

California Environmental Protection Agency



COMMUNITY AIR MONITORING BRANCH

STANDARD OPERATING PROCEDURE

FOR

ATEC 3454 Toxic Air Sampler

CAMB SOP 850

First Edition

Monitoring and Laboratory Division

March 2019

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California Environmental Protection Agency



Approval of Standard Operating Procedure

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SOP: CAMB SOP 850, First Edition

Section: Advanced Monitoring Techniques Section

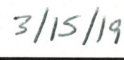
Branch: Community Air Monitoring Branch

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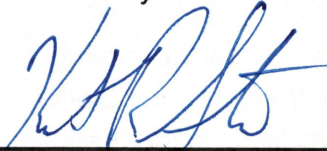
Walter Ham, Manager



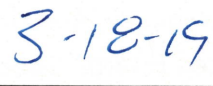
Date

Advanced Monitoring Techniques Section

Community Air Monitoring Branch



Kenneth Stroud, Chief



Date

Community Air Monitoring Branch

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Acronyms & Abbreviations

A/C	Alternating Current
ASTM	American Society for Testing and Materials
CAMB	Community Air Monitoring Branch
CARB	California Air Resources Board
CFR	Code of Federal Regulation
COC	Chain of Custody
Cr6+	Hexavalent Chromium, Chromium +6 oxidation state
EPA	Environmental Protection Agency
FS	Full Scale
ID	Inside Diameter
MFC	Mass Flow Controller
MFM	Mass Flow Meter
MLD	Monitoring and Laboratory Division
NIST	National Institute of Standards and Technology
NIOSH	National Institute of Occupational Safety and Health
NTP	Network Time Protocol
OD	Outside Diameter
SOP	Standard Operating Procedures
TM	Total Metals
USB	Universal Serial Bus
VOC	Volatile Organic Compound

Units

cc	Cubic centimeter
ccm	Cubic centimeters per minute
ccpm	Cubic centimeter per minute
ft.	Foot
hr	Hour
Hz	Frequency of once per second (sec^{-1})
in.	Inch
in. Hg	Inches of mercury
lpm	Liters per minute
min	Minute
mm	Millimeter
lb.	Pound by weight
psi	Pounds per square inch
psia	Pounds per square inch absolute
PTFE	Polytetrafluoroethylene
Torr	Pressure for one millimeter column of mercury at 0 °Celsius (mm Hg)

1 General Information

1.1 Introduction

This Standard Operating Procedure (SOP) describes procedures used by the California Air Resources Board (CARB) Community Air Monitoring Branch (CAMB) to operate the ATEC 3454 Toxic Sampler (Sampler) for the collection of a variety of chemical species in ambient air. Sampled chemical species may include, but are not limited to, carbonyls, hexavalent chromium (Cr6+), glycols, total metals (TM), mercaptans, and volatile organic compounds (VOCs). This document supplements the ATEC 3454 Sampler manual by describing modifications to operating procedures, if any, implemented by CAMB. This SOP is not intended to be a replacement for the Sampler manual.

NOTE: All operators must read the ATEC 3454 sampler manual prior to startup to familiarize themselves with the operation of the sampler.

1.2 Principle of Operation

The ATEC 3454 is a microcomputer-controlled air sampler designed for the unattended collection of ambient air into canisters, cartridges, and filter media for subsequent chemical analysis. System specifications are provided in [Table 1](#) and a system flow diagram is shown in [Figure 1](#).

Table 1. System Specifications

System Specifications	
24-hour Canister Flow rate	Nominal 8 ccpm. Accuracy $\pm 2\%$ FS
Event Canister Flow rate	Nominal 28 ccpm. Accuracy $\pm 2\%$ FS
Cartridge Flow Rate	Nominal 1 lpm
Cr6+ & TM Filter Flow Rate	15 lpm
Canister Pressure Measurement Range	0-50 psia. Accuracy $\pm 0.25\%$ FS
Maximum Canister Filling Pressure	30 psia
Canister Inlet Connection	Stainless steel 1/8 in. Swagelok ® OD tubing connector
Cartridge Inlet Connection	1/8 in. Swagelok ® OD tubing connector

System Specifications	
Cartridge Connections	1/8 in. Polypropylene Luer fittings
Cr6+ & TM Inlet Connections	1/4 in. Swagelok ® OD tubing connector
Outputs	Ethernet, USB
Fittings	1/4 in. & 1/8 in. Swagelok ®
Dimensions (width x height x depth)	Sampler module 1 & 2: 17 in. x 7 in. x 17.55 in. External Pump: 7.5 in. x 4 in. x 11 in.
Installation	Benchtop / Rack mounted
Weight	75 lbs., includes external pump
Power Requirements	115 VAC, 60 Hz, 8 Amp (when pump on)

