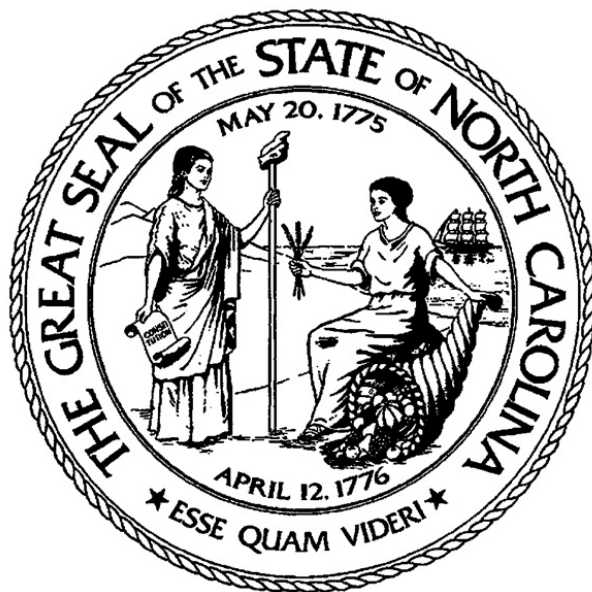# North Carolina Division of Air Quality

Quality Assurance Project Plan

Particulate Matter 2.5

2.24 Fine Particles

Section 1

Standard Operating Procedures for

Electronic Calibration Branch

Submitted by:

North Carolina

Division of Air Quality

1641 Mail Service Center

Raleigh, NC 27699-1641

QAPP Approval Sign-Off Sheet

I certify that I have read and approve of the contents of this revision of QAPP/SOP 2.24.1 with an effective date of 1/1/2011.

Document Preparer

Rik Tebeau, Environmental Specialist, _____ R Tebeau 12.17.10

Electronics Calibration Branch Representative

Frank Corduan, ECB Technician, _____ Frank Corduan 1-7-11

Electronics Calibration Branch Supervisor

Frank Stellitano, ECB Supervisor, _____ Frank R. Stellitano 1-10-11

Projects and Procedures Branch Supervisor

Joette Steger, Environmental Supervisor, _____ Joette Steger 1/5/2011

Ambient Monitoring Coordinator

Donnie Redmond, Ambient Monitoring Section Chief, _____ 1/13/11

Table of Contents   **Section 2.24.1**

Table of Contents   Section 2.24.1

2.24.1 PM$_{2.5}$ FRM Electronic Calibration Branch QAP/SOP

Note: The following is a list of "significant" changes from Revision 1

	Section
• 12-point refurbishment interval required at 18 months	5.0
• Supplying field operators with WINS oil and filters	5.1
• Monthly Maintenance Form submittal to RCO	5.3
• Temperature and Relative Humidity calibration	5.4

If you notice errors or omissions to this SOP, please notify the Supervisor of the Projects and Procedures Branch at (919) 715-0672.

1.0   SCOPE AND PURPOSE

The U.S. Environmental Protection Agency (EPA) began regulating fine particles in July 1997. The regulation set forth the reference monitoring method in the Code of Federal Regulations (CFR) at 40 CFR Part 50, Appendix L. This document is intended to assist the Electronic Calibrations Branch (ECB) with the North Carolina Division of Air Quality (NCDAQ) to use the EPA reference method to monitor the ambient atmosphere for particles with an aerodynamic diameter of 2.5 µm or less, known as fine particles (PM$_{2.5}$). Fine particles are formed in the atmosphere from gases such as sulfur dioxide, reactive oxides of nitrogen, and volatile organic compounds. Sources include power plants, diesel trucks, wood stoves, and industrial processes.

The goal of the NCDAQ PM$_{2.5}$ program is the measurement of fine particles in units of micrograms per cubic meter (μg/m^3). Using a Rupprecht & Patashnick Partisol$^®$-Plus Model 2025 PM$_{2.5}$ Sequential Sampler, particles are collected on

47mm diameter, 2µm pore-size Teflon® filters over a 24-hour time period. The concentrations are then compared to the National Ambient Air Quality Standard (NAAQS) of 35 μg/m^3 for 24 hours and 15 μg/m^3 annual arithmetic mean concentration.

This document focuses on the assembly and repairs of the Rupprecht & Patashnick Partisol®-Plus Model 2025 PM $_{2.5}$ Sequential Samplers and should be used in conjunction with the supplied Service Manual. The Service Manual is the reference method for all adjustments to the sampler by ECB technicians and will not be reproduced in this Standard Operating Procedure (SOP).

2.0   SAMPLER DESCRIPTION AND ASSEMBLY

2.1   Description of the R&P Model 2025 PM$_{2.5}$ Sequential Sampler:

The Partisol®-Plus Model 2025 Sequential Air Sampler is designed to meet the regulatory monitoring requirements for PM$_{2.5}$ (40 CFR Part 50, Appendix L). The sampler draws a known volume of air at a constant flow rate through a PM$_{10}$ inlet followed by a Well Impactor Ninety-Six (WINS). After a 24-hour sampling period, the pre-weighed Teflon® filter is collected and gravimetrically analyzed. The mass concentration is reported as μg/m^3.

Features of the Partisol®-Plus Model 2025 Sequential Air Sampler:

- An active volumetric flow control system that maintains a constant volumetric flow rate of 16.67 L/min by incorporating a mass flow controller, and ambient temperature and pressure sensors.
- The temperature of the collection filter is maintained within 5 °C of the outdoor ambient temperature by a continuous filter compartment ventilation system.
- The inlet is designed to remove particles with an aerodynamic diameter of greater than 10 µm and sends particles less than 10 µm to the next filtration stage. Figure 1 is a schematic of the PM$_{10}$ inlet head.

