BX-895 REAL TIME MODULE
OPERATION MANUAL

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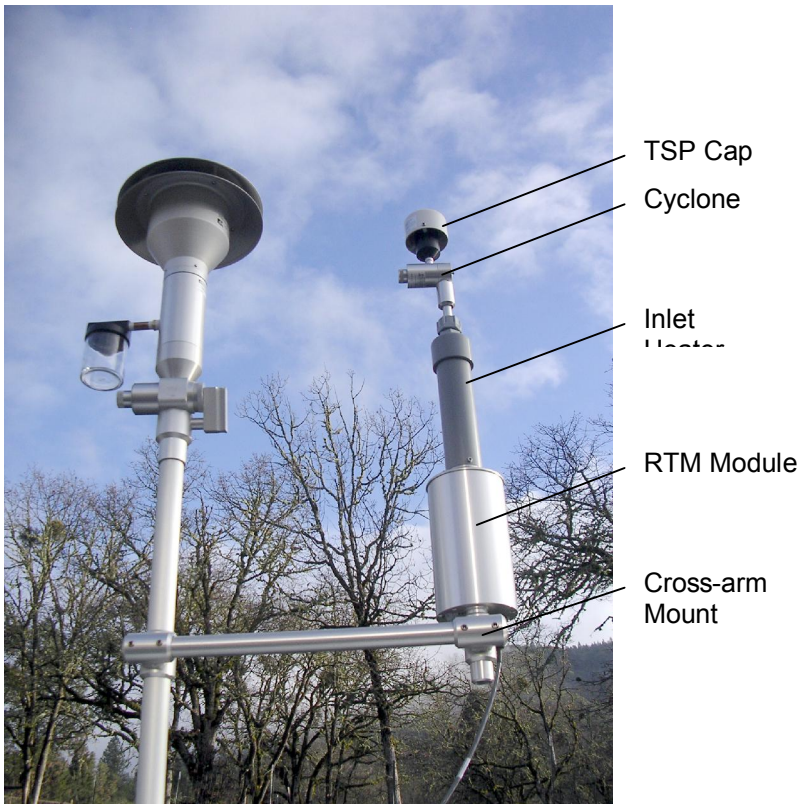
About the BX-895 RTM:

The Met One Instruments Inc. model BX-895 Real Time Module (RTM) is an optional add-on accessory that provides instant relative mass trending data to the BAM-1020 particulate monitor. Real time particulate data is useful when correlating changing wind conditions to particulate events, or when early predictions of the hourly concentration data from the BAM-1020 are needed.

The RTM mounts near the BAM-1020 inlet and samples ambient air at 2 L/min. The sample RH is controlled with an inlet heater. The air sample passes through a forward light scatter laser nephelometer engine where the particulate mass is measured. The mass signal is continuously scaled to an analog voltage output which represents the real-time particulate concentration. The output voltage is logged with one of the BAM-1020 met sensor inputs.

The BX-895 RTM replaces the older BX-894 inline RTM module, and is compatible with BAM-1020 units of all vintages with no modifications required. The RTM is a fully self-contained unit with its own PM_{10} or $PM_{2.5}$ size-selective cyclone inlet, inlet heater, flow system, and power supply. The RTM does not interfere with the normal hourly BAM-1020 concentration measurements in any way.



Model BX-895 mounted to a BAM-1020 inlet

BX-895 Specifications:

Parameter	Specification
Measurement Principle:	Forward light scatter laser nephelometer. Laser 670nm, 5mW.
Accuracy:	±15% of BAM-1020 hourly average, when scaled for local particulate.
Resolution:	1 µg/m^3.
Mass Range:	0 - 1000 µg/m^3
Particle Size Sensitivity:	.3 to 10 micron.
Voltage Output:	0 to 2.5$_{VDC}$. Voltage output updated in 1 second intervals.
Measurement Cycle:	Continuous operation from power up.
Real Time Averages:	Set by the MET SAMPLE in the BAM-1020: 1, 5, 10, 15, or 30 minutes.
Cut Point:	Uses PM_{10} or $PM_{2.5}$ cyclone to match the BAM. Nonlinear response to TSP.
Flow Rate:	2.0 lpm nominal. Manually auditable and adjustable.
Flow System:	Internal 10,000 hour diaphragm pump. No active flow controller or sensor.
Operating Temperature:	-10º to +50º C Ambient.
Ambient Relative Humidity:	Max 90%, non-condensing.
RH Control:	Integral inlet heater with sample RH sensor and 40% RH threshold.
Factory Service Interval:	One year under normal particulate conditions.
Mounting:	Standard cross arm fitting included. Compatible with many camera tripods.
Power Supply:	12 - 15$_{VDC}$ @ 13 watts max. Power supply included.

