STANDARD OPERATING PROCEDURES
FOR
THERMO SCIENTIFIC PARTISOL MODEL 2025i SEQUENTIAL AIR SAMPLER

AQSB SOP 404

Third Edition

MONITORING AND LABORATORY DIVISION

March 2020

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CALIFORNIA
AIR RESOURCES BOARD

Approval of Standard Operating Procedures (SOP)

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Section:	Operations and Data Support Section (ODSS)
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Date:

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REVISION HISTORY

Edition	Release Data	Changes
First	January 2003	New Document
Second	January 2016	Add Interferences Section Remove WINS Impactor Installation Section Add Siting Criteria Section Add Sample Make-up Procedures Update Data Download Section Add Maintenance and Troubleshooting Sections
Third	March 2020	ADA Remediation Add Quality Control Section

ACRONYMS

AMNS - Air Monitoring North Section
AMSS - Air Monitoring North Section
AQS - Air Quality System
AQSB - Air Quality Surveillance Branch
CARB - California Air Resources Board
CFR - Code of Federal Regulations
DAS - Data Acquisition System.
DMS - Data Management System
FEM - Federal Equivalent Method
FRM - Federal Reference Method
FRV Flow Rate Verification
LIMS- Laboratory Information Management System
LPM - Liters per Minute
MFC - Mass Flow Controller
MFM - Mass Flow Meter.
MLD - Monitoring and Laboratory Division
NAAQS – National Ambient Air Quality Standards
NIST - National Institute of Standards and Technology
NLB - Northern Laboratory Branch
ODSS - Operations and Data Support Section
PM2.5 – Particulate Matter 2.5 microns or smaller
PQAO - Primary Quality Assurance Organization
PST - Pacific Standard Time
QA – Quality Assurance
QAS – Quality Assurance Section
QA/QC - Quality Control/Quality Assurance
QMB - Quality Management Branch
SLPM - Standard Liters per Minute, gas flow at standard temperature and pressure
SOP - Standard Operating Procedure
U.S. EPA- United States Environmental Protection Agency
UTC- Universal Time Coordinated
VSCC – Very Sharp Cut Cyclone
WINS- Well Impactor Ninety-Six

1.0 GENERAL INFORMATION

1.1 Introduction

The purpose of these Standard Operating Procedures (SOP) are to supplement the manufacturer's Instruction Manual by describing modifications in hardware or procedures that may have been implemented by the Monitoring and Laboratory Division (MLD) of the California Air Resources Board (CARB). These modifications are designed to assure compliance with the Federal Reference Method for collection of particulate matter 2.5 microns or smaller (PM2.5) when using the Thermo Scientific Inc. Partisol 2025i Sequential Air Sampler. The sampler will be referred as the 2025i from this point forward.

This SOP is referencing the April 14, 2015 revision of the 2025i instruction manual.

1.2 General Description

The 2025i is designed to meet the EPA requirements for PM2.5 sampling (40 CFR Part 50, Appendix L). The 2025i can operate using a variety of inlet systems. By utilizing an automated filter exchange system that has the capability to hold up to 16 filters, the 2025i can run unattended for up to 2 weeks on a daily sampling schedule.

1.3 Principles of Operation

Ambient air is sampled starting at the top of the instrument at the PM10 inlet and through the PM2.5 very sharp cut cyclone (VSCC). The inlet and VSCC rely heavily on flow rate to cyclone out the correct particles. The sampler can maintain a constant volumetric flow rate of 16.67 liters per minute by utilizing a mass flow controller to vary flow based on ambient temperature and pressure. The microprocessor calculates the mass flow set point using the following formula:

$$Flow\ Rate_{(Set\ Point)} = Flow\ Rate_{(Vol)}\ x\ \frac{273.15}{Current\ Temp. + 273.15}\ x\ \frac{Current\ Pres.}{760}$$

The sample is collected on a 47mm filter housed in Delrin cassette. The 2025i sequential sampler has an automated filter exchange mechanism that allows for uninterrupted sampling on up to 16 filters at user selectable intervals. Please refer to Figure 1.1 for a flow schematic of the 2025i.

1.4 Sampling Train Overview

The sampling train transfers cassettes between parts of the sampling chamber at different times depending on the state of the sampler. In run mode, the sampler moves the sampled filter into the storage canister at the end of the run and the next sampling filter is moved into the sampling position. When the next scheduled run starts, the filter is already in place and no movement of filters occurs.

1.5 Safety Precautions

Installation, operation, maintenance, and calibration of the sampler should only be performed by properly trained personnel. High voltages (120 volts AC) are used to power the unit. Due to typical rooftop installations, the risks of working outdoors at elevation should also be considered. To prevent injury from the sampler falling over, the sampler should be securely mounted to the stand using the included hex head bolt hardware and washers. The stand should be properly secured or anchored to the floor/platform.

1.6 Interferences

Special precaution must be taken when handling the PM2.5 filter cassettes. It is strongly recommended that the instrument operator wear powderless nitrile gloves when handling the filters to prevent contamination. The Teflon filter is extremely delicate. Any foreign object touching the surface may result in pinholes and, subsequently, the invalidation of the sampling run.

1.7 Personnel Qualifications

Staff installing, operating, calibrating or performing maintenance on the Thermo 2025i should be familiar with the operating manual and this SOP. A basic understanding of the principles governing ambient air sampling is assumed.

U.S. EPA Quality Assurance Guidance Document 2.12 (U.S. Environmental Protection Agency, 2016) covers the specifics of field personnel qualifications, and provides the following general guidelines. All field operations personnel should be familiar with environmental field measurement techniques. Those who service the Thermo 2025i in the field must be conscientious and attentive to detail in order to report complete and high-quality PM data.

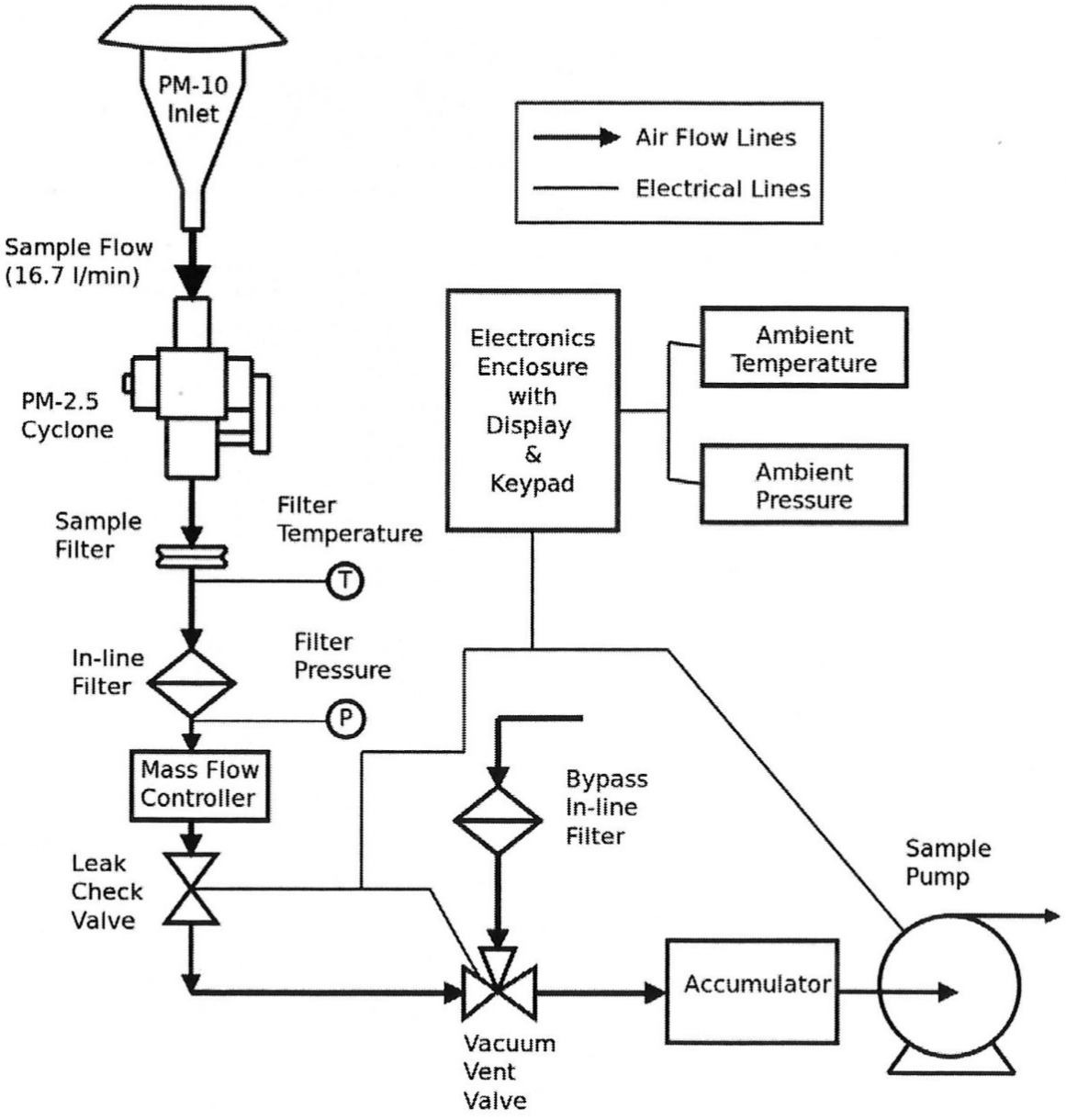

Figure 1.1. Flow Schematic

2.0 INSTALLATION PROCEDURE

2.1 Physical Inspection

Each 2025i should be supplied with the following:

Qty.	Description
1	Partisol enclosure with
1	PM2.5 VSCC
1	PM10 Inlet
1	Sample tube
1	Pass-through adaptor tube
3	Rain hoods and associated hardware
1	Flow audit adapter
2	Filter cassette canisters
1	Canister transport container
1	Ambient temperature sensor and cable
1	iPort Instruction Manual with software CD
1	9-to-9 pin computer cable
1	Operating Manual
1	Quick Start Guide
1	Leak check plate
1	Stand assembly
1	Quick Start Guide
1	10-key keypad

Upon receipt of the sampler(s), inspect sampler and accessories for shortage and for shipping damage. If shortage or damage is found, immediately notify your supervisor, and/or your agency's shipping department.

2.2 Vent Rain Hood Installation

There are three rain hoods that must be attached to the sampler. Attach the gaskets to the rain hoods by peeling the paper backing off the gaskets and applying the gaskets to the appropriate rain hood. Install the rain hoods with the included thumbscrews. The two small rain hoods are interchangeable and are to be installed on the back of the enclosure. The large rain hood is to be installed on the right side panel. Please refer to Figure 2.1 for a photo of the installed rain hoods.

Figure 2.1. Vent Rain Hood Installation

2.3 Temperature Sensor Installation

Remove the Phillips screws on the upper left side of the sampler enclosure. Use these screws to mount the temperature sensor. When mounting the temperature sensor, insert the washer and gasket between the sensor bracket and the enclosure, not under the head of the screw (see Figure 2.2). Secure the three-pin connector into the connection marked "Ambient Temperature" on the back of the sampler.

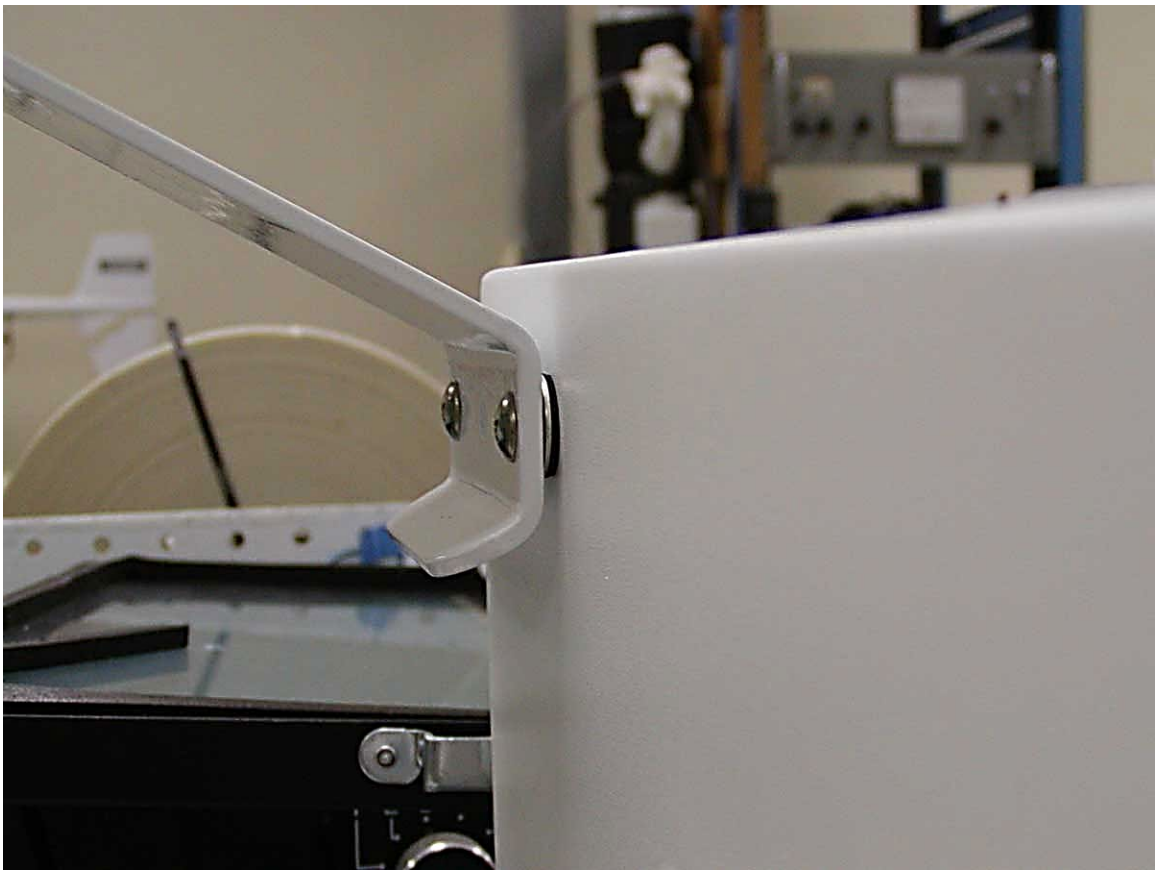

Figure 2.2. Ambient Temperature Sensor Installation

2.4 Very Sharp Cut Cyclone (VSCC) Installation

Although the use of a Well Impactor Ninety-Six (WINS) size selective inlet is a designated PM2.5 Federal Reference Method, CARB air monitoring stations must only utilize the VSCC for PM2.5 FRM filter samples.

Open the top cover of the sampler by releasing the two black latches. Remove the WINS impactor or pass-through adaptor tube, if present. Install the VSCC by pushing it down completely on the mounting tube. Install the downtube adapter to the top of the VSCC. Close and latch the top cover. Please refer to Figure 2.3 for a photo of an installed VSCC.

