Standard Operating Procedure
for
Partisol 2025i and 2000i FRM Air Samplers

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1 General Information/Overview

The Federal Reference Method (FRM) for the measurement of $PM_{2.5}$ (particulate matter with a mean aerodynamic diameter of 2.5 µm or less) is presented in 40 CFR 50, Appendix L. Sampler siting, operation, and quality assurance regulations are presented in 40 CFR 58. The operating procedures and information presented in this SOP are a supplement to the above cited regulations, the guidance presented in the manufacturer's instruction manual, and the EPA *Quality Assurance Handbook for Air Pollution Measurement Systems* Vol II section 1, and the EPA's *Quality Assurance Guidance Document 2.12 Monitoring $PM_{2.5}$ in Ambient Air Using Designed Reference of Class I Equivalent Methods*. Staff should continuously monitor CFR for changes to ensure that this document adheres to current requirements.

1.1 Principles of Operation

Thermo Scientific Partisol 2000i and 2025i FRM Air Samplers draw a known volume of ambient air at a constant flow rate through a size-selective inlet followed by a very sharp cut cyclone (VSCC), which is a particle size separator. Particles in the $PM_{2.5}$ size range are then collected on a polytetrafluorethylene (PTFE) filter with a polyfluoroalkoxy (PFA) support ring during a specified 24-hour sampling period. Each sample filter is weighed before and after sampling to determine the net weight (mass) gain of the collected $PM_{2.5}$ sample. The filter mass and the known volume of air sampled are used to calculate the mass concentration of PM2.5, reported as micrograms per cubic meter ($\mu g/m^3$), at ambient conditions.

The microprocessor reads, averages, and stores five-minute averages of ambient temperature, ambient pressure, filter temperature, and volumetric flow rate. In addition, the microprocessor calculates the average temperatures and pressure, total volumetric flow for the entire sample run time and the coefficient of variation of the flow rate.

1.2 Instrumentation Operation Overview

To prevent contamination, filter handling is completed in a clean, controlled environment. Specifically, when filters are being prepared for weighing, they are handled in an AirClean Workstation. The AirClean Workstation uses positive pressure to prevent any particulates from contaminating the filters. Prior to use, the workstation is cleaned with laboratory grade paper fiber optic cleaning wipes and rubbing alcohol.

Preweighed filters are placed into clear, polystyrene plastic protective cases for storage. When filters are prepared for sampling, they are transferred from the plastic cases into blue, plastic filter cassettes with metal backing frit, and the filter cassettes are then placed into individual metal tins, which prevent contamination prior to deployment. If operational needs dictate, filters may go directly from initial weighing and into the filter cassettes and metal tins. Once in the tins, filters are transported by common carrier or by hand to field offices for future use.

In preparation for sampling, the filter cassette is removed from the tin, placed in a filter cassette magazine or metal filter carrier, and taken to the site in a transport box. FRM samples are retrieved from the instruments within 177 hours of the end of sampling. Upon collection,

the filter cassette magazine or metal filter carrier is returned into a transport box, placed into a cooler, and maintained at ≤ 4°C, or below the average ambient temperature during sampling. Any abnormalities with the sampler or nearby environment are noted on the appropriate field data sheet. Upon return to the office, filters are removed from the magazines, inspected, and any abnormalities that are observed are noted on the field data sheet and the samples are placed back into the protective metal tins and stored in a refrigerator maintained at ≤ 4°C. Periodically, the filters are shipped or carried to the gravimetric laboratory for final weighing. If shipped, the samples are kept at ≤ 4°C.

To equilibrate the filters, they are taken to a climate controlled weighing room, removed from the tins and equilibrated for a minimum of 24 hours, but not more than 72 hours before post-sampling weighing.

After initial weighing, filters may be held for up to thirty days prior to sampling. Once sampled, the loaded filters may be held for up to ten days unless they are maintained at ≤ 4°C or less than the average ambient temperature during sampling, in which case they must be weighed within thirty days of the sample date. After the gross weighing, filters are stored in labeled polystyrene plastic protective cases and cataloged in closed cardboard boxes. They are stored in either a refrigerator or freezer for an archiving period of at least one year and kept for at least five years past the sampling date.

Both the 2000i and 2025i Partisols that ADEC utilizes are single channel samplers. However, the 2025i Partisols are able to automatically advance filters into the filter chamber. In order to automatically advance filters, the 2025i Partisols have filter cassette magazines that simplify filter exchange and transport, and minimize the risk of filter contamination during these procedures. The supply magazine contains pre-weighed filters prior to sample collection and the storage magazine receives the sampled filters.

1.3 Safety Precautions

Only properly trained personnel should perform the Partisol 2000i and 2025i FRM filter changes, installation, testing, operation, maintenance or calibration. As with all monitoring equipment, precautions should be taken when working around electricity, power tools and elevated platforms. Repair should be done by properly trained service personnel.

1.4 Partisol Display Screens

The Partisol utilize a LCD screen with a menu system to activate sampler functions, program the sampler for operation, and view stored data and errors. The menu system is navigated using pushbuttons, as shown in Figure 1.1 below.

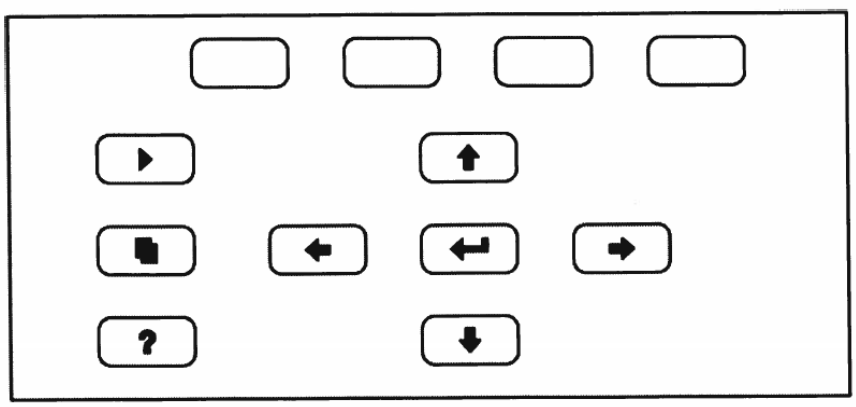


Figure 1.1 Front Panel Pushbuttons
Figure taken from Thermo Fisher's 2025i Partisol Instruction Manual

Table 1.1, located below, summarizes the functions of each of these keys. The default functions of the soft keys differ slightly between the 2025i and 2000i Partisols. Both have these soft keys: CTRST, SSET, and STAT. The CTRST soft key which enables the user to adjust the screen contrast. The SSET soft key navigates the user directly to the sample set up menu. To instantly view the status codes, the STAT key should be pressed. The 2000i Partisols also have a RECS soft key, which takes the user to the records menu. The 2025i Partisols have a FLTID soft key, which directs the user to a screen where the filter IDs can be entered for the next fourteen samples. All soft keys except the STAT key are programmable and information is available in the instrument manual for that process.