- Figure 2 depicts the WINS impactor that removes particles greater than 2.5 μm and allows 2.5 um in diameter and smaller particles to be collected on a Teflon® filter.

- The sampler uses standard 47 mm Teflon® filters housed in reusable cassettes.

- The sampler has a filter exchange and storage system that simplifies transportation, minimizes contamination and allows for up to 177 hours between site visits.

- A record of filter data is stored for each filter used in the sampler, and includes all U.S. EPA specified values such as error condition flagging and average temperatures and pressures. Filter data records also include sampled volume and analog input data averaged over the collection period.

- The sampler has a capacity to store 50 filter data records.

- Interval data are stored every five minutes, and include the five-minute averages of the filter temperature, ambient temperature, ambient pressure, and flow rate.

- The sampler has capacity to store 16 days of five-minute interval data.

- The sampler has capacity to store 32 days of 30 minute input data.

- A bi-directional RS232 interface for data transfer to or from a PC or Palmtop device.
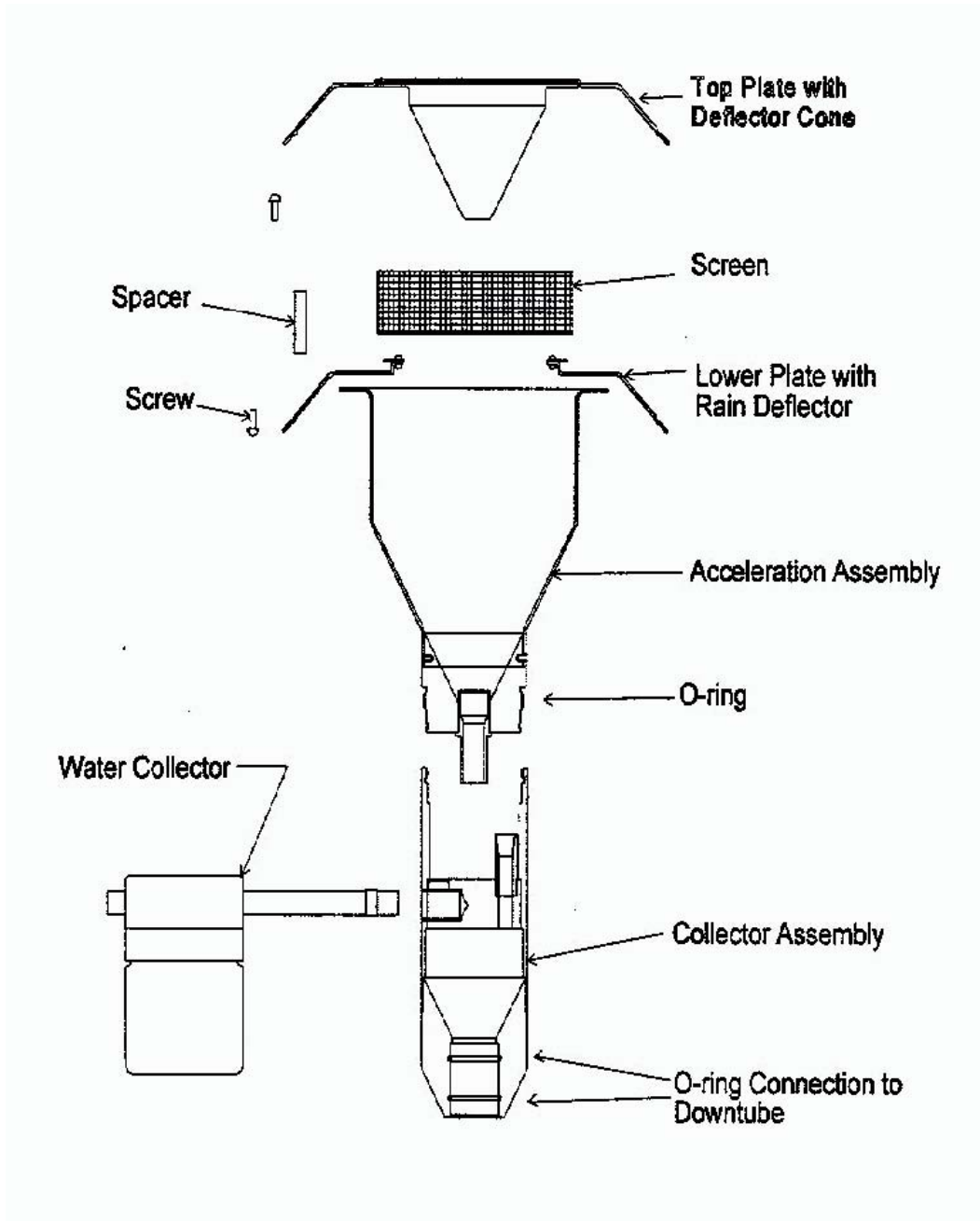
Figure 1. Exploded Cross-Sectional View of PM$_{10}$ Sampler Inlet Head
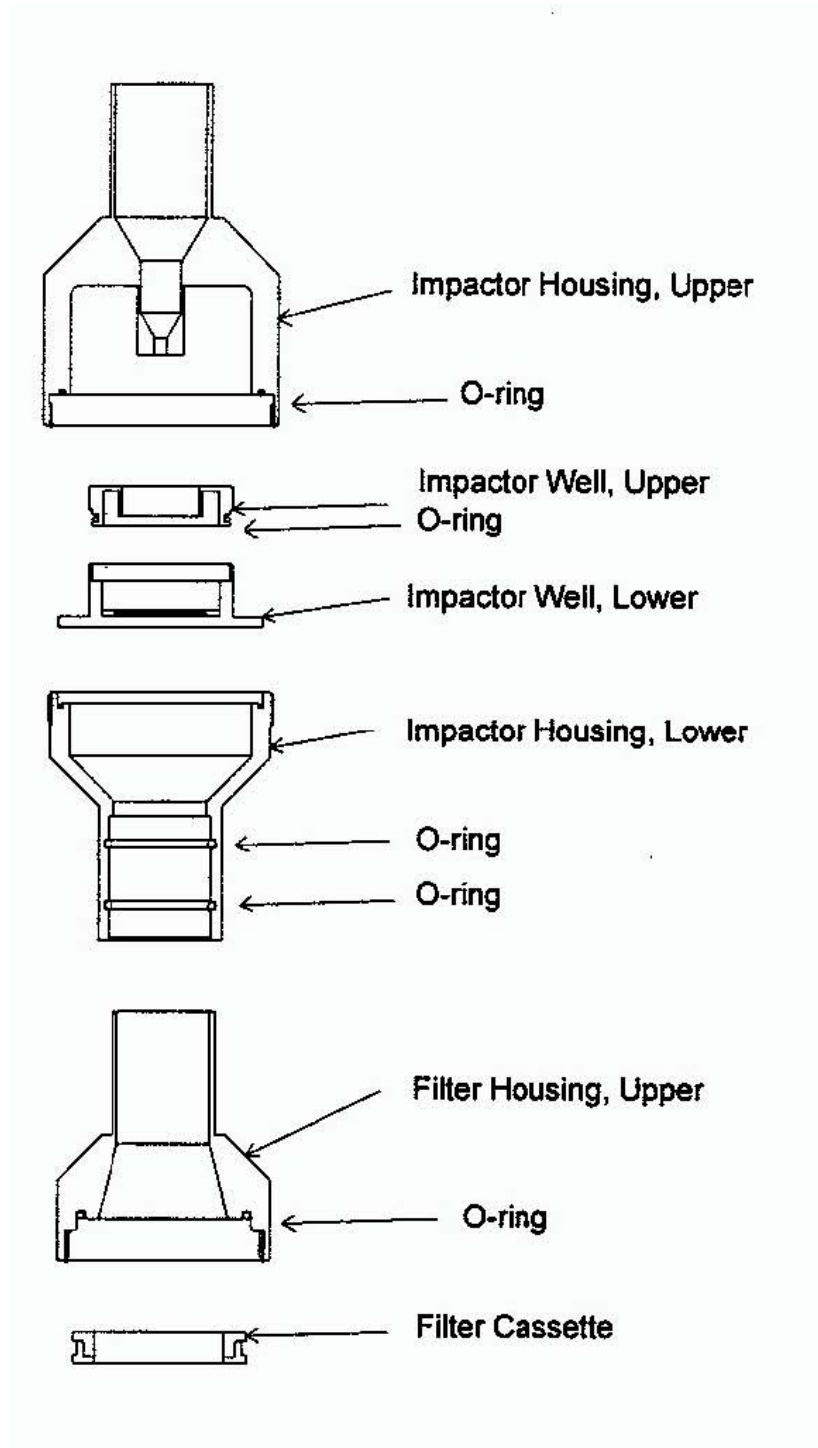
Figure 2. Exploded Cross-sectional View of PM$_{2.5}$ Impactor Well and Filter Holder

