# AEROCET-380
## Particulate Monitor
## Operation Manual

Revision A

**Met One Instruments, Inc**
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## Copyright Notice

AEROCET-380 Manual

## Technical Support

Should you require support, please consult your printed documentation to resolve your problem. If you are still experiencing difficulty, you may contact a Technical Service representative during normal business hours—7:00 a.m. to 4:00 p.m. Pacific Time, Monday through Friday.

|  |  |
|---|---|
| Voice: | (541) 471-7111 |
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|  | Met One Instruments, Inc. |
|  | 1600 NW Washington Blvd. |
|  | Grants Pass, OR 97526 |

## 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

*AEROCET-380 Operation Manual Rev A*

# 1   INTRODUCTION

## 1.1   About This Manual

This document is organized with the most important information grouped together for easy reference by the user. All AEROCET-380 owners and operators should read and understand the sections on installation, setup, and field calibrations. Other sections that provide in-depth information on subjects such as theory, diagnostics, accessories, and alternate settings provide valuable information which should be consulted as needed. Electronic version of this manual is also available.

## 1.2   Technical Service

This manual is structured by customer feedback to provide the required information for setup, operation, testing, maintaining, and troubleshooting your AEROCET-380 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 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.

| **Contact Information:** | Tel:  (541) 471 7111 | **Address:** | Met One Instruments, Inc. |
|---|---|---|---|
| | Fax:  (541) 471 7116 | | 1600 NW Washington Blvd. |
| | Web: www.metone.com | | Grants Pass, Oregon 97526 |
| | Email: service@metone.com | | U.S.A. |

## 1.3   About the AEROCET-380

The Met One Instruments, Inc. model AEROCET-380 is a type of nephelometer which measures real-time airborne TSP particulate concentration levels using the principle of forward laser light scatter.

**Laser Light Scatter System**
Sample air is drawn into the AEROCET-380 and through the laser optical module, where the particulate in the sample air stream scatters the laser light through reflective and refractive properties. This scattered light is collected onto a photodiode detector at a near-forward angle, and the resulting electronic signal is processed to determine a continuous, real-time measurement of airborne particulate mass concentrations.

## 1.4   Laser Radiation Safety and Conformity

**The AEROCET-380 is considered a Class I laser product. Class I products are not considered to be hazardous.**

This system contains a diode laser operating at < 5 mW power and 670 nm wavelength. This is visible to the naked eye and can cause damage to the eye if directly exposed. A protective optical housing fully encapsulates the laser beam and optics system within the AEROCET-380. Do not attempt to disassemble the optical module. Failure to comply with this instruction could cause accidental exposure to laser radiation. 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.**

- **US 21 CFR 1040.10.**

Always power down the system whenever service or repair work is being performed inside the instrument enclosure. Only trained technicians should attempt to repair the AEROCET-380.

## 1.5 AEROCET-380 Specifications

| PARAMETER | SPECIFICATION |
|---|---|
| **Measurement Principles:** | Particulate concentration by forward light scatter laser Nephelometer. |
| **Measurement Range:** | 0 to 100 mg/m$^3$ (0 to 100,000 $\mu$g/m$^3$) |
| **Measurement Sensitivity:** | 0.001 mg/m$^3$. |
| **Nephelometer Accuracy:** | ± 5% traceable standard with 0.6 µm PSL. |
| **Particle Size Sensitivity:** | 0.1 to 100 µm. Optimal sensitivity 0.5 to 10 µm particles. |
| **Long Term Stability:** | 5% with clean optics. |
| **Laser Type:** | Diode Laser, 5 mW, 670nm. Visible red. |
| **Display:** | 3.5" color LCD. |
| **Flow Rate:** | 2.0 liters/minute ± 0.1 LPM. Actual volumetric flow. |
| **Pump Type:** | Brushless Diaphragm (20,000 hour). |
| **Power:** | Input: 14.8V Li Battery, Output: 16.8VDC @ 1.8A |
| **Power Consumption:** | 5.25 W. |
| **Digital I/O:** | RS-485, USB C, WiFi |
| **Purge Filter** | 0.01 micron |
| **Pump Filter:** | 5.0 micron. |
| **Serial Communication:** | ASCII, MODBUS |
| **Internal Data Storage** | >15,000 records |
| **Operating Temperature:** | 0 - 40°C |
| **Ambient Humidity Range:** | 0 to 90% RH, non-condensing. |
| **Factory Service Interval:** | 24 Months typical, under continuous use in normal ambient air. |
| **Unit Weight:** | 2.3kg (5.1lbs) |
| **Unit Dimensions:** | 21.6cm high, 15.2cm wide, 21.0cm deep (8.5" x 6.0" x 8.25") |

**Specifications may be subject to change without notice**.

## 2 AEROCET-380 SETUP and STARTUP

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

### 2.1 Unpacking

When unpacking a new AEROCET-380, 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.

See section 12 Accessories for more details.

**ATTENTION:**
A Silicon Labs CP210x Driver for the USB connection must be installed before connecting to the USB Type C port.

Driver download weblink: https://metone.com/usb-drivers/

## 2.2 Layout



**Figure 2-1 - AEROCET-380 Layout**

| Component | Description |
|-----------|-------------|
| Power Switch | Switch that turns the AEROCET-380 on or off.  Press up to turn on and press down to turn off. |
| Charging Jack | Input jack for the battery charger.  This connection charges the internal battery pack and provides continuous operating power for the unit. |
| RS-485 Port | For RS-485 serial communication.  Optional cable required. |
| USB C Port | For USB serial communication. |
| Pump Filter | A 5 micron pump filter keeps any large particles from entering the sample pump. |
| Purge Filter | A 0.01 micron purge filter cleans the recirculated purge air which is used to keep the optics clean during normal operation. |
| Display | 3.5" color LCD display. |
| Keypad | 2 key membrane keypad. |
| Rotary Dial | Multifunction dial (rotate and press). |
| Inlet | Ambient air inlet |
| TSP Cap | The TSP cap prevents bugs and other large debris from combining with the air sample. It attaches over the air inlet nozzle. |

## 2.3 Default Settings

The AEROCET-380 comes with the user settings configured as follows:

| Parameter | Value |
|---|---|
| Sample Location ID | 1 |
| Sample Time | 5 Minutes |
| Self Test Period | 1 Hour |
| Count Units | ug/m3 |
| Baud Rate | 115200 |
| K Factor | 1.0 |

## 2.4 Initial Operation

Before operating the AEROCET-380 for the first time, it is recommended that the unit be fully charged. Information regarding charging the battery is found in Section 6 of this manual.

Complete the following steps to verify proper operation.
1. Press the power switch up to turn on the power.
2. Observe the Startup screen for 2 seconds then the Operate screen (Section 4.1)
3. Press **START/STOP** key. The AEROCET-380 will run a purge cycle, then a zero cycle, then begin sampling.
4. Observe the PM level on the display.
5. The unit is ready for use.

# 3  User Interface

The AEROCET-380 user interface is composed of a rotary dial, 2 button keypad, and an LCD display. The following table describes keypad functionality. Note some keys have more than one function.

| Key | Description |
|---|---|
|  | • Operate Screen:  Starts or stops a sample.<br>• Settings Menu:  Return to Operate screen.<br>• Edit Setting:  Cancel edit mode and return to Operate screen. |
|  | • Operate Screen: Display the Settings menu.<br>• Settings Menu:  Return to previous screen.<br>• Edit Setting:  Cancel edit mode and return the previous menu. |
|  | **Press Function**<br>    • Operate Screen: Display the sample history.<br>    • Settings Menu: Select the highlighted menu item.<br>    • Edit Setting: Enter setting edit mode.<br>**Dial Function**<br>    • Settings Menu: dial to move/scroll highlight to menu item.<br>    • Edit Setting: dial to change picklist and numerical parameters |

# 4 Operation

The following sections cover the basic operation.

