



AIR QUALITY SURVEILLANCE BRANCH

STANDARD OPERATING PROCEDURES

FOR

RM Environmental Systems Inc. (RMESI) 924 TOXICS AIR SAMPLER

AQSB SOP 801

Second Edition

MONITORING AND LABORATORY DIVISION

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1.0 GENERAL INFORMATION

1.1 Introduction:

The purpose of this Standard Operating Procedure (SOP) is to supplement the manufacturer's operator's manual for the RM Environmental Systems Inc. (RMESI) 924 Toxics Air Sampler by documenting procedures that have been implemented by the Air Quality Surveillance Branch (AQSB) of the Air Resources Board. These procedures are designed to formalize installation, configuration and operational procedures for RMESI 924 samplers.

This SOP describes all supplemental information or modifications to the sampler necessary to integrate it into the AQSB's ambient air monitoring network. As this document is supplemental to the operator's manual provided by the manufacturer, the AQSB requires operators to thoroughly review the RMESI 924 operator's manual.

1.2 Principle of Operation:

The RMESI Model 924 Toxic Air Sampler is designed for the unattended collection of ambient air samples on a variety of filter materials and solid sorbent tubes for laboratory analysis of collected compounds. The sampler is modular in design such that four individually controlled sampling channels can be readily installed. AQSB's standard configuration is as follows: channel one (1) is designated for Aldehydes, channel two (2) is designated for Total Metals, and channel three (3) is designated for Hexavalent Chromium (CrVI).

Sampling schedules are entered through the front panel keypad or from a remote computer via built-in modem. A "Reschedule" function allows a sampling schedule to be repeated at a later date without re-entering the schedule information.

System parameters, control settings, schedule, and sampling reports may be displayed on the front panel display or on a remote computer. At the end of the sampling period, a report is automatically printed which includes the calculated volume of air that passed through the sampling device.

The Control Module is the main system assembly. Removable legs elevate the Control Module about 28 inches above ground level. The Pump Box sits below the Control Module on the leg assembly shelves. The sampling inlet height is 2 meters above the mounting surface.

The Sampling Assembly is mast mounted to the rear of the Control Module and provides a weather shielded mounting rack for the Slider Valve Modules. Individual sampling modules provide mounting for the filter and/or tube holders. All electrical and pneumatic connections are made at the rear of the Control Module. When fully assembled with the mast in the raised position, the system has an overall height of about seven feet, requires a four-foot square mounting area and weighs about 180 pounds.

The Pump Box contains the Gast Model 1023 rotary vane vacuum pump and two cooling fans. The pump and fans are controlled by the computer and actuated by a solid state relay (mounted in the Control Module on the distribution assembly). The vacuum pump provides adequate capacity for simultaneous operation of four 30-LPM sampling channels while maintaining a vacuum greater than 25 inch Hg.



Figure 1.1 RMESI 924

1.3 Safety Precautions:

ALWAYS PRACTICE SAFETY FIRST. High voltages (120 volts AC) are used to power the unit. Unplug the sampler whenever possible while working around electrical components. Powering the unit off with the power switch does not remove electricity from the unit. Care should be taken when placing hands inside powered unit. Working outdoors in ambient (wet) weather conditions increases the risk of electrocution.

Rooftop sampling creates a hazard of falling. Care should be taken climbing to and descending from the rooftop platform.

Ensure the sampling platform and support structure can support the weight of the assembled sampler. The Control Module, Sampling Assembly, and Pump Box weighs approximately 180 lbs.

1.4 Interferences/Limitations:

The standard flow rate for Total Metals and CrVI (channels 2 and 3, respectively) is 12 LPM. For stations that experience low flow errors due to significant filter loading during periods of high condensing moisture, it is advisable to set the flows for these channels to 10 LPM.

2.0 INSTALLATION PROCEDURE

2.1 Physical Inspection:

Inspect equipment and accessories for completeness and check for any shipping damage upon receipt of a RMESI 924 sampler. If equipment is missing or damage is found, immediately notify your supervisor and/or your agency's shipping department.

2.2 Tools Required for Installation :

#3 Phillips Screwdriver
9/16" Open-End Wrench
11/16" Open-End Wrench
1" Open-End Wrench

2.3 Siting:

Siting of the RMESI 924 will be dictated by the type of ambient monitoring to be accomplished. In general, siting should conform to the PM_{2.5} siting guidelines stated in Title 40 Code of Regulations part 58, Appendix A, paragraph 3.5.2.2 and part 58, Appendix E, paragraph 8.

Ensure the sampler inlet is in an area of unobstructed airflow and has at least 2 meters separation from any rooftop obstructions. For other samplers, the sampler inlets shall be at least 2 meter apart (samplers with flow rates less than 200 liter per minute shall not be closer than 1 meter), and collocated samplers shall be no more than 4 meters apart.

3.0 CONFIGURATION

3.1 Introduction:

This section details the steps required for pre-sampling configuration, programming a sample run and using the reschedule menu.

Some samplers may arrive configured differently from AQSB's standard configuration detailed in section 1.2 of this SOP. If so, rearrange the mass flow controller (MFC) modules so that the 2 lpm MFC module is in channel one (1) and channels two (2) and three (3) have 30 lpm MFC modules in the Control Module.

