

# Ultrasonic Wind Speed and Direction Smart Sensor (S-WCG-M003) Manual



The Ultrasonic Wind Speed and Direction smart sensor is designed to work with HOB0® stations and is powered by its own built-in solar panel. 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.

## Ultrasonic Wind Speed & Direction Smart Sensor

S-WCG-M003

### Items included:

- North alignment tool
- U-bolts with hex nuts, brackets, spacers, and lock nuts for mounting on a mast or cross arm


### Items required:

- Phillips-head screw driver
- 10 mm wrench (if mounting on a mast or cross arm)
- Screws and drill (if mounting on a vertical surface)

### Accessories:

- Grounding kit (M-GKA)

## Specifications

	Wind Speed/Gust	Wind Direction
<b>Measurement Range</b>	0 to 41.16 m/s (0 to 92.07 mph)	0 to 359 degrees
<b>Accuracy</b>	±0.8 m/s (1.79 mph) or ±4% of reading, whichever is greater	0.2 to 3 m/s (0.44–6.7 mph): ±4 degrees >3 m/s (6.7 mph): ±2 degrees
<b>Resolution</b>	0.4 m/s (0.89 mph)	1 degree (0 to 359 degrees)
<b>Measurement Definition</b>	Wind speed readings are taken every three seconds for the duration of the logging interval <b>Wind speed:</b> Average speed for the entire logging interval <b>Gust speed:</b> The highest three-second wind recorded during the logging interval 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 Without Icing</b>	-15°C to 55°C (5°F to 131°F)	
<b>Environmental Rating</b>	Weatherproof	
<b>Housing</b>	Polyacetal	
<b>Dimensions</b>	Sensor length: 380 mm (14.96 inches) Sensor head diameter: 60 mm (2.36 inches) Sensor rod diameter: 16 mm (0.63 inches)	
<b>Weight</b>	200 g (7 oz)	
<b>Power Supply</b>	Photovoltaic panel, LIFEP04 3.2 V -600 mAh battery	
<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).

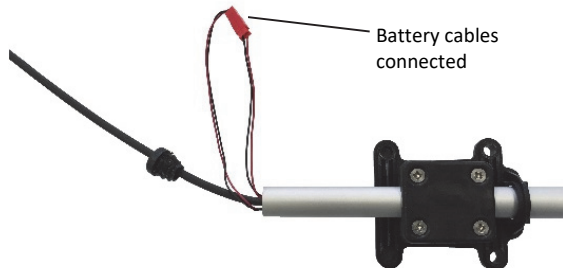
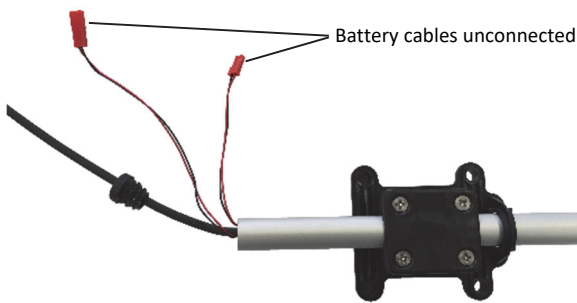
## Connecting the Sensor Battery

The smart sensor includes a factory-installed battery that has been disconnected for shipping. When connected, this rechargeable battery is charged by the solar panel on the top of the sensor head. Follow these instructions for connecting the battery.

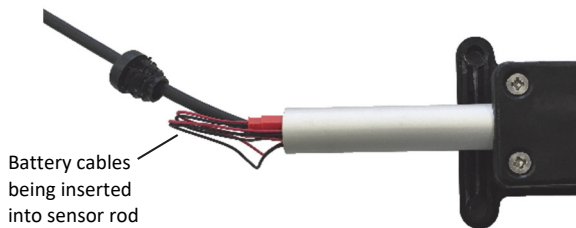
**Important:** It is recommended that you only connect the battery when you are ready to deploy the sensor because it will require regular, direct sunlight to remain charged. Once the battery is connected, it will lose its charge after 10 days if it does not receive any sunlight. **In addition, you must place the sensor under a light source for at least one minute after the battery is connected to activate the sensor.**

To connect the sensor battery:

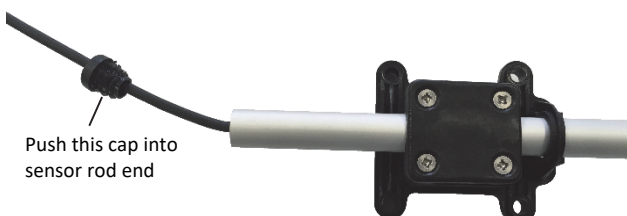
1. Connect the two battery cables.