## 4.1 About the Measurement

The AEROCET-380 is a nephelometer which measures real-time airborne particulate concentration levels using the principle of forward laser light scatter.  The included isokinetic probe enables the user to measure TSP (total suspended particulate) particles.  Additional cyclones can be obtained to measure $PM_1$, $PM_{2.5}$, or $PM_{10}$ particulate cut points.

## 4.2 Power Up

AEROCET-380 power is controlled by a switch located on the back of the unit. Press the power switch to the on position (towards the top of the case) to power up the unit.

The first screen shown on power up is the Startup screen. This screen briefly displays the company logo before loading the Operate Screen.

When the unit is started it first enters a Purge / Zero cycle where the purge pump is turned on to purge the dirty particles from the engine then it does a Zero calibration.  The unit will then perform a span check if this is enabled in the Sample Setup before sampling begins.

When the unit is stopped, the purge pump runs again for 30 seconds to clean out the engine before leaving it dormant.

## 4.3 Operate Screen

The Operate screen displays the sample status, date and time, battery status, sample data, and location.  Figure 4-1 shows the Operate screen.
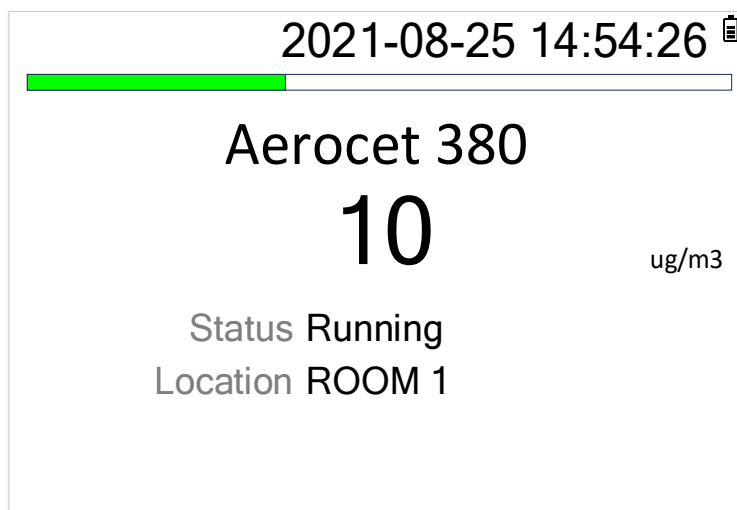
<div align="center">

**2021-08-25 14:54:26** 🔋

**Aerocet 380**

# 10
ug/m3

Status Running
Location ROOM 1

</div>

**Figure 4-1 - AEROCET-380 Operate Screen**

### 4.3.1 Sampling

The Operate Screen displays current sample information when the unit is sampling (real time data).  Concentration values (ug/m3, mg/m3) are time dependent so these values may fluctuate early in the sample; however, after several seconds the measurement will stabilize. The concentration units can be changed in the Sample Setup menu.

### 4.3.2  Sample Status

The top of the Operate screen displays the status of the AEROCET-380 while the unit is sampling.  A status bar fills with green as time progresses.  The status line below the sample mass data indicates whether the unit is purging, zeroing, or sampling.  The following table shows the various status messages and their meaning:

| Status | Description |
|---|---|
| Purging | Purge pump is turned on to purge the dirty particles from the engine. |
| Zeroing | Zero calibration is performed. |
| Span Settling/Sampling | Optional internal test to check that the unit can read high and zero concentrations. |
| Sampling | The AEROCET-380 is currently counting and taking real time samples. |
| Stopping | Waiting for the sample to finish before coming to a complete stop. |
| OFF | The AEROCET-380 is not sampling. |

### 4.3.3  Sample History

Sample history (previous data) can be viewed on the Operate screen when the unit is stopped or sampling. Pressing the knob puts the operate screen in History Mode.  History mode allows you to scroll through previously recorded samples and view the historical data.

In history mode, use the dial action of the rotary knob to scroll through the previous sample data records.  Use the ESCAPE button to exit history mode.  A new sample can be started without exiting the history mode by pressing the START button.

# 5   Main Menu

The Main Menu is accessible by pressing the MENU key while on the Operate screen.  The table below and Figure 5-1show the Main Menu items. Use the rotary dial to highlight the desired menu item and then press it to enter that menu screen.

| Menu Item | Description |
|-----------|-------------|
| Sample Setup | View / change location ID, sample time, concentration units, zero period, and enable/disable span test. |
| Toolbox | View / change memory, K-factors, display, and flow calibration. |
| Initial Setup | View / change serial settings, clock, and locations. |
| About | Display firmware version, serial number, service contact, calibration date, and run time. |