3.2 Pre-Sampling Configuration:

1. Turn on the front panel power switch. The display will flash the manufacturer's name, equipment model number and the system ROM version number.
2. Press **SELECT**, the date will be underlined. If the date is correct as shown, press \Rightarrow , otherwise press **SELECT**, the date will begin flashing. Enter the correct date (MM/DD/YY), then press **EXIT**.
3. The time will be underlined. If the time is correct as shown, press \Rightarrow , otherwise press **SELECT**. The time will begin flashing. Enter the correct time (hh:mm) then press **EXIT**. (ARB policy is to use Pacific Standard Time)
4. **RESET TO DEFAULT? N** (Normally **No** would be the correct response. A **Yes** response will clear and reset all schedules and functions to their default value). To reset, press **SELECT**, the '**N**' will begin flashing. Press \Rightarrow to change the '**N**' to a '**Y**', then press **EXIT**.
5. **CONTROL ID XXXXXXXX**. This is the AIRS station number that will be printed on the reports. If it is correct, press \Rightarrow . If not then press **SELECT**, the number will begin flashing. Enter the correct number and press **EXIT**.

Note: Since the AIRS station number is a nine digit number, truncate the first digit and enter the remaining 8 digits. The first two digits represent the state number and are "06" for California.

6. **PRINT FULL RPT? N** (This causes a report of all settings, schedule and completed runs to be printed.) If you don't want a full report printed, press \Rightarrow . Otherwise, press **SELECT**, the '**N**' will begin flashing. Press \Rightarrow to change the '**N**' to '**Y**', then press **EXIT**.

7. **PRINT CTRL RPT? N** (This causes a report of just the settings and schedule to be printed.) If you don't want a control report printed, press ⇨. Otherwise, press **SELECT**, the '**N**' will begin flashing. Press ⇨ to change the '**N**' to '**Y**', then press **EXIT**.

3.3 Programming Sample Run:

1. If the system is off, turn on the front panel power switch. The display will flash the manufacturer's name, equipment model number and the system ROM version number.
2. Verify that the DATE, TIME, CONTROL ID and the CALIBRATE menu information is correct. Check the CALIBRATE menu by pressing ⇨ until the Calibrate screen is selected. Press **SELECT**. Continue to press ⇨ while verifying MFC range, slope (s), and intercept (I) against most recent calibration report. If any calibration information different, press ⇨ to select incorrect information. Press **SELECT**, enter correct calibration information, then press **EXIT**. Press **EXIT** to leave the CALIBRATE menu.
3. Press ⇨ until the SCHEDULE menu is displayed. Press **SELECT** to select the channel number. (Aldehydes – Ch1, Total Metals – Ch2, CRVI – Ch3) Press **SELECT** again and the channel number will begin to flash. Enter the channel number you wish to program, then press **EXIT**. Each channel to be run must be programmed separately.
4. Press **SELECT** and the START DATE will begin to flash. Enter the start date and press **EXIT**.
5. Press **SELECT** and the START TIME will begin to flash. Enter the start time and press **EXIT**.
6. Press **SELECT** and the DURATION will begin to flash. Enter the DURATION (1 min to 24 hrs.) and press **EXIT**. (Typically 24 hrs.)
7. Press **SELECT** and the FILTER ID (Tracking number for the sample being collected, max eight digits) number will begin to flash. Enter the FILTER ID number and press **EXIT**. (Total Metals and Aldehydes filters are shipped with tracking numbers on the containers. CRVI is not.)
8. Press **SELECT** and CLEAR E-TIME and Avg./Total Flow is displayed. This data is normally cleared in the Elapsed Time Menu after the printout from the last run has been verified and the data recorded on the Monthly Quality Control Maintenance Check Sheet (see appendix A).

9. Press **SELECT** and the GROUP number (This number is used with the re-schedule menu to combine multiple channels into one group for simultaneous scheduling) will begin to flash. Press **EXIT** to accept the default, GROUP 1.
10. After the Group number is specified, the display returns to the beginning of the SCHEDULE Menu for the next channel.
11. Press **EXIT** to leave the SCHEDULE menu. Press ⇐ until you come to the FLOW menu.
12. Press **SELECT**. Press ⇒ until the channel you wish to program is underlined. Press **SELECT** and the channel flow will begin to flash. Enter the desired flow and press **EXIT**. Repeat until all flows have been entered, press **EXIT** to leave the FLOW menu.
13. At the Main menu, repeat step 2-7 of Section 3.2 of this SOP. Print the **CTRL RPT** on step 7 and verify that the next scheduled run date, time, and flow rates are correct. Press **EXIT** until no underlined or flashing sections are present
14. Install sample cartridge and filters in accordance with section 4.1 of this SOP.

3.4 Reschedule Menu:

Once the SCHEDULE and FLOW Menus have been set and a run completed, the RESCHEDULE Menu can be used to set up the next run.

1. Press ⇒ until RE-SCHEDULE appears on the display.
2. Press ⇐ until DAYS LATER is underlined, then press **SELECT**. GROUP number will appear.
3. Press **SELECT**. Group Number will flash.
4. Press ⇒ until GROUP Number 1 is displayed. Press **EXIT**.
5. Press ⇒ until the number for DAYS LATER is underlined.
6. Press **SELECT**. The number will flash. Enter 12. Press **EXIT**. N will be underlined for GO.
7. Press **SELECT**. The N will flash. Press ⇒ until Y is displayed. Press **EXIT**.
8. Enter the filter ID for channel 1. Press **EXIT**.

9. CLEAR E-TIME and Avg./Total Flow is displayed. If the data from the previous run has been deleted, press **EXIT**. Otherwise, ⇨ to the N, press **SELECT**, ⇨ to Y and press **EXIT**.
10. Enter the filter ID for the remaining channels. Press **EXIT** to leave the RE-SCHEDULE menu.
11. At the Main menu, repeat step 2-7 of Section 3.2 of this SOP. Print the **CTRL RPT** on step 7 and verify that the next scheduled run date, time, and flow rates are correct. Press **EXIT** until no underlined or flashing sections are present.
12. Install sample cartridge and filters in accordance with section 4.1 of this SOP.

