AEROCET 831
MANUAL

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AEROCET 831 Manual

NOTICE

CAUTION—Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

WARNING—This product, when properly installed and operated, is considered a Class I laser product. Class I products are not considered to be hazardous.

There are no user serviceable parts located inside the cover of this device.

Do not attempt to remove the cover of this product. Failure to comply with this instruction could cause accidental exposure to laser radiation.

Table of Contents

1. Introduction

The AEROCET 831 is a small, lightweight, battery operated, handheld mass profiler. This instrument simultaneously monitors PM1, PM2.5, PM4 and PM10 levels. The multifunction rotary dial provides simple and efficient operation. The internal battery pack provides 8 hours of continuous operation. The AEROCET 831 stores up to 2,500 sample events, which can be viewed on the display or exported to a computer via the USB port.

1.1. About the Measurement

The AEROCET 831 counts and sizes particles in 7 different size ranges then uses a proprietary algorithm to convert count data to mass measurements (µg/m3). Fundamentally, the AEROCET 831 calculates a volume for each detected particle then assigns a standard density for the conversion.

The standard density value is augmented by the K-Factor setting to improve measurement accuracy. The AEROCET 831 provides a separate K-Factor setting for each measurement range (PM1, PM2.5, PM4, PM10 and TSP). These K-Factors can be modified with Comet software.

K-Factor values should be empirically derived via comparison with a reference unit. If a reference unit is unavailable, the recommended K-Factor setting is 3.0.

1.2. Technical Service

This manual is structured by customer feedback to provide the required information for setup, operation, testing, maintaining, and troubleshooting your unit. 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 to expedite customer service. Please have your instrument serial number available when contacting the manufacturer.

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97526 U.S.A.

2. Setup

The following sections cover unpacking, layout and performing a test run to verify operation.

2.1. Unpacking

When unpacking a new ES-645, verify that the contents are undamaged. Any damages incurred to the equipment during shipping are the responsibility of the carrier. If any damage to the shipment is noticed before unpacking, **a claim must be filed with the commercial carrier immediately**. You should follow any special unpacking instructions provided by the carrier as you then carefully remove all items from the containers and inspect each component. It is recommended to document and photograph all damaged packages and items before, during, and after unpacking them. Contact Met One Instruments (see section 1.2 of this manual) to arrange for any replacement items needed.

Standard items (included) are shown in
Figure 1. Optional accessories are shown in Figure 2.

ATTENTION:
The USB drivers on the included Comet CD must be installed before connecting the AEROCET 831 USB port to your computer. If the supplied drivers are not installed first, Windows may install generic drivers that are not compatible with this product.

To install USB drivers:

Insert the Comet CD. The install program should run automatically and display the screen below. If an AutoPlay pop-up window appears, select “Run AutoRun.exe”. Finally, select “USB Drivers” to start the install process.

Note:
For proper communication, set the virtual COM port baud rate to 9600

32 Bit Operating Systems should install the 32 bit USB drivers.

64 Bit Operating Systems should install the 64 bit USB drivers.

AEROCET 831 Standard Accessories

AEROCET 831

MOI P/N: 831

Battery Charger

MOI P/N: 390031

USB Cable

MOI P/N: 500787

831 Manual

MOI P/N 831-9800

Calibration Certificate

MOI P/N: 831-9600

Comet Software CD

MOI P/N: 80248

Figure 1 – Standard Accessories

AEROCET 831 Optional Accessories

Zero Filter Kit

MOI P/N: 80846

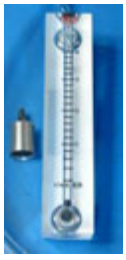
Boot

MOI P/N: 80450

Carrying Case

MOI P/N: 8517

Flow Meter Kit



MOI P/N: 80530

Figure 2 – Optional Accessories

2.2. AEROCET 831 Layout

The following figure shows the layout of the AEROCET 831 and provides a description of the components.

Figure 3 – AEROCET 831 Layout

Component	Description
Display	2X16 character LCD display
Keyboard	2 key membrane keypad
Rotary dial	Multifunction dial (rotate and press)
Charger Jack	Input jack for external battery charger.
Flow Adjust	Adjusts the sample flow rate
Inlet Nozzle	Sample nozzle
USB Port	USB communication port

2.3. Initial Operation

Before operating the AEROCET 831 for the first time, it is recommended that the unit be fully charged. Information regarding battery charging is found in Section 6.1. Complete the following steps to verify proper operation.

