Orion LT Wind Monitor™

User Manual

Version 1.10

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.

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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.

    5285 NE Elam Young Parkway, Suite C100

    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.

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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.

Table of Contents

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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.

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Specifications

Operating Conditions

Temperature Operation: -52 to +60°C (-61 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 200-400 kHz 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)

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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)

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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:

$V_w = 0.5 \times L \times (1/\,t_f - 1/tr$

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

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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.

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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
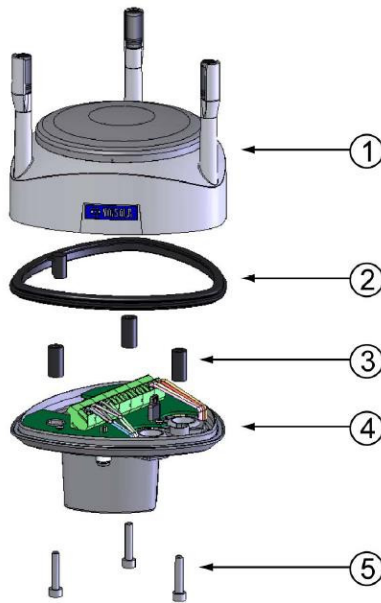
1: Top assembly

2: Silicon gasket

3: Spacers

4: Bottom assembly

5. Allen screws

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Bottom of the Transmitter
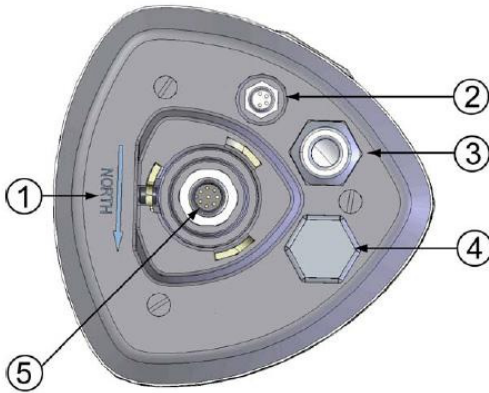
1: Alignment direction sign

2: Service port

3: Water tight cable gland

4: Unused cable gland, covered

5. Optional 8-pin M12 connector (not supplied with standard system).

Sensor Transmitter Dimensions

Dimensions in mm (inches)

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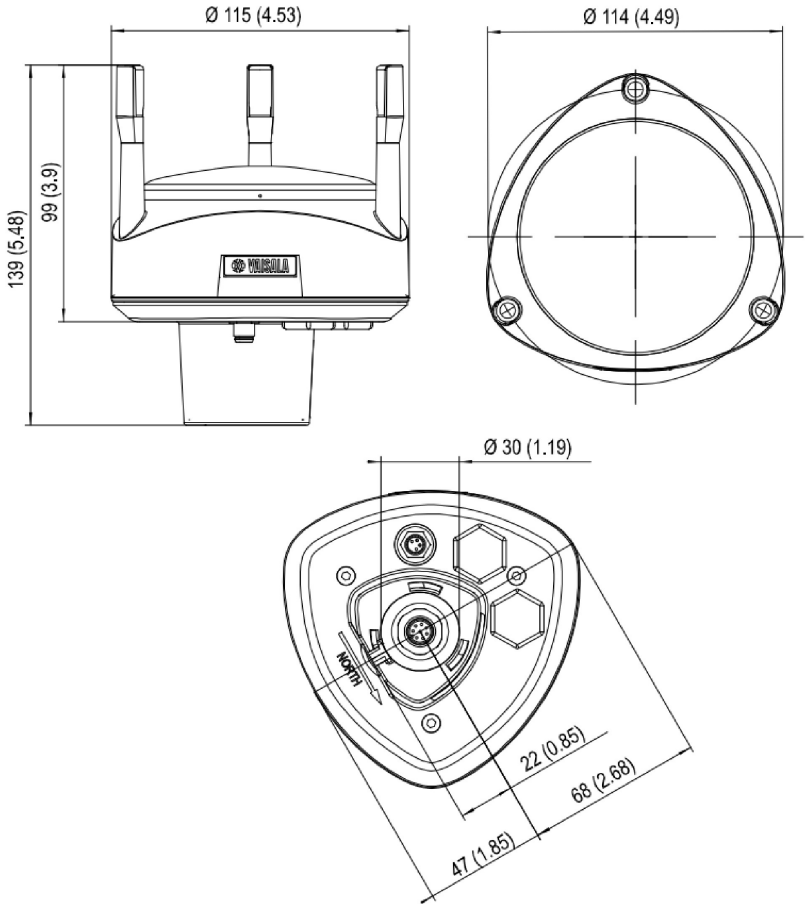
Mounting Adapter

