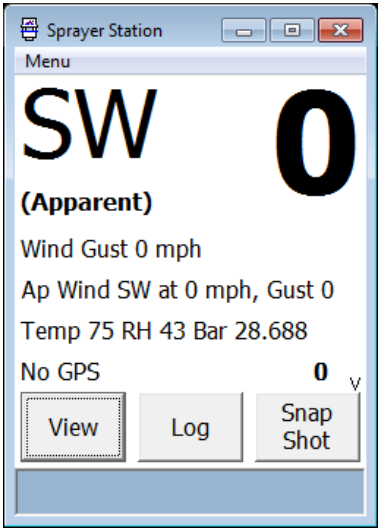
WatchDog®

# Sprayer Station

## PRODUCT MANUAL

Item # 3349SSH





Spectrum® Technologies, Inc.

# Contents



This manual will familiarize you with the features and operation of your new WatchDog Sprayer Station. Please read this manual thoroughly before using your instrument. For customer support, or to place an order, call Spectrum Technologies, Inc. at
(800) 248-8873 or (815) 436-4440
between 7:30 am and 5:30 p.m. CST
FAX (815) 436-4460
e-mail: info@specmeters.com
www.specmeters.com

# Introduction

Thank you for purchasing the WatchDog Sprayer Station. The Sprayer Station is designed to provide an accurate indication and record of the environmental conditions around a vehicle, whether it is stationary or in motion. It allows for real-time measurement of weather data before, during, and after a field operation.

# Components

Your WatchDog Sprayer Station package should contain the following components:

- Sensor Unit
- Mounting Post
- Cable Assembly
- Vehicle Power Adapter
- Hook & Loop Fastener Strips (2)
- User Guide

# Installing the Station

**Choosing the Mounting Location**

The Sensor Unit must be mounted in "clear air"—away from obstructions in any direction that will interfere with air flowing through the unit. Ideally, this would be on the roof of the cab or the tank. If the Sensor Unit is not the highest point, be sure to mount it far enough from any obstruction so there is no interference with the air flow.

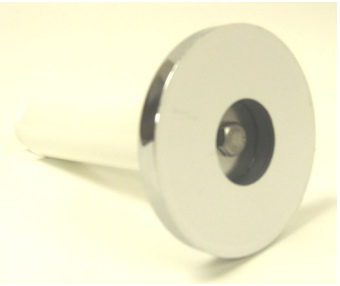
Because the Sensor Unit has an electronic compass, it should be at least 3' (1 m) away from strong magnetic fields from equipment such as radio transmitters. Because it has a GPS, be sure it is as far as possible from high-powered transmitting antennas to avoid mutual interfer-

ence. Similarly, mount the Sensor Unit far enough from an existing GPS unit to avoid interference, and to keep the Sensor Unit from blocking the GPS unit's view of the sky.

The Sensor Unit must be installed vertically—NOT tilted to one side. Tilting the unit will introduce an error in the compass reading.

If you are using the magnetic mount, remember that you must have a steel surface to attract the magnet. With a fiberglass roof, this usually requires applying an adhesive steel plate, as is used to provide a mounting point for GPS units. The magnetic mount can also be removed, and a standard ¼" bolt used to attach the mounting post to the vehicle.

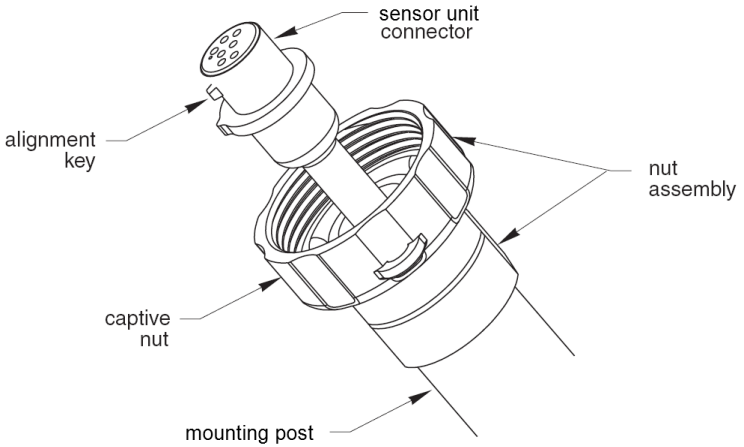
Once you have decided on a location, note which direction you want the cable to travel. At this time, you may wish to



mark the front of the mounting post (the side which will be pointing toward the front of the vehicle).

