID

D. START, END, AND RETRIEVAL TIMES

Position	Start date	Start time	End date	End time	Retrieval date	Retrieval time
1						

E. SAMPLER CHANNEL INFORMATION (Post-Sampling)

Position	Run Time	Run Time, Flag	Sample Volume (m3)	Avg. flow (L/min)	Avg. flow CV (%)	Avg. ambient T (° C)	Max. ambient T (° C)	Min. ambient T (° C)
1								

Position	Avg. BP (mm Hg)	Max. BP (mm Hg)	Min. BP (mm Hg)
1			

F. Comments _____

7.0 Sampler Calibration

The URG-3000N sampler can be calibrated for ambient temperature, barometric pressure, and flow rate. The calibration procedure should be performed if the sampler fails a verification

check when it is initially installed. A calibration of any of the sampler's parameters may be necessary if the sampler fails a monthly, quarterly, semiannual, or annual quality control check.

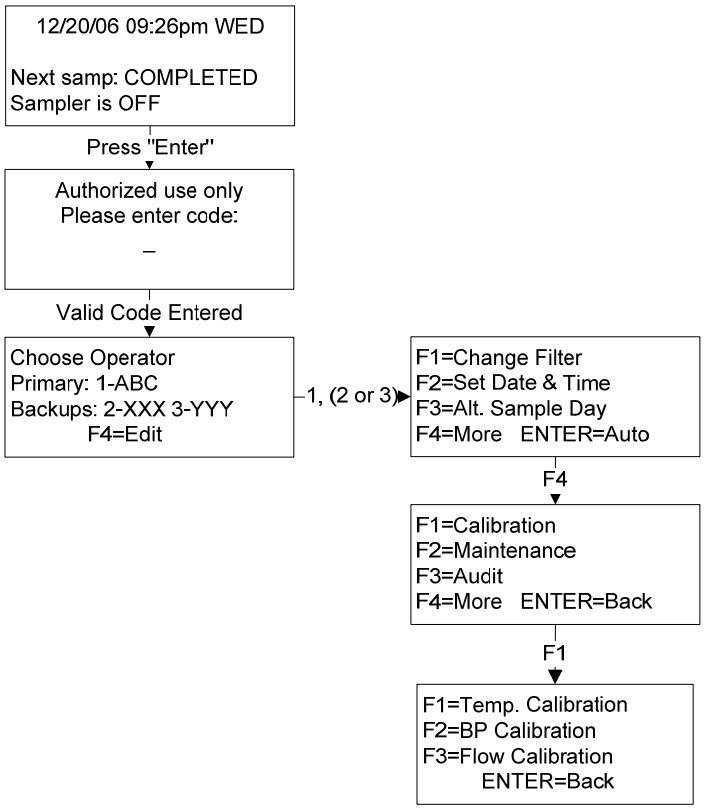
The overall procedures for performing a calibration are similar to the verification procedures on the URG-3000N with one major difference. The results from the verification checks are merely stored on the sampler's Compact Flash memory card. When a calibration of ambient temperature, barometric pressure, or flow rate is conducted, the results are also saved on the memory card, but will change the settings in the sampler for that parameter.

Before conducting a calibration, confirm the reference standards are certified as NIST-traceable and in good working condition. Allow the calibration standards to equilibrate to ambient conditions. Follow the procedures provided by standard's manufacturer regarding the length of time for the standard to obtain stable conditions.

Since the operator is changing the ambient temperature, barometric pressure, and flow rate setting in the sampler, the changes must be well documented. Record all calibration information on a CSN QA/QC Spreadsheet (see Figure 8.1) and field notebook. To assist the operator through the proper calibration steps, have a copy of the sampler's operation manual or the Calibration, Maintenance, and Audit Menu Trees for assistance in performing the verification. The Calibration, Maintenance, and Audit Menu Trees can be found in the Appendix A of this SOP.

From the AUTO MODE screen, Press the "**ENTER**" key to move from the AUTO MODE to the Authentication screen. Then enter "**1123**" to proceed to Choose Operator screen (for samplers deployed during Phases II and III, pressing "ENTER" allows the operator to proceed). Choose "**1**, **2**, or **3**" to proceed to the Main Menu screen. Press the "**F4**" key to show the second Main Menu. At the second Main Menu, press the "**F1**" key for the Calibration Menu screen (see screens for AUTO MODE to Calibration Menu in Figure 7.1 below).

Figure 7.1 Menu Tree from AUTO MODE Screen to Calibration Menu Screen



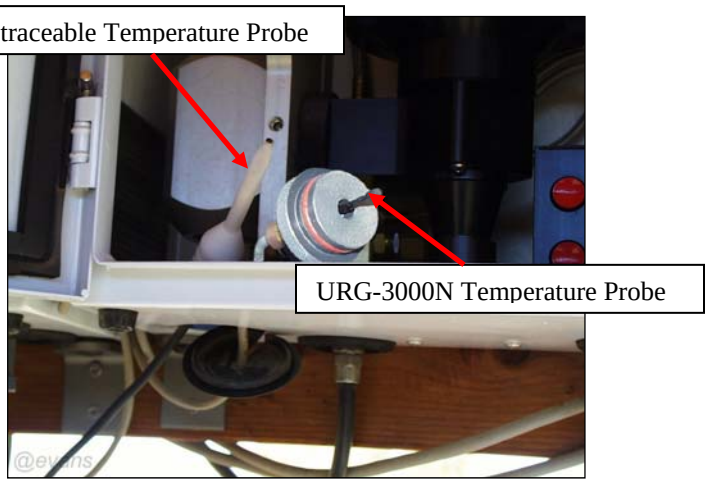
If the sampler does not respond after performing the proper ambient temperature, barometric pressure, and flow rate calibration procedures, refer to Section 10.0 Troubleshooting or the Operations Manual. If you are still unable to solve the problem, contact URG at (919) 942-2753, http://www.urgcorp.com/index.php/email-form or info@urgcorp.com..

7.1 Ambient Temperature Calibration (1-Point)

7.1.1 At the base of the inlet tee, locate the ambient temperature probe. While holding the ambient temperature probe cable, gently push the black plastic disc through the bottom of the Sample Module. Slowly loosen the nut holding the ambient temperature probe and carefully remove the probe plug and set it inside the module, away from direct sunlight (exposing the probe to ambient conditions).

7.1.2 Place the reference temperature probe alongside the sampler's ambient temperature probe and allow both temperatures to equilibrate (see Figure 7.2). If it is windy, it might be a good idea to place probes into the module for reading. This will minimize interference from wind.

Figure 7.2 Ambient Temperature Probe and NIST-traceable Temperature Probe



7.1.3 At the Calibration Menu, press the "**F1**" key to proceed to the ambient temperature calibration screen (see screen below).

```
Raw Offset  C     F
1457   0  20.0  68.0
SPACE=Calibrate
        ENTER=Back
```

7.1.4 Press the "**SPACE**" key to begin the ambient temperature calibration and the screen below will appear.

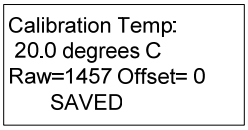
```
Raw Offset  C     F
1457   0  20.0  68.0
F1:+/-     F2:C/F
Ref. Temp (C):?
```

7.1.5 After the two probes equilibrate, record the sampler and reference standard values in degrees Celsius on the CSN QA/QC Spreadsheet and the field notebook. **The agreement should be within ±2 ºC**.

7.1.6 Enter the reference standard temperature value in degrees Celsius. Press the "**F1"** key to toggle between positive and negative values whereas pressing "**F2"** to toggle between Celsius and Fahrenheit. (Example: for 25.2 ºC; enter "**252**". The decimal place is fixed for a tenth degree.) The next screen shows the sampler's calibrated temperature in degrees Celsius (see screen below).

```
Calibration Temp:
 20.0 degrees C
Raw=1457 Offset= 0
YES=Save  NO=Cancel
```

7.1.7 Press the "**YES**" key to save to the Compact Flash memory card (see below). After a brief pause, the operator is returned to the Calibration Menu.

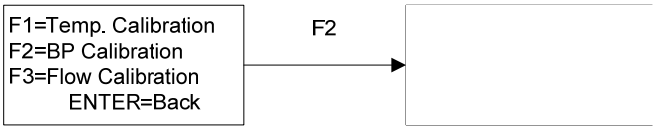


7.1.8 Remove the temperature reference standard and securely place the sampler's temperature probe back in the bottom of the inlet tee. Replace the black plastic disc.

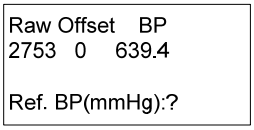
7.1.9 If the operator wishes to return to the AUTO MODE, press the "**ENTER**" key twice. To continue with a barometric pressure calibration and leak check and flow rate calibration, see Sections 7.2 and 7.3.

7.2 Barometric Pressure Calibration (1-Point)

7.2.1 At the Calibration Menu, press the "**F2**" key to proceed to the barometric pressure calibration screen (see screens below).



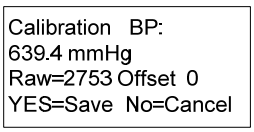
7.2.2 Press the "**SPACE**" key to begin the barometric pressure calibration and the screen below will appear.



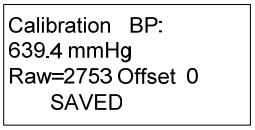
7.2.3 Record the sampler and the reference standard barometric pressure values in mm Hg on the CSN QA/QC Spreadsheet and the field notebook. **The agreement should be within ±10 mm Hg**.

7.2.4 Enter the barometric pressure (in mm Hg) of an equilibrated NIST-traceable reference standard using the keypad. (Example: for 754 mm Hg; enter 7540, the display screen will show 754.0 mm Hg. The decimal place is fixed for a tenth degree. If you entered "**754**", the display screen will show 75.4 mm Hg which is incorrect.)

7.2.5 After entering the reference standard's barometric pressure, the next screen shows the sampler's calibrated barometric pressure (see screen below).



7.2.6 Press the "**YES**" key to save to the Compact Flash memory card (see below). After a brief pause, the operator is returned to the Calibration Menu.

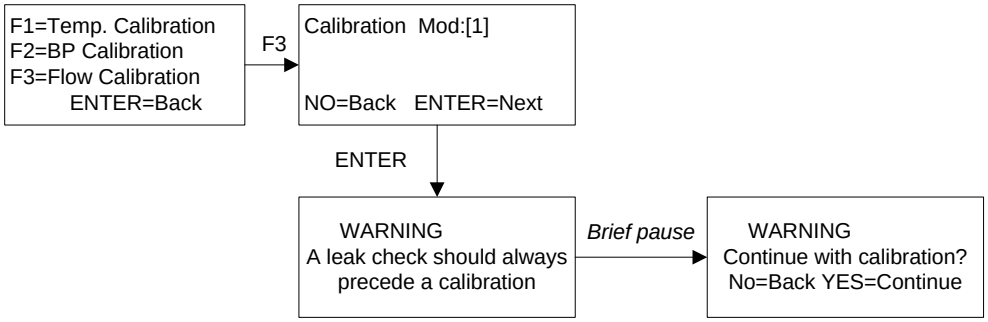


7.2.7 If the operator wishes to return to the AUTO MODE, press the "**ENTER**" key twice. To continue with a leak check and flow rate calibration, see Section 7.3.

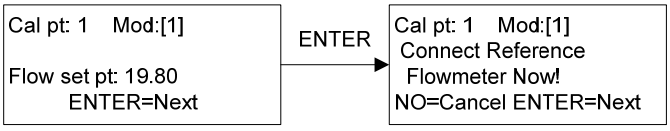
7.3 Flow Rate Calibration (3-Point)

Prior to conducting flow rate verification, a successful leak check must be completed (see Section 5.7). The operator should use a NIST-traceable calibration standard that has been equilibrated to ambient conditions. Follow the procedures provided by standard's manufacturer regarding the length of time for the standard to obtain stable conditions. The flow rate calibration must be conducted with the "AUDIT" cartridge. See Section 5.4 regarding proper procedure for inserting the "AUDIT" cartridge. If the flow audit adapter is not connected to the top of the downtube, remove the inlet cap and place the flow audit adapter on the top of the downtube. Connect tubing from reference standard to the flow audit adapter and begin the flow rate verification.

