C-5 SAM™
Weather Command

User Manual

Version 1.1
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COASTAL ENVIRONMENTAL SYSTEMS, INC.

820 First Avenue South, Seattle, WA 98134
Telephone: **800-488-8291 / 206-682-6048** • Fax: **206-682-5658**
www.CoastalEnvironmental.com

Software Notice

ALOHA Plume Dispersion Model

Make sure you have the most recent version of ALOHA®. A download is available on the U.S. Environmental Protection Agency website:

www.epa.gov/emergencies/content/cameo/aloha.htm

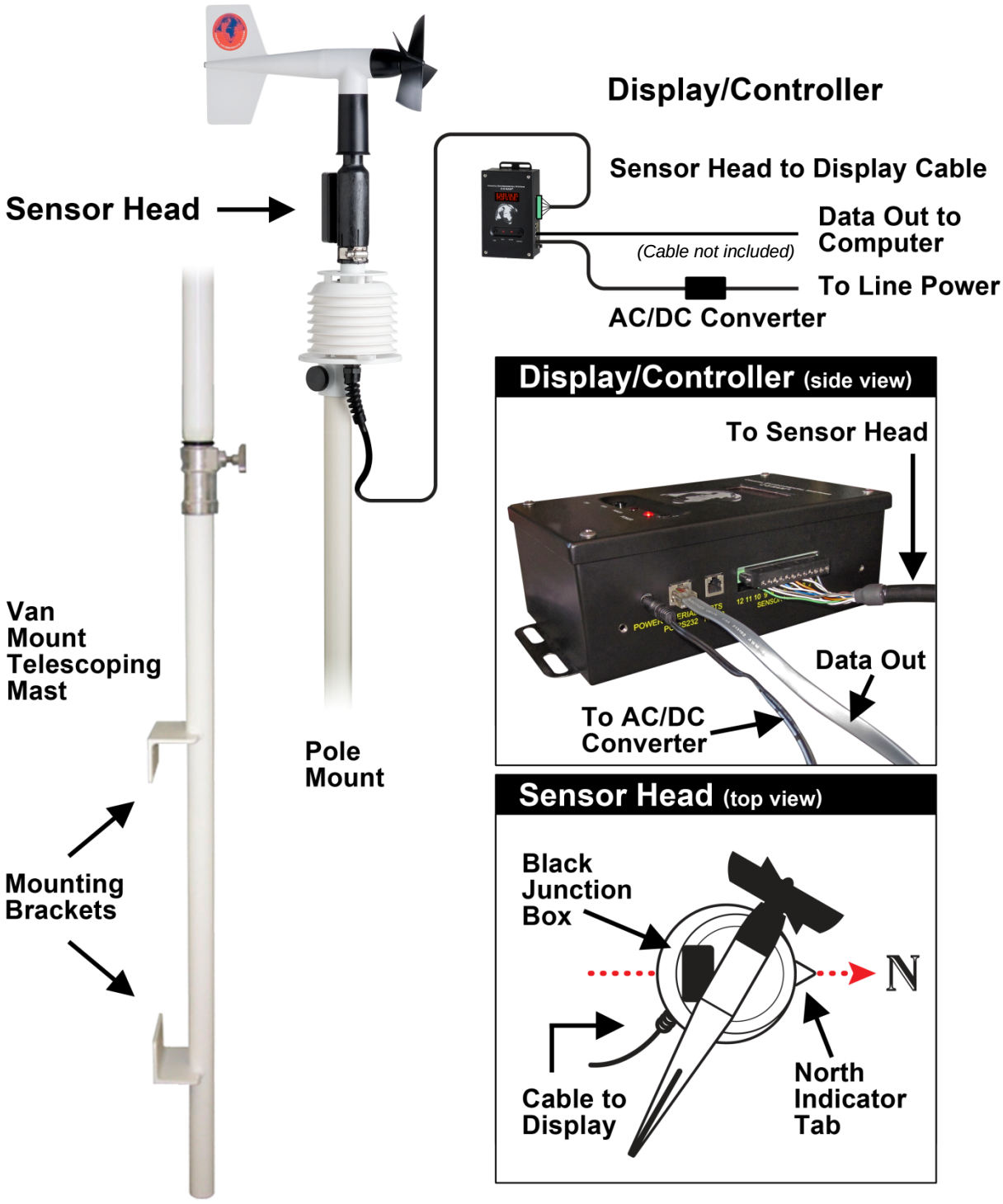

Figure 1. C-5 SAM™ with optional mounting styles shown (pole and vehicle mount)

1.0 Description

The C-5 SAM™ Weather Command is designed with the ruggedness and ease of use that has made the WEATHERPAK® so popular. C-5 SAM™ computes running averages of vector wind speed, vector wind direction, air temperature and stability of the wind. This data, along with the instantaneous measurements of wind speed, direction and air temperature (and optionally Relative Humidity and Barometric Pressure), are updated on the display screen every 30 seconds.