## Assembling the Sensor Unit, Cable, and Mount

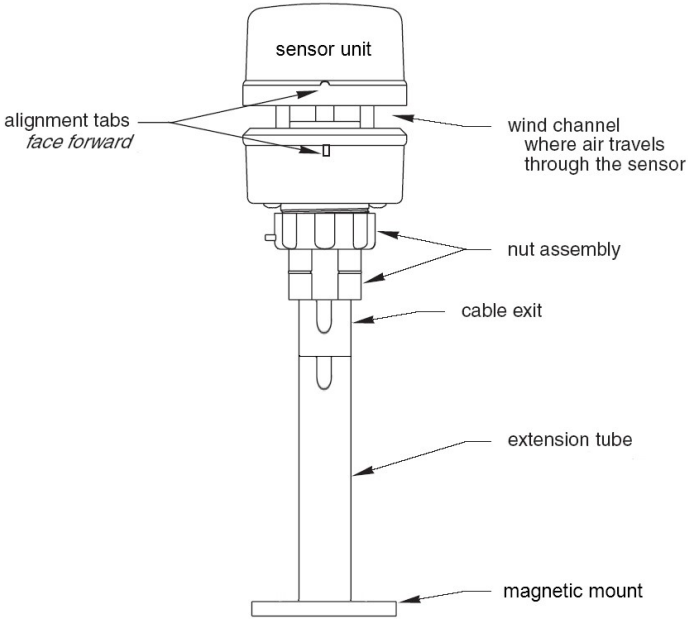
1. Gather the Sensor Unit, Mounting Post, and Cable Assembly.
2. With the nut assembly on the cable near the Sensor Unit connector, slide the cable into the cable exit slot at the top of the Mounting Tube. Leave several inches of cable topped by the connector above the nut assembly.
3. Screw the nut assembly onto the top of the Mounting Tube. Hand-tighten only. Do not over-tighten. Caution: If you want to use a thread lock, use plumber's tape. Do not use a liquid thread lock as it may weaken the plastic, causing it to swell and crack.
4. Remove the protective cover from the connector, and the




warning label from the bottom of the Sensor Unit. Plug the 7-pin connector into the Sensor Unit. The alignment key on the connector fits into a notch in the base of the Sensor Unit.

5. Be sure the alignment tabs on the Sensor Unit are facing forward and parallel to the centerline of the vehicle. Remember to orient the front of the Mounting Post forward as well, so the cable will exit in the correct direction. Slide the captive nut upward and screw it onto the base of the Sensor Unit. Hand-tighten only. Do not over-tighten. Be careful

NOT to rotate the Sensor Unit or loosen the nut assembly from the antenna mount/extension tube. Double check to be sure the alignment tabs are still facing forward.




## Alignment

Please note that, for clarity, the above diagram shows the sensor alignment tabs and the cable exit both facing forward, it is uncommon for the cable to run forward from the sensor. It would usually run to the rear or one of the sides, and the cable exit should be aligned accordingly. The sensor itself must face forward.

## Temporary Mount

For temporary mounting of the Sprayer Station, slip the cable through an open door or window. Caution: do not damage the cable when closing the door or window. For doors, avoid the area near the hinges as well as near the latch. Both areas exert extremely high forces on the cable.

**Permanent Mount**

The Cable Assembly will have to be disassembled in order to thread the cable through a hole in the wall or roof of the cab. Although the cable will fit through a ¼" hole, a larger hole is recommended to fit a grommet, to help ensure a watertight seal.

There are two versions of the connector box on the end of the cable. The first generation box is approximately the size and shape of a deck of cards, and has a sliding battery cover. The current generation box is smaller, and is labeled as "Item #3349CB". Instructions for the original box are available from Spectrum Technologies.

Disassembling the Cable Assembly:

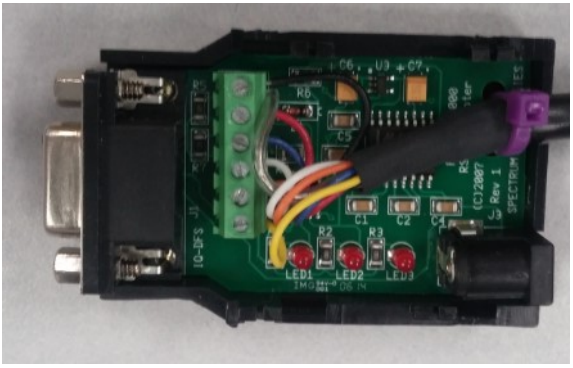

1. Open the connector box by inserting a screwdriver in the slots on the side and twisting to separate the top and bottom halves.
2. Using a small screwdriver (2 mm, 2.5 mm, or 1/10" blade – a small "electronics" screwdriver has a 1/8" blade which will not fit), loosen the six screws, and remove the wires from the terminal block.
3. Cut the wire tie holding the cable and pull the cable out of the connector box.