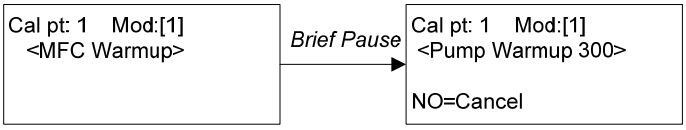
7.3.1 At the Calibration Menu, press the"**F3**" key and then the "**ENTER**" key to proceed to the flow rate calibration screen (see screens below).



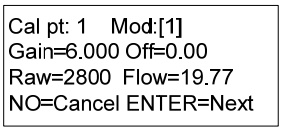
7.3.2 A successful leak check must be performed before continuing with flow rate calibration (leak < 225 mm Hg in 35 seconds). To continue with the flow rate calibration, press the "**YES**" key. The screen below shows the first calibration point of 19.80 L/min. Press the "**ENTER**" key to advance to the next screen and then press the "**ENTER**" key again to proceed to calibrate the first point.



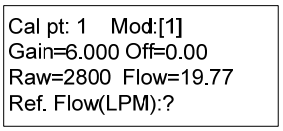
7.3.3 Check connections to reference flow meter, and press the "**ENTER**" key to continue. The MFC initiates after a brief pause, the following screens appear.



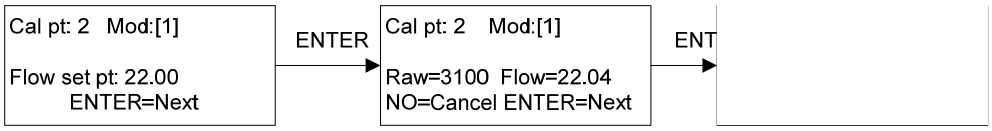
7.3.4 The MFC will run for 5 minutes at the first calibration flow rate of 19.80 L/min. At the end of the 5 minute warm up period, the screen below will appear showing the sampler's flow rate and vacuum at that time.



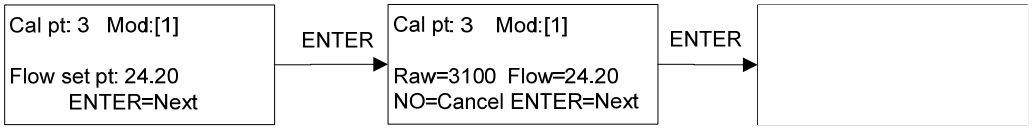
7.3.5 Press the "**ENTER**" key to continue to the next screen. In the screen below, the operator is prompted to enter the reference standard's flow rate in L/min. After the reference standard stabilizes, use the keypad to enter the reference standard's flow rate value. The decimal place is fixed at two decimal places so for a flow rate of 21.75 L/min., enter "**2175**". Record the sampler and reference standard values in L/min for Calibration Point 1 on the CSN QA/QC Spreadsheet and the field notebook. **The agreement should be within +/-10%.**



7.3.6 After entering the reference standard's flow rate for Calibration Point 1, the screen below appears showing the second calibration point of 22.00 L/min. Press the "**ENTER**" key. The MFC begins sampling at the second calibration point and displays the flow rate (see below). After the reference standard stabilizes, use the keypad to enter the reference standard's flow rate value. Record the sampler and reference standard values in L/min for Calibration Point 2 on the CSN QA/QC Spreadsheet and the field notebook. **The agreement should be within +/-10%.**

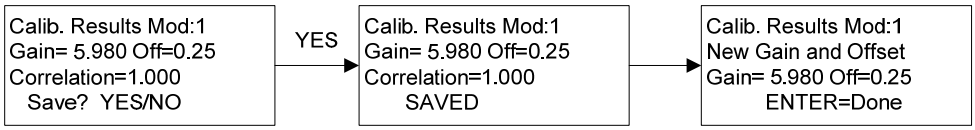


7.3.7 Repeat Step 7.3.6 with Calibration Point 3 (24.20 L/min).



7.3.8 After entering the reference standard's flow rate for Calibration Point 3, the screen below appears showing the new Gain, Offset, and Correlation

Coefficient. Press the "**YES**" key to save the flow rate calibration to Compact Flash memory card. Press the "**ENTER**" key to return to the Calibration Menu screen.



7.3.9 If the operator wishes to return to the AUTO MODE, press the "**ENTER**" key twice. This concludes the verification of the routine URG-3000N sampler. The sampler is ready for sampling.

8.0 Sampler 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. Carry out these checks before making any adjustments to the sampler. Record information about the site, the sampler, and the results of scheduled or special (unscheduled) quality control checks on the $PM_{2.5}$ CSN QA/QC Spreadsheet, (see Figure 8-1). 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 field operator's notebook.

8.1 Date and Time Checks

Conduct these checks monthly or whenever daylight savings time changes occur. Compare the date and time displayed on the sampler to the known date and to an atomic watch or cell phone. Record the information on the QA/QC data form. Refer to Figure 8.1.

8.2 Rotation of the filters in the AUDIT cartridge

The filter cassettes in the AUDIT cartridge should be rotated quarterly. Remove the filter cassette in the Number "1" position by popping off the retaining ring that holds the cassette in the cartridge. The Number "1" position is located to the right of the pin used to position the cartridge in the sampler when installed. Move a clean filter cassette to the Number "1" position. Mark the used filter cassette with a colored dot and replace all filter cassettes in the AUDIT cartridge.

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. The four filter cassettes should last for a full year. If a filter becomes contaminated or damaged

before the year ends, contact the contractor support laboratory for replacements before the end of the year.

8.3 Monthly Leak Check (see Section 5.7 for illustrations and screen displays)

Perform leak check upon startup and then monthly.

8.3.1 From the AUTO MODE screen, Press the "**ENTER**" key to move from the AUTO MODE to the Authentication screen. Then enter "**1123**" to proceed to Choose Operator screen (for samplers deployed during Phases II and III, pressing "ENTER" allows the operator to proceed). Choose "**1**, **2**, or **3**" to proceed to the Main Menu screen. Press the "**F4**" key to show the second Main Menu. At the second Main Menu, press the "**F3**" key for the Audit Menu screen.

8.3.2 At the Audit Menu, press the "**F1**" key and then the "**ENTER**" key to begin the leak check. Inspect that the flow audit adapter is in the open position. If not, open and remove the inlet cap at the top of the downtube. Place the flow audit adapter on the top of the downtube. Press the "**ENTER**" key when directed by the on screen commands.

8.3.3 Inspect and assure the pump shutoff valve is in the open position. Disconnect the vacuum from the side of the pump enclosure. Connect the pump shutoff valve to the vacuum (air) line and reconnect to the side of the pump enclosure.

8.3.4 Press the "**ENTER**" key when directed by the on screen commands.

8.3.5 Rotate the lever on the flow audit adapter 90º to close the adapter. Press the "**ENTER**" key and rotate the lever on the pump shutoff valve 90º to close the valve. Press the "**ENTER**" key and the vacuum will begin to drop and when it reaches 380 mm Hg, a timer will count for a maximum of 35 seconds.

8.3.6 After the countdown from 35 seconds, the results will be displayed as either PASSED or FAILED. The acceptance criterion is a vacuum drop of less than 225 mm Hg in 35 seconds. The timer will stop if the leak is greater than 225 mm Hg inside the 35 seconds. If the sampler fails the leak check, attempt another leak check. If the sampler fails both times, refer to Section 10 Troubleshooting or the Operations Manual. If you are still unable to solve the leak problem, contact URG at (919) 942-2753, http://www.urgcorp.com/index.php/email-form or info@urgcorp.com..

8.3.7 Record the pressure drop in mm Hg on the CSN QA/QC Spreadsheet and the field notebook. Press the "**ENTER**" key and slowly release the pressure in the sampler by turning the lever on the flow audit adapter.

8.3.8 Remove the flow audit adapter, the pump shutoff valve, and "AUDIT" cartridge and store in a safe place.

8.3.9 Restore the software program to the AUTO MODE screen.

8.4 Monthly Temperature Control Checks (see Section 5.5 for illustrations and screen displays)

Perform the temperature control checks upon startup and then monthly.

8.4.1 Locate the ambient temperature probe at the base of the inlet tee. While holding the ambient temperature probe cable, gently push the black plastic disc through the bottom of the Sample Module. Slowly loosen the nut holding the ambient temperature probe and carefully remove the probe plug and set it inside the module, away from direct sunlight (exposing the probe to ambient conditions).

8.4.2 Place the reference temperature probe alongside the sampler's ambient temperature probe and allow both temperatures to equilibrate.

8.4.3 From the Audit Menu, press the "**F3**" key.

8.4.4 After the two probes equilibrate, enter in the reference standard temperature value in degrees Celsius. Press the "**F1"** key to toggle between positive and negative values whereas pressing "**F2"** to toggle between Celsius and Fahrenheit. (Example: for 25.2 ºC; enter "**252**". The decimal place is fixed for a tenth degree.)

8.4.5 The sampler and reference standard values in degrees Celsius on the CSN QA/QC Spreadsheet and the field notebook. **The agreement should be within ±2 ºC**. If the results are out of tolerance, refer to the Operations Manual. If you are still unable to solve the problem, contact URG at (919) 942-2753, http://www.urgcorp.com/index.php/email-form or info@urgcorp.com..

8.4.6 The temperature reference standard and securely place the sampler's temperature probe back in the bottom of the inlet tee. Replace the black plastic disc.

8.4.7 Restore the software program to the AUTO MODE screen.

8.5 Quarterly Temperature Control Check

Perform the temperature control checks each calendar quarter. Follow the same steps as in Section 8.4 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.

8.6 Monthly Pressure Control Check (see Section 5.6 for illustrations and screen displays)

8.6.1 From the Audit Menu, press the "**F4**" key.

8.6.2 Enter the barometric pressure (in mm Hg) of an equilibrated NIST-traceable reference standard using the keypad. (Example: for 754 mm Hg; enter "**7540**", the display screen will show 754.0 mm Hg. The decimal place is fixed for a tenth degree. If you entered "**754**", the display screen will show 75.4 mm Hg which is incorrect.)

8.6.3 Record the sampler and reference standard values in mm Hg on the CSN QA/QC Spreadsheet and the field notebook. **The agreement should be within ±10 mm Hg**. If the results are out of tolerance, refer to the Operations Manual. If you are still unable to solve the problem contact URG at (919) 942-2753, http://www.urgcorp.com/index.php/email-form or info@urgcorp.com.

8.6.4 Restore the software program to the AUTO MODE screen.

8.7 Quarterly Pressure Control Check

Follow the same steps as in Section 8.6, 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.

8.8 Monthly Flow Rate Control Check (see Section 5.8 for illustrations and screen displays)

Perform the flow rate check upon startup and then monthly.

8.8.1 Prior to conducting flow rate verification, a successful leak check must be completed (see Section 5.7). The monthly flow rate check must be conducted with the "AUDIT" cartridge.

8.8.2 Remove the inlet cap and place the flow audit adapter on the top of the downtube. Connect tubing from reference standard to the flow audit adapter and begin the flow rate verification.

8.8.3 From the Audit Menu, press the "**F2**" key and press the "**YES**" key. Check the connections to reference flow meter, and press the "**ENTER**" key to continue.

8.8.4 The MCF initiates and runs for 5 minutes at the design flow rate of 22.0 L/min.

8.8.5 Press the "**ENTER**" key and enter the reference standard's flow rate in L/min. Use the keypad to enter the reference standard's flow rate value. The decimal place is fixed at two decimal places so for a flow rate of 21.75 L/min., enter "**2175**". The sampler's flow rate, the reference standard's flow rate, and the difference (sampler – reference standard) between the two values (all in L/min) are displayed.