2.2   Assembly

2.2.1   Unpacking and Inspection

Inspect the packing container upon receipt of a new sampler for damage. Notify the carrier of any damage and hold for their inspection. The carrier, not Thermo Scientific, is responsible for damage incurred during transit.

2.2.2   Parts Inventory

Inventory the shipping container contents using the enclosed packing list as a guide. Note any missing parts and notify Thermo Scientific of the discrepancies.

2.2.3   Sampler Assembly

Use the Quick Start Guide that accompanies the sampler for assembly instructions.

3.0   **Sampler Setup**

The sampler is operated and maintained through a series of menus on a Liquid
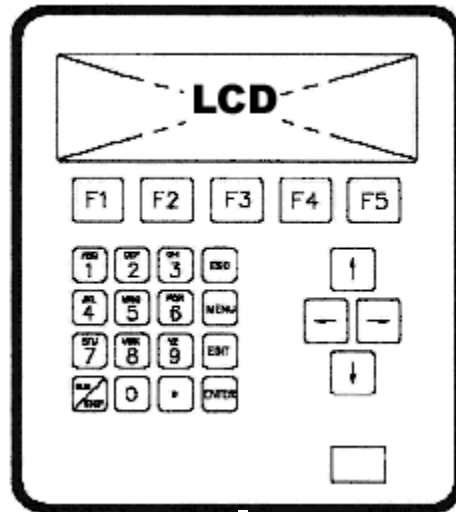
Figure3. Model 2025 Control Panel

Crystal Display (LCD). This display has an adjustment knob/rheostat to the right
of the screen. All operations are performed using this screen.

3.1   **Menu Hierarchy**

This section will guide you through the menu system of the Partisol®-Plus Model
2025 Sequential Air Sampler. Figure 4 is the menu hierarchy tree.

