

AEROCET 531 OPERATION MANUAL

AEROCET-531-9800 REV F



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AEROCET 531 Operational Manual

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Safety Notice

The contents of this manual have been checked against the hardware and software described herein. Since deviations cannot be prevented entirely, we cannot guarantee full agreement. However, the data in this manual is reviewed regularly and any necessary corrections are included in subsequent editions.

Faultless and safe operation of the product presupposes proper transportation, storage, and installation as well as careful operation and maintenance. The seller of this equipment cannot foresee all possible modes of operation in which the user may attempt to utilize this instrumentation.

The user assumes all liability associated with the use of this instrumentation. The seller further disclaims any responsibility for consequential damages.

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.

This system contains a laser operating at 785 nm. This wavelength is invisible to the naked eye and can cause damage to the eye if directly exposed. A protective housing protects the unit. To avoid the possibility of accidental exposure, always power down the system any time service or repair work is being performed.

Repair of instrumentation manufactured by Met One Instruments, Inc. should only be attempted by manufacturer trained service personnel.

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

Warranty

Products manufactured by Met One Instruments, Inc. are warranted against defects in materials and workmanship for a period of (1) year from the date of shipment from the factory. Offered products not manufactured by Met One Instruments, Inc. will be warranted to the extent and in the manner warranted by the manufacturer of that product.

Any product found to be defective during the warranty period will, at the expense of Met One Instruments, Inc. be replaced or repaired and return freight prepaid. 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 or modified other than by Met One Instruments, Inc. Opening the particle counter, e.g. removing the cover, voids warranty!

Consumable items such as bearings 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 or merchantability.

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1 Safety

1.1 Safety Indicators

This manual uses a **CAUTION** and a **WARNING** indication. Familiarize yourself with the following definitions for the meanings of these indicators.

A **CAUTION** indicates a hazard and calls attention to a procedure that if not correctly followed could result in damage to the instrument. Do not proceed beyond a caution indicator without understanding the hazard.

A **WARNING** indicates a hazard to you and calls attention to a procedure that if not correctly followed could result in injury or even death. Do not proceed beyond a warning without understanding the hazard.

2 Setting Up

2.1 Unpacking

When you unpack the AEROCET 531 and accessories, inspect the carton for obvious damage. If the carton is damaged notify the carrier. Unpack everything and make a visual inspection.

You should have the following:

Item	Description	Part Number
1	Carrying case	8517
2	AEROCET 531 Particle Mass Profiler & Counter	AEROCET 531
3	Miniature screwdriver	993020
4	Iso-kinetic Sample Probe with a short piece of tubing	G3110
5	Zero Particulate Filter	G3111
6	Custom Serial Cable	3228
7	Universal AC to DC converter module with IEC AC power cord	510640+400100
8	AEROCComm Software (CD)	3289
9	AEROCComm Software Manual	AEROCOM-9800
10	AEROCET 531 Operation Manual	AEROCET-531-9800
11	AEROCET 531 Calibration Certificate	Please call



If any of the above components are missing contact your supplier.

Keep the carton and packing material for reuse.

2.2 Optional Accessories

Description	Part Number
Temperature & Humidity Probe	G3120
Dwyer™ Ball Flow Meter	9801
Printer	G3115
Printer Paper	750509

2.3 Familiarization



Item	Description
Power Switch	Slide to turn the GT-531 ON or OFF.
Charging Jack	Plug Universal AC to DC converter module into the jack to charge the internal battery.
Serial Port	Used for RS-232 or RS-485 serial communication (Section 6).
Iso-kinetic Probe	Reduces count errors due to mismatched sample flow velocity.
Temp/RH Connector	Used to connect an external temperature and humidity probe.
Display Adjust	Adjusts the LCD display contrast.

Flow Adjust	Adjusts the flow rate of the GT-531.
-------------	--------------------------------------

2.4 Test Run

The battery pack inside the AEROCET 531 was charged at the factory and the instrument should be ready to use. The AEROCET 531 was shipped with the following factory settings.

Parameter	Value
Location	001
Sample	COUNTER
Mode	MANUAL
Printer	OFF
Volume, COUNTER	/FT3
Temperature Units	°F
Date/Time	Pacific Standard
Memory	Cleared

1. Remove the red rubber cap from the AEROCET 531 inlet nozzle.
2. Turn on the power switch that is located on the right side of the AEROCET 531.
3. On power up the product intro screen is displayed for 3 seconds. The intro screen displays the product name and firmware version.

Note: If there is no display or a dim display, or you here a long beep, the battery pack probably needs charging and you should refer to Section 7.3.

4. Next you will see the main counter screen (refer to Section 5.2.1).

```
14-APR 09:04:51
001 /ft3 73F 31%
0.5u      173,060
5.0u      710
```

5. Press the START button. You should hear the internal vacuum pump start running. After 1 minute the pump will stop and the 0.5µm and 5µm channels will show the cumulative counts of particles larger than 0.5µm and 5µm per cubic foot.