Table 1.1 Function of Front Panel Pushbuttons
Table taken from Thermo Fisher's 2025i Partisol Instruction Manual.

Key Name	Function
[ ] = Soft Keys	The [ ] (soft keys) are used to provide shortcuts that allow the user to jump to user selectable menu screens. For more information on processing soft keys, see "Soft Keys."
[▶] = Run	The [▶] is used to display the Run screen. The Run screen normally displays the current readings.
[■] = Menu	The [■] is used to display the Main Menu when in the Run screen, or to back up one level in the menu system. For more information about the Main Menu, see "Main Menu" later in this chapter.
[?] = Help	The [?] is context-sensitive, that is, it provides additional information about the screen that is being displayed. Press [?] for a brief explanation about the current screen or menu. Help messages are displayed using lower case letters to easily distinguish them from the operating screens. Press [▶] to return to the Run screen, or any other key to exit a help screen.
[↑] [↓] = Up, Down [←] [→] = Left, Right	The four arrow pushbuttons ([↑], [↓], [←], and [→]) move the cursor up, down, left, and right or change values and states in specific screens.
[↵] = Enter	The [↵] is used to select a menu item, accept/set/save a change, and/or toggle On/Off functions.

Possible display screens are the title, run (also called main), pressures, temperatures, sample stats, and wind screens. Upon initial power-up, the sampler displays the title screen that shows the manufacturer, model number and software version. Shortly after the boot sequence, the instrument enters the run screen, as shown in Figure 1.2. The other possible screens contain other information from the sampler's sensors (if installed). To change screens, press the run button to return to the main screen and use the up and down arrow keys to select the desired screen.

Further descriptions of the operating software and menu system are presented in Sections 5 and 9 of the manufacturer's operating manual.

1.5 Partisol Operational Modes

The Partisol have several possible operational modes including: stop, wait, sampling, done, error, audit, and service. In the middle of the screen, the current operating mode is shown; in Figure 1.2, the instrument is in sampling mode.

To enter audit mode, the instrument must either be in stop mode or sampling mode. From the main menu, select audit and calibration. From this menu, select audit mode, and press the right arrow button to enter audit mode. In audit mode, the user can perform a verification of the instrument, as described in section 3.3. Additionally, if the instrument is currently sampling, placing the sampler in audit mode allows a field blank to be collected.

Stop mode allows the instrument to exit wait, sampling or done mode; to enter stop mode, press the run button followed by the right arrow button. Note that if the instrument is sampling and stop mode is entered, the sample run will be interrupted and it typically will not be considered a valid sample for the day.

Service mode is useful for troubleshooting and is used to calibrate the instrument. Prior to entering service mode, the instrument must be in stop mode. Once in stop mode, select service mode from the main menu and press enter. When the instrument is in service mode, a wrench icon is present on the display screen. For troubleshooting the Partisols, service mode allows access to manual motion, which enables the isolation of the various components to determine which part is experiencing an error. Entering service mode also permits the selection of calibration in the audit and calibration menu.

Until the defined sampling period begins, the Partisol should be in wait mode. To enter wait mode from stop mode, press the run button twice and the right arrow button. Note that wait mode should only be entered once the next sampling period has been programmed.

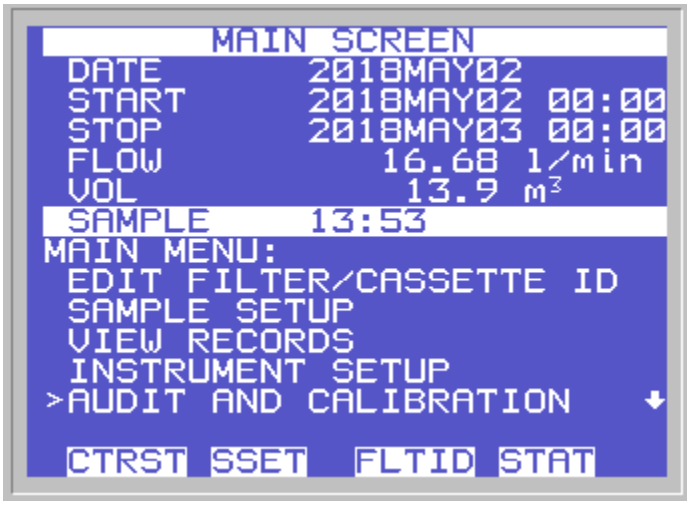


Figure 1.2 Partisol 2025i Main Menu Screen

1.6 Sampler Inlet and Flow Schematics

Ambient air entering the Partisol first passes through a PM_{10} inlet; the inlet is designed to remove particles with aerodynamic diameter greater than 10 μm and send the remaining smaller particles to the next stage. If the instrument will be used as a FRM to sample for $PM_{2.5}$, a Very Sharp Cut Cyclone (VSCC) must also be installed. VSCCs remove particles less than 10 μm, but greater than 2.5 μm in diameter and allow particles of 2.5 μm in diameter and smaller to be collected on the PTFE filter surface. The design flow rate for both Partisols is 16.7 liter per minute.

2 Installation

Prior to installing the instrument, the siting requirements, equipment required, and manufacturer guidelines must be considered. These guidelines should not be considered a substitution for experience.

2.1 Siting Requirements

Samplers should be sited to meet the goals of the specific monitoring project. For routine sampling to determine compliance with the National Ambient Air Quality Standards, sampler siting is described in the *Quality Assurance Project Plan for the State of Alaska Air Monitoring & Quality Assurance Program,* and is regulated by 40 CFR Part 58.

Samplers should be mounted on a safe, suitable monitoring platform according to the following guidelines:

1. The sampler must be exposed to unobstructed airflow in all directions for a minimum of 1m horizontal distance.
2. The sampler inlet must be placed between 2 and 15 m above ground level.
3. If a sampler is collocated with other samplers, the spacing between sampler inlets is as follows:
    a. If collocated with other $PM_{2.5}$ or PM_{10} low-volume samplers (flow rate ≤ 16.7 L/min) maintain a distance between sampler inlets of 1-4m.
    b. If collocated with total suspended particulate samplers (TSP) or other high-volume samplers (flow > 200 L/min), maintain a distance between sampler inlets of 2-4 m.

