Using the Gill Instruments WindSonic Opt 3 Wind Speed and Direction Sensor with the HOBO® RX3000 Station

This application note describes how to connect and operate the Gill WindSonic sensor (Opt 3 with analog outputs) with the HOBO RX3000 station. The sensor is compatible with any RX3000 configuration (cellular, Ethernet, or Wi-Fi) that is equipped with the optional four-channel analog input module (RXMOD-A1). It is suggested that a 6-watt solar panel be used to ensure that the battery is kept charged properly.

Note: A connector housing and terminals are included with each sensor. However, cable for connecting the sensor to the RX3000 station must also be purchased. Compatible cable:

- Gill 3-pair cable (026-02660)
- Belden (9730)

Additional mounting option (more information about mounting is included later in this document):

- Gill WindSonic Mounting Bracket (1771-PK-115)

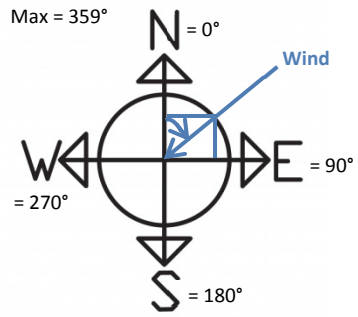
Note: The default configuration of the Gill WindSonic Opt 3 sensor is compatible with the RX3000 station as depicted in this instruction. No changes to the as-received configuration are required.

Portions of the Gill WindSonic Technical Manual are used within this application note, but the full manual is available at http://gillinstruments.com/data/manuals/windsonic-manual.pdf?iss=21.20150501.

Important: Currently neither the RX3000 station nor HOBOlink® software have the ability to calculate vector averaging for wind direction. Vector averaging of your wind direction data is very important in accurately measuring wind direction. If this Gill WindSonic sensor is deployed, you will need to calculate vector averaging in Microsoft® Excel® or another program using the raw wind direction data recorded by the logger. Information on how to do this is included in this document. (Onset's smart sensor-based wind direction sensors have vector averaging included in their smart sensor electronics).

Why is vector averaging needed?

Wind direction is logged as the number of degrees from north, on a scale of 0 to 359. For example, wind from the northeast is logged as 45°. Straight (linear) averaging does not work for directions going from 359 to 0. For example, if you apply a linear average of direction readings of 354 and 2 degrees, you get an average of 178 degrees rather than the correct direction average of 358.



Wind Direction Logging

Follow these steps to calculate vector averaging in Excel:

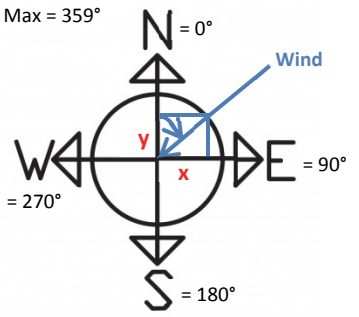
1. Calculate sines: SIN(RADIANS(angle)
2. Calculate cosines: COS(RADIANS(angle)
3. Calculate x and y components as averages over desired range of readings:

   x = AVERAGE(sines)

   y = AVERAGE(cosines)
4. Convert the x & y components to degrees: MOD(DEGREES(ATAN2(y,x)),360)

   ATAN2 is arctangent with two arguments

   MOD is used to ensure angle is 0–359



Vector Averaging

Note: See the spreadsheet "Wind Data Averaging.xlsx" on www.onsetcomp.com. It includes the calculations described above. This spreadsheet is also used to process the

wind data into the desired output logging interval. For example, if you want data at 15-minute intervals, set up the module to log at 1-minute intervals and then use the spreadsheet to process 15-minute data for average wind speed, maximum wind gust, and average wind direction.

WindSonic™

Wind Speed & Direction Sensor

GILL

Key Features

- Wind Speed & Direction Sensor
- 0-60m/s (116 knots) Wind Speed
- 0-359° Wind Direction
- NMEA output
- Low Power consumption
- Fast start-up
- Solid-state – maintenance-free
- Corrosion Free

The Gill WindSonic is a low-cost anemometer, which utilises Gill's proven ultrasonic technology to provide wind speed and direction data via one serial or two analogue outputs. To confirm correct operation, outputs are transmitted together with an instrument status code.

With a robust, corrosion-free polycarbonate housing, this small, lightweight wind sensor is recommended for use in harsh environmental conditions and is particularly suited to marine & offshore (ships, data buoys) and land based installations. The WindSonic has no moving parts, offering maintenance-free operation in a wide range of applications.