Reassembling the Cable Assembly:

1. Thread the seven wires into the holes on the side of the terminal block, and tighten the screws to secure the wires. The wire colors should be matched to the marked terminals as:

    - TD(A) or TDA — Yellow
    - TD(B) or TDB — Orange
    - RD(A) or RDA — White
    - RD(B) or RDB — Blue
    - GND — Black and Clear
    - +12VDC or +12 — Red

2. Secure the cable with a wire tie through the two holes on the circuit board.
3. Press the two case halves together, making sure the LEDs are under the holes next to the label.




Interior Terminal Block

## Connecting to your Laptop

Attach the connector box to your PC with the 9-pin seral connector. If your PC's power cable prevents a direct connection, you must use a 9 pin male/female serial extension cable. If your laptop does not have a serial port, attach a USB to Serial converter cable (available from Spectrum Technologies as Item # 3661USB).

If your cable has anchor screws, use them to hold the cable securely to the connector box. If you have anchor nuts (as seen in the photo below), use a wrench or pliers to unscrew the anchor nuts. No disassembly is required.


## Replacing the Humidity Sensor

The humidity sensor on item 3349SSH can be replaced with sensor item number 3349H.

To replace the sensor, use a Phillips screwdriver or wrench to unscrew the two screws and pull off the old sensor and replace with the new sensor.

# Communicating With the Sprayer Station

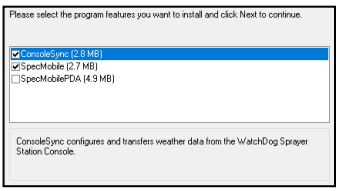
Communication with the Sprayer Station can done with:

1. Sprayer Station Console and Console Sync software. Instructions for using this platform are shipped with the console.
2. Selected sprayer systems manufactured by Raven Industries, which provides instructions.
3. PC running Specware Mobile software. See below.

# SpecWare Mobile Software

SpecWare Mobile software is downloaded directly from the Spectrum Technologies website.

1. Go to www.specmeters.com/software
2. Click on the “SpecWare Mobile and ConsoleSync Install” Link to the Download page
3. Run SpecWare.Mobile.Setup.exe from where it downloaded (usually your “Downloads” folder)
4. You can choose to install any or all of the three features: "ConsoleSync" is the standard program used to configure and download the Sprayer Station Console. "SpecMobile" is used to connect the Sprayer Station directly to the PC. "SpecMobilePDA" is software to install on PDAs running Windows Mobile 6 (discontinued in 2010), and by default is not installed.

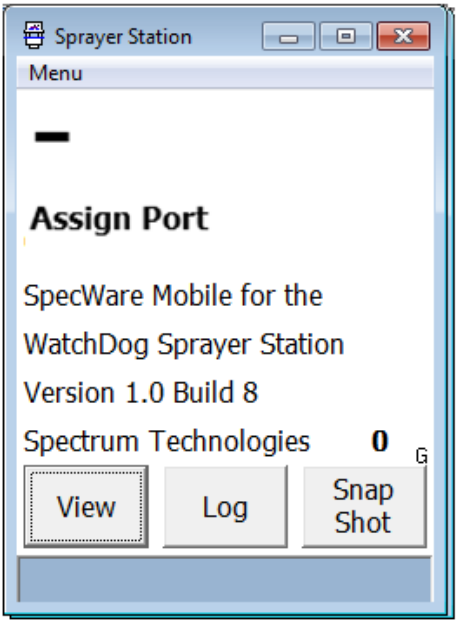



A desktop icon and a Start menu entry will be created to run SpecWare Mobile. Once the SpecWare Mobile software is installed, you are ready to begin using your Sprayer Station.

# Configuring the Station with SpecWare Mobile

Connect your PC or laptop to the Sprayer Station using the cable you attached to the Connector Box earlier. Check that the pilot light on the side of the Vehicle Power Cable is illuminated. This ensures that the Sprayer Station is receiving power. Start SpecWare Mobile using the menu or icon.