2.2 Equipment for Installation

Partisol® 2025i Sequential Air Sampler or Partisol® 2000i Air Sampler

Filter cassettes
Rain hoods (total of 3)
47mm Teflon filters.
PM_{10} inlet
Downtube

VSCC (for $PM_{2.5}$ sampling only)
Calibration equipment as defined in Section 3.0.
Laboratory equipment as defined in Section 5.0.
Partisol stand and screws
Ambient temperature sensor
Suitable power source
Ethernet or RS-232 cable (if setting up remote connectivity)

Additionally, if a 2025i Sequential Air Sampler is being set up, these items may also be needed:

Partisol Insulating Jacket (if winter conditions warrant)
2 filter cassette magazines
VSCC assy adapter (for $PM_{2.5}$ sampling only)
Magazine friction rings (for temperatures below -10°C)

2.3 Instrument Installation

Prior to the first use, the instrument should be set up following the manufacturer's operating manual.

Install the sampler on the supplied stand. If the instrument will be a Federal Reference Method sampler for $PM_{2.5}$, a VSCC must also be installed. A PM_{10} inlet must be fitted to the top of the sample tube and the ambient temperature sensor must be installed prior to operation.

After the instrument is set up, an external leak check, as described in Section 3.3, should precede a flow check or calibration. Upon successful completion of a leak check, the instrument must be calibrated, as described in Section 3.4. In the instrument set up menu, select system setup and change report volume from standard to. Additionally, in the instrument set up menu, select flow calibration set up, and select flow; the number of points must be changed from three to five.

After rechecking the instrument through a verification, it is ready to be used for sampling, as described in Section 4.1.

Remote Access
If setting up remote connectivity for the instrument, connect a RS-232 cable or a ethernet cable to the appropriate port on the sampler. If using an ethernet cable, navigate from the main menu to instrument set up, communications, and TCP/IP settings. Confirm that DHCP is on. Connect the ethernet cable to the router and power cycle the instrument. On the instrument, navigate back to TCP/IP Settings; an IP address should have been assigned.

In the iPort program on the site computer, go to file and select preferences. A screen should appear similar to Figure 2.1 below. In the ethernet section, which is denoted by an orange rectangle in the figure, enter the IP address from the sampler and check the enable box for

direct TCP/IP. Additionally, in the instrument section, change the size to full. From here, under instrument, select TCP connect, and IP address. Enter the IP address for the sampler. At this point, it should be possible to remotely connect to the instrument in the iPort program by selecting instrument, TCP connect, and connect.

The process for setting up the RS-232 connection is similar. The RS-232 cable should be connected to the site server. In the iPort program, go to preferences and make sure that the direct TCP/IP box is not checked. Next, under comm, select connect, edit the communication settings for the instrument, and set the polling config as 25. From instrument, select poll serial and edit config; setting this as 25. Under instrument, select poll serial and poll config 25 to connect to the sampler.

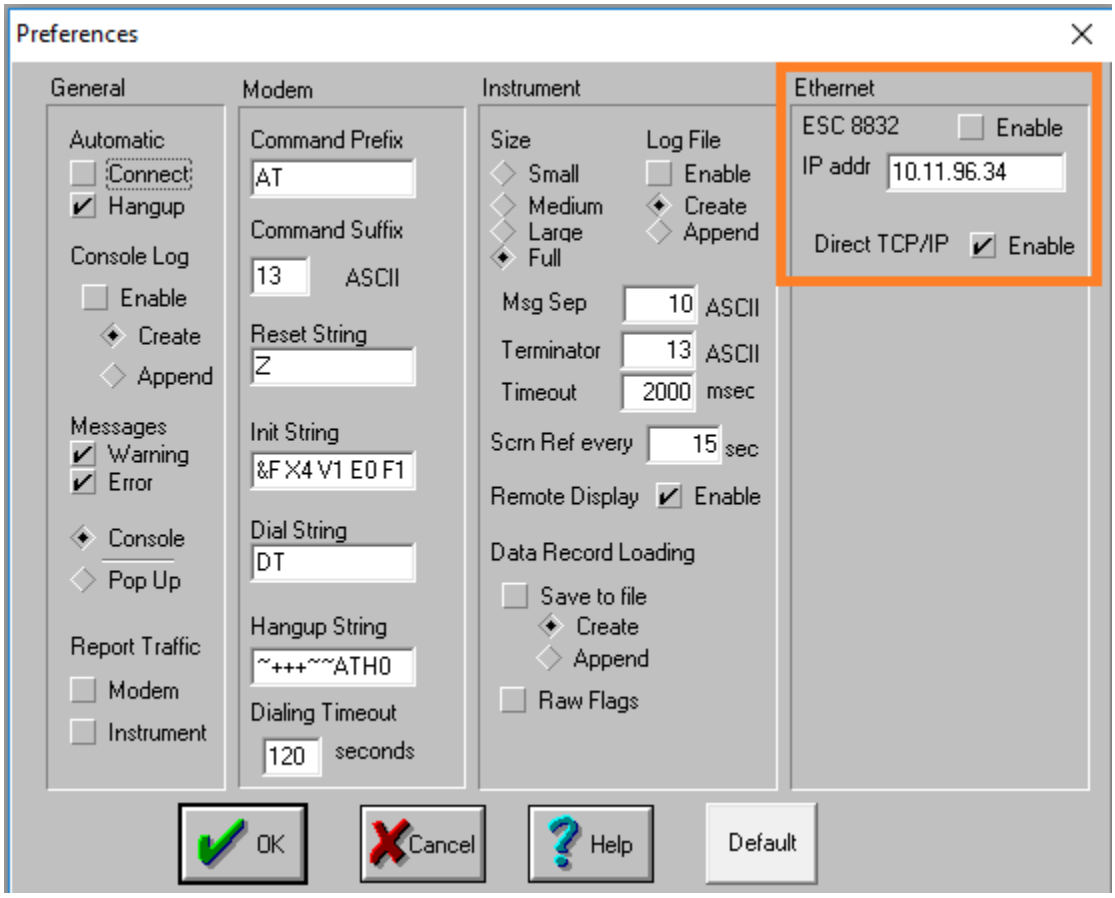


Figure 2.1 iPort Preferences Screen

2.3.1 2025i Instrument Installation

In addition to the steps described above in Section 2.3, for the 2025i Partisol, a VSCC assy adapter must be connected to the top of the VSCC; from here, the lid of the instrument can be opened and the VSCC installed.

To properly set up the 2025is for sampling, two changes must be made in the instrument set up menu. First, from the instrument set up menu, select default sample set up, select method,

and change the method to time. Second, from the instrument set up menu, select default sample times and set the start time at 00:00 and the duration at 24h 00m. For daily sampling, the repeat time should be set at 24h 00m.

3 Calibration & Verification Procedures

Because $PM_{2.5}$ concentration standards are not available for determining calibration relationships, individual components of the sampling method must be calibrated to ensure integrity of reported data.

A verification consists of performing a leak check and comparing the sampler values for flow, temperature, and ambient pressure to a calibration standard. Verifications are to be completed at least every thirty days, and prior to all but the initial set-up calibration. In addition to taking place at least every thirty days, each month there must be a flow check completed at least fourteen days past the prior month's flow check.