WIND SPEED

Range	0 - 60 m/s (116 knots)
Accuracy	±2% @12 m/s
Resolution	0.01 m/s (0.02 knots)
Response Time	0.25 seconds
Threshold	0.01 m/s

DIRECTION

Range	0 - 359° (No dead band)
Accuracy	±2° @12 m/s
Resolution	1°
Response Time	0.25 seconds

MEASUREMENT

Ultrasonic Output Rate	0.25, 0.5, 1, 2 or 4 Hz
Parameters	Wind Speed & Direction or U and V (vectors)
Units of Measure	m/s, knots, mph, kph, ft/min

OUTPUTS

Option 1	RS232
Option 2	RS232 + RS422 + RS485 + NMEA*
Option 3	RS232 + RS422 + RS485 + NMEA* 0-5V or, 0-20mA or 4-20mA
Option 4	SDI-12 (refer to manual or separate data-sheet for technical specification)
Baud Rate	2400 to 38400
Anemometer Status	Supplied as part of standard message

* NMEA 0183
** Download software free from www.gill.co.uk

POWER REQUIREMENT

Anemometer	5-30VDC Option 1 & 2
	7-30VDC Option 3
	9-30VDC Option 4
Current Drain	Dependent on option selected e.g. < 2mA @ 12V (SDI-12) to 44mA @ 12V (4-20mA) Refer to manual for further advice
	Start up time < 5 seconds

MECHANICAL

External Construction	LURAN S KR 2861/1C ASA/PC
Size	142mm x 160mm
Weight	0.5kg

ENVIRONMENTAL

Protection Class	IP66
Operating Temperature	-35°C to +70°C
Storage Temperature	-40°C to +80°C
Operating Humidity	< 5% to 100% RH
EMC	EN 61326:1998

OPERATIONAL

MTBF	15 years
Warranty	2 years
Factory Calibration	Traceable to National Standards

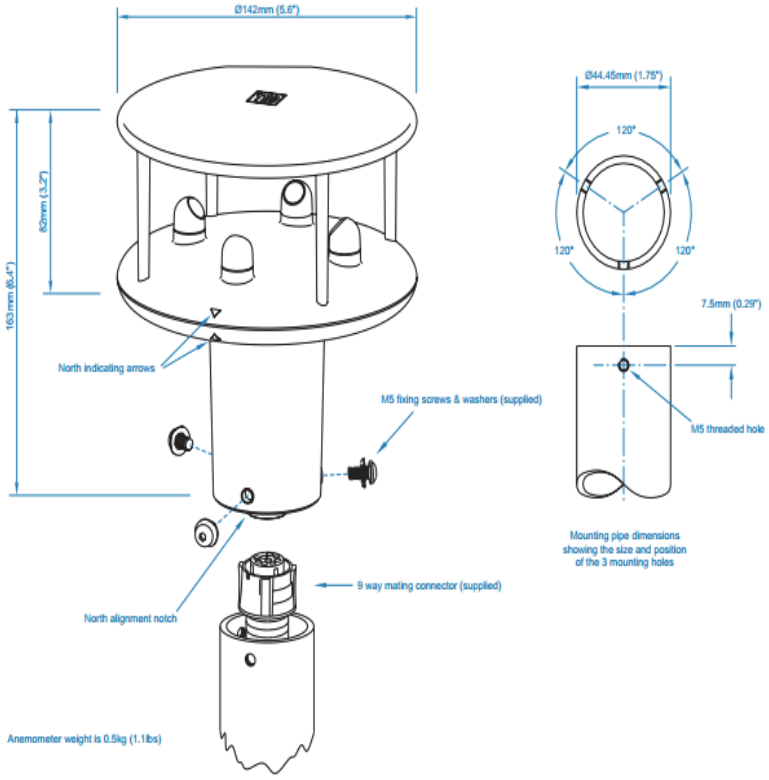
ACCESSORIES

Pipe Mounting	44.45mm (1.75 in) diameter
Wind Software	Display / Logging**
Cables	Available to match output options
Display	See Gill Display datasheet

WindSonic™ Wind Speed & Direction Sensor

Typical Applications

- Remote weather monitoring stations
- Building controls
- Data buoys
- Marine vessels
- Small airports & helipads
- Road & rail tunnels
- Environmental field sites
- Ports & harbours
- Mobile weather monitoring vehicles
- Coastal weather monitoring stations

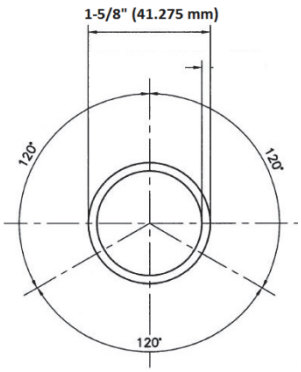


Specifications may be subject to change without prior notice.