To facilitate easy installation and north alignment, the Orion Sensor Transmitter comes standard with a mounting adapter. The mounting adapter is easily connected to the end of the mast and the sensor transmitter simply snaps into it. The north alignment needs to be performed only once.
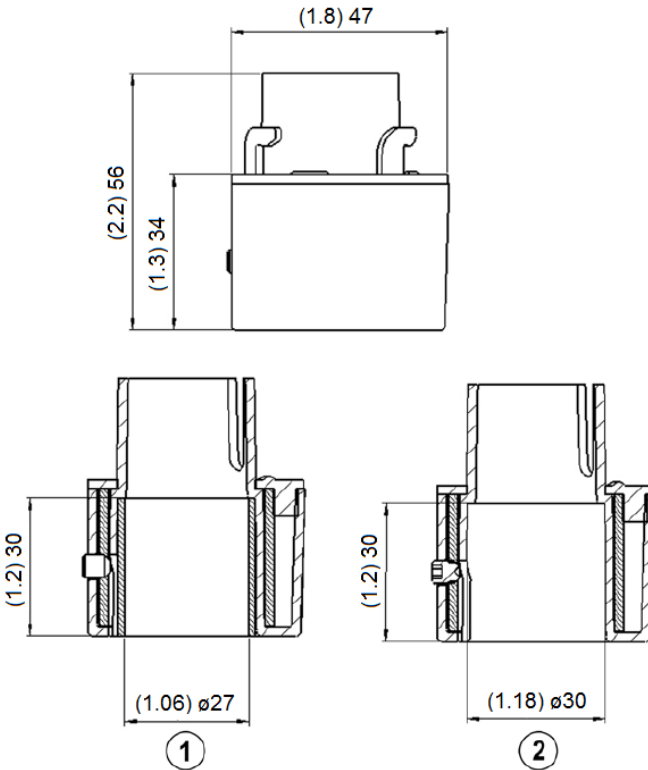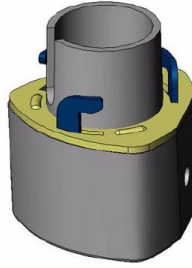
1. Mounting Adapter with adapter sleeve for Ø1.05" mast

2. Mounting Adapter without adapter sleeve for Ø1.18" mast

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Heating (Optional)

Heating elements located below the precipitation sensor and inside the wind transducers keep the precipitation and wind sensors free from snow and ice. A heating temperature sensor (T_h) beneath the precipitation sensor controls the heating.

Note that (T_h) is measured inside the transmitter, where temperature is much higher than the ambient temperature (T_a).

Three fixed temperature limits, namely +4 °C, 0 °C, and -4 °C (+39 °F, +32 °F, +25 °F) control the heating power as follows:

- When ambient temperature (T_a) falls below +4 °C, heating is enabled.