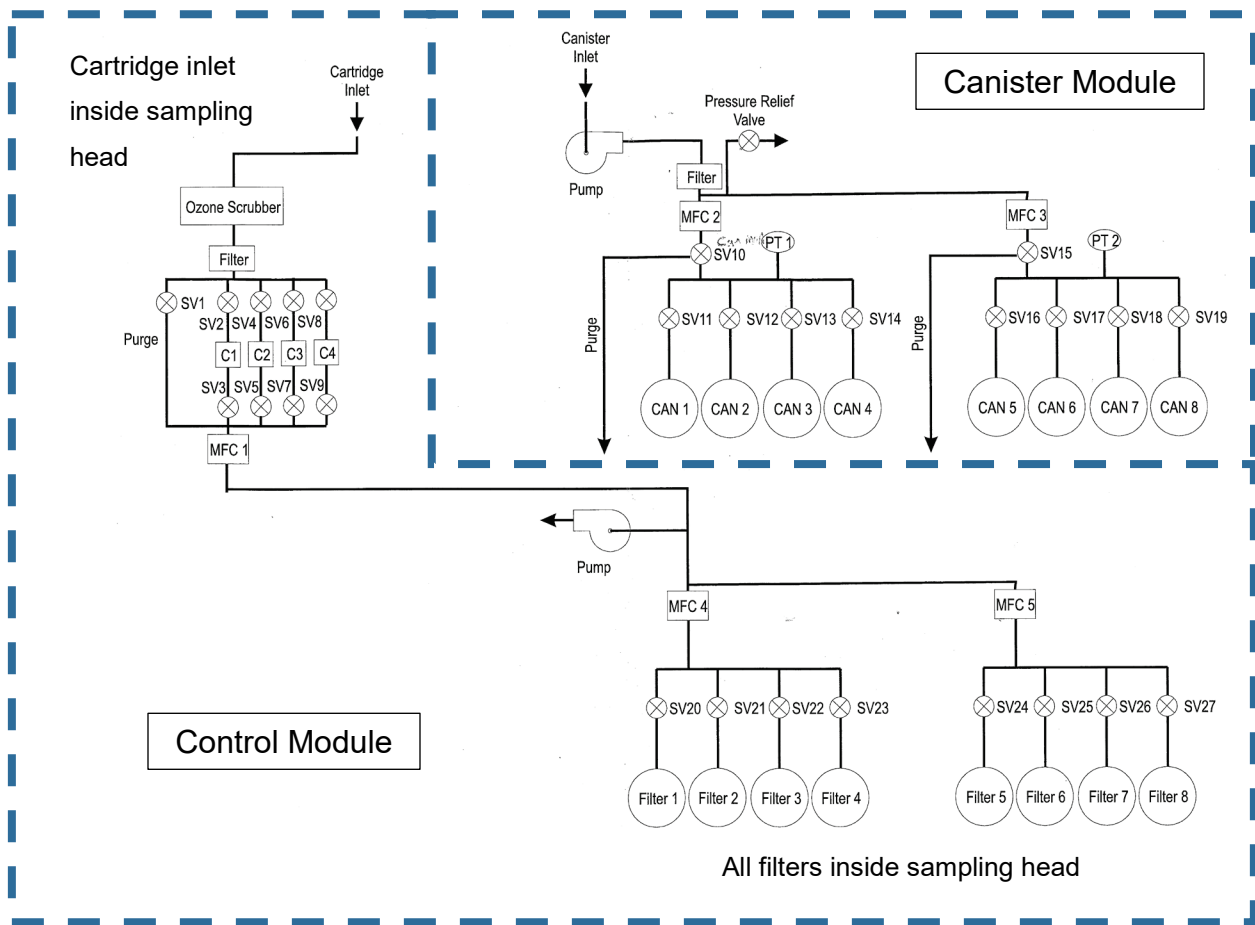


Figure 1. System Flow Diagram

This Sampler can be programmed to collect simultaneous samples from five sampling ports. The Sampler is also capable of collecting sequential samples. The Sampler's mass flow controller (MFC) capabilities include:

1. MFC 1: Canister event ports 1 through 4, 6-hour toxic air samples triggered by event, 0-20 ccm, accuracy $\pm 0.25\%$ FS.
2. MFC 2: Canister ports 5 through 8, 24-hour toxic air samples, 0-20 ccm, accuracy $\pm 0.25\%$ FS.
3. MFC 3: Cartridge ports 1 through 4, 24-hour carbonyl cartridges, 0-2 lpm, accuracy $\pm 0.25\%$ FS.
4. MFC 4: Chromium 6 ports 1-1 & 1-2: 24-hour Cr6+ sample, 0-20 lpm, accuracy $\pm 0.25\%$ FS.
5. MFC 5: Metals ports 1-3 & 1-4, 24-hour TM sample, 0-20 lpm, accuracy $\pm 0.25\%$ FS.

Sample collection can be initiated manually from the front panel for event-triggered sampling, troubleshooting, or to perform a "leak check" when connecting new canisters, cartridges, and filters. The onboard computer controls the scheduling of the Sampler. Preprogrammed sampling schedules can be input manually through the front panel keypad/touchscreen or from a remote computer via an Ethernet connection.

Airborne toxic compounds are collected into 6-liter "SUMMA" electro-polished whole air canisters. These samples undergo laboratory chemical speciation using a variety of methods including U.S. Environmental Protection Agency (U.S. EPA) [TO-14/TO-15](#) Methods. Prior to sample collection, a rotary vane pump is used to pressurize the sample canister up to 13 psi following CARB's requirements. During sampling, a mass flow controller (MFC) is used to maintain a constant flow into the canister over a desired sample collection period. When sampling is not taking place, the sample canister is isolated from the rest of the sampling system. All materials (e.g. stainless steel, Teflon™, Viton™, and copper) used in the sample path are non-reactive. This same SUMMA canister approach can be used for other chemical species and laboratory methods, including mercaptans following American Society for Testing and Materials ([ASTM](#)) [Method D5504](#). Additional operation methods for airborne toxic sampling using SUMMA canisters are defined in [AQSB SOP 805](#).

Additional airborne toxic sampling methods for laboratory chemical speciation involve collecting samples using filter media or sorbent cartridges. The carbonyl cartridge, TM, and Cr6+ filter sampling methods are defined in [AQSB SOP 801](#). Detailed descriptions of the collection and analysis of glycols by sorbent cartridge can be found in [NIOSH 5523](#).

1.3 Safety Precautions

- DO NOT operate in an explosive atmosphere or in the presence of flammable gases or vapors.
- Modules should be placed indoors or other protective enclosure.
- The inlet bulkhead connector can be hot when the sampler is operating or after it has been shut down. Take care when connecting gas lines or working at the rear of the sampler by wearing protective gloves or avoiding contact with these surfaces.
- Sampler components should be secured to a stable surface.
- Some of the Sampler components are heavy. To avoid injury, please use proper lifting procedures when moving or installing the analyzer. Use a partner if necessary.
- Fall protection and proper work-at-heights precautions need to be followed while working with the Sampler inlet head.

1.4 Interferences/Limitations

- As presently configured, only one sample can be collected per port at a time.
- Residence time for the sample collection is limited by the necessary separation between the Sampler inlet head and Control Module (approximately 15 feet).
- When sampling for carbonyls, ozone must be scrubbed/removed to prevent sample oxidation and other interferences.

2 Installation

2.1 Basic Tools and Supplies Needed

- Open end wrenches and a screwdriver set.
- Shelf mount to hold sampler (19 in. wide by 23 in. deep).
- 1/4 in. OD Teflon or equivalent tubing made of inert materials.
- 1/8 in. OD stainless steel or copper tubing.

2.2 Equipment and Apparatus

The Sampler is shipped with the following standard equipment:

- Two sampler modules: Control Module & Canister Module, see [Figure 2](#). These modules include all of the control, communication hardware, and firmware to perform all sampling tasks.