Note: Do not change any of the factory default settings before reading section 5 about the User Interface.

6. The AEROCET 531 is now checked out and ready for use, however you should read the rest of this manual to better understand how to use and maintain this instrument.

7. Be sure to switch off the AEROCET 531 power when you are finished sampling to conserve battery power.

If the AEROCET 531 failed the test run, first check to see if the factory defaults are still set properly, program them in if they are not (Section 5), then try another test sample. If there is still a problem refer to Section 8 Troubleshooting.

Note: NEVER let moisture (e.g. rain) enter the sample inlet. Also put the AEROCET 531 in a watertight enclosure if you plan to use it outdoors.

3 AEROCET 531 Overview

The AEROCET 531 is a combined Mass Profiler and Particle Counter in a small, hand held, battery operated, and completely portable unit.

When used as a particle counter the AEROCET 531 provides visual real time count information in two channels on the LCD display. After one minute, the AEROCET 531 displays the two most popular cumulative particle sizes: $>0.5\mu\text{m}$ and $>5.0\mu\text{m}$.

When used as a Mass Profiler the AEROCET 531 provides a fast indication of particulate mass concentration per cubic meters of sampled air for the most commonly tested particle size fractions; PM1, PM2.5, PM7, PM10 and TSP.

The AEROCET 531 measurements can compare quite favorably with expensive reference methods. The AEROCET 531 uses the stored particle count data from eight different particle size ranges and a proprietary algorithm to derive the mass concentration for the aerosol sample.

The sensor in the AEROCET 531 incorporates a long life laser diode, an efficient light collecting elliptical mirror and unique optics to provide a high concentration limit.

The AEROCET 531 contains a 6V Ni-MH Self-contained battery pack, a vacuum pump, an isokinetic probe, microprocessor electronics, a computer interface and a LCD display all in one small package.

3.1 Calibration

The AEROCET 531 was calibrated at the factory using NIST traceable polystyrene spheres. When measuring an aerosol that is significantly different than a typical aerosol, a “K-factor” should be applied to compensate for the error.

The “K-factor” is applied using the AEROCComm software.

3.2 Operating Modes

The AEROCET 531 can be operated manually or programmed to run continuously.

When used manually, the AEROCET 531 is easy to use since the user interface consists of just a START/STOP button and a MENU button with four arrow selection buttons.

The AEROCET 531 can be programmed to continuously take and store samples unattended. The AEROCET 531 will run continuously with its charger plugged in.

The stored measurements can be printed or downloaded to a computer through the AEROCET 531 standard serial interface. Data is output to the serial port at the completion of a measurement cycle. If the printer port is turned ON then data will be formatted for the printer, if the printer port is turned OFF data will be formatted for computer storage.

3.3 Operational Feedback

At the end of a manual measurement cycle the instrument will produce a short beep to signal the operator that the cycle has been completed.

During the measurement cycle the top or time line of the display is replaced with a progress bar graph and a countdown timer that shows the sample time left in seconds.

3.4 Applications as a particle counter

- Clean room monitoring, verification, and hepa filter testing, FED. STD 209
- Indoor and outdoor (*) air quality studies
- Finding leaks and sources of contamination air ducts and filtration systems
- Hospitals and nursing homes
- Test the efficiency of residential air purifiers and vacuum cleaners
- Check filters for particle leaks
- Epidemiological studies
- Reentrainment studies

3.5 Applications as a particulate mass monitor (**)

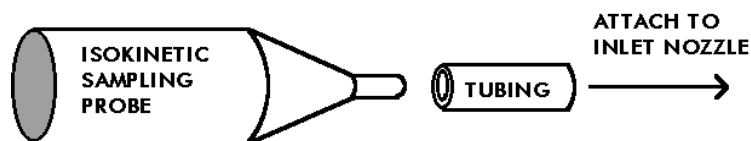
- Process control monitoring in sawmills, grain elevators, quarries etc.
- Mines and ore processing plants
- Indoor and outdoor (*) air quality studies
- Finding leaks and sources of contamination air ducts and filtration systems
- Concerned citizen groups that want to do their own air quality studies
- Event monitoring, fence line monitoring
- Epidemiological studies

(*) only with proper protection (e.g. watertight enclosure) and proper precautions (e.g. no moisture can enter the sample inlet).

(**) if high accuracy is required or atypical aerosols (e.g. Sahara dust) is being sampled Met One Instruments recommends a K-factor calibration at the sampling location prior to conducting the measurements.

3.6 Iso-kinetic Sampling

The AEROCET 531 comes with an iso-kinetic probe that attaches to its inlet nozzle with the short piece of Tygon tubing provided.



The iso-kinetic probe helps reduce count errors related to the sample flow velocity and the aerodynamics of small particles.

The iso-kinetic probe should be used for most sampling applications.