Calibrations are to be performed at these specified intervals:

- Initial set up of equipment
- When the monitor fails the verification of temperature, pressure, or flow
- Following a factory reset of the instrument
- Following electromechanical maintenance, such as replacement of the mass flow controller or a sensor
- At minimum, every 365 days

The following sections respectively describe the verification and calibration procedures for ambient temperature, ambient pressure, multipoint flows, and filter temperature. If the ambient temperature, ambient pressure, or flow rate need to be calibrated, all three must be calibrated as the flow rate is based on the ambient temperature and pressure.

3.1 Calibration of Transfer Standards

Following established EPA methods and procedures, all calibration transfer standards must be certified against NIST-traceable standards at least once per year. Calibration of these transfer standards will be conducted by the transfer standard manufacturer or an accredited vendor.

3.2 Verification and Calibration Equipment

A transfer standard with proper calibration traceable to NIST which measures flow, temperature, and pressure.
An unexposed filter, installed in a filter cassette
Two clean filter cassette magazines (2025i Only)
Two transport boxes (2025i Only)
One 2000i transport box

Partisol 1pt QC check form, Figure A-1
Partisol Calibration form, Figure A-2

3.3 Verification Procedures

The instrument must be in audit mode prior to performing a verification. Instructions for entering audit mode are detailed in Section 1.5. If the instrument is in sampling mode, take care not to enter stop mode as that will likely result in an invalid sample. Additionally, if the instrument is sampling, make note of the time audit mode is entered as the instrument can typically only be paused for one hour in order for the sample to be valid.

All verification results must be recorded in the site log or on the verification form, which is included in Appendix A.

To verify or audit any parameters, a cassette must first be placed into the filter chamber. For the 2025i Partisol, install one of the empty filter cassette magazines in the collection side of the 2025i (right side). Place the blue cassette with an unexposed filter installed into the other empty filter cassette magazine and install this magazine in the supply side (left side). In the audit menu, select advance filter and press the right arrow button.

Performing an external leak check
Navigate to the audit and calibration menu. Scroll to leak checks and press enter. Scroll to external and press enter. Close the leak check valve as directed and begin the test. Once the test is completed, slowly release the valve. To pass, the test must run for 60 sec and ΔP must be < 25 mm Hg.

If the "as found" external leak check fails, it is best practice to complete an "as found" check of the other criteria (ambient air temperature, ambient pressure, flow, and filter temperature) prior to troubleshooting. If an external leak check fails, an internal leak check should be completed if the issue is not readily apparent.

Performing an internal leak check
Insert the solid red leak check disk into the filter chamber. From the audit and calibration menu, scroll to leak checks and press enter. Select internal leak check and press the right arrow to begin the test. A passing internal leak check must run for 60 sec and the (ΔP) must be less than 140 mm Hg. If the internal leak check fails, that indicates that the leak exists between the pump and the filter chamber.

Note: For the 2025i, the sampler may have a shuttle error if the instrument attempts to automatically advance the red disk out of the filter chamber. It's recommended to manually open the instrument up to the filter chamber and physically remove the red disk.

Verification of the ambient air temperature, pressure, and flow
Install the NIST transfer standard on the sampler's downtube. From the audit and calibration menu, select audit. Scroll to flow and press the right arrow button to turn the pump on. Allow the temperature sensor on the transfer standard to equilibrate and observe the readings on the

transfer standard and sampler for any abnormal fluctuations. Compare the readings from the NIST transfer standard to the displayed values for ambient temperature, ambient pressure, and flow in the audit screen.

Prior to testing the filter temperature on the 2025i Partisol, an external leak check must be completed as the VSCC must first be uninstalled. To verify the filter temperature reading, place the attached temperature probe for the transfer standard into the filter chamber. Take care not to pinch the temperature probe cable and close the instrument. Allow the temperature sensor to equilibrate and, once equilibrium is reached, compare the filter temperature reading from the transfer standard to the displayed value for the filter temperature in the audit screen.

The acceptable ranges for these criteria can be found in the QA Handbook Volume II, Appendix D Validation Tables. If any of these criteria are not met, recalibration is necessary. Following the check, turn the pump off by scrolling down to flow and pressing the left arrow button.

Internal Clock

At least monthly, the instrument clock must be verified against NIST time and corrected if needed. To view the time on the instrument in seconds, it must be in stop mode; from the main menu, select instrument set up and date/time to view the clock on the sampler. For an instrument that is sampling, the time can be verified by comparing the clocks exactly when the sampler clock changes over to the next minute. If remote connections to the instrument have been set up as described in section 2.3, corrections to the clock can be made using the iPort program (shown below). Once connected remotely to the instrument, click on the button next to the time, as indicated with an arrow in Figure 3.1 below. Enter the correct time and click ok.

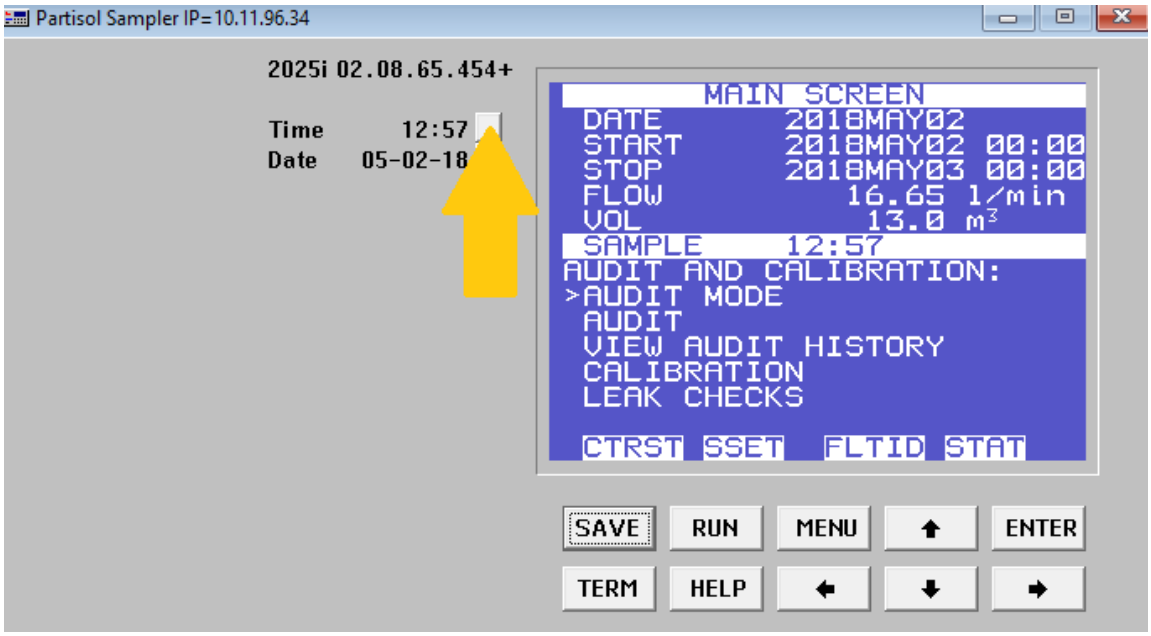


Figure 3.1 Remote Connection Screen in iPort Program for 2025i Air Samplers

3.4 Instrument Calibration

Unless the instrument is being installed at a site, an "as found" verification of ambient temperature, ambient pressure, filter temperature, and flow must be completed prior to calibration. A passing external leak check should also be completed prior to calibration. A copy of the calibration form is located in Appendix A.