- Heating keeps T_h > +4 °C until T_a < -1 °C

- Heating keeps T_h > 0 °C until T_a < -15 °C

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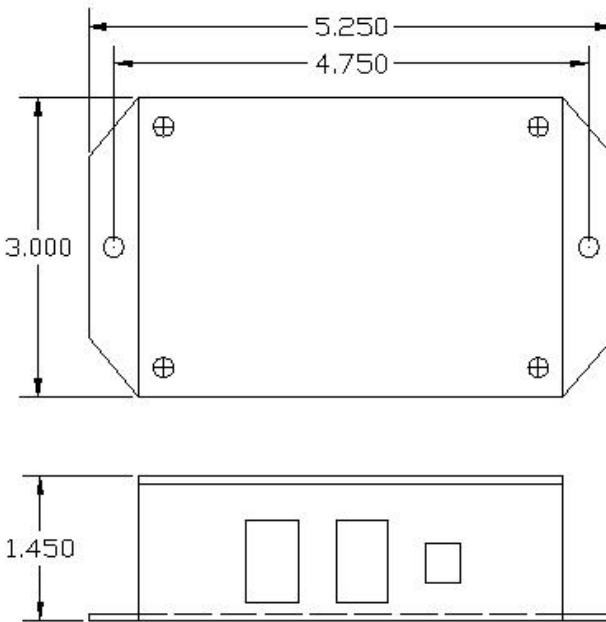
The Interface Module is used to supply power to the sensor transmitter and to provide two RS-232 communication ports. The RS-232 ports can be connected to computers, display consoles, transceivers, and other such devices.

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.

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The green LED will remain solid to indicate power is being supplied to the Orion LT sensor transmitter.

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Surge/Lightning Protector

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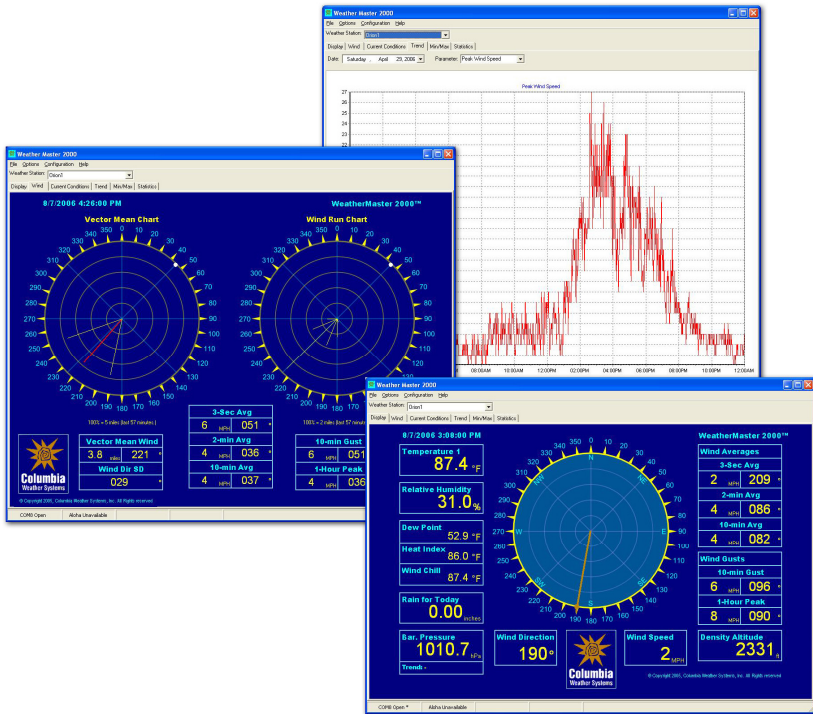
WeatherMaster is a professional grade weather monitoring software. This software package is designed for specialized markets that require robust weather calculations, interoperability with computer models, and data interfaces to other industrial systems. WeatherMaster utilizes Microsoft Access database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

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

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Weather Display Console (Optional)

Displays weather information • Designed to be viewed clearly from a distance • Industrial grade WVGA touchscreen.

Seven-inch, TFT color LCD panel with 800 x 480 pixel resolution.

Performs computations for wind chill, heat index and other calculated parameters • 200MHz ARM9 CPU

Serial or Ethernet connection: Connects directly to weather station with serial port or connects to a Weather MicroServer over a network utilizing an existing Ethernet infrastructure -- no extra wiring. The MicroServer configuration also allows for data from one weather station to be monitored from multiple display consoles at various locations.

Screens can be factory-customized to meet specialized market and industry requirements.

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 (Optional)

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

The MicroServer has 128MB flash memory for operation and 8 GB SD card for data logging.

The Orion LT transmitter connects to the MicroServer via COM2.

