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# MODEL 831 MANUAL



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## Copyright Notice

Model 831 Manual

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## Technical Support

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### 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

<b>1. Introduction .....</b>	<b>3</b>
1.1. About the Measurement .....	3
<b>2. Setup .....</b>	<b>3</b>
2.1. Unpacking.....	3
2.2. 831 Layout .....	5
2.3. Initial Operation .....	5
<b>3. Operation .....</b>	<b>6</b>
3.1. User Interface .....	6
3.2. Power On/Off .....	6
3.3. Start/Stop a Sample .....	6
3.4. Sample Screen .....	6
<b>4. Settings Menu.....</b>	<b>7</b>
4.1. To View Settings.....	7
4.2. To Edit Settings .....	7
<b>5. Serial Communications .....</b>	<b>9</b>
5.1. Connection .....	9
5.2. Commands .....	9
5.3. Real Time Output .....	10
5.4. Comma Separated Value (CSV) .....	10
<b>6. Maintenance .....</b>	<b>11</b>
6.1. Charging the Battery.....	11
6.2. Service Schedule.....	11
6.3. Flash Upgrade .....	12
<b>7. Troubleshooting.....</b>	<b>12</b>
<b>8. Specifications.....</b>	<b>13</b>
<b>9. Electrical &amp; Safety Conformity .....</b>	<b>14</b>
<b>10. Warranty / Service.....</b>	<b>15</b>

## 1. Introduction

The 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 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 831 counts and sizes particles in 7 different size ranges then uses a proprietary algorithm to convert count data to mass measurements ( $\mu\text{g}/\text{m}^3$ ). Fundamentally, the 831 calculates a volume for each detected particle then assigns a standard density for the conversion.

The standard density value is adequate for most sampling environments. However, some environments are heavily influenced by high or low density materials which can reduce measurement accuracy. For these environments, the 831 provides a K-Factor setting for each measurement range (PM1, PM2.5, PM4 and PM10). These K-Factors can be modified with Comet software.

## 2. Setup

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

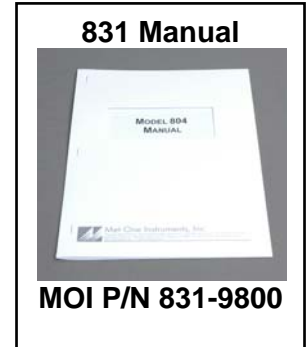
### 2.1. Unpacking

When unpacking the 831 and accessories, inspect the carton for obvious damage. If the carton is damaged notify the carrier. Unpack everything and make a visual inspection of the contents. Standard items (included) are shown in Figure 1. Optional accessories are shown in Figure 2.

#### **ATTENTION:**

The included USB driver CD must be installed before connecting the 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. See section 5.1.

### Model 831 Standard Accessories



**Figure 1 – Standard Accessories**

### Model 831 Optional Accessories



**Figure 2 – Optional Accessories**

## 2.2. 831 Layout

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



Figure 3 – 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

The battery should be charged before initial operation. Refer to Section 6.1 of this manual for battery charging information.

Complete the following steps to verify proper operation.

1. Press the Power key for 0.5 seconds or more to turn on power.
2. Observe the Startup screen for 3 seconds then the Sample screen (Section 3.4)
3. Press Start / Stop key. The 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 Model 831.

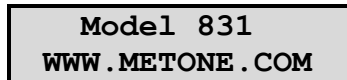
#### 3.1. User Interface

The 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 for power on. Press the Power key for power off. During power on, the 831 will display the Startup Screen (Figure 4) for approximately 3 seconds then display the Sample Screen.

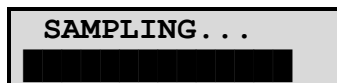


**Figure 4 – Startup Screen**

*Note: The 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. Start/Stop a Sample

Press the START/STOP key to start a sample. The 831 will sample for 1 minute then stop. During the measurement, the 831 will display a progress bar (Figure 5).