To calibrate, the instrument must be placed into service mode, as described in Section 1.5.

Prior to any adjustments, record the calibration constants. From the audit and calibration menu, select calibration, scroll to flow, and press enter; the screen will display the slope and intercept for the flow calibration. Press the menu button and select cal intercepts. Record the calibration constants for ambient temperature, ambient pressure, and filter temperature.

Install the transfer standard on the sampler and allow the filter temperature probe to equilibrate to the ambient temperature.

Press the menu button to return to the audit and calibration menu. Select calibration and scroll to ambient temperature and press enter. From here, enter the reference device value in °C and press the enter key to save the value. Press the menu button and scroll to ambient pressure and press enter. Enter the reference device ambient pressure reading in mm Hg and press the enter key to save the value. Note that the ambient temperature and pressure should be calibrated prior to calibrating the flow as those values are used to determine the actual flow.

To calibrate the flow, press the menu button and select flow. Press enter and enter the reference device actual flow value once the flow has stabilized. The instrument will automatically advance to the next flow set point and this process should be repeated for each of the five flow set points.

To calibrate the filter temperature, place the reference device's attached temperature probe into the filter chamber. Allow the temperature sensor to equilibrate and, once equilibrium is reached, from the calibration menu, select filter temperature. Enter the reference device value in °C and press the enter key.

After calibrating the instrument, each parameter must be verified. Additionally, an external leak check should be completed after reinstalling the VSCC on the 2025i Partisol.

To exit service mode, press the menu button until the main menu is reached, scroll and select service mode and press the enter button.

4 Operational Procedures

4.1 Installation of new Filters/ Collection of used Filters

In the lab, filters are prepared for deployment inside of an AirClean Workstation, as discussed in Section 1.2. Prior to deployment, filters are inspected for filter damage or extraneous matter. Filter IDs are recorded on field logs sheets; a copy of a field log sheet is

included in Appendix A. After sampling, filters are transported back to the lab in a cooler. Ice packs can be added to the cooler if needed to maintain the temperature.

If a field blank is being collected or any verifications are being completed, perform those tasks prior to deploying new filters.

Check the instrument for any alarm codes, which are indicated by a bell symbol on the display screen. If there are any alarms, from the main menu, select system status and press enter. If a 2025i alarm code indicates "no filters", press the enter button to clear the error. If there is a different error for either Partisol model, record the alarm code on the field log sheet. The instrument manual contains more detailed descriptions for each of the alarm codes in Chapter 9 to assist in any necessary troubleshooting.

2000i Partisol
Lift the handle to open the filter chamber, remove the sampled filter (if applicable) assembly, and place a new filter assembly into the filter chamber, with the sampled filter going into the transport box.

2025i Partisol
Remove a filter cassette magazine containing new filters from the transport box and install on the left side (supply side) of the instrument. The filters on the right side (collection side) should be collected and a clean empty filter cassette magazine installed.
The sampled filters should immediately be placed in the cooler and the temperature probe should be reset. Upon arrival at the lab, the minimum, maximum, and current temperature values from the temperature sensor should be recorded on the field log for each filter in the transport temperature section.

Programming a Sample Run
2000i Partisol
Place the instrument in stop mode as described in Section 1.5. From the main menu, select sample set up. Scroll to sample, press enter, select start, and change the start date to the desired day. Confirm that the instrument will be sampling, as required, from midnight to midnight. Press the menu button and scroll to filter ID to input the correct id number. Put the instrument in wait mode by pressing the run button twice and the right arrow button.

2025i Partisol
To program a sample run on a 2025i Partisol that is not sampling, place the instrument in stop mode, enter sample setup, select apply default times, and press the right arrow key. Press the menu button to return to the sample set up screen. At this point, sampling dates should be shown for the next fourteen samples, with the first sample run beginning the next day at midnight and ending at 11:59pm. If necessary, adjust the first sample start date to the desired date. From here, enter the filter IDs. To do this, the FLTID soft key can be pressed, which enters a screen where the filter IDs for the next fourteen samples can be entered. Alternatively, from the sample set up screen, each sample can be selected. For each sample, scroll down to filter ID and press enter to edit the number. After entering the filter IDs, place the instrument in wait mode. From here, the filter for the next sampling day can be pre-

advanced by entering the sample set up menu, selecting advance filter and data, and pressing the right arrow button.

To program a sample run, on a 2025i Partisol that is sampling, only the filter ID numbers should need to be entered, as described in the paragraph above.

4.2 Sample Records

The instrument can be in any mode to view and download sample records.

Viewing Sample Records
Press the menu button to reach the main menu. Scroll to records and press the enter button. Select filter records and press enter. Press the up button repeatedly to view the records for the past 64 sampling events.

Downloading Records
To download the records onto a USB stick, place the USB stick in the USB port on the sampler. Press the menu button to reach the main menu. Scroll down and select the USB menu item. Scroll to instrument sample data, select port 1, and scroll to export data logs, press enter. Select the desired data records to download and follow the instrument's prompts on the instrument display. When the download is complete, remove the USB stick from the sampler.

It's also possible to download records electronically through the iPort program. To set up instruments for this remote connection, see section 2.3. To remotely connect to instruments where this has been set up, remotely login to the site, and open the iPort program. From here, go to instrument, TCP connect, and select connect. This will load a screen with the instrument display. To download records through a remote connection, after connecting with the sampler via iPort, select instrument and load records. On the screen that loads, filter records should be selected and the file extension should be changed to "csv", as shown in Figure 4.2. Select OK and the file will download to the Thermo iPort folder.