8.8.6 Record the sampler and reference standard values in L/min on the CSN QA/QC Spreadsheet and the field notebook. **The agreement should be within ±10 %**. If the results are out of tolerance, refer to the Operations Manual. If you are still unable to solve the problem, contact URG at (919) 942-2753, http://www.urgcorp.com/index.php/email-form or info@urgcorp.com.

8.8.7 Remove the flow audit adapter and replace the inlet cap. Remove the "AUDIT" cartridge and place in a safe place. Restore the software program to the AUTO MODE screen.

8.9 Quarterly Flow Rate Control Check

Conduct a flow rate check each calendar quarter using the same steps as in Section 5.8, 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. Consult the manufacturer or the operator's manual for procedures for maintenance, adjustment, and calibration of sample flow rates.

Figure 8.1 CSN QA/QC Spreadsheet

Chemical Speciation Network Performance Audit Worksheet URG 3000N - Primary Sampler				**US Environmental Protection Agency**	
Note - Cyan fields are entered from TSA worksheet or calculated - yellow fields are to be filled in here					
Location				Date	
AQS Site ID					
AQS Sampler POC					
Audit Information					
Auditor(s)				Affiliation	US Environmental Protection Age
Audit Type	Select From Dropdown List				
Operator				Affiliation	
Phone No.	-				
Sampler Model		URG 3000 N		Controller S/N	
				Pump S/N	
				Sampler S/N	
Last Calibration Date					
Audit Reference Standards					
Flow Reference Std Model		Select From Dropdown List		Standard S/N	
	Specify if "Other"			Calibration Date	
Temperature Ref Std Mod		Select From Dropdown List		Standard S/N	
	Specify if "Other"			Calibration Date	
BP Std Model		Select From Dropdown List		Standard S/N	
	Specify if "Other"			Calibration Date	
Significant Findings:					
General Findings:					

URG 3000N - Primary Sampler

Clock Test:

If Local Time is under daylight savings, convert Ref Std to Local Standard Time. Daylight Saving Time begins for most of the United States at 2:00 a.m. on the first Sunday of April. Time reverts to standard time at 2:00 a.m. on the last Sunday of Octobe

	Time (hh:mm)		Difference	5 minutes or less?	
	Ref Std	URG	Minutes	Pass	Fail
Audit					
Recalibrated					
Date					

Leak Test

	Initial Audit		After Correction	225 mm Hg drop or higher fails		
	A mm Hg		B mm Hg	Fail A	Fail B	Pass
Channel 1		Channel 1				

Flow Test **Calibration**

For the reference standard, enter "UR" for under range and "OR" for over range flow readings.

		L/min				Less than 10%?	
	Lower Limit	Ref Std	Upper Limit	URG	% Difference	Pass	Fail
Channel 1	NA		NA				

Retest after Calibration

		L/min				Less than 10%?	
	Lower Limit	Ref Std	Upper Limit	URG	% Difference	Pass	Fail
Channel 1	NA		NA				

Reference Standard vs Design Flow

		L/min				Less than 10%?	
	Lower Limit	URG	Upper Limit	Ref Std	% Difference	Pass	Fail
Channel 1	19.8	22.0	24.2				

Retest after Calibration

		L/min				Less than 10%?	
	Lower Limit	URG	Upper Limit	Ref Std	% Difference	Pass	Fail
Channel 1	19.8	22.0	24.2				

Ambient Temperature Test

		Degrees C				Less than 2 degrees?	
	Lower Limit	Ref Std	Upper Limit	URG	Difference	Pass	Fail
	NA		NA				

Retest After Recalibration

	NA		NA				

Pressure Test

		mm Hg				Less than 10 mm Hg?	
	Lower Limit	Ref Std	Upper Limit	URG	Difference	Pass	Fail
	NA		NA				

Retest after recalibration

	NA		NA				

9.0 Sampler Service and Maintenance

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

9.1 Sampler Service

9.1.1 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.

1. Grasp the motor to the right of the solenoid manifold firmly and pull downwards (see Figure 9.1).
2. Next, grasp the motor and swing it to the left (see Figure 9.2).
3. You can now use the large wheel located above the solenoid manifold to manually raise and lower the solenoid manifold (see Figure 9.3).

Figure 9.1 Moving the Motor

Figure 9.2 Rotating the Motor

Figure 9.3 Use the Wheel to Raise and Lower Solenoid Manifold

9.1.2 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.

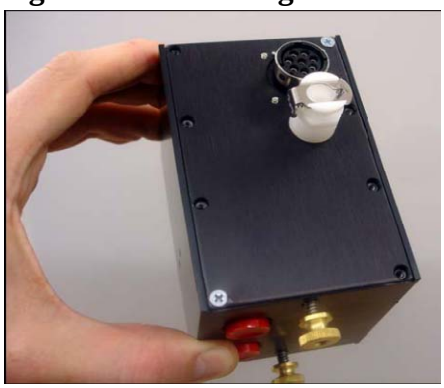
1. First, remove the vacuum sensor tube by pressing in the quick-release adaptor and lifting at the same time. Next, reach behind it to remove the motor control cable by twisting the metal nut counter-clockwise (see Figure 9.4).
2. Then remove the 12-pin controller cable from the bottom of the Sample Module which is connected through to the electronic box (see Figure 9.5).
3. Unscrew the two brass-headed bolts in the front of the electronic box (see Figure 9.6).
4. Now remove the electronic box (see Figure 9.7).

Figure 9.4 Removing the Vacuum Sensor Tube

Figure 9.5 Removing the Controller Cable

Figure 9.6 Unscrew Bolts

Figure 9.7 Removing the Electronic Box



9.1.3 Mass Flow Controller

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

1. Remove the six (6) small screws from the front panel of the pump enclosure (see Figure 9.8). The door will slide down and off.
2. Remove the hose that connects to the front of the MFC and runs to the air line on the enclosure wall (see Figure 9.9).
3. Remove the hose that connects to the rear of the MFC and runs to the pump outlet (see Figure 9.10).

4. Unscrew the two (2) flathead screws holding the MFC data cable and remove the cable (see Figure 9.11).
5. Unscrew the two (2) Philip screws on the MFC base plate. The MFC and the base plate can now be removed (see Figure 9.12). Save the mounting plate and send the MFC for repair or replacement.

Figure 9.8 Removing the Panel Pump Enclosure

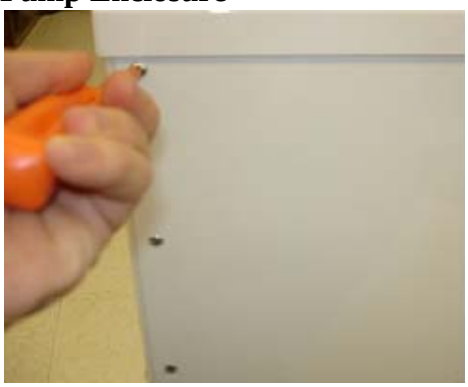


Figure 9.9 Removing Front Hose on to MFC

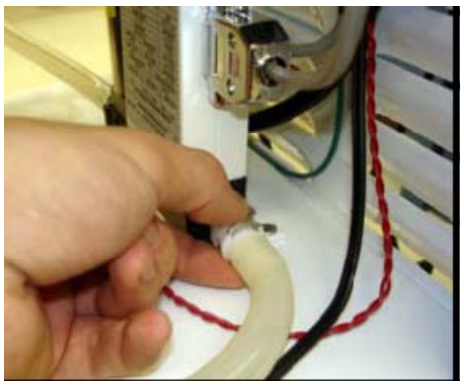


Figure 9.10 Removing Rear Hose to MFC

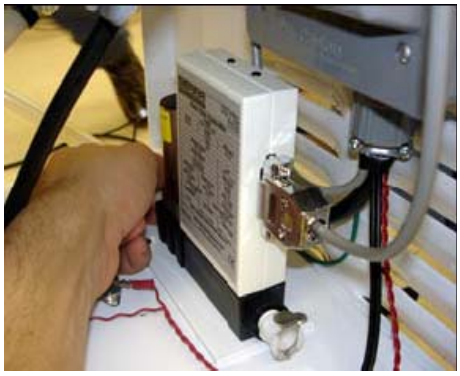


Figure 9.11 Removing MFC Data Cable

Figure 9.12 Removing MFC and Base Plate

9.1.4 Pump Removal

The 120V pump inside the pump enclosure may need to be serviced or replaced. To remove the pump, follow the steps below.

1. Unplug the power from the top outlet of the power terminal inside the pump enclosure (see Figure 9.13).
2. Remove the four (4) nuts on the bottom of the pump enclosure (see Figure 9.14).
3. Disconnect the hose the runs from the MFC to the pump (see Figure 9.15).
4. 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 9.16.)
5. 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 9.17).

Figure 9.13 Unplug Power from Power Terminal

Figure 9.14 Remove Nuts from Bottom of Pump Enclosure

Figure 9.15 Disconnect Hose From MFC to Pump

Figure 9.16 Disconnect Outlet Hose

Figure 9.17 Removing Pump

9.1.5 Replacing Fuses/MOVs

In the Controller Module near the keypad/display (see Figure 9.18), 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 9.19 has a 4A 250VAC fuse on the top left that may need to be replaced.

Figure 9.18 Metal Oxide Varistors

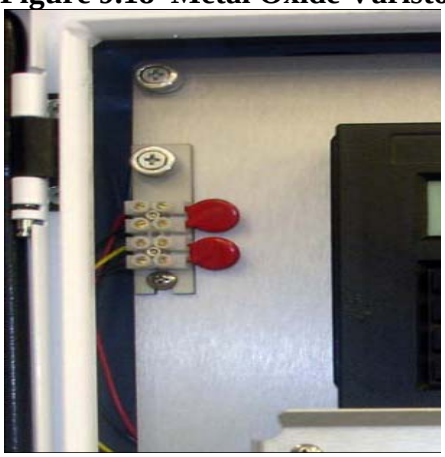
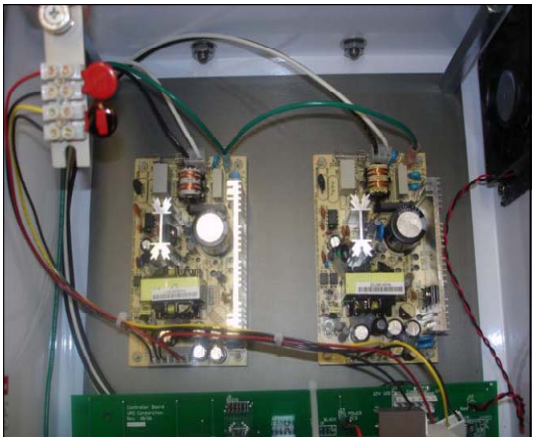


Figure 9.19 Boards with Fuses



9.1.6 Cyclone Removal

In order 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 Section 9.1.2 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 9.20). Then lift up and carefully remove the cyclone and cassette manifold body (see Figure 9.21).

Figure 9.20 Unscrewing the Cyclone Ring

Figure 9.21 Removing the Cyclone

9.1.7 Pump Enclosure Heater

The installation of a pump enclosure heater is recommended for cold-weather environments. Shown in Figures 9.22 and 9.23 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 9.22 Four Mounting Brackets for Heater

Figure 9.23 Available Heater

9.2 Maintenance

Record all maintenance activities in the site notebook. On the CAFDF, record activities that may affect the sample weight or analysis.

9.2.1 Every Visit

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

9.2.2 Monthly

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

9.2.3 Quarterly

1. Inspect O-rings
2. Clean the interior of the Sample and Controller Modules with Kimwipe tissues or paper towel to remove bugs, dirt, or water deposits.
3. Check all Tygon tubing and vacuum lines; replace if necessary.
4. Clean sampler inlet surfaces.
5. Inspect electrical line connections.