C-5 SAM™ can be used as a stand alone station independent of any computer or supporting electronics. It can be used for routine monitoring or in conjunction with the ALOHA plume dispersion model. With or without the dispersion model, the data will allow you to estimate downwind travel time and distance, locate potential impact areas, and target your evacuation zone or identify it in pre-planning practices.

List of Components

1. **Display/Controller Box.** The data is displayed in real time on a Vacuum Fluorescent Display (VFD) with dim/bright switch. The Display/Controller contains the electronics for collection and display of the weather data. It includes an AC power supply to power the unit from 110 VAC source (240 VAC power supply optional). An RJ-45 (Serial) receptacle provides data-out to your computer for historical record keeping, or to feed data in **real time** to the ALOHA dispersion model.

2. **Sensor Head.** This includes the air temperature sensor (relative humidity – optional), the wind monitor with propeller and a data cable to go to the Display/Controller box.

3. **Sighting Compass.** This compass allows you to easily align the sensor head N arrow to TRUE North. Failure to do this will result in incorrect data.

4. **Mounting Platform** (optional). There are vehicle or pole mount options.

2.0 Setup

2.1 Align the sensor head toward TRUE NORTH.

A compass needle points toward MAGNETIC NORTH and the C-5 SAM™ must be aligned to TRUE NORTH. The easiest way to align the sensor head with north is to use the sighting compass provided with the C-5 SAM™ and follow the following procedure.

1. Determine the magnetic variation for the location where the C-5 SAM™ will be used. A list of some major cities and a link to a declination web site are provided on page 10 of this manual. Once determined, the magnetic variation for your particular city, (e.g. 17° E for Seattle or 3° W for Chicago) must be taken into account when sighting the compass.

2. Hold the sighting compass at eye level with your arm fully extended. Be sure the sights in front and in back of the compass are lined up with your line of vision. Turn your body or move your arm until you also have the compass N in line with the sights.

3. Now compensate for the magnetic variation of your city. For an EAST variation SUBTRACT; for a WEST variation ADD the degrees to 360° (NORTH). For example, if you are in Seattle you must subtract 17°. (Remember that on a compass 360 and 0 are both North). Move the compass until you can see your calculated variation. In the Seattle example, this would be approximately 340° on the compass. The sight is now pointed at TRUE NORTH.

4. While holding aim at TRUE NORTH, select a stationary object in the distance (e.g. a tree, flag pole or peak of a roof) as a TRUE NORTH reference point. This reference point should be at least 100 feet away but, the more distant the better.

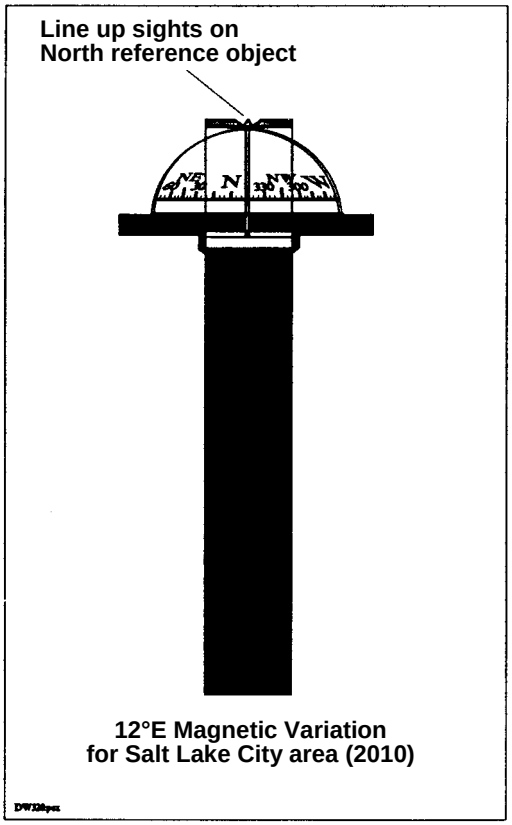

Figure 2. Hand-held sighting compass

5. Slip the sensor head on to the mount (portable tower, vehicle mount, or a permanently mounted pole). Aim the north indicator tab, the white plastic arrow head located on the sensor head, to aim towards the selected reference. Once properly aligned, tighten the locking knob located on the neck of the sensor head.

6. Now raise the sensor head; taking care to keep the arrow head aligned with the reference point. If the C-5 SAM™ is moved during use, remember to re-align to the reference point. If the distance moved is significant, the original reference point may no longer be valid and the new position may require repeating the referencing procedure.

2.2. Connect all cables.

1. The Display/Controller box should be wall mounted or attached firmly to a base.
2. Route the sensor-head cable ad to the Display/Controller box (an optional "Through-Bulkhead Connector Kit" is available, call Coastal). Plug the cable into the 12 pin connector/terminal strip on side of the Display/Controller box.
3. Insert the power plug into its receptacle, and then plug the power supply into a 110 VAC outlet.
4. The data cable can be plugged into RJ connector on the Display/Controller to a Serial COM port of a computer or a Serial to USB converter.

2.3 Turn on power.

Press the power switch on the front of the Display/Controller box. The power light next to the switch should illuminate.