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

The MicroServer offers the following:

- XML Weather Data

- FTP weather data in XML or CSV format

- Modbus/TCP, Modbus RTU (Serial RS-485) interfaces

- SNMP, BACnet, DNP3 Ethernet interfaces

- Weather Underground & Anything Weather interface

- CWOP interface

- Years' worth of data logging at 1-minute interval

- Interface to optional visibility, solar radiation sensors, and temperature sensors

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

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.

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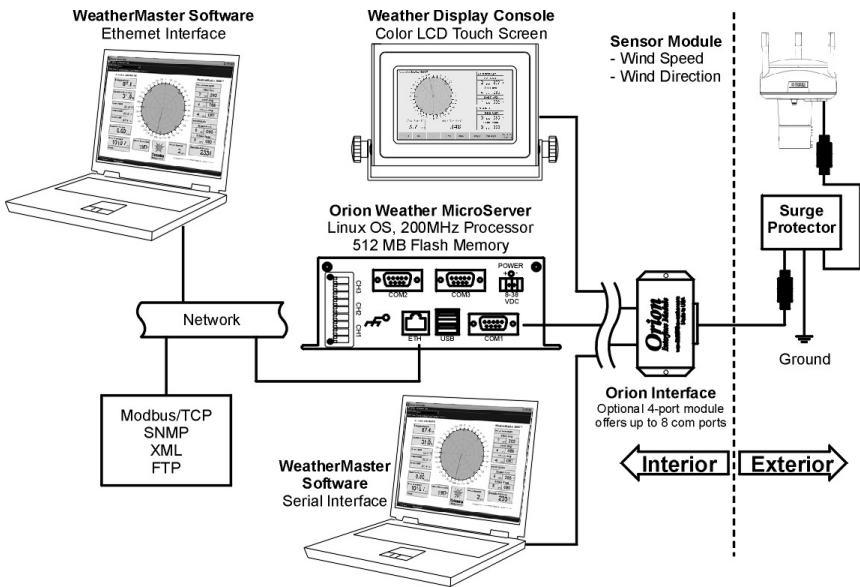
Installation Overview

Unpacking the System

Installing the Sensor Transmitter

Installing the Mast

Installing the Mounting Adapter

Installing the Surge Arrestor

Connecting the Sensor Transmitter to the Interface Module

Unpacking the System

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

   ❑ 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 software and user manual **(Optional)**

   4. Weather MicroServer **(Optional)**

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❑ MicroServer

❑ Power supply

❑ 7-foot 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.

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Installing the Orion LT Sensor Transmitter

Site Selection:

Finding a suitable site for the sensor transmitter is important in obtaining 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 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.

Location

Do not attach the sensor transmitter to a 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. For normal roof mounting, the recommended minimum distance from power 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 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.

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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 Orion LT sensor transmitter 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, 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 (Part No. 81547) is available from the factory.

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Installing the Mounting Adapter
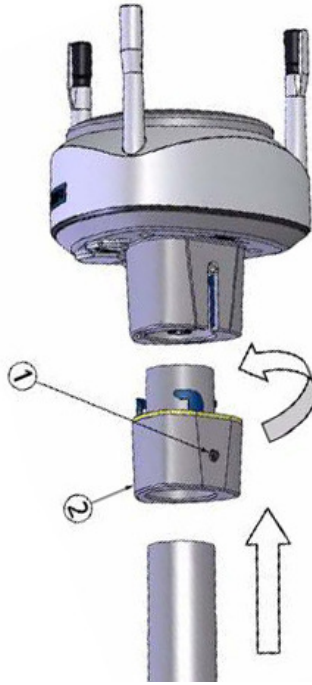
1. Insert the mounting adapter ② in the transmitter lower side as shown in the diagram above.

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.