6. 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.
7. 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.

10.0 Troubleshooting

At this time, the manufacturer has identified three troubleshooting issues below that could develop when operating the URG-3000N sampler. When an issue develops, review Section 9.0 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.

10.1 Display Not Shown

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

1. Check the power as discussed in 10.2;
2. Check the fuses discussed in Section 9.1.5; or
3. Refer to the Operations Manual or contact URG.

10.2 No Power

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

1. Check that the power cable running to the lower stand (pump enclosure) is properly plugged in an electrical outlet;
2. Attempt to use another device in the outlet that the URG-3000N sampler is using to determine if AC power is available;
3. 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
4. Refer to the Operations Manual or contact URG.

10.3 Leak Check Failed

If the leak check failed in Section 5.7, try the following steps to determine where the leak is occurring.

1. Re-seat the "AUDIT" cartridge and re-attempt leak check.

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

10.4 Removing 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.

10.5 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.

10.6 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 will release the residual vacuum and allow the pump to start again.

11.0 References

1. Operation Manual (Revision 5.6). Sequential Particulate Speciation System URG-3000N. URG. October 2008.

2. EPA Guidance for Preparing Standard Operating Procedures (SOPs). EPA QA/G-6. Office of Environmental Information. Washington, D.C. April 2007.

3. IMPROVE Standard Operating Procedures, SOP 251 Sample Handling. University of California. Davis, CA. September 12, 1996.

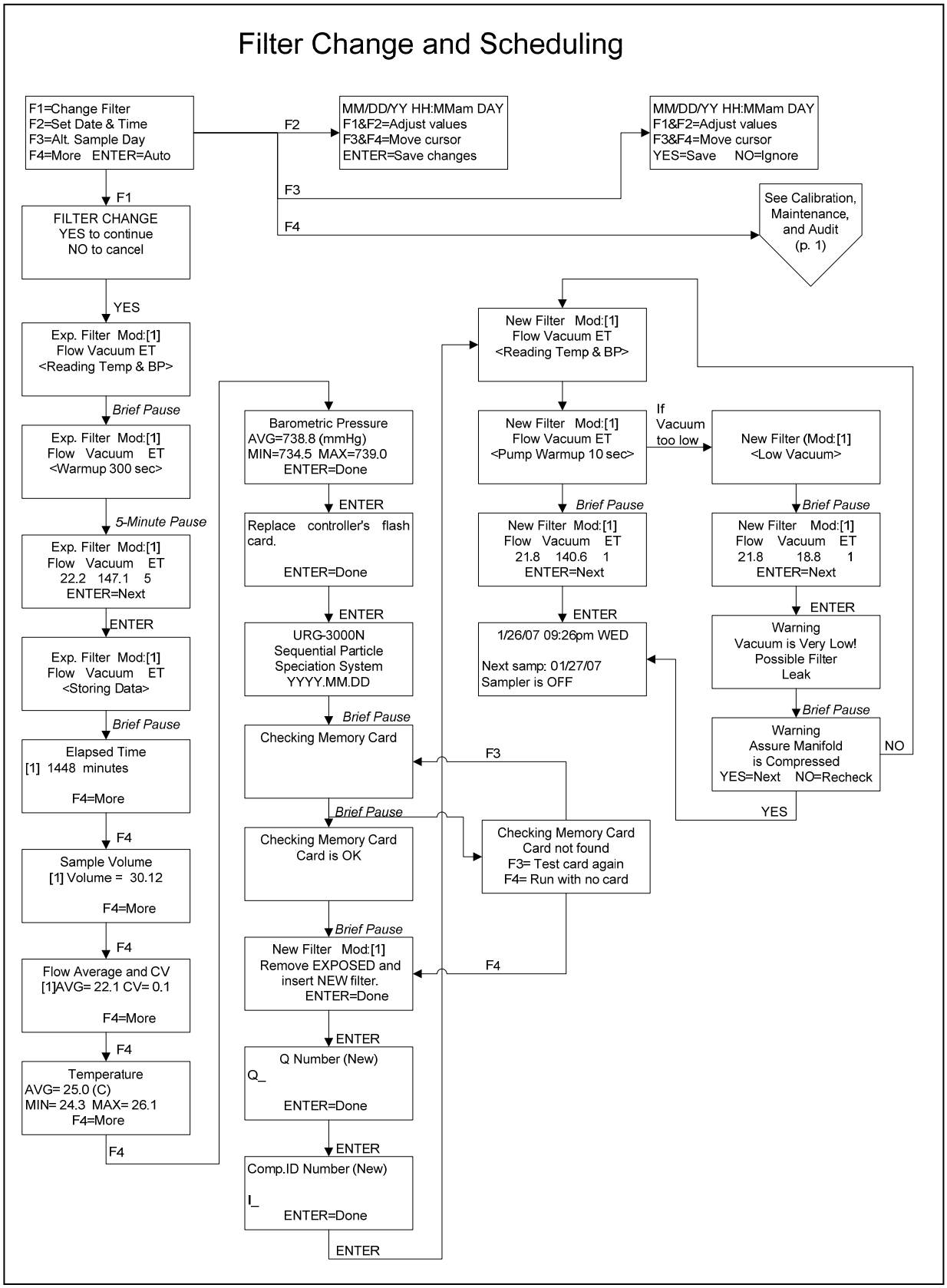
4. IMPROVE Standard Operating Procedures, SOP 226 Annual Site Maintenance. University of California. Davis, CA. September 12, 1996.

5. 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.