## Main Menu

Sample Setup
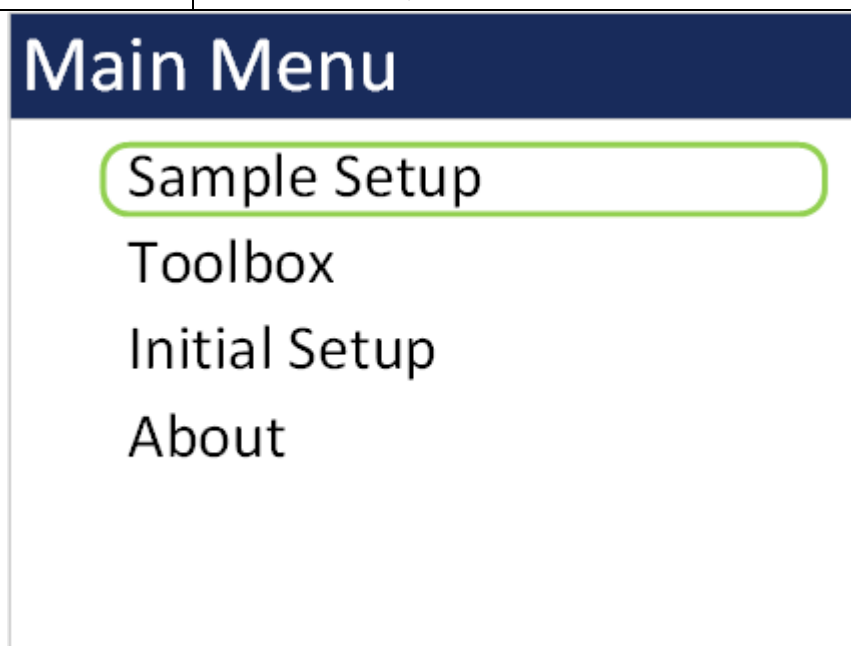
Toolbox

Initial Setup

About

**Figure 5-1 - Main Menu Screen**
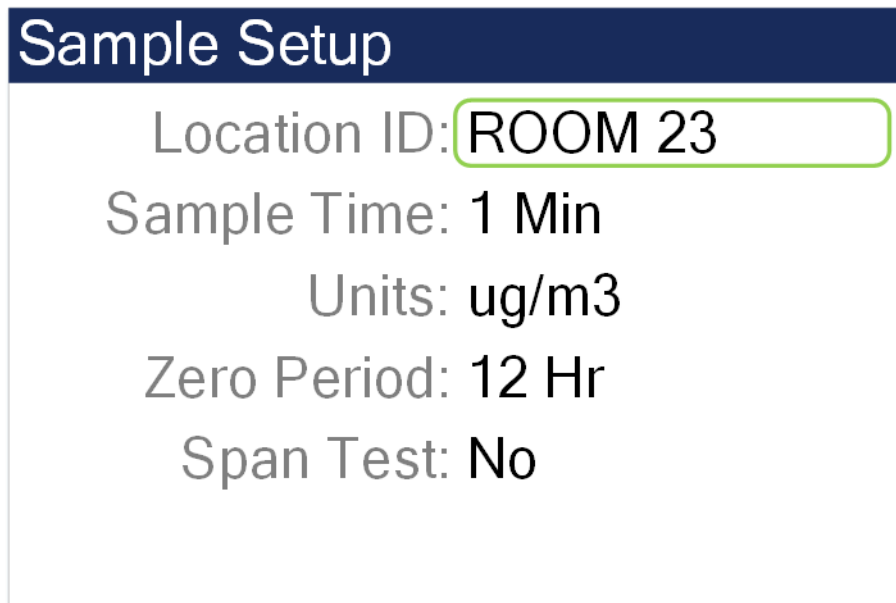
## 5.1   Edit Main Menu Items

To change settings, press MENU to display the Main Menu, rotate the dial to navigate to the desired item and press the dial to display the item view/edit screen.

To edit pick list items (e.g. Units: ug/m3 or mg/m3), rotate the dial to navigate to the item. Press the dial to select the item. Rotate the dial to change the setting. Press the dial to save the setting or ESCAPE to cancel and return to the previous screen.

To edit alpha-numeric and numeric values (e.g. Location), rotate the dial to navigate to the item. Press the dial to select the item. Rotate the dial to increment or decrement a value. Press the dial to select the next character. Press the dial for all remaining characters to save the value or ESCAPE to cancel and return to the previous screen.

## 5.2   Sample Setup

Figure 5-2 shows the Sample Setup screen.  The 5 parameters are covered in the following sections.



**Figure 5-2 - Sample Setup Screen**

### 5.2.1   Location ID

The Location ID is used to assign a unique name to a location or area. This important field is included in sample data records (display and csv output).  Use the dial to scroll through a list of custom location IDs.  To edit the list, see toolbox location ID in section 5.4.4.

### 5.2.2   Sample Time

The Sample Time is the length of time the unit will sample for.  The sample time is user selectable from 1 minute, 2 minutes, 5 minutes, 10 minutes, 15 minutes, 30 minutes, or 60 minutes.

### 5.2.3   Units

This setup feature allows the user to select the concentration to be displayed in ug/m3 or mg/m3.

### 5.2.4   Zero Period

The Zero Period allows the operator to select the Auto Zero / Self-Test time interval. This is user selectable intervals of 1-Hr, 2-Hr, 12-Hr, 24-Hr.

When the unit is started it first enters a Purge / Zero cycle where the purge pump is turned on to purge the dirty particles from the engine then it does a zero calibration.  A span check then occurs after the zero calibration if it is enabled.  This sequence is repeated at the interval selected for the Zero Period.

### 5.2.5  Span Test

The span check can be enabled/disabled by selecting Yes/No in the Span Test screen.  This test causes the instrument to briefly detect a high concentration. It then verifies that the instrument continues to read at or near zero.

### 5.3  Toolbox
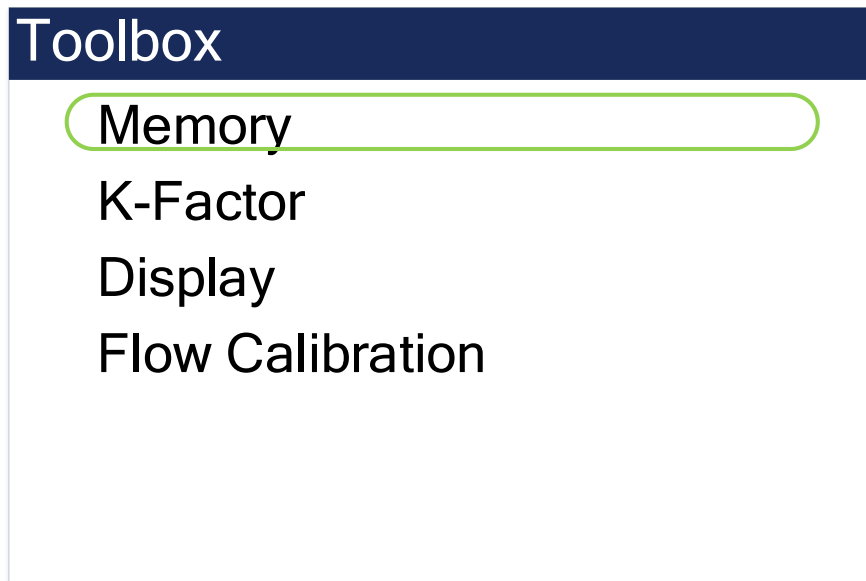
Figure 5-3 shows the Toolbox screen.



**Figure 5-3 - Toolbox Screen**

### 5.3.1  Memory

The AEROCET-380 can store up to 15,000 sample records in its memory.  For instructions on viewing stored data, see Section 4.3.3.  Because this memory is circular, once all records are full, any new samples taken will overwrite the oldest stored sample data.

The Memory screen provides indication of the available memory capacity and a means to completely erase all data currently saved in memory. The Free field shows the percentage of space available for data storage. When 0% is displayed, the memory is full and the oldest data will be overwritten by new data.

Press down on the rotary dial to activate the CLEAR command and erase the unit's memory. A confirmation screen will appear.  Select the CLEAR option on the confirmation screen to

continue with erasing the data and then returning to the memory screen. Selecting CANCEL on the confirmation screen will return to the Memory screen without erasing the data.
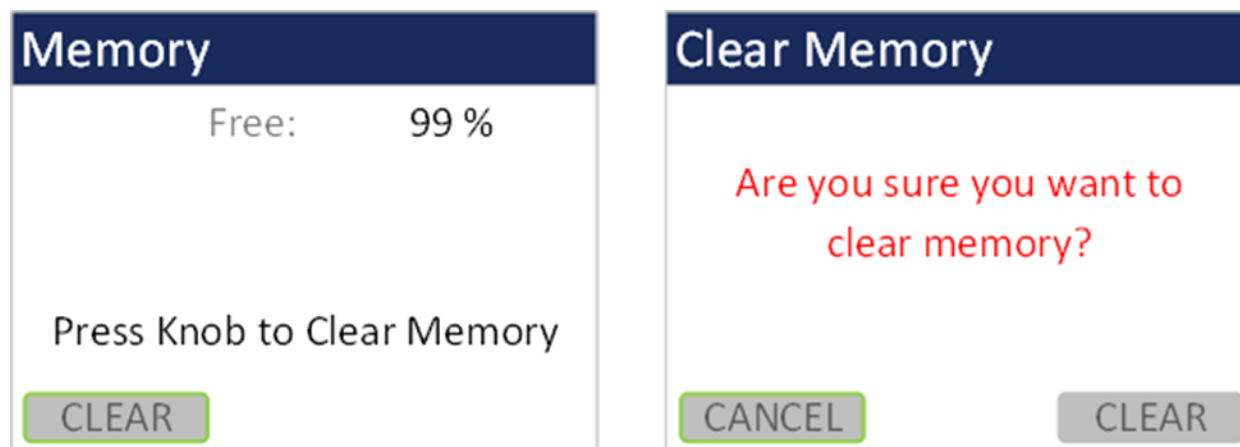


**Figure 5-4 - Memory Screens**

### 5.3.2  K-Factor

The K-Factor for the mass concentration can be set in the K-Factor screen. A K-Factor is a multiplier that is related to the specific gravity of the particulate being measured. It improves the accuracy of the mass measurement when derived from a reference or gravimetric device, because not all air is created equal. The accuracy of the mass output can be affected by variations in size, color, shape, and index of refraction of the sampled particles.

