

# Orion LT Wind Monitor™

## **User Manual**

Version 1.08

Serial Number: \_\_\_\_\_

Date Purchased: \_\_\_\_\_

All specifications subject to change without notice.

Printed in U. S. A.

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# Welcome!

Welcome to the Columbia Weather Systems family of users and congratulations on your purchase of the Orion LT Wind Monitor.

**Please read this manual completely prior to installation.**

# Important Notice: Shipping Damage

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

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 in writing, preferably by facsimile, about the shipping damage.
3. Wait for the transport company's representative to inspect the shipment personally.
4. After inspection, request permission from Columbia Weather Systems for return of the damaged instrument by calling the Service Department, (503) 629-0887.
5. Return approved items to us at the following address:

**Columbia Weather Systems, Inc.**

**2240 NE Griffin Oaks Street, Suite 100**

**Hillsboro, OR 97124**

6. After return authorization is issued and we receive the instrument, an estimate of the cost of repair will be sent to you for submittal to the transport company as a claim.

## ESD Protection

Electrostatic Discharge (ESD) can cause immediate or latent damage to electronic circuits. Vaisala products are adequately protected against ESD for their 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 make sure you are not 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.

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# SECTION 1: INTRODUCTION

## The Orion LT Wind Monitor

The Orion LT provides ultrasonic wind direction and speed measurements.

Available in three configurations – fixed-mount, vehicle-mount, and portable – Orion LT data can be monitored with our proprietary Weather Display Console and WeatherMaster™ Software, as well as with third-party software.

The Weather MicroServer is available for Ethernet connectivity, Modbus/TCP, Modbus RTU and SNMP interface, Weather Underground and CWOP interface, XML weather data, and FTP.

## Specifications

### Operating Conditions

Temperature Operation: -52 to +60°C (-6- to +140°F)

Relative Humidity: 0 to 100%

Wind\*: 0 to 60 m/s

\* Due to the measurement frequency used in the sonic transducers, RF interference in the 200-400kHz range can disturb wind measurement.

### Wind Speed

Range: 0-135mph (0-60 m/s)

Accuracy: ±3% at 10 m/s

Resolution: 1 mph (1 m/s)

Units Available: knots, mph, km/hr, m/s

### Wind Direction

Azimuth: 0-360°

Accuracy: ±3°

Resolution: 1°

Units Available: ° Azimuth

### Input Voltage

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

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

Output: 12 VDC, 1.25A

The Orion LT can also be powered directly using a DC voltage source

Input: 5 to 30 VDC (60 mA at 12 VDC)

**Heating Power Source**

Input: 5 to 30 VDC (1.1 A at 12 VDC)

**Sensor Housing**

Protection class: IP66 (with mounting adapter)

Materials: Polycarbonate + 20% glass fiber, stainless steel (AISI 316)

Weight: 595 g (1.3 lbs)

# Principles of Measurements

## Wind Measurement

Both wind speed and direction are measured using advanced ultrasonic technology. The sensor utilizes ultrasound to determine horizontal wind readings. The array of three equally-spaced ultrasonic transducers on a horizontal plane is an ideal design that ensures accurate wind measurement from all directions, without blind angles or corrupted readings.

The wind sensor has no moving parts, which makes it virtually maintenance free.

Wind speed and wind directions are determined by measuring the time it takes the ultrasound to travel from each transducer to the other two.

The wind sensor measures the transit time (in both directions) along the three paths established by the array of transducers. This transit time depends on the wind speed along the ultrasonic path. For zero wind speed, both the forward and reverse transit times are the same. With wind along the sound path, the up-wind direction transit time increases and the down-wind transit time decreases.

The wind speed is calculated from the measured transit times using the following formula:

$$V_w = 0.5 \times L \times (1/t_f - 1/t_r)$$

where:

$V_w$  = Wind speed

$L$  = Distance between the two transducers

$t_f$  = Transit time in forward direction

$t_r$  = Transit time in reverse direction

Measuring the six transit times allows  $V_w$  to be computed for each of the three ultrasonic paths. The computed wind speeds are independent of altitude, temperature and humidity, which are cancelled out when the transit times are measured in both directions, although the individual transit times depend on these parameters.

Using  $V_w$  values of two array paths is enough to compute wind speed and wind direction. A signal processing technique is used so that wind speed and wind direction are calculated from the two array paths of best quality.

The wind speed is represented as a scalar speed in selected units (m/s, kt, mph, km/h). The wind direction is expressed in degrees (°). The wind direction reported indicates the direction that the wind comes from. North is represented as 0°, east as 90°, south as 180°, and west as 270°.

The wind direction is not calculated when the wind speed drops below 0.05 m/s. In this case, the last calculated direction output remains until the wind speed increases again to the level of 0.05 m/s.

The average values of wind speed and direction are calculated as a scalar average of all samples over the selected averaging time (1 ... 900 s). The sample count is based on a 4 Hz sampling rate. The minimum and maximum values of wind speed and direction represent the corresponding extremes during the averaging time.