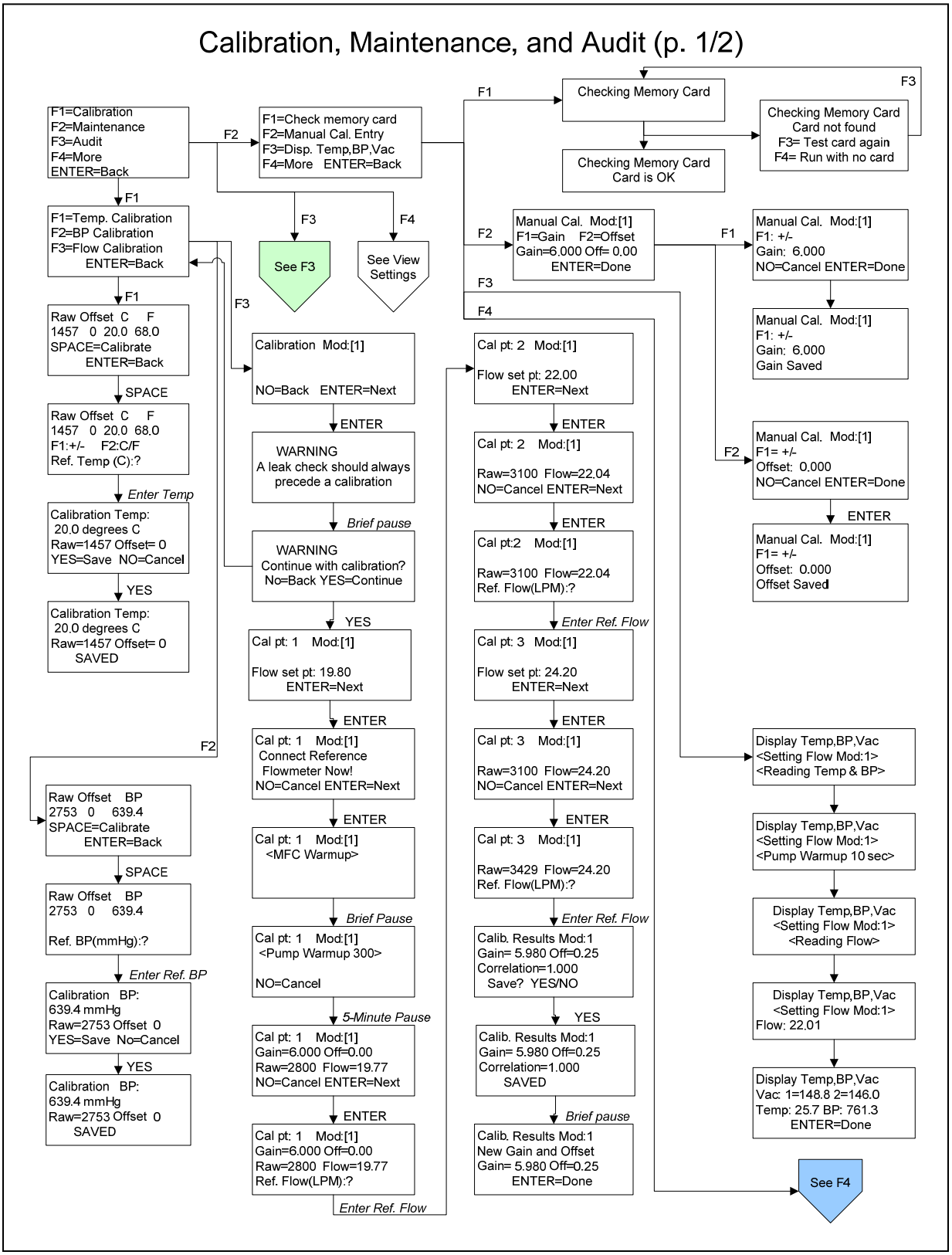
Appendix A

Menu Trees

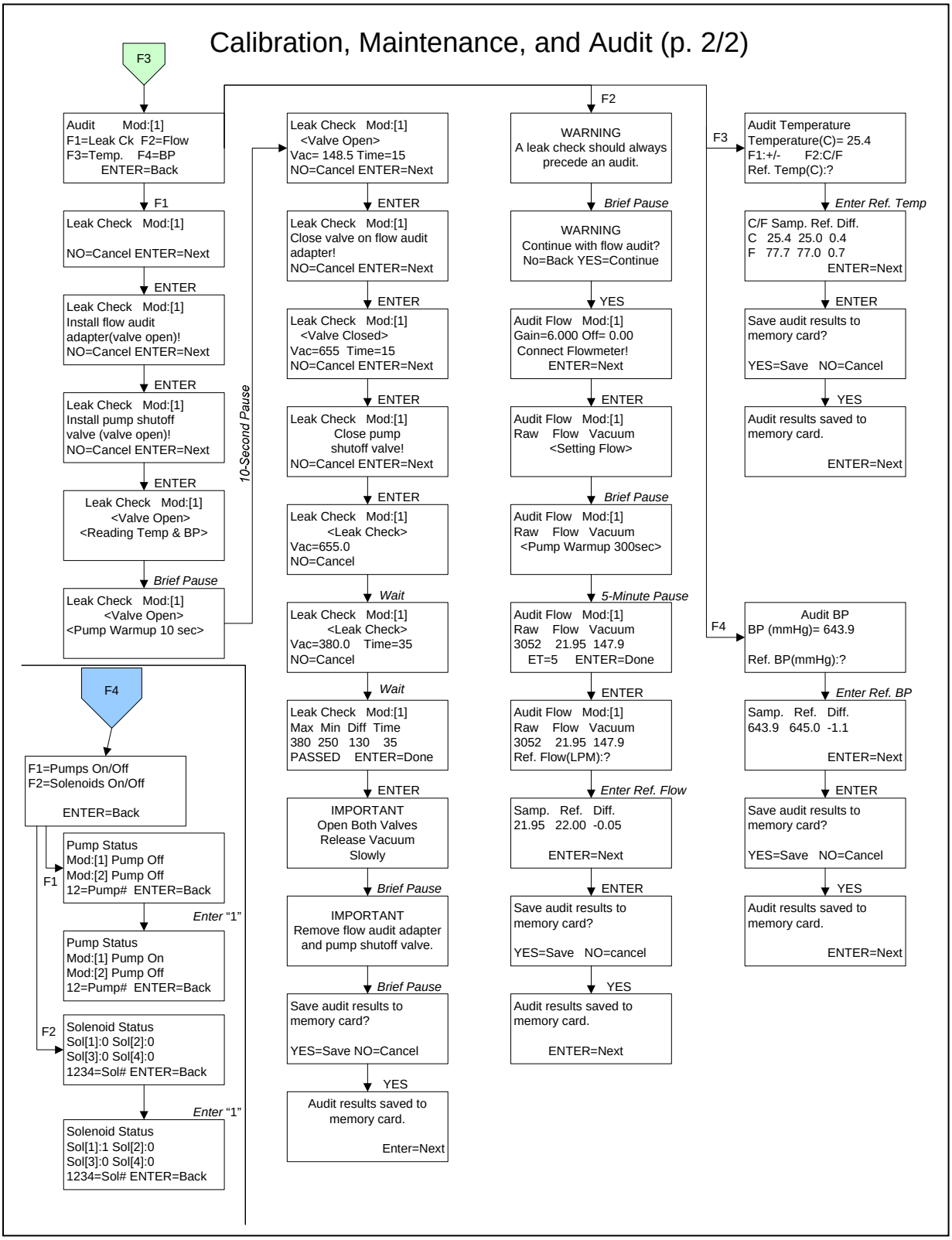
Filter Change and Scheduling



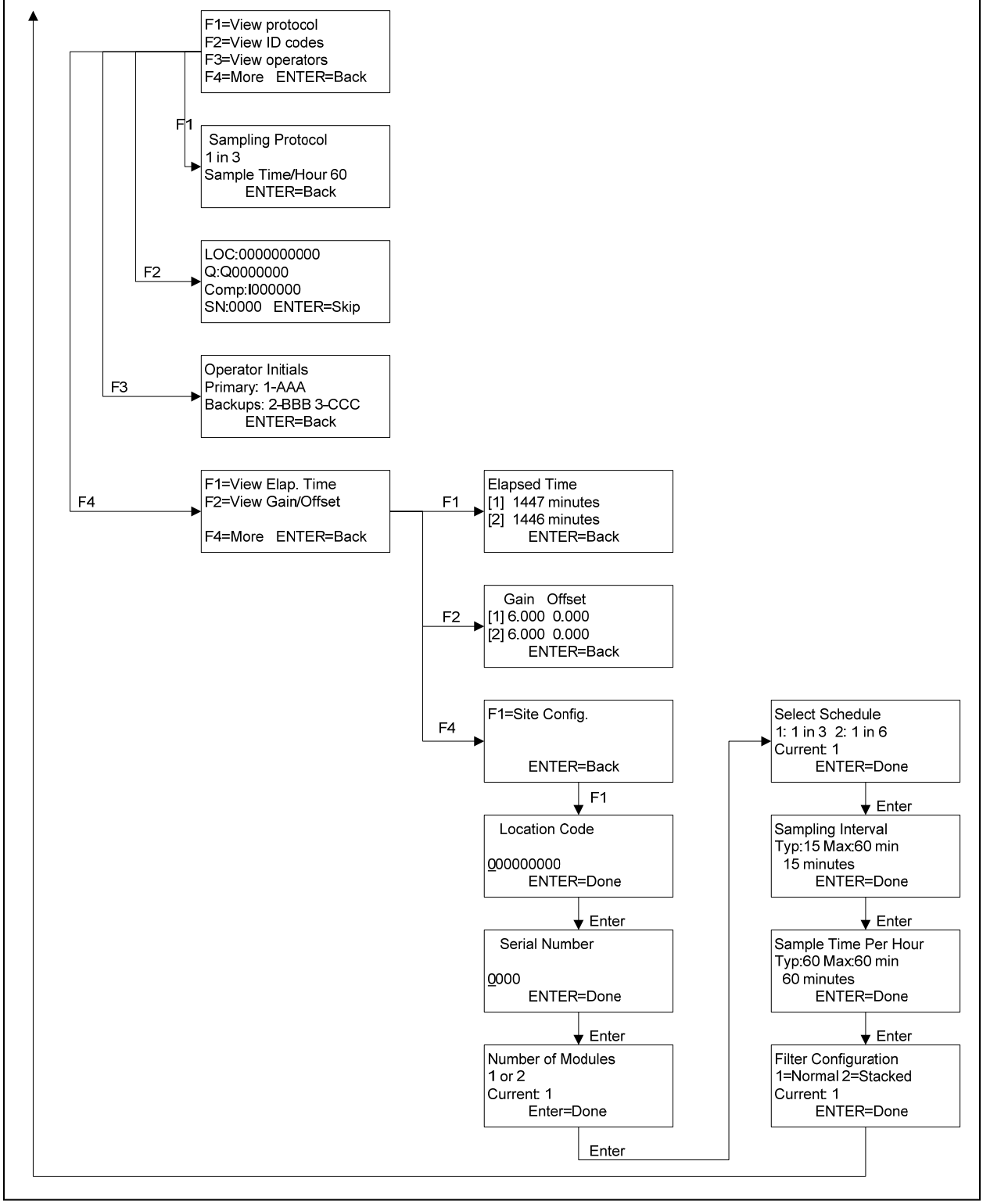
Calibration, Maintenance, and Audit (p. 1/2)



Calibration, Maintenance, and Audit (p. 2/2)



View Settings, Site Configuration



Appendix B

Quick Filter Change Guide

- Current Status Screen (Auto Mode) will be shown.
- Press **ENTER** Key
- Enter Auth Code (1123) and press **ENTER**; for samplers deployed during Phases II and III, pressing “ENTER” allows the operator to proceed
- Press **F1** key at Main Menu
- Press **YES** to continue Filter Change
- Record Date/Time and Statistics on Log Sheet: Elapsed Time, Sample Volume, Flow Average, Flow CV, Temp Min/Max/Average, Bar. Pressure Min/Max/Average– use **ENTER** key to progress.
- Replace Used Compact Flash Memory Card with New Memory Card when prompted,
- Replace Exposed Filter with New Filter when prompted, press **ENTER**
- Enter Q# and Comp. ID # for New Filter.
- Press **ENTER** to restart and memory card check
- Pass Vacuum Check
- Ensure sampler has returned to AUTO MODE
- Keep Exposed Filter and Used Memory Card together.
- Close Controller Door.

Appendix C

Sampler Parts, Assembly, and Installation Procedure at Site

Table of Contents

List of Figures

C.0 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.

C.0.1 Module Box

- C.0.1.1 Sample Module
- C.0.1.2 One 20” length 12-pin standard control cable for attaching Sample Module to Controller Module and Mass Flow Controller (MFC)
- C.0.1.3 Temperature probe (partially installed in inlet tee)
- C.0.1.4 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
- C.0.1.5 Inlet cap
- C.0.1.6 Roof flashing for inlet
- C.0.1.7 Quick Filter Change Guide (attached to enclosure door)
- C.0.1.8 Copy of inspection and status checklist

C.0.2 Controller Module Box

- C.0.2.1 Controller Module
- C.0.2.2 One 72” length 115VAC power cable
- C.0.2.3 Compact Flash memory card

C.0.3 Stand Box

- C.0.3.1 Lower stand components
- C.0.3.2 Pump enclosure: MFC, snap thermostat, fan, power terminal
- C.0.3.3 30” length standard pump relay cable

C.0.4 Stand Rain Shield Box

- C.0.4.1 Rain shield
- C.0.4.2 Two upright supports
- C.0.4.3 Two roof supports
- C.0.4.4 Two lower stand supports
- C.0.4.5 Two module supports

C.0.5 Pump Box

- C.0.5.1 One 120V pump
- C.0.5.2 Assorted mounting hardware
- C.0.5.3 Exhaust tube
- C.0.5.4 Rubber feet