MENU
HIERARCHY
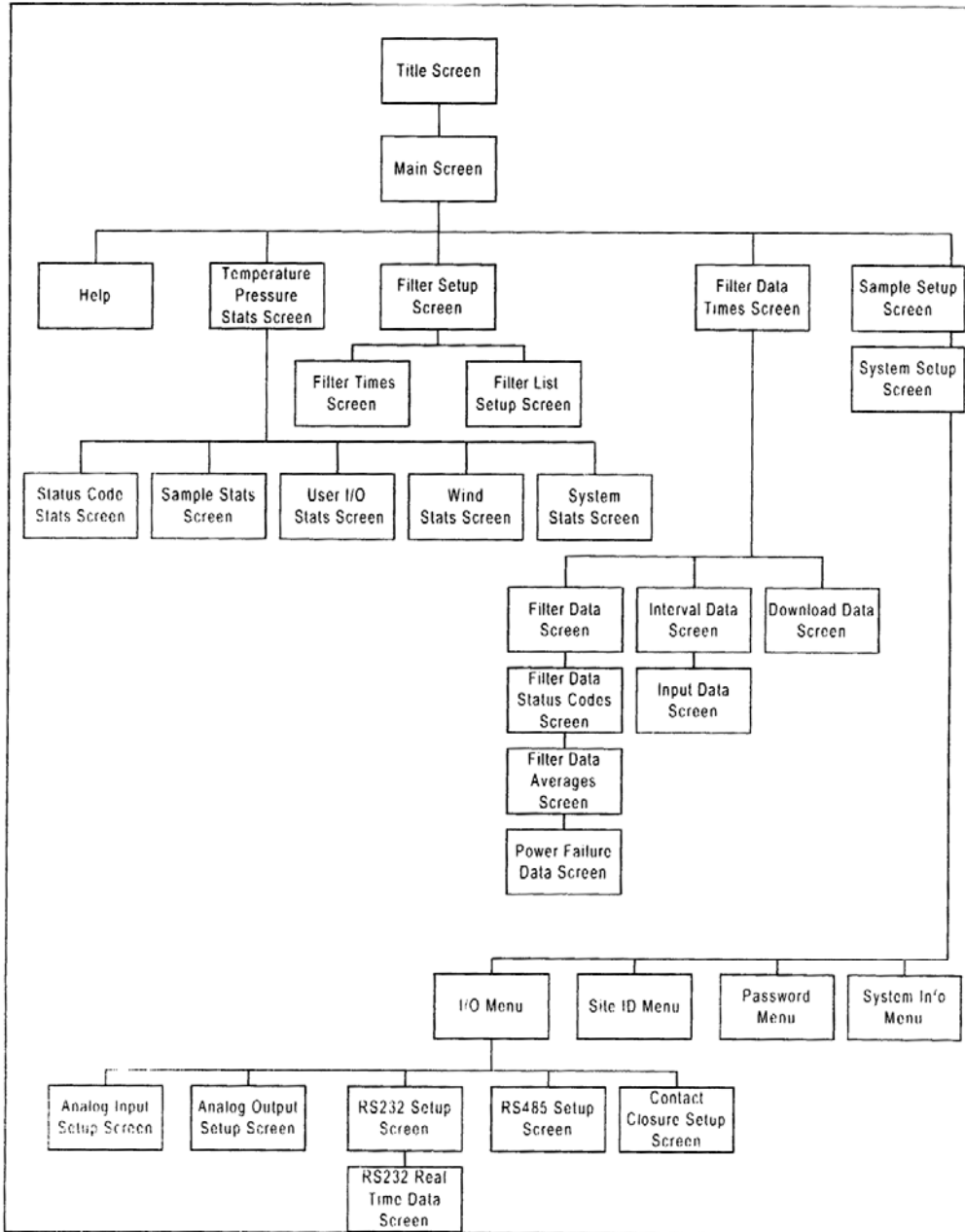
Figure 4. Partisol®-Plus Model 2025 Menu Hierarchy

3.1.1 Initial Screen

Upon initial power up, or if after the sampler is shut down, the screen shown in (Figure 5) will be visible in the LCD.

System Information
Software Version   3.200

Software Date: 1-July-99
Serial Number: 10019
Filter Exchange: SINGLE
Int Board Rev: 1
Flow Type 1:   20

F1   F2   F3   F4   F5

Figure 5. Partisol®-Plus Model 2025 Initial Start-Up Screen

This screen will display for 30 seconds, showing the software version, date of the software, and the serial number of the sampler.

3.1.2 Main Screen

The Main Screen (Figure 6) appears after the initial screen. The upper right corner denotes the operating mode (STOP, Wait, SRV, SAMP, Audit, and Done). The upper left corner shows the current status. (The complete list of Status Codes is found in Appendix A).

```
Stat:OK       Partisol 2025       Mode:Done
    Current Time: 09.27 97/07/23
    Start Sample: 00.00 97/07/24
     Stop Sample: 00.00 97/07/25.
        Filter ID: 123456
     Cassette ID:  100123
            Blank:   No
  ┌────────┬────────┬────────┬────────┬────────┐
  │  Help  │ Stats  │FiltSet │  Data  │ Setup  │
  └────────┴────────┴────────┴────────┴────────┘
      F1       F2       F3       F4       F5
```

Figure 6. Main Screen of Partisol®-Plus Model 2025

3.1.3   Sample Setup Screen

From the Main Screen, press <F5:Setup> key, to advance to the Sample
Setup Screen (Figure 7).

```
    Sample Definition Method:   Basic
  Default Sample Start Time:   00:00
    Default Sample Duration:   24:00
 Default Sample Repeat Time:   00:00
          Default Filter Type:      P
 Sample Flow Rate:             16.7
 Flow Error Mode: Err      Separators: No
  ┌────────┬────────┬────────┬────────┬────────┐
  │  Help  │ SetEPA │        │        │ System │
  └────────┴────────┴────────┴────────┴────────┘
      F1       F2       F3       F4       F5
```

Figure 7. Sample Setup Screen of Partisol®-Plus Model 2025

The Basic mode is the EPA default of daily sampling. If the Basic mode is not
displayed, place the cursor to the mode position and select <EDIT>, use the
<F1/F2> keys to scroll to the Basic mode. Press <ENTER> to save this selection.

