

# Davis® Wind Speed and Direction Smart Sensor (S-WCF-M003) Manual



The Davis Wind Speed and Direction smart sensor is designed to work with HOB0® stations. The smart sensor has a plug-in modular connector that allows it to be added easily to a HOB0 station. All sensor parameters are stored inside the smart sensor, which automatically communicates configuration information to the logger without the need for any programming or extensive setup. **Note:** This sensor has been modified to work with Onset station loggers only.

## Wind Speed & Direction Smart Sensor

S-WCF-M003

### Items required:

- Weather-resistant cable ties or cable clips
- Electrical tape
- Handheld compass, local area map, or handheld GPS

If mounting on tripod or mast:

- Adjustable wrench

If mounting on wooden surface:

- Drill with 5 mm (3/16 inch) drill bit

### Accessories:

- Grounding kit (M-GKA)

## Specifications

|  | Wind Speed/Gust   | Wind Direction  |
|--|---|---|
| <b>Measurement Range</b>                     | 0 to 76 m/sec (0 to 170 mph)  | 0 to 355 degrees  |
| <b>Accuracy</b>                              | ±1.1 m/sec (±2 mph) or ±5% of reading, whichever is greater   | ±7 degrees  |
| <b>Resolution</b>                            | 0.5 m/sec (1.1 mph)   | 1 degrees (0 to 355 degrees)  |
| <b>Starting Threshold</b>                    | ≤1 m/sec (2.2 mph)  | 1 m/sec (2.2 mph)   |
| <b>Measurement Definition</b>                | Cup revolutions are accumulated every three seconds for the duration of the logging interval<br><b>Wind speed:</b> Average speed for the entire logging interval<br><b>Gust speed:</b> The highest three-second wind recorded during the logging interval<br>See <i>Measurement Operation</i> . | Unit vector averaging used; vector components for each wind measurement are calculated every three seconds for duration of logging interval (see <i>Measurement Operation</i> ) |
| <b>Operating Temperature Range</b>           | -40°C to 65°C (-40°F to 149°F)  |   |
| <b>Environmental Rating</b>                  | Weatherproof  |   |
| <b>Housing</b>                               | Polycarbonate wind cups   | UV-resistant ABS wind vane and black-anodized aluminum anemometer arm   |
| <b>Bearing Type</b>                          | Sealed stainless steel  |   |
| <b>Turning Radius</b>                        | 108 mm (4.25 in.)   | Approximately 135 mm (5.25 in.)   |
| <b>Dimensions</b>                            | 470 x 191 x 121 mm (18.5 x 7.5 x 4.75 in.)  |   |
| <b>Weight</b>                                | 1.332 kg (2 lb, 15 oz)  |   |
| <b>Bits per Sample</b>                       | 8 for each channel, 24 total  |   |
| <b>Number of Data Channels*</b>              | 3   |   |
| <b>Measurement Averaging Option</b>          | Automatic averaging (see <i>Measurement Operation</i> )   |   |
| <b>Cable Length Available</b>                | 3 m (9.8 ft)  |   |
| <b>Length of Smart Sensor Network Cable*</b> | 0.5 m (1.6 ft)  |   |

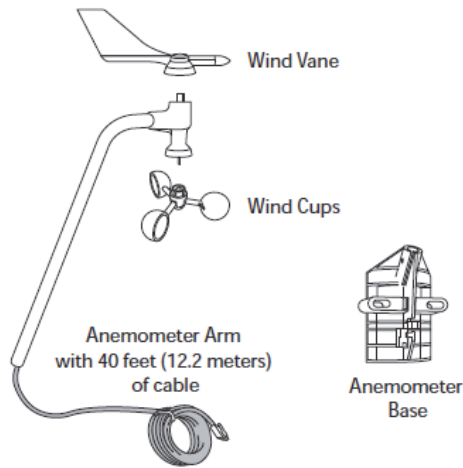


The CE Marking identifies this product as complying with all relevant directives in the European Union (EU).

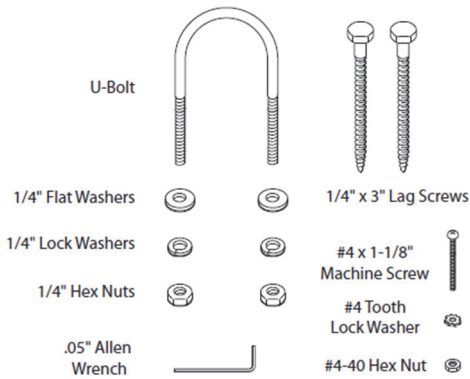
\* A single HOB0 station can accommodate 15 data channels and up to 100 m (328 ft) of smart sensor cable (the digital communications portion of the sensor cables).

## Components

The smart sensor includes the components shown below.