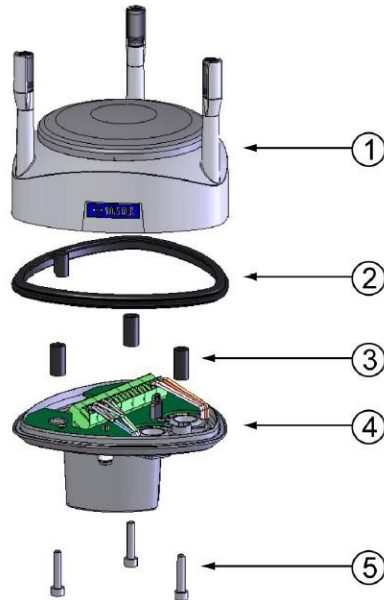


## SECTION 2: PHYSICAL DESCRIPTION

### Orion LT Sensor Transmitter

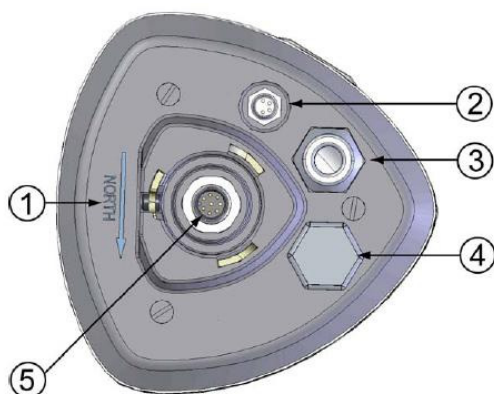
The Orion LT Sensor Transmitter is an all-in-one sensor unit containing ultrasonic wind speed and direction sensor.

#### Sensor Transmitter Components



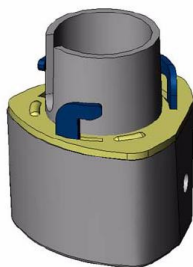
- 1: Top assembly
- 2: Silicon gasket
- 3: Spacers
- 4: Bottom assembly
- 5: Allen screws

## Bottom of the Transmitter



- 1: Alignment direction sign
- 2: Service port
- 3: Water tight cable gland
- 4: Unused cable gland, covered
- 5. Optional 8-pin M12 connector (not supplied with standard system).

## Mounting Adapter



To facilitate easy installation and north alignment, the Orion LT Sensor Transmitter comes standard with a mounting adapter. The mounting adapter is easily connected on the end of the mast and the sensor transmitter simply snaps into it. The north alignment needs to be performed only once.

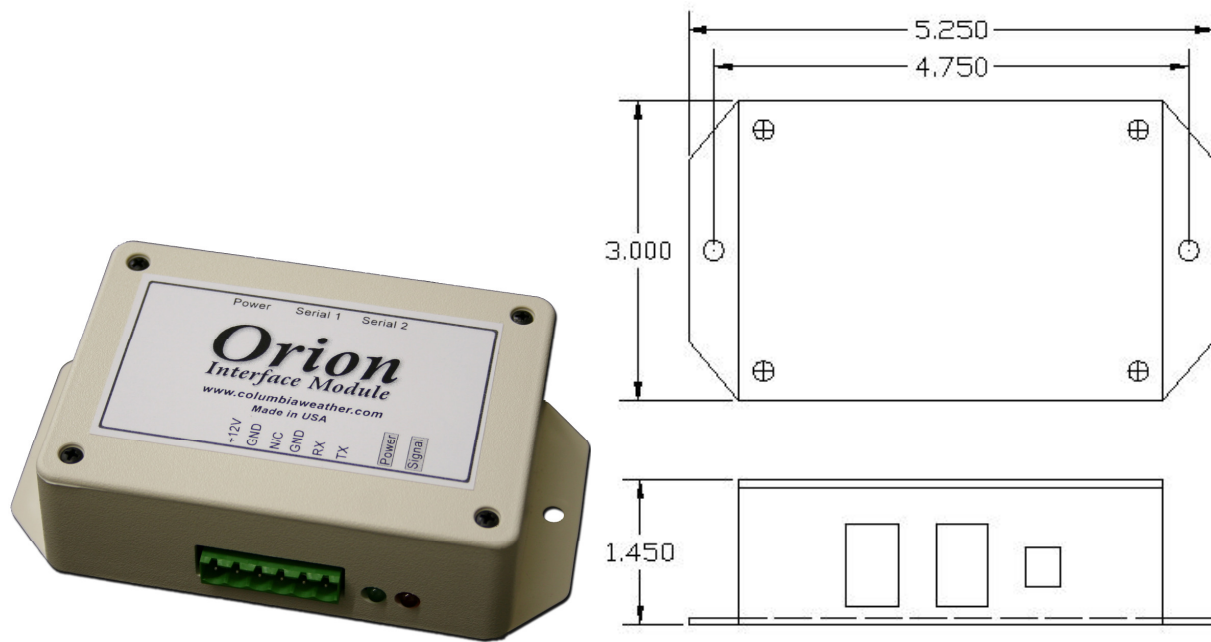
## Heating (Optional)

Heating elements located below the top stainless steel cap and inside the wind transducers keeps the precipitation and wind sensors free from snow and ice. A heating temperature sensor ( $T_h$ ) underneath the top stainless steel cap controls the heating.

Three fixed temperature limits, namely +3 °C, -2 °C, and -4 °C (+37 °F, +38 °F, +25 °F) control the heating power as follows:

|                         |                    |
|-------------------------|--------------------|
| $T_h > +3$ °C           | heating is off     |
| $-2$ °C < $T_h$ < +3 °C | 50% heating power  |
| $-4$ °C < $T_h$ < -2 °C | 100% heating power |
| $T_h < -4$ °C           | 50% heating power  |

## Orion Interface Module



The Orion Interface Module is used to supply power to the sensor transmitter and to provide two RS-232 communication ports. The RS-232 ports can be connected to computers, display consoles, transceivers, and other such devices.

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 flash every second to indicate a data record being transmitted.

## Surge/Lightning Protectors



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 Orion Surge Protector. This compact transient overvoltage suppressor is designed for weather stations in areas with an elevated risk of lightning strike such as on top of high buildings, or anywhere with cable lengths greater than 100 feet.