Default start time is midnight 00:00. Duration for the network is 24 hr. To change to a three-day sampling period, the Default Sample Repeat Time is 72:00. Precision (six-day) monitors use a repeat time 144:00.

The default filter type "P" is changed to read "T". Separators are always "No".

3.1.4   Time Set Up

1) Press <RUN/STOP> to enter the STOP mode to change the time. In the Main Screen, press <F5: Setup>.

2) Press <F5:System>. From the Sample Setup Screen to enter the System Setup Screen (Figure 8).

```
                    System Setup
Average Temp: 99      Standard Temp:   99
Average Pres: 999     Standard Pres:  999
Date Form: 98:06:21   Average Time:    30
Time Form:  13:00:00
Curr Time:  05:00:00
Curr Date:  98:04:10
 ┌────────┬────────┬────────┬────────┬────────┐
 │  Help  │  I/O   │Site ID │ Passwd │SysInfo │
 └────────┴────────┴────────┴────────┴────────┘
     F1       F2       F3       F4       F5
```

Figure 8. System Setup Screen

3) Scroll the cursor to the Curr Time, and press <EDIT>. The cursor should transition to a large block.

4) Enter the Eastern Standard Time (EST) utilizing each section between the colons separately. If the next minute is 8:07, in the first area insert 08, shift the cursor to the next block and insert 07.

5) When it is 8:07 exactly, press the <ENTER> key. This will save the change.

6) Enter the date in a similar manner.

7) Press <ESC> key to return to the Sample Definition Method screen.

3.1.4.1   System Setup Verification

1) From the Sample Definition Screen, press <F5:System>.

2) Use the default values shown in the System Setup Screen (Figure 9).

```
                    System Setup
Average Temp: 99       Standard Temp:   99
Average Pres: 999      Standard Pres:  999
Date Form: 98:06:21    Average Time:    30
Time Form:   13:00:00
Curr Time:   05:00:00
Curr Date:   98:04:10
```

Help	I/O	Site ID	Passwd	SysInfo

Function Keys in Browse Mode

Help	I/O	Site ID	Passwd	SysInfo

Function Keys in Edit Mode

-List	+List	Bksp	ChSign	

F1	F2	F3	F4	F5

Figure 9. The System Setup Screen

3) Average Temp: 99 is the default to use the temperature sensor on the exterior of the sampler. Average Press: 999 is the default to use the samplers' internal pressure sensor to maintain a constant volumetric flow rate. The date format is yr: mo: day. Average time is 30 minutes. Current date and time are adjusted by using the edit mode, see section 2.2.3.

4) Move the cursor to the value to be changed and then press <EDIT>. Use the keypad to change the value. Hours, min, day, mo, and yr are entered separately. Change the day and press <ENTER> to accept the change. Move cursor to the month and press <EDIT>. Change the month and press

<ENTER>. Continue changing each block. In the edit mode, only the lower set of function keys will appear. If there are limited options on updating a field use <+ List> or< – List> to view the options. Press <ENTER> to save the change.

3.1.5   Site Identification

```
              Site Identification

ID1:     371830014

ID2:     510

             Function Keys in Edit Mode

                        Bksp    A <--    A -->

     F1        F2        F3       F4       F5
```

Figure 10. Site Identification Screen

1) From the System Setup Screen, press <F3: Site ID> to enter the Site Identification Screen.(Figure 10)

2) Move the cursor to the ID1 row (AQS code) at the first position. Press <EDIT>, then 3, press <F5:A→> to move to the next digit, press 7, press <F5: A→> to move to the next digit. Continue until the entire AQS code is entered. Press <ENTER> to lock in the number, i.e., 371830014 is the AQS number for Millbrook in Raleigh. A complete listing of AQS codes is found in Appendix C. For counties that only have two (2) digits in the county code, insert a zero before the county code. For example, Hickory is 370350004.

3) Move the cursor to the ID2 row at the first position. Reference Appendix C to determine the site ID2 code for a particular site. For the Millbrook collocated,

6-day sampler, use 510. Press <EDIT>, then <u>5</u>, press <F5:A→> to move to the next digit, press <u>1</u>, press <F5:A→> to move to the second digit, press <u>0</u>. Press <ENTER> to save the code.

4) Press <ESC> twice to return to the Main Menu. To leave the Service Menu, select exit.

3.1.6   System Information

1) From the Site Identification screen, press <ESC> to return to the System Set-Up screen, press <F5> to review the System Information Screen.

2) The System Information screen is shown in Figure 11.
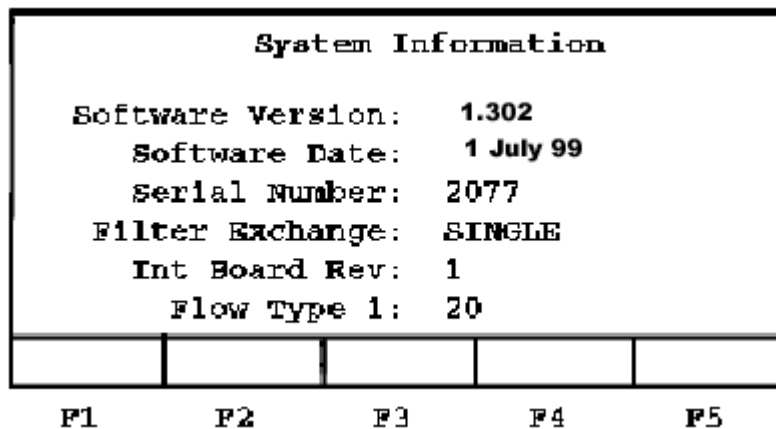

Figure 11. System Information Screen.