When SpecWare Mobile is first brought up, the following screen will be displayed.



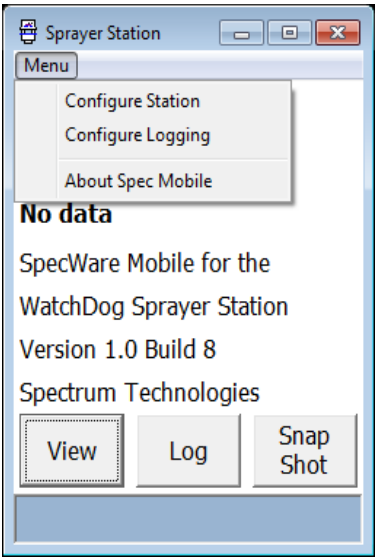
## Identifying the Com Port

You must identify the communications (or serial) port the Station is plugged into. The COM port associated with the cable can be seen in the PC's Device Manager. Access to this feature differs for different Windows operating systems.

For Windows 10, right-click on the Start menu icon. This will bring up a dropdown menu. Select **Device Manager**. For other operating systems, use the search engine to locate and open the Device Manager. Click on the symbol to the left of **Ports (COM & LPT)**. This will expand the selection.

A built-in serial port will be labeled "Communications Port". A USB to Serial converter will generally have "USB to Serial" in its name. In either case, the communications port number, (i.e. COM1) will be in parentheses.

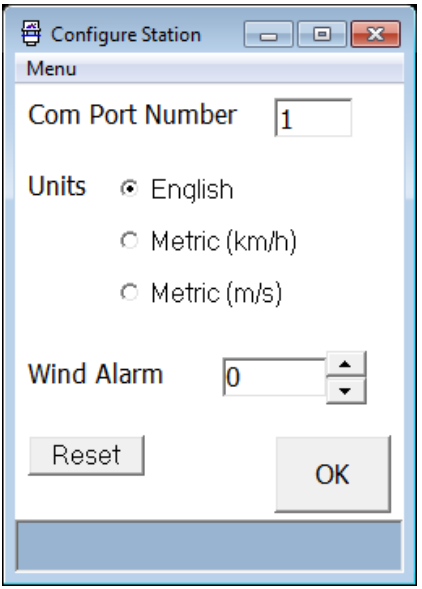
Once you have identified the communications port, you must configure the station parameters in SpecWare Mobile. Click the **Menu** button in the upper left corner to display the menu options.



## Configure Station

From the dropdown menu, select the **Configure Station** option to bring up the **Configure Station** screen.

Type in the COM port identified on p. 13.




Select the measurement system you wish to use. If the English units option is selected, speed is displayed in mph, temperature is displayed in degrees Fahrenheit, and pressure in in-Hg. The Metric options display temperature in degrees Celsius and pressure in hPa (equivalent to mbar). The two options for the metric speed parameter are km/h or m/s.

The Wind Alarm is set using the up/down arrows. 0 indicates no alarm. For any other value, if the true wind reaches or exceeds the Wind Alarm value, the wind speed value on the main screen will have a bright yellow background.

The Sprayer Station has been preset to send six specific data messages to the PC. Under rare situations, the Sprayer Station can forget those settings. The “Reset Station” button is used to re-educate the Sprayer Station.

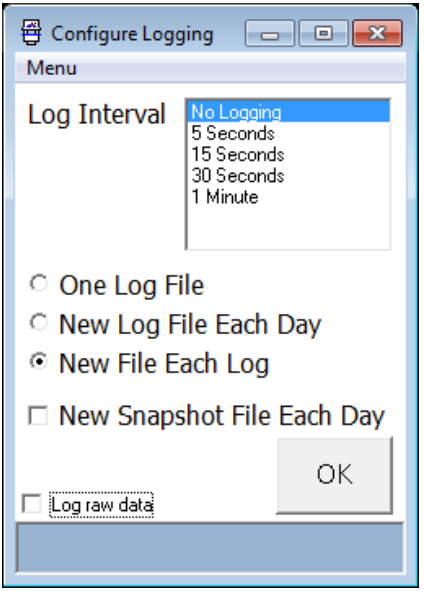
Click **OK** to save your selections, and return to the main screen.