4.0 SAMPLE HANDLING AND PREPARATION

4.1 Introduction:

Sample media for toxics sampling is prepared and shipped to AQSB ambient air monitoring stations by the ARB's Monitoring and Laboratory Division's Inorganics Laboratory. The filter media and sorbent tubes should be kept in their shipping containers until ready for use.

Prior to sampling, station operators should complete the required entries on the 24-Hour Field Sample Report (see Appendix C). Include the site name, site AIRS number, technician name, agency, filter and sorbent tube ID#, scheduled sampling date and sampler property number. Take the filter, 24-Hour Field Sample Report, and Monthly Quality Control Maintenance Check Sheet to the field sampling location.

4.2 Filter/Cartridge Handling:

A. Changing Filter Samples

1. Push in on the metal tab of the quick disconnect of the channel to be changed and pull down.
2. Unscrew the bottom of the filter holder being careful not to drop the filter, if one is installed.
3. If present, remove the used filter cassette and place it in its proper shipping container for return to the lab.
4. Wipe all dirt from the support screen, o-ring, faceplate and rubber gasket.
5. Be sure o-ring and support screen (fine grid side up) are in place and undamaged.
6. Remove the new filter cassette from its shipping container and place it on the o-ring making sure that it is seated properly with the cassette placed so that the filter is next to the support screen.
7. Ensure that the rubber gasket is in place on top of the cassette and screw it into the holder. Do not over tighten as a torn filter may result.
8. Push in the metal tab on the quick disconnect and slide it onto the filter holder.
9. Record the filter number on the filter box or shipment envelope and toxics log sheet.

B. Changing Aldehyde Cartridge Samples

1. Push in the metal tab on the quick disconnect tube fitting and pull down.
2. Unscrew the bottom of the filter holder being careful not to drop the filter, if one is installed.
3. If present, remove the used filter cassette and place it in it's proper shipping container for return to the lab.
4. Unscrew two halves of cartridge holder.
5. Remove used Aldehyde cartridge if present, cap the ends with the yellow caps provided and place in the plastic container for shipment to lab.
6. Wipe all dirt from the support screen, o-ring, faceplate and rubber gasket.
7. Remove new Aldehyde cartridge from the plastic container, remove yellow caps and place yellow caps back into the plastic container.
8. Insert Aldehyde cartridge into the bottom half of cartridge holder and place rubber gasket over top end of cartridge.

Note: Use of the older-type cartridge holder (from Xontech 920) is permitted with slight modifications. Do not use rubber gasket for this type of setup. Also, a different size male quick disconnect nipple is required to mate with RMESI 924 fitting.

9. Screw two halves of cartridge holder together until snug.
10. Remove the new filter cassette from it's numbered container and place it on the o-ring making sure that it is seated properly with the cassette placed so that the filter is next to the support screen.
11. Ensure that the rubber gasket is in place on top of the cassette and screw it into the holder. Do not over tighten as a torn filter may result.

12. Push in the metal tab on the quick disconnect and slide it onto the filter holder.

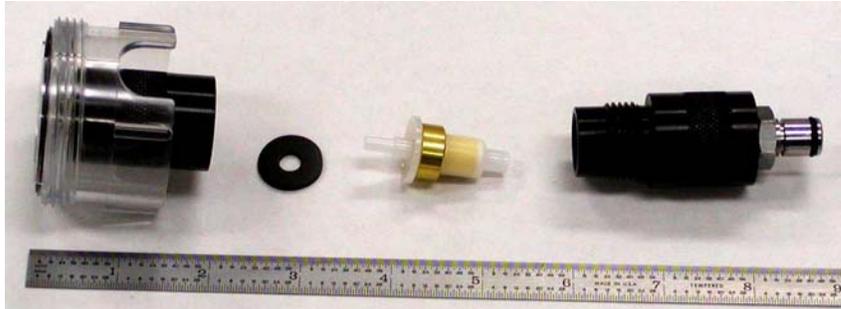


Figure 4.1 Aldehyde Cartridge Holder Assembly

5.0 DATA RETREVIAl

5.1 Introduction:

This section of the SOP covers the data retrieval procedures for the RMESI 924 sampler. This includes QC criteria for sample invalidation and shipping methods.

5.2 General Information:

Field personnel have the primary responsibility for retrieving and recording the sample run information and forwarding this information to the appropriate MLD laboratory. Sampling information is recorded on sample printout and will accompany the sampled media to the laboratory (see figure 5-1 below).

```
STATION ID      #      35305
CH 1, FILTER   #         5
START 13:45,   04/22/03
STOP 13:55,    04/22/03
DURATION                0:11
START FLOW           0.702 Lpm
END FLOW              0.695 Lpm
AVERAGE FLOW        0.701 Lpm
TOTAL VOLUME         8 L
FE 0:00,           PF 8:08
```

Figure 5.1
Sample Run Printout

5.3 Quality Control Criteria for Filter Samples:

Quality control invalidation criteria for filter samples collected by the RMESI Model 924 Toxics Air Sampler are listed below. All samples collected in the field are to be checked using these criteria. If the sample does not meet these criteria, the sample is invalid. The sample filter and RMESI 924 printout should be sent to the laboratory with a clear, concise explanation of the invalidation. A make-up sample should be collected on the next PM₁₀/SSI sampling date if possible, but no later than the next scheduled Model 924 sampling date.

1. Filter Contamination – Filters or sorbent tubes which are dropped or become contaminated with any foreign matter (i.e. dirt, finger marks, ink, liquids, etc.) are invalid.
2. Damaged or Torn Sample Media – Filters or sorbent tubes with tears, pinholes or damage which occurred before, during or after sampling are invalid.

3. Sample Flow Rate

- a. If average flow rate, as printed on the RMESI 924 printout is less than 9.0 LPM for channels 2 or 3, or .600 LPM for the channel 1, the sample is invalid.
- b. If average flow rate, as printed on the RMESI 924 printout, exceeds 14.0 LPM for channels 2 or 3, or .800 LPM for the channel 1, the sample is invalid.
- c. If start and stop flow rates, as printed on the RMESI 924 printout, differ by more than 10%, the sample is invalid.
- d. If the total time of the sample, as printed on the RMESI 924 printout, is less than 1380 minutes or greater than 1500 minutes, the sample is invalid.
- e. If the sample start time, as printed on the RMESI 924 printout, begins before 23:30 or ends after 00:30, the sample is invalid

5.4 Shipping Sample Media to Laboratory:

1. In the Control Module, advance the printer paper with the paper feed switch. Remove the automatic printout for the specific sample. Check the printout for start and stop times, start, stop and average flow rates, volume and power failures.
2. Package the printout with the sample media in the proper mailer. Complete the Laboratory Toxics Data Sheet. Include site name, operator name, type of sample, type of analysis, air sampler ID and date shipped. Ship media to the laboratory.
3. If the sample is invalid for any reason, then the run should be repeated on the next scheduled one-in-six sampling day, if practical.
4. Login the appropriate data onto the Sampling Log for Toxics. This log sheet is to be returned to the AQSB section manager in your area on a monthly basis.

6.0 CALIBRATION INFORMATION

6.1 Introduction:

This section of the SOP covers the calibration procedures for the RMESI 924 sampler. This section is intended to detail AQSB's calibration procedure and does not significantly deviate from the manufacturers operating manual. Read the procedures outlined in this document and examine the user's manual before attempting to calibrate a 924 sampler.

6.2 Overview:

Calibration of the sampler's mass flow controllers is necessary to establish flow rate traceability of the field measurement to a primary standard via a flowrate transfer standard.

There are three CALIBRATE MENU items for each channel which control the MFC's operation:

'F' is the full scale value of the MFC installed for the channel.

'S' is the slope for that channel.

'I' is the intercept for that channel.

The MFC's should first undergo a three (3) data point "As Is" flow verification. A five (5) data point MFC calibration must be performed if the results of the "As Is" flow verification shows any point greater than 5.0% from true flow. A MFC calibration is performed in the RAW mode (or in the CORRECTED mode with the channel slope and intercept set to 1.000 and 0.000, respectively) and provides a calibration slope and intercept for the MFC's. A follow-up 3 data point "Final" flow verification will be performed after the MFC calibration to ensure that the MFC's are within specifications.

Section 8.0 of this SOP outlines the procedure for an "As Is" and "Final" flow verification. The two procedures are identical; and for the purposes of step 8.0 alone, the two are simply called a flow verification. Section 7.0 of this SOP outlines the procedure for a MFC calibration.

The flow calibration and both types of flow verifications on channels 2 and 3 are performed without filter cartridges or media installed; a filter cartridge is used for channel 1. Currently, there is not an adapter available to allow the filter cartridges or media to be installed during a calibration or verification procedures.

In accordance with Appendix A of RMESI's Operation Manual, the number of channels operating during the calibration should be the same number operating during sample collection. Therefore, channels 1, 2, and 3 should be in operation simultaneously during both verification procedures and the calibration procedure.

The selection of the upper and lower data points on the “As Is” flow verification, “MFC Calibration”, and “Final” flow verification should encompass all requirements of step 3 of section 5.3 of this SOP. It is not necessary that they be equal in magnitude from the set point, they should be equal in magnitude from each other. This will ensure that the resultant calibration information does not bias flow rates towards the upper or lower data points selected.

Set Point	Channel 1 (Aldehydes)	Channels 2 and 3 (Total Metals and CrVI)
SP 1	.600 LPM (low flow rate criteria, Section 5.3)	9.0 LPM (low flow rate criteria, Section 5.3)
SP 2	.700 LPM	12.0 LPM
SP 3	.800 LPM (high flow rate criteria, Section 5.3)	15.0 LPM (encompasses high flow rate criteria, Section 5.3)

Figure 6.1 “As Is” and “Final” Flow Verification set points

Set Point	Channel 1 (Aldehydes)	Channels 2 and 3 (Total Metals and CrVI)
SP 1	.600 LPM (low flow rate criteria, Section 5.3)	9.0 LPM (low flow rate criteria, Section 5.3)
SP 2	.650 LPM	10.5 LPM
SP 3	.700 LPM	12.0 LPM
SP 4	.750 LPM	13.5 LPM
SP 5	.800 LPM (high flow rate criteria, Section 5.3)	15.0 LPM (encompasses high flow rate criteria, Section 5.3)

Figure 6.2 MFC Flow Calibration set points

6.3 Calibration Apparatus for RMESI 924:

A certified Flow Transfer Standard (3 lpm and 30 lpm)
Calibration Adapter
RMESI 924 Operators Manual
Calibration worksheet
Laptop PC
Basic set of tools

7.0 MFC CALIBRATION PROCEDURE

7.1 Introduction:

The RMESI 924 sampler requires calibration of the MFC's using a flow transfer standard that has been certified against a primary flow standard. The certification of the transfer standard is referenced to 25C and 760 mm Hg. The RMESI 924 is calibrated to standard flow conditions; the calibration does not need to be corrected for altitude or temperature.

In accordance with Appendix A of RMESI's 924 Operation Manual, the number of channels operating during the calibration should be the same number operating during sample collection. Therefore, channels 1, 2, and 3 should be in operation simultaneously during the calibration procedure.

This calibration should be performed only after an "As Is" flow verification shows that one of the MFC's exceed the flow criteria of $\pm 5.0\%$ from true flow.

7.2 Procedure:

1. Press \Rightarrow to the CHn CORRECTED LPM display (where n is the channel number being calibrated). Press **SELECT**. Press **SELECT** again and change to RAW mode. Press **EXIT**.

To perform the calibration in the CORRECTED mode, press **EXIT** twice. Press \Rightarrow to CALIBRATE menu. Press **SELECT**. Press \Rightarrow to select MFC channel being calibrated. Press **SELECT**. Press \Rightarrow until S (slope) value underlined. Press **SELECT**. Enter slope value of **1.000**. Press **EXIT**. Press \Rightarrow to select I (intercept), press **SELECT**. Enter intercept value of **0.000**. Press **EXIT** twice. Press \Rightarrow to MANUAL RUN menu. Ensure channels 1, 2, and 3 are set to MAN. Press \Rightarrow to CHn CORRECTED LPM display (where n is the channel number being calibrated).

2. Press \Rightarrow to select SET point. Press **SELECT**. Enter the first set point for the channel being calibrated and press **EXIT** (see figure 6.2). Allow the reading to stabilize. Enter flow rate from RMESI 924 display and transfer standard display into Calibration page of the calibration worksheet.
3. Repeat step 2 for the remaining four set points.

4. Press **EXIT** to Main menu. Press \Rightarrow to CALIBRATE menu. Press **SELECT**. Press \Rightarrow to select MFC channel being calibrated. Press **SELECT**. Press \Rightarrow until S (slope) value underlined. Press **SELECT**. Enter slope value calculated from Calibration worksheet. Press **EXIT**. Repeat with I (intercept) value from spreadsheet.
5. Perform "Final" flow verification procedure as described in section 8.2 of this SOP.

8.0 MULTIPOINT FLOW VERIFICATION PROCEDURE

8.1 Introduction:

An “As Is” flow verification is required to be performed biannually. A “Final” flow verification is required every time a multi-point calibration (outlined in section 7.0) is performed. The two verifications are identical and hence will be referred to simply as verification. The verification compares the standard flow rate calculated from the flow transfer standard with the flow rate display of the RMESI 924. At each set point in the verification, the flow rate of the RMESI 924 must be within 5.0% of true flow as measured by flow transfer standard.

In accordance with Appendix A of RMESI’s Operation Manual, the number of channels operating during the verification should be the same number operating during sample collection. Therefore, channels 1, 2, and 3 should be in operation simultaneously during both verification procedures.

8.2 Procedures:

1. Remove sample line from filter holder base on channel being verified.
2. Remove filter holder base from assembly ring of the channel being verified.
3. On control panel, press ⇨ to the CALIBRATE menu.
4. Press **SELECT**. CHANNEL NUMBER will be underlined. Press **SELECT** to change channel number. Channel number will begin flashing. Enter channel number to be verified. Press **EXIT**.
5. The FULL SCALE value for the channel chosen will be displayed. If the value is correct, press **EXIT**, otherwise press **SELECT**. The full scale value will begin to flash. Enter the correct value (from ID plate on the mass flow controller) for the displayed channel.
6. Press ⇨ to the MANUAL RUN menu. Press **SELECT**. Press ⇨ to the channel 1. Press **SELECT**. OFF will begin to flash. Press ⇨ to MAN. Press **EXIT** (The pump should come on). Repeat for channels 2 and 3 (all channels normally operating during a scheduled sample run should be operating during the verification procedure).
7. Press ⇨ to the CH n Corrected LPM display (where n is the channel number being verified). Press **SELECT**. Press ⇨ to select SET point. Press **SELECT**. Enter the desired flow rate for the channel being verified (see figure 6.1). Press **Exit**.

8. Install calibration adapter into filter holder and re-assemble filter holder. Connect ¼” tube from calibration adapter to flow transfer standard. If verifying channel 1, ensure a filter cartridge is installed per Section 4.1 part B of this SOP.

NOTE: Do not connect or disconnect electrical cable from slider valve assembly with power applied, as this will damage the RMESI Model 924 computer board. As a safety feature, the slider-actuating cam is attached to the shaft of the slider motor with nylon tipped set screw. The set screw will shear off in the event that an obstruction (such as a finger or the flow adapter) becomes lodged between the slider and the inlet port. To prevent this from happening, remove the set screw from the top of the slider valve assembly and manually open (slide) the cover plate. Mark the correct screw hole with a pen on the slider actuator cam to ensure proper reinstallation after all test are performed.

9. Enter flow rate from RMESI 924 display and transfer standard display into the appropriate Calibration page of the calibration worksheet. Repeat step 2 for the remaining two set points.
10. Install cap adapter to the inlet port on the flow transfer standard to perform leak check. Record flow rate on calibration sheet. Alternately, perform leak check by removing ¼” tube from flow adapter and install cap adapter.

Note: Leak check results should show displayed flow less than 0.04 LPM for channel 1 and 0.6 LPM for channels 2 and 3. If leak present, repeat section 8.2 of this SOP once leak is repaired.

11. Slowly remove cap from adapter to vent vacuum that built up during leak check.
12. Compare each targeted and indicated flow rate on control panel with corrected flow rate from the transfer standard. Each deviation must be less than $\pm 5.0\%$ from true. If the flow rate criteria are met for each set point, complete the rest of this section, then repeat this entire section for next MFC to be verified. If the flow rate criteria are not met, the multi-point calibration outlined in Section 7.0 must be performed. If Section 7.0 already performed, commence troubleshooting for possible leaks or MFC replacement.

Deviation in percent equals the Flow rate as read on the RMESI 924 display minus the flow rate as read on the Flow Transfer Standard display divided by the flow rate as read on the Flow Transfer Standard display times 100.

$$\% \text{Deviation} = \frac{Q_{\text{observed}} - Q_{\text{actual}}}{Q_{\text{actual}}} * 100$$

13. Remove calibration adapter from filter holder.

14. Press **EXIT**. Press the MANUAL RUN menu. Press ⇨ to channel 1. Press **SELECT**. Press to **OFF**. Press **EXIT**. Repeat for channels 2 and 3.
15. Replace filter holder into slider valve assembly. Replace slider valve cover and set screw if removed in step 11.

9.0 LEAK CHECK PROCEDURE

9.1 Leak Check:

Use this procedure for the Quarterly leak check.

1. Press \Rightarrow to the MANUAL RUN menu. Press **SELECT**. Press \Rightarrow to the channel 1. Press **SELECT**. OFF will begin to flash. Press \Rightarrow to MAN. Press **EXIT** (The pump should come on).
2. Press \Rightarrow to the CH n Corrected LPM display (where n is the channel number being verified).
3. Remove sample line from filter holder base on channel being checked.
4. Remove filter holder base from assembly ring of the channel being checked.
5. Install calibration adapter into filter holder and re-assemble filter holder.
6. Cap Adapter.
7. Note flow rate on RMESI 924 readout. (Must be less than 2% of Full Scale)

 $2\% \text{ of } 30 \text{ LPM} = .6 \text{ LPM}$
 $2\% \text{ of } 2 \text{ LPM} = .04 \text{ LPM or } 40 \text{ CCM}$
8. Remove calibration adapter from filter holder.
9. Press \Rightarrow to the MANUAL RUN menu. Press **SELECT**. Press \Rightarrow to the channel 1. Press **SELECT**. MAN will begin to flash. Press \Rightarrow to OFF. Press **EXIT** (The pump turn off).
10. Replace filter holder into slider valve assembly.
11. Repeat procedure for channels 2 and 3.

10.0 ROUTINE SERVICE CHECKS

10.1 General Information:

Perform the following routine service checks using the attached schedule and the procedures documented below. Checks may be performed more frequently but should be performed no less than the prescribed intervals. The Model 924 Quality Control Check Sheet should be completed when the samples are changed and forwarded monthly to the appropriate Air Monitoring Section.

10.2 Each Run:

1. Record sample data from printout.
2. Check o-rings and gaskets for placement, resiliency and damage.
3. Inspect the printer paper to ensure that enough paper remains on the roll to print the reports. Inspect printer output. Replace printer ribbon if print is not clear and distinct.

10.3 Monthly Checks:

1. Check system time. The system clock must be set to Pacific Standard Time (PST) plus or minus 2 minutes.
2. Check pressure on vacuum manifold. Vacuum should be greater than 25 in/Hg.
3. Inspect tubing and power cords for loose connections, kinks, cracks or other defects. Repair or replace parts as necessary.

10.4 Quarterly Checks:

1. Clean Control Box Filter.
2. Clean Inside Control and Pump Boxes.
3. Clean Control and Pump Box Exteriors.
4. Perform Leak test on each sampling channel.

10.5 Semiannual Checks:

1. Perform an “As Is” flow verification of the operating channels.
2. Change pump intake and exhaust filters.
3. Check Clock and Memory Battery.

10.6 Annual Checks:

1. Replace Pump Vanes.

11.0 MAINTENANCE PROCEDURES

The following table lists the required preventive maintenance tasks and the cycle time for each task (Per RM Environmental Systems Inc. Model 924 Toxic Air Sampler Operation Manual Dated October, 2002).

11.1 Preventive Maintenance Schedule

Maintenance Task	PM Cycle	Operation Manual Reference Section	Page
Change Printer Paper	as required	9.2	37
Change Printer Ribbon	as required	9.3	38
Clean Control Box Filter	3 months	9.4	38
Check Clock & Memory Battery	6 months	9.5	39
Clean Pump Exhaust Filter	500 hrs	9.6	39
Replace Pump Vanes	1000 hrs	9.7	39
Clean Control & Pump Boxes	3 months	9.8	40
Clean Inside Pump Box	3 months	9.8.1	40
Clean Inside Control Box	3 months	9.8.2	40
Check Mass Flow Controllers	6 months	6.2	25

Figure 11.1 Preventative Maintenance Schedule Table

Appendix A

AQSB MONTHLY QUALITY CONTROL MAINTENANCE CHECK SHEET 801 CALIFORNIA AIR RESOURCES BOARD MONTHLY QUALITY MAINTENANCE CHECK SHEET RMESI 924 TOXICS SAMPLER

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

	Sample Date	Sample Number	TIME (PST)			FLOW (LPM)			Volume (L)
			Start	Stop	Total	Start	Stop	Avg.	
Aldehydes									
Total Metal									
Cr+6									

	Sample Date	Sample Number	TIME (PST)			FLOW (LPM)			Volume (L)
			Start	Stop	Total	Start	Stop	Avg.	
Aldehydes									
Total Metal									
Cr+6									