4.0   Documentation

Each new Rupprecht & Patashnick Partisol®-Plus Model 2025 PM $_{2.5}$ Sequential Sampler will undergo a series of tests taken from the EPA questionnaire in Figure 12. If the answer to any question is NO, then the acceptance criteria have failed and the sampler is rejected for service with the NCDAQ.

**SEQUENTIAL AND SINGLE CHANNEL FRM SAMPLER
TESTING AND ACCEPTANCE CRITERIA**

Yes   No

1. Check the enclosed packing list. Were all parts listed included in the delivery of the monitor?

2. Were any of the enclosed parts broken during the shipping of the monitor?

3. Check the enclosed assembly instructions. Did all parts fit together during assembly of the monitor?

4. Does the motor turn on when supplied with electrical power?

5. Using an independent timing mechanism, check to ensure the timer operates properly. Check to see if the timer will automatically turn on and off during a set time by setting the timer to start and stop the monitor while the operator is present.

6. Does the computer boot up and operate properly? Check to see if the computer has working software by performing manual input of information into the computer.

7. Does the computer download information properly? Check this by manually trying to download information.

8. Does the internal fan operate properly? Check this by supplying electrical power to the unit and checking if the fan will turn on and off.

9. Does the temperature sensor operate properly? Check this by taking a temperature reading with the internal fan off and then with the internal fan on and checking to see if the temperature readings change.

10. Does the filter holder apparatus operate properly? Check this by manually installing a filter into the holder apparatus and checking to see if the filter is sealed into the unit.

11. Does the casing protect the internal unit from weather? Check this by visually inspecting the unit's gaskets and seals for holes, leaks, etc. Note: This is a visual inspection only. Do not take apart the unit.

12. Does the unit support structure keep the unit secure and upright?

13. When all parts are assembled and operated together, does the unit function properly? Check this by assembling the unit as the instructions dictate, installing a filter, setting the timer, and operating the unit as a normal monitoring period.

14. a.   Does unit calibrate?
     b.   Does unit pass calibration?

_____   (Accept / Reject)
Certifying Official

City/State: _____   Telephone Number: _____

Serial Numbers for Samplers Accepted: Serial Numbers for Samplers Being Rejected:

Figure 12. EPA Acceptance Test Form.

5.0   Site Support/Preventive Maintenance Program

The purpose of Site Support and the Preventive Maintenance (PM) Program is to reduce the number of sampler failures, and field repairs performed by ECB technicians. Site Support may include telephone support as well as supplying routine maintenance items to field operators. A scheduled rotation is implemented in which each sampler will be refurbished on an 18 month basis. It is understood that unforeseen complications arise that will force variations in the schedule.

5.1   Site Support

ECB will provide materials and technical assistance to field operators as part of daily operations. Field Operators may require consumable parts and materials to keep the samplers running smoothly. The list of parts and materials include:

- V-seals
- Various O-rings
- Circular 37 mm diameter, borosilicate glass fiber without binder, and thickness between 300-500 micrometers. Before ordering, verify that the WINS filter meets all specifications (save brochures or verbal confirmations).
- Dioctyl sebacate WINS impactor oil
- A graduated 1 mL pipette for WINS oil
- Vacuum grease
- Cotton swabs
- Kim Wipes
- gauge

5.2 **Routine Pick Up of Samplers from the Field**

1) Inform the Regional Ambient Monitoring Coordinator (RAMC), several days in advance, that a sampler is scheduled to be replaced

2) Ensure that a closing verification has been performed by the regional office prior to removal from the site.

3) Before pick-up, record the site identification and download the filter, input, and interval data.

4) After the sampler is replaced, make sure that a temperature and pressure verification and a flow calibration is performed by regional personnel prior to sample collection.

5) Inform the Raleigh Central Office (RCO) of the sampler replacement.

5.3 **In-House Maintenance Procedures**

The following *ECB PM 2.5 Maintenance Schedule Form* (Figure 13), is both a guide and a log of the maintenance work to be performed on a sampler that returns from the field. A copy of this form will be signed by the technician performing the preventive maintenance. Any other maintenance performed should also be noted on the form. A copy of the completed form will accompany the sampler to the field and be presented to the regional personnel at the site. Additionally, the *ECB PM 2.5 Maintenance Schedule Forms,* will be emailed to: (1) The Chief of Ambient Monitoring, (2) The PPB Supervisor and (3) The PPB FRM Chemist on a monthly basis. RCO is responsible for uploading the forms onto the P: / drive and updating the internal web page with the latest emailed version of the *ECB PM 2.5 Maintenance Schedule Form.*

UNIT#_____. SN#_____. FAS#_____. DATE_____. TECH_____. REPAIR___

PM 2.5 MAINTENANCE SCHEDULE

1- RECORD SITE I.D.s & DOWNLOAD FILTER, INPUT & INTERVAL DATA

1a- UPGRADE NEW SOFTWARE, [check 'ak' protocol & 't' filter type]

2- CHECK KEYPAD [worn/cracked & contrast knob]. REPLACE BATTERIES

3- INSPECT & CLEAN HEAD [inlet], DOWN TUBE & "O" RINGS

4- CHECK PROPER MOTION OF CASSETTE MAGAZINES [hand pump-5lbs]

5- INSPECT & CLEAN WINS IMPACTER [proper threading & "o" rings]

6- REPLACE "V"- SEALS.

