



Orion Air Quality Monitor™ User Manual



Orion AQM530™

(Orion AQM™ and AQM Plus™)

User Manual

Version 2.01

Serial Number: _____

Date Purchased: _____

All specifications subject to change without notice.

Printed in U. S. A.

© Copyright 2021 Columbia Weather Systems, Inc. All Rights Reserved.

Proprietary Notice: Orion AQM530, Orion AQM, Orion AQM Pluse, Orion, Capricorn 2000, Capricorn 2000MP, Capricorn 2000EX, Capricorn FLX, Magellan, Magellan MX, Vela, and Pulsar Weather Stations are trademarks of Columbia Weather Systems, Inc. The information and drawings contained herein are the sole property of Columbia Weather Systems, Inc. Use of this publication is reserved exclusively for customers of Columbia Weather Systems, Inc. and their personnel. Reproduction of this material is forbidden without the express written consent of Columbia Weather Systems, Inc.

Parts of the Orion AQM530 user manual were adapted from the Air Quality Transmitter AQT530 User Guide with permission from Vaisala Oyj.

Welcome!

Congratulations on your purchase of an Orion Air Quality Monitor (AQM530).

The AQM530 Air Quality Monitoring System is based on the Vaisala AQT530 transmitter.

Please read this manual completely prior to installation.

Do not attempt to open the laser particle counter (LPC) for service. Removing the cover may cause exposure to harmful class 3B laser radiation and electrical shock.

Warning: Do not leave the sensor unpowered for more than three (3) months.

Important Notice: Shipping Damage

BEFORE YOU READ ANY FURTHER, please inspect all system components for obvious shipping damage. The Orion AQM530 is a high precision instrument and can be damaged by rough handling. Your unit was packaged to minimize the possibility of damage in transit. Please save the shipping container for any future shipment of your Orion sensor.

In the event your order arrives in damaged condition, it is important that the following steps be taken immediately. The title transfers automatically to you, the customer, once the material is entrusted to the transport company.

NOTE: DO NOT RETURN THE INSTRUMENT TO COLUMBIA WEATHER SYSTEMS until the following steps are completed. Failure to follow this request will jeopardize your claim.

1. Open the container and inspect the contents. Do not throw away the container or any damaged parts. Try to keep items in the same condition as originally received.
2. Notify the transport company immediately.
3. Request the transport company's representative inspect the shipment personally.
4. After inspection, request a Return Materials Authorization (RMA) from Columbia Weather Systems by calling (503) 629-0887.
5. Return approved items to us at the following address:

Columbia Weather Systems, Inc.

5285 NE Elam Young Parkway, Suite C100

Hillsboro, OR 97124

6. After a repair evaluation, an estimate of the cost of repair will be sent to you.

ESD Protection

Electrostatic Discharge (ESD) can cause immediate or latent damage to electronic circuits. The Orion AQM530 is adequately protected against ESD for its intended use. However, it is possible to damage the product by delivering electrostatic discharges when touching, removing, or inserting any objects inside the equipment housing.

To avoid delivering high static voltages yourself:

1. Handle ESD sensitive components on a properly grounded and protected ESD workbench. When this is not possible, ground yourself with a wrist strap and a resistive connection cord to the equipment chassis before touching the boards. When neither of the above is possible, at least touch a conductive part of the equipment chassis with your other hand before touching the boards.
2. Always hold the boards by the edges and avoid touching the component contacts.

Table of Contents

WELCOME!	4
IMPORTANT NOTICE: SHIPPING DAMAGE	6
ESD PROTECTION.....	7
TABLE OF CONTENTS	9
SECTION 1: INTRODUCTION	11
THE ORION AIR QUALITY MONITOR.....	11
MEASURING SPECIFICATIONS - (AQM530)	13
<i>Operating Conditions</i>	13
<i>Temperature</i>	13
<i>Relative Humidity</i>	13
<i>Barometric Pressure</i>	13
GAS MEASURING SPECIFICATIONS	14
PARTICLE MEASURING SPECIFICATIONS.....	15
AQT530 TRANSMITTER COMPLIANCE.....	15
POWER.....	17
<i>Sensor Housing</i>	17
<i>Principles of Measurements</i>	18
<i>Measurement List</i>	18
<i>Device Health Index</i>	19
<i>Gas Measurement Validity</i>	19
<i>Device Status</i>	19
<i>Air quality index criteria</i>	19
<i>Air quality index</i>	19
SECTION 2: PHYSICAL DESCRIPTION	23
ORION AIR QUALITY MONITOR	23
<i>Mechanical Drawing</i>	25
<i>AQM530 Internal Diagram</i>	26
<i>Interface Module</i>	27
WEATHER MICROSERVER (REQUIRED)	29
SURGE/LIGHTNING PROTECTOR (OPTIONAL).....	30
SECTION 3: SYSTEM CONFIGURATIONS	31
<i>Weatherproof Enclosure</i>	33
<i>Cloud based configuration</i>	34
<i>Cloud based configuration with solar power</i>	35
SECTION 4: INSTALLATION	37

INSTALLATION OVERVIEW.....	37
UNPACKING THE UNIT	37
<i>Installing the Orion Air Quality Monitor (AQM530)</i>	39
<i>Site Selection:</i>	39
<i>Installing the Mast</i>	39
<i>Mounting Method</i>	39
<i>Routing Cable</i>	39
<i>Installing the AQM530 on a Mast</i>	41
<i>Installing the Surge Arrestor</i>	42
<i>Connecting the AQM530 to the Interface Module</i>	43
CONNECTING THE AQM530 TO THE WEATHER MICROSERVER.....	45
<i>Telescoping Tripod and Tiedown Kit</i>	46
<i>Specifications</i>	47
<i>Sensor Mast</i>	48
<i>Roof Mounting</i>	48
<i>Wall Mounting</i>	49
SECTION 5: MAINTENANCE	51
CLEANING	51
MAINTENANCE SCHEDULE.....	51
SECTION 6: TROUBLESHOOTING.....	53
SECTION 7: USER SUPPORT INFORMATION	55
LIMITED WARRANTY.....	55
EXCLUSIONS.....	55
RETURN FOR REPAIR PROCEDURE	56
REFERENCE.....	58
GLOSSARY.....	58
<i>PM2.5 Particulates</i>	58
<i>PM10 Particulate</i>	58
<i>AQI</i>	58
<i>Aspirating Radiation Shield</i>	58
<i>Barometric Pressure</i>	58
<i>Celsius Temperature Scale</i>	58
<i>Fahrenheit Temperature Scale</i>	58
<i>Relative Humidity</i>	58
<i>Sea Level Pressure</i>	58
UNIT CONVERSION	59
<i>Speed</i>	59
<i>Temperature</i>	59
<i>Distance</i>	59
<i>Pressure</i>	59

SECTION 1: INTRODUCTION

The Orion Air Quality Monitor



The Orion Air Quality Monitor 530 (AQM530) is a **near reference** instrument that measures Carbon Monoxide (CO), Nitrogen Dioxide (NO₂), Ozone (O₃), and particle concentration levels (PM_{2.5} and PM₁₀). In addition, it measures air temperature, barometric pressure, and relative humidity for measurement compensations.

The AQM530 system is available in three different models:

Model 9070 - Particulate and Gas Monitoring – previously Orion AQM Plus

Model 9080 - Gas Monitoring Only – previously Orion AQM

Model 9090 - Particulate Monitoring Only

The Weather MicroServer offers Ethernet connectivity, web browser interface and Modbus/TCP, Modbus RTU, and XML interfaces.