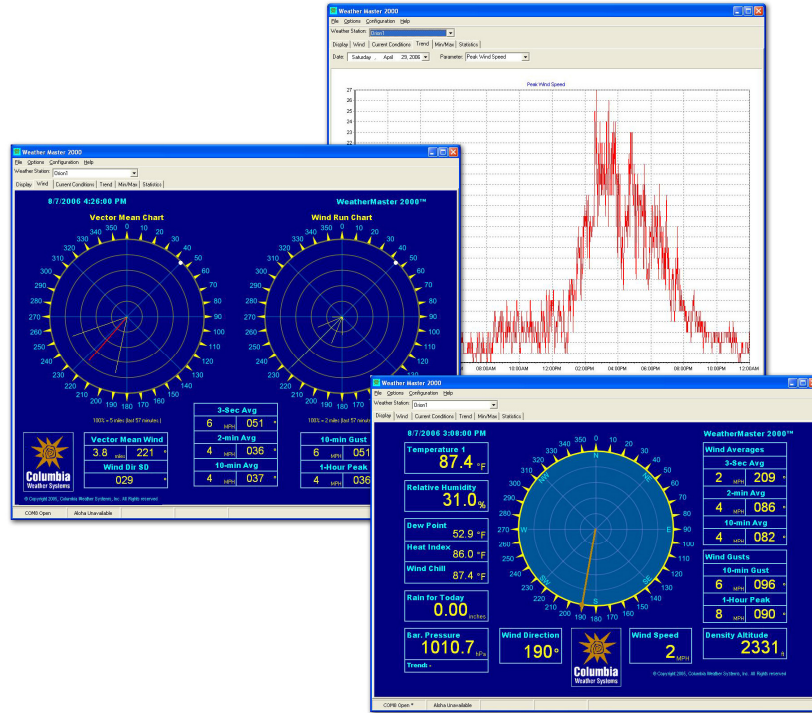
- Superior 3-stage surge protection
- Tolerates up to 10kA surge currents
- Both differential and common mode protection on each channel
- Filtering against HF and RF noise
- Two power channels and two data channels
- Environmental protection class IP66

Catalog Number: 8355

Includes adjustable mounting kit



# WeatherMaster™ Software (Optional)



WeatherMaster is a professional grade weather monitoring software. This software package is designed for specialized markets that require robust weather calculations, interoperability with computer models, and data interfaces to other industrial systems. WeatherMaster utilizes Microsoft Access database for easy data access and manipulation.

Please refer to the WeatherMaster user manual for installation and operation procedures

## Weather Display Console (Optional)



The Weather Display uses “intelligent” touch-screen technology. With its programmable microprocessor and abundant memory, the Weather Display can display weather information, perform complex computations, and store relatively large amounts of weather data.

The Weather Display is also available in a 19” rack-mount chassis and a panel-mount configuration.

Please refer to the Weather Display Console user manual for more information.

## Weather MicroServer

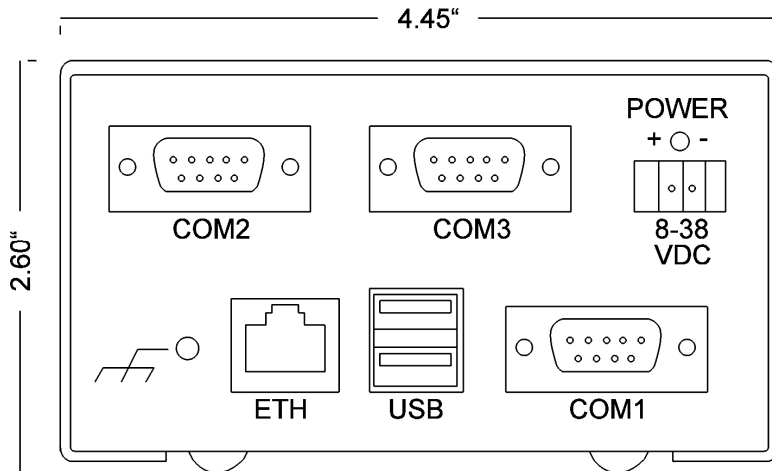
The Weather MicroServer uses a small computer board that runs an imbedded Linux operating system.

The MicroServer has 512MB flash memory for data logging and operation.

The Orion LT transmitter connects to the MicroServer via COM1.

The MicroServer has two RS-232 COM ports and an Ethernet port

A second Orion LT transmitter can be connected to COM2.



The MicroServer offers the following:

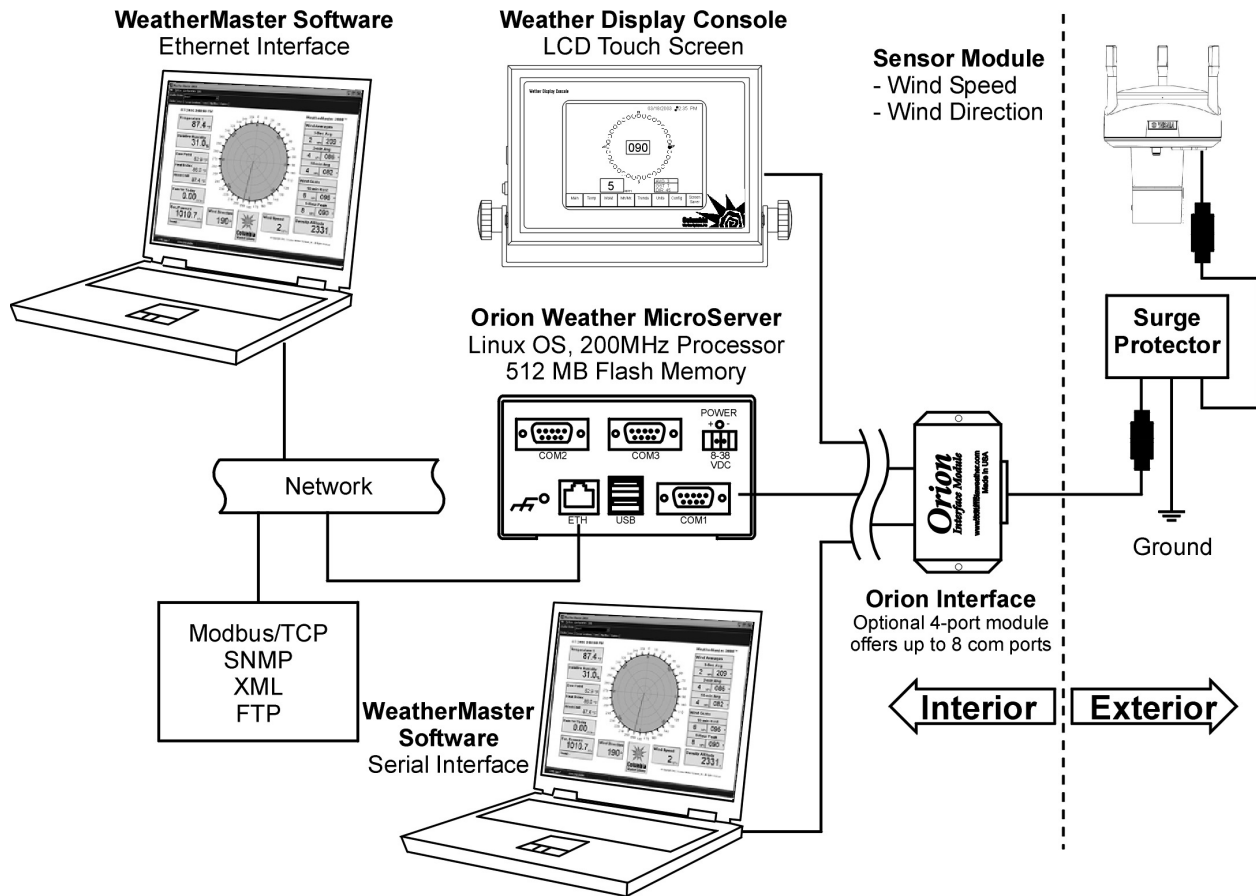
- XML Weather Data
- FTP weather data in XML or CSV format
- Modbus/TCP, Modbus RTU, and Modbus ASCII interfaces
- SNMP interface
- Weather Underground interface
- CWOP interface
- Three months of data logging at 1-minute interval
- Interface to optional visibility and solar radiation sensors



# SECTION 3: INSTALLATION

## Weather Station System Configuration

The Orion LT Weather Station can be installed in multiple configurations depending on the communication options, power availability and viewing options.



## Installation Overview

Unpacking the Unit

Installing Sensor Transmitter

Installing the Interface Module

Connecting the Sensor Transmitter to the Interface Module

Connecting to Weather Display, Computer, and/or MicroServer

## Unpacking the Unit

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

**CAUTION:** Beware of damaging any of the wind transducers located at the top of the three antennas. Dropping the device can break or damage the transducers. If the antenna bends or twists, the re-aligning can be difficult or impossible.

Unpack the Orion LT weather station and verify that all parts are included.

1. Standard system includes:

- Orion LT Sensor Transmitter
- 50 ft sensor cable + additional cable length if ordered
- Orion Interface Module
- (2) 3-position terminal blocks
- Interface module power supply
- User Manual
- 6-foot RS-232 cable + additional cable length if ordered

2. Weather Display Console (Optional)

- Display Console
- Power supply
- 6-foot RS-232 cable + additional cable length if ordered
- User manual

3. WeatherMaster 2000 software and user manual (optional)

4. Weather MicroServer (optional)

- MicroServer
- Power supply
- Ethernet cable
- User manual

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

Save the shipping carton and packing material in case the unit needs to be returned to the factory. If the system does not operate or calibrate properly, see Section 6: Maintenance and Section 7: Troubleshooting, for further instructions.

## Installing the Orion LT Sensor Transmitter

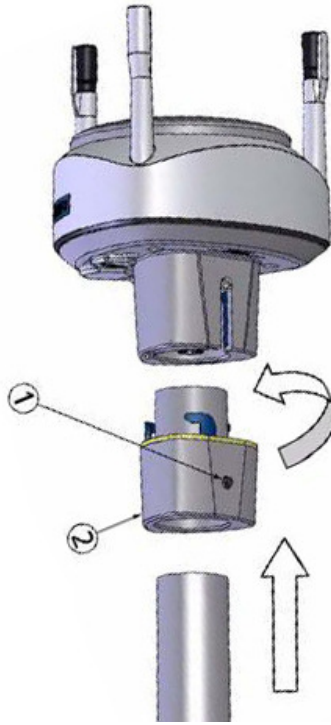
### Site Selection:

Finding a suitable site for the sensor transmitter is important for getting representative ambient measurements. The site should represent the general area of interest.

The sensor transmitter should be installed in a location that is free from turbulence caused by nearby objects, such as trees or buildings.

**WARNING:** To protect personnel (and the device), a lightning rod should be installed with the tip at least 40 inches (one meter) above the sensor transmitter. The rod must be properly grounded, compliant with all local applicable safety regulations.

### Installing the Mounting Adapter



1. Insert the mounting adapter ② in the transmitter lower side as shown in the diagram above.
2. Turn the adapter firmly until you feel that it has snapped into the locked position.
3. Align the transmitter in such a way that the arrow (at the bottom of the transmitter) points to north (see North Alignment).
4. Tighten the fixing screw ① to fix the adapter firmly to the mast.