When taking a sample of typical indoor or outdoor aerosols the opening of the iso-kinetic probe should always face upward. The AEROCET 531 can be held in your hand or placed on a flat surface with its display facing towards you.

When sampling in an area that has a constant airflow, such as a clean room, duct, vent or the downstream side of a filter, always align the opening of the iso-kinetic probe to the air movement.

The length of the Tygon tubing going from the inlet of the AEROCET 531 to the iso-kinetic probe can be increased if necessary. However, longer lengths can burden the pump and slow the sample flow rate or cause premature pump failures. Also, count losses, especially for larger particles, will increase. Met One Instruments recommends to keep the tubing length as short as possible. The tubing length should never exceed four feet.

The sampling height will affect the AEROCET 531 reading. Taking a sample near the floor can give results several times higher than a sample taken at eye level.

When using the AEROCET 531 to analyze a contamination problem be aware that not all contamination problems are continuous, some are the result of a short-term event or burst of particles. Locating the source will require taking a number of samples in the same area. It may be necessary to connect the AEROCET 531 to a computer and log data over 24 hours to detect a fast contamination event.

3.7 G3120 Relative Humidity/Temperature Sensor

Relative Humidity and Temperature measurements may be added to the AEROCET 531 at any time by plugging in the G3120 Relative Humidity/Temperature Sensor into the plug on the top of the unit.

The screen will now include actual readings of both measurements; data will now include the measurements in each data record.

3.8 G3115 Printer

Printed records may be added to the AEROCET 531 at any time by plugging in the optional G3115 printer. This printer is a complete 40 character wide portable printer with an internal battery and an external AC adapter/charger.

4 AEROCET Term Definitions

AEROCET 531 commonly used terms are defined in this section.

4.1 Location (or Sample Location)

Each sample event can have a sample location number assigned to it. The sample location number range is from 001 to 999. Location numbers are required for sampling to begin. Location numbers are very useful in searching the database.

4.2 Sample (or Sample Type)

Refers to the type of sample Counter or Mass.

A COUNTER sample type consists of two particle sizes— $>0.5\mu\text{m}$ and $>5.0\mu\text{m}$.

A MASS sample type consists of five mass ranges—PM1, PM2.5, PM7, PM10 and TSP.

4.3 Mode (or Operation Mode)

The mode will be set to either MANUAL or AUTO.

When set to MANUAL operation the START button causes the unit to take one sample and then stop.

When set to AUTO operation the START button causes the unit to take continuous samples until the STOP button is pressed.

4.4 Interval (or Sample Interval)

There is a one (1) minute sample interval for a COUNTER sample type.

There is a two (2) minute sample interval for a MASS sample type.

4.5 Event (or Sample Event)

One complete sample interval is considered to be a sample event. The AEROCET 531 memory can store 3520 events after which the memory must be cleared.

4.6 Printer Mode

At the end of each sample, data is sent to the RS-232 serial port. With the cable provided you can connect the AEROCET 531 to a serial printer or a computer.

With the optional G3115 Printer connected and the Printer mode turned ON the printer will print a report of each sample event. A sample of the G3115 Printer report is shown in Appendix A.

When set to OFF the printer output format is a One-line style report that may be used for computer interface. See Appendix A for an example.

4.7 Volume Units

When the unit is set in `COUNTER` mode, the display shows either particles per cubic foot (`FT3`) or particles per liter (`LITERS`).

When the unit is set in the `MASS` mode the volume is always expressed as mass per cubic meters.

4.8 Temperature Units

If a Met One Instruments G3120 Relative Humidity/ Temperature Sensor is connected to the AEROCET 531, the ambient temperature value is displayed in either `C` (Celsius) or `F` (Fahrenheit).

4.9 Low Battery Warning

When the internal battery pack output goes below 5.80 volts DC, a low battery message (`Low Battery!`) is displayed on the main sample screen. If the output goes below 5.50 volts the charge battery warning `Charge battery!` is displayed on the screen (refer to section 5.10).

5 User Interface

The AEROCET 531 has a very simple and user-friendly interface. The following section describes the user interface in detail. Please read Section 4 for a definition of terms that are used below.

5.1 Intro Screen

On power up the product intro screen is displayed for 3 seconds. The intro screen displays the product name and firmware version.

```
AEROCET 531
V1.10
www.metone.com
```

5.2 Main Screen

There are two main screens. The one displayed depends on the Sample Type selected—COUNTER or MASS.

5.2.1 Counter Main Screen

This screen shows the results of a COUNTER sample event.

```
14-APR 09:04:51
001 /ft3 73F 31%
0.5u      173,060
5.0u      710
```

Line	Description
1	If the unit is not taking a sample the current date and time is displayed. If the unit is taking a sample then a progress bar and seconds remaining is displayed. One sample event takes 60 second to complete. If you are viewing a previous stored sample then the date and time represents the time the sample event was stored.
2	First the location number is displayed, then the counter volume units (/ft3 for particles per cubic feet or /l for particles per liter). If you have an external temperature and humidity sensor plugged in then the ambient temperature (F or C) and relative humidity values (%) are displayed.
3	This line displays the 0.5µm particle size and the associated cumulative counts of particles per sample event.
4	This line displays the 5.0µm particle size and the associated cumulative counts of particles per sample event.