If you wish to connect the Display/Controller directly to a vehicle or other power, eliminate the power supply and wire in 9–12 volts DC (minimum 1 Amp) directly to the controller. On the power plug, the tip is (+) and the ring is (-).

3.0 Operation

Forty-five seconds after the C-5 SAM™ is powered on it begins sampling. It reads the sensors once each second and then automatically applies an algorithm to the sensor data to calculate five-minute running averages. This calculated data is transmitted, along with the "INSTANTANEOUS" data, every thirty seconds to the receiver and subsequently to the plume model. In addition, Sigma Theta is calculated. This is a measurement of air turbulence, which affects the mixing or dispersion of a chemical in the atmosphere. Sigma Theta is also referred to as "Stability." The "INSTANTANEOUS" data is the last direct sensor reading prior to the thirty-second update. The operator may be able to detect a trend (i.e. wind shift) by comparing the "5 MINUTE RUNNING AVERAGE" and "INSTANTANEOUS" data. At 30 second intervals the display will be updated to show the current weather conditions. The first display update occurs about one minute after turning the unit on. The data light on the front panel of the Display/Controller box will turn on briefly when the data on the display is updated.

If the C-5 SAM™ unit has been out of operation for five minutes, a value of –1 (minus one) in the wind stability field indicates the average data has not been calculated over a full five minute period. (You need a full 5 minutes to calculate a valid number for stability).

The data on the screen appears as follows:

Figure 3. Close-up of data on display – international versions will display metric units

Wind Speed (WS)	5 minute running average (see details below) in mph or m/s
Wind Direction	5 minute running average of direction wind is coming “from” in degrees or ordinal points (N, W, SW, etc.); see the table that translates ordinal points to degrees
Instantaneous Wind Speed (IW)	Exact wind speed during last one second before updating display (see details below)
Stability (STAB)	Value describing how much wind “mixing” is occurring within the wind direction (see details below)
Temperature (TEMP)	5 minute running average of air temperature in °F or °C
Relative Humidity (RH)	5 minute running average in percentage (Optional)
Identification (ID)	Your C-5 SAM™ unit identification (assigned at the factory)
Barometric Pressure (BP)	Average barometric pressure in in/Hg (inches of Mercury) (Optional)

STABILITY

Stability of the wind is the biggest determinant of how far plume will travel downwind. Stability is measured by electronically checking where the vane is located every second. Since the vane in normal wind is always moving—the stability will never be zero (unless you held the vane in place perfectly for 5 minutes).

Stability is the standard deviation of the wind direction and can range from 0 to about 120. As was discussed you will never see zero nor will you ever see 120, however, a wind with a stability value above 25 is considered somewhat unstable. Typically in these conditions the plume will disperse more rapidly (it will, however, be broader). A stability value of 10 or less means the air is not mixing much and the plume will travel further down range.

For more precise downwind distances it is necessary to use a plume dispersion model which considers the exact chemical type, all the weather conditions, how much was spilled, etc.

5 MINUTE RUNNING AVERAGE

A measured 5-minute running average of wind speed is typically lower than most people's estimate of the wind speed. This is because the wind comes in gusts and eddies, creating high speeds interspersed with low speed areas. It is not uncommon for people to guess the wind speed at about twice as high as the 5-minute average.

INSTANTANEOUS WIND SPEED

This is the speed of the wind one second before the Display/Controller updates the display. It is not a gust speed. It is possible to have an instantaneous speed of 0 to 1 in an 8 MPH average wind—it just happened to occur during that one second sample.

The above calculations have been determined by the U.S. EPA, NOAA and other agencies to be the best representation of the meteorological conditions that will most accurately reflect traveling distances and locations of hazardous vapors etc. and still present the data in a timely manner. The C-5 SAM™ outputs data in compliance with the criteria established by U.S. EPA to properly update ALOHA® chemical plume modeling software.

MISSING DATA

If the sensor head is not connected, all the fields on the display show an “M” as missing data except ID and BP.

If you are connected to a PC – AND if the sensor head is not connected, all data fields on the screen will show “M” except ID, BP, power and checksum.

Chart showing Ordinal compass points and degrees (equivalent)

ORDINAL COMPASS POINT	DEGREES
N	**0° OR 360°**
NE	**45°**
E	**90°**
SE	**135°**
S	**180°**
SW	**225°**
W	**270°**
NW	**315°**

Sample Table of Magnetic Variation (2010)

City	Magnetic Variation
Chicago	3° W (-3)
Denver	9° E (+10)
Miami	6° W (-6)
Salt Lake City	12° E (+13)
Seattle	17° E (+17)
St. Louis	1° (-1)
Washington D.C.	11° W (-11)

NOTE: The chart above is for 2010 and the variation shifts slightly each year. Consult your local airport, weather service, or a marine supply dealer for the current year magnetic variation for your location.

Links to useful web sites such as the NOAA Declination Computer can be found on Coastal’s web site:

http://www.coastalenvironmental.com/magnetic-declination.shtml