The Weather MicroServer can upload the weather data to our cloud-based CWS Weather Server for real-time monitoring.

WeatherMaster Software is available to display and store the data in a database.

Please note: The Orion AQM530 serves as a direct replacement for the Orion AQM & AQM Plus

Measuring Specifications - (AQM530)

Operating Conditions

Operating Temperature: -22 to +104°F (-30 to +40°C) ¹⁾

Storage Temperature: +68 to +70°F (+20 to +25°C)

Operating Relative Humidity: 15 to 100 %RH, non-condensing ²⁾

Storage Relative Humidity: 20 to 75%RH

Pressure: 23.62 to 33.95 inHg (800 to 1150 hPa)

1) *Optimal performance at -14 to +86 °F (-10 to +30 °C)*

2) *Optimal performance at 15 to 90%RH. Operation in low humidity environments may weaken the gas measurement performance.*

Temperature

Range: -22 to +104°F (-30 to +40°C)

Accuracy: @68°F (20°C) ±0.5°F (0.3°C)

Resolution: 0.1°F

Units Available: °F, °C

Relative Humidity

Range: 0 - 100%

Accuracy: 0 to 90%RH ±3%RH

90 to 100 %RH: ±5 %RH

Resolution: 0.1%RH

Units Available: %RH

Barometric Pressure

Range: 23.62 to 33.95 inHg (800 to 1150 hPa)

Accuracy: ±0.44 inHg (15 hPa)

Resolution: 0.029 inHg (1 hPa)

Units Available: InHg, Kpa, mbar, hPa

Gas Measuring Specifications

Measurement Performance:

Property	NO ₂	NO	O ₃	CO
Concentration Range	2000 ppb	2000 ppb	2000 ppb	10000 ppb
Detection Limit	5 ppb	5 ppb	5 ppb	10 ppb

Field performance:

Property	NO ₂	NO	O ₃	CO
Correlation with Reference ³⁾	R ² : 0.70	R ² : 0.75	R ² : 0.50	R ² : 0.85
Accuracy ⁴⁾	7 ppb	15 ppb	11 ppb	183 ppb
Unit to Unit Correlation ⁵⁾	R ² : 0.93	R ² : 0.96	R ² : 0.84	R ² : 0.97
Precision ⁵⁾	3 ppb	3 ppb	4 ppb	25 ppb

- 1) *All values are based on 1-hour averages with factory calibration, no linear correction applied. Values are obtained from global field testing in major climate zones against reference instruments. The values represent typical values and may be different based on the location.*
- 2) *At 10 V/m RF field test, the presence of electromagnetic interference in the range of 800 to 900 MHz may cause additional deviation for NO₂ and O₃.*
- 3) *Typical R² against a reference grade instrument derived from field tests globally.*
- 4) *Mean absolute error against reference.*
- 5) *Mean absolute difference of AQT530 reading from average reading of AQT530s.*

Particle Measuring Specifications

Measurement Performance:

Property	PM _{2.5}	PM ₁₀
Size Range ¹⁾	0.6 to 2.5 µm	0.6 to 10 µm
Concentration Range ²⁾	0 to 1000 µg/m ³	0 to 2500 µg/m ³
Detection Limit	0.1 µg/m ³	0.1 µg/m ³

1) Spherical equivalent size of DEHS particles. Lower detection limit of 0.6 µm defined as 50% detection efficiency for DEHS particles.

2) Specified with ISO12103-1, A1 ultrafine test dust.

Field performance:

Property	PM _{2.5}	PM ₁₀
Correction with Reference ²⁾	R ² : 0.65	R ² : 0.75
Accuracy ³⁾	9 µg/m ³	13 µg/m ³
Unit-to-Unit Correlation ⁴⁾	R ² : 0.97	R ² : 0.97
Precision ⁴⁾	2 µg/m ³	3 µg/m ³

1) All values are based on 1-hour averages with factory calibration, no linear correction applied. Values are obtained from global field testing in major climate zones against different reference equivalent methods. The values represent typical values and may be different based on the location and reference instrument. Majority of particle mass within size range.

2) Typical R² against a reference grade instrument derived from field tests globally.

3) Mean absolute error against reference.

4) Mean absolute difference of AQT530 reading from average reading of AQT530s.

AQT530 Transmitter Compliance

EU Directives	EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU)
Compliance Marks	DE, China RoHS, FCC, RCM, UKCA
EMC Immunity ¹⁾	CISPR 32/EN 55032, Class B
Cold	IEC 60068-2-1

Dry Heat	IEC 60068-2-2
Damp Heat	IEC 60069-2-78
Eye Safety	IEC 60825-1:2014
IP Rating	IP65 ²⁾

- 1) *At 10 V/m RF field test, the presence of electromagnetic interference in the range of 800 to 900 MHz may cause additional deviation for NO₂ and O₃ measurements.*
- 2) *Specified for gas measurement device only.*

Power

The Orion AQM530 is supplied with a wall mount switching power supply

Input: 100 - 240 VAC, 50/60 HZ, 0.6A

Output: 12 VDC, 2.08A

Transmitter operating voltage: 10 to 25 VDC

Power consumption, Max ¹⁾: 10W

Power Consumption (average with default settings)

Gas and particle measurement: 1.8 to 4.4 W ²⁾

Gas measurement: 1.4 to 3.8 W ³⁾

Particle measurement: 1.7 to 2.0 W ⁴⁾

- 1) *Humidity management active, particle measurement active, temperature <0 °C (32 °F).*
- 2) *Maximum consumption when humidity > 85%RH, temperature <0 °C (32 °F), default particle measurement cycle.*
- 3) *Maximum consumption when humidity > 85%RH*
- 4) *Maximum consumption when temperature <0 °C (32 °F), default particle measurement cycle.*

Sensor Housing

Protection class: IP65

Protected against dust that may harm equipment.

Protected against water spray from all directions.

Materials: Anodized aluminum, stainless steel

Weight: 2.4kg (5.29lb)

Dimensions: 13.19 x 5.24in

Principles of Measurements

The supplementary air quality measurement of the Orion AQM530 modernizes the way air quality can be monitored.

For gas measurements the AQM530 utilizes industry standard electrochemical cell technology. By using proprietary advanced algorithms, individual factory calibration, and improved humidity robustness, parts per billion (ppb) concentrations at different environmental conditions can be measured reliably in one compact package. Algorithms compensate for the impact of ambient conditions and aging of the sensor elements, removing the need for costly gas sampling and equipment.

Particulates are measured with a state-of-the-art proprietary optical laser particulate counter (LPC). Single particulates scatter light and, based on the intensity and number of pulses detected, the particle size and concentrations are calculated.

The Orion AQM530 measures the most important air pollutants in one compact package.

Gases: NO₂, NO, O₃, and CO.

Particulates: PM₁₀ and PM_{2.5}

Environmental Conditions: Temperature, relative humidity, and barometric pressure.

Measurement List

- Nitrogen Dioxide
- Carbon Monoxide
- Nitric Oxide
- Ozone
- PM 10 micron count
- PM 2.5 micron count
- Air Quality Index
- AQI Criteria
- Gas Measurement Validity
- Device Health Index
- Device Status
- Elapsed Seconds
- Main Pollutant

Device Health Index

Combined percentage of usage of sensor cells, decreases from 100%

100% = Full health

0% = All sensors need to be replaced

Gas Measurement Validity

0 = Measurement is not valid

1 = Measurement is valid (includes 24-hour stabilization time after power-up and temperature is within valid range; below 100°F (38.0 °C)).