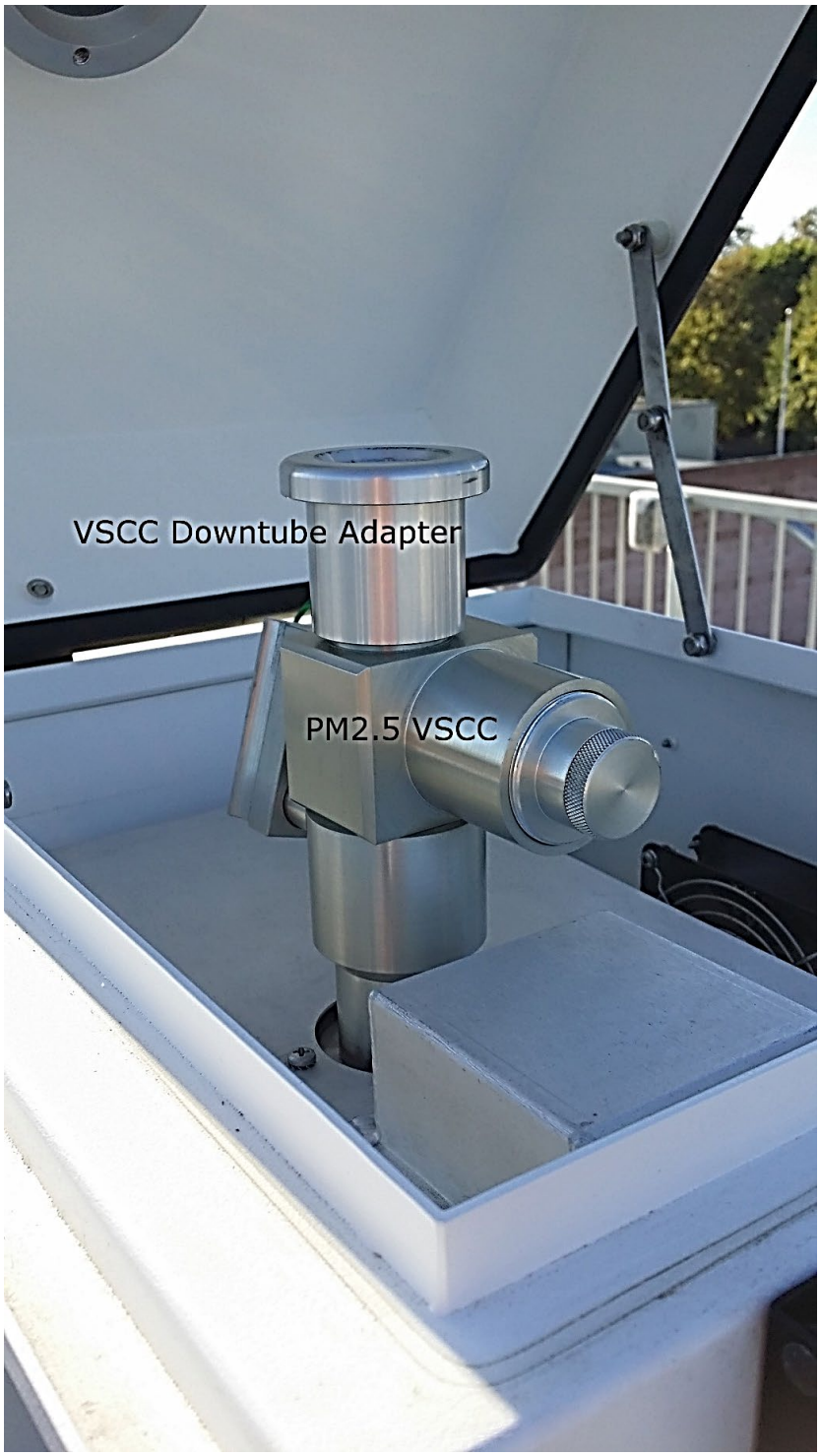

Figure 2.3. Installed VSCC with Downtube Adapter

2.5 PM10 Inlet Installation

Insert the 1¼" OD sample tube into the instrument bulkhead. Ensure that the tube is pushed past both the lower and upper O-rings of the bulkhead until it stops. Tighten the dome connector to ensure a tight and leak-free grip. Place the PM10 inlet onto the tube ensuring it is firmly in place.

2.6 Stand Assembly

Follow the stand assembly diagram and instructions located in the Instruction Manual in Chapter 2-7.

2.7 Supply and Take-Up Canister Loading and Installation

1. Obtain an empty canister from its transport case. Remove the orange cap on the supply canister. Use a bulb pump or compressed air to move the piston in the supply canister to the top of the canister. The top of the piston should be level with the top edge of the canister for the loading side only. Detach the bulb pump from the canister.

2. Place one filter cassette on the piston and push it down until the top of the cassette is level with the top of the canister. Repeat with additional filter cassettes if loading multiple filters.

3. Note the order of the filters for future reference. Replace the orange cap when finished to protect the filters from contamination. Place the canister back in the transport case for transport to the site.

4. Open the sampler door to access the filter transport assembly. The left canister mount is the supply side (new filters). The right mounting position is the take-up side (sampled filters).

5. Remove the orange cap on the canister. Align the grooves on the top of the cassette with the mounting studs on the left mounting ring. Mount the canister so that the hose connection faces to the left. Push the canister upward and twist counterclockwise to lock it in place. Position the piston on the second canister to line up with the "J" notch as shown in Figure 2.4. Mount the take-up canister on the right side mounting ring.

6. Connect the air supply tube to the supply (left side) canister by pushing it onto the connector until it snaps into place. See Figure 2.4.

Figure 2.4. Piston Position for Storage Canister

The piston of the storage side canister should be lined up with the bottom of the "J" notch as indicated in Figure 2.4 to prevent the shuttle errors.

Figure 2.5. Sampler Compartment Layout

2.8 Siting Criteria

The installation of the 2025i should follow the siting criteria requirements in 40 CFR Part 58, Appendix E for the sampled filters to be considered valid. General siting criteria include being >10 meters from a tree drip line, being >2 meters horizontally away from a structure or another probe, and the probe inlet being 2-7 meters above ground.

3.0 INSTRUMENT CONFIGURATION

3.1 Keypad Button Definitions:

1. CTRST soft key adjusts screen contrast.
2. SSET soft key goes directly to Sample Setup Screen.
3. FLTID soft key goes directly to Filter Setup Screen.
4. STAT soft key goes to status code screen.
5. Run/Stop Key [▶]. Single press goes to full screen statistics, second press changes between RUN/WAIT and STOP modes Menu.
6. Key [■] goes back one menu level.
7. The ↑↓←→ arrow keys are used for navigating the menus.
8. The ↵ or Enter key is used to confirm and save settings

Figure 3.1. Instrument Keypad & Display

3.2 Main Screen and Menu Screen

Most setup functions can be reached by pressing [■] from the main menu and using the ↓↑ arrows to select your desired option. Pressing [▶] once from any menu screen returns you to the main screen.

3.3 Instrument Setup

The settings below are recommended when following the U.S. EPA's sampling schedule.

1. Select Instrument Setup menu from the main menu.

2. Select "Default Sample Setup". The parameters should be as follows:

Method:	BASIC or TIME
Flow:	16.67
Filter Type:	A
Separators:	No

In BASIC mode, the sampler will automatically adjust the sampling schedule based on the initial sample run. In TIME mode, the sampler will automatically adjust the sampling schedule after the initial sample and the user will also have the ability to adjust individual sample runs. TIME mode is recommended when running make ups or extra filters. See section 3.9 for more details.

3. Select the ◼ key to return to the Instrument setup menu. Choose "Default Sample Times". The parameters should be as follows:

Start Time:	00:00
Duration:	24 hr
Repeat:	24 hr for everyday sampling 72 for 1 in 3-day sampling 144 for 1 in 6-day sampling (Dependent on the site sampling schedule).

4. Select the ◼ key to return to the Instrument Setup menu. Scroll down and select "Site ID". Change the Site ID to match your designated site.

5. Select the ◼ key to return to the Instrument Setup menu. Select "Date/Time". Adjust date and time to match the time standard.

6. Select the ◼ key to return to the Instrument Setup menu. Select Time Zone. Ensure that the sampler is set to UTC (GMT).

3.4 Average Time Interval Setup

The Average Time parameter defines the time interval that is averaged by the sampler when storing data. The default and recommended setting is 30-minute average. This setting can be found under Instrument Setup > Datalogging > Configure Datalogging > Logging Period Min.

3.5 Checking and Resetting Status Codes

The 2025i is equipped with a red lamp on the exterior of the unit to alert the operator of any errors. The lamp will illuminate when the sampler encounters an issue. An alarm icon will also show on the instrument display. More information about each issue can be viewed in the instrument status code screen which can be accessed by pressing the STAT soft key button.

1. While in the status code screen, more information about certain status codes can be obtained by highlighting the individual status code and selecting it by pressing the ↵ key. Record the status code if necessary, for future reference. Contact the instrument shop or Thermo Scientific customer support for more detailed information about individual status codes.

2. To reset status codes, the sampler must be in STOP mode. To enter STOP mode, press the ▶ key from the main screen and confirm by pressing the ↵ key.

3. Enter the status code screen and highlight any status code. Press the ↵ key. Confirm with the ↵ key to clear the status code. All status codes except for shuttle errors will be cleared.

   Note: If the no filters are present during the filter exchange, a “No Filter” error will appear. The site operator will have to clear the error, load new filters, and manually advance the next filter before the instrument will run again.

3.6 Stop Mode

If the sampler is in Run Mode, placing it in Stop Mode will result in the loss of the current sampling event and automatically invalidate the filter cassette in the sampling position. To maintain the sampling list and sample filter order, an un-sampled/dummy filter must be advanced to the

sampling position after the sampler has been placed in Stop Mode. At the start of the next sampling event, the dummy filter will be cycled through and the next filter cassette will be sampled.

To manually advance a filter cassette:

1. Place a dummy filter at the top of the supply canister.

2. From the main menu, select Audit and Calibration then select Audit Mode.

3. Select Advance Filter to move the dummy filter into sampling position. The unused filter will be cycled through to the storage canister. Take the filter from the storage canister and place it back into the supply side canister at the top position. This filter will be sampled at the start of the next scheduled sampling date and the dummy filter will be pushed through to the storage canister.

4. To perform a leak check, refer to section 8.3 "External Leak Check Verification" of this SOP. To perform a flow verification, refer to section 8.5 "Flow Rate Verification.

3.7 Sample Set-Up Procedures

The following procedure is used to setup the sample list through the front screen.

1. Return to the main menu using the ◾ key and select the Sample Setup Screen or press the SSET key.

2. Select "Apply Default Times" to seed the Filter List. Press the ↵ key.

3. Select "Sample01". Select Start time. The next sampling event will automatically be set to midnight of the next day. Change the start date, if necessary.

4. Press the FLTID button to access the filter ID screen. In the FLTID screen, column 1 is Filter ID, column 2 is Cassette ID, and column 3 is filter blank status.