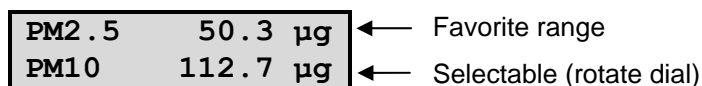


**Figure 5 – Sampling Screen**

*Note: Press the START/STOP key during a sample to stop the sample and discard the results.*

#### 3.4. 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) and the 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.



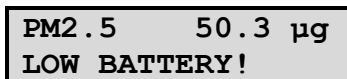
**Figure 6 – Sample Screen**



### 3.4.1. 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 831 stops sampling. A low battery condition is shown in Figure 7 below.



**Figure 7 – Low Battery**

The 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.

## 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.
FAVORITE	Pin favorite PM range to the top display line.
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/YYYY (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	831 will display the last record (Date, Time, Location, and Record Number). Rotate dial to scroll through records. Press to view record.
PM1 12.8 µg PM2.5 50.3 µg PM4 72.4 µg PM10 112.7 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. 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.

### 4.2.5. 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.

#### 4.2.6. 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.

#### 4.2.7. About

831 80878-1 v1.0.0	View model number and firmware version.
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### 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.

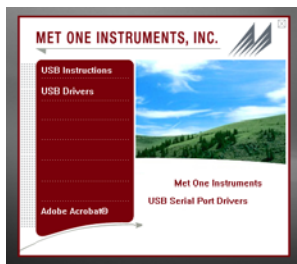
#### 5.1. Connection

##### ATTENTION:

The included USB driver CD must be installed before connecting the 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 USB Drivers 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 38400

#### 5.2. Commands

The 831 provides serial commands for accessing stored data and settings. The protocol is compatible with terminal programs such as Windows HyperTerminal.

The unit returns a prompt (\*) when it receives a carriage return to indicate a good connection. Serial commands and descriptions are listed in Table 2 below.

**Table 2, Serial Commands**

<u>Protocol Summary:</u>		
<ul style="list-style-type: none"> <li>• 38,400 Baud, 8 Data bits, No Parity, 1 Stop Bit</li> <li>• Commands (CMD) are UPPER or lower case</li> <li>• Commands are terminated with a carriage return &lt;CR&gt;</li> <li>• To view setting = CMD &lt;CR&gt;</li> <li>• To change setting = CMD &lt;SPACE&gt; &lt;Value&gt; &lt;CR&gt;</li> </ul>		
<b>CMD</b>	<b>Type</b>	<b>DESCRIPTION</b>
?,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
SK	K-Factor	View / change K-Factors x = 1 - 4 (PM1, PM2.5, PM4, PM10) y = K-Factor value Range = 0.10 to 9.99

### 5.3. Real Time Output

The 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, Location, PM1, PM2.5, PM4, PM10, Status

#### CSV Example Record:

31/AUG/2010 14:12:21,001,12.8,50.3,72.4,112.7,000<CR><LF>

*Note: Status bits: 000 = Normal, 016 = Low Battery, 032 = Sensor Error, 64 = Sensor Noise, 112 = Low battery, Senor 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

#### **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.

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 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 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 831. Storing a discharged battery will degrade its performance.

### 6.2. Service Schedule

Table 3 shows the recommended service schedule for the 831.

**Table 3, Service Schedule**

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

#### **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 using the small wrench provided in the flow meter kit
- Connect the flow meter to the inlet nozzle
- Start a sample
- Observe the flow meter reading after approximately 30 seconds.
- The flow rate should be 0.1 CFM (2.83 LPM)  $\pm 5\%$ .

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.