Device Status

Status reported by device

0 = Unknown. Status information not yet available, starting up

1 = Operating normally

2 = Degraded. Operating but functionality degraded

3 = Faulty

Air quality index criteria

-1 = AQI calculation failed

0 = O3 8-h average

1 = O3 1-h average

2 = PM2.5 24-h average

3 = PM10 24-h average

4 = CO 8-h average

5 = SO2 1-h average

6 = SO2 24-h average

7 = NO2 1-h average

Air quality index

0 to 500

-1 (AQI calculation failed)

Computing the AQI

The air quality index is a piecewise linear function of the pollutant concentration. At the boundary between AQI categories, there is a discontinuous jump of one AQI unit. To convert from concentration to AQI this equation is used:

$$I = \frac{I_{high} - I_{low}}{C_{high} - C_{low}}(C - C_{low}) + I_{low}$$

where:

I = the (Air Quality) index,

C = the pollutant concentration,

C_{low} = the concentration breakpoint that is $\leq C$,

C_{high} = the concentration breakpoint that is $\geq C$,

I_{low} = the index breakpoint corresponding to C_{low} ,

I_{high} = the index breakpoint corresponding to C_{high} .

EPA's table of breakpoints is:

O₃ (ppb)	O₃ (ppb)	PM_{2.5} (µg/m ³)	PM₁₀ (µg/m ³)	CO (ppm)	SO₂ (ppb)	NO₂ (ppb)
<i>C_{low} - C_{high}</i> (avg)	<i>C_{low} - C_{high}</i> (avg)	<i>C_{low} - C_{high}</i> (avg)	<i>C_{low} - C_{high}</i> (avg)	<i>C_{low} - C_{high}</i> (avg)	<i>C_{low} - C_{high}</i> (avg)	<i>C_{low} - C_{high}</i> (avg)
0-54 (8-hr)	-	0.0-12.0 (24-hr)	0-54 (24-hr)	0.0-4.4 (8-hr)	0-35 (1-hr)	0-53 (1-hr)
55-70 (8-hr)	-	12.1-35.4 (24-hr)	55-154 (24-hr)	4.5-9.4 (8-hr)	36-75 (1-hr)	54-100 (1-hr)
71-85 (8-hr)	125-164 (1-hr)	35.5-55.4 (24-hr)	155-254 (24-hr)	9.5-12.4 (8-hr)	76-185 (1-hr)	101-360 (1-hr)
86-105 (8-hr)	165-204 (1-hr)	55.5-150.4 (24-hr)	255-354 (24-hr)	12.5-15.4 (8-hr)	186-304 (1-hr)	361-649 (1-hr)
106-200 (8-hr)	205-404 (1-hr)	150.5-250.4 (24-hr)	355-424 (24-hr)	15.5-30.4 (8-hr)	305-604 (24-hr)	650-1249 (1-hr)
-	405-504 (1-hr)	250.5-350.4 (24-hr)	425-504 (24-hr)	30.5-40.4 (8-hr)	605-804 (24-hr)	1250-1649 (1-hr)
-	505-604 (1-hr)	350.5-500.4 (24-hr)	505-604 (24-hr)	40.5-50.4 (8-hr)	805-1004 (24-hr)	1650-2049 (1-hr)

Suppose an air quality monitor records a 24-hour average fine particle (PM_{2.5}) concentration of 12.0 micrograms per cubic meter. The equation above results in an AQI of:

$$\frac{50 - 0}{12.0 - 0} (12.0 - 0) + 0 = 50,$$

corresponding to air quality in the "Good" range.

AQI	Category
0-50	Good
51-100	Moderate
101-150	Unhealthy for Sensitive Groups
151-200	Unhealthy
201-300	Very Unhealthy
301-500	Hazardous

SECTION 2: PHYSICAL DESCRIPTION



Orion Air Quality Monitor

The Orion Air Quality Monitor measures the pollution content of ambient air.

The AQM530 measures the following gases: CO, NO₂, NO, and O₃.

The AQM530 also includes a laser particle counter for PM_{2.5} and PM₁₀ particulate measurements.

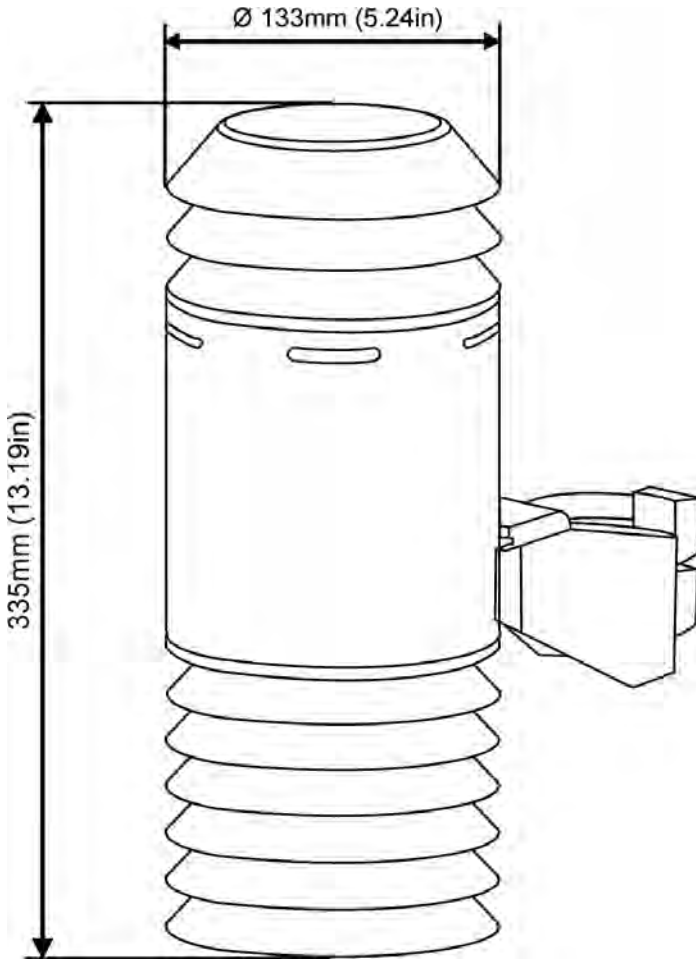
The transmitter includes a combined Temperature and Humidity sensor and a barometric pressure sensor for ambient measurements and internal compensation for gas and particle measurements.

Each sensor is enclosed in an IP65-rated weatherproof casing and can be installed outdoors.