The smart sensor also includes a hardware kit with the items most commonly needed for installation as shown below. The items you use from the kit depend on where you install the sensor. You may need to adapt or purchase additional hardware to fit your individual requirements.



## Assembling the Smart Sensor

### Attaching the Wind Vane

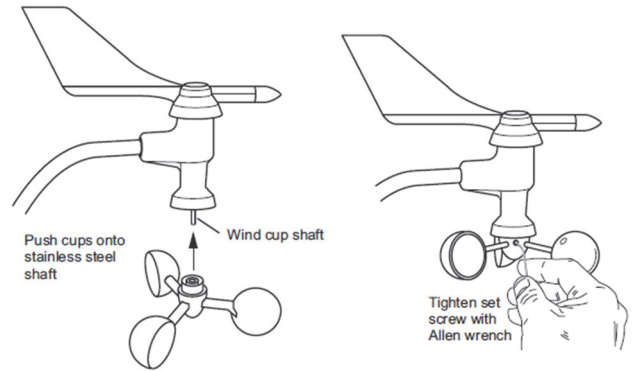
The wind direction has been calibrated in the factory so that the wind direction will be correct when the arm is installed pointing north and the vane is installed correctly.

1. Slide the wind vane onto the wind vane shaft. The shaft's cross-section is D-shaped to ensure that the anemometer is installed correctly.
2. Tighten the set screw in the wind vane with the Allen wrench.

### Attaching the Wind Cups

1. Push the wind cups onto the anemometer's stainless steel wind cup shaft.

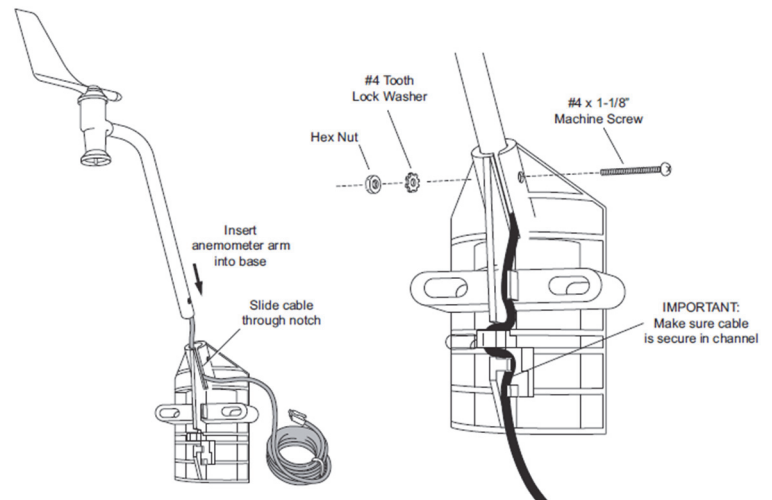
2. Slide the wind cups up the shaft as far as possible.



3. Use the Allen wrench provided to tighten the set screw on the side of the wind cups. The wind cups should drop slightly when you let go.
4. Ensure the set screw is screwed in fully and very tight. Failure to do so will cause the anemometer to function improperly.
5. Spin the wind cups; they should spin freely. If they do not spin freely, take them off and repeat these steps.

### Attaching the Anemometer Arm to the Base

1. Insert the anemometer arm into the base, sliding the cable through the notch in the base as shown below. Be sure to line up the small hole in the arm with the holes in the base.



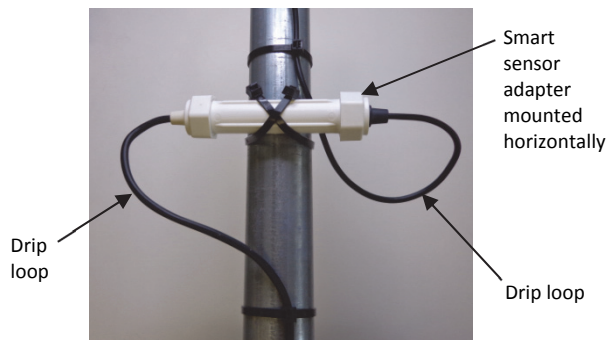
2. Insert the machine screw through the holes in the base and arm.
3. Slide the tooth-lock washer and hex nut onto the machine screw. Tighten the hex nut while holding the screw with a Phillips head screwdriver to prevent it from turning.
4. Press the sensor cable firmly and completely into the zig-zagging channel in the base, starting from the arm and progressing downward to the bottom of the base.

## Mounting

### Mounting Considerations

Use the following guidelines to determine the best location for installing the sensor.