1. Press the Power key for 0.5 seconds or more to turn on the power.
2. Observe the Startup screen for 3 seconds then the Sample screen (Section 3.5)
3. Press Start / Stop key. The AEROCET 831 will sample for one minute and stop.
4. Observe the mass values on the display
5. Rotate the Select dial to view additional PM ranges.
6. The unit is ready for use

3. Operation

The following sections cover the basic operation of AEROCET 831.

3.1. User Interface

The AEROCET 831 user interface is composed of a rotary dial, 2 button keypad and a LCD display. The keypad and rotary dial are described in the following table.

Control	Description	
Power Key	Power the unit on/off. For power on, press for 0.5 seconds or more.	
Start/Stop Key	Sample Screen	START / STOP a sample event
	Settings Menu	Return to Sample screen
	Edit Settings	Cancel edit mode and return to the Settings Menu
Select Dial	Rotate the dial to scroll through selections or change values. Press the dial to select item or value.	

3.2. Power On/Off

Press and hold the Power key momentarily to power on the unit. Similarly, press and hold the Power key momentarily to power off the unit. During power on, the AEROCET 831 will display the Startup Screen (Figure 4) for approximately 3 seconds then display the Sample Screen.

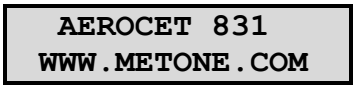


Figure 4 – Startup Screen

Note: The AEROCET 831 will power down after 5 minutes to preserve battery power providing the unit is stopped and there is no keyboard activity or USB communications.

3.3. Sample Modes

The AEROCET 831 has two sample modes: Manual and Continuous (Section 4.2.4). Manual mode configures the unit for single sample events. Continuous mode configures the unit for nonstop sampling.

3.4. Start/Stop a Sample

Press the START/STOP key to start a measurement. The AEROCET 831 will display the progress bar below (Figure 5). In Manual mode, the AEROCET 831 will sample for one minute and stop. In Continuous mode, the AEROCET 831 will run consecutive one-minute sample events until the operator presses the START / STOP key or the battery is depleted. Use the select dial to select the PM range you want to display on the top of the screen.

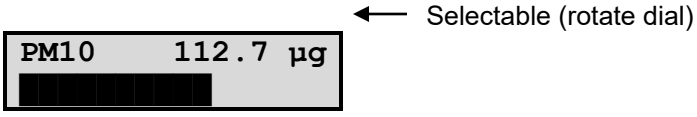


Figure 5 – Sampling Screen

3.5. Sample Screen

The Sample Screen displays mass measurement results. The first line displays the Favorite range (default = PM2.5). Select a Favorite range in the Settings Menu (Section 4.2.5) and the AEROCET 831 will pin the Favorite range to the top display line. The second line scrolls (rotary dial) through the remaining ranges and battery capacity. The Sample Screen is shown in Figure 6 below.

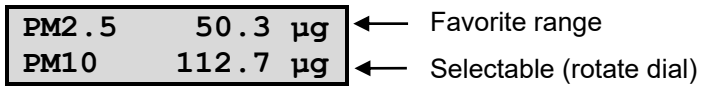


Figure 6 – Sample Screen

3.5.1. Warnings / Errors

Status messages are displayed on the second line of the Sample Screen. When this occurs, simply rotate the dial to view any PM range on the top line.

A low battery warning indicates there is approximately 15 minutes of operation before the AEROCET 831 stops sampling. A low battery condition is shown in Figure 7 below.

Figure 7 – Low Battery

The AEROCET 831 will display “Sensor Noise” or “Sensor Error” if it detects a problem in the particle sensor. If you observe one of these messages, contact the service center (see section 1.2).

4. Settings Menu

Use the Settings Menu to view or change settings. The Settings Menu is shown in Table 1 below.

4.1. To View Settings

Press the Select dial to navigate to the Settings Menu. Rotate the Select dial to scroll through the settings in Table 1. To return to the Sample screen press Start/Stop or wait a few seconds and the unit will return automatically.