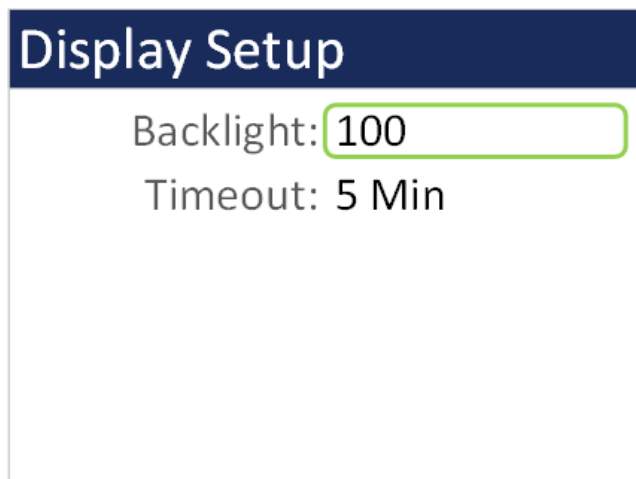The individual user k-factor can be set from 0.1 to 20.0.

The AEROCET-380 calibration is performed using ideal polystyrene latex (PSL) spheres, which provide a powerful tool for assessing the sensitivity, accuracy, and resolution. The particle detector is compared to a reference poly-dispersed suspension of PSL spheres in clean filtered air for both calibration and certification of performance specifications.

Calculate the K-Factor as the reference concentration divided by the AEROCET-380 light scatter concentration over the same time period. For example, if the reference total concentration was 51 µg/m$^3$ and the AEROCET total concentration was 38 µg/m$^3$, then the K-Factor would be 51 divided by 38 or 1.34.
The K-Factor is only valid at the same site and for the same particulate type. If the local particulate source changes, the K-Factor may no longer be valid.

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### 5.3.3 Display

The Display screen allows the user to change the backlight brightness from 10-100% and select the display timeout to dim the screen for none, 1, 5, or 10 minutes.



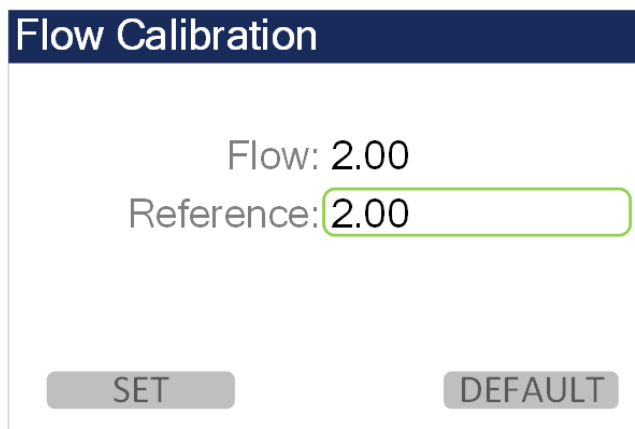**Figure 5-5 - Display Setup Screen**

### 5.3.4 Flow Calibration

The Flow Calibration is used for field audits or calibrations of the sample flow measurement. Remove the TSP cap and any cyclones from the Aerocet-380 inlet tube, and then connect the top of inlet tube to the outlet of a traceable flow meter using a length of appropriate flexible tubing. The AEROCET-380 flow rate should be maintained to within ±0.1 LPM (1.9 to 2.1 LPM) for proper cut-point performance of inlet cyclones.



**Figure 5-6 - Flow Calibration Screen**

The Flow parameter is the current reading from the AEROCET-380 flow sensor, in actual volumetric liters per minute. The AEROCET-380 should automatically regulate to the setpoint (2.0 LPM) when the flow calibration screen is entered. This may take a moment.

The Reference parameter is where one can enter the correct value from your traceable flow meter, using the scroll wheel. **The flow reading that you enter must be in actual conditions**. The Flow value should change to match the Reference value when you select the SET key.

The DEFAULT key can be selected to clear out all previous field calibrations and restore the factory calibration for the sensor. Use this if difficulty is encountered during the calibration. Press ESCAPE to escape without changes.

Note: To audit the AEROCET-380 flow rate without changing the calibration, simply compare the flow value to a traceable standard and record the results. If the SET key is not selected, then no flow calibrations are affected.

## 5.4 Initial Setup
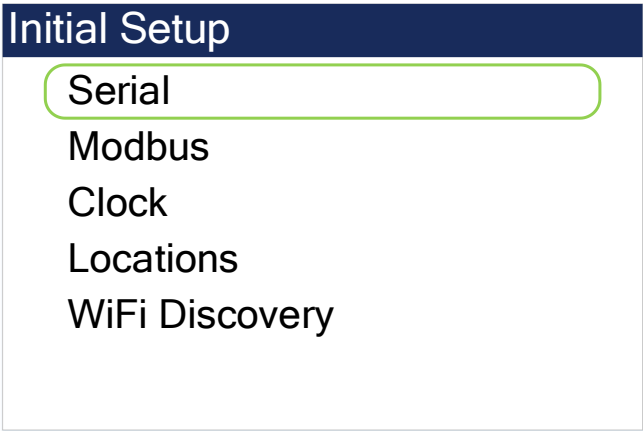
Figure 5-7 shows the Initial Setup Screen.

**Initial Setup**
- Serial
- Modbus
- Clock
- Locations
- WiFi Discovery

**Figure 5-7 - Initial Setup Screen**

### 5.4.1 Serial

The Serial setting controls various communication behavior of the AEROCET-380 The following table lists the Serial settings and describes their meanings.
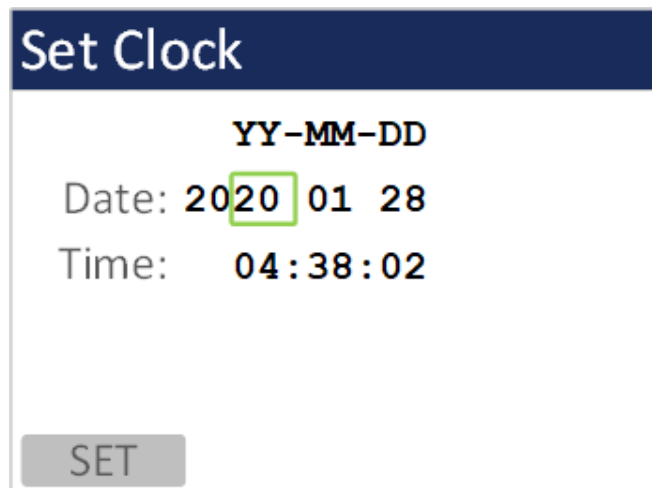
| Selection | Description |
|-----------|-------------|
| Network ID | Unique ID assigned to each device for networking mode (1 – 999) |
| 485 Baud | Baud rate for the 485-serial port.  The baud rate list includes 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200. |
| WiFi Baud | Baud rate for the WiFi connection.  Same baud rates as listed above. |

### 5.4.2 Modbus

The Modbus setup screen allows the user to select the port that will transfer the Modbus communication and the Modbus Address needed for the protocol.  Port selections are USB, RS-485, and WiFi.  The Address range is 1-247.