C.0.6 Inlet Box

- C.0.6.1 One 36” length downtube

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

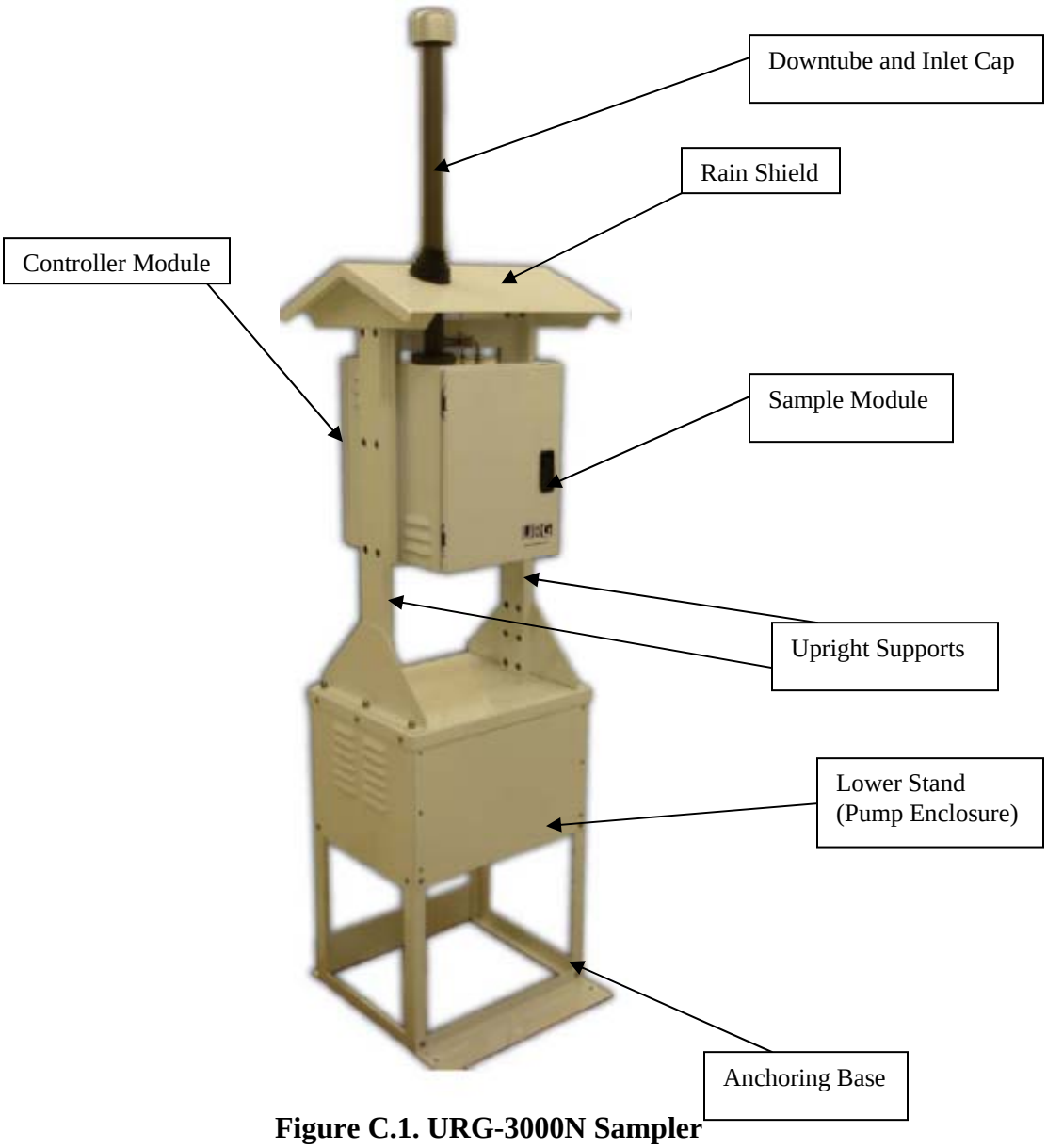


Figure C.1. URG-3000N Sampler

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

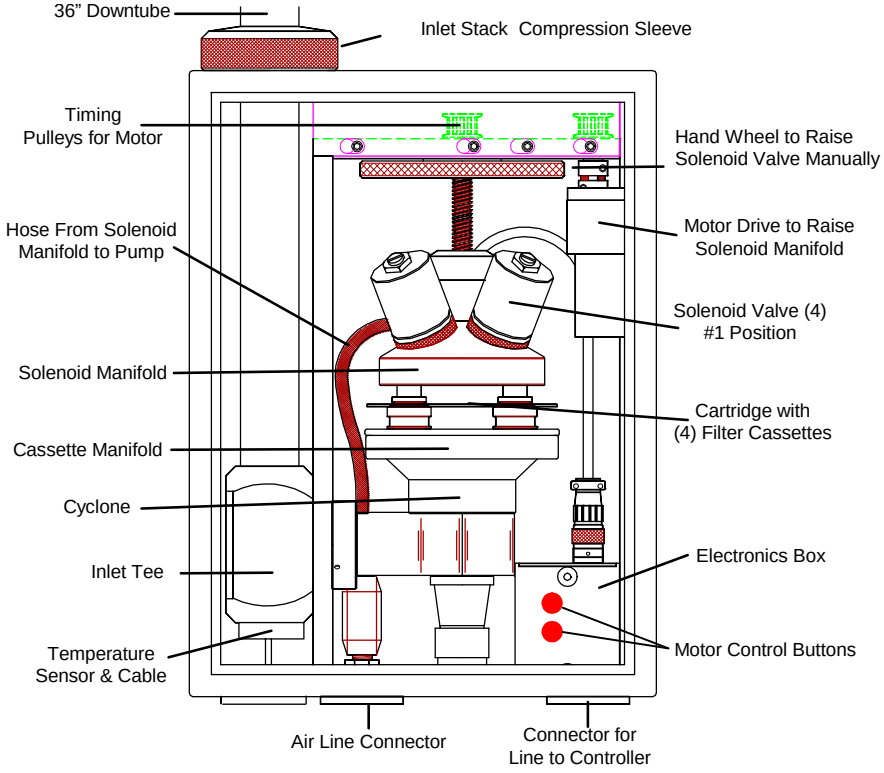


Figure C.2. Interior of the Sample Module

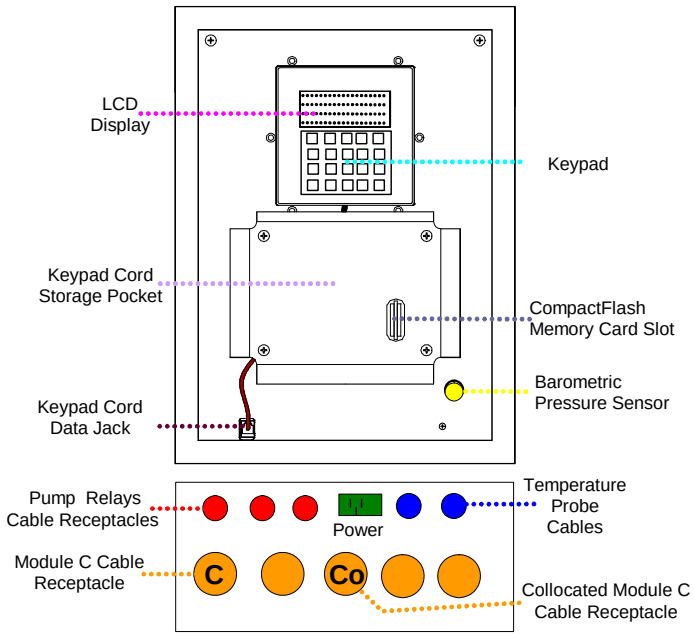


Figure C.3. Controller Module

C.1 Sampler Assembly and Installation Procedure at Site

C.1.1 Upright Supports and Rain Shield Assembly

C.1.1.1 Install one roof support to the roof with six (6) S.S. nuts with integrated lock washers and tighten (see Figure C.4).

C.1.1.2 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 C.5).

C.1.1.3 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 C.6).

Figures C.4 to C.6. Installing the Roof Support to the H-Body



C.1.1.4 Install the second roof support on the H-body. H-Body should look like the Figure C.7 below on the left.

C.1.1.5 Install the roof assembly as shown in the center Figure C.8 below. Line up all the studs with the holes and press fit everything together.

C.1.1.6 Assembly should look like the Figure C.9 below on right.

C.1.1.7 Install and tighten all connectors. The roof connector nuts require an 11/32" open end wrench to access the studs at the peak.

Figures C.7 to C.9. Installing the Second Roof Support to the H-Body



C.1.2 Upright Support Assembly to Lower Stand

C.1.2.1 Place the completed upright support assembly from Step C.1 on the top surface of the lower stand (pump enclosure).

C.1.2.2 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.1.2.3 The mounting feet are installed in the wrong direction to allow for easier shipping. Figure C.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

C.1.2.4 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 the Figure C.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.

Figures C.10 to C.12 Installing of the Upright Support to the Base and the Proper Installation of the Support Feet



C.1.3 Pump Enclosure

C.1.3.1 Connect the Tygon exhaust tubing to the brass L-shaped fitting and screw into the pump as shown in Figure C.13.

C.1.3.2 Unscrew the six (6) screws in the side panel of the lower stand and place the pump in the pump enclosure.

C.1.3.3 Screw the four (4) rubber feet into the bottom of the pump.

C.1.3.4 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.

C.1.3.5 Align the exhaust tubing through the opening in the bottom of the lower stand (pump enclosure).

C.1.3.6 Connect a vacuum hose with “Colder” fittings from the pump to the Mass Flow Controller (MFC) (see Figure C.13).

C.1.3.7 Connect electrical line from pump to gray power box in the pump enclosure (see Figure C.14).

C.1.3.8 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 C.13 Interior of the Pump Enclosure

Figure C.14 Mass Flow Controller and Power Box

1. Fan: The Pump Enclosure Fan is used to regulate the temperature within the enclosure. It is regulated by the Snap Thermostat.

2. 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.

3. Mass Flow Controller: The Mass Flow Controller is located on a bracket within the pump enclosure.

4. 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.

5. 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.

6. Enclosure Heater: This heater is available for usage with the URG-3000N in colder environments. For Phase I units, this was an optional feature.

C.1.4 Connecting Modules to Upright Support Assembly

C.1.4.1 Unscrew one of the set screws on the module support (assembled in Section C.1).

C.1.4.2 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 C.15)

C.1.4.3 Direct the handle at the top of the Controller Module through the opening behind the set screw.

C.1.4.4 Tighten the set screw to secure the top of the Controller Module (see Figure C.16).

C.1.4.5 Repeat Steps C.1.4.1 through C.1.4.4 with the Sample Module.

C.1.4.6 Open the door of the Sample Module.

C.1.4.7 Take rubber roof flashing boot and slide 1/3 down the downtube.

C.1.4.8 Loosen the nut at the top of the Sample Module for inserting the downtube.

C.1.4.9 Insert the downtube through opening in the roof rain shield and Sample Module until it reaches the inlet tee inside the Sample Module.

C.1.4.10 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*.)

C.1.4.11 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.

C.1.4.12 Slide the rubber roof flashing boot on top of the roof boot mounted in the roof rain shield.

C.1.4.13 Attach the inlet cap at the top of the downtube.

Figure C.15 to C.17 Inserting the Module Boxes and the Downtube

C.1.5 Connecting the Pump Relay Cable

C.1.5.1 Connect the pump relay cable from the side of the lower stand as shown in Figure C.18 to the controller module as shown in Figure C.19.

C.1.5.2 Align the prongs on the pump relay cable plug with the receiver end of the controller module.

C.1.5.3 Turn plug until locked into place.

Figure C.18 Side View of Pump Relay Cable Connection

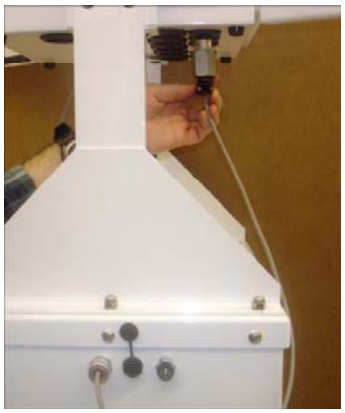


Figure C.19 Connection of the Pump Relay Cable to bottom of Controller Module

C.1.6 Connecting the Controller Cable

C.1.6.1 Connect the *single end* of the 20" 12-pin data cable (without the MFC connector) to the Controller Module as shown in Figure C.20.

C.1.6.2 Connect the other 12-pin data cable to Sample Module as shown in Figure C.21.

C.1.6.3 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 C.22.

Figure C.20 Connection of the Controller Cable to Controller Module

Figure C.21 Connection of the Controller Cable to Sample Module

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

C.1.7 Connecting the Vacuum (Air) Line

C.1.7.1 Connect the 30" Air line with "Colder" fittings to the Sample Module and the side of the lower stand (pump enclosure) as shown in Figures C.23 and C.24.

Figure C.23 Connection of Air Line to the Sample Module

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

C.1.8 Connecting the Ambient Temperature Probe

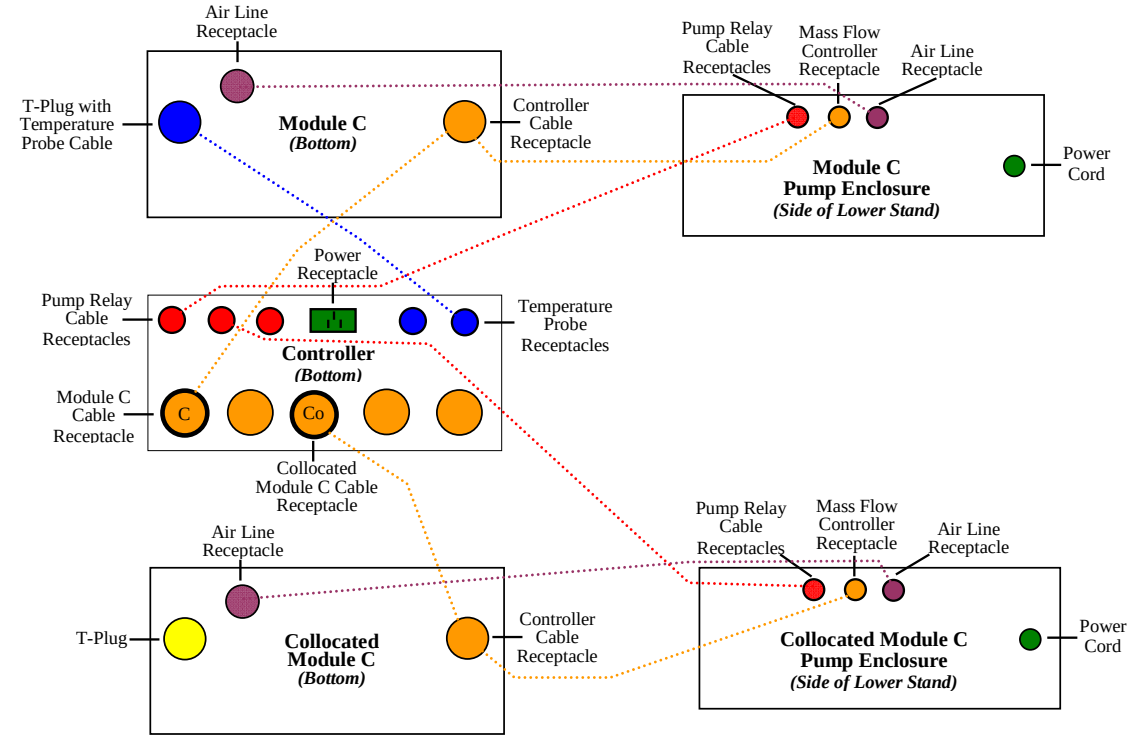
C.1.8.1 Mount the ambient temperature probe at the base of the inlet tee as shown in Figure C.25.