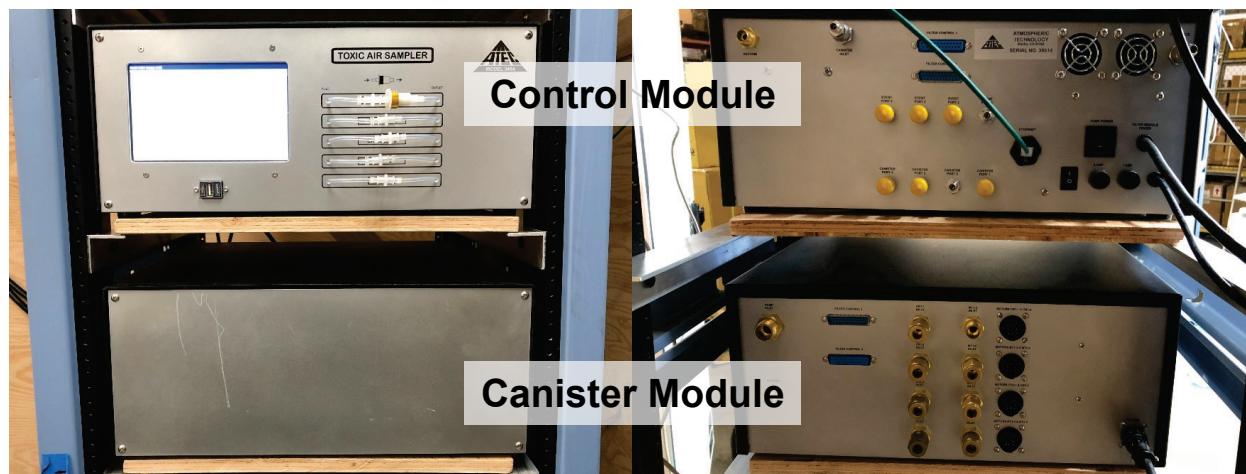


Figure 2. ATEC Case Pics

- One external pump, which provides the vacuum, required for sampling air into and exhausting out of the Sampler.
- Polyethylene tubing: (1) 1/2 in. tube connects vacuum pump to the Control Module, (1) 1/4 in. tube connects Control Module to Canister Module, (4) 3/8 in. tubes connect Cr6+ and TM sampling head connection points to Control Module.
- Stainless Steel tubing (with Swagelok compression tube fittings on each end, 1/8" OD): (1) tube connects Summa canister to the Canister Module
- Polytetrafluoroethylene (PTFE) tubing (with Swagelok compression tube fittings, 1/8: OD): (1) tube connects cartridge inlet inside sampling head to Control Module.
- (1) Universal Serial Bus (USB) flash drive: pre-loaded with recovery software.
- (3) Alternating-current (A/C) power cables.
- (2) Control cable sets: (1) set of (4) grey 1/4 in. cables connect sampling head actuators to Control Module and (1) set of flat cables connect Control Module to Canister Module.
- (1) Sampling head: (2) Cr6+ filter slots and (2) TM filter slots fit onto a 3 ft. length of 1-5/8 in. aluminum tubing.

2.3 Basic Sampler Setup

- Place the Sampler on a flat surface and secure to prevent movement.
- Place the Sampler in an environmentally controlled environment.
- Place the external vacuum pump near-by or on the floor.
- Attach tubing from the various inlets to Control Module and Canister Module.
- Connect the A/C power cables to the: A) Control Module, B) between the Control Module and Canister Module, and C) from the Canister Module to the external vacuum pump.

2.4 Sampler Siting Requirements

This sampler has no special siting requirements. However, general monitoring station siting requirements in Title 40 Code of Federal Regulation Part 58 ([40 CFR 58](#)) [Subpart G](#) may be applicable. All field sampling criteria are dictated by analytical laboratory methods. Ensure the Sampler inlet is in an area of unobstructed airflow. Efforts to meet the requirements in Sections [2.07](#) and [2.09](#) of Volume II of CARB's Air Monitoring Quality Assurance Manual will be considered at each location.

3 Operation Methods

3.1 Sampler Loading Procedures

The following section outlines the methods for collecting samples using the Sampler.

1. Ensure that the sampler is connected to power and turn on power to the Control Module.
2. Allow the system to warm-up. Main Tab screen will appear after five minutes.
3. Complete Chain of Custody (COC) forms for all sampling media loaded into Sampler.
4. Install cartridge(s), filter(s), and/or SUMMA canister(s).
5. Set up media run(s) with the on-board software system using the SOP Tab. The cartridge and canister inlet tubing must pass an auto leak check prior to setting up a run. The cartridge and canister inlet tubing are automatically purged prior to run for 10 minutes. The purge flow rates are 18ccpm for 24-hour canister, 180 ccpm for event canister, and 1 lpm for the cartridge. Each sample has the following parameters: (1) Start Time & Date, (2) Duration, (3) Label. The media will be run at a 1-in-6 day schedule and should run for 24-hours starting at midnight PST. For on-board software operation, refer to Display and Function Tabs in the ATEC 3454 Manual.

3.2 Sampling Removal Procedures

1. Check Summary Tab screen to verify samples ran and identify errors.
2. Complete COC forms for all samples removed from Sampler.
3. Remove cartridge(s), filter(s), and/or SUMMA canister(s).
4. Follow CARB sample handling SOPs for each respective sample media.

4 Collection Media Installation and Removal

4.1 Filter/Cartridge Handling

4.1.1 Changing Filter substrates

1. Open sampling head lid to access filter substrates.
2. Disconnect the pump sampling line from the quick-connect fitting on the filter holder.
3. Remove the filter holder by:
 - a. Loosening the wingnut on the tensioner;
 - b. Rotate the tensioner down towards the sampling head surface;
 - c. Rotate the aluminum retention bracket up to allow the holder to be lifted; and
 - d. Slide the filter holder upwards from the guideposts (see [Figure 3](#)).

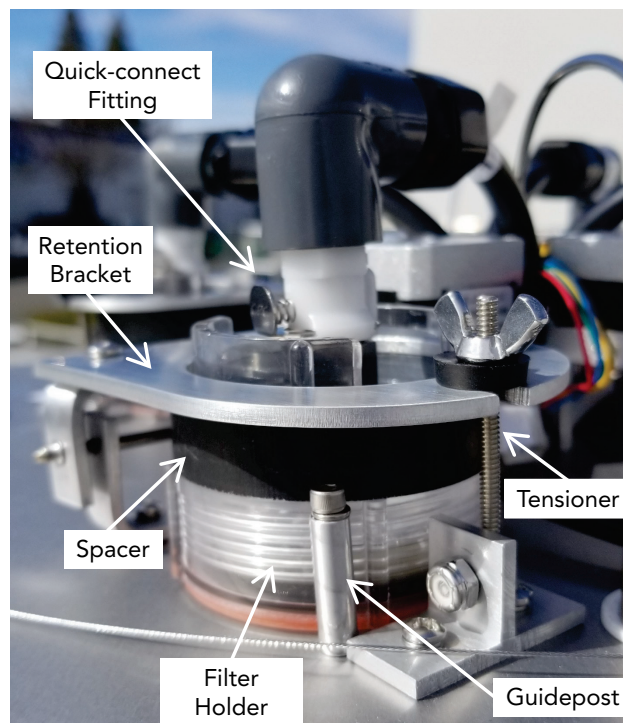


Figure 3. Filter Cassette Holder

4. Remove filter cassette by:
 - a. Removing the black spacer from the back of the filter holder;
 - b. Unscrewing the filter holder base from the cassette support; and
 - c. Once separated the filter cassette can be removed and placed into its transport container. See Figure 4 for reference.