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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 referenced to true north, which uses the earth's geographic meridians, or 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
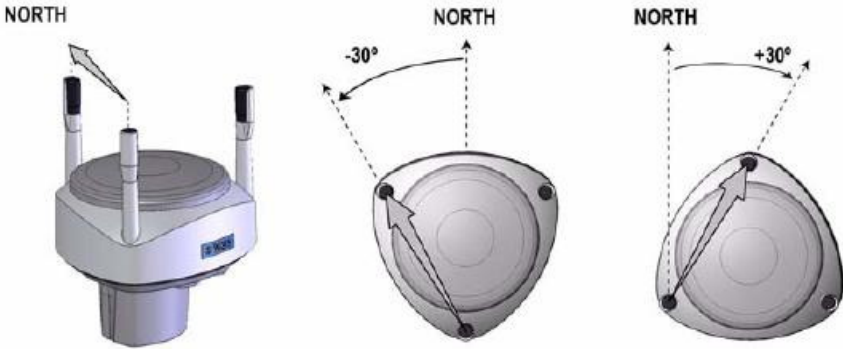
1. If the sensor transmitter is already mounted, loosen the fixing screw on the mounting adapter.

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.

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Installing the Surge Arrestor
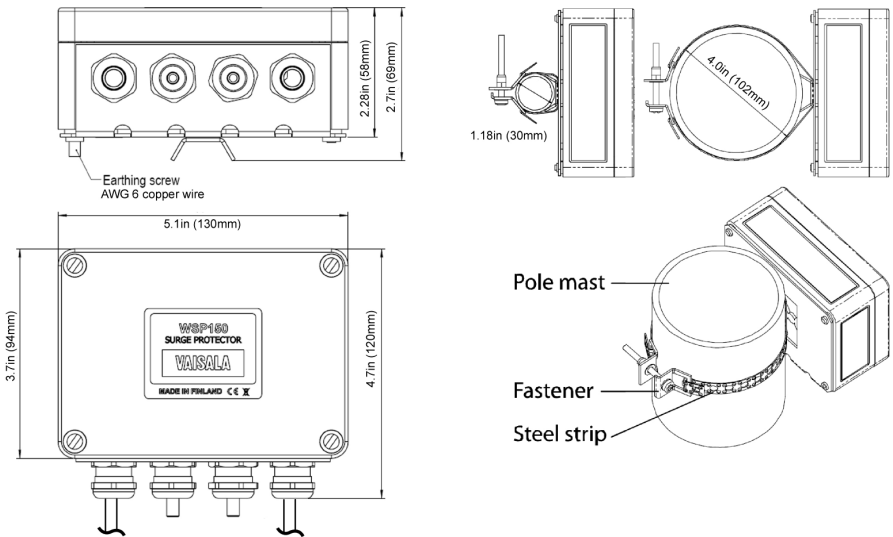
1. Attach the unit to the mast close to the weather sensor with the adjustable mounting clamp, see figure above.

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. Ground the unit using the grounding screw located on the back of the unit with an AWG 6 (16 mm^2) copper wire.

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Connecting the Sensor Transmitter 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	+12 V	RED & Brown*
2	Ground	White, Bare & Blue*
3	No Connection	
4	Signal Ground	Green
5	RX	Black
6	TX	Orange

* For optional heater

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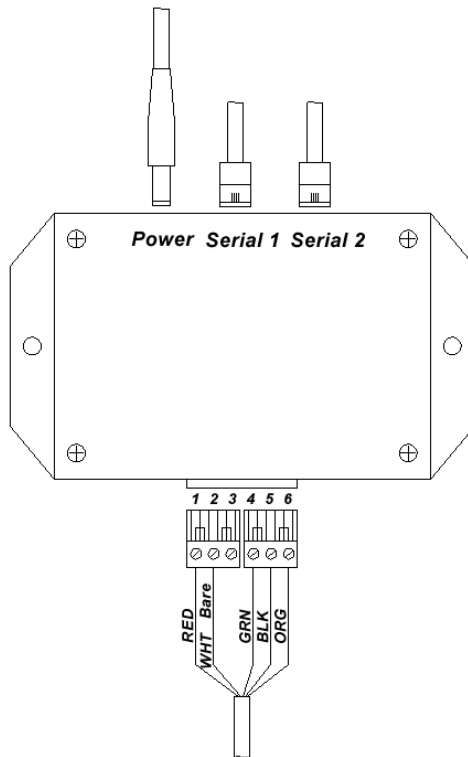
For heated sensor transmitters, connect the brown wire along with the red wire to position 1 and connect the blue wire along with the white and bare wires to terminal 2.