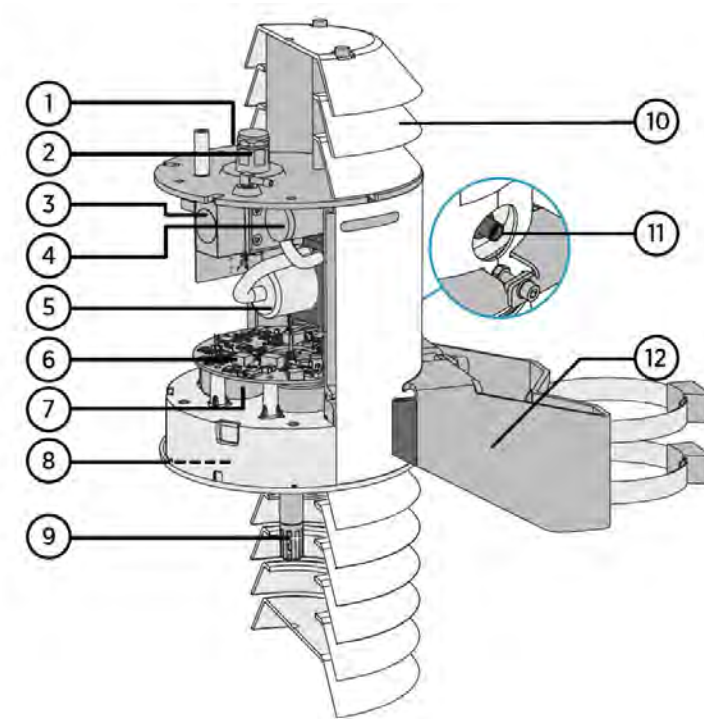
The AQM530 requires a 24-hour stabilization period before using the measurement results. To ensure optimal measuring accuracy, a stabilization period of 48-hours is recommended.

The AQM530 communicates with the MicroServer on COM2 over Modbus RTU (RS-485).

Mechanical Drawing

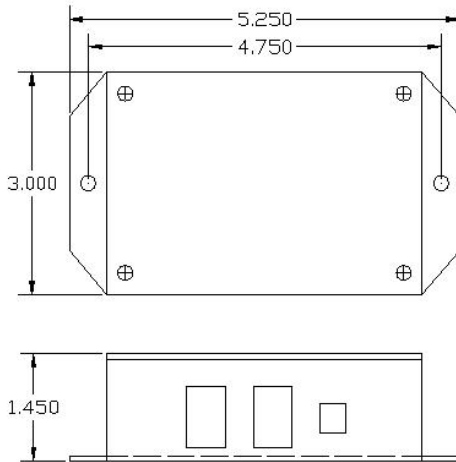


AQM530 Internal Diagram



1. Laser particle counter (LPC) module
2. Air inlet
3. LPC
4. Pump
5. LPC filter
6. Base module
7. Electrochemical gas sensors (0, 1, or 4 per device, depends on device configuration)
8. Bottom plate (not shown)
9. Humidity and Temperature Probe (HMP110)
10. Radiation shield
11. M12 connector
12. Mounting bracket

Interface Module



The Interface Module is used to supply power to the sensor transmitter and to provide two RS-485 communication ports. The RS-485 port connects to the Weather MicroServer or a wireless transceiver.

The Interface Module has two LED indicators. The green LED is a power indicator and the red LED is a data indicator. In normal operation, the red LED will be solid to indicate a data record being transmitted. The green LED will also be solid to indicate power is being supplied to the AQM530.

Weather MicroServer (Required)

The Weather MicroServer uses a small computer board that runs an embedded Linux operating system.

The MicroServer has 32MB flash memory for operation and 8 GB SD card for data logging.

The AQM530 connects to the MicroServer via COM2.

The MicroServer has two additional RS-232 COM ports for additional sensors and an Ethernet port for the web browser interface.



The MicroServer offers the following:

- XML Weather Data
- Modbus/TCP, Modbus RTU (Serial RS-485) interfaces
- CWS Weather Server
- One year of data logging at 1-minute interval
- Interface to an optional weather station
- Interface to optional wind and rain sensors, visibility, solar radiation sensors, and temperature sensors

Please refer to the Weather MicroServer user manual for more information.

Surge/Lightning Protector (Optional)



A nearby lightning strike may induce a high voltage surge which the internal suppressor of your weather instrument may not be able to withstand, causing significant damage to the weather station. Protect your weather station investment with the Surge Protector. This compact transient overvoltage suppressor is designed for weather stations in areas with an elevated risk of lightning strikes such as the top of high buildings, or installations with cable lengths greater than 100 feet.

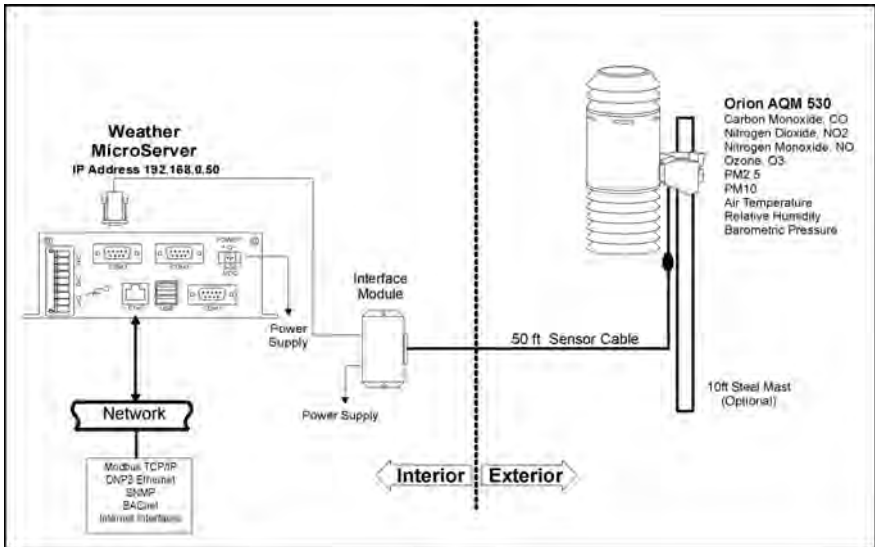
- Superior 3-stage surge protection
- Tolerates up to 10kA surge currents
- Both differential and common mode protection on each channel
- Filtering against HF and RF noise
- Two power channels and two data channels
- Environmental protection class IP66

Part Number: 8355-1

Includes adjustable mounting kit

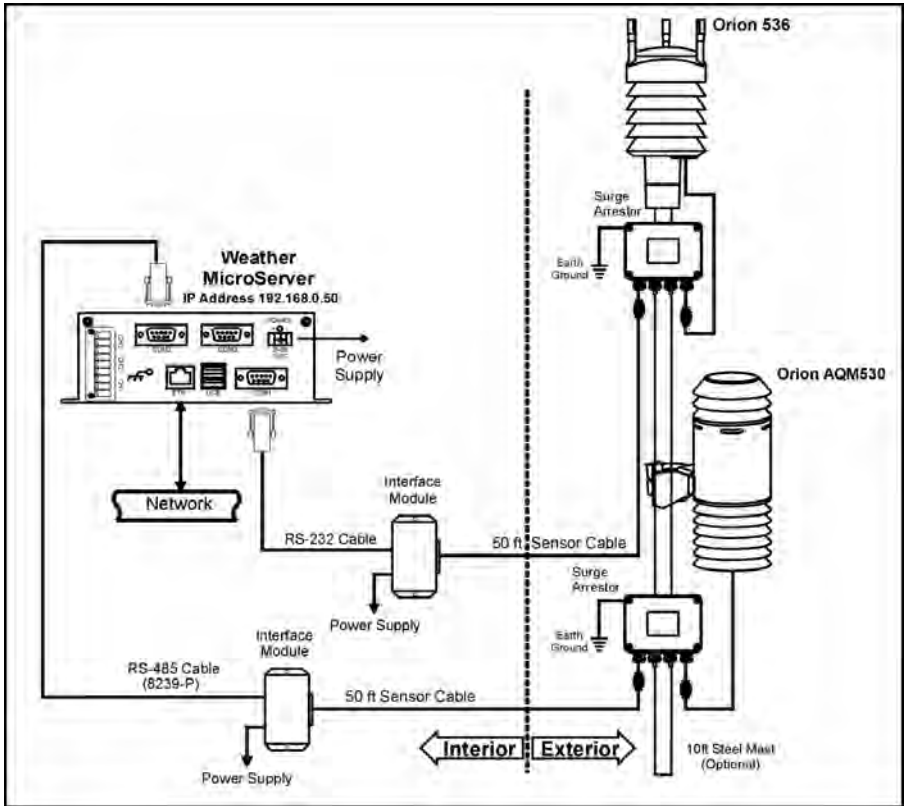
SECTION 3: SYSTEM CONFIGURATIONS

The AQM530 can be installed in multiple configurations depending on communication options, power availability and viewing options.