Key	Description
START STOP	Press this key to start and stop a sample event.
MENU ESC	Press this key to go to the main menu. This key is disabled when the unit is sampling!
ENTER	This key is used in conjunction with the left and right arrow keys to navigate previously taken sample events that are stored in memory. Pressing this key returns you to the current sample event.
LEFT	This key navigates back in time to previously taken sample events.
RIGHT	This key navigates forward in time to previously taken sample events.

5.2.2 Mass Main Screen

This screen shows the results of a MASS sample event.

14-APR	09:16:05
001 /m3	73F 31%
PM1	0.000 mg
PM2.5	0.002 mg

Line	Description
1	If the unit is not taking a sample the current date and time is displayed. If the unit is taking a sample then a progress bar and seconds remaining is displayed. One sample event takes 2 minutes (120 seconds) to complete. If you are viewing a previous stored sample then the date and time represents the time the sample event was stored.
2	First the location number is displayed and then the volume units for mass concentration (always cubic meters). If you have an external temperature and humidity sensor plugged in then the ambient temperature (F or C) and relative humidity values (%) are displayed.
3	This line displays the mass (mg) per cubic meter for the associated PM range. Use the up and down arrow keys to scroll through the other PM ranges (PM1, PM2.5, PM7, PM10, TSP).
4	Same as 3 for the next PM range.

Key	Description
-----	-------------

START STOP	Press this key to start and stop a sample event.
MENU ESC	Press this key to go to the main menu. This key is disabled when the unit is sampling.
ENTER	This key is used in conjunction with the left and right arrow keys to navigate previously taken sample events that are stored in memory. Pressing this key returns you to the current sample event.
UP	Press the up key to display smaller PM size ranges.
DOWN	Press the down key to display larger PM size ranges.
LEFT	This key navigates back in time to previously taken sample events.
RIGHT	This key navigates forward in time to previously taken sample events.

5.3 Main Menu Screen

The main menu screen allows you to navigate to other screens. The menu list contains items. Use the up and down arrow keys to traverse the menu list.

TAKE SAMPLE
SAMPLE SETUP
RECALL DATA
PRINT DATA

Menu Item	Description
TAKE SAMPLE	Press ENTER to go to the main screen.
SAMPLE SETUP	Press ENTER to go to the SAMPLE SETUP screen.
RECALL DATA	Press ENTER to go to the RECALL DATA screen.
PRINT DATA	Press ENTER to go to the PRINT DATA screen.
MEMORY	Press ENTER to go to the MEMORY screen.
SETTINGS	Press ENTER to go to the SETTINGS screen.
CLOCK	Press ENTER to go to the CLOCK screen.

Key	Description
START STOP	Pressing this key goes to the main screen and starts a sample event.
MENU ESC	Pressing this key goes to the main screen.
ENTER	Pressing this key goes to the selected menu item.
UP	Pressing this key moves the cursor up or scrolls the menu list down.
DOWN	Pressing this key moves the cursor down or scrolls the menu list up.

5.4 Sample Setup Screen

The Sample Setup screen allows you to configure the unit for sampling operation. It lets you identify the location of your sample event; the type of sample; the mode of operation; and the hold time.

Location: 001 Sample: COUNTER Op Mode: MANUAL HoldTime: 001
--

Line	Description
1	This line displays the location number of the sample event. The range is from 001 to 999, a value must be entered for correct database operation.
2	This line displays the sample type selection— COUNTER or MASS.
3	This line displays the operation mode selection — MANUAL or AUTO. In the MANUAL mode the unit takes one sample and stops. In the AUTO mode the unit takes samples until the STOP key is pressed.
4	This line displays the HoldTime selection —000 to 999 minutes. When Op Mode is configured for AUTO mode, then the hold time is the amount of time between samples. The pump is turned OFF between samples when the HoldTime is greater than 4 minutes.

Key	Description
MENU ESC	Pressing this key cancels your selections and returns to the main menu.
ENTER	Pressing this key saves your selections and returns to the main menu.
UP	Pressing this key increments the value in a number field or the next item in a list field.
DOWN	Pressing this key decrements the value in a number field or the next item in a list field.
LEFT	Pressing this key moves the cursor to the left or to the previous field.
RIGHT	Pressing this key moves the cursor to the right or to the next field.

5.5 Recall Data Screen

The Recall Data screen allows you to find previously taken sample events for display on the main screen. If the exact time is not known, then enter an approximate time and the database will locate the sample event closest to the time entered.