The mounting adapter installs on a mast as follows:

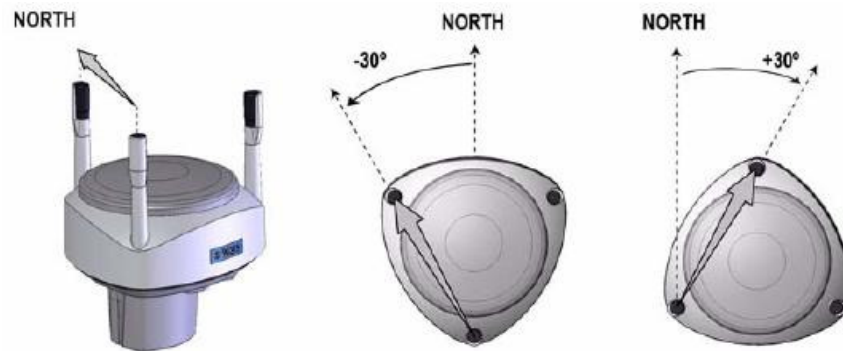
1. Mounting adapter with sleeve mounts on a 1.05 inch (26.7 mm) outside diameter mast.
2. Mounting adapter without sleeve mounts on a 1.18 inch (30 mm) outside diameter mast.

### North Alignment

To help the alignment, there is an arrow and text **North** on the bottom of the transmitter. The transmitter should be aligned in such a way that this arrow points to the north.

Wind direction can be referred either the true north, which uses the earth's geographic meridians, or to magnetic north, which is read with a magnetic compass. The magnetic declination is the difference in degrees between the true north and magnetic north.

## Compass Alignment



1. If the sensor transmitter is already mounted, loosen the fixing screw on the mounting adapter.
2. Use a compass to determine that the transducer heads are exactly in line with the compass and that the arrow on the bottom of the transmitter points to north.
3. If wind direction is referenced to True North, adjust the north orientation of the sensor by the magnetic declination for your area.
4. Tighten the fixing screw on the mounting adapter when done.

Once the sensor transmitter is aligned to north, the transmitter can be removed from the mounting adapter without losing the north orientation.

## Installing the Mast

See **Optional Sensor Mounting Hardware** for more information on sloped roof mounting, flat roof mounting and wall mounting

## Location

Do not attach the sensor transmitter to radio transmitting mast or tower.

Select a mounting location that will allow the sensor cable to be routed away from other data cables to avoid interference.

Do not mount sensors close to power lines or telephone lines. For normal roof mounting, the recommended minimum distance from power or telephone lines is 25 ft. (8 m). Use extreme caution when working close to power lines.

## Mounting Method

Choose the appropriate mounting method for the installation and obtain the necessary mounting hardware. Refer to Section 4 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 secure the cable to mast. Be sure that one is used at the mast base. Tighten the tie wraps securely and clip off any excess length with a wire cutter tool.

Route the cable back to the Interface Module.

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. Use insulated standoffs (user supplied, see Section 4) when routing cable to help avoid this problem.

**CAUTION:** There may be electric wires in the wall. We recommend that you shut off the electricity in the room(s) where you are drilling.

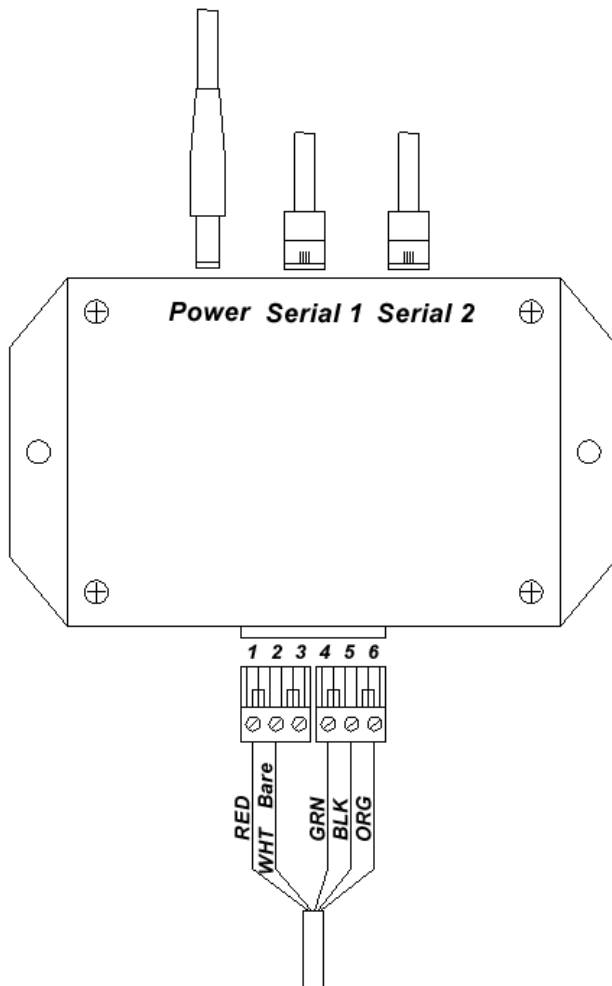
**Note:** If the standard 50 ft. cable provided with the sensor transmitter is not long enough, it may be extended by splicing on an appropriate length of 22-gauge, stranded, seven conductor shielded cable with the same color code. When cutting and splicing, insure good contacts, proper color coding of the terminal leads, and a good seal. (A good solder splice, and water proof insulation are essential; merely twisting the respective wires together is not adequate.) Additional cable (Catalog No. 81542) and a water tight splice kit (Cat. No. 81580) are available from the factory.

Once the sensor transmitter has been placed, route the cable back to the Interface Module.