### 6.2.1. Annual Calibration

The 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
Low measurement values	1. Low flow rate 2. Inlet screen clogged	1. Check flow rate 2. Check inlet screen
High measurement values	1. High flow rate 2. Calibration	1. Check flow rate 2. Send to service center
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

<b>Operating Principle</b>	Particle count to mass conversion
<b>Features</b>	
Sample Duration	1 minute
Data storage	2,500 records
Display	2-line by 16-character LCD
Controls	2 button keypad with rotary dial
Calibration	NIST, ISO, JIS
<b>Performance</b>	
PM Levels	PM1, PM2.5, PM4 and PM10
Concentration Range	0 – 1,000 $\mu\text{g}/\text{m}^3$
Resolution	0.1 $\mu\text{g}/\text{m}^3$ (display / serial output)
Sensitivity	0.5 $\mu\text{m}$
Accuracy	$\pm 10\%$ to calibration aerosol
Flow rate	0.1 CFM (2.83 lpm)
<b>Electrical</b>	
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
<b>Physical</b>	
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)
<b>Environmental</b>	
Operating Temperature	0° C to +50° C
Storage Temperature	-20° C to +60° C
<b>Accessories</b>	
Battery charger / adapter	
USB Cable	
Operation manual	
Comet software	

## 9. Electrical & Safety Conformity

The manufacture certifies that this product operates in compliance with following standards and regulations:

- FDA / CDRH This product is tested and complies with 21 CFR, Subchapter J, of the health and Safety Act of 1968.
- European Community (CE) Directive 72/23/EEC  
EN 61010-1 (Safety)
- IEC 60825-1 Ed.1.1 (1998-01)
- EN 60825-1 W/A11 (1996)
- US 21 CFR 1040.10

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# CE Declaration of Conformity CE

CE MARKING

**Manufacturers Name:** Met One Instruments, Inc.

**Manufacturer's Address:** Met One Instruments, Inc.  
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Grants Pass, Oregon 97526  
United States of America  
Phone: 541-471-7111  
FAX: 541-471-7116  
E-Mail: [metone@metone.com](mailto:metone@metone.com)

**Declares, that the product(s):**

**Product Names:** Particulate Monitor, Aerosol Mass Monitor, Particle Counter

**Model Numbers:** GT-321, GT-321-1, GT-331, GT-521, GT-526, BT-637, 804, 831

**Product Options:** All

**Are in compliance with the following documents:**

**EMC:** Emissions: CISPR 11:1990 / EN 61326-1  
Immunity: EN50082-1 / EN 61326-1



Tom Pottberg  
President  
April 20, 2012



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## 10. Warranty / Service

### Warranty

Products manufactured by Met One Instruments, Inc. are warranted against defects and workmanship for a period of two (2) years from the ship date.

Any product found to be defective during the warranty period will, at the option of Met One Instruments, Inc., be replaced or repaired. In no case shall the liability of Met One Instruments, Inc. exceed the purchase price of the product.

This warranty may not apply to products that have been subject to misuse, negligence, accident, acts of nature, or that have been altered or modified other than by Met One Instruments, Inc. Consumable items such as filters, bearings pumps and batteries are not covered under this warranty.

Other than the warranty set forth herein, there shall be no other warranties, whether expressed, implied or statutory, including warranties of fitness of merchantability.

### Service

Any product being returned to Met One Instruments, Inc. for service, repair or calibration, including items sent for warranty repair, must be assigned a return authorization (RA) number. Please call (541) 471-7111 or send an email to [service@metone.com](mailto:service@metone.com) requesting an RA number and shipping instructions.

All returns must be shipped to the factory, freight pre-paid. Met One Instruments, Inc. will pay the shipping charge to return the product to the end user after repair or replacement of an item covered by warranty.

All instruments sent to the factory for repair or calibration must be free of contamination resulting from sampling chemicals, biological matter, or radioactive materials. Any items received with such contamination will be disposed and the customer will be billed a disposal fee.

Replacement parts or service/repair work performed by Met One Instruments, Inc. are warranted against defects in material and workmanship for a period of ninety (90) days from the date of shipment, under the same conditions as stated above.

REV 2011