## Configure Logging

From the dropdown menu, select the **Configure Logging** option to set your data logging preferences.

Snapshots and data logs are stored in the PC's "My Documents" folder in a sub-folder named "SpecMobile".

Logging is started and stopped via the **Log** button on the main screen (pp. 17 and 20). The WatchDog Sprayer Station can log location and weather data continuously at one of 4 specified intervals. If you want to disable logging, choose the **No Logging** option.




By default, all log records are written to a single file named "Sprayer.Log.txt". This is indicated by the **One Log File** option.

The **New Log File Each Day** option creates a new log file for each day, named "Sprayer.Log.*yyyymmdd*.txt", where *y*, *m*, and *d* refer to the year, month, and day when the data was collected.

The **New File Each Log** option creates a new file each time logging is started using the **Log** button. The files are named "Sprayer.Log.*yyyymmdd.hhmm*.txt". For these files, *hhmm* indicates the hour and minute when logging was initiated.

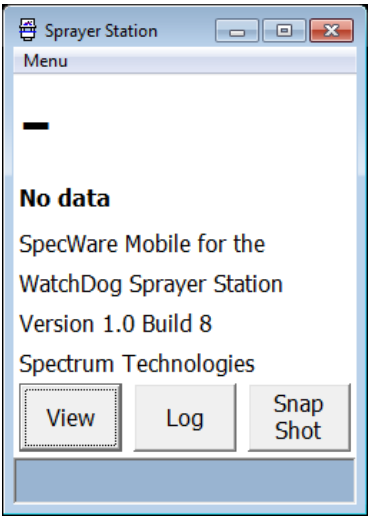
When the **Snap Shot** button (pp. 17 and 20) is pressed on the main menu, the default is to save data in a universal file named "Sprayer.Snap.txt". If the **New Snapshot File Each Day** option is selected in the Configure Logging screen, Spec Mobile instead saves snapshots in files named "Sprayer.Snap.*yyyymmdd*.txt". Again, *y*, *m*, and *d* refer to the year, month, and day when the data was collected

The **Log raw data** check box in the lower left corner will activate logging of the actual weather data messages being sent from the Sprayer Station. Typically, this option will be disabled. It is provided for researchers who require the raw data, and for problem resolution.

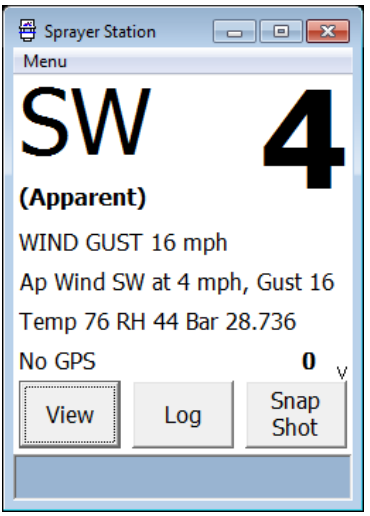
Click **OK** to save your selections, and return to the main screen.

# Using the WatchDog Sprayer Station

Start SpecWare Mobile using the Start menu or the Desktop icon. The "No data" screen will display until the program receives weather data from the Sprayer Station Sensor Unit. If this does not occur within 10 seconds, please refer to the Troubleshooting section (p. 24). Once enough data has been received, the display will switch to the standard display view.




Initial Display



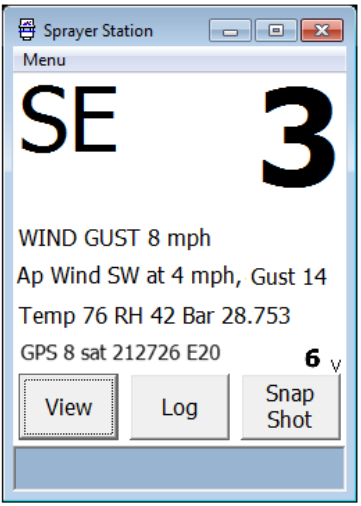

Standard Display
No GPS found

The standard display view screen is updated once every 5 seconds, averaging the data received during that time. The image on page 17 shows weather data without GPS information. This will be displayed until the GPS obtains a position fix. The GPS time to first fix is one minute. Note that a GPS fix will not be possible when there is not a clear view of the sky, such as indoors, or in a heavily forested location. The standard display view consists of the following information:

**Wind**

Wind Direction and Wind Speed

The large text at the top of the standard display will display either the apparent or true wind speed and direction. Apparent wind is the wind a person riding on the vehicle would feel. True wind is the wind that would be measured if the vehicle were stationary. It is computed from the apparent wind and the GPS-provided course and speed.