## Connecting the Sensor Transmitter to the Interface Module

Attach the wires from the end of the sensor cable to the terminal block screws on the Interface Module as follows:

|   | Signal | Standard Color | Heated Color          |
|---|--------|----------------|-----------------------|
| 1 | +12 V  | RED            | RED and Brown         |
| 2 | GND    | White and Bare | White, Blue, and Bare |
| 3 | N/C    | No connection  | No connection         |
| 4 | GND    | Green          | Green                 |
| 5 | RX     | Black          | Black                 |
| 6 | TX     | Orange         | Orange                |



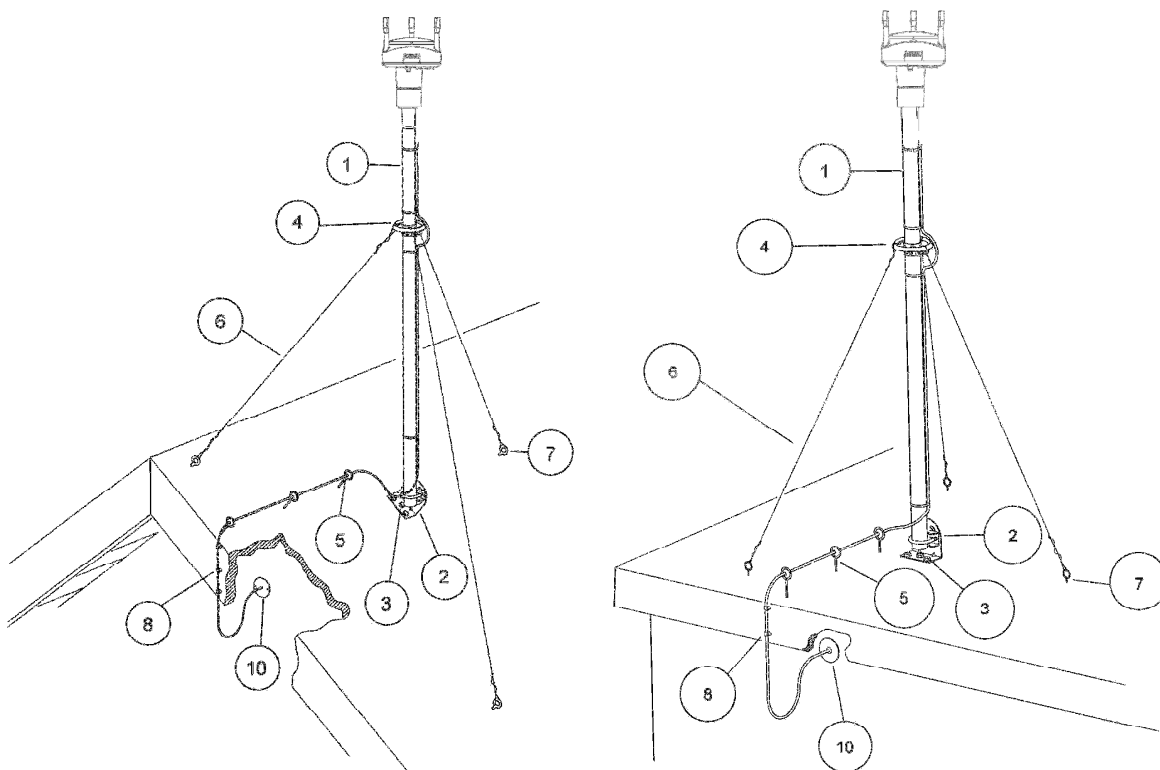
## Section 4: Optional Sensor Mounting Hardware

Fiberglass and steel 10-foot masts are available for use with either Roof Mounting Hardware Kit (Cat. No. 88002). Only the steel 10-foot mast is available for use with the Wall Mounting Kit (Cat. No. 88003).

A 10-foot free standing tripod is also available.

### Roof Mounting

The Roof Mounting Kit (Cat. No. 88002) is suitable for both a slanted and flat roof installation. The figure and table below illustrates and describes the individual parts. Items included in the kit are marked with an asterisk (\*). Individual parts are also available.



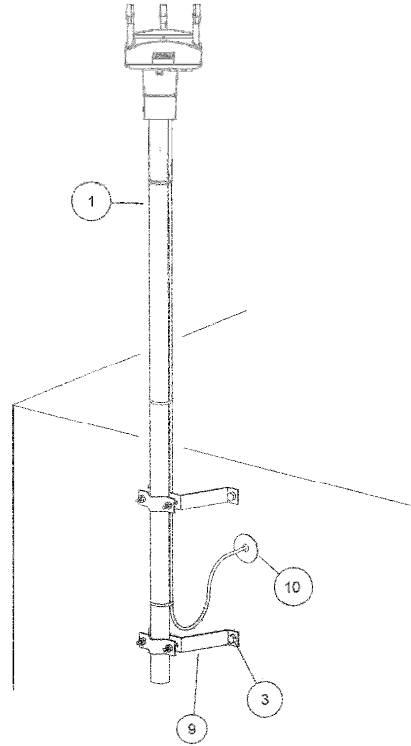
| Description  | Pkg. | Ref | Catalog No.   |
|--|------|-----|---------------|
| Mast, 10 ft. (steel or fiberglass)                             | 1    | 1   | 88005 / 88004 |
| *Universal Mast Mount  | 1    | 2   | 88010         |
| Lag Screw, Roof Mast Mount<br>1/4" x 4" (for shake roofs)      | 3    | 3   | 88020         |
| *Lag Screw, Roof Mast Mount<br>1/4" x 2 1/4" (for comp. roofs) | 4    | 3   | 88030         |
| *Guy Ring and Collar   | 1    | 4   | 88040         |
| *Cable Standoffs, Wood Screw                                   | 4    | 5   | 88050         |
| Cable Standoffs, Nail-In<br>(for masonry application)          | 2    | 5   | 88060         |

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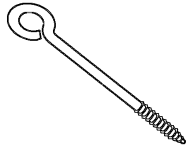
|                                  |        |             |       |
|----------------------------------|--------|-------------|-------|
| Guy Wire Clamps, 1/8"            | 3      | (not shown) | 88070 |
| *Steel Guy Wire, Galvanized      | 50 ft. | 6           | 88080 |
| *Eye Bolt Wood Screws, 1/4" x 3" | 4      | 7           | 88090 |
| Turnbuckles, 6" open x 4" closed | 2      | (not shown) | 88100 |
| *Cable Nail Clips                | 20     | 8           | 88110 |
| Wall Feed Through Tube           | 1      | 10          | 88130 |
| *Cable Feed Through Bushings     | 4      | 10          | 88140 |

## Wall Mounting

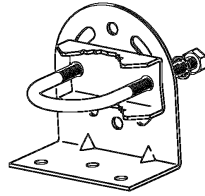
The figure and table below illustrates and describes the individual parts in the Wall Mounting Kit (Catalog No. 88003). Only available with the steel mast. Items included in the kit are marked with an asterisk (\*). Individual parts are also available.