After the sample is shown the database may be scrolled using the UP/DOWN arrows to review the contents of the record or the LEFT/RIGHT arrows to move from sample to sample.

Recall Data/Time 20-Apr-01 07:00

Line	Description
2	This line displays the date and time selection for recalling a previously taken sample event. The default date and time is the same as the last used selection.

Key	Description
MENU ESC	Pressing this key cancels your selection and returns to the main menu.
ENTER	Pressing this key saves your selection, finds the nearest sample event time, and returns to the main screen for display.
UP	Pressing this key increments the value in a number field or the next item in a list field.
DOWN	Pressing this key decrements the value in a number field or the next item in a list field.
LEFT	Pressing this key moves the cursor to the left or to the previous field.
RIGHT	Pressing this key moves the cursor to the right or to the next field.

5.5.1 Recall Data Records

After the selected data record is recalled the following keys may be used to scroll through the memory. Records of Mass and Count are not separated in data recall.

Key	Description
MENU ESC	Press this key to go to the main menu. This key is disabled when the unit is sampling.
ENTER	This key is used in conjunction with the left and right arrow keys to navigate previously taken sample events that are stored in memory. Pressing this key returns you to the current sample event.
UP	Press the up key to display smaller PM size ranges.
DOWN	Press the down key to display larger PM size ranges.
LEFT	This key navigates back in time to previously taken sample events.
RIGHT	This key navigates forward in time to previously taken sample events.

5.6 Print Data Screen

The Print Data screen allows you to select which previously take sample events to print as a ticket style report. If the exact time is not known, then enter an approximate time and the database will locate the sample event closest to the time entered.

Type: COUNTER
Location: 001
13-Apr-01 17:15
20-Apr-01 09:39

Line	Description
1	This line displays the sample event type selection— COUNTER, MASS or ALL.
2	This line displays the location identification of the sample event. The range is from 000 to 999 where 000 will select all locations.
3	This line displays the initial sample event time selection.
4	This line displays the final sample event time selection.

Key	Description
-----	-------------

MENU ESC	Pressing this key cancels your selection and returns to the main menu.
ENTER	Pressing this key saves your selections and starts the printing process. The printing process status shown on the Printing Status screen
UP	Pressing this key increments the value in a number field or the next item in a list field.
DOWN	Pressing this key decrements the value in a number field or the next item in a list field.
LEFT	Pressing this key moves the cursor to the left or to the previous field.
RIGHT	Pressing this key moves the cursor to the right or to the next field.

5.6.1 Printing Status Screen

The Printing Status screen shows the progress of the printing process.

Printing Status Scanning...116 Printing...10 Finished!

Line	Description
2	This line displays the number of sample events scanned for printing.
3	This line displays the actual number of sample events printed.
4	Finished! is displayed when the printing processed is complete.

Key	Description
MENU ESC	Pressing this key cancels printing process and returns to the main menu.

5.7 Memory Screen

The Memory screen allows you to clear the memory where the samples events are stored. Up to 3520 sample events can be stored. When memory is full no further readings can be taken until the memory is cleared.

Free: 99%
Samples: 123
Press ENTER to
Clear memory!

Line	Description
1	This line displays the percentage of memory free for sample event storage.
2	This line shows the number of sample event currently store in memory.

Key	Description
MENU ESC	Press this key to cancel and return to the main menu.
ENTER	Press this key to clear memory

5.8 Settings Screen

The Settings screen allows you to selection the counter volume units, the ambient temperature units, and printer mode.

```

Counter..
..   Volume: FT3
Temperature: F
Printer: OFF
  
```

Line	Description
2	This line displays the counter volume unit selection— FT3 or LITER. (FT3 (/ft ³) for particles per cubic feet and LITER (/l) for particles per liter).
3	This line displays the ambient temperature unit selection— F or C.
4	This line displays the Printer mode selection —OFF or ON. In the ON mode the output is designed for the G3115 printer. In the OFF mode the printer output is a one line per event style report. Appendix A shows an example of each report style.

Key	Description
MENU ESC	Pressing this key cancels your selections and returns to the main menu.
ENTER	Pressing this key saves your selections and returns to the main menu.
UP	Pressing this key increments the value in a number field or the next item in a list field.
DOWN	Pressing this key decrements the value in a number field or the next item in a list field.
LEFT	Pressing this key moves the cursor to the left or to the previous field.
RIGHT	Pressing this key moves the cursor to the right or to the next field.

5.8.1 Clock Screen

The Clock screen allows you to set the unit's real time clock.

```
Set Clock
Date:14-APR-2001
Time:09:46:03
```

Line	Description
2	This line displays the date to be set to.
3	This line displays the time to be set to.

Key	Description
MENU ESC	Pressing this key cancels your selections and returns to the main menu.
ENTER	Pressing this key sets the clock to your selections and returns to the main menu.
UP	Pressing this key increments the value in a number field or the next item in a list field.
DOWN	Pressing this key decrements the value in a number field or the next item in a list field.
LEFT	Pressing this key moves the cursor to the left or to the previous field.
RIGHT	Pressing this key moves the cursor to the right or to the next field.