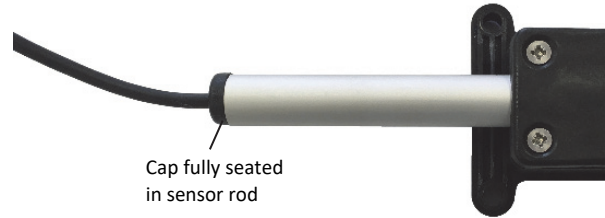
2. Insert the connected battery cables into the sensor rod tube.



3. Once the cables are fully inserted, push and twist the cap into place at the end of the sensor rod.



The cap should be fully seated in the sensor rod without any gaps as shown below. If there is a gap, remove the cap and push the battery cables further in the sensor rod to make more room for the cap.



4. Slide the sensor rod up so that the bottom is flush with the bottom of the sensor base. Loosely tighten the four screws to keep the sensor rod in place.



5. Place the solar panel of the sensor under a light source (a bright lamp or direct sunlight) for at least one minute to activate the sensor.

Once these steps are complete, mount the sensor using the guidelines in the next section.

**⚠ WARNING:** Do not cut open, incinerate, heat above 85°C (185°F), or recharge the battery. The battery may explode if the sensor is exposed to extreme heat or conditions that could damage or destroy the battery case. Do not dispose of the sensor or battery in fire. Do not expose the contents of the battery to water. Dispose of the battery according to local regulations for lithium batteries.

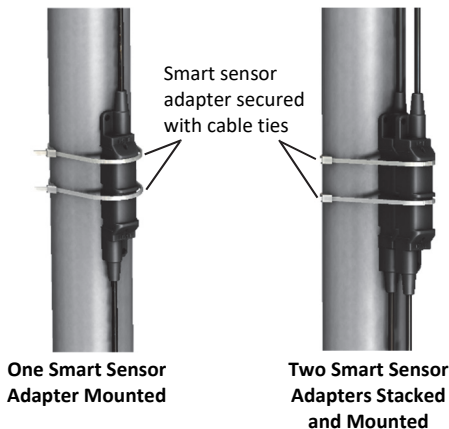
## Mounting

### Mounting Guidelines

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

- The sensor can be damaged with improper handling. Store the sensor in its shipping box until you are ready to install it.
- Mount the sensor in the sunlight within 10 days of connecting the battery to prevent it from losing all charge.

- Choose a location free of turbulence and magnetic fields resulting from electricity, engines, radio transmitters, radars, etc.
  - For the most accurate readings, the sensor should be mounted 3 m (9.8 ft) or more above the ground and 10 m (32.8 ft) away from nearby objects.
  - When mounting the sensor on a roof, the sensor must be mounted at a height equal to the building's length or five times the building's height. Install the sensor in the middle of the roof when possible. You may do this by mounting the sensor on an Onset tripod or mast, or a metal pipe. It is not recommended to install the sensor on a slanted roof because it can generate upwards turbulence that will affect the sensor measurements.
  - You may mount the sensor on a wooden post.
  - Mount the sensor in a location that receives direct sunlight for several hours a day to ensure the built-in solar panel is charged regularly. Make sure the sensor is positioned in the sun and not under the forest canopy or obstructions.
  - The sensor must be aligned to true north when mounted to ensure accurate wind direction readings. Use the alignment tool as described *North Alignment*.
  - If the sensor is mounted on the same mast as a rain gauge, mount the wind sensor away from the rain gauge on a half cross arm (M-CAB) so that the wind sensor does not interfere with rainfall measurements. If there is no rain gauge on the same mast, mount the wind sensor directly to the top of the mast.
  - The tripod or mounting mast must be properly grounded. For field installations, you can use Onset's Grounding Kit (M-GKA).
  - If the station is deployed in an area subject to frequent thunderstorms, installing a lightning rod nearby can reduce the risk of damage.
  - To minimize measurement errors due to ambient RF, keep the sensor cable as far as possible from other cables carrying high frequency or high-current signals.
- After the sensor is mounted on a mast, secure the smart sensor adapter to the mast with the cable ties as shown. Multiple smart sensor adapters can be stacked as shown in the example below on the right.