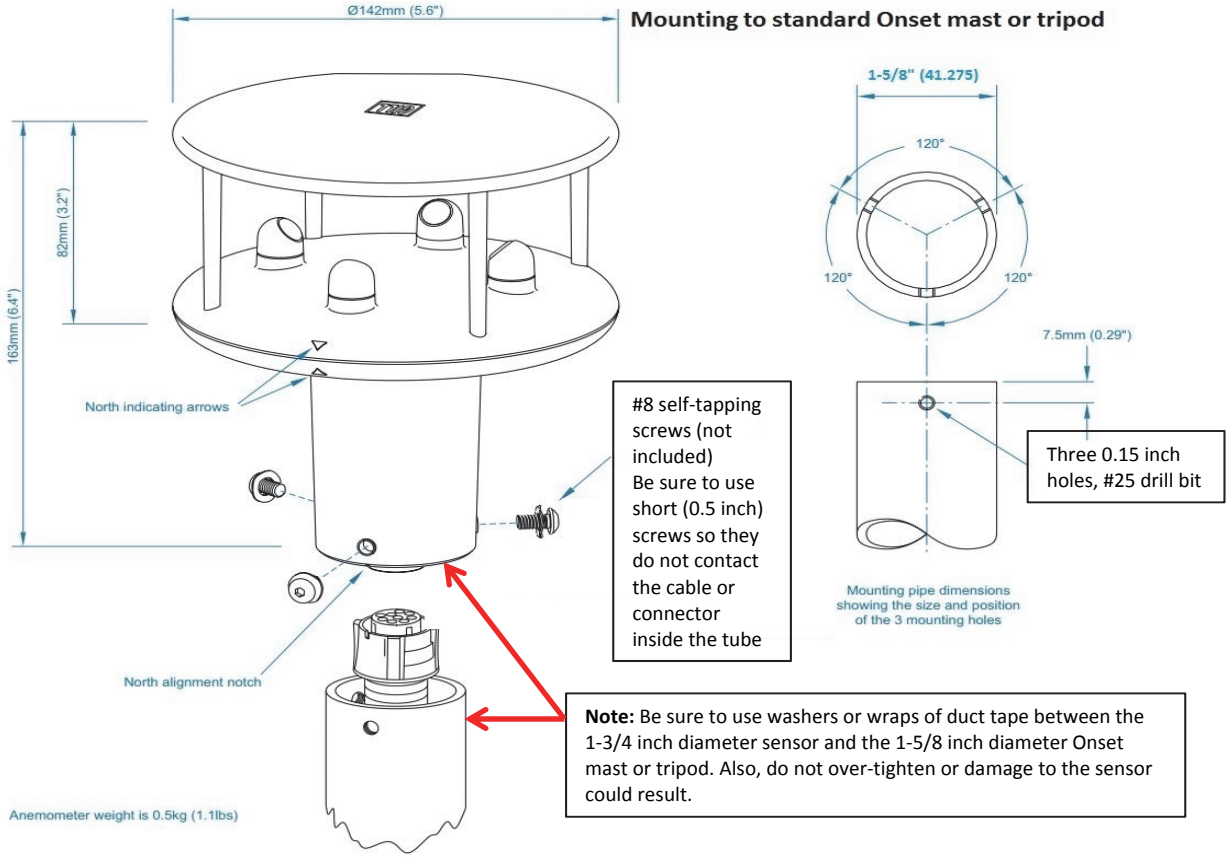
Mounting

The WindSonic sensor is designed to be mounted on a 1-3/4 inch (44.45 mm) tube or Gill mounting bracket. This bracket can be purchased from Gill and will fit on any standard Onset 1-5/8 inch (41.275 mm) tripod or bracket.

Gill WindSonic Mounting Bracket (1771-PK-115)