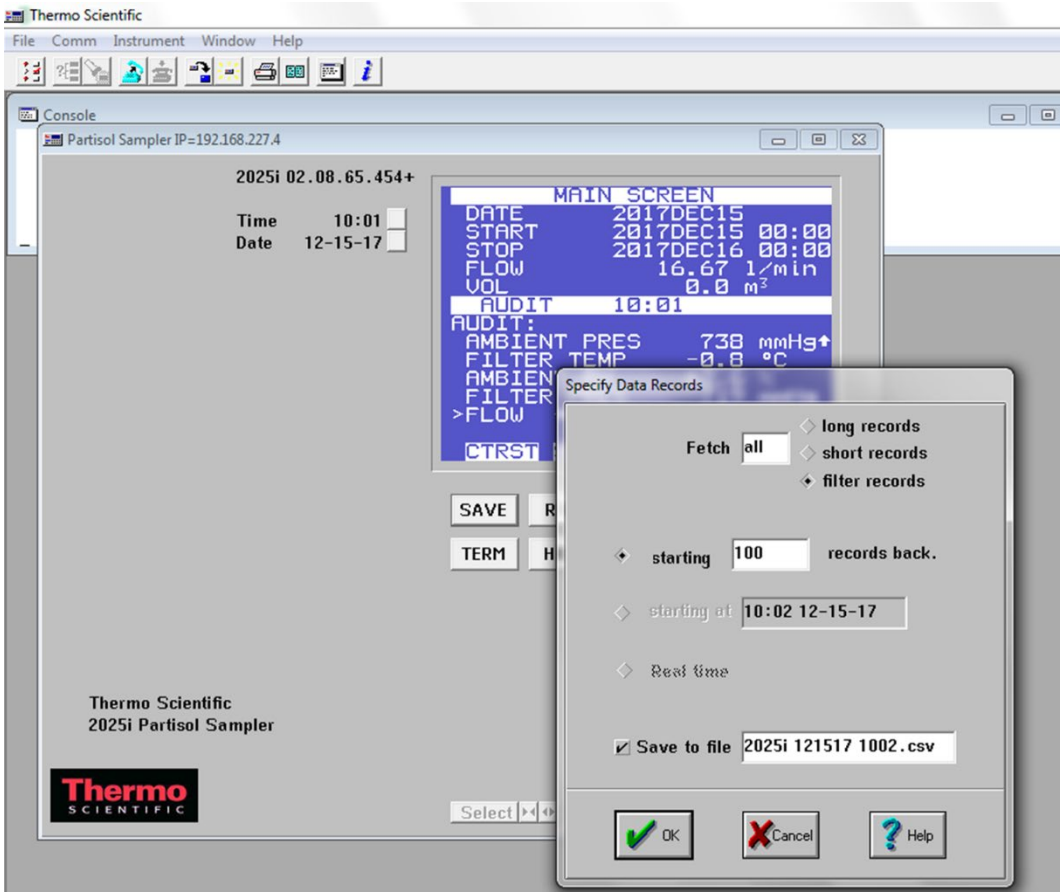


Figure 4.2 iPort Screens for downloading records from 2025i instrument

If there are any issues with remotely connecting to the instrument, it's likely that the IP address was changed. This can be checked by the site operator and adjustments can be made in the iPort program if needed as described in section 2.3.

4.3 Field Blanks

To collect field blanks, the field blank filter needs to be placed inside the filter chamber for approximately two minutes; the start and stop time should be recorded on the filter field log. To collect a field blank on an instrument that is sampling, the instrument must be paused, as described in Section 1.5. For the 2025i Partisol, the field blanks are automatically advanced into the filter chamber by entering audit mode and selecting advance filter. The field blank must then be collected from the filter chamber; for the 2025i this requires selecting advance filter from the audit menu. The field blanks are prepared in the same way as the sampling filters, collected under the same procedures. For lab analysis, the field blank I.D's are blind.

5 Data Calculations and Validation

The following subsections describe the routine procedures used to calculate 24-hour $PM_{2.5}$ concentrations and to validate individual samples.

5.1 Data Calculations

To calculate the 24 hour average $PM_{2.5}$ concentration, first determine the total sample volume (V_a), which should be available as part of the filter data downloaded from the sampler. If the total sample volume is not available it can be alternatively calculated from the average volumetric flow rate (Q_{avg}) and the total sample duration (t) as follows:

$$V_a = (Q_{avg})(t)(10^3)$$

where:

V_a = total sample volume (actual m^3)
Q_{avg} = average sample flow rate (L/min)
t = total sample duration (min)
10^3 = units conversion (m^3/L)

Using the final weight and tare weight of the sample filter, determine the total filter mass gain ($M_{2.5}$) as:

$$M_{2.5} = (M_f - M_I)(10^3)$$

where:

$M_{2.5}$ = total mass gain (µg)
M_f = final filter weight (mg)
M_I = initial (tare) filter weight (mg)
10^3 = units conversion (µg/mg)

The $PM_{2.5}$ concentration can then be calculated as follows:

$$PM_{2.5} = M_{2.5} / V_a$$

5.2 Data Validation

The following applies to the validation of single $PM_{2.5}$ concentrations based upon the field and laboratory data. Additional validation techniques (i.e. statistical techniques) may be specified in the Quality Assurance Project Plan (QAPP).

As part of the data review process, several criteria must be verified, a full list of which is located in the Quality Assurance Handbook Volume II, Appendix D. Other items which must be checked are: the field logs for any notes, the post run status code in the instrument's record, and that shipment temperature and sample holding time criteria were met. In some cases, the post-run status code may not be OK, but data invalidation or qualification may not be necessary; an example of this would be when the instruments are paused during a sample run. If criteria are not met, the Quality Assurance Officer should be notified and together with the site operator and data reviewers will determine if data need to be submitted with appropriate qualifiers or null codes.

6 Sampler Maintenance

This section presents the regular maintenance schedule that allows the monitoring network to operate for longer periods of time without system failure. The operator may find that increasing the frequency of maintenance is necessary due to the operational demands on the samplers or the high level of particulates coinciding with events such as wildfires. All maintenance activities are to be documented in the sampler logbook. Table 6.1 is a summary of required maintenance procedures and frequencies.

TABLE 6.1 Maintenance Schedule for Partisol Air Samplers

Parameter	Interval
Single point flow rate verification	Every 30 days
External Leak Check	Before each flow rate check and before and after VSCC maintenance
Pressure verification	Every 30 days
Temperature verification (both ambient air and filter temperature sensors)	Every 30 days
Cleaning VSCC	Every 30 days[1]
Cleaning PM10 inlet	Every 90 days per QAPP[1]
Changing fan filters	Every 30 days[1]
Cleaning filter chamber	Every 30 days[1]
Cleaning downtube	Every 90 days[1]
Temperature calibration	On installation, every 365 days, or if the single point check fails
Flow rate calibration	On installation, every 365 days, or if the single point check fails
Pressure calibration	On installation, every 365 days, or if the single point check fails
V-seal inspection	Every 6 months
Test batteries	Every 6 months
Replacing particle trap filter[2]	Every 6 months
Replacing large in-line filter[3]	Every 6 months
Replacing pump	Every year

[1]During periods of high particulate concentrations, it's advisable to complete these items more frequently if the 2025i is used for daily sampling.
[2] 2025i only
[3] 2000i only

6.1 Maintenance Procedures

Usually maintenance items are completed the same time as operational checks. Prior to maintenance, a leak check should be completed. While maintenance items are being completed, there should not be any field blanks or samples in the filter chamber. After maintenance is completed, the leak check should be repeated.