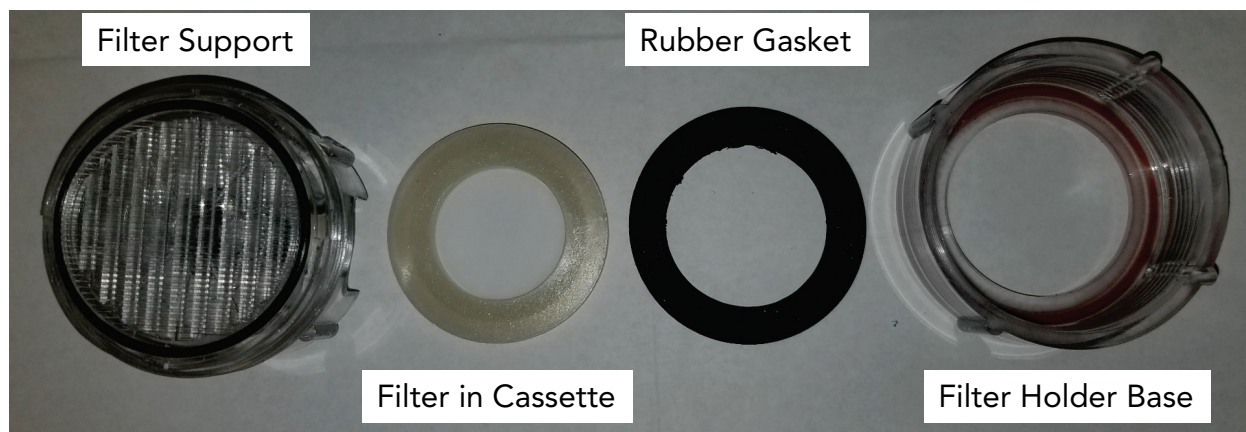


Figure 4. Filter Holder Disassembled

5. Inspect and wipe dirt from support spacers, O-rings, and rubber gaskets with a clean lint-free laboratory wipe.
6. Install a new filter cassette by:
 - a. Ensure the filter support screen is properly oriented. The surface touching the filter/cassette should be reasonably smooth. The side of the support with deep channels should be oriented towards the quick-connect fitting. See Figure 5 for reference. Proper orientation is critical to ensure a uniform particulate deposition pattern on the filter, which is necessary for metals analysis by X-ray Fluorescence (XRF);

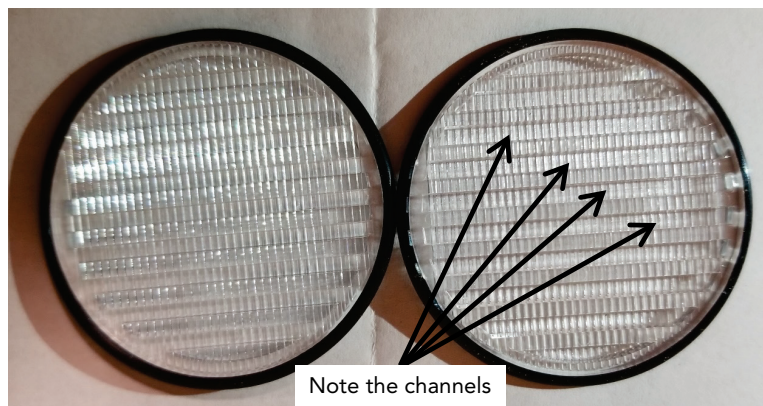


Figure 5. Filter Support Screen

- b. Align the filter cassette between the plastic alignment ridges on the filter support (see Figure 6,A and B);
- c. Place the rubber gasket onto the filter cassette face (Figure 6 C); and
- d. Screw tighten the filter holder base (Figure 6 D). A 50% gasket compression is ideal.

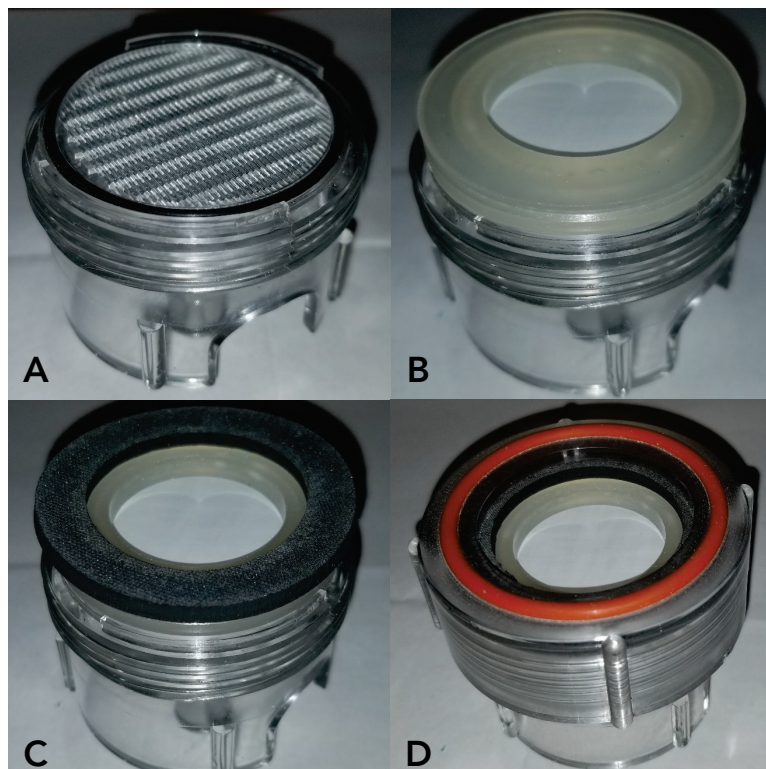


Figure 5. Installation Sequence of Filter Cassette

7. Place the filter holder base onto the sampler head surface in between the guideposts.
8. Place the black spacer onto the filter holder against the filter support.
9. Rotate the retention bracket into position against the spacer.
10. Rotate the tensioner into position to restrain the retention bracket. Tighten the wingnut on the tensioner until the o-ring on the filter base is uniformly compressed against the sampler head surface, and no visible light gaps are observed.
11. Push in the metal tab on the quick disconnect and slide it onto the fitting on the filter holder support.
12. Close sampling head.
13. Set up next media run with the on-board software system using the SOP Tab.

14. Record removal and installation time on COC forms. Sample Cartridges should be loaded in the Sampler no more than five days prior to sampling date. After sampling, samples should be retrieved from the Sampler within 48 hours (or next available business day), placed in an ice cooler, and delivered to the laboratory.

4.1.2 Changing Cartridge substrates

1. At the front of the Control Module, remove carbonyl cartridges (if present) by separating Luer fittings at each end, placing original Luer cap ends onto cartridge, and placing cartridges into original plastic container.
2. Take the new Carbonyl cartridge out of the plastic container, remove Luer caps and place caps back into the plastic container.
3. Insert the Carbonyl cartridge by connecting Luer fitting to each end at front of Control Module. Cartridge orientation should follow the schematic display on Control Module (Figure 2).
4. Set up sample run(s) with the on-board software system using the SOP Tab.
5. Record removal and installation time on COC forms. Provide additional comments as necessary.
6. Sample cartridges should be loaded in Sampler no more than five days prior to sampling date. After sampling, the sample should be retrieved from the Sampler within 48 hours (or next available business day), placed in cooler containing, and delivered to the laboratory for analysis.