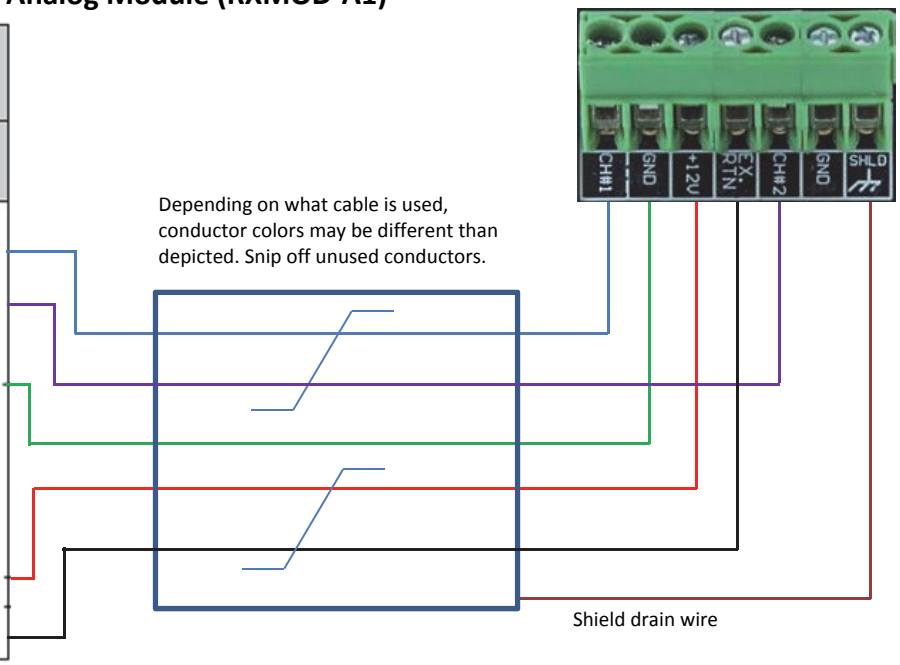


If you plan on mounting the sensor to a standard Onset tripod or mast, you must drill three mounting holes in the top of the mast or tripod (see the following drawing for more detail). Note that when using an Onset mast or tripod, the sensor cable must be passed completely through the tripod or mast to be properly connected to the RX3000 station.



Wiring to the RX3000 Station Analog Module (RXMOD-A1)

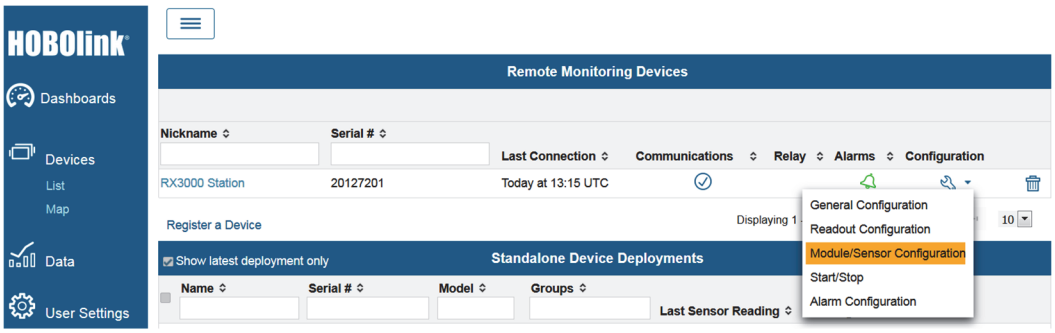
WindSonic 9 Way circular connector	
Signal names	**Pin nos.**
Analogue Channel 1 (Speed)	8
Analogue Channel 2 (Direction)	9
Signal Ground (Analogue Return)	1
V supply +	2
V supply -	3



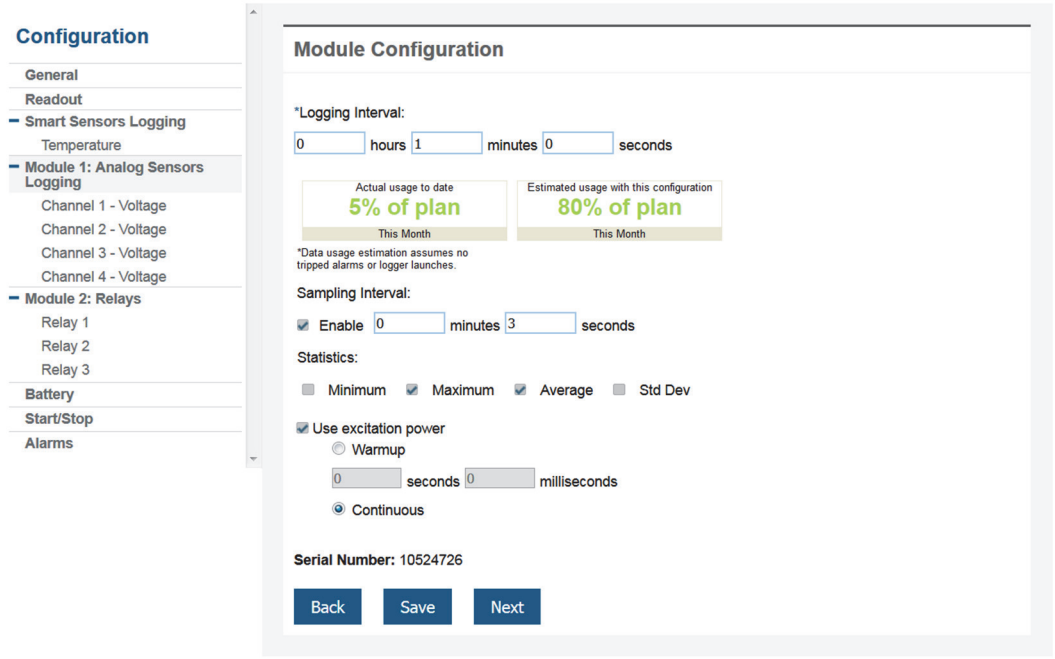
The full Gill manual that includes the Gill wiring diagrams can be found here:
http://gillinstruments.com/data/manuals/windsonic-manual.pdf?iss=21.20150501