5. Move the cursor to Filter ID and label the sample with the laboratory cassette ID using the ↑↓→← keys. The Filter ID will help you identify the correct filter when looking up the sample run records.

6. Repeat Step 5 for the rest of the filters in the Supply Canister.

7. If a sample is a filter blank, move the cursor to the Filter Blank column and press the enter key to toggle the selection to "YES". If a sample is labeled a filter blank, the filter will be adjusted to a 0 minute run time and the filter dates on subsequent filters will automatically be adjusted to maintain your original sampling schedule. Filter blanks will run immediately following the preceding sample filter. Please refer to section 6.4 for more information filter blanks.

8. Verify the start date and time for all samples. In TIME mode, the site operator can adjust individual sample times after the filter list is populated.

9. If the sample is STOP mode, press the ▶ key to return to the main screen and again to place the sampler in WAIT mode.

3.8 Make-Up Runs

Per U.S. EPA regulations (40 CFR Part 50, Appendix N), valid PM2.5 make-up samples must run prior to the next sampling day or exactly seven days after the missed or invalid sample. Because of these requirements, 1-in-1, or daily, sites are not able to run make-up samples. Valid make-up samples are necessary to maintain data completeness if regular samples are missed or voided. For a site to gain/maintain attainment status, three years of complete data for that site is required. A year meets data completeness requirements when the quarterly data capture rates for all four quarters are at least 75 percent. Having data completeness <75% can result in non-attainment status. Samples that do not run on the scheduled run dates and do not meet the criteria of make-up samples but are otherwise considered valid are called extra samples. Per the CFR, "extra samples are used in mean calculations and are included in the series of all daily values subject to selection as a 98th percentile value, but are not used to determine which value in the sorted list represents the 98th percentile."

NOTE: Extra samples are not used to meet data capture requirements.

The 2025i allows the user to schedule make-up runs in the cases of missed or invalid samples. In BASIC mode, the 2025i cannot run user adjusted filter sampling schedules needed to run make-up filters. In BASIC mode, filter sampling is limited to running at a pre-determined time interval such as every 72 hours for a 1-in-3 sampling schedule. The 2025i TIME sampling mode, however, does allow the user to program start and stop times for each filter in the filter list. This mode will allow the user to program valid make-up samples.

Procedure for TIME Sampling Mode

1. The sampler must be in STOP mode to change the sampling mode. If the sampler is in WAIT mode, press the ► key and place the sampler in STOP mode.

2. Select Instrument Setup from the main menu. Choose Default Sample Setup. Record all parameters. These parameters should not require re-programming when returning to BASIC Sampling Mode, but the information should be recorded in case an error occurs.

3. Change the Method from BASIC to TIME.

4. Change the Repeat field to 24 hours, if necessary. The 2025i considers the Repeat Time in the sample's time frame. Therefore, a repeat duration greater than 24 hours will not allow you to program back to back sample runs.

5. Return to the main menu. Select Audit and Calibration. Enter Audit Mode. Load a dummy filter to the top position of the supply canister and select Advance Filter. Load the makeup filters in the supply canister. Exit Audit Mode.

6. TIME sampling mode allows the user to program custom sampling times for each filter in the filter list. Therefore, all filters run in TIME mode must be entered into the filter list. From the main menu select "Sample Setup" or Select SSET soft key to enter the Sample Setup screen. Select "Apply Default Times" to reset the run schedule to match your default settings. Program the Start time for each filter starting from the top of the list. Define filter blanks as necessary. Filter blanks will automatically be set for a 0 minute run time. Label each filter with the cassette ID in the Filter ID field. Verify the sample list and any changes made.

7. Select ► key to enter WAIT mode.

8. After all make up samples in TIME sampling mode have been completed, return the sampler to BASIC mode or select "Apply Default Times" prior to the next scheduled sample to avoid losing scheduled samples. Verify that the sampling list matches your site's sampling schedule.

    a. To change the sampling mode, the sampler must be in STOP mode. If the sampler is in WAIT mode, press the ► key on the lower left

corner of the keypad to place the sampler in STOP mode.

b. Select "Instrument Setup" from the main menu. Choose Default Sample Setup.

c. Change the Method from TIME to BASIC. Follow the procedure described in section 3.7 to complete Sample Setup.

d. Enter the Sample Setup screen and verify that the new samples will run at their scheduled start times for your air monitoring site.

3.9 Updating Firmware via USB

Updating to the most current firmware revision will ensure that the instrument is up to date for any known bugs or glitches.

1. Although the firmware update should not erase any stored data, it is recommended that the instrument operator record all pertinent data such as the flow and meteorological calibration values, sample ID numbers, sample run times, and any unrecorded sample records.

2. Download the latest firmware revision from the Thermo Scientific online library (Thermo Scientific Air Quality Library), registration may be required) or contact the Operation and Data Support Section staff for more information.

3. Copy the firmware file to the root directory of your USB flash drive and plug the USB drive into one of the two ports on the front panel of the 2025i.

4. The sampler must be in Service Mode to update the firmware. To toggle service mode, go to the Service Mode option in the main menu. Press the ↵ key and confirm to enter Service Mode.

5. Scroll to USB from the Main Menu and press the ↵ key.

6. Select the applicable USB port and press the ↵ key.

7. Scroll to Firmware Update and confirm your selection.

8. Select the latest firmware revision from the on-screen list.

9. Follow the onscreen directions to complete the firmware update. The sampler will automatically reboot when the firmware update is complete.

This step can take up to 10 minutes.

10. The sampler should maintain all information stored in the memory, but the site operator should verify that all information prior to the firmware update has not changed.

3.10 Resetting Instrument Memory

WARNING: RESETTING THE MEMORY ERASES ALL CALIBRATION AND SAMPLER SETTINGS AND RESTORES ALL SETTINGS TO DEFAULT FACTORY VALUES. USE THIS OPTION ONLY WHEN NECESSARY. RECORD ALL CALIBRATION OFFSETS BEFORE RESETTING TO AVOID RE-CALIBRATING THE SAMPLER AFTER RESET.

Viewing Calibration Values

1. To view the flow calibration values, the instrument must be in Service Mode

2. Select "Audit and Calibration" then "Calibration"

   a. The flow calibration values will be listed under "Flow"

   b. The meteorological calibration values will be listed under "Cal. Intercepts"

To reset the memory, select Restore User Defaults under Instrument Setup.

4.0 DATA RETRIEVA DATA

4.1 General Information

Field personnel will have the responsibility of ensuring the PM2.5 sampling information for each filter run is properly retrieved. The sampling information for the FRM samplers can be obtained either manually or electronically downloaded to a USB flash drive.

For each sample, field personnel will complete a PM2.5 chain of custody form MLD-140. Please see Appendix A for an example of a completed form.

4.2 Viewing Sample Summaries

1. Select the ▪ key until you are in the Main menu.

2. Select View Records and then Filter Records to bring up the stored filter records.

3. Use the ↓↑ keys to scroll through the filter runs. The oldest record will appear at the top of the list. Pressing the ↑ arrow will bring you immediately to the bottom of the list and the most recent sample run. The ←→ keys are used to scroll through the data fields for a specific run.

4. Record the pertinent data to the MLD-140 field sample report form.

4.3 USB Data Download

1. Insert a USB flash drive into an available USB port on the front of the instrument.

2. Press the ▪ key and scroll down to the USB menu.
   Note: It may take up to a minute before the USB flash drive is recognized and for the USB menu to appear.

3. Select the port used in Step 1 and press the Enter key to select your desired file destination.

4. Scroll down to instrument sample data and select Export Data Logs. The types of exportable data logs include:

   - Filter Data Log: 24 hour run data and filter and ambient meteorological values recorded for the last 64 runs

- User Data: Instrument status and conditions recorded at 30 minute intervals

- Interval Data: Instrument status and conditions recorded at 5 minute intervals

5. Select Filter Data Log and follow the on-screen instructions to download the necessary data logs for the laboratory chain of custody form.

6. The USB flash drive can be removed when the download is complete.

7. The data is located in the 2025i folder in the root directory of the USB drive and can be viewed on a computer using Microsoft Excel.

5.0 DATA SUBMITTAL (Field to Laboratory)

5.1 General Information

Once field personnel have retrieved sampling information, the data will be forwarded to the laboratory. Sampling information must be recorded on the MLD-140 field sample report form and must accompany the sampled filters once they are shipped back to the laboratory.

5.2 Sample Chain of Custody

The chain of custody process begins once the filter is conditioned and inspected by laboratory personnel. After pre-sampling conditioning is complete, filters will be weighed, placed in filter rings, and prepared for shipping. Each filter will be associated with a barcode number that will be attached to a MLD-140 field sample report form. Laboratory personnel will annotate the pre-sampling weight of the filter, date, and initials on the report sheet. The sample report sheet and filter will then be shipped to the field.