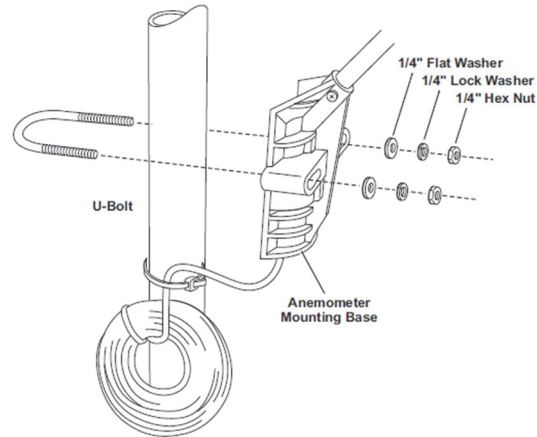
- To ensure correct orientation of the wind vane, the smart sensor must be mounted so that the anemometer arm points north. See *North Alignment* for steps on finding true north.
- For the most accurate readings, the smart sensor should be mounted 2 m (7 ft) or more above the ground and consistent with meteorological standards for the application. The smart sensor should be mounted at least 2.1 m (7 ft) above the roof line if mounted on a roof and mounted at a distance of at least five times the height of the nearest tree, building, or other obstruction. You may do this by mounting the smart sensor on an Onset tripod or mast, or a metal pipe. You may mount the smart sensor on a wooden post if it has a side facing due north for mounting.
- The tripod or mounting mast must be properly grounded. For field installations, you can use Onset's Grounding Kit (M-GKA).
- If you live in an area subject to frequent thunderstorms, installing a lightning rod nearby can reduce the risk of damage.
- Be sure to secure the sensor cable with cable ties to protect it from damage.
- Secure the mast the wind sensor is mounted on so that it does not vibrate. If you are using Onset masts or tripods, secure them with guy wires.
- The sensor can be damaged with improper handling. Store the sensor in its shipping box until you are ready to install it.
- To minimize measurement errors due to ambient RF, use the shortest possible probe cable length and keep the probe cable as far as possible from other cables carrying high frequency or high current signals.
- To provide long-term protection from moisture entry, the smart sensor adapter must be mounted horizontally and with the cable wires routed with drip loops so that water drains away from the cable entry point as shown in the example below. When mounted properly, the housing is weatherproof (but not waterproof).



### Mounting on a Mast

Follow these instructions for mounting the sensor on a tripod or mast. The U-bolts included can be used for mounting the sensor on a mast or tripod with an outside diameter ranging from 32–44 mm (1.25–1.75 inches). Larger U-bolts (not supplied) can be used to mount on a mast or tripod with a maximum outside diameter of 64 mm (2.5 inches). To mount the sensor on a mast or tripod smaller than 32 mm (1.25 inches), use a U-Bolt that fits the anemometer base openings, but has a shorter threaded section.

1. Place the U-bolt around the pole so that its two ends extend through the holes in the mounting base. Loosely secure with the flat washers, lock washers, and hex nuts.

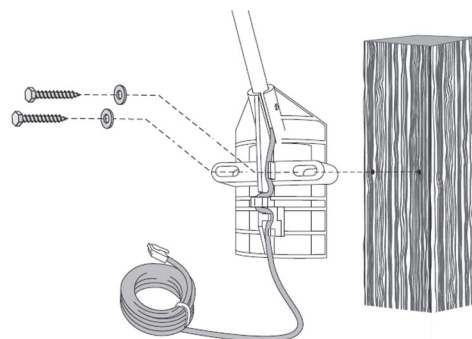


2. Raise the anemometer to the desired height on the pole and swivel it so the anemometer arm is pointing north.
3. Using an adjustable wrench or 7/16 inch wrench, tighten the hex nuts until the anemometer is firmly fastened on the pole.

### Mounting on a Wooden Post or Surface

Follow these instructions for mounting the sensor on a wooden post or surface. The sensor must be mounted on the side that is facing due north (the mounting arm must point north for proper wind direction measurements).

1. Hold the anemometer base against the wood surface and use a pencil to mark the location of the two holes on the base.
2. Use a drill with a 5 mm (3/16 inch) drill bit to make pilot holes in these locations.
3. Drive the 3-inch lag screws through the holes in the anemometer base and into the wood.



## Secure the Cables

To prevent fraying or cutting the anemometer cables where it is exposed to weather, secure it so it does not whip about in the wind. Use cable clips or weather resistant cable ties to secure the cable. Place clips or cable ties approximately every 1 to 1.6 m (3 to 5 ft). Do not use metal staples to secure cables as they can cut the cables. Make sure there are drip loops on both sides of the smart sensor housing, which must also be mounted horizontally as described under *Mounting Considerations*.

## Connecting the Sensor to a Station

To connect the sensor to a station, stop the station from logging and insert the smart sensor's modular jack into an available smart sensor port on the station. See the station manual for details on operating stations with smart sensors.