Configuring the Analog Module with HOBOlink

In HOBOlink, select Devices from the left menu and the click List and find your station in the list. From icon, select Module/Sensor Configuration as shown below.



Select the Analog Sensor Module from the menu on the left (Module 1 in this example). Set the logging interval and sampling interval as shown below. It is recommended that you use a 1-minute logging interval—the fastest rating—so that you get as many wind direction readings as possible for vector averaging later. You can use a program like Excel to process the data into the logging intervals desired. Enable "Use excitation power" and select Continuous. Click Next.



Note: This configuration was successfully used in a location with plentiful sun, a 6-watt solar panel and typical weather station sensors attached. These include:

- Temp/RH
- Rainfall
- Soil Moisture
- Solar Radiation
- Barometric Pressure

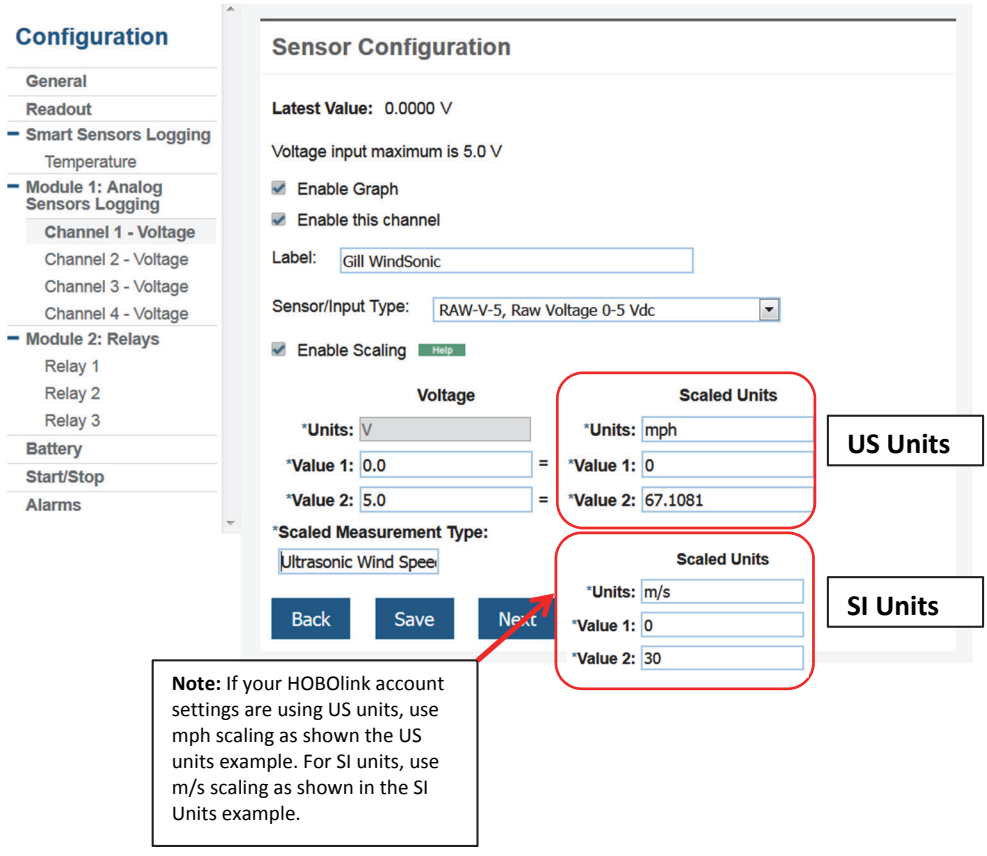
For applications using additional analog sensors or where sunlight is limited at the installation location, you may need to adjust these settings to conserve battery power. See *Notes for Monitoring & Conserving Power* for more details.