4.2 **Canister Handling**

To install and remove canisters follow the steps below:

1. Ensure that the vacuum is maintained in the SUMMA canister. A minimum of 27 in. Hg is needed.
2. Connect 1/8 in sampling tube to 1/4 in connection on canister via adapter fitting. Only use Swagelok ® compression fittings.
3. Set up next sample run with the on-board software system using the SOP Tab. The Sampler will perform a leak test and have the operator open and close the Summa Canister valve. The Sampler will check pressures of canister/sampling system prior to programming the next canister.
4. Record removal and installation time on COC forms.

5. Once sampling is complete, isolate the canister from the sampling system by closing the canister valve.
6. The canister should be filled to approximately 13 psi in 24 hours with a sampling flow rate of 8 ccpm.
7. Remove canister and install the next one.
8. Canisters must be capped using a 1/4 in. plug at the inlet at all times when transporting or not in use to avoid sample contamination. The Sampler intake must also be capped using a 1/4 in. plug when transporting or not in use. Canisters must be transported in appropriate cases to prevent damage.
9. Obtain clean evacuated SUMMA canisters from CARB's Monitoring and Laboratory Division (MLD) or by an accredited laboratory.
10. If the canister has not been used within 2 months from the certification date, it should be returned for re-certification.



Figure 4. Canister Gauge

4.3 Troubleshooting

4.3.1 Frozen control screen

1. Cycle power off
2. Wait 15 seconds
3. Cycle power on.

Note: The time often freezes 15-30 seconds during each process.

4.3.2 Failed leak test

1. Inspect fittings for tightness.
2. Inspect for debris, misalignment, deformed fittings, and/or filter cassette damage.
3. If debris is found, clean surfaces with clean lint-free laboratory wipe.
4. Repeat leak test.

4.3.3 Pressure tolerance error

Viewing sample data to find when error occurred. Refer to item [4.3.2](#).

4.3.4 Flow tolerance error

Viewing sample data to find when error occurred. Refer to item [4.3.2](#).

4.3.5 Sample(s) collection failed to occur

Typically caused by software crash which yields a frozen screen. Refer to item [4.3.1](#).

5 Calibration

5.1 *Quality Control Checks (Each Sample Collection Event)*

- An auto-leak test should be performed prior to all cartridge and canister runs.
- The MFC zero will drift over time. To compensate for this, the sampler software auto zeros the MFC prior to sampling. However, a “zero tolerance” error flag will be displayed whenever the computer needs to zero compensate +/- 1% of the range of the MFC. At this point, ATEC recommends that the MFC zero be mechanically adjusted to eliminate excessive software compensation which may be a cause of an MFC malfunction.

5.2 *Leaks - Quality Control Checks (Monthly)*

- A manual leak check is performed on each filter ports used. There are four filter ports inside the sampling head and only two are used regularly. The other two channels serve as spares. A manual leak check is performed by comparing the flow of a National Institute of Standards and Technology (NIST) traceable flow meter at filter inlet to the mass flow meter reading of the control module. Flows must be within \pm two percent of the set point.

- Check system time. The system clock must be set to Network Time Protocol (NTP) plus or minus two minutes.

5.3 Flow Check and Adjustment (Annual)

- Each mass flow controller should be calibrated on an annual schedule. The mass flow controllers can be calibrated either electronically or manually. Manual calibration consists of adjusting the zero (no flow) and span potentiometers using a reference flow standard. The potentiometers can be accessed on the side of the flow controller housing. Electronic calibration can be performed by inserting the appropriate calibration constants into the advanced portion of the setup screen.
- Flow assessment should be performed with a NIST-traceable mass flow meter (MFM) with certifications within the designated range of the sampler. Perform an “As Is” flow verification and adjust if drift is greater than \pm five percent.

6 Data Retrieval

6.1 Data Collection Methods

- All sample run information will be logged by the on-board software system and can be viewed by selecting the Data Tab. The entire data set can be downloaded to a USB drive inserted into the USB port below the screen. Pressing the Store button will transfer all available data. Once all of the files have been received, a message will appear confirming completion of the transfer.
- Additionally, all past sample runs and hourly channel status information will be logged using the onsite CARBLogger and will be available in real-time via a cellular connection. All field personnel will be tasked with ensuring all communication cables are properly connected and are in good operational condition.

6.2 Data Sampling Frequency

- Sample run data records each 24-hour sample. The stored data includes: filter start time; filter stop time and total sampling volume; average, minimum, and maximum flow rate; error status, and elapsed time.
- If errors occur during sampling, an error code is generated. The error values are:

0 No Errors

16 Flow Rate Tolerance Exceeded
32 Flow Rate Zero Exceeded
64 Power Failure
128 Aborted

6.3 Data Record Example:

tt

Metals 1-3 Started Thursday, September 20, 2018 12:26:00

Flow Rate Set Point 15.00 l/min

Stopped Friday, September 21, 2018 12:26:06

Total Volume 21761.42 liters

Total Sample Time 24.00 hours

Average Flow Rate 15.11 l/min

Minimum Flow Rate 15.11 l/min

Maximum Flow Rate 15.12 l/min

Flow Controller Zero 0.000 l/min

Error Code 0

Error Status OK No Errors

Time	Flow Rate	Volume
Thursday, September 20, 2018 12:26:31	0.49	3.82
Thursday, September 20, 2018 12:31:31	15.11	79.57
Thursday, September 20, 2018 12:36:35	15.11	156.03
Thursday, September 20, 2018 12:41:38	15.11	232.50

Thursday, September 20, 2018 12:46:42	15.11	308.98
Thursday, September 20, 2018 12:51:46	15.11	385.44
Thursday, September 20, 2018 12:56:49	15.11	461.90
Thursday, September 20, 2018 13:01:53	15.11	538.37
Thursday, September 20, 2018 13:06:56	15.11	614.84
Thursday, September 20, 2018 13:12:00	15.11	691.31
Thursday, September 20, 2018 13:17:04	15.11	767.78
Thursday, September 20, 2018 13:22:07	15.11	844.24
Thursday, September 20, 2018 13:27:11	15.11	920.71
Thursday, September 20, 2018 13:32:14	15.11	997.17
Thursday, September 20, 2018 13:37:18	15.11	1073.63
Thursday, September 20, 2018 13:42:22	15.11	1150.09

7 Display and Function Tabs

7.1 Overview

This Sampler has (12) tab functions including; Main, Time/date, Setup, Network, Schedules, Data, Leak Checks, SOP, Manual, Advanced, Summary, CalCurve. These tabs allow the operator to enter or retrieve information from the Sampler. A visual example of the screen display for each respective tab is shown in the following sections.