Typically, the VSCCs and PM_{10} inlets are cleaned in the lab for ease. At the time of cleaning, all O-rings are visually inspected and a small amount of silicone grease is applied.

Similarly, clean air intake filters are brought to the site, exchanged with dirty filters, and the dirty filters are then cleaned in the office and later reused.

At least every six months, the V-seals should be visually inspected for damage and replaced if necessary. Prior to checking the V-seals, any filters used for sampling must be removed from the filter chamber.

For the 2000i Partisol, the large in-line filter should be replaced approximately every six months. Thermo recommends turning the sampler off for this maintenance item.

For the 2025i Partisol, Thermo recommends that the particle trap filter, as shown in Figure 6.1 below, be replaced every six months.

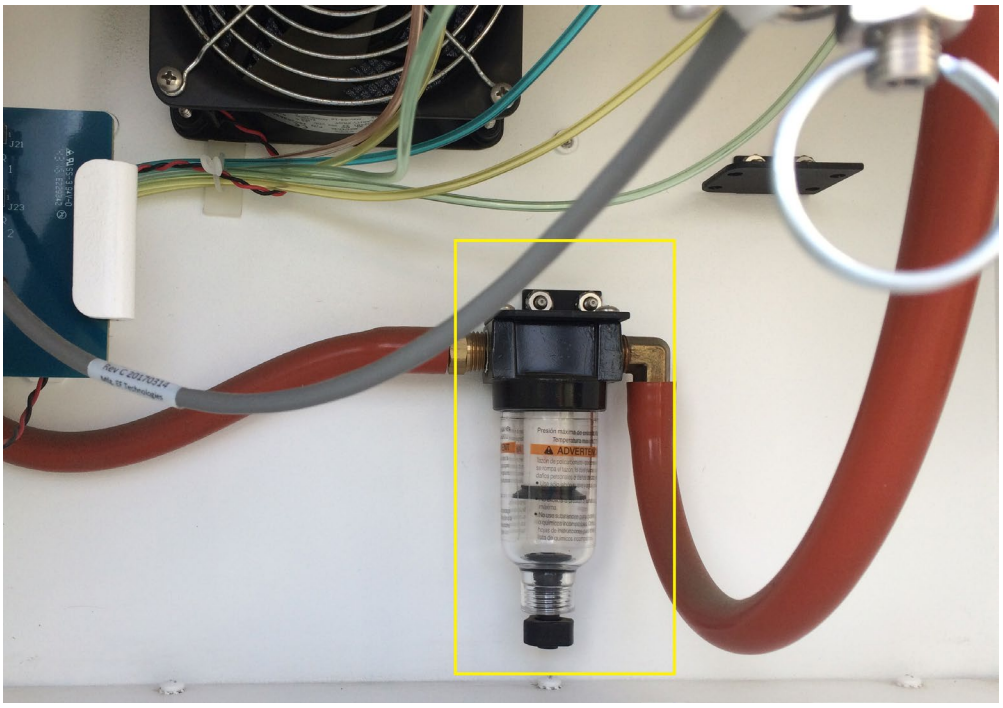


Figure 6.1 Location of Particle Trap Filter on Partisol 2025i (marked with yellow rectangle)

6 Performance Audits

Performance audits are designed to evaluate the accuracy of the sampler in measuring the key parameters involved in collecting a valid $PM_{2.5}$ sample. The parameters are the volumetric flow rate, ambient air temperature, filter temperature, barometric pressure, absence of leaks, and time. Audits will be conducted according to the specifications laid out in 40 CFR Part 58 Appendix A and in accordance with the frequency and personnel requirements specified in the QAPP. Performance audits are to be conducted by personnel not directly involved in the routine operation, data processing or reporting of the $PM_{2.5}$ monitoring network and are typically completed by the Quality Assurance Officer. Furthermore, performance audits are

to be conducted using transfer standards different from those used in the routine calibration and operation of the sampler. It is acceptable for the audit transfer standards to be certified against the same primary standard as the routine transfer standards. An audit report should be prepared for submittal to the ADEC-AQI Section Chief within 30 days of the completion of the audit.

7 Troubleshooting

Whenever possible, an as found leak check and flow check should be completed prior to correcting any instrument concerns. These procedures are described in Section 3.3.

It is common in colder temperatures for the 2025i Partisol to have shuttle errors. If a shuttle error has occurred, it's recommended to first attempt to advance a disk that will not be used for sampling into the filter chamber. If this attempt is unsuccessful, manually open the instrument up to the filter chamber and inspect the filter chamber; filter cassettes occasionally catch instead of properly advancing. If any filter cassettes are improperly situated, correct the issue. Attempt to advance a disk into the filter chamber; if successful, the instrument can be set up for sampling after completing an external leak check. It's strongly recommended that very detailed notes be recorded into the site log to ensure there is no future confusion regarding the filter IDs for each of the sample days.

If the instrument is malfunctioning, refer to the user's manual. If additional support is necessary, notify other departmental staff and/or consult with Thermo technical support. As a last resort, the instrument may be sent to Thermo Scientific for repair.

Depending on the severity of the issue, it may be necessary to perform a verification and calibration on the instrument prior to utilizing it for sampling. These procedures are discussed in Sections 3.3 and 3.4. If there is doubt as to whether these steps are necessary, consult with the Quality Assurance officer.