Within 30 days of pre-conditioning, the filter must be used for sampling. When the filter is loaded on the sampler, field personnel must document the date, time, and name of person loading the sampler. After sampling, field personnel must document date, time and name of personnel removing the sample from the sampler. The temperature of the filter will also be documented at this time. If the filter is not being shipped to the laboratory right away, the filter will be placed in a freezer for storage until shipping. Field personnel will document date, time, and filter temperature when the filter is placed in refrigerator. When the filter is shipped to the laboratory, the date, time, filter temperature, and the personnel shipping the filter will be documented on the sample report.

Once the filter arrives at the laboratory, the date, time, filter temperature, and person receiving the filter will be noted on the sample report. Laboratory personnel will then enter the filter information into the Laboratory Information Management System (LIMS). LIMS will generate a LIMS sample identification number that will be documented on the sample report. The filter will then be prepared for post-sampling conditioning or placed in a refrigerator for storage until post-conditioning can occur. The date, time, filter temperature, and name of analyst will be documented once post-conditioning begins.

5.3 Completing the MLD-140 Field Sample Report

On the field sample report, field personnel will record the following information: start date and time, elapsed time, volume, flow CV, and minimum,

maximum, and average values for the ambient temperature, filter temperature, and ambient pressure. Field personnel may also note any unusual local conditions they may have observed during the sample run by circling the appropriate condition code. “No Unusual Conditions” may be used if no unusual conditions were observed during the sample run.

6.0 SAMPLE FILTER HANDLING PROCEDURES

6.1 General Information

Federal regulations stipulate specific time frames and environmental conditions for FRM PM2.5 sample filters at various stages in the sampling program. If these time frames and conditions are not met, sample filters may be flagged or invalidated by the receiving laboratory. In addition to these requirements, operators should practice the usual care to prevent or minimize contamination of the sample filters, filter cassettes, or anything else which may come in contact with the sample filters.

6.2 Pre-Sampling Filter Handling Procedures

Sample filters must be used within 30 days of the pre-sample weighing procedure. If 30 days have elapsed before the cassette is to be used, do not use the filter and return it to the laboratory for a replacement. The sample filter temperature must be within 5°C of the ambient temperature while installed in the sampler.

6.3 Post Sampling Filter Handling Procedures

Sampled filters must be removed from the sampler within 177 hours after the end of sampling and placed in cold storage immediately (40 CFR Part 50, Appendix L Section 10.10).

Sampled filters must be kept at a temperature of less than 4°C during storage and shipping which allows the laboratory up to 30 days from the end of sampling for analysis. If at any time during storage or shipping the temperature exceeds but is kept at no greater than 25°C, the laboratory has up to 10 days to analyze the filter.

Sampled filters and the MLD-140 field sample report form will be shipped in an insulated shipping container containing sufficient Blue Ice or other chilled media to assure that sample filters arrive at the laboratory at a temperature no greater than 25°C, or preferably 4°C or less. Other cold storage methods may also be employed if they comply with these temperature requirements.

Shipping containers will contain an irreversible temperature indicator or other suitable means to determine whether temperature requirements of the sample filters have been exceeded during transit. This requirement also applies when sampled filters are being transported from remote or satellite sites to central or main locations.

Samples received at the laboratory at temperatures greater than 4°C will be noted on the field sample report form and entered into LIMS. LIMS will automatically flag the sample so that gravimetric analysis is prioritized to meet the 10 day analysis deadline.

Sampled filters should be shipped to the laboratory weekly on Monday, Tuesday, Wednesday to avoid Saturday, Sunday, or holiday arrivals when staff may not be present to receive the samples.

More information about the laboratory documentation and handling procedures can be found in the Standard Operating Procedure for the Determination of PM2.5 Mass in Ambient Air by Gravimetric Analysis (SOP MLD 55) in section 7.3.10.

6.4 Field and Trip Blank Handling Procedures

Upon receipt and identification of filter blanks, treat these filters the same as filters to be sampled with the exception that no air will be drawn through the filter. Field blanks are to be installed in the sampler for the same time period as a valid filter sample, cycled through the sampler, stored in a cooler, and returned to the laboratory with the sampled filters. Once programmed into the sample schedule, field blanks will automatically cycle through immediately following a regular or make-up sample.

Trip blanks are to accompany all standard filters and field blanks, but are not loaded into the instrument. For Trip Blanks, fill out the MLD-140 field sample report form with exception of run data. For Field Blanks, in addition to the above, fill in the sample start date/time, total elapsed time, volume, sample load time, and sample removal time. The elapsed time and volume should be zero.

7.0 CALIBRATION AND QUALITY CONTROL CHECK OVERVIEW

7.1 Introduction

This section describes the calibration procedure for the 2025i. The procedures listed are in reference to the 2025i Instruction Manual and are not intended to replace the Instruction Manual.

7.2 Overview

The calibration of FRM samplers must be performed on a six-month basis. There are several parameters that must be calibrated with fine particulate matter samplers. These parameters include flow or volume, temperature, pressure, and time.

The primary purpose of the verification/calibration is to verify that the volumetric flow of the PM2.5 sampler is at 16.67 liters per minute (LPM), or that the sampler collects a volume of 1 cubic meter of air per hour. Monthly quality control checks should be performed to ensure that the sampler stays within the intended operating ranges. Refer to 40 CFR Part 50, Appendix L for further information. Chapter 8 of the 2025i instruction manual outlines the full calibration procedure.

The calibration procedures should be completed in the following order:

1. Verification (As-Is Calibration) – Single Point
2. Adjustments – Multi Point
3. Verification (Final Calibration) – Single Point

7.3 Apparatus Needed

- National Institute of Standards and Technology (NIST) traceable flow transfer standard
- NIST-traceable temperature standard
- NIST-traceable pressure standard
- AQSB Calibration form 404B
- Calibration filter cassette (Part #59-004648-001)
- Leak check filter cassette with filter
- Leak check plate and filter cassette (Part #36-012078)
- Empty Delrin Cassette

8.0 VERIFICATION AND QUALITY CONTROL CHECK PROCEDURES

8.1 General Information

All flow and external leak check verifications must be performed with a white Delrin cassette and 47mm Teflon filter. All the following verification procedures can be done in the Audit mode that allows the user to resume the sampling event immediately after the verification is complete.

A quality control check should be completed on a monthly basis by the operator. During a quality control check, all parameters should fall within the acceptable ranges: flow ±4.1% of true or between 16.34 and 17.00 LPM, temperature ±2.1°C from true, and ambient pressure ±10.1 mm Hg from true. If any of the parameters are out of range, a calibration must be performed.

8.2 Ambient Temperature and Barometric Pressure Sensor Verification

1. From the main menu, select Audit and Calibration then select Audit Mode.

2. Place an audit cassette into the supply canister and select Advance Filter to move the filter into sampling position.

3. Select Audit from the menu. The Audit screen will display the ambient temperature and pressure readings. Verify the readings with your standard and record all values on the Monthly Check Sheet.

The ambient pressure reading should be within 10.1 mmHg of the transfer standard. The ambient temperature reading should be within 2.1°C of the temperature standard. If the temperature and/or pressure readings are out of tolerance, the ambient temperature sensor and/or barometer must be re-calibrated. Calibration procedures are listed in Section 9.

8.3 External Leak Check Verification

Before verifying the flow of the sampler, it is important to ensure that the sampling train does not have a leak. Additional information can be found in Chapter 9-63 in the instruction manual.

1. Remove the PM10 inlet and replace it with the leak check adaptor. Ensure that the adaptor is in the closed position.

2. From the Audit and Calibration menu select Leak Check. Select External and follow the on screen instructions to complete the leak check. A passing leak

check value is <25 mmHg. If the leak check fails, troubleshoot the error, and redo the leak check. Refer to section 12.3 for more information. Record the value on your Monthly Check Sheet.

3. Slowly move the lever of ball valve on the leak check adaptor to the open position to release vacuum. Remove adapter from sampler inlet.

4. Before proceeding to the Flow Rate Verification in Section 8.5, the instrument must pass the Leak Check Verification. Any issues causing leaks must be addressed with the appropriate repairs.

8.4 Clock Verification & Adjustment

Units of time are used in several aspects of sampler operation. Examples are the start and stop times, volume/flow calculations, run dates, etc. Therefore, it is necessary to document the time setting of the sampler. The requirement in 40 CFR Part 50, Appendix L, Section 7.4 states that the sampler must not lose more than 1 minute per month.

1. Observe the sampler time from the Main Screen. Record this value on the calibration or monthly check data sheet.

2. At the same time, record the value of your time keeping device.

3. Identify your time keeping device on the data sheet. Include the make, model, ID number, date last certified, and bias of your clock. Enter all data on the appropriate datasheets and record any repairs or changes for future reference.