Installation:

The BX-895 RTM module is easy to install:

1. Remove the PM_{10} inlet and the cyclone (if used) from the BAM-1020 inlet tube. Install the included crossarm assembly onto the BAM inlet tube, then replace the BAM inlets. Install the RTM into the fitting on the other end of the crossarm. **Note:** If your BAM-1020 has a BX-592 temperature sensor, you may opt to install the RTM on the end of the existing sensor crossarm instead.
2. Install the $PM_{2.5}$ or PM_{10} cyclone onto the RTM inlet. Install the TSP cap on top of the RTM cyclone to keep water and debris out of the cyclone. **Note**: The cyclone used on the RTM inlet must match the cut point of the BAM-1020. If the BAM uses a $PM_{2.5}$ cyclone, then the RTM should also use a $PM_{2.5}$ cyclone. If the BAM is set up for PM_{10} (no cyclone), then the RTM should use a PM_{10} cyclone.
3. Adjust the height of the RTM crossarm so that the RTM inlet is approximately 6 inches (15 cm) below the louvers of the BAM PM_{10} inlet. The RTM should be located at the far end of the crossarm, away from the BAM inlet. The RTM must not obstruct the airflow into the BAM inlet.
4. Connect the signal cable to the bottom of the RTM, then route it into the BAM shelter. Connect the other end of the signal cable to one of the unused BAM met sensor input channels. Use channel 1 if available. Channels 4 and 6 are not recommended since they are usually used for other temperature and RH parameters.

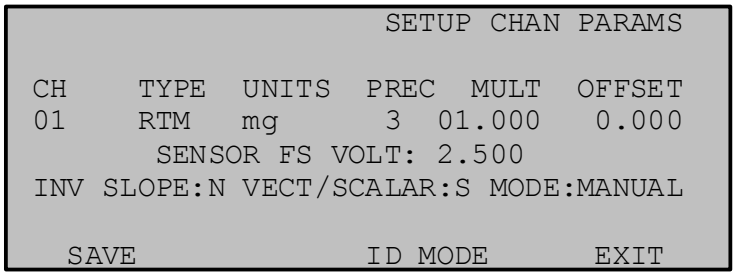
RTM Wire Color	BAM Terminal Name
Yellow	Channel 1 SIG
Black	Channel 1 COM
-	Channel 1 POWER
-	Channel 1 ID

5. The RTM uses too much power to be powered by the BAM sensor input channel. It is supplied with a separate 12_{VDC} power supply. Connect the power supply to the prewired jack on the BAM end of the sensor cable. When the power supply is plugged in, the RTM pump should turn on and begin sampling automatically.

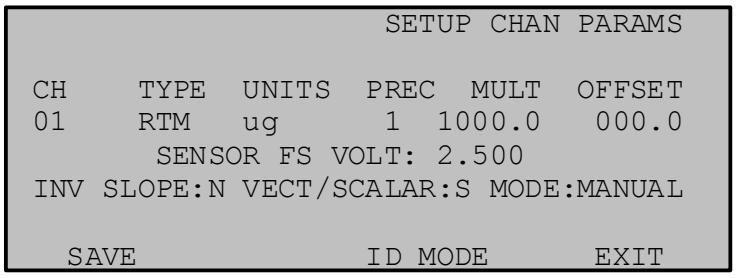
BAM-1020 Setup for the RTM:

The BAM-1020 logs averages of the RTM mass concentration signal using the average period set by the MET SAMPLE setting in the SETUP > SAMPLE menu of the BAM-1020. The data may be stored in 1, 5, 10, 15, 30, or 60 minute averages. Setting the average period to 1 minute will cause the BAM memory to fill up in only 3 days, while setting it to 10 minutes will cause the memory to fill in 30 days. Consider how fine of real-time resolution you really need for your application, then set the MET SAMPLE setting in the BAM accordingly.