4.2. To Edit Settings

Press the Select dial to navigate to the Settings Menu. Rotate the Select dial to scroll to the desired setting then press the Select dial to edit the Setting. A blinking cursor will indicate edit mode. To cancel edit mode and return to the Settings Menu, press Start/Stop.

Table 1, Settings Menu

Function	Description
LOCATION	Assign a unique number to a location or area. Range = 1 - 999
HISTORY	Display previous samples. See Section 4.2.2
FREE MEMORY	Display the percent of available memory space. When Free Memory = 0%, the oldest data will be overwritten with new data.
MODE	Manual mode for single sample events. Continuous mode for nonstop sampling.
FAVORITE	Pin favorite PM range to the top display line.
SENSITIVITY	High (default): Improved sensitivity for normal operation. Recommended use for indoors and low concentrations. Low: Improved accuracy for higher concentrations and better correlation with older 831s. Recommended use for outdoors and higher concentrations.
TIME	Display / set time. Time format is HH:MM:SS (HH = Hours, MM = Minutes, SS = Seconds).
DATE	Display / set date. Date format is DD/MMM/YYY (DD = Day, MMM = Month, YYYY = Year)
ABOUT	Display model number and firmware version

4.2.1. Location Number

`Press to Change` `LOCATION 001`	View screen. Press Select to enter Edit mode.
`Rotate and Press` `LOCATION 001`	Blinking cursor indicates Edit mode. Rotate dial to scroll value. Press dial to select next digit. Repeat action until last digit.
`Rotate and Press` `LOCATION 001`	Rotate dial to scroll value. Press dial to exit Edit Mode and return to view screen.

4.2.2. Sample History

`Press to View` `HISTORY`	Press Select to view history.
`30/MAR/2011 L001` `10:30:45 #1000`	AEROCET 831 will display the last record (Date, Time, Location, and Record Number). Rotate dial to scroll through records. Press dial to view record.

PM1 12.8 µg PM2.5 50.3 µg PM4 72.4 µg PM10 112.7 µg TSP 256.2 µg Location 001 DATE 30/MAR/2011 TIME 10:30:45	Rotate dial to scroll through record data. Press Start/Stop to return to previous screen.

4.2.3. Free Memory

Press to Change FREE MEMORY 80%	View available memory. Press Select to enter edit mode.
Press and Hold to Clear Memory	Press and hold Select dial for 3 seconds to clear memory and return to view screen. Return to view screen if no action for 3 seconds.

4.2.4. Mode

Press to Change MODE MANUAL	View screen. Press Select to enter Edit mode.
Rotate and Press MODE MANUAL	Blinking cursor indicates Edit mode. Rotate dial to toggle value. Press dial to select value and return to view screen.

4.2.5. Favorite

Press to Change FAVORITE PM2.5	View screen. Press Select to enter Edit mode.
Rotate and Press FAVORITE PM2.5	Blinking cursor indicates Edit mode. Rotate dial to scroll ranges. Press dial to select range and return to view screen.

4.2.6. Sensitivity

Press to Change SENSITIVITY HIGH	View screen. Press Select to enter Edit mode.
Rotate and Press SENSITIVITY HIGH	Blinking cursor indicates Edit mode. Rotate dial to toggle value. Press dial to select value and return to view screen.

4.2.7. Time

Press to Change TIME 10:30:45	View time. Press Select to enter edit mode.
Rotate and Press TIME 10:30:45	Blinking cursor indicates Edit mode. Rotate dial to scroll values. Press dial to select next digit. Repeat action until last digit.
Rotate and Press TIME 10:30:45	Last digit. Rotate dial to scroll values. Press dial to exit Edit mode and return to view screen.

4.2.8. Date

Press to Change DATE 30/MAR/2011	View date. Press Select to enter edit mode.
Rotate and Press DATE 30/MAR/2011	Blinking cursor indicates Edit mode. Rotate dial to scroll values. Press dial to select next digit. Repeat action until last digit.
Rotate and Press DATE 30/MAR/2011	Rotate dial to scroll values. Press dial to exit Edit mode and return to view screen.

4.2.9. About

AEROCET 831 80865-1 V2.0.0	View model number and firmware version.