Also, this sampling configuration will provide Maximum and Average values for both wind speed and direction based on 3-second samples. This means that along with the raw 1-minute data from each sensor there will be additional Average and Maximum data columns based on 20 samples every minute. These average data values should only be used for the wind speed data! Do not use the average wind direction data directly from the RX3000 station; it is not valid because it does not include vector averaging. You can access data with a custom export configuration; see *Creating a Custom Export Data Query for Wind Speed and Direction Data* for details.

Important: Statistical sampling is applied "globally" to all analog channels within a single analog module on the RX3000 station, which in this case is both wind speed and wind direction. The recommended configuration described above produces the required data for both sensors: the Average and Maximum data for wind speed and the raw 1-minute logged data for wind direction that will be used for vector averaging. If this configuration becomes a problem and the second analog module slot is open on your RX3000 station, consider purchasing a second analog module (RXMOD-A1) to accommodate the wind direction output for the WindSonic sensor. This would allow the wind speed and direction to be logged by independent modules.

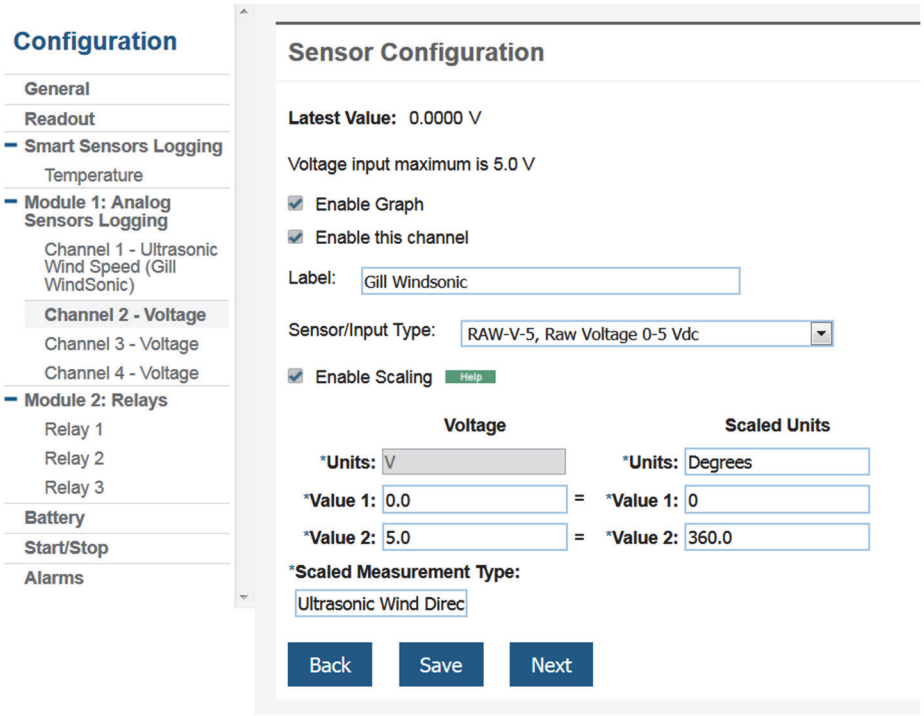
Configuring the Wind Speed Channel with HOBOlink

Configure the Ultrasonic Wind Speed channel as shown below and click Next when done.



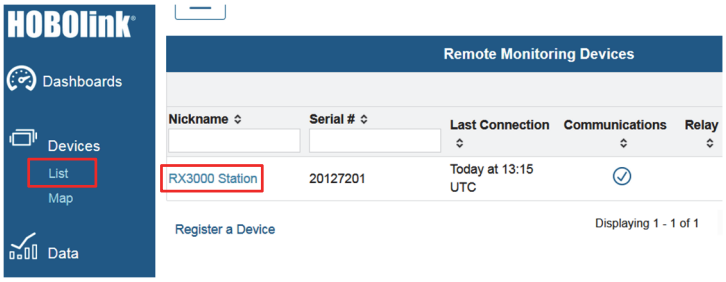
Configuring the Wind Direction Channel with HOBOlink

Configure the Ultrasonic Wind Direction channel as shown below and click Save when done.

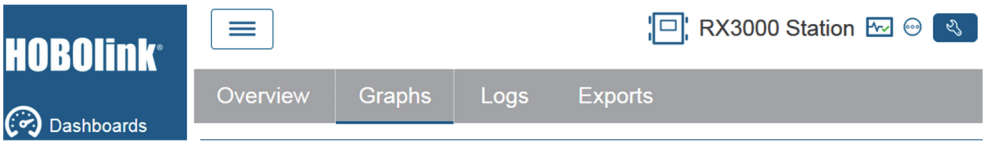


Checking Latest Conditions in HOBOlink

Under Devices, select List and then select your station.