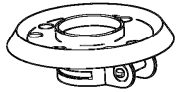
| Description                  | Pkg. | Ref | Catalog No. |
|------------------------------|------|-----|-------------|
| Mast, 10 ft.                 | 1    | 1   | 88005       |
| *4" Wall Mount               | 2    | 9   | 88120       |
| Lag Screw, 1/4" x 2 1/4"     | 4    | 3   | 88030       |
| *Cable Nail Clips            | 20   | 8   | 88110       |
| Wall Feed Through Tube       | 1    | 10  | 88130       |
| *Cable Feed Through Bushings | 4    | 10  | 88140       |



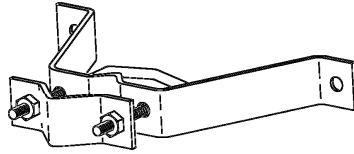
EYE BOLT SCREW



UNIVERSAL MAST MOUNT



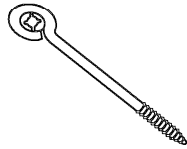
GUY RING & COLLAR



4" WALL MOUNT

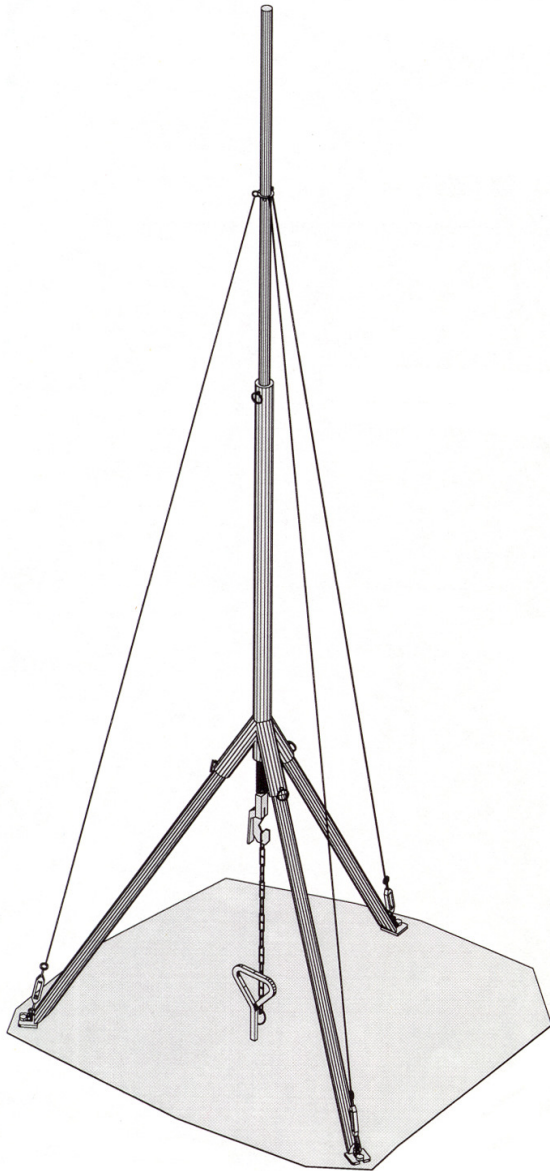


CABLE NAIL CLIP



CABLE STANDOFF

## Tripod



The instrumentation tripod is designed to provide up to 10 feet of stable, secure support for your meteorological sensors.

Constructed from welded aluminum and is 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.

Insert the legs into the main body and install the stainless steel retainer pins. Extend the mast to the desired height and insert another retainer pin. Install the guy wires to complete the installation.

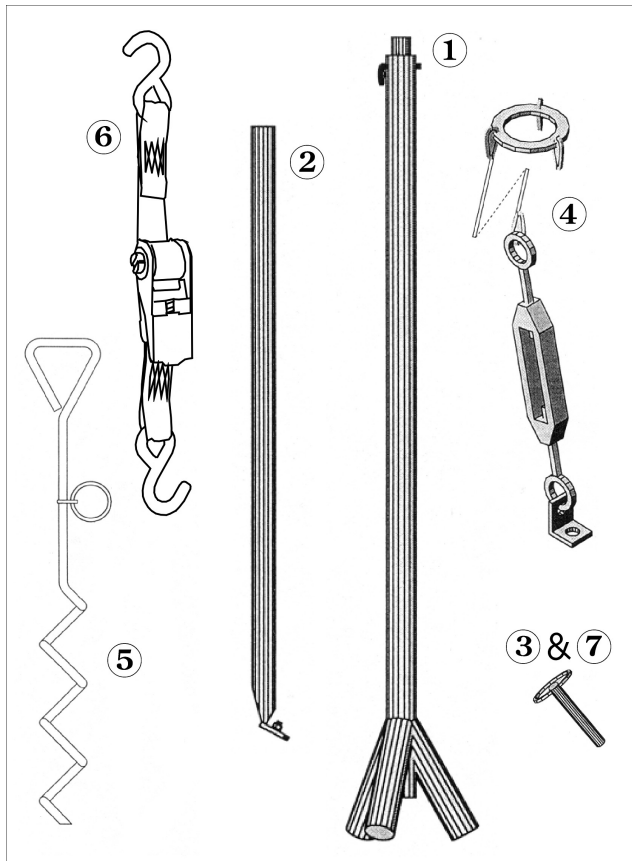
### Specifications

Capacity: Supports up to 60 lbs.