7.2 Main Tab

The Main tab is the default display. The canister flow rates (cc/min) and pressures (psia) along with the cartridge and filter flow rates (liters/min) and total volumes (liters) are displayed. These values are continuously updated every 5 seconds. One of the following status indicators will also be shown in each status box, depending upon the sampling conditions:

Sampling—The channel is sampling

Waiting—The channel has been programmed to sample

Purging—The channel is purging prior to sampling

Idle—The channel has not been programmed to sample

Aborted—Operator terminated sampling

Finished—A successful sample has been collected without errors

Used Can—Canister starting pressure exceeded used can limit—no sampling occurred

Leak Err—Cartridge failed the leak check on start-up

Post Leak Err—Cartridge failed auto leak check at the end of sampling

Temp Tol—Ozone scrubber temperature exceeded $\pm 5^{\circ}\text{C}$

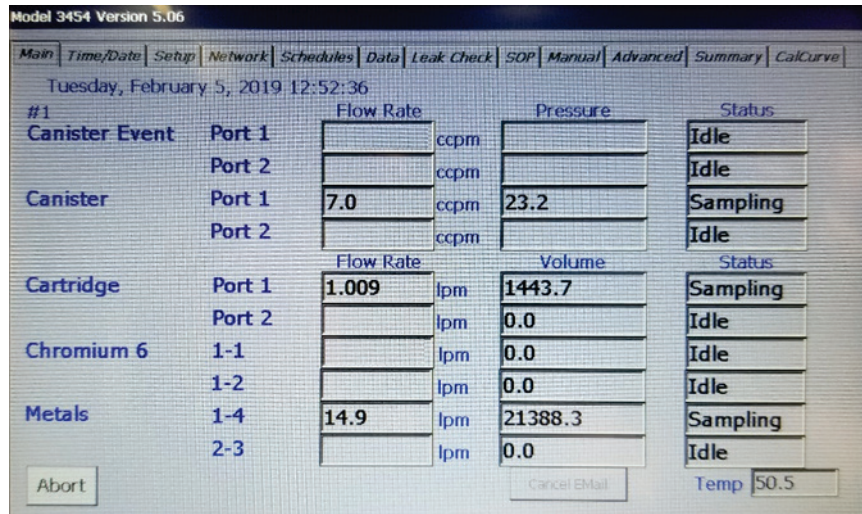
Press Tol—Canister pressure tolerance exceeded

Flow Tol—Cartridge flow rate tolerance exceeded

Zero Tol—Cartridge MFC required excess zero compensation

Errors—Multiple errors, power outage, or sample aborted

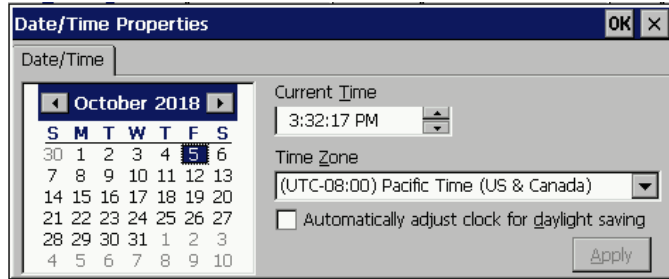
This screen displays current sampling information, as shown below:



The Abort button is used to terminate sampling after sampling has started. Once the Abort button is pressed, the channels that are sampling will be put through shut down process, which may take a moment (~1-2 minutes) to complete. Also, pressing the Abort button will require the operator to enter a new sampling sequence to resume sampling.

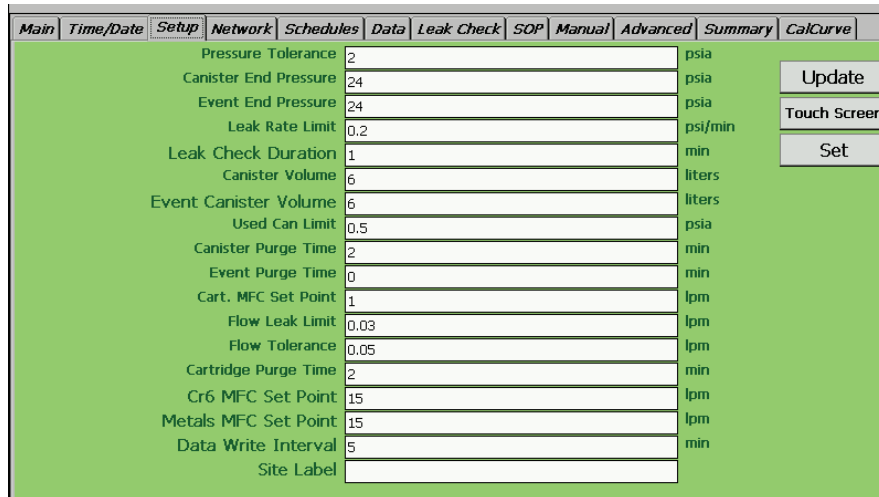
7.3 Time/Date Tab

The time and date can be changed using the Time/Date tab. When this tab is selected, an operating system screen will appear and allow the operator to change time, date, time zone, etc. Once this window is closed, the main screen should display the changed day of the week, date, and time.



7.4 Setup Tab

The Setup tab is used to enter operating parameters. This section is designed to allow field operators to change common operating parameters. When the Setup tab is selected, a screen appears which shows the following operating parameters. This screen also enables recalibration of the touchscreen and the installation of software updates.



7.5 Network Tab

The Network tab is used to transfer Sampler event data files. Files can be retrieved through the Ethernet connection at the back of the Control Module.

The screenshot shows the 'Network' configuration screen. At the top, there is a menu bar with tabs: Main, Time/Date, Setup, Network, Schedules, Data, Leak Check, SOP, Manual, Advanced, Summary, and CalCurve. The 'Network' tab is selected. The main area is titled 'EMail Notification' and contains several input fields and checkboxes. There are checkboxes for 'Require Authentication', 'SSL Connection', 'Sample Summary', and 'Sample Data File'. The 'SSL Connection' checkbox has a note: '(Passwords will be encrypted on this device)'. Below these are buttons for 'Disable Network' and 'Change Local IP'. At the bottom right, there are input fields for 'Remote IP Address' (0.0.0.0) and 'Local IP Address' (192.168.0.54), along with a 'Set' button.

7.6 Schedules Tab

The Schedules tab is used to create sampling schedules. When the Schedules tab is pressed, a screen appears which shows the start date, start time, and duration. The values in each box can be changed by touching the text box and using the keypad or calendar to enter the appropriate values. All times are in 24-hr time format with midnight being 00:00. A 24-hour run starting at midnight would be entered with a start time of 00:00 and a duration of 24:00 hours for the date entered in the “date” box. An identification label (e.g. Filter tt) can also be entered for each channel. This label will appear with the data to identify each sample.

If additional channels are to be used, the Next button must be pressed to display the schedule for another channel. The start date, start time, and duration can be entered. The Done button can be used to return to the main screen. The Prev button will show the previous screen.