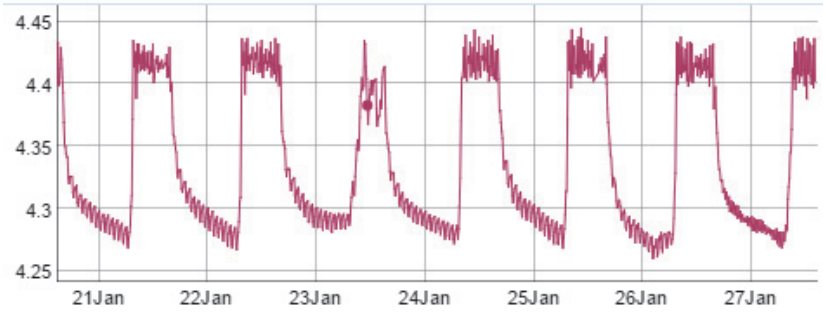
Select Overview to check the current readings or select Graphs to view a graph of the readings. The graph also displays the Average and Maximum values. Note that the Average Wind Direction values may be grossly off for certain wind directions due to the module calculating linear averages rather than vector averages.



Monitoring and Conserving Power

If you deploy an RX3000 station that has the optional analog module configured to provide excitation to a sensor, follow these guidelines for monitoring and conserving power.

Monitor the recharging pattern of your battery as depicted in HOBOlink. This requires the graph to be enabled for the battery channel. (From your device page, select Module/Sensor Configuration. Select Battery and then select Enable Graph and click Save.) Below is an example of an RX3000 station that is efficiently recharging each day over a one week period.



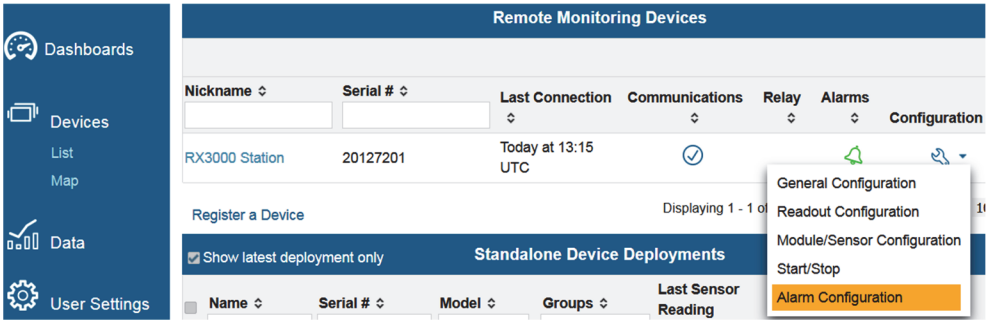
If your RX3000 does not appear to be recharging properly with this configuration, try the following (one at a time):

- Remove un-needed sensors.
- Decrease the connection interval for the station in Readout Configuration.
- Decrease the analog module sampling interval in Module Configuration.
- Use a sensor warm-up time for excitation power instead of continuous power. Note that the sensor needs at least a 10-second warm-up time to stabilize.

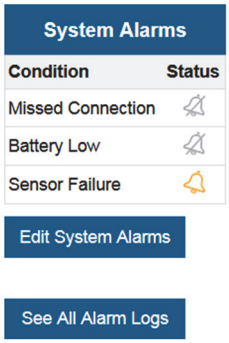
Setting up a Low Battery Notification in HOBOlink

You can configure HOBOlink to send a low battery alarm notification to your email address if the RX3000 station is using more power than can be recovered by daily recharging. To do this:

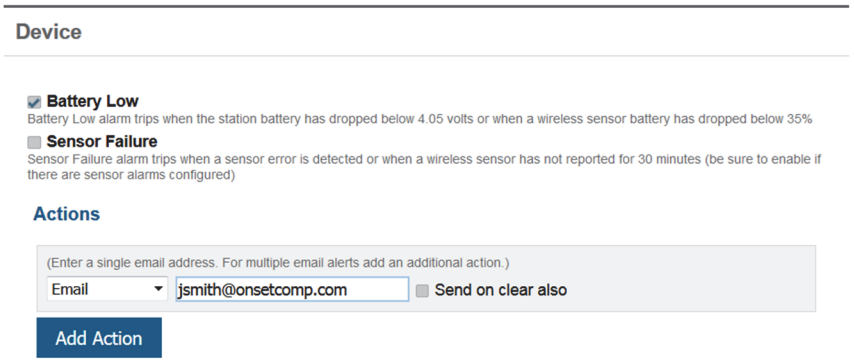
1. In HOBOlink, select Devices from the left menu and the click List and find your station in the list. From  icon, select Alarm Configuration as shown below.