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SECTION 4: OPTIONAL SENSOR MOUNTING HARDWARE

Telescoping Tripod and Tiedown Kit
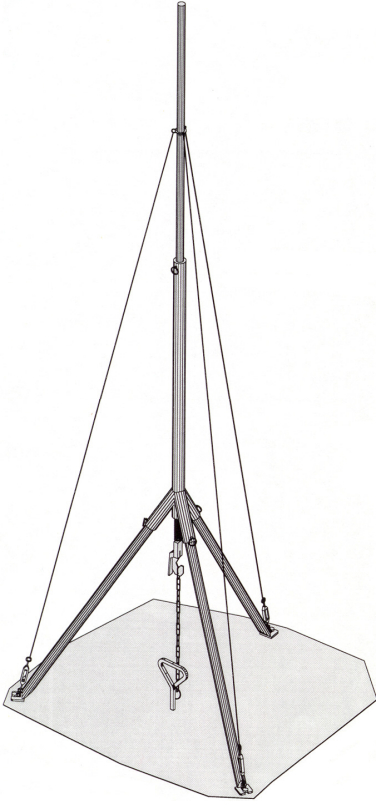
The tripod is designed to provide up to 10 feet of stable, secure support for your meteorological sensors. Constructed from welded aluminum and powder coated for appearance and longevity, the 15-pound tripod can easily support up to 60 pounds of equipment. An optional tie-down kit allows for additional 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:
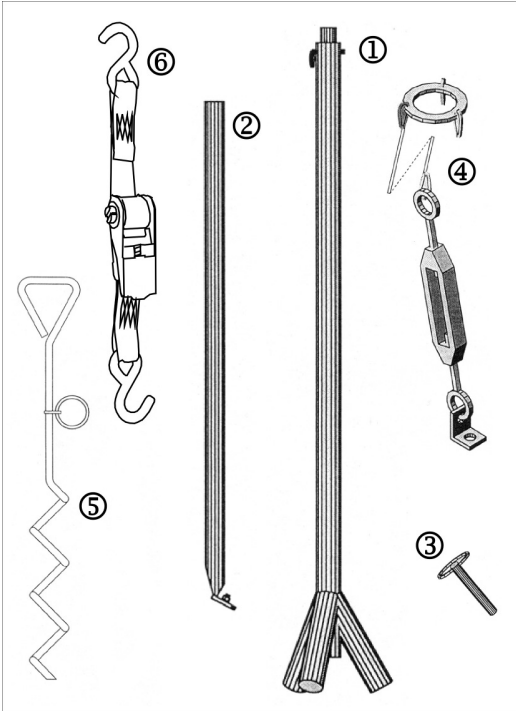
Description	Ref.	Qty.
Body/Mast Assembly	1	1
Legs	2	3
Retainer Pins	3	4
Guy Wire Ring with 3 Wires and Turnbuckles	4	1
Anchor Screw with Chain	5	1
Clamp with Strap	6	1

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 illustrates and describes the individual parts.
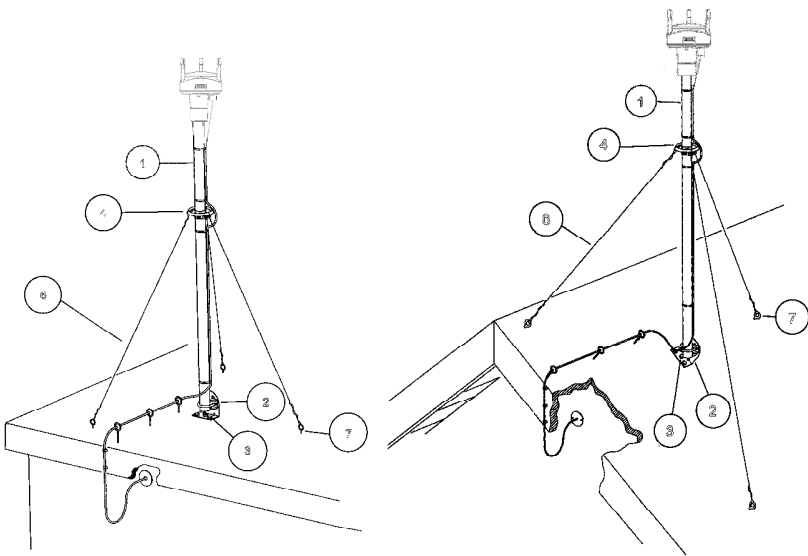
Description	Ref.	Qty.	Part No.
Steel mast, 10 ft.	1	1	88005
Universal Mast Anchor	2	1	88010
Lag Screw, Roof Mast Mount 1/4" x 2 1/4" (for comp. roofs)	3	4	88030
Guy Wire Clamp, 1/8"	4	1	88070
Steel Guy Wire, Galvanized	6	50ft.	88080