The screenshot shows the 'Schedules' configuration screen for 'Cartridge Port 1'. The background is yellow. At the top, there is a menu bar with tabs: Main, Time/Date, Setup, Network, Schedules, Data, Leak Check, SOP, Manual, Advanced, Summary, and CalCurve. The 'Schedules' tab is selected. The main area contains four input fields: 'Start Date' (10/4/2018), 'Start Time' (10:48), 'Duration' (24.00 Hours), and 'Run Label' (tt). At the bottom, there are three buttons: 'Prev', 'Next', and 'Exit'.

7.7 Data Tab

The Data tab is used to display or download data. After sampling has been completed, the Data tab can be pressed to display the Data screen. The stored data includes: sample start time; sample stop time and total volume; average, minimum, and maximum flow rate; error status, and elapsed time.

- If errors occur during sampling, an error code will be generated. The error code is that occurred during the run period. The error values are:
0 No Errors
16 Flow Rate Tolerance Exceeded
32 Flow Rate Zero Exceeded
64 Power Failure
128 Aborted
- The entire data set can be downloaded to a flash drive inserted into the USB port below the screen. Pressing the Store button will transfer all available data to the USB drive. Once all of the files have been transferred, a message will appear confirming completion of the transfer.
- The Next button on the Data screen will advance to the next filter data or Exit can be used to return to the main screen.
- If a power failure occurs during sampling, the Sampler will resume sampling based on the programmed sampling schedule. The sampling schedule and data will not be lost during a power failure. The actual sampling time will be shorter than programmed because of the power loss. Sample data will show a power loss error, and the volume/time data will show the missing sampling interval during the power outage.

Main | Time/Date | Setup | Network | Schedules | Data | Leak Check | SOP | Manual | Advanced | Summary | CalCurve

Cartridge Port 1

Started: 10/4/2018 10:48:05 N/A psia

Stopped: 1/1/0001 0:00:00 N/A psia

Flow: 9367.5 0.86 0.87 lpm
 Avg Min Max

Status: Flow Rate Tolerance

Volume: 1215.6 Liters Elapsed Time: 23.34 Hours

Prev Next Data Files Exit

FileStore

Files to Store:

Store

Start: 10/5 /2018

End Date: 10/5 /2018

Ada

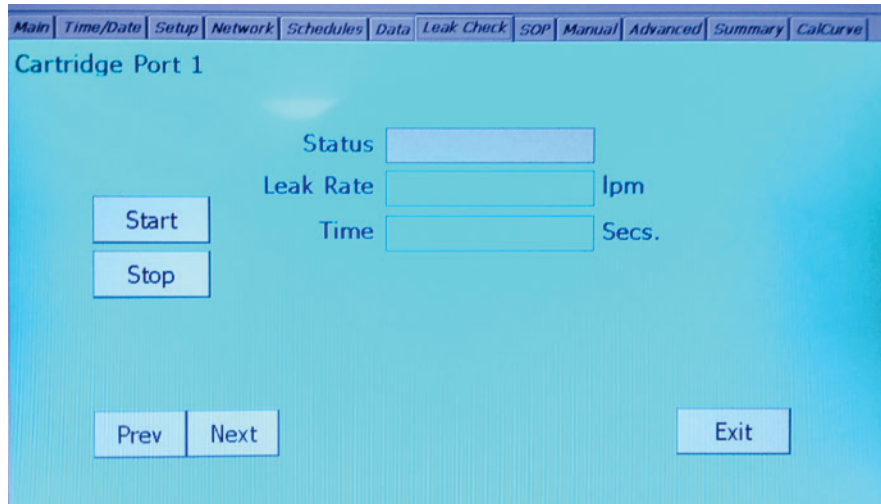
Rem

Exit

Select date range for files to move to USB
Press Add to move files to Store Box
Press Rem to remove files from Store Box
Press Store to move files USB drive

7.8 Leak Test Tab

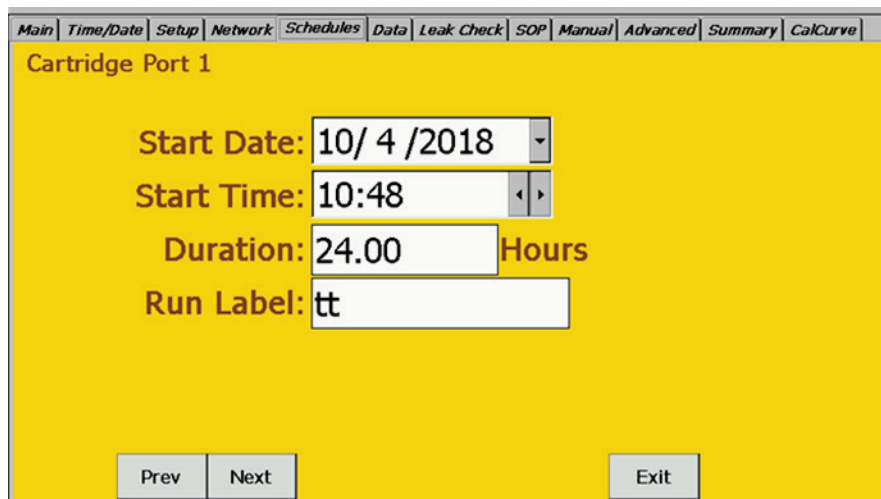
The Leak Test tab is used to start an individual channel and the external pump to detect whether the Sampler has leaks. This tab is not available when unit is performing a run.



7.9 SOP Tab

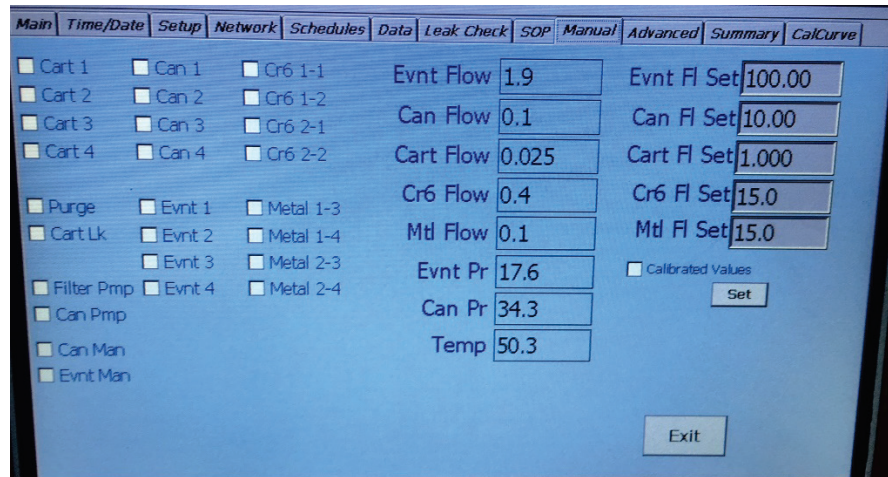
The SOP tab provides an instruction for scheduling each programmed run. The SOP software guides the user through the required procedures.