The standard Orion Air Quality Monitoring Station includes the AQM530 Transmitter, Weather MicroServer with power supply, 50ft Sensor Cable and Interface Module with power supply. The optional 10ft Steel Mast and Surge Arrestor can be added to the system as well.

Orion AQM530 and Orion 536 Sensor



Adding the Orion 536 Weather Station provides a complete system to measure the following weather and air quality parameters:

- Wind Speed & Direction
- Temperature
- Pressure
- Humidity
- Rainfall
- Gases: NO₂, NO, CO, Ozone (O₃)
- Particle concentration: PM_{2.5} and PM₁₀.

Weatherproof Enclosure

For outdoor installations, the MicroServer can be housed in a 12"x10"x6" weatherproof enclosure.



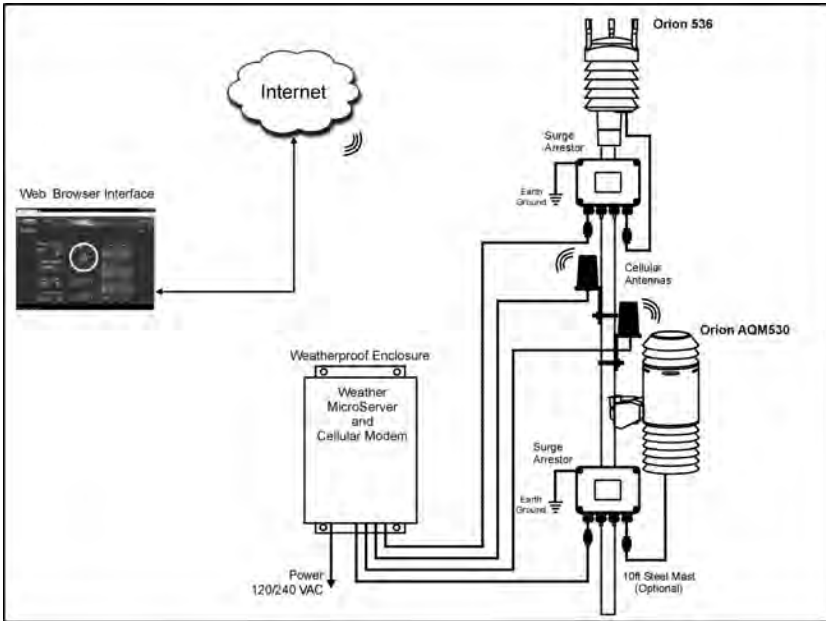
The system enclosure includes a power supply, mounting panels, terminal blocks for sensor connections as well as optional hardware to mount the enclosure onto a mast.

The enclosure houses the MicroServer and Interface Module. The enclosure also includes a connection diagram.

A lug on the outside of the enclosure is provided for grounding the unit to Earth Ground. A 14 to 16 AWG copper wire is recommended for proper grounding.

Cloud based configuration

Below is an example of a configuration with a cellular modem for remote monitoring. Diagram shows optional Orion weather station.



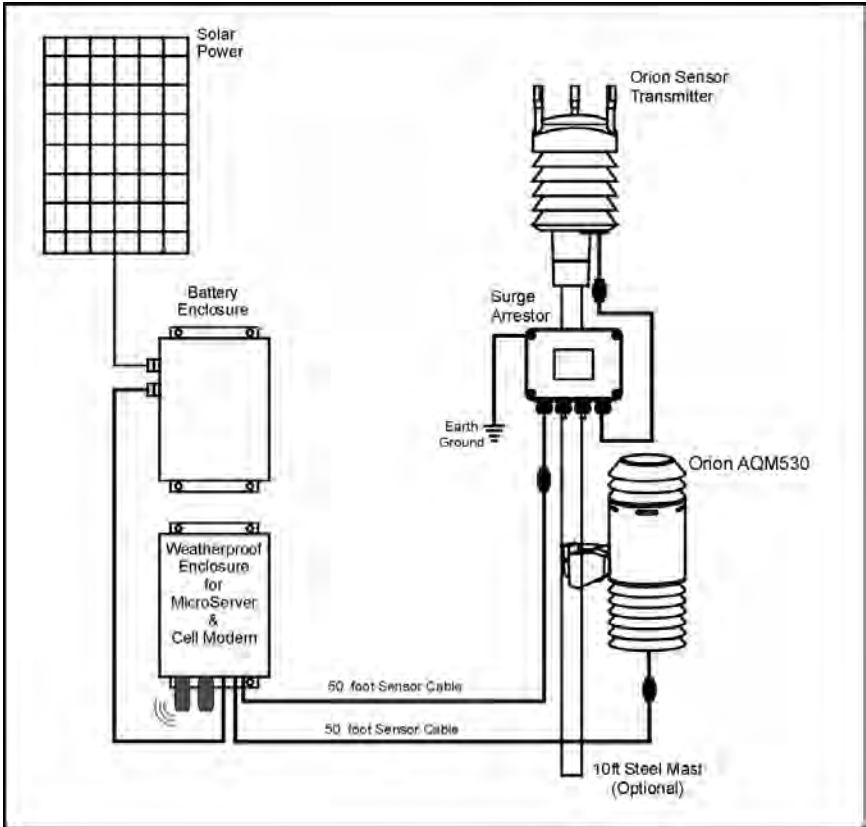
This system is shown with the Orion AQM530, 50ft sensor cable, Interface Module, MicroServer, Cellular Modem and weatherproof enclosure with power supply. The MicroServer and Cellular Modem are housed in the weatherproof enclosure.

The cellular modem provides remote direct access to the weather data through a web browser interface and can be monitored remotely from computer or device with Internet access.

The MicroServer is also able to upload the data to the CWS Weather Server (cloud application) for real-time data monitoring without a direct access to the station.

Cloud based configuration with solar power

Below is an example of a configuration with a cellular modem and solar power system for remote monitoring. Shown with optional Orion Weather Station.



This system includes the Orion AQM530, 50ft sensor cable, Interface Module, MicroServer, Cellular Modem and weatherproof enclosure with power supply. The MicroServer and Cellular Modem are housed in the weatherproof enclosure.

The system also includes a solar power system which consists of the solar panel, battery, and battery enclosure.

The Orion Weather Station can also be added to the system (as shown in the diagram) to provide additional weather parameters.

SECTION 4: INSTALLATION

Warning: Do not leave the sensor unpowered for more than three (3) months.

Installation Overview

Unpacking the System

Installing the AQM530

Installing the Mast

Installing the Mounting Plate

Installing the Surge Arrestor (optional)

Connecting the AQM530 to the Interface Module

Connecting the AQM530 to the MicroServer

Unpacking the Unit

The AQM530 comes in a custom shipping container. Be careful when removing the device.