5.9 Memory Full Screen

The Memory Full screen appears when the sample event is full. Full means that 3520 sample events have been stored.

```
Memory Full!  
Press ENTER to  
    continue...  
or ESC to cancel
```

Press **ESC** to return to the main screen.

Pressing **ENTER** displays the following screen.

```
Memory Full!  
Contents:  
    to Printer
```

Use the up and down arrow keys to select a Contents option of either **to PRINTER**, **to PC**, or **DELETE**.

Press **ESC** to cancel your selection and return to the main screen.

If your selection is **to PRINTER** then pressing **ENTER** goes to the Print Data screen.

If your selection is **DELETE** then pressing **ENTER** goes to the Memory screen.

If your selection is **to PC** then pressing **ENTER** goes to the following message screen.

```
Connect to PC  
and run AEROComm
```

5.10 Charge Battery Screen

When the battery voltage goes below 5.50 volts this screen appears. All keys are disabled and this screen will remain until the battery voltage goes above 5.80 volts.

```
>>> Warning <<<  
Charge battery!!  
  
Battery: 5.48 V
```

6 Serial Interface

The serial interface to the AEROCET 531 is a standard 9 pin (DB-9) connector. It is located on the right hand side of the instrument as shown below. Communication with the AEROCET 531 requires a custom serial cable provided by Met One Instruments.

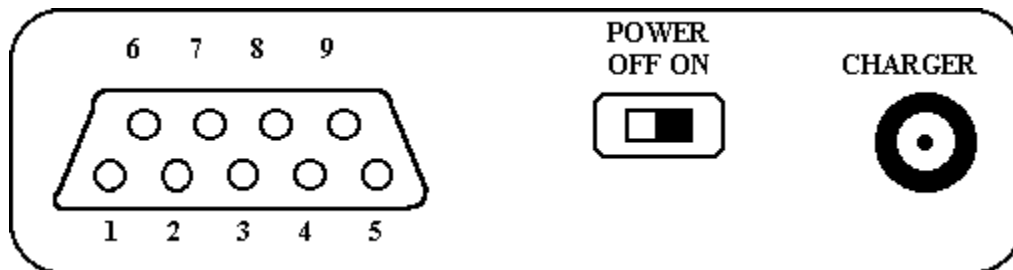
CAUTION: Standard serial cables will not work and may cause damage to the instrument if connected.

At the end of a sample, event data are sent to the serial port. The RS-232 serial port is configured at 9600 baud, 8 data bits, no parity, and 1 stop bit (9600 8N1).

With the cable provided, you could connect the AEROCET 531 to a serial printer or a PC computer.

Below is a description of the DB-9 connector.

Pin	Function	Comm. Type
1	Chassis Ground	
2	TX	RS-232
3	RX	RS-232
4	DTR	RS-232
5	Ground	RS-232 & RS-485
6	Not used	
7	Not used	
8	A	RS-485
9	B	RS-485



7 Maintenance

7.1 Service Schedule

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 voids warranty and may result in exposure to invisible laser radiation that can cause blindness.

Sensor, vacuum pump and filter replacement requires access to the inside of the AEROCET 531. A factory-authorized person must do this. Contact Met One Instruments for service information.

Calibrating particle sensors like the one in the AEROCET 531 requires specialized equipment and a skilled technician. Met One Instruments, Inc. maintains a calibration facility for calibrating particle counters according to industry-accepted methods like ASTM and JIS using NIST traceable standards.

The sensor in the AEROCET 531 should be recalibrated on a yearly basis.

7.2 Service Schedule Table

Item To Service	Frequency	Done By
Zero Count Test	Weekly	Customer
Flow Rate Test	Monthly	Customer
Replace Internal Filter	Yearly	Factory service only
Replace Pump	Yearly	Factory service only
Replace Battery Pack	Yearly	Factory service only
Calibrate Sensor	Yearly	Factory service only

7.3 Battery Pack

CAUTION: There are no user serviceable components inside the AEROCET 531. Do not attempt to change the internal battery pack. The wrong battery pack could cause serious damage or a fire. Only a factory qualified person should change and properly dispose of the battery pack.

When the internal battery pack output goes below 5.80 volts DC, a low battery message (`Low Battery!`) is displayed on the main sample screen. If the output goes below 5.50 volts the charge battery warning `Charge battery!` is displayed on the screen (refer to section 5.10).

To charge the battery pack, connect the AC power cord from the AC to DC converter module to an AC power outlet. The module is universal and will work with power line voltages of 100 to 240 volts, 50 to 60 Hz. Take the plug on the end of the cord coming from the converter module and plug it into the charger input socket on the side of the AEROCET 531 just below the power switch. Completely charging a discharged battery pack may take up to 15 hours.