### 5.4.3  Clock

Use the Clock selection to set the date and time.  Turn the dial to select year/month/date/hour/minute/second to change.  A green box will surround the selection. Press the dial to edit.  Turn the dial to change, then press to confirm the change.  Press the dial on the SET box to change the settings and return to the Initial Setup screen.
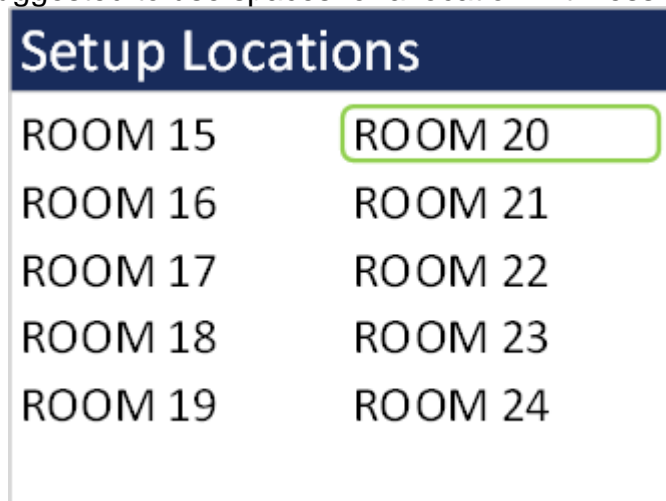


**Figure 5-8 - Clock Screen**

### 5.4.4  Locations

The Locations  screen allows the user to set up to 10 predefined alpha numeric locations. Each location can use up to 7 characters.  To enter a new location, press the dial on the location to change.  Rotate the dial to scroll through alpha/number/space options for each character.  Press the dial to select each character.  All 7 characters must be selected to save the location ID.  It is suggested to use spaces for a location with less than 7 characters.



**Figure 5-9 - Locations Screen**

### 5.4.5  WiFi Discovery

The WiFi Discovery  screen is a troubleshooting feature that determines the unit WiFi credentials if it was set up as a DHCP connection instead of a static connection and the IP address changes.  Section 7 explains how to connect the unit to a wireless network.  Select WiFi Discovery to begin the procedure.

The subsequent screens describe each process step.  An initial warning explains that this is only intended to be used to recover a lost IP Address.  Select CONTINUE.  A green bar will show the progress of the scan.
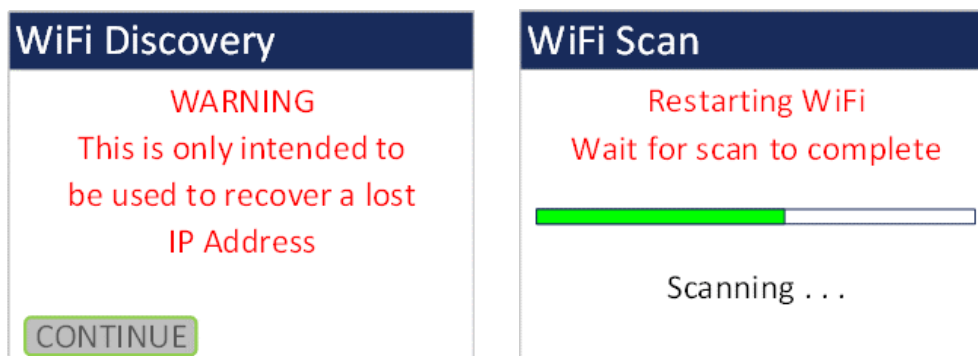


**Figure 5-10 - WiFi Discovery Screens**

Once the scan completes the WiFi connection credentials will display on the screen.  If the unit was never set up for WiFi a time out message will appear.  Press escape to exit this screen.
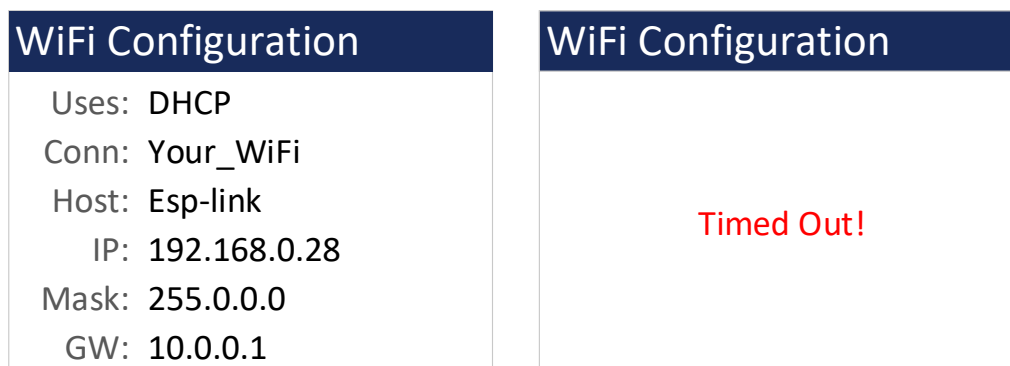


**Figure 5-11 - WiFi Configuration Results (left) and Time Out Screen (right)**

### 5.5 About Screen

Figure 5-12 shows the ABOUT screen. The ABOUT screen shows the manufacturer's serial number, the firmware version, Met One Instruments, Inc. service contact details, date of last calibration, and instrument run time.

| About |
| :--- |
| Aerocet 380 |
| A12345 |
| 83604 R1.0.0 |
| Service@metone.com |
| 541-471-7111 |
| Calibration Date: 10/14/2021 |
| Run Time: 00d 01h 32m |

**Figure 5-12 - About Screen**

## 6  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 to an AC power outlet and the DC plug to the socket on the back of the AEROCET-380.  The battery charger is universal and will work with power line voltages of 100 to 240 volts, 50 to 60 Hz.  The battery charger LED will be Red while charging and the LED will turn Green when the battery is fully charged.

When fully charged the battery inside the AEROCET-380 will power the unit for about 8 hours of continuous sampling when the backlight is set to timeout.  For continuous operation, operate the unit with the battery charger attached.  Charge the battery before storing the AEROCET-380.  Storing a discharged battery will degrade its performance.

# 7  WiFi Configuration and Setup

The WiFi on the AEROCET-380 will need to be connected to the local network where it is used. This section covers the initial setup and configuration of the WiFi.  Valid credentials for a WiFi network in range and either a computer or smartphone that can connect to that network must be used to configure the AEROCET-380.

1. After powering on the AEROCET-380, the WiFi interface will generate a local network that allows the user to connect to it and configure the connection.
2. On a WiFi enabled computer or smartphone search for an open WiFi network that starts with "ESP_" and connect to the network.
3. On the connected device open a web browser and go to IP address 192.168.4.1
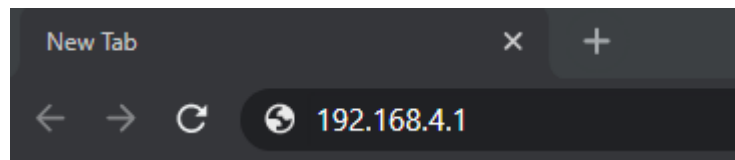