Unpack the AQM530 and verify that all parts are included.

1. Standard system includes:

- Air Quality Monitor
- Mounting Bracket
- 50 ft sensor cable + additional cable length if ordered
- Interface Module
- (2) 3-position terminal blocks
- Interface module power supply
- User Manual
- 6-foot RS-485 cable + additional cable length if ordered

2. Weather MicroServer (Required):

- MicroServer
- Power supply
- 7-foot Ethernet cable

- ❑ User manual

3. Surge Arrestor (Optional)

- ❑ Surge Arrestor & Mounting Hardware

Inspect all system components for obvious shipping damage (Refer to “Important Notice: Shipping Damage” in case of damage).

NOTE: Save the shipping carton and packing material in case the unit needs to be returned to the factory. If the system does not operate properly, see **Maintenance** and **Troubleshooting** sections, for further instructions.

Installing the Orion Air Quality Monitor (AQM530)

Site Selection:

Finding a suitable site for the monitor is important in obtaining representative ambient measurements. The site should represent the general area of interest.

Protect the AQM530 from direct sunlight in high temperatures. Fast temperature changes can temporarily decrease the performance and direct sunlight can raise the operating temperature over the allowed limit.

Avoid installing the device next to trees or other vegetation. Large amounts of insects may obstruct airflow to the device.

Do not mount the device close to high-powered radio transmitters or antennas. Make sure that power lines or generators cannot affect the performance.

If you use a radio communication device, install it to a different height and away from the AQM530. Recommended minimum distance to radio communication is 1 m (3 ft).

Installing the Mast

There are three acceptable methods for mounting the mast to a roof or building structure: Sloped roof mounting, flat roof mounting or wall mounting. See **Optional Sensor Mounting Hardware** for more information.

Mounting Method

Choose the appropriate mounting method for the installation and obtain any necessary mounting hardware. Refer to Optional Sensor Mounting Hardware section for information on optional sensor mounting hardware and accessories which are available from the factory.

If the mounting hardware is not obtained from the factory, be certain to use metal parts which are plated or galvanized to assure maximum longevity.

Secure the mast to the roof, using guy wires with sufficient tensile strength or to building wall using a wall-mount hardware kit.

Routing Cable

Use plastic tie wraps to secure the cable to mast, particularly at the mast base. Tighten the tie wraps securely and clip off any excess length with a wire cutter tool.

Once the AQM530 has been placed, route the cable back to the Interface Module or weatherproof enclosure.

CAUTION: There may be electric wires in the wall. When routing cable through walls, we recommend that you shut off the electricity in the room(s) where you are drilling.

Any mast or tower should always be properly earth grounded to minimize electrical storm damage. The use of a properly grounded metal mast or tower, however, does not insure protection from electrostatic discharge. These items could become electrically charged resulting in damage to the sensors and/or console. This could damage the system in the event of an electrical storm.

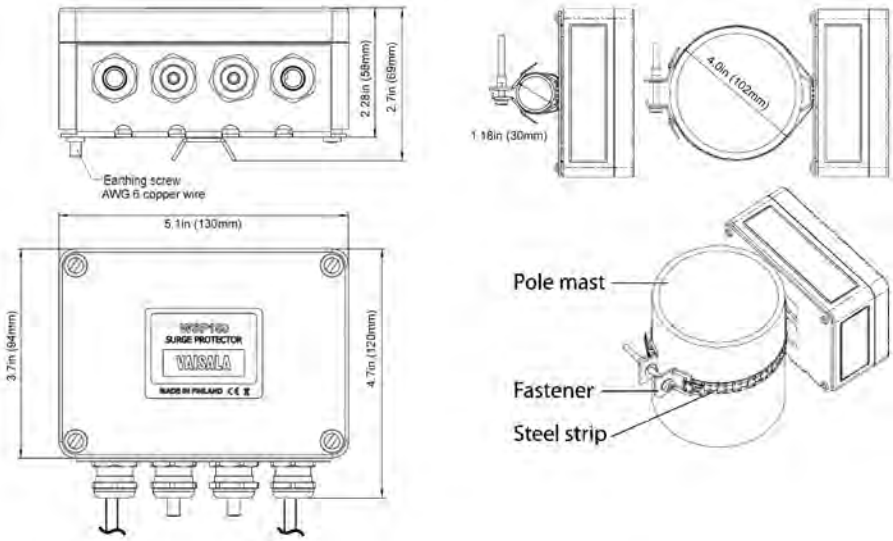
Note: If the standard 50 ft. cable provided with the sensor transmitter is not long enough, additional cable (Part No. 81547) is available from the factory.

Installing the AQM530 on a Mast



1. Attach the provided mounting bracket to the mast using the provided hose clamps. Use 7mm socket wrench to tighten.
2. Connect the sensor cable to the AQM530.
3. Attach the AQM530 to the mounting bracket. Use 5mm Allen key to tighten the screw and nut.

Installing the Surge Arrestor

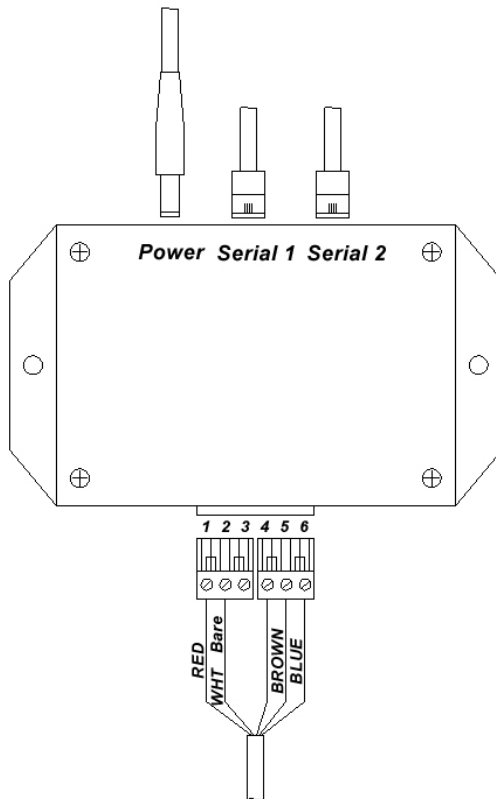


1. Attach the unit to the mast close to the weather sensor with the adjustable mounting clamp, see figure above.
2. Slide the steel strip beneath the latch on the back of the enclosure.
3. Wrap the steel strip around the pole mast. You may shorten the strip to a suitable length.
4. Loosen the fastener by backing up the screw half way.
5. Attach the steel strip ends to the fastener by latching the fastener to a hole on the strip and folding it over.
6. Tighten the fastener's screw in order to secure the unit to the pole.
7. If the mast is not grounded, ground the unit using the grounding screw located on the back of the unit with an AWG 6 (16 mm²) copper wire.