The battery pack inside the AEROCET 531 when fully charged will power the AEROCET 531 for about five hours of continuous use. Under normal intermittent or manual operation however, the battery should last for about 8 hours.

If the AEROCET 531 is used on a daily basis, connect the charger at the end of each day. The battery pack will not be damaged if left connected to the charger over long periods.

If the AEROCET 531 is used in an area where AC power is available it is recommended to leave the charger connected to the AEROCET 531.

If the AEROCET 531 is to be stored charge the battery pack. Storing a discharged Ni-MH battery for any length of time will degrade its performance!

7.4 Zero Count Test

Met One Instruments recommends to periodically perform a zero count test as described below. False counts caused by air leaks or spurious noise will cause errors that are especially apparent when sampling relatively clean aerosols.



1. Attach the zero particulate filter (Part Number G3111) to the AEROCET 531 inlet nozzle. The zero filter removes 99.99% of all particles larger than 0.3 micron. If using another zero filter, that zero filter must be large enough that it does not create a restriction and load down the small vacuum pump inside the AEROCET 531.
2. Since the air passing through the AEROCET 531 is now virtually particle free, the output should be zero.
3. If using the AEROCET 531 in mass mode, select the PM1 range and take a sample. The result of the 2-minute sample should be zero micrograms.
4. If using the AEROCET 531 in count mode, select the 0.5 μ m range and take a sample. The result of the 1-minute sample should be zero counts.
5. If it does not read zero it could be caused by a leak in the flow path inside the AEROCET 531 or the zero filter is bad. If it is determined that there is a leak, the AEROCET 531 must be sent back to the factory for repair.

7.5 Flow Rate Test

The sample flow rate of 0.1-cfm is set at the factory. Variations in local temperature and pressure may change this flow rate. Variation in the flow rate will reduce the accuracy of the instrument.

Testing the flow rate is an easy procedure but it requires a flow meter that is $\pm 3\%$ accurate at 0.1-cfm. The flow meter must be non-loading to avoid loading the internal flow system. Most hot wire, ball type, and differential pressure type flow meters are non-loading.

Met One Instruments sells a flow meter (Part number 9801) upon request.



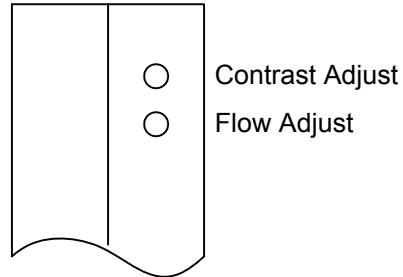
1. To test the flow rate, connect the flow meter to the sample inlet nozzle of the AEROCET 531 using a short piece of flexible 1/8 " ID tubing, Tygon tubing is a good choice.
2. Turn on the AEROCET 531 and note the flow meter reading. The flow rate should be 0.1-cfm $\pm 5\%$ (2.83 l/min $\pm 5\%$).
3. The flow rate can be adjusted by a trimpot located in the lower of the two access holes in the left side of the AEROCET 531 case (see section 2.3). Use the small screwdriver that came with the AEROCET 531 to make the adjustment. Turn the adjustment pot clockwise to increase the flow and counter-clockwise to decrease the flow.
4. Monitor the flow rate while adjusting the trimpot.

7.6 Display Contrast Adjust

The LCD display can be adjusted for optimum contrast by a trimpot located in the upper of the two access holes in the left side of the AEROCET 531 case (see section 2.3). Use the small screwdriver provided to make the adjustment.

Turn the adjustment pot to the desired contrast.

Contrast is affected by temperature; units used outdoors will often require adjustment.



8 Troubleshooting

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 voids warranty and may result in exposure to invisible laser radiation that can cause blindness.

A factory-authorized person should do replacement of the sensor, vacuum pump, filter or any component inside the AEROCET 531.

Symptom	Possible Cause	Correction
Does not turn on, no display	<ol style="list-style-type: none"> 1. Low battery 2. Defective Battery 	<ol style="list-style-type: none"> 1. Charge battery 10 hrs 2. Send to service center
Display turns on but pump does not	<ol style="list-style-type: none"> 1. Low Battery 2. Defective pump 	<ol style="list-style-type: none"> 1. Charge battery 10 hrs 2. Send to service center
Keypad functions do not work	Loose connector or defective component inside	Send to service center
Sample result remains at zero after sampling	<ol style="list-style-type: none"> 1. Pump stopped 2. Laser diode bad 	<ol style="list-style-type: none"> 1. Send to service center 2. Send to service center
Sample result is lower than normal	<ol style="list-style-type: none"> 1. Flowrate is low 2. Debris may be stuck in the inlet nozzle and blocking the beam 3. Contaminated optics in sensor 	<ol style="list-style-type: none"> 1. Check flowrate 2. Blow pressurized air into the nozzle. <u>Do not</u> put any object down into nozzle! 3. Send to service center
Sample result is higher than normal	<ol style="list-style-type: none"> 1. Air leak in sensor 2. Noisy laser 	<ol style="list-style-type: none"> 1. Send to service center 2. Send to service center
Battery pack does not hold a charge	<ol style="list-style-type: none"> 1. Defective or worn out battery pack 2. Defective power cords 3. Defective charger module or chords 	<ol style="list-style-type: none"> 1. Send to service center 2. Check with an Ohm-meter 3. Contact your distributor to get another charger