4. If the sampler time is off by more than 2 minutes, an adjustment to the clock should be made. Navigate to the Main Menu > Instrument Setup > Date/Time to make the necessary adjustments to the clock.

8.5 Flow Rate Verification

1. Replace the leak check adaptor with the measuring head of your flow standard.

2. In the Audit and Calibration menu, scroll down to the Flow field. Press the → key to start up the pump. Allow the pump to warm up for 15 minutes before proceeding to the next step.

3. Once the flow and temperature readings on your standard have stabilized,

record the corresponding values from both the sampler and instrument onto AQSB Calibration Form 404.

4. Stop the pump after verifying the flow rate by pressing the ← key.

5. Disconnect the take-up canister and take the top Delrin cassette from the take-up canister and place it back into the supply canister. Advance the filter to move it into the sampling position. This filter will remain in place when the sampler begins the next run. Doing this step will ensure that the filter list remains correct.

6. Select Audit Mode from the Audit and Calibration Menu. Exit Audit Mode. This will place the sampler back in WAIT mode. Do not use the ▶ button to return to wait mode as it will only place the sampler in STOP mode.

9.0 MULTI-POINT CALIBRATION PROCEDURE

9.1 General Information

All flow calibrations and external leak checks must be performed with a white Delrin cassette and 47mm Teflon filter. Internal leak checks must be performed with the white Delrin cassette with the solid leak check plate. The Filter Temperature Calibration should be performed with an empty Delrin cassette. Calibrations should be performed by someone independent of the day-to-day site operations, if possible. Calibrations should also be completed using a NIST-traceable standard and one that is not used for the monthly quality control checks.

The adjustments made on a 2025i sampler should be performed in the following order:

1. Filter and Ambient Temperature
2. Pressure
3. Leak Check
4. Multi-Point Flow
5. Verification of Calibrations (Final Calibration)

Before adjustments are made, flow rate, pressure, and temperature verifications must be performed. This step is also known as an As-Is Calibration. The as-is calibration will allow the site operator to certify that all prior samples were sampled under valid conditions. A passing verification requires that the criteria specified in section 8.1 of this SOP are met following verification procedures listed in section 8.0 of this SOP.

Parameters that are out of the acceptable ranges must be adjusted and with a final calibration to confirm. A passing flow rate verification will be between 16.00 and 17.34 LPM, but a final calibration should be performed if the flow is not within 2.1% of the set point (between 16.34 and 17.00 LPM).

All calibration information and data must be recorded on the calibration form 404.

A calibration can only be completed while the instrument is stopped and in Service Mode. To stop the instrument, press the ► key twice and confirm to place it in Stop mode. To place it in Service Mode, navigate to and select "Service Mode" from the main menu. Press the Enter key to enable service mode.

9.2 Ambient Temperature Sensor Calibration

1. Select “Instrument Setup” from the main menu to enter the Instrument Setup Screen. Select Flow Cal Setup. If the BGI DeltaCal is being used for the calibration, ensure that “Use FTS Constants” is set to “NO”.

2. Navigate to the main menu and select the “Audit and Calibration” menu.

3. Place the calibration cassette into the top position of the left side supply canister. Select “Advance Filter” to advance the calibration cassette to the sampling position.

4. Select "Calibration".

5. Select “Ambient Temp.” The instrument will display the current reading and will allow you to input the reading from your temperature standard. Input the ambient temperature reading from your standard into the “Set To” field. Press the Enter key to save any changes.

9.3 Filter Temperature Sensor Calibration

1. Select “Instrument Setup” from the main menu to enter the Instrument Setup Screen. Select Flow Cal Setup. If the BGI DeltaCal is being used for the calibration, ensure that “Use FTS Constants” is set to “NO”.

2. Following the previously listed steps to manually advance a filter, advance an empty Delrin cassette to the sampling position.

3. Unlatch the top cover of the instrument and remove the VSCC. Place the external temperature probe on your temperature standard, into the downtube of the sampler. Position the external probe as close as possible to the sampler’s filter temperature sensor. See Figure 9.1.

4. Return to the main menu by pressing the ◥ key until the sampler is at the main menu. Select Audit and Calibration Menu.

5. Select Calibration. Select Filter Temp. Change the “Set To” field to match the temperature standard and hit enter. Verify that the 2025i value matches the standard.

6. Select ◥ key to return to the Calibration menu.

7. Replace the VSCC and downtube adapter onto the downtube. Close the top

cover of the instrument and secure the 2 black latches.

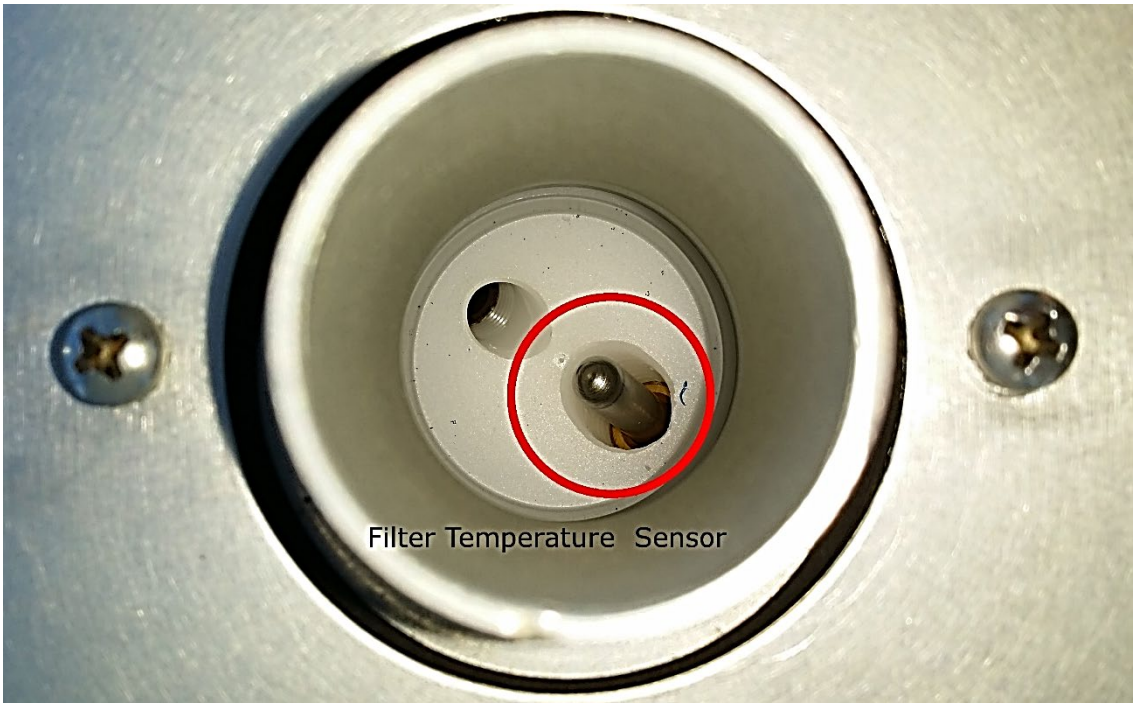

Figure 9.1. Filter Temperature Sensor

9.4 Barometric Pressure Calibration

1. From the Audit and Calibration menu, select "Ambient Pressure". The instrument will display the current barometric pressure reading and will allow you to input the reading from your standard in the “Set To” field.

2. Change the “Set To” field to match the reading from your pressure standard and hit enter to save.

3. Verify that the new 2025i value matches the standard.

4. Select the key to return to the Calibration menu.

9.5 Leak Checks

Before verifying/calibrating the flow of the sampler it is important to ensure that the sampling train does not have a leak. Both Internal and External leak checks should be performed during a calibration. Additional information can be found in Chapter 9-63 in the instruction manual.

1. Remove the PM10 inlet from the instrument and place the leak check adaptor on the downtube. Close the valve on the leak check adaptor.

2. Load a calibration filter cassette, external leak check cassette, then leak check cassette with the solid leak check plate in the supply canister. Ensure that the order is correct, and the solid leak check cassette is in the uppermost position.

3. Choose advance filter to move the leak check cassette into the sampling position.

4. Select Leak Check, Internal Leak Check in the Audit and Calibration Menu. Verify your choice by pressing the ▪ key. This will begin the countdown clock for the internal leak check. Once the countdown ends, record your results onto your calibration sheet.

5. Return to the Audit and Calibration menu by pressing the ▪ key.

6. Select Advance Filter to advance the external leak check cassette into the sampling position.

7. Choose External Leak Check and follow the onscreen instructions to start the test. Once the countdown ends, record your results on the calibration form.