Shipping Weight: 17 lbs

Shipping Box Dimensions: 70" x 8" x 8"

Tripod and Tie Down Kit Catalog Number: 88019

**Tripod 10-foot (Catalog No. 88019) Parts List:**

| Item # | Description                                   | Qty |
|--------|---|-----|
| 1      | Body/Mast Assembly                            | 1   |
| 2      | Legs  | 3   |
| 3      | Retainer Pins                                 | 4   |
| 4      | Guy Wire Ring with<br>3 Wires and Turnbuckles | 1   |

**Tiedown Kit Parts List:**

| Item # | Description             | Qty |
|--------|-------------------------|-----|
| 5      | Anchor Screw with Chain | 1   |
| 6      | Clamp with Strap        | 1   |
| 7      | Retainer Pin            | 1   |



## Orion LT Sensor Data Output Definition

Wind data is transmitted every second. A Supervisory message is transmitted every 60 seconds when heating is turned off and every 15 seconds when heating is turned on.

The RS-232 interface is as follows:

Bits per Second (baud rate): 9600

Data bits: 8

Parity: None

Stop bits: 1

Flow control: None

**Note: The # sign after a parameter value indicates an invalid value.**

### Wind data

Example:

0r1,Dn=240D,Dm=249D,Dx=260D,Sn=4.3S,Sm=4.9S,Sx=5.4SMCO

where

0r1 = Wind message

Dn = Wind direction minimum (D = degrees)

Dm = Wind direction average (D = degrees)

Dx = Wind direction maximum (D = degrees)

Sn = Wind speed minimum (S = mph)

Sm = Wind speed average (S = mph)

Sx = Wind speed maximum (S = mph)

MCO = CRC-16 code

### Supervisory Data:

Example:

0r5,Th=69.0F,Vh=0.0N,Vs=17.0V,Vr=3.483VCa~

where

0r5= Supervisory message

Th = Heating temperature (F = °F)

Vh = Heating voltage (N = heating is off)

Vs = Supply voltage (V = V)

Vr= 3.5 V reference voltage (V = V)

Ca~ = CRS-16 code

## CRC-16 Computation

The computation of the CRC is performed on the data response before parity is added. All operations are assumed to be on 16 bit unsigned integers. The least significant bit is on the right. Numbers preceded by 0x are in hexadecimal. All shifts shift in a zero. The algorithm is:

Initialize the CRC to zero. For each character beginning with the address, up to but not including the carriage return (<cr>), do as follows:

```
{
    Set the CRC equal to the exclusive OR of the character and itself
    for count =1 to 8
    {
        if the least significant bit of the CRC is one
        {
            right shift the CRC one bit
            set CRC equal to the exclusive OR of 0xA001 and itself
        }
        else
        {
            right shift the CRC one bit
        }
    }
}
```

## Encoding the CRC as ASCII Characters

The 16 bit CRC is encoded to three ASCII characters by using the following algorithm:

1 st character = 0x40 OR (CRC shifted right 12 bits)

2nd character = 0x40 OR ((CRC shifted right 6 bits) AND 0x3F)

3rd character = 0x40 OR (CRC AND 0x3F)

The three ASCII characters are placed between the data and <cr><lf>. Parity is applied to all three characters, if selected for the character frame.

The CRC computation code is added to the end of the response, if the first letter of the command is sent by using lower case.

# SECTION 5: CALIBRATION

## Factory Calibration

The wind sensor is checked in a zero wind verifier that meets Vaisala's manufactured specifications.

The Zero wind verifier measures the ultrasonic speed transmitted and received in zero-wind environment. Once calibrated, the wind readings will be accurate over the full range of the sensor.

Field calibration is not available or required.



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## **SECTION 6: MAINTENANCE**

This chapter contains instructions for the basic maintenance of the sensor transmitter.

### **Cleaning**

To ensure the accuracy of measurement results, the sensor transmitter should be cleaned when it gets contaminated. Leaves and other such particles should be removed from the precipitation sensor and the transmitter should be cleaned carefully with a soft, lint-free cloth moistened with mild detergent.

### **Factory Calibration and Repair Service**

Send the device to Columbia Weather Systems, Inc. for calibration and adjustment, see Section 8: USER SUPPORT INFORMATION for more information.



## Section 7: Troubleshooting

This chapter describes common problems, their probable causes and remedies.

| <b>Problem</b>  | <b>Possible Cause</b>  | <b>Action</b>        |
|---|--|----------------------|
| Wind measurement failure. Both the speed and direction sensors are not reporting correct data | Blockage (trash, leaves, branches, bird nests) between the wind transducers.<br><br>Check that the wind transducers are not damaged. | Remove the blockage. |





## SECTION 8: 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 LT 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 LT Weather Station to be free from defects in materials and/or workmanship when operated in accordance with the manufacturer's operating instructions, for one (1) years 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 place that number on the outside of the box.
2. In the event factory service is required, return your Orion LT Weather Station 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 phone 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.  
2240 NE Griffin Oaks Street, Suite 100  
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.

## Unit Conversion

### 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



Columbia Weather Systems, Inc.  
2240 NE Griffin Oaks Street, Suite 100  
Hillsboro, OR 97124-6463

**Telephone**

(503) 629-0887

**Fax**

(503) 629-0898

**Web Site**

<http://www.columbiaweather.com>

**Email**

[info@columbiaweather.com](mailto:info@columbiaweather.com)

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