## Measurement Operation

Wind direction measurements are averaged over the logging interval or a 3-second timeframe (whichever is greater). If you set up the sensor to log faster than every 3 seconds, the same sensor reading will be recorded until a new 3-second average is calculated. For example, if the sensor is logging at a 1-second interval, the sensor will report the same wind direction (its calculated average) for three samples before calculating and reporting a new value for another three samples. Measurement averaging for this sensor is independent of the logger's measurement averaging. Therefore the automatic measurement averaging for this sensor is not affected by any sampling intervals entered for averaging on other sensors.

### Direction Averaging

Unit vector averaging is used to determine wind direction because traditional averaging would produce inaccurate results. For example, three measurements of 350, 11, and 12 degrees—which are all winds from the north—averaged together would result in 126 degrees, which incorrectly indicates a southeasterly wind. Instead, the vector components (North/South and East/West) for each wind measurement are calculated every three seconds for the duration of the logging interval. At the conclusion of the logging interval, the North/South and East/West components are averaged and then re-combined to calculate the average wind direction for the logging interval.

## North Alignment

The sensor must be oriented to true north to obtain meaningful data. There are two methods to align the sensor:

- Compass Alignment
- Global Positioning Satellite (GPS) alignment

**Note:** The magnetic declination must be known to align the direction sensor to true north using a magnetic compass. Worldwide declination information is available from the National Space Science Data Center at: <http://nssdc.gsfc.nasa.gov/space/cgm/cgm.html>.

## Compass Alignment

Tools required:

- Compass
- Binoculars
- Tape (such as electrical, packing, or duct tape)

Two people are required to complete this procedure.

1. Position the wind vane so that it points in the same direction as the mounting arm. Secure the vane on the arm with a piece of tape so that the vane cannot rotate.
2. While standing 150 to 200 feet south of the sensor, use the compass to determine magnetic north. If true north is the same as magnetic north, align yourself so the compass points north and directly at the sensor. If you are in area with an east variation, align yourself so that the station is that number of degrees to the east of magnetic north. If you are in an area with a west variation, align yourself so that the station is that number of degrees to the west of magnetic north.
3. While viewing the sensor through binoculars, instruct another person to rotate the arm to point the vane north. The vane should seem to disappear from sight when properly aligned.
4. Once you've obtained the correct position, secure the sensor base and remove the tape.

## GPS Alignment

Tools required:

- Handheld GPS with WAAS-enabled receiver or any similar high accuracy GPS device
- Flag, orange cone, or other temporary marker
- Laptop computer with logger software installed

This procedure requires only one person, but is easier to complete with two people. In this procedure, you will be using the GPS receiver first to create an arbitrary waypoint and then to determine the bearing from the sensor to that waypoint. You will then align the sensor so that when the vane is pointed at the waypoint, the direction reported by the logger software matches the GPS receiver's bearing to the waypoint.

1. Connect the sensor to the station and connect the station to a laptop with HOBOWare installed.
2. Pick a visible location that is at least 100 meters (110 yards) away from the sensor and walk to it. Establish a waypoint with the handheld GPS receiver. You may want to use averaging to minimize the waypoint position error if your GPS receiver is so equipped. (For best results, the estimated position error of the waypoint should be less than 10 feet if the distance to the sensor is 100 meters, and less than 20 feet for a distance of 200 meters. Mark the waypoint with a flag, orange cone, or other suitable marker. Walk back to the sensor and determine the bearing to the waypoint you just created with the GPS receiver. Again you may need to determine the average value of the bearing to keep the errors to a minimum.

3. View the current sensor readings in the software while positioning the arm. For U30-NRC or Micro Stations, select Status in HOBOWare to get the current reading. For RX3000 Stations, use the RX3000 Manager in HOBOWare to view the latest conditions. You can also check the latest reading in HOBOLink, but the data is only updated when the station connects to HOBOLink. Refer to the software user's guide or online help for details on operating HOBOWare or HOBOLink.
4. Point the sensor vane directly at the waypoint flag or marker and rotate the sensor mounting arm until the wind direction sensor value in the logger software matches the angle obtained with the GPS receiver.
5. Once the vane is in position, secure the mounting base and then double-check that the reported angle is correct.

## Maintenance

The sensor does not normally require any maintenance other than an occasional cleaning. If the vane becomes dirty, rinse it with mild soap and fresh water. Do not immerse the sensor in water or use any organic solvents to clean the unit. Do not attempt to lubricate the wind cup shaft or bearings or the wind vane shaft. Natural or synthetic lubricants will inhibit the normal operation of the anemometer.

## Verifying Sensor Accuracy

It is recommended that you check the accuracy of the sensor annually. The sensor cannot be calibrated. If the smart sensor is not providing accurate data, then it is damaged or possibly worn out if it has been in use for several years.