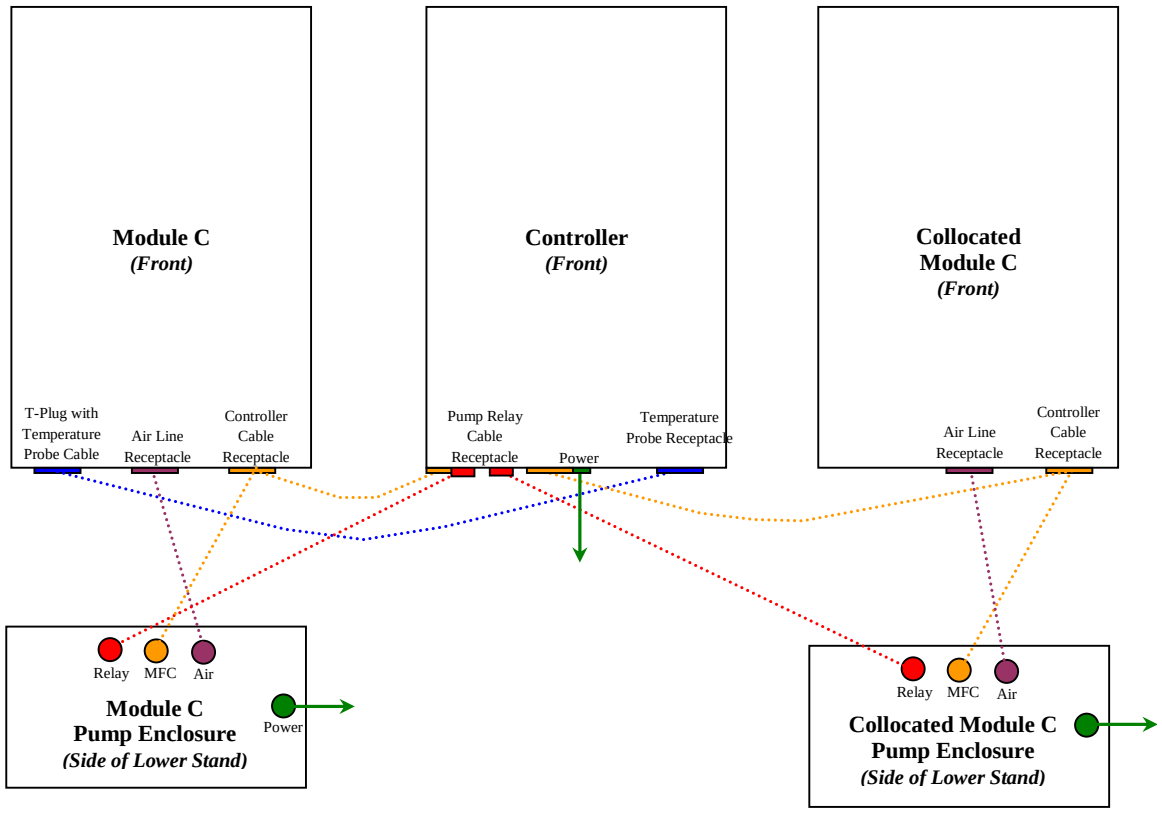
C.1.8.2 Drop the cable out of the bottom of the Sample Module and secure the plastic disc in the hole.

C.1.8.3 Plug the connector into the base of the Controller Module as shown in Figure C.25.

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

Figure C.26 Wiring Diagrams for URG-3000N





C.1.9 Installing Keypad and Memory Card

C.1.9.1 The Keypad has magnetic strips on the back, which allow it to sit in a holder as shown below in Figure C.27. Directly below the Keypad holder is a cord storage area and memory card slot.

C.1.9.2 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.1.9.3 Plug this data jack into the designated jack on the controller, also shown below in Figure C.27.

C.1.9.4 Insert a compatible Compact Flash memory card into the slot as shown in Figure C.28. (For routine sampling, the card for each sampling event will be provided with the filter cartridge by the contract service laboratory.)

C.1.9.5 Close up view of the keypad is shown in Figure C.29.

Figure C.27 Front View of Controller Module

Figure C.28 Inserting the Compact Flash Memory Card

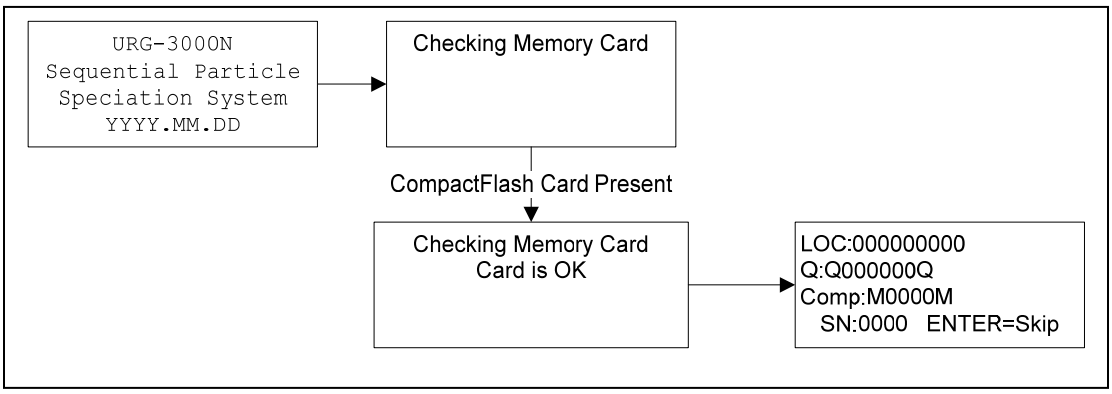
Figure C.29 Close Up View of Keypad

C.1.10 Powering Up the Sampler

C.1.10.1 Connect the 72” 115VAC power cable to the Controller Module and grounded receptacle.

C.1.10.2 Connect the pump power cable to a ground receptacle.

C.1.10.3 The LCD display screen on the controller keypad should illuminate and display, in sequence, the following four screens:



C.2 Completing the Installation

C.2.1 Leveling the sampler

C.2.1.1 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 above have been completed.

C.2.1.2 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.2.1.3 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.

C.1.2.4 Secure the anchoring base to the platform with screws and washers.

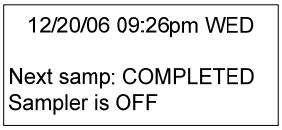
C.2.2 Setting Time and Date

NOTE: The operating area for the sampler may include more than one time zone. The field scientists in the $PM_{2.5}$ 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.

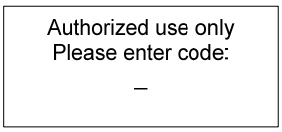
After powering up the sampler, the program is initiated and the display screens shown in C.1.10 are displayed. At the last screen, ID Codes, the operator is asked to press the "**ENTER**" key to proceed to the next screen shown below.

This screen is the default AUTO MODE screen. All operations begin at this screen.

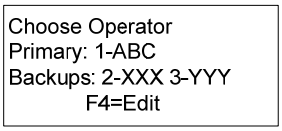


C.2.2.1 Press the "**ENTER**" key to move from the AUTO MODE to the MENU MODE.

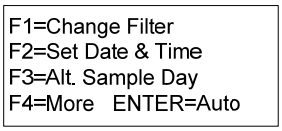
C.2.2.2 The Authentication screen appears (see below). Enter in "**1123**" to proceed to Choose Operator screen (for samplers deployed during Phases II and III, pressing "ENTER" allows the operator to proceed).



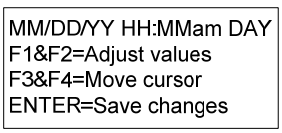
C.2.2.3 Choose "**1**, **2**, or **3**" from the Choose Operator screen to proceed to the Main Menu screen (see below).



C.2.2.4 At the Main Menu screen (see below), press the "**F2**" key to advance to the next screen to set date and time.



C.2.2.5 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, a screen will appear and prompt you to re-enter the proper date.



C.2.2.6 Press the "**ENTER**" key to save changes. The sampler software will return the operator to the Main Menu screen (see screen in Step C.2.2.4).

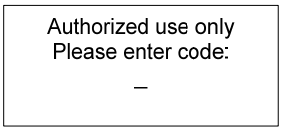
C.2.2.7 Press the "**ENTER**" key to return to the AUTO MODE screen (see screen in Section C.2.2). The EPROM chip defaults to the 1-in-3 day CSN sampling schedule when the sampler is set to the correct date and time.

C.2.3 Setting the Alternative Sample Day

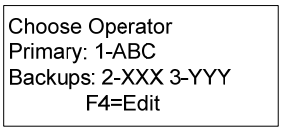
During special studies, the operator may wish to operate the sampler on schedules other than a 1-in-3 or 1-in-6. The Alternative Sample Day menu will permit the operator to change the sampling day.

C.2.3.1 Press the "**ENTER**" key to move from the AUTO MODE to the MENU MODE.

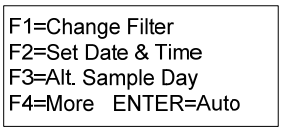
C.2.3.2 The Authentication screen appears (see below). Enter in "**1123**" to proceed to Choose Operator screen (for samplers deployed during Phases II and III, pressing "ENTER" allows the operator to proceed).



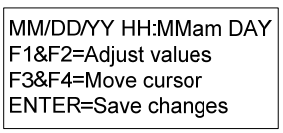
C.2.3.3 Choose "**1**, **2**, or **3**" to proceed to the Main Menu screen (see below).



C.2.3.4 At the Main Menu screen (see below), press the "**F3**" key to set an alternative date and time.



C.2.3.5 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.



C.2.3.6 Press the "**ENTER**" key to save changes. The sampler software will return the operator to the Main Menu screen.

C.2.3.7 Press the "**ENTER**" key will return to the AUTO MODE screen.

C.2.4 Setting the Site Configuration Information

The operator should set up the site configuration using the following menu tree (see Figure C.30). All steps from the AUTO MODE screen to the Site Configuration Menu are identified.

C.2.4.1 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.