5. Serial Communications

Serial communications, firmware field upgrades and real time output are provided via the USB port located on the side of the unit.

5.1. Connection

ATTENTION:

The USB drivers on the included Comet CD must be installed before connecting the AEROCET 831 USB port to your computer. If the supplied drivers are not installed first, Windows may install generic drivers that are not compatible with this product.

To install USB drivers:

Insert the Comet CD. The install program should run automatically and display the screen below. If an AutoPlay pop-up window appears, select “Run AutoRun.exe”. Select “USB Drivers” to start the install process. Follow the on-screen prompts to complete the installation process. You may be prompted to re-boot your computer when the driver installation is complete.

Note:
For proper communication, set the virtual COM port baud rate to 38400

32 Bit Operating Systems should install the 32 bit USB drivers.

64 Bit Operating Systems should install the 64 bit USB drivers.

5.2. Commands

The AEROCET 831 provides serial commands for accessing stored data and settings. All commands are terminated by a carriage return. Also, these commands are not case sensitive. The following tables lists the available commands. These commands are available via USB. The settings (baud rate, parity and stop bits) must match the computer setting.

Table 2, Serial Settings

Serial Settings	Value
Baud Rate	38400
Data Bits	8
Parity	None
Port Name	The COM port connected to the device. (ie. COM1)
Stop Bits	1

Table 3, Serial Commands

Command	Type	Description
?,H	Help	View the help menu
1	Settings	View the settings
2	All data	Returns all available records.
3	New data	Returns all records since last ‘2’, ‘3’ or ‘4’ command.
4	Last data	Returns the last record or last n records (n = <Value>)
D	Date	Change date. Date is format is MM/DD/YY
T	Time	Change time. Time format is HH:MM:SS
C	Clear data	Displays a prompt for clearing the stored unit data.
S	Start	Start a sample
E	End	Ends a sample (abort the sample, no data record)
ID	Location	View / change the location number. Range 1-999.
OP	Op Status	Replies OP x, where x is “S” Stopped or “R” Running
RV	Revision	View Software Revision
SM	Mode	0 = Manual, 1 = Continuous
SK	K-Factor	View / change K-Factors x = 1 - 4 (PM1, PM2.5, PM4, PM10, TSP) y = K-Factor value Range = 0.10 to 9.99 Format: SKx yy Examples: SK1 2.0 changes PM1 K factor to 2.0 SK2 1.9 changes PM2.5 K factor to 1.9

5.3. Real Time Output

The AEROCET 831 outputs real time data at the end of each sample. The output format is a comma separated values (CSV). The following sections show the format.

5.4. Comma Separated Value (CSV)

A CSV header is included for multiple record transfers like Display All Data (2) or Display New Data (3).

CSV Header:

```
Time,Loc,PM1,PM2.5,PM4,PM10,TSP,Status
```

CSV Example Record:

```
23/JUN/2014 12:35:31,001,0.0,0.1,0.2,0.8,3.3,000<CR><LF>
```

Table 4, Status Bits

Code	Error/Alarm Type
000	Normal/No Alarm
016	Low Battery
032	Sensor Error
064	Sensor Noise
112	Low Battery, Sensor Error, and Sensor Noise

6. Maintenance

WARNING:
There are no user serviceable components inside this instrument. The covers on this instrument should not be removed or opened for servicing, calibration or any other purpose except by a factory-authorized person. To do so may result in exposure to invisible laser radiation that can cause eye injury.

6.1. Charging the Battery

To charge the battery, connect the battery charger module AC power cord to an AC power outlet and the battery charger DC plug to the socket on the side of the AEROCET 831. The universal battery charger will work with power line voltages of 100 to 240 volts, at 50/60 Hz. The battery charger LED indicator will be Red when charging and Green when fully charged. A discharged battery pack will take approximately 2.5 hours to fully charge.

When fully charged, the battery will power the AEROCET 831 for approximately 8 hours of continuous sampling or 24 hours of intermittent sampling. For extended operation, operate the unit with the battery charger attached. Also, charge the battery before storing the AEROCET 831. Storing a discharged battery will degrade its performance.

Caution:
The provided battery charger is designed to work safely with this device. Do not attempt to connect any other charger or adapter to this device. Doing so may result in equipment damage.

6.2. Service Schedule

Table 2 shows the recommended service schedule for the AEROCET 831.

Table 2, Service Schedule

Item To Service	Frequency	Done By
Flow rate test	Monthly	Customer
Zero test	Optional	Customer or Factory Service
Calibrate Sensor	Yearly	Factory service only

6.2.1. Flow Rate Test

The sample flow rate is factory set to 0.1cfm (2.83 lpm). Continued use and ambient temperature/pressure variations may cause minor changes in flow which can reduce measurement accuracy. A flow calibration kit is available separately that includes everything needed to test/adjust the flow rate. To test the flow rate:

- Remove the inlet screen holder
- Connect the flow meter with inlet adapter (PN 80530) to the instrument inlet
- Start a sample
- Observe the flow meter reading after approximately 30 seconds
- The flow rate should be 0.1 CFM (2.83 LPM) ±5%

If the flow is not within this tolerance, it can be adjusted using a trim pot located in an access hole in the side of the unit. Turn the adjustment pot clockwise to increase the flow and counter-clockwise to decrease the flow.

6.2.2. Zero Count Test

The AEROCET 831 automatically monitors system noise and displays a System Noise warning when the noise level is high (see Section 3.5.1). This diagnostic reduces the necessity for an inlet filter zero count test. However, a zero count kit (PN 80846) can be purchased separately if desired.

6.2.3. Annual Calibration

The AEROCET 831 should be sent back to Met One Instruments yearly for calibration and inspection. Particle counter calibration requires specialized equipment and training. The Met One Instruments calibration facility uses industry accepted methods such as ISO and JIS.

In addition to calibration, the annual calibration includes the following preventative maintenance items to reduce unexpected failures:

- Inspect the exhaust filter
- Inspect and clean the optical sensor
- Inspect the pump/tubing
- Cycle and test the battery

6.3. Flash Upgrade

Firmware can be field upgraded via the USB port. Binary files and the flash program must be provided by Met One Instruments.

7. Troubleshooting

The following table covers some common failure symptoms, causes and solutions.

Symptom	Possible Cause	Correction
Low battery message	Low battery	Charge battery 2.5 hrs
Sensor Noise	Possible contamination	Contact service center
Sensor Error	Sensor failure	Send to service center
Does not turn on, no display	1. Dead battery 2. Defective Battery	1. Charge battery 2.5 hrs 2. Send to service center
Display turns on but pump does not	1. Low Battery 2. Defective pump	1. Charge battery 2.5 hrs 2. Send to service center
Suspect measurement values	1. Flow rate off 2. Inlet screen clogged	1. Check flow rate 2. Check inlet screen
Battery pack does not hold a charge	1. Defective battery pack 2. Defective charger module	1. Send to service center 2. Contact service center

8. Specifications

Operating Principle	Particle count to mass conversion

Features

Sample Duration	1 minute
Sample Modes	Manual and Continuous
Data storage	2,500 records
Display	2-line by 16-character LCD
Controls	2 button keypad with rotary dial
Calibration	NIST, ISO, JIS

Performance

PM Levels	PM1, PM2.5, PM4, PM10, and TSP
Concentration Range	0 – 1,000 µg/m^3
Resolution	0.1µg/m^3 (display / serial output)
Sensitivity	High = 0.3µm, Low = 0.5µm
Accuracy	± 10% to calibration aerosol
Flow rate	0.1 CFM (2.83 lpm)

Electrical

Light Source	Laser Diode, 780 nm, 40 mW (typical)
AC Adapter/Charger	AC to DC module, 100 – 240 VAC to 8.4 VDC
Battery Type	Li-ion rechargeable Battery
Battery Operating Time	8 hours continuous operation 24 hour intermittent operation
Battery Recharge Time	2.5 hours typical
Communication	USB Mini B Type

Physical

Height	6.25” (15.9 cm)
Width	3.63” (9.22 cm)
Thickness	2.00” (5.08 cm)
Weight	1.74 lbs – 28 ounces – (0.79 kg)

Environmental

Operating Temperature	0º C to +50º C
Storage Temperature	-20º C to +60º C

Accessories

Battery charger / adapter
USB Cable
Operation manual
Comet software

Contact :

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