8. If both leak checks pass, continue to the flow calibration. If either of the leak checks fail, correct the issue then re-do both leak checks before proceeding. A passing value for the Internal Leak Check is 140 mm Hg or less. An external leak check value of less than 25 mm Hg is considered passing.

9.6 Flow Rate Calibration

1. After conducting a leak check, carefully remove the leak check adaptor from the sampler inlet and insert your flow standard in its place.

2. Following the procedures in Section 9.5, a calibration filter cassette will be in the supply canister tube. Advance the filter so that it is in the sampling position.

3. From the Audit and Calibration Menu select Flow. The display will show three calibration points. The system will start the flow calibration at 15.003 LPM. Let the flow stabilize and change the “Actual” field to match the flow

standard and select the enter key. The 2025i will automatically proceed to the next point. Repeat for the 16.667 LPM and the 18.337 LPM points.

4. Once all points have been completed, the sampler will adjust the Offset and Span values automatically. Ensure that the slope and intercept have updated.

5. Place a dummy filter on top of the supply canister.

6. Enter Audit Mode and advance the dummy into the sampling position.

7. Exit Audit Mode and return the sampler to WAIT Mode. Verify that the filter list is correct and adjust, if necessary.

8. Remove the flow transfer standard and reinstall the PM10 inlet.

10.0 ROUTINE SERVICE CHECKS

10.1 General Information

Completion of the routine maintenance items listed below is essential to the normal operation of the 2025i sampler. Additional information regarding preventative maintenance can be found in chapter 10 of the Instruction Manual. The frequency of the checks listed below should be a guideline, but checks should be performed more frequently, if needed, based on instrument usage and age.

10.2 Post Run Checks

1. After each run, review the summary data for compliance with Measurement Quality Objectives for FRM PM2.5.

2. Complete and return the sample report form with the appropriate filter(s).

10.3 Weekly Checks

1. Inspect the water trap on the PM10 inlet and empty if necessary.

2. Ship sampled filters within appropriate conditions as outlined in section 6.3.

10.4 Monthly Checks

1. Perform leak and flow verification checks. The leak rate should not exceed 25mm Hg. The sampler's indicated flow rate should be within ±4.1% of the flow measurement standard.

2. Compare the sampler's indicated flow rate to the design flow rate of 16.67 LPM. This should not exceed ±5.1%.

3. Perform temperature sensor verifications for both the filter and ambient sensors. The sensors should be within ±2.1°C of the transfer standard.

4. Perform pressure sensor verification. The pressure sensor should be within ±10.1 mm Hg of the transfer standard.

5. Perform a clock and date verification check. The clock should be within ±2 minutes of the time standard and the date should be correct. Record results for all verification procedures. Adjust the clock, if necessary.

6. Perform leak check and record results.

7. Disassemble, clean, and inspect the PM10 inlet. Lubricate the O-rings if necessary. Replace the O-rings if the rubber is cracked or damaged.

8. Clean VSCC inlet.

9. Check "V" seals at the top and bottom of the PM2.5 VSCC. Lubricate if necessary. Replace the v-seals if the rubber is cracked or if they are damaged.

10. Clean interior compartment and the sample downtube.

10.5 Semi-annual Checks

1. Clean the foam air intake filters under the rain hoods and replace as necessary.

2. Check the particle trap filter and replace as necessary.

3. Replace sintered filters for pump and pressure vent valve.

4. Perform temperature, pressure, flow, and clock calibrations.

10.6 Annual Checks

1. Replace the particle trap filter.

2. Rebuild pump.

3. Check clock battery, replace as necessary.

11.0 MAINTENANCE PROCEDURES

11.1 General Information

In addition to the information provided below, Chapter 10 of the 2025i Instruction Manual provides information on servicing various parts of the instrument.

11.2 Sampler Maintenance

- The exterior of the sampler, filter compartment, and downtube should be wiped down with a clean cloth and a simple degreaser (such as 409) when required.

- Check "V" seals and replace when necessary. See operator's manual, chapter 10-16 "V Seals Cleaning and Replacement" for more information.

11.3 PM10 Inlet Maintenance

- Clean the PM10 monthly with deionized water and lint free tissue. Refer to chapter 10-3 in the Instruction Manual for further instructions.

11.4 VSCC Maintenance

- The VSCC must be cleaned once a month. Disassemble the entire VSCC and clean with a Kimwipe, deionized water, and compressed air.

- Check all O-rings for wear or damage. Replace and/or lubricate the O-rings if necessary.

12.0 TROUBLESHOOTING

12.1 Filter Cassette Problems

Using the proper filter cassettes is critical in this sampler. The standard CARB filter cassette is the white Delrin cassette. Please note that the blue polycarbonate cassettes are no longer recommended for use in valid PM2.5 samples. If the wrong filter cassettes are used, the sample cassette may become jammed in the instrument. The proper filter cassettes have a beveled edge along the top outer rim of the ring. If the edges of the filter cassettes are unbeveled, contact the laboratory for replacements.

12.2 Shuttle Errors

To avoid a Shuttle Error, place the piston on the take-up canister even with the bottom of the J-shaped groove as pictured in Figure 2.4.

More information on the cause of the shuttle error can be found by going to the Status Code screen and selecting the shuttle error status code. Record this status code for future reference. If the error code indicates "Initial Conditions", proceed to the steps below to diagnose the problem.

1. Select Service Mode from the main menu and toggle the unit to enter service mode.

2. Return to the main menu by pressing the ► key. Enter the Service settings menu.

3. Check to ensure the following is true:
   Lift/Push Actuator: 0
   Lift Status 2: Up
   Push Status 2: Dn
   Shuttle Status: Ret
   Filter Status 2: Off

4. If the Push Status 2 is not indicating "Dn", remove the storage canister and recheck the condition. If the condition indicates "Dn", move the piston on the storage canister down to the J-shaped groove and reload the canister.

5. If a shuttle error leads to an invalid sample, it is imperative to schedule a make-up sample as detailed in section 3.9 of this SOP.

12.3 Leak Check Failure

Ensure that the leak check cassette is properly seated. If it is, ensure that the leak check cassette is not worn or damaged. Request a new leak check cassette from the laboratory if necessary.

If the cassette is not the issue, clean and lubricate or replace the v-seals if necessary. If this fails, the sampler may need additional repair. More information about V-Seal maintenance can be found in section 10-16 of the Instrument Manual.

13.0 QUALITY CONTROL AND ASSURANCE

13.1 General Information:

To ensure that the ambient air monitoring data collected throughout California can be considered quality data and complies with procedures and regulations set forth by the U.S. EPA, CARB has a robust quality assurance program which includes several types of performance audit activities. SOPs ensure that quality control and assurance activities are conducted consistently and in accordance with program requirements. When instruments are found to be operating outside CARB's Performance Criteria, a corrective action notification (CAN) or Air Quality Data Action (AQDA) request may be issued.

13.2 Quality Control (Field Sample Validation Criteria):

Quality control invalidation criteria for PM2.5 filter samples collected on FRM samplers are listed below. All samples collected in the field are to be checked using these criteria. If a sample does not meet these criteria, the sample is invalid.

NOTE: IF A SAMPLE IS INVALIDATED, THE FILTER AND THE COMPLETED REPORT FORM SHOULD BE RETURNED TO THE LABORATORY. IF REQUIRED, A MAKE-UP SAMPLE SHOULD BE COLLECTED IN ACCORDANCE WITH SECTION 3.8 OF THIS SOP.

1. Filter Contamination – Filters which are dropped or become contaminated by any foreign matter (i.e., dirt, finger marks, ink, liquids, etc.) are invalid.

2. Damaged or Torn Filters – Filters with tears or pinholes which occurred before, during or after sampling are invalid.

   NOTE: Care should be used when removing a filter from the sampler. If filter is torn, ripped or otherwise damaged a filter when removing it, the filter is considered invalid and a make-up run should be conducted.

3. Average Flow Rate – The average flow rate for a 24-hour period must be within 5 percent of 16.67 L/min at actual conditions. If this limit is exceeded, the sample is invalid.

4. Flow Rate Verification – Should an FRV fail QC acceptance criteria ($\pm$ 4.1% from true), data collected back to the last valid FRV check are considered invalid. No data should be collected until the flow deviation is resolved.

5. Missing Flow Rate Verification – Should an FRV not be completed within a 30 day period, but data are considered valid, data should be flagged with the AQS Qualifier code, (1- Deviation from Critical Criteria). The data flag range should cover the period beginning the first day after last FRV check until the next valid FRV check is accomplished.

6. Variability in Flow Rate - The coefficient of variation (CV, sample standard deviation divided by the mean) of the flow rate, measured over a 24-hour period, shall not be greater than 2 percent. If the CV exceeds 2 percent, the sample should be invalidated, and a make-up sample taken.