**Figure 7-1 - Web browser with IP address**

4. Navigate to the WiFi Station tab and click "Switch to STA+AP Mode" so that the AEROCET-380 can scan for networks in the area.
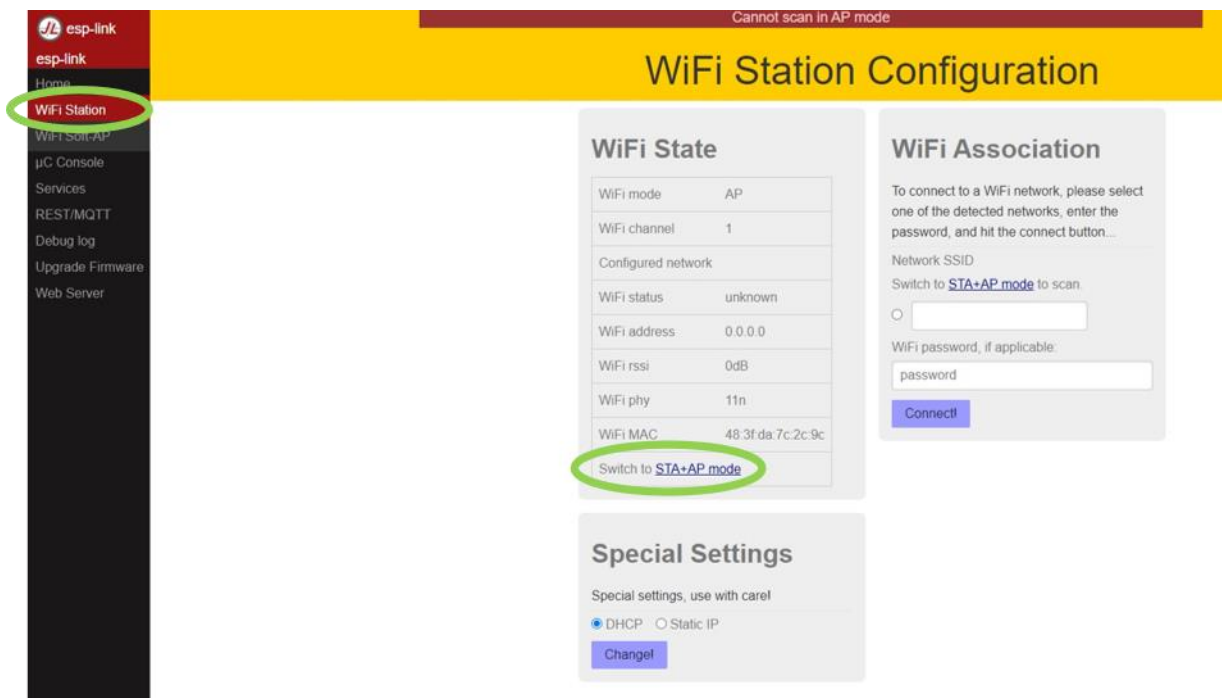


**Figure 7-2 WiFi Station tab**

5. Choose a WiFi network, enter the password, and click connect.
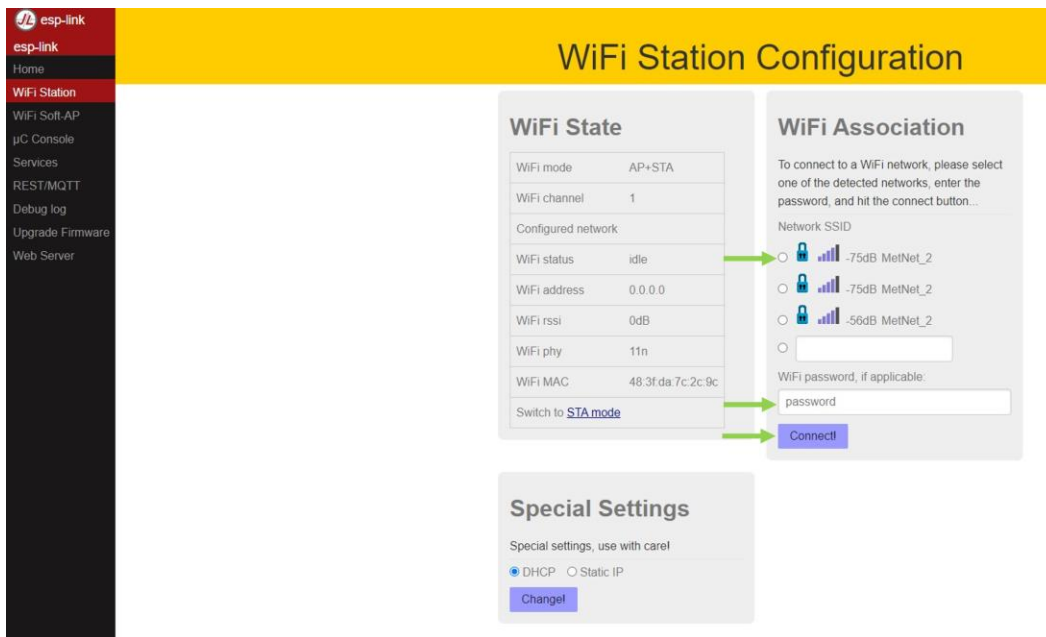
**Figure 7-3 - WiFi Station Configuration**

6. After the AEROCET-380 has connected to the network it will show the internal IP address it was assigned from the network. Click the IP address to automatically navigate to the new IP address. The dock will now automatically shut off its hosted network.
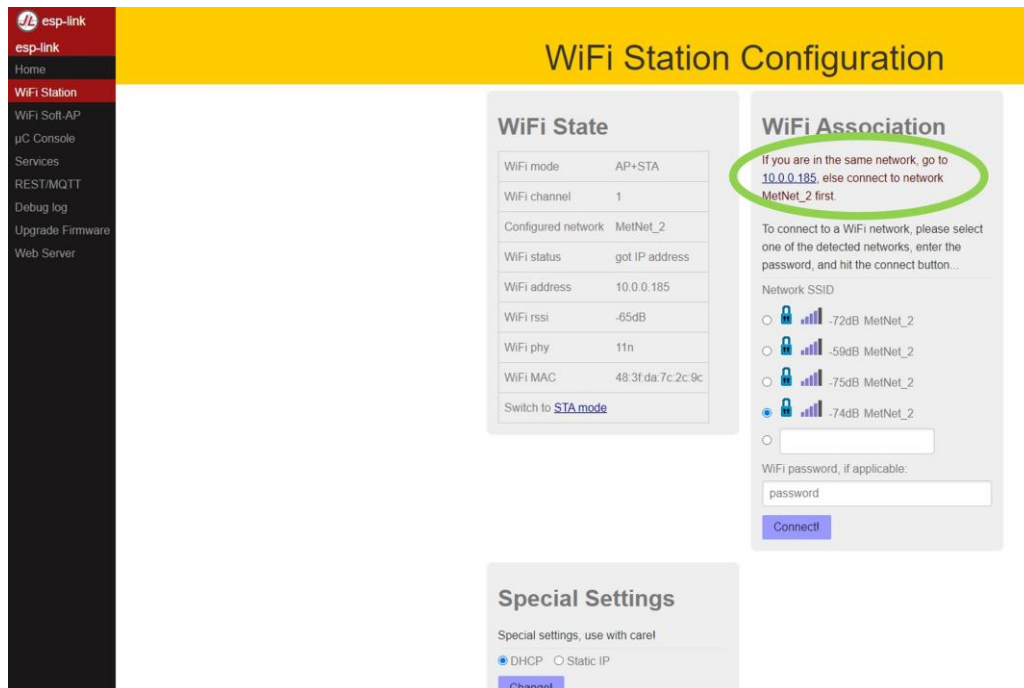


**Figure 7-4 - WiFi Station Configuration**

7. Connect the computer or smartphone to the same network that you selected for the WiFi.

8.  In the web browser you should now be on the new IP address that the network assigned to the dock.
9.  Navigate to the uC Console tab and set the baud rate from the drop down tab.  This must match the WiFi Baud of the measurement device.  Default WiFi Baud is 115200.



**Figure 7-5 - Microcontroller Console**

10. You can now communicate with the device over WiFi using serial commands. A TCP/IP connection is made using the assigned IP through Port 23.

# 9   Serial Communications

AEROCET-380 provides serial communications via WiFi, or USB and RS-485 connectors located on the back of the unit.  The following sections discuss the various serial communications.