7- CHECK FILTER EXCHANGE OPERATION [guide arm corrosion & bumpers]

**8- REPLACE PUMP [pressure test—40lbs steady. & 34 to 38lbs filter exchange]
      IF NOT REBUILD [23-27lbs from pump]**

9- INSPECT OR REPLACE VACUUM TUBING

9a- INSTALL "FT" CONNECTER

9b- REPLACE SINDERED FILTER

10- CLEAN OR EXCHANGE PARTICLE TRAP FILTER

11- INSPECT & CLEAN FANS/FILTERS

12- CLEAN EXTERNAL TEMP. PROBE & PLUG. [check "o" ring]

13- PERFORM TEMP., PRESSURE & HUMIDITY CALIBRATION

14- PERFORM INTERNAL & EXTERNAL LEAK TESTS

15- DO 3 POINT CALIBRATION---THEN PERFORM AUDIT

16- RUN TEST SAMPLES, THEN DOWNLOAD DATA

17- CREATE STATUS CODE [red light works?]

18- CLEAN 2.5 [inside & out]

19- ENTER INFO. IN LOG BOOK   **rev. 12/2003**

Figure 13. ECB PM 2.5 Maintenance Schedule Form.

5.4   Temperature and Relative Humidity Calibration

1) All three temperature sensors are equilibrated to the indoor conditions at the ECB lab. The ambient sensor is placed in the cabinet so it is in close proximity to the cabinet temperature sensor and the filter temperature sensor.

2) Using a NIST certified electronic thermometer/relative humidity device, determine the temperature of the three sensors.

3) From the Service Menu, enter the Sensor Calibration Screen. Press <EDIT> and record the measured reference temperature in °C in the Actual column of the Amb Temp row of the Sensor Calibration screen, press <ENTER>. The sampler will automatically adjust the offset.

4) Repeat step 3 for the Cabinet Temperature sensor and for the Filter Temperature sensor.

5) Determine the current percent relative humidity. From the Service Menu, enter the Sensor Calibration Screen. Press <EDIT> and enter the measured relative humidity in the Actual column of the Amb RH row of the Sensor Calibration screen, press <ENTER>. The sampler will automatically adjust the offset.

6) A single point temperature verification is performed with mineral thermometer. If the temperature varies by greater than two degrees, the sampler temperatures are re-calibrated following the procedures outlined in section 3.2 of the Service Manual.

APPENDIX A   Status Codes

Hexadecimal On Filter File	Status Code Sampler	Status
0	OK	No Status Conditions
(H) 1	M	Flash Memory
(H) 2	C	Automatic System Calibration Failed
(H) 4	Y	System Reset Occurred
(H) 8	Z	Power Failure
(H) 10	F1	Flow 1 Out of Range
(H) 20	F2	Flow 2 Out of Range
(H) 40	F3	Flow 3 Out of Range
(H) 80	S1	Flow 1 Stop due to 10% Dev for 5 min.
(H) 100	S2	Flow 2 Stop due to 10% Dev for 5 min.
(H) 200	S3	Flow 3 Stop due to 10% Dev for 5 min.
(H) 400	A	Ambient Sensor Out of Range
(H) 1800	T	Filter or Comp Sensor Out of Range
(H) 1000	E	Electronics Temperature Out of Range
(H) 2000	R1	Diff of Filter Temp1 and Amb Temp >5°
(H) 4000	R2	Diff of Filter Temp2 and Amb Temp >5°
(H) 8000	X	Filter Exchange Mechanism Failure
(H) 10000	N	Out of Filters
(H) 20000	O1	Coeff of Variation for Flow 1 Too High
(H) 40000	O2	Coeff of Variation for Flow 2 Too High
(H) 80000	O3	Coeff of Variation for Flow 3 Too High
(H) 100000	P	Elapsed Sample Period Out of Range
(H) 200000	L	Leak Check Failed
(H) 400000	D	Audit Performed During Sampling
(H) 800000	B	Blank Filter
(H) 1000000	S	Stop Key Pressed
(H) 2000000	V	Flow#1> 1 lpm in WAIT Mode

APPENDIX B Deciphering Hexadecimal Status Codes

When the Partisol-Plus Sampler's PRC 5: Status Codes are downloaded, they are displayed as hexadecimal numbers. This appendix explains how they relate to the sampler's status codes. The hexadecimal number system is a base-16 number system that uses 16 symbols (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E and F) to represent number values.

Dec	Hex
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	A
11	B
12	C
13	D
14	E
15	F

When downloaded, the Partisol-Plus Sampler's Status Codes are displayed in hexadecimal form. The sampler may display more than one code at a time. When the unit does show more than one status code, it adds the codes together and displays them as a hexadecimal sum.

For example, if the unit displays the Flash Memory status code (hexadecimal number "1") and the System Reset Occurred status code (hexadecimal number "4") at the same time, the two status codes (when downloaded) will be displayed as the hexadecimal number "5." The Status Code Table has only two status codes that would add up to a value of "5". By looking at this table and breaking down the downloaded status codes, you can determine which status codes the unit has displayed. To properly use the Status Code table, you must separate the status

APPENDIX B Deciphering Hexadecimal Status Codes (Cont.)

codes on the table into place holders: the "1's," "10's," "100's," "1,000's," "10,000's," and "100,000's" and the "1,000,000's" place. To break down the downloaded status codes, you must match each section of the status code with these place holders. Refer to the following two examples for assistance with deciphering hexadecimal status codes.

Example 1: Decipher the following downloaded status code: 20C30

1. First, look at the Status Code table and break down the status code into its different place holders:

2. There are no status codes displayed in the "1's" place of the original status code.

3. In the "10's" place of the original status code, a status code of "30" is displayed. Because there are no status codes in the table that match this number, you will need to break down this number further. In the "10's" place of the table, there are only two status codes that, when added together, will amount to "30": "10" *Flow 1 Out of Range* and "20" *Flow 2 Out of Range.* These are two of the status codes that the unit is displaying in its original status code. Now, subtract "30" from the original status code: 20C30 – 30 and you are left with "20C00".