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Eye Bolt Wood Screws, 1/4" x 3"   7   4   88090

Turnbuckles, 6" open x 4" closed   (not shown) 3   88100

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Wall Mounting

The figure and table below illustrates and describes the individual parts in the Wall Mounting Kit (Part No. 88003). Individual parts are also available.
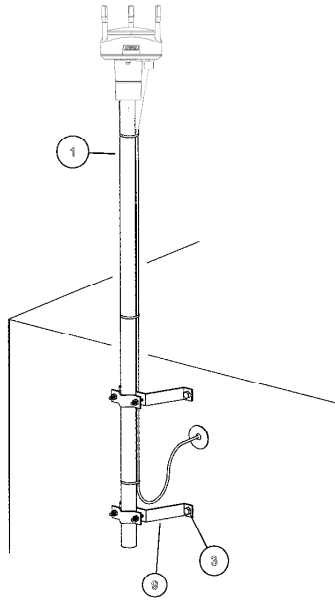
Description	Ref.	Qty.	Part No.
Mast, 10 ft.	1	1	88005
Lag Screw	3	4	88030
4" Wall Mount Bracket	9	2	88120

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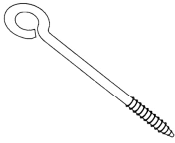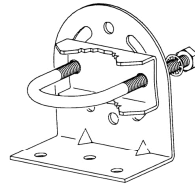
EYE BOLT SCREW   UNIVERSAL MAST ANCHOR
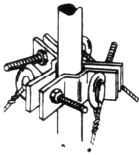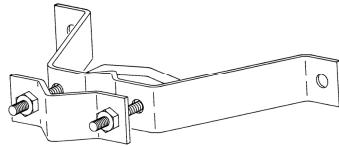
GUY WIRE CLAMP   4" WALL MOUNT BRACKET

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SECTION 5: OPERATION

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

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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

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Connecting the Orion LT to a Computer
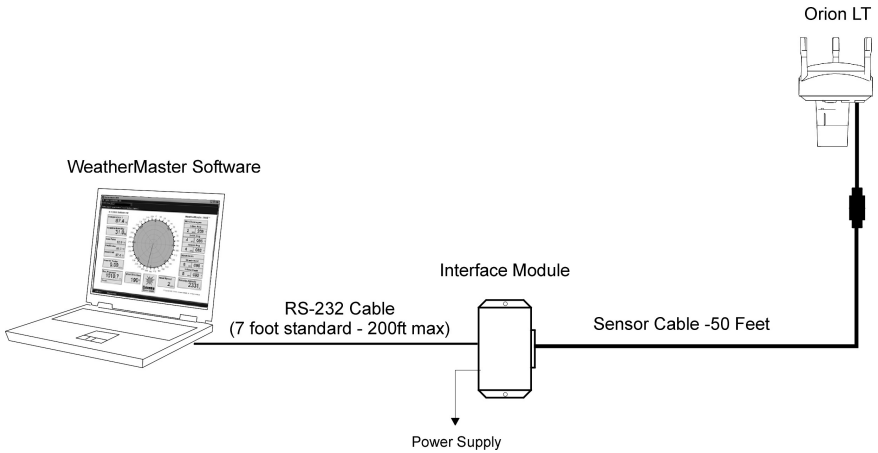
Connect the provided RS-232 cable to either serial port on the Interface Module. Connect the opposite end of the RS-232 cable and DB-9 connector to an available serial port on the computer.