**ATTENTION:**

A Silicon Labs CP210x Driver for the USB connection must be installed before connecting to the USB Type C port.

Driver download weblink: https://metone.com/usb-drivers/

## 9.1   Commands

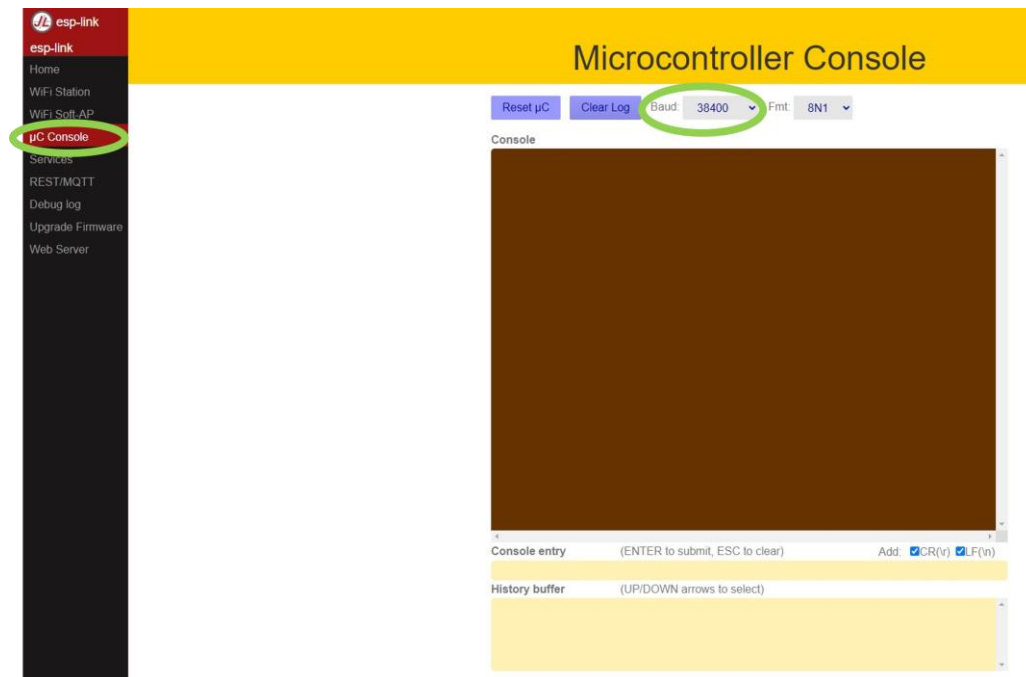The AEROCET-380 provides serial commands for accessing stored data and settings.  All commands are terminated by a carriage return.  These commands are not case sensitive.  The following table lists the available commands.  These commands are available via USB, RS-485, and WiFi hardware interfaces. The settings (baud rate, parity and stop bits) must match the computer setting for proper communication regardless of the hardware interface type.

### 9.1.1   Computer Mode

Computer Mode is intended for connecting the unit directly to a data logger or computer program such as Comet.  This is the default mode of the unit.

In Computer Mode, all commands are preceded by the <Esc> (ASCII 27) character.  No characters are echoed back to the user when entering commands.  All commands are executed using the <ENTER> key.
Each time the <Esc> key is pressed, the unit will reset to Computer Mode and restart the command input.

### 9.1.2   User Mode

User Mode is intended for direct user interaction.  In User Mode, all incoming characters are echoed back to the terminal.  The user can wake the unit into User Mode by sending 3 <CR> (Enter Key) characters within 3 seconds.  An asterisk "*" will be displayed when the unit is in Terminal Mode.

### 9.1.3  Serial Commands

The following table lists the available serial commands.

| Command | Description |
|---------|-------------|
| # | 7500 Protocol support |
| ? | Help command |
| 1 | Report settings |
| 2 | Report all the data |
| 3 | Report the new data |
| 4 | Report the last record(s) |
| C | Clear the data file |
| E | Stop sample |
| H | Help Menu |
| Q | Exit Terminal Mode |
| S | Start sample |
| X | Exit Terminal Mode |
| BL | Back Light (%) |
| CU | Count Units.  CU 0=ug/m3, CU 1=mg/m3 |
| DS | Report data log channel descriptors |
| DT | Date / Time (YYYY-MM-DD HH:MM:SS) |
| ID | Location ID |
| MA | Modbus Address (1-247) |
| MP | Modbus Port.  MP 0=USB, MP 1=RS-485, MP 2=WiFi |
| OI | Output Interval.  OI 0=Off, OI 1=On |
| PR | Print File |
| QH | Report data record header |
| RQ | Report (ReQuest) data record readings |
| RV | Report Firmware Revision |
| SK | Set K Factor |
| SS | Serial Number |
| ST | Sample Time.  ST 0=1-min, ST 1=5-min, ST 2=10-min, ST 3=15-min, ST 4=30-min, ST 5=1-hour |
| SPAN | Span Check Yes/No.   SPAN 0=No, SPAN 1=Yes |
| DSCRC | Get the data log channel descriptors CRC |
| STPER | Self Test Period.  STPER 0=1 HR, STPER  1=2 HR, STPER 2=12 HR, STPER 3=24 HR |
| DISPTO | Manual Display Timeout.  DISPTO 0=None, DISPTO  1=1-min, DISPTO  2=5-min, DISPTO 3=10-min |

## 9.2 Output

A Comma Separated Value (CSV) report will be generated for each data inquiry.

### 9.2.1 Comma Separated Value (CSV)

The CSV output fields are both comma separated and fixed length.

**CSV Header:**

Time,Conc,Flow,BV,Loc,Status (Time, Concentration, Flow, Battery Voltage, Location, Status)

**CSV Example Record:**
2014-05-05 14:47:43,0000231,001,000,*01751

### 9.2.2 Status

The last entry of the CSV output is the status indicating alarms or errors. Status bits combinations are possible. For example, 6 = Span Test failure and IOP Current alarm.

| Status Bits | | |
|---|---|---|
| **Bit** | **Value** | **Condition** |
| | 0 | OK (no alarms or errors) |
| 0 | 1 | Zero Calibration self test failure |
| 1 | 2 | Span Test failure |
| 2 | 4 | IOP Current alarm |
| 3 | 8 | Pressure Sensor failure |
| 4 | 16 | Flow Failure (more than 5% for 5 minutes) |
| 5 | 32 | Not Used |
| 6 | 64 | Internal Link Down |
| 7 | 128 | Low Battery |

## 9.3 MODBUS Communication

The AErocet-380 supports MODBUS communications protocol with any serial connection that is set in the Modbus Setup in Section 5.4.2. The serial transmission is RTU mode. The following MODBUS registers are used to access various readings.