Alternatively, mount the smart sensor adapter to a flat surface using two screws (no larger than a #6) and two washers as shown in the example at right.

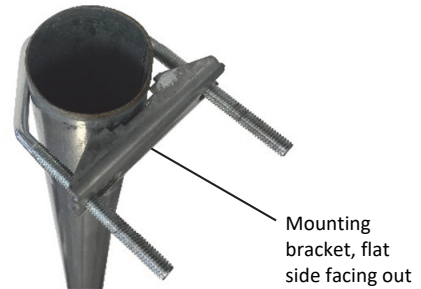


- Secure the sensor cable with cable clips or weather resistant cable ties to protect it from damage in the wind. Place clips or cable ties approximately every 1 to 1.6 m (3 to 5 ft). Do not use metal staples to secure the cable as they can cut the cable.
- Secure the mast that the sensor is mounted on so that it does not vibrate. If you are using an Onset mast or tripod, secure it with guy wires.

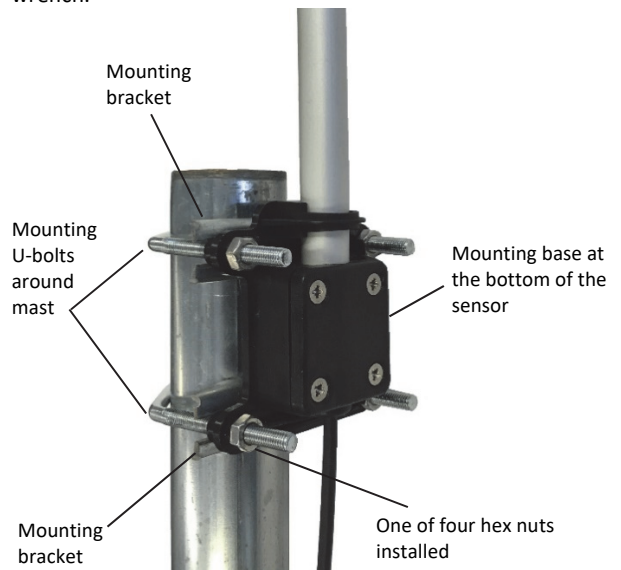
### Mounting on a Mast

Follow these instructions for mounting the sensor on a tripod or mast. The mounting U-bolts included can be used for mounting the sensor on a mast or tripod with an outside diameter ranging from 35–48 mm (1.38–1.89 inches).

1. Connect the battery if you haven't already done so (see *Connecting the Sensor Battery*).
2. Place the mounting U-bolt around the mast and slide the bracket over the threaded U-bolt ends as shown in this example. Make sure the flat part of the bracket is facing out.



3. Repeat step 2 with the other U-bolt and bracket.
4. Insert the ends of the U-bolts through the four holes in the square sensor base at the bottom of the sensor rod. Loosely install the hex nuts on the four bolt ends with a 10 mm wrench.

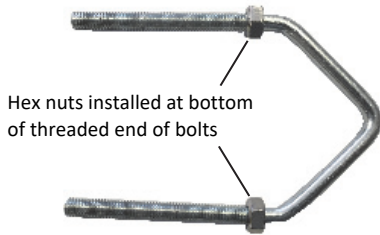


5. Raise the sensor to the desired height on the mast.
6. Use the wrench to tighten the hex nuts until the sensor is firmly fastened on the mast. Do not overtighten the hex nuts.
7. Follow the steps in *North Alignment* to make sure the sensor is pointed to true north.

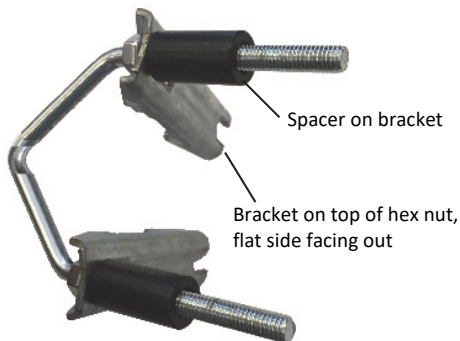
**Mounting on a Tripod Cross Arm**

Follow these instructions for mounting the sensor on a cross arm.