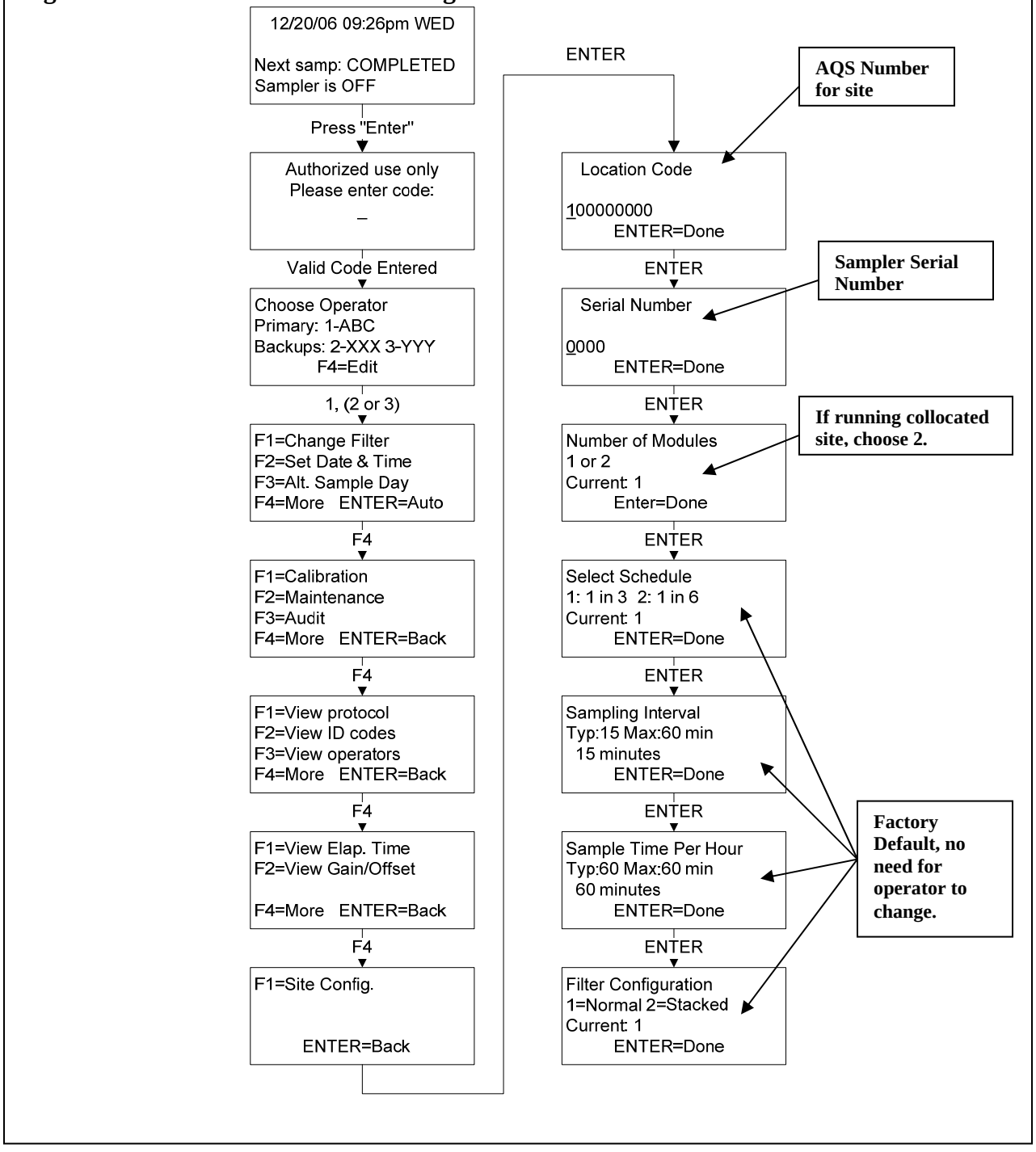
C.2.4.2 The remaining screens in the Site Configuration Menu are set at the factory default for running the sampler in the CSN. *If the site is using this sampler for collocation, enter "**2**" using the keypad for Number of Modules. This only needs to be done prior to running collocated samplers. In 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.2.4.3 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.

C.2.4.4 Collect the installation tools and shipping material and put them in a place where they will be safe and out of the way.

C.2.4.5 Installation of the URG-3000N sampler is complete. Proceed with ambient temperature, barometric pressure, and flow rate verification prior to beginning sampling (see Section 5.0 Verification). Perform a leak check on the sampler prior to conducting flow rate verification.

Figure C.30 Menu Tree for Site Configuration



Appendix D

Sampler Collocation Information

The information below is based on the current URG Operations Manual and is subjected to change. If you need further assistance regarding collocation sampling, please contact URG at (919) 942-2753, http://www.urgcorp.com/index.php/email-form or info@urgcorp.com.

D.1 Optional Boxes for Collocation Module

D.1.1 Collocated Module Box
- D.1.1.1 Sample Module
- D.1.1.2 66” length 12-pin extended control cable for attaching Collocated Sample MFC
- D.1.1.3 T-plug (installed in inlet tee to replace the temperature probe in Collocated Sample Module)
- D.1.1.4 Inlet cap
- D.1.1.5 Roof flashing for inlet

D.1.2 Collocated Stand Box
- D.1.2.1 Lower stand components
- D.1.2.2 Pump enclosure: MFC, snap thermostat, fan, power terminal
- D.1.2.3 120” extended pump relay cable

D.1.3 Collocated Stand Rain Shield Box
- D.1.3.1 Rain shield
- D.1.3.2 Two upright supports
- D.1.3.3 Two roof supports
- D.1.3.4 Two lower stand supports
- D.1.3.5 Two module supports

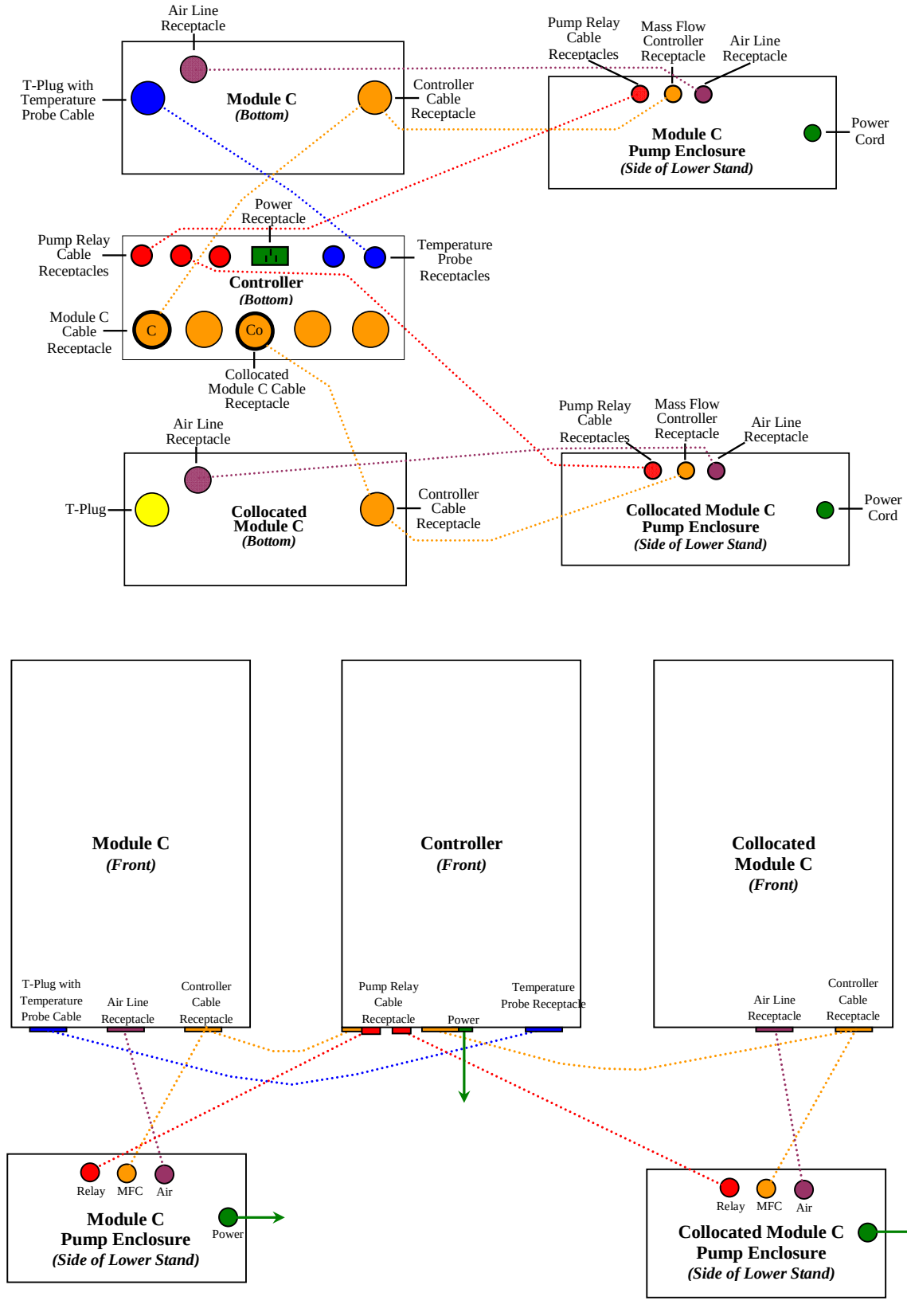
D.1.4 Collocated Pump Box
- D.1.4.1 One 120V pump
- D.1.4.2 Assorted mounting hardware
- D.1.4.3 Exhaust tube
- D.1.4.4 Rubber feet

D.1.5 Collocated Inlet Box
- D.1.5.1 One 36” downtube

D.2 Installing the (Optional) Collocated Sample Module

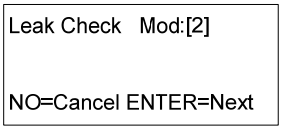
The optional Collocated Sample Module is installed in exactly the same way as the Routine Sample Module. The only differences are that the controller cable is 42” longer and pump relay cable is 90” longer than the cables provided for the Routine Sample Module so that the Collocated Sample Module can be placed 1 meter (inlet to inlet) away from the Routine Sample Module. The Controller Module of the routine sampler setup operates the Routine Sample Module and the Collocated Sample Module. Figure D.1 shows the wiring connections for the Collocated Sampler, the Routine Sample Module, and the Controller Module.

Figure D.1 Wiring Diagrams for Collocated Sampler



D.3 Verification of a Collocated Sampler

For those CSN sites that have a collocated URG-3000N sampler, a leak check and flow rate verification must be performed prior to using the sampler. The collocated Sample Module has its own pump and MFC. When the collocated Sample Module is put into operation, the operator must use the software program to change the Number of Modules Function from one to two modules. When conducting a leak check or flow rate verification (audit) or calibration, make sure that the screen displays a Number 2 in the upper right corner (see example screen below). This represents Module 2. See the Operations Manual for assistance.



The leak check procedure is conducted the same way as the routine module (see Section 5.7). Record the pressure drop in mm Hg on the CSN QA/QC Spreadsheet and the field notebook for the collocated sampler. If the sampler fails the leak check, attempt another leak check. If the sampler fails both times, refer to Section 10 Troubleshooting or the Operations Manual. If you are still unable to solve the leak problem, contact URG at (919) 942-2753, http://www.urgcorp.com/index.php/email-form or info@urgcorp.com.

The flow rate verification (see Section 5.8) for the collocated sampler is performed after a successful leak check just like the routine sampler. Record the sampler and reference standard values for the collocated sampler in L/min on the CSN QA/QC Report Form and the field notebook. **The agreement should be within ±10 %.** If values do not agree within acceptance criteria, perform a flow rate calibration (see Section 7.3).

The collocated sampler does not have an ambient temperature probe or barometric pressure sensor. A T-plug is put in place of the ambient temperature probe. The Routine Controller Module measures the ambient temperature and barometric pressure sensor for controlling the MFC of the collocated Sample Module.

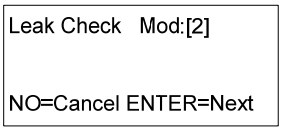
D.4 Filter Changing Procedure for Collocation Sample

The Filter changing procedure for the collocated Sample Module is conducted exactly as the Routine Sample Module. Follow Steps 6.1.1 through 6.2.5 and the software will toggle from the Routine Sample Module to the Collocated Sample Module. When the Compact Flash memory cards return to the support laboratory, each sample module, Routine and Collocated, will have the same Location Code (AQS Number) and Serial Number for the Controller Module, but the Q Numbers and Comp ID Numbers will be different because these numbers are assigned by the support laboratory based on the sampling event. When the support laboratory sends the filter

cassette and CAFDF to the site operator, after the Site Name in parenthesis is the word "Collocated" to differentiate between the routine and the collocated sample.

D.5 Calibration of a Collocated Sampler

For those CSN sites that have a collocated URG-3000N sampler, a flow rate calibration must be performed. Prior to conducting flow rate verification of the collocated sampler, a successful leak check must be completed (see Section 5.7). When conducting a flow rate calibration, make sure that the screen displays a Number 2 in the upper right corner (see example screen below). This represents Module 2. See the Operations Manual for assistance.



The flow rate calibration (see Section 7.3) for the collocated sampler is performed after a successful leak check just like the routine sampler. Record the sampler and reference standard values for the collocated sampler in L/min on the CSN QA/QC Spreadsheet and the field notebook. **The agreement should be within ±10 %**.

The collocated sampler does not have an ambient temperature probe or barometric pressure sensor. A T-plug is put in place of the ambient temperature probe. The Routine Controller Module measures the ambient temperature and barometric pressure sensor for controlling the MFC of the collocated Sample Module.