A serial to USB converter may be required if the computer or laptop does not have a serial port installed.

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Connecting the Orion LT to the Weather MicroServer

Orion LT

Weather MicroServer

Interface Module

RS-232 Cable
(7 foot standard - 200ft max)

Power
Supply

Sensor Cable -50 Feet

Power Supply

Connect the provided RS-232 cable to either serial port on the Interface Module. Connect the opposite end of the cable and DB-9 connector to COM 1 on the MicroServer, securing it with the attached screws.

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Connecting the Orion LT to the Weather Display Console
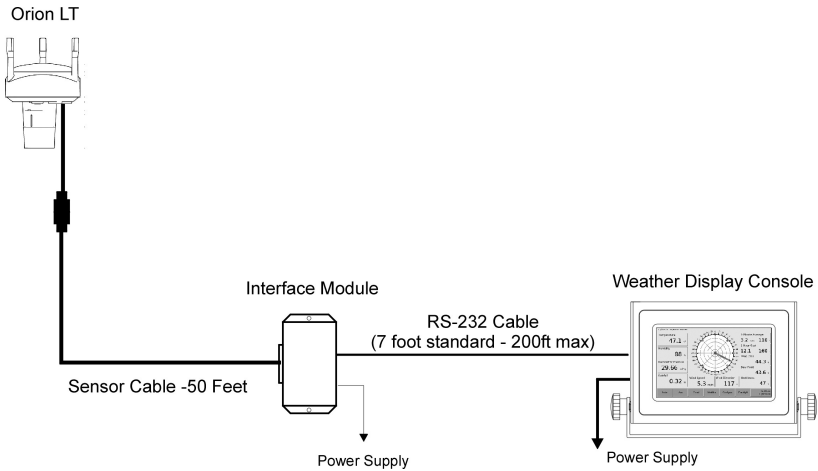
Orion LT

Interface Module

Weather Display Console

RS-232 Cable
(7 foot standard - 200ft max)

Sensor Cable -50 Feet

Power Supply

Power Supply

Connect the provided RS-232 cable to either serial port on the Interface Module. Connect the opposite end of the cable to the serial port (bottom port) on the Weather Display Console.

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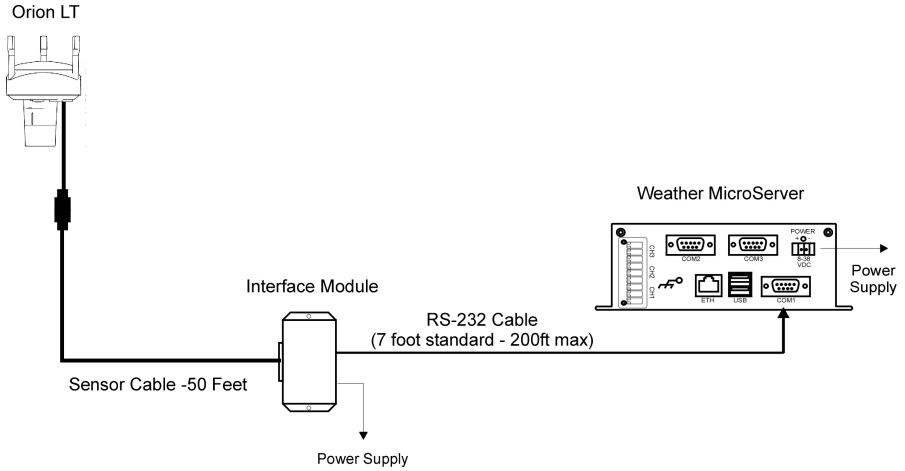
Initialize the CRC to zero. For each character beginning with the address, up to but not including the carriage return (<cr>), do as follows:

```
{
      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

          }


          e
     lse

          {

               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.

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SECTION 7: TROUBLESHOOTING

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

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

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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.

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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.
                    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

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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

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

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