- Pressing the SOP tab initializes the program. The Back, Next, and Exit buttons are used to advance through the procedure or return to the main screen.
- Initially, the program brings up a screen that requires the user to review the number of filters to be sampled. SOP leads the user through a scheduling procedure to program the sampling times. When scheduling has been completed, the Next button returns the program to the main screen.



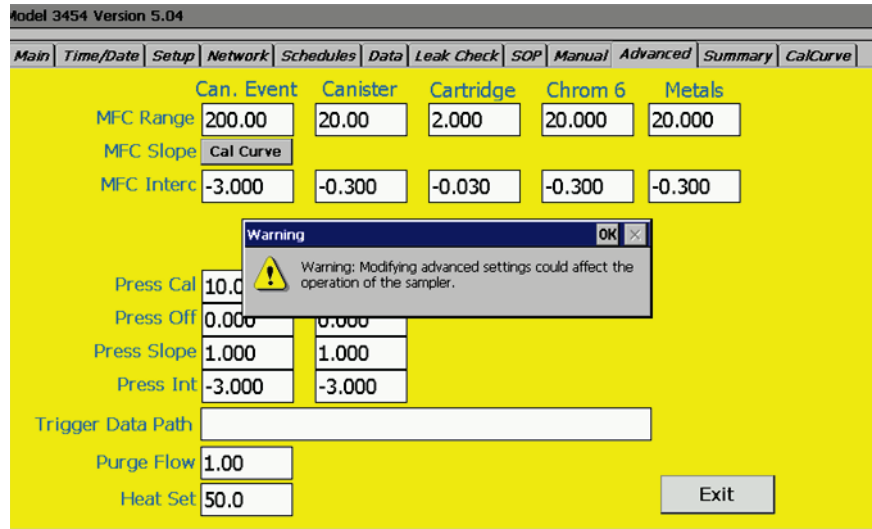
7.10 Manual Tab

The Manual tab is provided to allow the operator to activate any solenoid valve or the pump. This tab is useful in troubleshooting and testing individual components. In addition, the flow set point of each mass flow controller can be individually set. Upon leaving the manual mode screen, all settings revert to the values used in automatic mode. **IMPORTANT:** The flow rates shown in this mode are not adjusted by the calibration constants (slope and intercept) entered in the Advanced tab unless the “Calibrated Values” check box is checked.



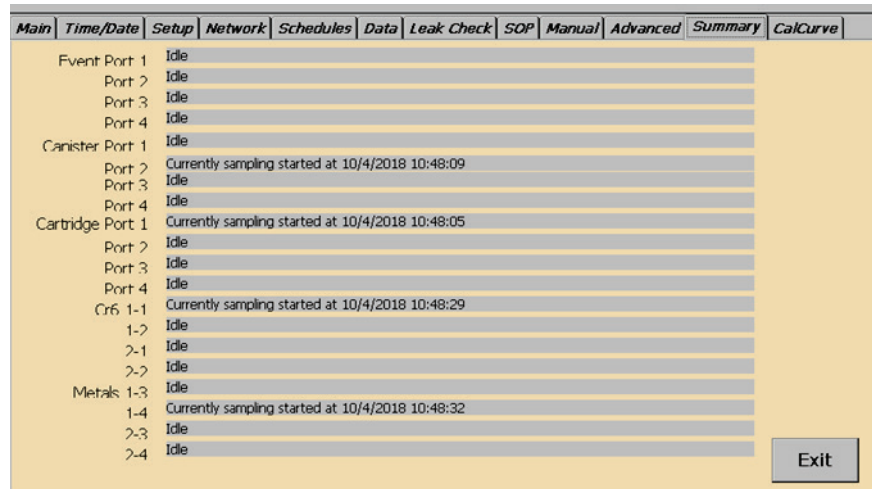
7.11 Advanced Tab

The Advanced tab is used to change values for MFC ranges, slopes and intercepts. It can be used to change values of MFM ranges. Portions of this screen can only be accessed with a password and should only be used by individuals familiar with the operation and calibration of components used. Changing the values in the Advanced tab will alter the accuracy of the sampler. The MFC Cal Curve button is accessible in this tab, or adjusted in the Cal Curve tab (refer to 7.13).



7.12 Summary Tab

The Summary tab displays detailed current and finished sampling information. The main screen displays the following:



7.13 Cal Curve Tab

The Cal Curve tab is used to adjust MFC calibration slopes at (5) different flow increments. This tab can be accessed using Advance tab.

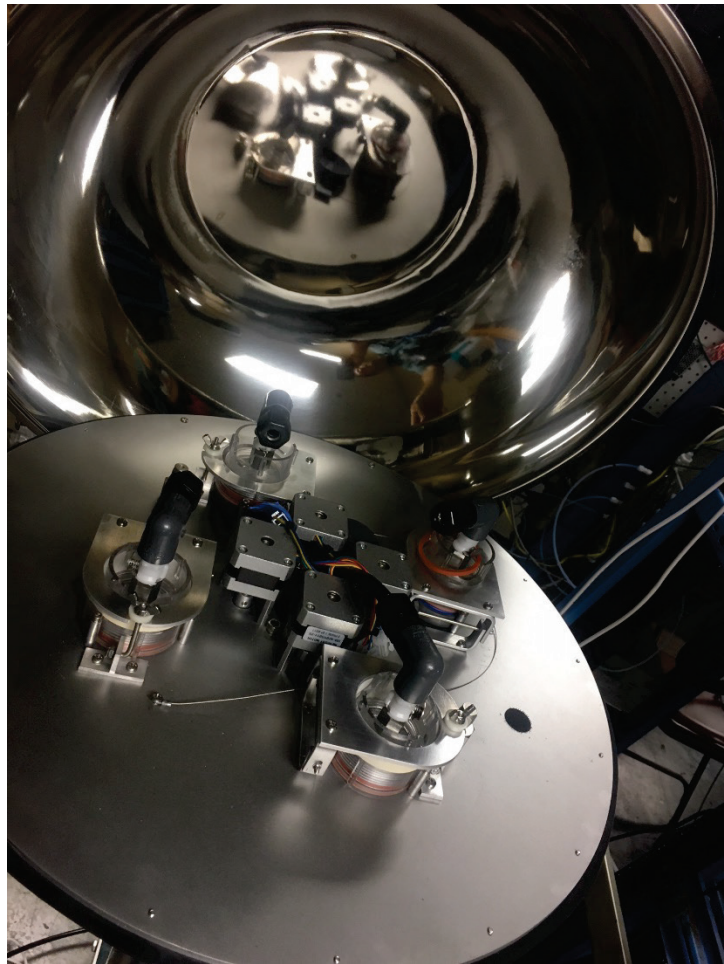
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Appendix A: Sampling Head Information



View from below head assembly



View inside Sampler head assembly