You will need to manually configure the BAM sensor input channel to correctly scale the RTM output voltage as shown in the examples below. See section 6.8 of the BAM-1020 manual. Enter the SETUP > SENSOR menu on the BAM-1020, and select the CH channel number that matches the input you are using for the RTM. The examples below use channel 1. Use the arrow keys to name the channel in the TYPE field, such as “RTM”. Label the UNITS field either “mg” (milligrams) or “ug” (micrograms). Milligrams are used most often. The MULT multiplier is set to 1.000 for milligrams or to 1000.0 for micrograms. These settings will cause the BAM to scale the RTM output as 0 to 2.5 volts equals 0.000 to 1.000 mg, or 0 to 1000 ug.



RTM channel setup for milligrams (mg)



RTM channel setup for micrograms (µg)

In applications where relative particulate trending is desired, the BAM input channel is left with a multiplier slope of 1 as described above, Hourly averages of the RTM data will usually be

lower than the hourly BAM concentrations, since no k-factor (slope correction) is implemented. However, the relative RTM output is useful for trending.

In applications where non-relative, accurate real-time concentration data is needed, you will need to adjust the MULT multiplier value in the BAM setup. The required multiplier will vary depending on the particulate type and color characteristics common in that location. Multipliers of between 3 and 5 are common. Run the BAM and RTM for a few days with no slope correction, then download the data and calculate hourly averages of the RTM data. Compare the RTM hourly averages to the BAM hourly data, then calculate a multiplication factor (linear regression) which will cause the RTM data to match the BAM. Change the MULT value in the channel setup screen to match your multiplication factor. For example, if the BAM data is 3.5 times higher than the uncorrected RTM hourly averages, then you would change the MULT to 03.500 (mg) or 3500.0 (ug). This should cause future RTM data to match the BAM data within 15% or better at that site.

The BAM-1020 data array may be downloaded as usual, and the real-time concentration data will be included in the selected channel of the data array just like a met sensor.
Note: *Remember that the BAM hourly concentration value shown in the data array is for air sampled during the previous hour, while the real-time data will be for the current hour!* This will be important to understand when you try to correlate the data between the two.

Other Applications:

The BX-895 can be used independently of the BAM-1020 for low cost perimeter monitoring or particulate mass studies with an analog data logger. The included cross arm mount is compatible with Met One tripods and towers. The mounting post on the bottom of the BX-895 may be removed so that the unit can be mounted to a standard camera tripod using the existing ¼”-20 threaded hole.

Maintenance:

The BX-895 is designed for minimal field maintenance:

- The particle traps on the PM_{10} or $PM_{2.5}$ cyclone should be emptied monthly, by unscrewing the grit cap and cleaning it out. The cyclone body should be fully disassembled and cleaned quarterly for best accuracy and to prevent corrosion.
- The flow system may be audited periodically by connecting a traceable flow reference to the inlet of the RTM. The flow is factory set for 2.0 L/min with the internal potentiometer located on the 80390 PCB. . The flow rate should be verified to be within 20% (0.4 L/min) for most relative particulate trending applications. When optimal cyclone cut-point accuracy is desired, the flow should be maintained within 10% (0.2 L/min). The BX-895 does not have any active flow control or a flow meter, so the internal potentiometer may need to be adjusted to compensate for changes in altitude or temperature. A truss-head screw on the bottom of the unit retains the body tube. Remove the screw and slide the body tube down to access the inside. The potentiometer is located on the 80390 board near the bottom plate inside. (NOTE: DON’T ADJUST POTENTIOMETER ON THE 80380 BOARD, This is the laser current adjustment)

- The purge filter which circulates clean air around the optics may eventually become dirty and restrict the flow. It is located inside the unit. A new filter may be obtained from the Service Department.
- The internal RH sensor, inlet heater, pump, and optical module should only be serviced by factory technicians. The BX-895 RTM should be returned for factory service on a periodic basis. High concentration environments will require more frequent service.