### 9.3.1 MODBUS 4x Registers

| Name | Address | Type | Points | Description |
|---|---|---|---|---|
| Modbus Address | 0 | Int16 | 1 | Modbus address |
| Byte Order | 1 | Int16 | 1 | Value 1 to 4 |
| Year | 100 | Uint16 | 1 | Set time Year |
| Month | 101 | Uint16 | 1 | Set time Month |
| Day | 102 | Uint16 | 1 | Set time Day |
| Hour | 103 | Uint16 | 1 | Set time Hour |
| Minute | 104 | Uint16 | 1 | Set time Minute |
| Second | 105 | Uint16 | 1 | Set time Second |
| Date/Time | 106 | Uint32 | 2 | Set Unix time (Seconds since Jan 1 1970) |

### 9.3.2 MODBUS 3x Registers

| Name | Addr | Type | Points | Description |
|---|---|---|---|---|
| MB_Year | 100 | word | 1 | Currrent Time Year |
| MB_Mon | 101 | word | 1 | Currrent Time Month |
| MB_Day | 102 | word | 1 | Current Time Day |
| MB_Hour | 103 | word | 1 | Current Time Hour |
| MB_Min | 104 | word | 1 | Current Time Min |
| MB_Sec | 105 | word | 1 | Time - Sec |
| MB_DateTime | 106 | dword | 2 | Unix Timestamp (Seconds since Jan 1 1970) |
| MB_Serial | 201 | string | 4 | Serial Number (8 Bytes including 0 terminator) |
| MB_Rev | 205 | string | 20 | Auto Met + Revision String |
| MB_Inst_Time | 1000 | dword | 2 | Current Timestamp (Unix) |
| MB_Inst_Stat | 1002 | dword | 2 | Status Word |
| MB_Curr_Location | 1004 | string | 4 | Location String |
| MB_Inst_Conc | 1008 | float | 2 | Instantaneous Concentration |
| MB_Inst_Flow | 1010 | float | 2 | Current Flow |
| MB_Inst_AT |  | float | 2 | Current AT |
| MB_Inst_BP | 1012 | float | 2 | Current BP |
| MB_Inst_BV | 1014 | float | 2 | Current Battery Voltage |
| MB_Avg_Time | 2000 | dword | 2 | Last Record Timestamp (Unix) |
| MB_Avg_Stat | 2002 | dword | 2 | Status Word |
| MB_Last_Location | 2004 | string | 4 | Last Record Location string |
| MB_Avg_Conc | 2008 | float | 2 | Average Concentration |
| MB_Avg_Flow | 2010 | float | 2 | Average Flow |
| MB_Avg_AT | 2012 | float | 2 | Average Temperature |
| MB_Avg_BP | 2014 | float | 2 | Average BP |
| MB_Avg_BV | 2016 | float | 2 | Battery Voltage |

# 10 Maintenance

This section provides information about routine maintenance of the AEROCET-380. The case of the AEROCET-380 should never be removed or opened for any reason. **Opening or removing the case of the AEROCET-380 voids the warranty and may result in exposure to laser radiation, which can cause eye injury.**

## 10.1 Suggested Periodic Maintenance Intervals

The table below shows the service schedule for the AEROCET-380.

| Maintenance Item | Suggested Period |
|---|---|
| Flow Audit/Calibration | Monthly |
| Replace PUMP filter and PURGE filter | Yearly |
| Factory service, recalibration, and optical system cleaning | Every 24 months |

## 10.2 Flow Audit and Calibration

This procedure is discussed in Section 5.3.4.

## 10.3 PUMP and PURGE Filter Changes

The AEROCET-380 PUMP FILTER and PURGE FILTER are the two filter cartridges located on the side panel of the instrument. They can be removed by unscrewing the black aluminum filter holders with a coin or flat head screwdriver using the slot in the face of the holder. The expected lifetime of the two filters is greater than one year, but in heavy particulate areas they may need to be replaced more often.

The 5 micron PUMP filter keeps any large particles from entering the sample pump. The 0.01 micron PURGE filter cleans the recirculated purge air which is used to keep the optics clean during normal operation.
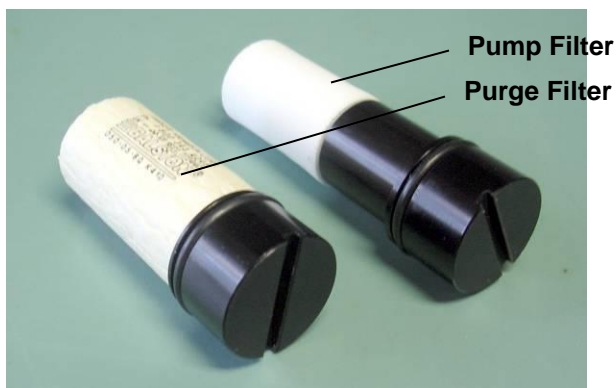
## 10.4 Factory Service

The AEROCET-380 needs to be periodically returned to the factory for service and recalibration. The recommended period is typically two years during continuous use. However, some users establish their own interval depending on the harshness of the sampling conditions, particulate levels, and data scrutiny. High concentration operation will often require more frequent factory service.

Factory service primarily consists of optical system cleaning, laser/detector checks, and recalibration. As-found calibration checks can also be requested. Contact the Met One technical service department to schedule AEROCET-380 service. A Return Authorization (RA) number must be obtained before the unit is returned.

Refer to section 1.2 to contact Met One for technical assistance and/or factory services.

## 10.5 Flash Upgrade

AEROCET-380 is firmware upgradeable via the USB C serial connection using a Met One Instruments flash burn program.  The flash program must be provided by Met One Instruments, Inc.  Refer to section 1.2 to contact Met One for more information about flash upgrades.

# 11 Troubleshooting

The following section covers some common failure symptoms, causes and solutions.  The AEROCET-380 case should never be removed or opened for any reason.  **Opening or removing the case will void the warranty and may result in exposure to laser radiation, which can cause eye injury.**  Refer to section 1.2 to contact Met One for more information and technical support.

| Symptom | Possible Cause | Solution |
|---|---|---|
| Display does not turn on | • Low Battery<br>• Defective Battery | • Charge battery<br>• Contact service center |
| Pump does not turn on when a sample is started | • Low Battery<br>• Defective pump | • Charge battery<br>• Contact service center |
| Keypad/rotary dial does not work | • Loose connector<br>• Internal hardware failure | • Contact service center |
| Sample result is lower than normal | • Atypical sample results may be real<br>• Flow rate is not 2 LPM<br>• Optics may be contaminated | • Audit and calibrate flow<br>• Contact service center |
| Sample result is higher than normal | • Atypical sample results may be real<br>• Flow rate is not 2 LPM<br>• Optics may be contaminated | • Audit and Calibrate flow<br>• Contact service center |
| Battery does not hold a charge | • Defective or worn out battery<br>• Defective charger | • Contact service center |
| Flow rate does not reach 2.0 LPM setpoint | • Dirty Filter<br>• Defective pump | • Change filter<br>• Contact service center |
| Unit will not communicate using WiFi | • WiFi has not been set up<br>• No internet connection<br>• Wifi was originally configured to DHCP and the IP address has changed | • Configure the Wifi connection per Section 7<br>• Verify WiFi is enabled and detected at location<br>• Perform a WiFi Discovery per Section 5.4.5 |
| Data does not transfer completely when using WiFi | • High data transfer speeds can cause data to drop | • Lower the WiFi baud rate |

**Instrument Expert**
**Original factory packaging**
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## 12 Accessories

The following is a list of included accessories and replacement parts for the AEROCET-380.

| Replacement Parts (not included) | | |
|---|---|---|
| **Description** | **Part Number** | **Graphic** |
| Purge Filter Holder, Black Aluminum | **80588** |  |
| Pump Filter Holder, Black Aluminum | **80588-1** | |
| Purge Air Filter, 0.01 micron | **580302** | |
| Pump Filter, 5 micron | **580292** | |

| Included Accessories | | |
|---|---|---|
| Li-Ion Smart Charger with power cord | **81818-1** |  |
| Smart Charger power cord | **400113** | |
| Sampling TSP Cap | **80485** |  |
| Sample Tube | **81885** |  |
| USB C communication cable | **502116** | |
| RS-485 communication cable | **83393** | |

| Optional Accessories | | |
|---|---|---|
| PM2.5 Sharp Cut Cyclone | **SCC 112** | |
| PM10 Sharp Cut Cyclone | **SCC 110** | |