2. Under System Alarms on the alarm page, click Edit System Alarms.



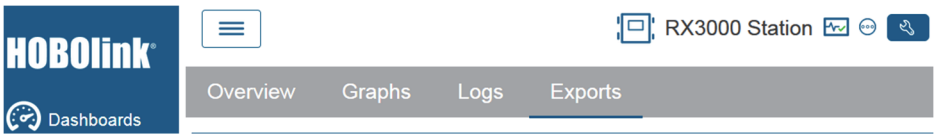
3. Under Device, enable “Battery Low” and type your email address. Click Add Action and then click Save.



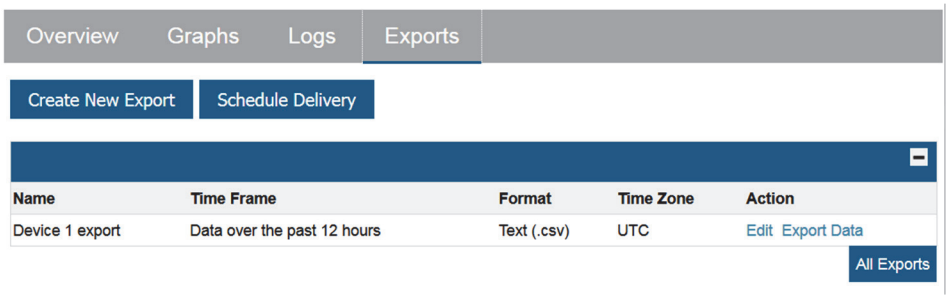
Creating a Custom Export Data Query for Wind Speed and Direction Data

You can set up a custom export that includes the wind speed and direction data. To do this:

1. Under Devices, select List and then select your station. Select Exports.



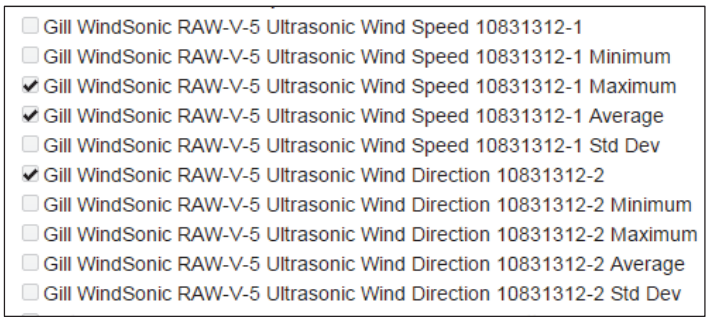
2. Click Create New Export.



3. Under Export Settings, type a name for the export, select your preferred format for the export, and select the time zone.
4. Select your data export time frame (for automatic data delivery, be sure to select “over the past”).
5. Select the device (your RX3000 station) and the sensors that you want to include in your export. Click Save to save this export for future use. Click Export Data if you want to create an export file immediately.

Important: Do ***not*** include Average Wind Direction as this will not include vector averaging, which needs to be calculated in Excel.

For example, if you selected the following sensor channels in step 5:



then this would be the sample export based on those selections:

	A	B	C	D
1	Time, GMT-05:00	Gill WindSonic, Avg, mph	Gill WindSonic, Max, mph	Gill WindSonic, Wind Direction, Degrees
2	1/18/2016 16:09	7.416	7.416	285.96
3	1/18/2016 16:10	7.922	16.371	324.87
4	1/18/2016 16:11	4.461	10.97	138.79
5	1/18/2016 16:12	3.546	8.608	221.94
6	1/18/2016 16:13	6.668	13.933	174.96
7	1/18/2016 16:14	3.132	5.937	233.06
8	1/18/2016 16:15	2.38	5.376	40.95
9	1/18/2016 16:16	3.72	6.849	190.97
10	1/18/2016 16:17	3.095	6.019	356.77
11	1/18/2016 16:18	4.378	8.425	282.97
12	1/18/2016 16:19	2.926	5.876	272.76
13	1/18/2016 16:20	2.049	3.789	201.95
14	1/18/2016 16:21	2.891	5.439	311.81
15	1/18/2016 16:22	1.334	3.15	113.96

Note: This is the column of data that will need to be vector-averaged.