Connecting the AQM530 to the Interface Module

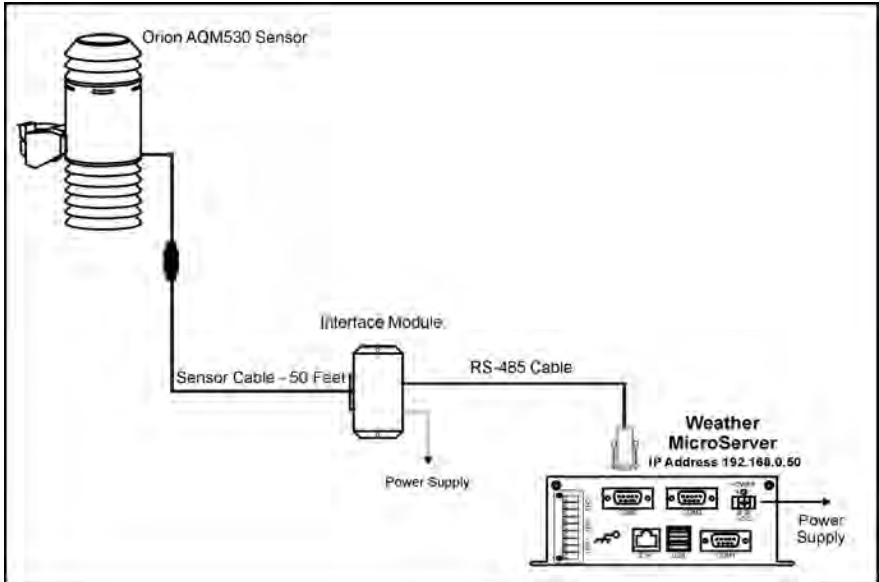
Using a #1 Straight Slot screwdriver, attach the wires from the end of the sensor cable to the terminal block screws on the Interface Module as follows:

Terminal Number	Signal	Color
1 (Power)	+12 V	Red
2 (GND)	Ground	White & Bare
3 (AUX)	No Connection	
4 (SIG GND)	No Connection	
5 (RX)	RX	Brown
6 (TX)	TX	Blue



Connecting the AQM530 to the Weather MicroServer

Connect the provided RS-485 cable to either serial port on the Interface Module. Connect the other end of the cable and DB-9 connector to COM 2 on the MicroServer, securing it with the attached screws.



Optional Sensor Mounting Hardware

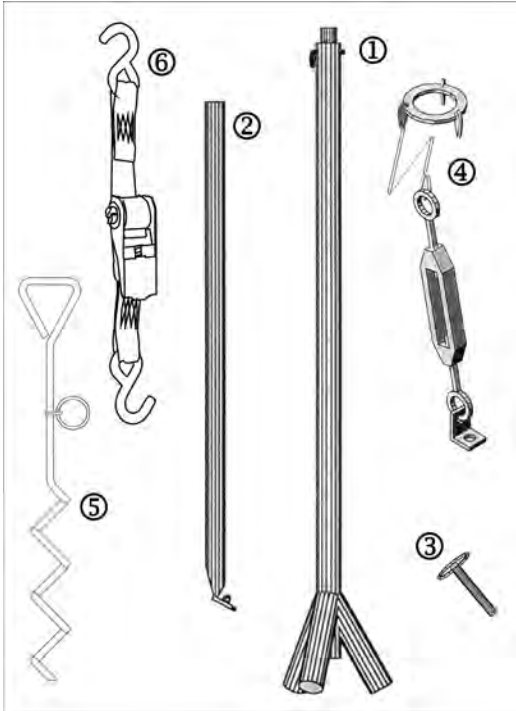
Telescoping Tripod and Tiedown Kit



The tripod is designed to provide up to 10 feet of stable, secure support for your meteorological sensors. Constructed from welded aluminum and powder coated for appearance and longevity, the 15-pound tripod can easily support up to 60 pounds of equipment. An optional tie-down kit allows for additional security in high-wind areas.

To install, insert the legs into the main body and secure with stainless steel retainer pins. Extend the mast to the desired height and insert another retainer pin. Install the guy wires to complete the set-up.

Tripod Parts List:



Description	Ref.	Qty.
Body/Mast Assembly	1	1
Legs	2	3
Retainer Pins	3	4
Guy Wire Ring with 3 Wires and Turnbuckles	4	1
Anchor Screw with Chain	5	1
Clamp with Strap	6	1

Specifications

Capacity: Supports up to 60 lbs.

Shipping Weight: 17 lbs

Shipping Box Dimensions: 71" x 9" x 9"

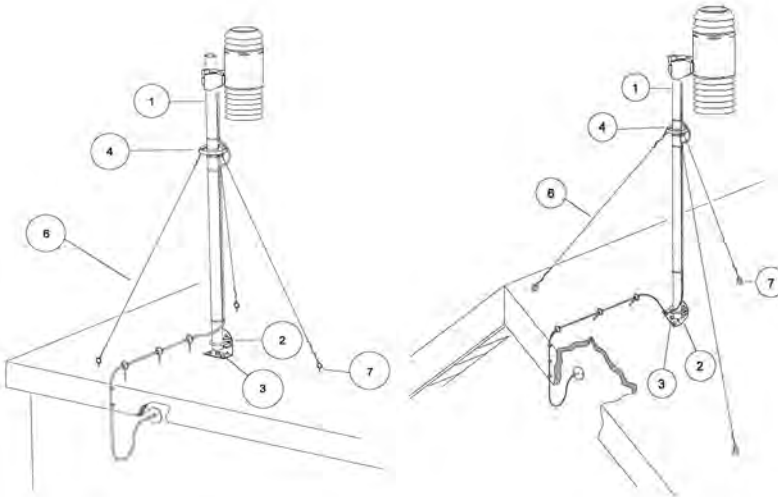
Tripod and Tiedown Kit Part Number: 88019

Sensor Mast

10-foot steel mast available for use with Roof Mount Hardware Kit (Part No. 88002) or Wall Mount Kit (Part No.88003).

Roof Mounting

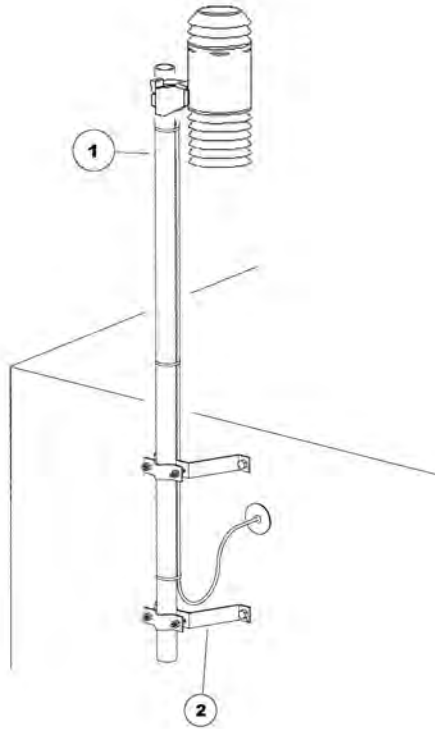
The Roof Mount Kit (Part No. 88002) is suitable for both a slanted and flat roof installation. The figure and table below illustrate and describe the individual parts.



Description	Ref.	Qty.	Part No.
Steel mast, 10 ft.	1	1	88005
Universal Mast Anchor	2	1	88010
Lag Screw, Roof Mast Mount 1/4" x 2 1/4" (for comp. roofs)	3	4	88030
Guy Wire Clamp, 1/8"	4	1	88070
Steel Guy Wire, Galvanized	6	50ft.	88080
Eye Bolt Wood Screws, 1/4" x 3"	7	4	88090
Turnbuckles, 6" open x 4" closed (not shown)	3		88100

Wall Mounting

The figure and table below illustrate and describe the individual parts in the Wall Mounting Kit (Part No. 88003). Individual parts are also available.