7. Start/Stop Times – The sampler must operate for at least 23, but not more than 25, hours (1,380 to 1,500 minutes). Samples taken for less than 23 hours are invalid for the daily average but can be used to determine exceedances of the PM2.5 standard. Therefore, samples collected for run times less than 23 hours be should returned to the laboratory for processing.

8. Sample Removal - Within 177 hours (7 days, 9 hours) of the end of the sample collection period, the filter, while still contained in the filter cassette, shall be carefully removed from the sampler. Samples removed from sampler after 177 hours from end of sample collection are invalid.

6. Power Failure – If a power failure during a sample run causes the start/stop time requirement to be violated, the sample is should still be returned to the laboratory for processing.

7. Report Form – The filter is considered invalid if a completed 24-Hour PM2.5 Air Sample Report is not included with the sample.

13.3 Data Completeness:

A year meets data completeness requirements when quarterly data capture rates for all four calendar quarters are at least 75 percent. Three years of valid annual means are required to produce a valid annual $PM_{2.5}$ NAAQS design value.

13.4 Flow Rate Verifications:

A one-point flow rate verification (FRV) must be performed at least once every month (each verification minimally separated by 14 days) on each PM2.5 monitor used in CARB's ambient air monitoring network. The FRV is made by checking the operational flow rate of the monitor. If the FRV is made in

conjunction with a flow rate adjustment, the verification must be made prior to such flow rate adjustment. Flow rate verifications must be made using certified flow rate transfer standards. FRV's are reported to AQS. The percent differences between the audit and measured flow rates are used to assess the bias of the monitoring data (using flow rates in lieu of concentrations).

If during a FRV the reading of the sampler's flow rate indicator or measurement device differs by ± 4.1 percent or more from the flow rate measured by the flow rate standard, a new multipoint calibration shall be performed and the flow rate verification must then be repeated. In addition, the sampler's flow rate indicator should be compared to the design flow rate of 16.67 LPM. This should not exceed ± 5.1 percent.

13.5 Semi-Annual Flow Audits:

A semi-annual flow rate audit for FRM monitors used in CARB's ambient air monitoring network must be conducted twice a year. The two audits should ideally be spaced between 5 and 7 months apart. The EPA strongly encourages more frequent auditing. The audit should (preferably) be conducted by an operator/auditor other than the routine site operator. The audit is made by measuring the monitor's normal operating flow rate(s) using a certified flow rate transfer. The flow rate standard used for auditing must not be the same flow rate standard used for verifications or to calibrate the monitor. However, both the calibration standard and the audit standard may be referenced to the same primary flow rate or volume standard. Report the audit flow rate of the transfer standard and the corresponding flow rate measured by the monitor to AQS. The percent differences between these flow rates are used to evaluate monitor performance.

REFERENCES

Thermo Scientific Instruments, Inc., (2011) Partisol 2025i Sequential Air Sampler Instruction Manual. Prepared by Thermo Scientific Inc., Franklin, MA, Part Number 110100-00

United States Code of Federal Regulations, (2006) Title 40 Part 50 Appendix L, Reference Method for the Determination of Fine Particulate Matter as PM2.5 in the Atmosphere. Prepared by the US Government Publishing Office

United States Code of Federal Regulations, (2013) Title 40 Part 50 Appendix N, Interpretation of the National Ambient Air Quality Standards for PM2.5. Prepared by the US Government Publishing Office

United States Code of Federal Regulations, (2013) Title 40 Part 58 Appendix E, Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring. Prepared by the US Government Publishing Office

APPENDIX A - Chain of Custody Form, MLD-140.

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CARB 24 Hour – FIELD SAMPLE REPORT
Delrin Cassette (FRM) PM 2.5 Samplers

Bar Code:
LIMS Sample ID:

Site Name: Sacramento DP – PM10 C
AIRS Site Number:
Field Technician:
Agency:

Cassette I. D. Number: R
Scheduled Sampling Date:
Sampler Property #:

Filter Expiration Date:

SAMPLE SUMMARY

Start Date / Time: /
Stop Date / Time: /
Total Elapsed Time: Hr:min
Volume: M^3
Flow CV: %

	MIN	AVG	MAX
Ambient Temp(°C):			
Filter Temp (°C):			
Pressure (mmHg):			

Local Condition Codes: (Circle One)	
NO UNUSUAL CONDITIONS	
High Winds	Forest Fire
Farming Nearby	Construction Nearby
Sanding/Salting Streets	Highway Construction
Roofing Operations	Prescribe Burn

Sampler Flag Codes: (Circle One, as necessary)
F. Flowrate 5-min average, out of spec
T. Filter Temp differential, 30 minutes interval out of spec
E. Elapsed sample time, out of spec

Operator Comments

CHAIN OF CUSTODY

ACTION	DATE	TIME	FILTER TEMP °C	NAME
Sample Load				
Sample Removal				
Sample Placed in Freezer				
Sample Shipped to Lab				
Sample Received at Lab				
Start Post-conditioning				

FOR LABORATORY USE ONLY

	MASS	DUP MASS	DATE	ANALYST
PRE-WEIGHT				
POST-WEIGHT				

Lab Comments:

MLD-140 (2/18) Ver 4.

APPENDIX B - Monthly Quality Control Form

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CALIFORNIA AIR REOURCES BOARD
MONTHLY QUALITY CONTROL MAINTENANCE CHECK SHEET
Thermo Scientific 2000i/2025i - FRM PM2.5 AIR SAMPLER

Location:_____ Month/Year: _____
Station Number: _____ Technician: _____
Property Number: _____ Agency: _____

Operator Instructions:

Each Run: Remove sampled filter(s), download, record, and review sample data, install new sample filter(s), program the sampler for next run.

Weekly: Inspect PM10 inlet water collection jar and drain if necessary;

Monthly: Disassemble, clean, and inspect O-rings of the inlet, clean interior cabinet and down tube, clean or replace air intake filters, inspect V-seals, clean very sharp cut cyclone.

Date performed: _____

Perform flow, temperature, pressure, leak check and clock verification.

Date performed: _____

Semiannually: Perform flow, temperature, pressure calibrations and leak check. Last cal date:_____

Results

ACTION	Sampler	Standard	Difference	Control Limits*
Leak Check				<25 mm Hg*
Sampler Display Flow Rate				± 4.1% or 16.02 - 17.38 LPM
Design Flow Rate	16.67			± 5.1% or 15.82 - 17.52 LPM
Ambient Temp.				± 2°C
Ambient Pressure				±10 mm Hg
Clock Time (PST)				± 2 Min

*** If control limits are exceeded, investigate to determine cause and repeat check immediately. If second check also exceeds limits, request a re-calibration.**

Standards

Standard	Make/Model	Serial I.D. Number	Date Certified	Slope	Intercept
Flow Rate					
Temperature					
Pressure					

Operator Comments:

Date	Comments or Maintenance Performed:

_____ _____
Reviewed by: Date:

AQSB QC Form 403/404 (Thermo 2000i/2025i) (Feb 2020)

APPENDIX C- AQSB Calibration Form 404

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Thermo Scientific Inc. Partisol FRM Calibration Report (BGI DeltaCal/Alicat)

ID Information:		Instrument:		Calibration:	
Station Name	Roseville	Make	Thermo	"As Is"	X
ARB Site Number	31-822	Model	2000i	"Multi-Pt/Final"	
Station Address	151 N. Sunrise Blvd	Property #	20112266 (P)	Calibration Date	1/23/2019
Agency	CARB	Serial #	NA	Report Date	1/23/2019
Operator:	Vandermast			Previous Cal. Date	7/21/2018

Flow Standard:	
Make & Model	Deltacal
Serial #	20071237
Certification Date	8/20/2018
Certification Exp.	8/20/2019

Time Standard:	
Make & Model	Iphone7+
Certification #	NA
Certification Date	NA

Time:	Sampler:	Standard:
Date	1/23/2019	1/23/2019
Hours:Minutes	11:15	11:15

Time= +/- 2 minutes

Temperature:	Sampler	Standard	Difference From True	% Deviation	Previous Offset	New Offset
Ambient	13.5	16	2.50	15.63%	-10.8	-10.8
Filter	14.2	14.2	0.00	0.00%	-10.4	-10.4

Temperature = +/- 2.0 Celsius

Pressure: (mm Hg)	Sampler	Standard	Difference From True	% Deviation	Previous Offset	New Offset
Ambient	760	762	2.00	0.26%	1.2	1.2

Pressure = +/- 10 mm Hg

Leak Test: (LPM)	Pressure Drop (mm Hg)
External	16

< 25 mm Hg

Flow Verification Tests (LPM)	Sampler Display	Flow Transfer Standard	Percent From True	Previous Span	Previous Offset	New Span
Flow	16.7	16.89	1.32%	1	-0.74	1

Flow = +/- 4% From True

Comments			
Calibrated By:	D. Goto		Checked By: