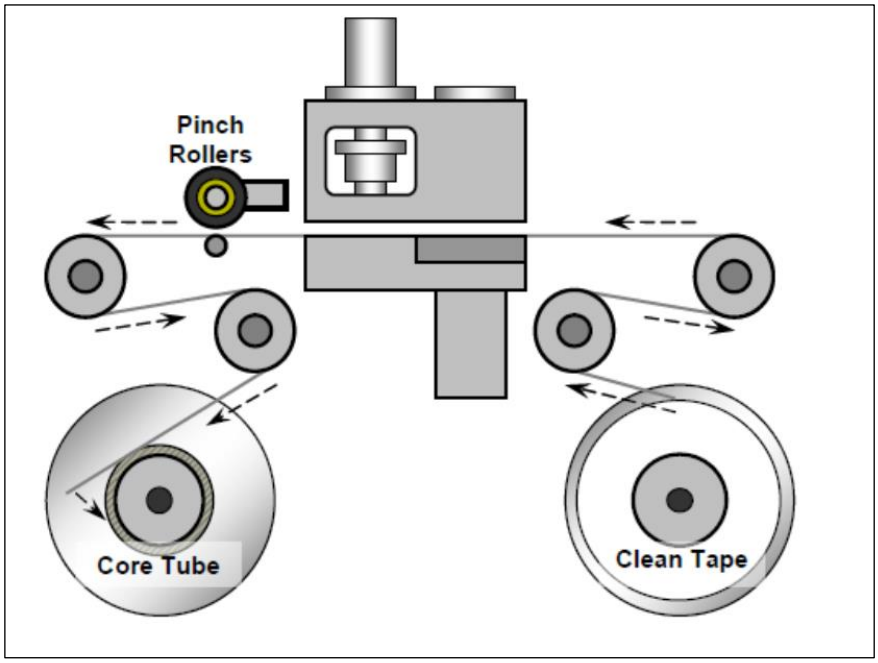
# MET ONE BAM-1020 OPERATION (Soft Key Display)

## Install Filter Tape

1. Remove the plastic reel covers.
2. Install an empty rubber or cardboard core on the take-up (left) reel.
3. Ensure the pinch rollers are lifted and secured with the latch.
4. Handle the filter tape only by its edges to avoid contaminating the sampling surface. Load the new roll of filter tape on the supply (right) reel and guide the tape into the transport assembly as shown in the drawing on the door of the BAM.
5. Use adhesive tape to fasten the loose end of filter tape to the empty core on the take-up reel.
6. Rotate the reels by hand until the filter tape is taut.
7. Install the plastic reel covers. Tighten them just until the metal plates behind the reels begin to turn.
8. Align the filter tape with the score marks on the edges of the rollers.
9. Unlatch the pinch rollers to lower them onto the tape.
10. **Select TAPE Menu >TENSION** to set the tension on the tape.

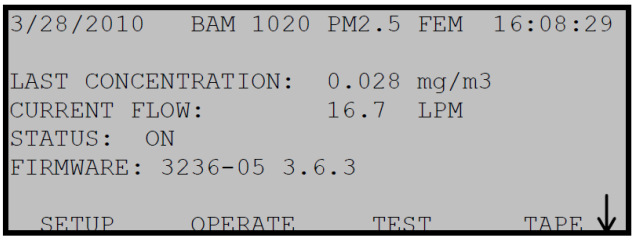



**Filter Tape Loading Diagram**

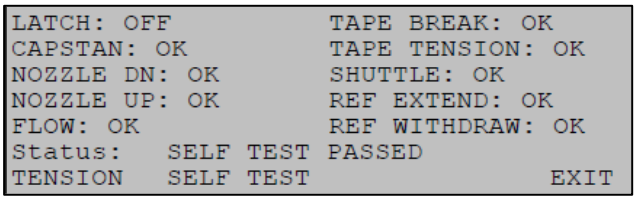
## Self-Test

The BAM's built-in Self-Test function automatically tests the tape and flow systems to ensure that the BAM is ready to enter sampling mode. The Self-Test should be run initially and after any interruption to sampling, such as a quality control check, filter tape change, or performance evaluation.

1. **Select TAPE** > **SELF-TEST**.
2. The Self-Test will run. You will hear mechanical noises and then the pump will turn on.
3. When it is done, read the "Status" line. If it displays SELF TEST PASSED, select EXIT to return to the home screen.
4. If the status displays ERROR OCCURRED, look for an error in the individual test parameters. Resolve the error and repeat the self-test until it passes, then select EXIT to return to the home screen.




**BAM 1020 Home Screen**




**Self-Test Status Screen**

**Note**: A quick way to ensure the BAM is left on the home screen is to ensure that there is not an EXIT button at the bottom of the screen. The home screen is the only screen without an EXIT option.

## Leak Check

1. **Select TEST > TAPE**. Press FWD to advance the tape to a clean, unsampled spot.
2. Ensure that the leak check adapter is installed above the VSCC in place of the PM10 head. Turn the leak check adapter valve to the closed position (perpendicular to the inlet).
3. Select **TEST > PUMP** and turn the pump on.
4. Allow the pump to stabilize for 20-30 seconds.
5. Read the flow rate on the BAM display and record it in the **As-Found** Leak Check section of the BAM QC form. The flow rate must be ≤ 1.5 lpm for the leak check to pass.
6. Turn off the pump and slowly open the flow audit adapter valve. Opening the valve before equilibration of the pressure can push debris from the filter into the detector.

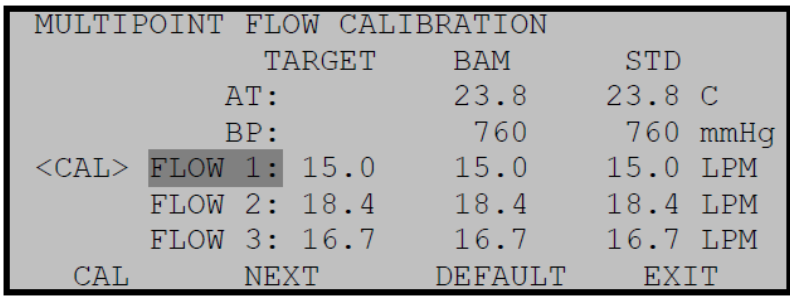
If a leak greater than 1.5 lpm persists, perform the nozzle and vane cleaning procedures. If the leak persists after thorough nozzle and vane cleaning, repeat the leak check with a rubber shim (part 7440 from BX-308 tool kit) under the nozzle. If the leak check passes with the rubber shim, the leak is in the probe line. Check the flow audit adapter, VSCC, and BAM inlet for signs of leaks. If the leak check fails with the rubber shim, the leak is internal to the BAM body.

## Ambient Temperature, Pressure and Flow Verification

As temperature and pressure change, so does the density of air. They are measured to correct flow (and by extension concentration) to a value that can be compared across meteorological conditions.

1. Select **TEST > FLOW** to enter the calibration menu for ambient conditions and flows. The default password is F1 F2 F3 F4.

The MULTIPOINT FLOW CALIBRATION screen allows the user to view or verify and calibrate the ambient temperature, pressure and flows.




For each parameter, the BAM column shows the instrument's indicated value. The STD column is identical to the BAM column by default, although the STD column is typically whatever the operator last entered for a calibration. Operators can input actual values into the STD column from their transfer standards to recalibrate the BAM when needed.

Note: Operators should complete a full initial QC before making any changes to the STD column. If recalibration is needed, record the results of the initial QC checks in the QC form labeled "**as found**." Calibrate the necessary parameters following the steps in the Calibration section. Then repeat the QC checks and record the results in the QC form labeled "**as left**."

Select NEXT to navigate through the MULTIPOINT FLOW CALIBRATION screen. The soft arrow keys are used to adjust the values in the "STD" column and should only be pressed when recalibration is necessary.

2. Remove the PM10 inlet head and install the flow audit device (DeltaCal or AliCat) above the VSCC on the inlet downtube in the correct direction of flow.
3. Allow the flow audit device to equilibrate for 5 minutes. If using the Ali-Cat flow device, insert the tip of the certified, NIST-traceable thermometer into the radiation shield and allow it to equilibrate for five minutes.
4. Record the indicated ambient temperature (AT) from the BAM column on the **As-Found** section of the QC form.
5. Measure the actual ambient temperature inside the radiation shield using the NIST-traceable thermometer or flow audit device and record it on the **As-Found** section of the QC form.
    a. If the temperature verification passes (±2°C) no further action is needed. If it fails, you will need to calibrate it as described in the Calibrate section below.
6. Select **NEXT** to navigate to the barometric pressure (BP) line and record the indicated BP on the **As-Found** section of the QC form.
7. Measure the actual BP at the BAM inlet using a certified BP standard or flow audit device and record it on the **As-Found** section of the QC form.
    a. If the pressure verification passes (±10 mmHg) no further action is needed. If it fails, you will need to calibrate it as described in the Calibrate section below.

Although the BAM operates at a flow rate of 16.7 lpm, the QC check tests the BAM at three flows between 15.0 and 18.4 lpm. Testing three flows ensures not only that the operating and design flows are accurate but also that the slope of the BAM's mass flow sensor is properly calibrated.

### Three-Point Flow Verification

8. Following the ambient temperature and pressure check, select **NEXT** to navigate to the "**Flow 1**" line (15.0 lpm) on the MULTIPOINT FLOW CALIBRATION screen and record the BAM's indicated flow on the **As-Found** section of the QC form.
9. Read the actual flow rate measured by the flow audit device and record it on the **As-Found** section of the QC form.
10. Select NEXT to navigate to "**Flow 2**" (18.4 lpm) and "**Flow 3**" (16.7 lpm) and record the indicated and actual flows on the **As-Found** section of the QC form.
11. Select EXIT to return to the home screen.

The acceptable ranges for each parameter are:

- Ambient Temperature: ±2°C
- Ambient Pressure: ±10 mm Hg
- Flow: ±4% of reference standard and ±5% of design flow (16.7 LPM)

If any parameter falls outside of these ranges, be sure to document the observed value in the **As Found** section on the QC form and proceed with calibration as described below. After calibration, repeat the QC check and record the results in the **As-Left** section of the QC form. Record all calibration activities in the site log.

### Ambient Temperature, Pressure and Flow Verification (as needed)

**Note:** Operators should complete a full initial QC before making any changes to the STD column. If recalibration is needed, record the results of the initial QC checks in the QC form labeled "**as found**." Calibrate the necessary parameters following the steps below. Then repeat the QC check and record the results in the QC form labeled "**as left**."

1. **Select TEST > FLOW** to return to the MULTIPOINT FLOW CALIBRATION screen.
2. Use the **NEXT** key to navigate through the parameters. Adjust the STD values using the soft arrow keys to match the actual readings from the flow audit device.
3. When all necessary parameters have been adjusted and recorded on the QC form, select **CAL** to store the results and recalibrate the BAM.
4. Record the BAM column values and STD column actual values onto the **As-Left** section of the QC form.
5. Select EXIT to return to the home screen.

### Clock Verification

1. Verify that the BAM clock is the same time as the data logger clock. If not connected to a logger, time should be set to the time reported by an internet-connected device (i.e. cell phone).
2. Record the BAM clock time and "as-found" BAM time in the Clock Verification section of the BAM QC form.
3. If the BAM does not report the same time as the data logger or internet-connected device, adjust the BAM clock in the **SETUP > CLOCK** menu and record the results on the QC form as the "as-left" BAM time.

### Self -Test

Perform the self-test after every QC check and any other interruption to sampling, such as a filter tape change or performance evaluation.

1. **Select TAPE** > **SELF-TEST**.
2. The Self-Test will run. You will hear mechanical noises and then the pump will turn on.
3. When it is done, read the "Status" line. If it displays SELF TEST PASSED, select EXIT to return to the home screen.

4. If the status displays ERROR OCCURRED, look for an error in the individual test parameters. Resolve the error and repeat the self-test until it passes, then select EXIT to return to the home screen.

5. Remove the flow audit device or transfer standard and re-install the SCC or VSCC and PM10 inlet head.

**Note:** Always return to the home screen following any sampling interruption, including QC checks and maintenance.

- Entering the **TEST or TAPE** menus automatically puts the BAM into MAINTENANCE mode.

- The home screen will display STATUS: MAINTENANCE when these menus have been accessed in the previous hour. The BAM will automatically return to sampling (ON) mode at the top of the next hour if the home screen is displayed.

- Pressing the OPERATE soft key at the main menu will not interrupt the sample if already running. The DOWN arrow can be used to set the **Operate Mode** from **ON** to **OFF**. ***This will simply stop the measurement cycle but will not power-down the BAM 1020.***

- ***Even if the Operation Mode is set to OFF, or the BAM 1020 stops due to an error, it will still automatically set the mode back to ON at the top of the hour and try to run a new cycle.***

- It is not necessary to enter the OPERATE menu to suspend or restart sampling. It is not recommended to enter the OPERATE menu at all, but even if the OPERATE menu is used to turn operation off, the BAM will still automatically return to ON mode and begin sampling at the top of the hour.

## Perform Leak Check

1. **Select TEST > TAPE**. Press FWD to advance the tape to a clean, unsampled spot.
2. Ensure that the leak check adapter is installed above the VSCC in place of the PM10 head. Turn the leak check adapter valve to the closed position (perpendicular to the inlet).
3. Select **TEST > PUMP** and turn the pump on.
4. Allow the pump to stabilize for 20-30 seconds.
5. Read the flow rate on the BAM display and record it in the **As-Left** Leak Check section of the BAM QC form. The flow rate must be ≤ 1.5 lpm for the leak check to pass.

6. Turn off the pump and slowly open the flow audit adapter valve. Opening the valve before equilibration of the pressure can push debris from the filter into the detector.

## Final Checks

Before leaving the site, always verify that the flow audit device is removed, the VSCC and PM10 head are installed, the BAM displays the home screen, and the results of all QC checks and maintenance are recorded in the electronic logbook.

**Note**: *Pressing the down arrow button on the main menu will display flow statistics. This screen displays the flow, temperature and pressure statistics for the current measurement cycle.*