ABRIDGED STANDARD OPERATING PROCEDURES

DRAFT VERSION, JANUARY 2005

FOR

MET ONE INSTRUMENTS
E-BAM
MASS MONITOR

AND

AIRSIS
AQEB-2000 TELEMETRY SYSTEM

January 28, 2004

1.0 INSTALLATION PROCEDURE

1. Assemble tripod: lift the tripod and remove the three lock pins, spread the tripod legs and re-insert the three lock pins. If the E-BAM is to be used under conditions that require additional stability, the tripod may be bolted to a firm surface using the ¼-inch holes in the tripod feet.
2. Install E-BAM cabinet: Lift up the E-BAM enclosure with the aerosol inlet oriented upwards. Slide the slot on the back of the cabinet down over the tab on top of the tripod and attach the bottom of the cabinet to the tripod using the ¼-inch nut and bolt provided.
3. Install E-BAM inlet adaptor tube: Remove the plastic end caps from the inlet adaptor tube and push the tube into the E-BAM inlet. It must go through two O-rings so push and twist it all the way in until it stops. Hand-tighten the large black lock screw located at the top of the E-BAM enclosure.
4. Install $PM_{2.5}$ and PM_{10} inlet: Push the $PM_{2.5}$ sampling inlet onto the inlet adaptor tube. It must go through an O-ring seal so push and twist it all the way in until it stops. Repeat with the PM_{10} inlet.
5. Install cross arm and temperature sensors: Install the cross arm on the pipe at the top of the tripod and tighten the two Allen screws. Clip the temperature sensor onto one arm of the tripod, and plug the signal cable into the 5-pin plug under the cabinet. Attach any accessory sensors to the other arm of the cross arm.
6. Connect the power source.

2.0 INITIAL E-BAM START-UP PROCEDURE

1. Undo the latch and swing open the E-BAM door.
2. Note that the display is on and displaying, **ARE YOU READY TO START?** Press the white "hot" key under YES to proceed.
3. If the time and date on the display are correct, push the right "soft" key on the keypad directly under where **YES** is displayed. Press **NO** to make a change. Use the arrow keys to make changes. **NOTE:** Airsis satellite system users should set the time in be in GMT (not local) time. When finished, press **SET** to save the changes. Press **CONTINUE** to exit without making changes.
4. The next screen depicts the E-BAM location filter, advance, and averaging start-up screen. Press EDIT to make changes. Press OK to proceed to the next screen.
5. If the nozzle packing material has not been removed, the nozzle will move upward and the display screen, will ask you to remove nozzle-packing material. Remove the stainless steel nozzle-packing material from under the nozzle and press **CONTINUE**.
6. The next screen will be shown while the unit checks to see if the filter paper is loaded. If the unit finds that the filter tape is **not loaded**, the screen will ask you to load the filter tape. When finished, answer **CONTINUE**. The filter tape will move and take up tension.
7. After the tape is checked, the BATTERY condition is displayed in the power start-up screen, as shown below. Press **CONTINUE** to proceed to the self test (refer to section 4.0).

NOTE: When the E- BAM is first powered on it will require a one-hour warm-up period. Data acquired during the first hour should be discarded.

3.0 OPERATION

1. Check to ensure that the date and time are correct. Edit if needed.

2. Check to ensure that the sample flow rate is correct. Edit if needed by pressing MENU/SELECT, SETUP, MENU/SELECT again, CONTINUE twice. The next screen is FLOW RATE. Press SET to select the desired setting.
3. Check to ensure that the temperature value displayed seems appropriate for the ambient conditions. **NOTE: The pump will not come on in OPERATE mode if the temperature sensor is not connected.**
4. Check to ensure that the set points for the moisture-controlled heater are correct. Edit if needed by pressing MENU/SELECT, SETUP, MENU/SELECT again, and CONTINUE three times to the HEATER screen. Press SET to select setting. **NOTE: Set Delta-T to NO unless it is required, otherwise the E-BAM will turn off the heater even though the humidity is high.**

4.0 SELF TEST

The following procedures should be used to conduct a SELF TEST.

1. Go to the **MENU SCREEN**
2. Use the UP/DOWN arrow keys to select SELF TEST.
3. Press the SELECT key.
4. The **SELF TEST** will take several minutes. When the self test is complete, answer **CONTINUE** and the E-BAM will **begin sampling**.

5.0 FLOW AUDIT

1. Go to the **MENU SCREEN**
2. Use the UP/DOWN arrow keys to select FIELD CALIBRATION and then press SELECT key.
3. Select **LEAK CHECK** in the PUMP TEST screen
4. Remove the PM_{10} inlet and replace with a leak test valve (BX-305).
5. Close the valve on the leak test valve.
6. The flow rate should drop to under 1.5 liters per minute (LPM). If the flow is under 1.5 LPM, remove the leak test valve and connect the flow audit device. If the flow is greater than 1.5 LPM, clean the nozzle and vane (which is the crosshatch-piece under the filter paper) with a Q-tip and alcohol.
7. Compare the reading of the audit device with the flow rate value displayed by the E-BAM. If the difference between the E-BAM flow rate and the audit device reading is greater than 2 percent, a **FLOW CALIBRATION** will need to be done.

6.0 CALIBRATION

1. Go to the MENU SCREEN and use the UP/DOWN arrow keys to select FIELD CALIBRATION, and then press SELECT key.
2. The FIELD CALIBRATION screen has seven selections. Select **TEMPERATURE** from the FIELD CALIBRATION screen.
3. Place a NIST-traceable temperature sensor in close proximity to the E-BAM temperature sensor. Allow an equilibration period of at least 15 minutes. If the test is an ambient test [above 20 Celsius (68 F)], select POINT:HIGH. If the test is an ice bath test, select POINT:LOW. **NOTE: It is recommended that the ambient point (HIGH) be done first, due to the long equilibration period required for the temperature sensors to warm up.**
4. Compare the reference temperature reading to the E-BAM reading on the LCD. If the readings are within 0.5 C (1 F), no recalibration is necessary. If the readings differ by more than 0.5 C (1 F), enter the reference temperature measurement into the REF:XX.X field and press **CALIBRATE**.
5. Repeat steps 3 and 4 for the second point.

6. Conduct single point calibration procedure for pressure, at ambient pressure. If the pressure values are within 2 mmHg, no recalibration is necessary.
7. Select a flow rate in the FIELD CALIBRATION, **FLOW** screen
8. Remove the PM_{10} inlet and place the reference flow audit device on the inlet tube. Wait for 5 minutes for the flow to equilibrate.
9. Compare the reference flow to the E-BAM flow. If the flows are within 2 percent, no recalibration is necessary.
10. To recalibrate the flow, enter the Reference Flow Meter reading into the REF:XX.X LPM entry and press CALIBRATE.
11. Repeat the above procedure for the remaining FLOW SP.

7.0 MEMBRANE TEST

NOTE: Never bump or touch the membrane. Always keep the membrane in their protective plastic case when not in use.

1. Select MEMBRANE TEST, from the MENU, FIELD CALIBRATION screen.
2. Press the START key once you are ready to start the calibration.
3. The filter tape will advance, the nozzle will lower, and the E-BAM will take a 4-minute blank ZERO count. Press CANCEL to re-start the test.
4. After the 4-minute count insert the ZERO Membrane; the nozzle will lower and the E-BAM will take a 4-minute ZERO count.
5. After the 4-minute sample, remove the ZERO membrane.
6. After the 4-minute blank SPAN count, insert the SPAN membrane.
7. Note the test results and take out the SPAN membrane.

If the ZERO or SPAN test failed, rerun the test. If the failure continues, clean the detector and re-run the test. If the failure persists, contact the factory service center. Press OK to return to the FIELD CALIBRATION MENU.

8.0 TROUBLESHOOTING

A basic troubleshooting guide is provided the table below.

Troubleshooting Guide for E-BAM Mass Monitor

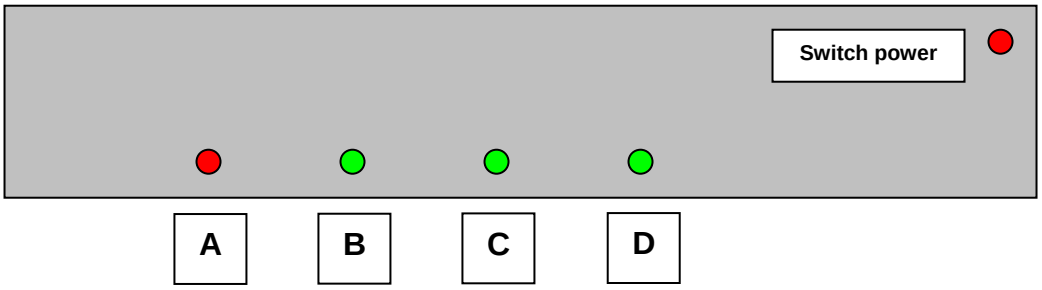
SYMPTOM	PROBABLE CAUSE	REMEDY
Low or no 12 Volt DC power	Bad battery, discharged battery, bad connection	Test battery, charge or replace if necessary, clean battery connections, replace power cable.
Pump will not start	Bad pump	Check pump and replace if bad. Lift nozzle and check for obstruction in flow path.
Flow rate is too low	Air leak, bad pump, obstruction in air path	Check for an air leak. Check pump and replace if bad.
No filter tape movement	Bad motor/drive	Replace the motor/drive unit.
Filter tape slips	End of tape is slipping on take up spool	Tape end of filter tape to the take up spool.
Filter tape is being cut by the nozzle	Debris under nozzle	Lift nozzle and clean off debris.
Nozzle does not move	Bad motor or limit switch	Replace the motor or limit switch.

9.0 DATA RETRIEVAL

The E-BAM will utilize the AIRSIS remote satellite telemetry system to transmit data from the E-BAM using the AQEB-2000 satellite modem to the AIRNow Website, where data will be accessible with a username and password.

SATELLITE MODEM SETUP

1. Place E-BAM tripod in the highest location available with a clear view of the sky. Buildings or large natural barriers will obstruct the AQEB-2000 modem's ability to obtain satellite communications.
2. Assemble brackets and hang the unit on the E-BAM tripod.
3. Screw the satellite antenna to the top of the AQEB box making sure it is firmly seated.
4. To maintain backup battery charge, plug the power cord into a 110-Volt power outlet.
5. Plug in 7-pin data cable to Serial Communication Port on the bottom of E-BAM.
   The following diagram shows the various states of the satellite modem and corresponds to the LED indicators located on the monitor. LED indicators verify that the satellite modem has power, the modem is receiving information from the E-BAM, and the antenna is properly placed for the modem to "see" the satellites.



A. Modem initialized light is on.
B. Serial Data measurement Digital 0 from E-BAM light is on.
C. Serial Data measurement Digital 1 from E-BAM light is on.
D. Light is ON when satellite is in view and OFF between satellite passes. (If this green LED light does not illuminate within 30 minutes, reposition the antenna to a higher and unobstructed position.)

6. After the E-BAM battery is fully charged, turn on the AQEB-2000 and confirm the light is on above the power switch. The first red LED should illuminate after a few seconds. This indicates the modem has power.
7. Lights A+B+C will be on when the modem is functioning and data are being sampled. Light D will be on when the satellite is in view.

NOTES:

1. **This unit is equipped with an internal battery and should be charged for a full day before the unit is connected for use.**
2. **The door of E-BAM must be completely closed during unit operation.**
3. **The E-BAM unit must be set to Greenwich Mean Time (GMT) *not* local time. Website time postings will be converted and accurate for local time.**