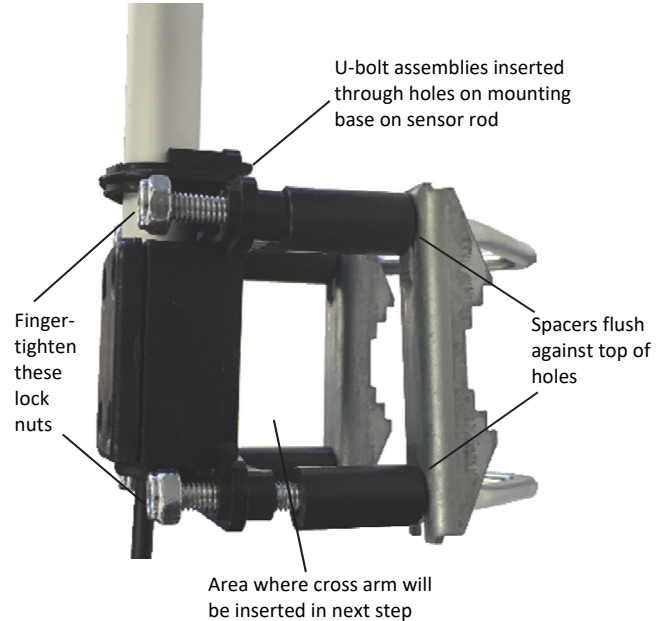
1. Attach the cross arm to the mast before installing the sensor.
2. Connect the battery if you haven't already done so (see *Connecting the Sensor Battery*).
3. Use a 10 mm wrench to install two hex nuts at the base of the threaded end of the U-bolts as shown. Tighten the hex nuts all the way down to the end of the threads. Repeat with the other U-bolt.



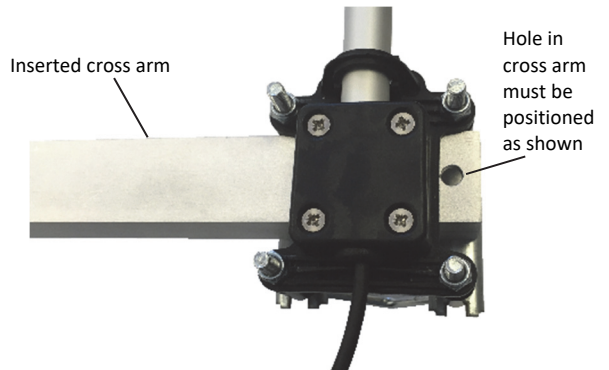
4. Insert the threaded bolt end through the hole in the bracket so that the bracket rests on top of the hex nut with the flat end facing out. Place a spacer on top of the bracket as shown below. Repeat for the other threaded bolt end and for both ends of the other U-bolt.



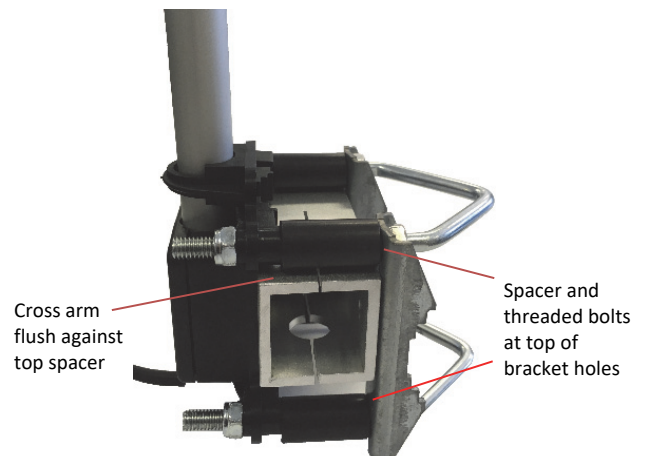
5. Insert both bolt assemblies through the bottom of the mounting base and secure with finger-tightened lock nuts.



6. Slide the assembly above over the end of the cross arm as shown below. Make sure the hole in the cross arm is centered on the sensor mounting base as shown.



7. Make sure the cross arm is flush against the top spacer. The spacer and threaded bolts should be flush against the top of the bracket holes. Tighten the locknuts with a wrench. Do not overtighten them.