9 Specifications – AEROCET 531

OPERATING PRINCIPLE	Counts individual particles utilizing scattered laser light and calculates the equivalent mass concentration using a proprietary algorithm.
PERFORMANCE	
Mass Mode	
Mass Concentration Ranges	PM1, PM2.5, PM7, PM10, and TSP
Concentration Range	0 - 1 mg/m ³
Sample Time - Mass Mode	2 minutes
Particle Mode	
Particle Size Range	Two channels - 0.5 and 5.0 µm
Concentration Range	0 - 3,000,000 particles per cubic foot (105,900 particles/L)
Sample Time - Particle Mode	1 minute
Accuracy	± 10%, to calibration aerosol
Sensitivity	0.5 µm @ 2 to 1 peak to valley (JIS), 2 to 1 S/N
Flow Rate	0.1 cfm (2.83 lpm)
ELECTRICAL	
Light Source	Laser Diode, 5 mW, 780 nm
Power	6V Ni-MH Self-contained battery pack - provides 8 hours of typical intermittent operation, up to 5 hours continuous use. Full recharge may take up to 15 hours.
AC Adapter/Charger	AC to DC module, 100-240 VAC to 9 VDC @ 350 mA typical
Communications	RS-232
Particle Certifications	Meets or exceeds CE, ISO, ASTM and JIS international certifications.
Mass Certifications	Requires proper use of appropriate K-factors for measured material
INTERFACE	
Display	16 character x 4 line LCD
Keyboard	7 key membrane type
PHYSICAL	
Size	Height = 6.25" Width = 4.0" Thickness = 2.12" (15.9 cm) (10.2 cm) (5.4cm)
Weight	1.94 lbs - 31 ounces - (0.88 kg)
ENVIRONMENTAL	
Operating Temperature	0° to +50° C
Storage Temperature	-20° to +60° C
ACCESSORIES	
Supplied	Operation Manual Serial Cable (Custom Met One Part Number 3228) Communications Software (AEROComm, Met One Part Number 3289) AC to DC Converter Module with IEC AC Power Cord Iso-kinetic Sample Probe Screwdriver Carrying Case Zero Particulate Filter (Met One Part Number G3111)
Optional	RH & Temperature Probe (Met One Part Number G3120) Flow Meter (Met One Part Number 61082) Printer (Met One Part Number G3115)

10 Appendix A

Following are examples of G3115 Printer and Computer One-line report styles.

From the Sample Setup screen set the `Printer` to `ON` for Printer reports and to `OFF` for Computer One-line style reports

10.1 Counter Report using G3115 Printer

```
20-APR-2001 12:52:46
001      24C 40%
0.5u      333,420 /ft3
5.0u      590 /ft3
```

10.2 Mass Report using G3115 Printer

```
20-APR-2001 12:56:37
001      24C 40%
PM1      .001 mg/m3
PM2.5    .005 mg/m3
PM7      .010 mg/m3
PM10     .012 mg/m3
TSP      .015 mg/m3
```

10.3 Counter One-line Style

```
20-APR-2001, 13:12:38
Location, 001
Volume,      /ft3
Time,        0.5u,          5.0u, AT(C), RH(%)
13:13:39,   267070,        610,    24,    38
13:14:39,   257280,        380,    24,    38
13:15:39,   250800,        660,    25,    38
13:16:39,   254680,        520,    25,    38
13:17:39,   253620,        540,    25,    38
```

10.4 Mass One-line Style

```
20-APR-2001, 12:57:30
Location, 001
Time,      PM1, PM2.5,   PM7,   PM10,   TSP, AT(C), RH(%)
12:59:32, .001, .005, .009, .011, .013, 24, 39
13:01:32, .001, .004, .011, .014, .022, 24, 39
13:03:32, .001, .004, .011, .014, .018, 24, 39
13:05:32, .001, .004, .009, .010, .013, 24, 39
13:07:32, .001, .004, .007, .009, .015, 24, 40
13:09:32, .001, .004, .010, .012, .016, 24, 39
```



Declaration of Conformity



CE MARKING

Manufacturer's Name: Met One Instruments, Inc.

Manufacturer's Address: Met One Instruments, Inc.
1600 NW Washington Blvd
Grants Pass, Oregon 97526
United States of America
Phone: 541-471-7111
FAX: 541-471-7116
E-Mail: 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, AEROCET-531

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
January 26, 1999



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