4. In the "100's" place of the new status code (20C00), a status code of "C00" is displayed. Because there are no status codes in the table that match this number, you will need to break down this number further. So, convert C00 to a decimal number. From the table, you see that "C" is 12, which converts "C00" to "1200."

5. In the "100's" place of the table, there are only two status codes that, when added together, will amount to "1200": "400" *Ambient Sensor Out of Range* and "800" *Filter or Compartment Temp Sensor Out of Range.* These are two more of the status codes that the unit is displaying in its original status code. Now, subtract "C00" from "20C00": 20C00 - C00 and you are left with "20,000".

APPENDIX B Deciphering Hexadecimal Status Codes (Cont.)

6. In the "10,000's" place of the Status Code table, the status code "20000" *Coeff of Variation for Flow 1 Too High*, matches the "20,000" status code. This is the last status code that the unit is displaying in its original status code. Therefore, the downloaded status code, "20C30," breaks down into the following status codes, according to the Status Code table:

   10 - *Flow 1 Out of Range*
   20 - *Flow 2 Out of Range*
   400 - *Ambient Sensor Out of Range*
   800 - *Filter or Compartment Temp Sensor Out of Range*
   20000 - *Coeff of Variation for Flow 1 Too High***.**

Example 2: Decipher the following downloaded status code: 70B002

1. First, look at the Status Code table and break down the status code into its different place holders:

2.) In the "one's" place of the original status code, a status code of "2" is displayed. In the "one's" place of the Status Code table, the "2" status code matches the 2 "Automatic System Calibration Failed" status code. This is one of the status codes that the unit is displaying in its original status code. Now, subtract "2" from "70B002": 70B002 - 2 = 70B000. Continue to break down this status code to decipher the rest of the status codes displayed in this number.

3. In the "10's" place of the new status code, there are no status codes displayed.

4. In the "100's" place of the new status code, there are no status codes displayed.

5. In the "1,000's" place of the new status code (70B000), a status code of "B000" is displayed. Because there are no status codes in the Status Code table that match this number, you will need to break down this number further.

APPENDIX B Deciphering Hexadecimal Status Codes (Cont.)

6. Convert "B000" to a decimal number. From the table you see that "B" is "11", which converts "B000" to "11,000." Next, look at the Status Code table to decipher the "11,000" status code. In the "1,000's" place of the table, there are three status codes that, when added together, will amount to "11,000": "1000" *Electronics Temperature Out of Range*, "2000" *Diff of Filter Temp 1 and Ambient Temp > ±5° C* and "8000" *Filter Exchange Mechanism Failure.* There are three more of the status codes that the unit is displaying in its original status code.Now, subtract "B000" from "70B000":70B000 - B000 and you are left with 700000. Continue to break down this status code to decipher the rest of the status codes displayed in this number.

7. In the "10,000's" place of the new status code, there are no status codes displayed.

8. In the "100,000's" place of the new status code (700000), a status code of "700000" is displayed. Because there are no status codes in the Status Codes table that match this number, you will need to break down this number further.

9. In the "100,000's" place of the PRC 5: Status Code, there are three status codes that, when added together, will amount to "700,000": 100000 "Elapsed Sample Period Out of Range," (H) 200000 "Leak Check Failed" and 400000 "Audit Performed in Middle of Sample." These are three more status codes that the unit is displaying in its original status code. Therefore, the downloaded status code, "70B002," breaks down into the following status codes, according to the Status Code table:

    2 - *Automatic System Calibration Failed*
    1000 - *Electronics Temperature Out of Range*
    2000 - *Diff of Filter Temp 1 and Ambient Temp > ±5° C*
    8000 - *Filter Exchange Mechanism Failure*
    100000 - *Elapsed Sample Period Out of Range*
    200000 - *Leak Check Failed*
    400000 - *Audit Performed in Middle of Sample.*

Appendix C   Site Identification Codes

SITE	SITE code	SITE_ID1(AQS)	SITE_ID2
ARO			
Bryson City	BY	371730002	109
Marion	MJ	371110004	105
Marion A	MJ A	371110004	106
Waynesville Rec Center	MR	370870012	111
Spruce Pine	SP	371210001	108
FRO			
Candor	CN	371230001	603
Linkhaw	LH	371550005	605
Fayetteville	WO	370510009	601
MRO			
Grier Sch, Gastonia	GM	370710016	305
Hickory	HC	370350004	307
Hickory A	HCA	370350004	308
Rockwell	UR	371590021	313
RRO			
Durham Armory	DA	370630015	517
Lake Wheeler Rd Field Lab	FF	371830020	519
West Johnston rural Clayton	JW	371010002	521
Millbrook	ML	371830014	509
Millbrook A	ML A	371830014	510
Rocky Mt	SR	370650004	513
Pittsboro	UP	370370004	501
WARO			
Dillard School	DM	371910005	707
Jamesville	JV	371170001	709
Lenoir College	LC	371070004	701
Pitt Co. Agricultural Center	PG	371470006	711
WIRO			
Castle Hayne	CH	371290002	807
Kenansville	KE	370610002	801
WSRO			
Boone	BN	371890003	411
Colfax	CX	370810014	419
Burlington	HD	370010002	401
Lexington	LX	370570002	409
Mendenhall	MH	370810013	413
Mendenhall A	MHA	370810013	414
Cherry Grove	UC	370330001	403

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