Appendix A: Forms

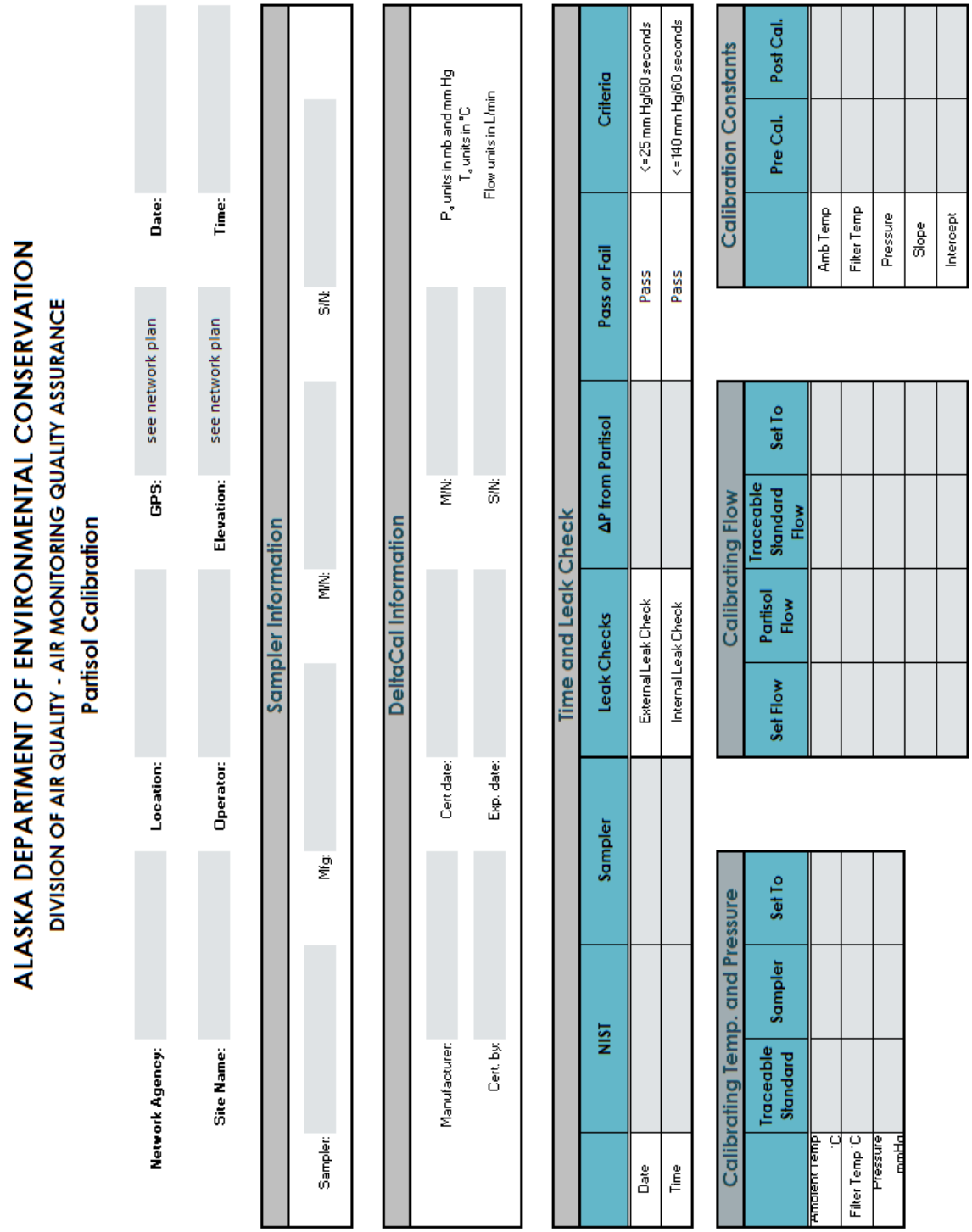
ADEC - AIR QUALITY
QC Report - Partisol - PM2.5

Date:
Time:
Last Audit:
Site:

Sampler Info	Sampler Type M/N Serial #	**Partisol PM2.5** **2025i FRM**	Recheck of Results after Corrections	Operator: Criteria & Information
Clock Time & Date	Traceable Std: Sampler: Difference:	 **0:00:00**	 **Corrected Y/N**	± 1 min of NIST Time
Vacuum Leak Check	ΔP from Partisol	mmHg	mmHg	external: ≤ 25 mmHg/60 seconds internal: ≤ 140 mmHg/60 seconds
Ambient Temperature	Traceable Std: Sampler: Difference:	°C °C **0.0** °C	°C °C **0.0** °C	± 2 °C
Filter Temperature	Traceable Std: Sampler: Difference:	°C °C **0.0** °C	°C °C **0.0** °C	± 2 °C
Barometric Pressure	Traceable Std: Sampler: Difference:	mm Hg mm Hg **0.0** mm Hg	mm Hg mm Hg **0.0** mm Hg	± 10 mmHg
Traceable Sampler Flow Check	Traceable Std: Sampler:	lpm lpm	lpm lpm	QC Transfer Standard / BGI Delta Cal Cert. Date / Exp. Date
	% Difference from Q act	**#DIV/0!** %	%	Accuracy % Δ ≤ ± 4%
	% Difference from Design	100.00 %	%	Design Condition % Δ ≤ ± 5%
Calibration Constants	Ambient Temp: Filter Temp: Baro. Pressure: Flow Slope: Flow Intercept:			Maintenance Items Date: 1: Inspect/clean Case-Fan Filters 2: Inspect/clean interior of cases 3: Inspect/clean sample inlets & jar 4: Inspect/Lube 'O' rings & Cass. Seals

Notes:

Figure A-1 Verification Form for 2025i Partisol Sampler



ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF AIR QUALITY - AIR MONITORING QUALITY ASSURANCE
Partisol Calibration

Network Agency: | Location: | GPS: see network plan | Date:
Site Name: | Operator: | Elevation: see network plan | Time:

Sampler Information
Sampler: | Mfg: | M/N: | S/N:

DeltaCal Information
Manufacturer: | Cert date: | M/N: | P_a units in mb and mm Hg; T_a units in °C; Flow units in L/min
Cert. by: | Exp. date: | S/N:

Time and Leak Check

	NIST	Sampler	Leak Checks	ΔP from Partisol	Pass or Fail	Criteria
Date			External Leak Check		Pass	<= 25 mm Hg/60 seconds
Time			Internal Leak Check		Pass	<= 140 mm Hg/60 seconds

Calibrating Temp. and Pressure

	Traceable Standard	Sampler	Set To
Ambient Temp °C			
Filter Temp °C			
Pressure mmHg			

Calibrating Flow

	Set Flow	Partisol Flow	Traceable Standard Flow	Set To

Calibration Constants

	Pre Cal.	Post Cal.
Amb Temp		
Filter Temp		
Pressure		
Slope		
Intercept		

Figure A-2 Calibration Form for 2025i Partisol Sampler

Partisol 2025i Field Log

Site Identification:			Sampler ID:				Sampler S/N:						Particulate:			
Filter Number	Install	By	Run	Retrival	By	Run Time	Flow		Volume	T_{amb} °C			P_{amb} (mmHg)			Data
	Date	(init)	Date	Date	(init)	(hr.:min.)	(lpm)	% cv	(m³)	Min.	Avg.	Max.	Min.	Avg.	Max.	Flags
Filter Temperatures (Min,Max, As Found°C)			Transport:						Storage:					By (init):		
Comments:																
Filter Temperatures (Min,Max, As Found°C)			Transport:						Storage:					By (init):		
Comments:																
Filter Temperatures (Min,Max, As Found°C)			Transport:						Storage:					By (init):		
Comments:																
Filter Temperatures (Min,Max, As Found°C)			Transport:						Storage:					By (init):		
Comments:																
Filter Temperatures (Min,Max, As Found°C)			Transport:						Storage:					By (init):		
Comments:																
Filter Temperatures (Min,Max, As Found°C)			Transport:						Storage:					By (init):		
Comments:																

Figure A-3 Field Log Sheet for the 2025i Partisol Sampler