Technical Support:

Should you still require support after consulting your printed documentation, we encourage you to contact one of our expert Technical Service representatives during normal business hours of 7:00 a.m. to 4:00 p.m. Pacific Standard Time, Monday through Friday. In addition, technical information and service bulletins are often posted on our website. Please contact us and obtain a Return Authorization (RA) number before sending any equipment back to the factory. This allows us to track and schedule service work and expedite customer service.

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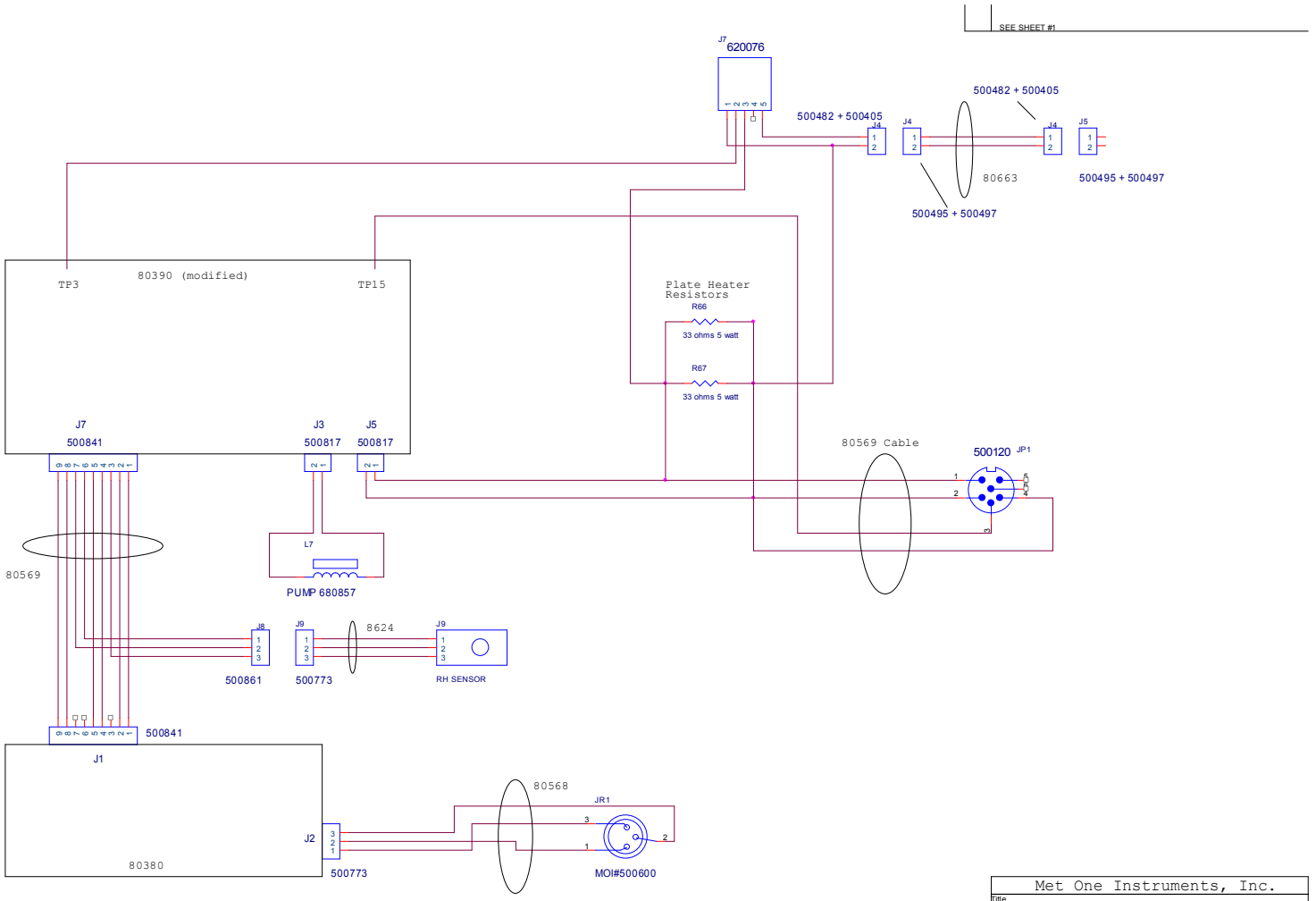
Appendix A

Internal wiring



Met One Instruments, Inc.		
Title: RTM Wiring diagram		
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