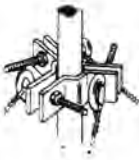
Description	Ref.	Qty.	Part No.
Mast, 10 ft.	1	1	88005
4" Wall Mount Bracket Pair	2	1	88003



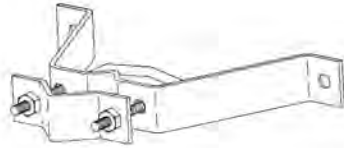
EYE BOLT SCREW



UNIVERSAL MAST ANCHOR



GUY WIRE CLAMP



4" WALL MOUNT BRACKET

SECTION 5: MAINTENANCE

Cleaning

Clean the device as needed. With large amounts of fine dust, for example sand or smoke particles, the device might not perform ideally and might need more frequent maintenance, or the device may be unsuitable for use at the location. In this case it is absolutely necessary to check the condition of the device more often and take the necessary actions to keep the device clean.

Maintenance schedule

The laser particle counter (LPC) filter needs to be replaced every 2 years.

The electrochemical gas sensors/base module needs to be replaced every 2 years.

The humidity and temperature sensor needs to be replaced every 4 years.

When the device health is lower than 30%, it is recommended to send the unit in to have the electrochemical gas sensors replaced.

SECTION 6: TROUBLESHOOTING

The chart below describes common problems, their probable causes, and remedies.

Problem	Possible Cause	Action
Loss of communication from AQM530 Example: Red LED on Interface Module is off	Poor cable connection Interface Module wiring is incorrect	Check all cable connections between sensor and optional monitoring device.
Loss of communication from AQM530 Example: Both LEDs on Interface Module are off	Blown fuse Power supply failure	Check the Interface Module fuse, replace if needed. Verify power supply voltage is present.

SECTION 7: USER SUPPORT INFORMATION

This section consists of the following items:

1. **One-Year Limited Warranty:** Please read this document carefully.
2. **Return for Repair Procedure:** This procedure is for your convenience in the event you must return your Orion for repair or replacement. Follow the packing instructions carefully to protect your instrument in transit.

Limited Warranty

Columbia Weather Systems, Inc. (CWS), warrants the Orion AQM530 to be free from defects in materials and/or workmanship when operated in accordance with the manufacturer's operating instructions, for one (1) year from date of purchase, subject to the provisions contained herein. CWS warranty shall extend to the original purchaser only and shall be limited to factory repair or replacement of defective parts.

EXCLUSIONS

Certain parts are not manufactured by CWS (i.e., certain purchased options, etc.) and are therefore not covered by this warranty. These parts may be covered by warranties issued by their respective manufacturers and although CWS will not warrant these parts, CWS will act as agent for the administration of any such independent warranties during the term of this warranty. This warranty does not cover normal maintenance, damage resulting from improper use or repair, or abuse by the operator. Damage caused by lightning or other electrical discharge is specifically excluded. This warranty extends only to repair or replacement and shall in no event extend to consequential damages. In the event of operator repair or replacement, this warranty shall cover neither the advisability of the repair undertaken, nor the sufficiency of the repair itself.

THIS DOCUMENT REFLECTS THE ENTIRE AND EXCLUSIVE UNDERSTANDING OF THE PARTIES, AND EXCEPT AS OTHERWISE PROVIDED HEREIN, ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, PARTICULARLY THE WARRANTIES OF MERCHANT ABILITY AND/OR FITNESS FOR A PARTICULAR PURPOSE ARE EXCLUDED.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Return for Repair Procedure

1. In the event of defects or damage to your unit, first call the Service Department Monday through Friday, 8:30 am to 4:00 pm PST, (503) 629-0887 to determine the advisability of factory repair. The Service Department will issue an RMA number (Return Merchandise Authorization) to help us identify the package when received. Please write that number on the outside of the box.
2. In the event factory service is required, return your Orion AQM530 as follows:
 - A. Packing
 - ◆ Wrap the Sensor Transmitter in a plastic bag first.
 - ◆ Pack in original shipping carton or a sturdy oversized carton.
 - ◆ Use plenty of packing material.
 - B. Include:
 - ◆ A brief description of the problem with all known symptoms.
 - ◆ Your telephone number.
 - ◆ Your return street shipping address (UPS will not deliver to a P.O. box).
 - ◆ Write the RMA number on the outside of the box.
 - C. Shipping
 - ◆ Send freight prepaid (UPS recommended).
 - ◆ Insurance is recommended. (The factory can provide the current replacement value of the item being shipped for insurance purposes.)
 - D. Send to:

Columbia Weather Systems, Inc.
5285 NE Elam Young Parkway, Suite C100
Hillsboro, Oregon 97124
 - E. C.O.D. shipments will not be accepted.

3. If your unit is under warranty, after repair or replacement has been completed, it will be returned by a carrier and method chosen by Columbia Weather, Inc. to any destination within the continental U.S.A. If you desire some other specific form of conveyance or if you are located beyond these borders, then you must bear the additional cost of return shipment.
4. If your unit is not under warranty, we will call you with an estimate of the charges. If approved, your repaired unit will be returned after all charges, including parts, labor and return shipping and handling, have been paid. If not approved, your unit will be returned as is via UPS COD for the amount of the UPS COD freight charges.

Reference

Glossary

PM2.5 Particulates

Particulates or droplets that are 2.5 microns or smaller in width.

PM10 Particulate

Particulates or droplets that are 10 micron or smaller in width.

AQI

Air Quality Index (AQI) is EPA's index for reporting air quality. It has a range of 0 to 500 with the higher value corresponding to greater level of pollution.

Aspirating Radiation Shield

A device used to shield a sensor such as a temperature probe from direct and indirect radiation and rain while providing access for ventilation.

Barometric Pressure

The pressure exerted by the atmosphere as a consequence of gravitational attraction exerted upon the "column" of air lying directly above the point in question.

Celsius Temperature Scale

A temperature scale with the ice point at 0 degrees and the boiling point of water at 100 degrees.

Fahrenheit Temperature Scale

A temperature scale with the ice point at 32 degrees and the boiling point of water at 212 degrees.

Relative Humidity

Popularly called humidity. The ratio of the actual vapor pressure of the air to the saturation vapor pressure.

Sea Level Pressure

The atmospheric pressure at mean sea level, either directly measured or, most commonly, empirically determined from the observed station pressure.

In regions where the earth's surface pressure is above sea level, it is standard observational practice to reduce the observed surface pressure to the value that would exist at a point at sea level directly below.

Unit Conversion

Particle Concentration

1 ppb = 0.001 ppm

Speed

Kilometers per hour = 1.610 x miles per hour

Knots = 0.869 x miles per hour

Meters per second = 0.448 x miles per hour

Feet per second = 1.467 x miles per hour

Temperature

Temperature in °C = $5/9$ (temperature in °F - 32)

Temperature in °F = (1.8 x temperature in °C) + 32

Distance

Millimeters = 25.4 x inches

Pressure

Millibars = 33.86 x inches of mercury

Kilopascals = 3.386 x inches of mercury

Pounds per square inch = 0.49 x inches of mercury

Standard atmospheres = 0.0334 x inches of mercury



Columbia Weather Systems, Inc.
5285 NE Elam Young Parkway, Suite C100
Hillsboro, OR 97124

Telephone

(503) 629-0887

Fax

(503) 629-0898

Web Site

<http://www.columbiaweather.com>

Email

support@columbiaweather.com

Part Number: 81670

Version 2.01

Printed in U.S.A.