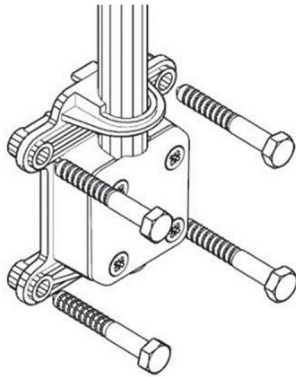


- Follow the steps in *North Alignment* to make sure the sensor is pointed to true north.

### Mounting on a Vertical Surface

Follow these instructions for mounting the sensor on a wooden post or vertical surface with user-supplied screws.

- Connect the battery if you haven't already done so (see *Connecting the Sensor Battery*).
- Hold the sensor rod base against the surface where you will be mounting the sensor and use a pencil to mark the location of the four screw holes on the base.
- Use a drill with a 5 mm (3/16 inch) drill bit to make pilot holes in these locations.
- Drive four lag screws with a maximum diameter of 6 mm (0.24 inches) through the holes in the sensor base and into the mounting surface.



- Follow the steps in *North Alignment* to make sure the sensor is pointed to true north.

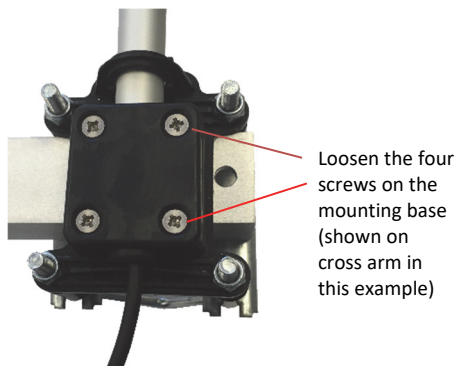
### North Alignment

The sensor must be oriented to true north to obtain meaningful wind direction data.

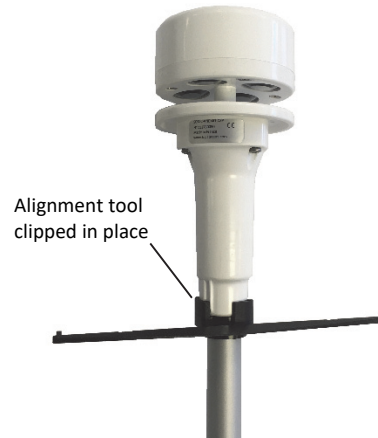
Tools required:

- Alignment tool (included)
- GPS or compass
- Flag, cone, or other temporary marker
- Phillips-head screwdriver

- Use a Phillips-head screwdriver to slightly loosen the four screws on the sensor rod mounting base so that the sensor rod can be adjusted. (If the rod already moves freely, you do not need to loosen the screws any further.)



- Clip the alignment tool on the sensor tube and slide it so that it snaps into the dedicated slots. Do not tamper with the slots. The tool must gently find its place.



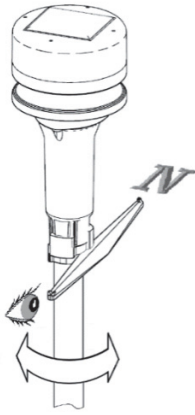
- Using your GPS or a magnetic compass, go to a point that is directly north of the station and at least 100 m (328 ft) away from the station. To determine this point, move until the station is directly south of you.

#### Compass instructions:

- Get the declination angle for your location to align the sensor to true north. Worldwide declination information is available at <https://www.ngdc.noaa.gov/geomag-web/#declination>.
- Go about 100 m (328 ft) to the north of the station with a marker (e.g. flag or orange cone) and compass.
- Using the compass, move to where the station is due south of you and determine true north by doing the following:
  - If there is a west declination, move due west from your position until the station is east by the declination angle from magnetic south.
  - If there is an east declination, move due east from your position until the station is west by the declination angle from magnetic south.
- Place your marker where you are standing (this is true north).

- GPS instructions:** 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.

- Use the alignment tool to align the sensor so it is pointing north.



- Once the sensor is aligned to north, tighten the screws and remove the alignment tool.

## Maintenance

The sensor does not normally require any maintenance other than an occasional cleaning. Use a clean soft cloth with mild soap and fresh water. Do not use alcohol-based cleaning products.

## 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.

## 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.