	Sample Date	Sample Number	TIME (PST)			FLOW (LPM)			Volume (L)
			Start	Stop	Total	Start	Stop	Avg.	
Aldehydes									
Total Metal									
Cr+6									

OPERATOR INSTRUCTIONS:

1. Each Run: Check and record sampling information.
 Inspect printer paper and ribbon.
 Check rings and gaskets.
2. Monthly: Check system time, reset if time off by +/- 2 minutes (PST).
 Check pressure on vacuum manifolds. Vacuum should be greater than 25 in.
 Inspect tubing and power cords for cracks, loose connections or other defects.
4. Quarterly: Clean control assembly fan filter, pump assembly, inside control assembly and exterior.
 Perform leak test on each sampling channel. Date performed: _____
5. Semi-Annual: Calibrate mass flow meters. Date last calibrated: _____

Date	Comments or Maintenance Performed:

Reviewed by: _____ Date: _____

Appendix B

AQSB RMESI 924 TOXICS SAMPLER CALIBRATION REPORT

ARB Calibration Report for RMESI 924 - As Is Flow Verification

Flow Verification Report:

ID Information:

Station Name: San Francisco	Make: RMESI	Calibration Type: As Is
Site #: 90-306	Model #: 924	Calibration Date: 05/24/06
Station Address: 10 Arkansas St.	Property #: 20021010	Prev. Cal. Date: NA
	Firmware Rev. #: 1.5	

Transfer Standard ID:

Make & Model: Tylan 4 In 1	MFC Serial #a:
Prop. #: 20003921	MFC Ch. 1: 227277000103
Cert. Date: 03/20/06	MFC Ch. 2: 227277010206
Cert. Exp.: 06/15/06	MFC Ch. 3: 227277010209

Transfer Standard Certification Equation:

	m:		x:		b:	
0-30, MFC Pos. #: 4	AF =	1.0856	* Display	+	-1.3192	SLPM
0-3, MFC Pos. #: 2	AF =	1.0882	* Display	+	-0.0213	SLPM

Flow Verification Results:

Pollutant:	CH 1	CH 2	CH 3	Pump Vac. ("Hg):	25.8
Instrument Range, LPM:	2	30	30		
Air Flow Rate, SLPM:	0.70	10.00	10.00		
Instrument Leak Check (LPM):	0.000	0.000	0.000		

Flow Verification Data:

Flow Verification Channel 1:

As Is Cal. Settings	Slope: 1.000	Intercept: 0.000			
RMESI 924					
Set Point:	Display:	Display:	SLPM (y):	Percent Difference from True Setpoint	Display
0.800	0.796	0.730	0.773	3.48%	2.96%
0.700	0.695	0.678	0.716	-2.30%	-3.00%
0.600	0.597	0.556	0.584	2.79%	2.27%
Calibration required?	Yes	(Enter value as "Yes" or "No")			

Flow Verification Channel 2:

As Is Cal. Settings	Slope: 1.000	Intercept: 0.000			
RMESI 924					
Set Point:	Display:	Display:	SLPM (y):	Percent Difference from True Setpoint	Display
15.000	14.970	14.200	14.096	6.41%	6.20%
12.000	11.970	11.500	11.165	7.48%	7.21%
9.000	8.974	8.700	8.126	10.76%	10.44%
Calibration required?	Yes	(Enter value as "Yes" or "No") Warning, outside allowable range!			

Flow Verification Channel 3:

As Is Cal. Settings	Slope: 1.000	Intercept: 0.000			
RMESI 924					
Set Point:	Display:	Display:	SLPM (y):	Percent Difference from True Setpoint	Display
15.000	14.970	14.200	14.096	6.41%	6.20%
12.000	12.020	11.500	11.165	7.48%	7.66%
9.000	9.000	9.200	8.668	3.83%	3.83%
Calibration required?	Yes	(Enter value as "Yes" or "No") Warning, outside allowable range!			

Run Table Macro (Press blue arrow to initiate macro)

Comments:			
Calibrated by:		Checked by:	

ARB Alignment Report for RMESI 924 Sampler - MFC Calibration

MFC Calibrator Report:

ID Information:

Station Name:	San Francisco	Make:	RMESI	Calibration Type:	Calibration
Site #:	90-306	Model #:	924	Calibration Date:	05/24/06
Station Address:	10 Arkansas St.	Property #:	20021010	Prev. Cal. Date:	05/24/06
		Firmware Revision #:	1.5		

Transfer Standard ID:

Make & Model:	Tylan 4 In 1
Prop. #:	20003921
Cert. Date:	03/20/06
Cert. Exp.:	06/19/06

MFC Serial #'s:

MFC Ch. 1:	22727700103
MFC Ch. 2:	227277010206
MFC Ch. 3:	227277010209

Transfer Standard Certification Equation:

		m:	x:	b:	
0-30, MFC Pos. #:	4	AF =	1.0856	* Display	+ -1.3192 SLPM
0-3, MFC Pos. #:	2	AF =	1.0882	* Display	+ -0.0213 SLPM

MFC Calibration Results:

Pollutant:	CH 1	CH 2	CH 3	Pump Vac. ("Hg):	25.8
Instrument Range, LPM:	2	30	30		
Air Flow Rate, SLPM:	0.70	10.00	10.00		

Calibration Data:

MFC Calibration Channel 1:

RMESI 924 Set Point:	Display:	Transfer Standard Display:	SLPM:
0.800	0.796	0.790	0.773
0.750	0.746	0.690	0.730
0.700	0.699	0.640	0.675
0.650	0.646	0.590	0.621
0.600	0.597	0.540	0.566
Calculated	Slope: 1.0488		
	Intercept: -0.0578		
	Correlation: 0.9992		

MFC Calibration Channel 2:

RMESI 924 Set Point:	Display:	Transfer Standard Display:	SLPM:
15.0	14.97	14.2	14.10
13.5	13.45	12.8	12.58
12.0	11.97	11.5	11.17
10.5	10.45	10.1	9.65
9.0	8.97	8.7	8.13
Calculated	Slope: 0.9920		
	Intercept: -0.7457		
	Correlation: 0.9999		

MFC Calibration Channel 3:

RMESI 924 Set Point:	Display:	Transfer Standard Display:	SLPM:
15.00	14.97	14.20	14.10
13.50	13.43	12.90	12.69
12.00	12.02	11.50	11.17
10.50	10.45	10.10	9.65
9.00	8.96	8.70	8.13
Calculated	Slope: 0.9985		
	Intercept: -0.8049		
	Correlation: 0.9998		

Comments:	
Calibrated by:	Checked by:

ARB Calibration Report for RMESI 924 - Final Flow Verification

Flow Verification Report:

ID Information:

Station Name:	San Francisco	Make:	RMESI	Calibration Type:	Final
Site #:	90-306	Model #:	924	Calibration Date:	05/24/06
Station Address:	10 Arkansas St.	Property #:	20021010	Prev. Cal. Date:	05/24/06
		Firmware Rev. #:	1.5		

Transfer Standard ID:

Make & Model:	Tylan 4 In 1	MFC Serial #s:	
Prop. #:	20003921	MFC Ch. 1:	227277000103
Cert. Date:	03/20/06	MFC Ch. 2:	227277010206
Cert. Exp.:	06/19/06	MFC Ch. 3:	227277010209

Transfer Standard Certification Equation:

	m :	x :	b :	
0-30, MFC Pos. #:	4	AF =	1.0856	* Display +/- -1.3192 SLPM
0-3, MFC Pos. #:	2	AF =	1.0882	* Display +/- -0.0213 SLPM

Flow Verification Results:

Pollutant:	CH 1	CH 2	CH 3	Pump Vac. ("Hg):	25.8
Instrument Range, LPM:	2	30	30		
Air Flow Rate, SLPM:	0.70	10.00	10.00		
Instrument Leak Check (LPM):	0.000	0.000	0.000		

Calibration Data:

Flow Verification Channel 1:

Final Cal. Settings	Slope:	1.049	Intercept:	-0.058	
RMESI 924			Transfer Standard	Percent Difference from True	
Set Point:	Display:	Display:	SLPM (y):	Setting	Display
0.800	0.795	0.750	0.795	0.65%	0.02%
0.700	0.696	0.660	0.697	0.44%	-0.13%
0.600	0.595	0.580	0.610	-1.62%	-2.44%

Flow Verification Channel 2:

Final Cal. Settings	Slope:	0.992	Intercept:	-0.746	
RMESI 924			Transfer Standard	Percent Difference from True	
Set Point:	Display:	Display:	SLPM (y):	Setting	Display
15.000	14.950	14.800	14.748	1.71%	1.37%
12.000	11.950	12.200	11.925	0.63%	0.21%
9.000	8.950	9.400	8.885	1.29%	0.73%

Flow Verification Channel 3:

Final Cal. Settings	Slope:	0.999	Intercept:	-0.805	
RMESI 924			Transfer Standard	Percent Difference from True	
Set Point:	Display:	Display:	SLPM (y):	Setting	Display
15.000	14.920	14.900	14.856	0.97%	0.43%
12.000	11.940	12.200	11.925	0.63%	0.12%
9.000	8.930	9.500	8.994	0.07%	-0.71%

Comments:	
Calibrated by:	Checked by:

Appendix C AQSB RMESI 924 TOXICS DATA SHEET

[Place data sheet inside plastic pouch]

TOXICS
(920)

CALIFORNIA AIR RESOURCES BOARD Xontech 920 Toxics Data Sheet/Sample Tracking

Site Name: _____ Site Number: _____

Station Operator/Agency: _____ Scheduled Sampling Date: _____

Project Name (If Applicable): _____

	Cartridge #	Run Date	TIME (PST)			FLOW (LPM)			Volume (L)
			Start	Stop	Total (min)	Start	Stop	Average	
Total Metal (T)									
Chromium+6(C)									
Aldehydes (A)									

Type of Sample: Regular Collocated Trip/Field Blank Make Up

Air Sampler ID Number: _____

Observed Unusual Sampling Condition No Unusual Conditions Farm Operation Nearby Rain
 Wind-Blown Sand/Dust Fire Nearby Unknown
 Construction Nearby Other _____

INVALID SAMPLE INFORMATION

Reason for Sample Invalidation	Status of Make-up Sample
T C A	T C A
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Low flow rate (<90% of set point)	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Will run make-up on: _____
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> High flow rate (>110% of set point)	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Flow rate varies >10% of set point	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Unable to run make-up, equipment needs repair/replacement/calibration, notified supervisor
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Sampling period out of range (<23 or >25 hours)	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Sampling equipment inoperative	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Damaged sampling media	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Lab unable to provide sample media	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Sample media not available
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Other reasons: _____	

Field Comments: _____

Sample Tracking

Action	Transfer Method (Check One)		Name & Initials	Date/Time
	Carrier	Person		
Released by Lab				
Received by Field				
Released by Field				
Received by Lab				

====FOR LABORATORY USE ONLY====

Sample conditions upon received:	T	C	A
LIMS Sample ID :	T	C	A

Lab Comments: _____