Standard Display
GPS found

The wind direction is displayed in the upper left corner, using eight compass points. Wind speed is displayed in the upper right corner. Wind speed units are specified in the station configuration (p. 14). If GPS data is available, the true wind will be computed and displayed. Otherwise, the apparent wind will be displayed and the **Apparent** indicator will appear.

Wind Gust
Wind gust is the maximum wind speed detected during the previous 5-second interval. The apparent or true wind gust is displayed on the first text line.

Apparent Wind
The apparent wind direction, speed, and gust is displayed on the second text line.

**Weather Values**
The current temperature, relative humidity, and barometric pressure are displayed on the third line. Relative humidity is displayed as a percent. Temperature is displayed in degrees Fahrenheit or Celsius. Barometric pressure is displayed in inches or millimeters of mercury, based on whether English or Metric units were specified in the station configuration (p. 14).

**GPS Information**
GPS information is displayed on the fourth line.

Satellites
The number of GPS satellites currently being received is displayed as a number on the right side of the fourth line. A GPS position fix is not obtained until at least three satellites are being received, and the more satellites, the more accurate the position fix, and the computation of the vehicle and true wind speeds.

Monitor
On the far right of the fourth line is a small letter (a "V" on the screen image). This letter will frequently change during normal operation. The six data messages sent by the Sprayer Station Sensor Unit are assigned a letter which is displayed in real-time by SpecWare Mobile. The data sentences are sent individually at one second intervals.

**Control Buttons**

View
Pressing the View button cycles between the standard display, a GPS-oriented display, and a record count display (which is used for troubleshooting).

Log
Pressing the Log button will start and stop the logging function. The logging interval is set in the logging configuration (p. 15). The log button will change appearance when the logging function is active.

SnapShot
The SnapShot button records a snapshot of the currently displayed wind, weather, and GPS information.

# Logging Weather and GPS Data

SpecWare Mobile stores logged data in a folder with the name of "SprayerStation". This folder is will be created by SpecWare Mobile in the “My Documents” folder and will contain the three types of log files. These files will be appended until they are deleted or renamed. A new file will then be created.

Sprayer.Log.txt
When a log interval has been specified in the **Configure Logging** screen (p. 15), and logging is activated using the **Log** button (p. 20), records are written to a text file with tabs separating the values. This format can be easily imported into Excel (using the text import wizard) or other programs. The first record of the file is a header record, identifying the columns.

By default, all log records are written to a single file named “Sprayer.Log.txt”. This is indicated by the **One Log File** option in the **Configure Logging** screen. If you want to have a separate file for each field application with full control of the file names, stop SpecWare Mobile, and use File (or Windows) Explorer to rename the file. Restarting logging will create a new log file.

Alternatively, selecting the **New Log File Each Day** option in the **Configure Logging** screen places all log records in files by day, named “Sprayer.Log.*yyyymmdd*.txt”, where *y*, *m*, and *d* refer to the year, month, and day when the data was collected.

Similarly, the option **New File Each Log** creates a new file each time logging is started using the "Log" button. The files are named "Sprayer.Log.*yyyymmdd.hhmm*.txt", where *h* and *m* refer to the hour and minute when logging was initiated.

Sprayer.Snap.txt
When the SnapShot button is pressed, a record is written to the "Sprayer.Snap.txt" file. The format is the same as the Log file.

Similar to the Log files, checking the **New Snapshot File Each Day** option in the **Configure Logging** screen saves any snapshots in daily files named:
"Sprayer.Snap.*yyyymmdd*.txt".

Sprayer.Raw.txt
If the **Log raw data** box is checked in the **Configure Logging** screen, NMEA 0183 sentences from the Sensor Unit will be written to the "Sprayer.Raw.txt" file. Most people will not want to activate this option. Typically, this option will be disabled. It is provided for researchers who require the raw data, and for problem resolution.

Log file format
The Log and SnapShot files contain the following data:

Date and Time, Temperature, Relative Humidity, Dew Point, Barometric Pressure, Apparent Wind Direction, Apparent Wind Speed, Apparent Wind Gust

If a GPS position fix is available, the records will also contain:

True Wind Direction, True Wind Speed, True Wind Gust Satellite Count, UTC, Latitude, Longitude, Course, and speed

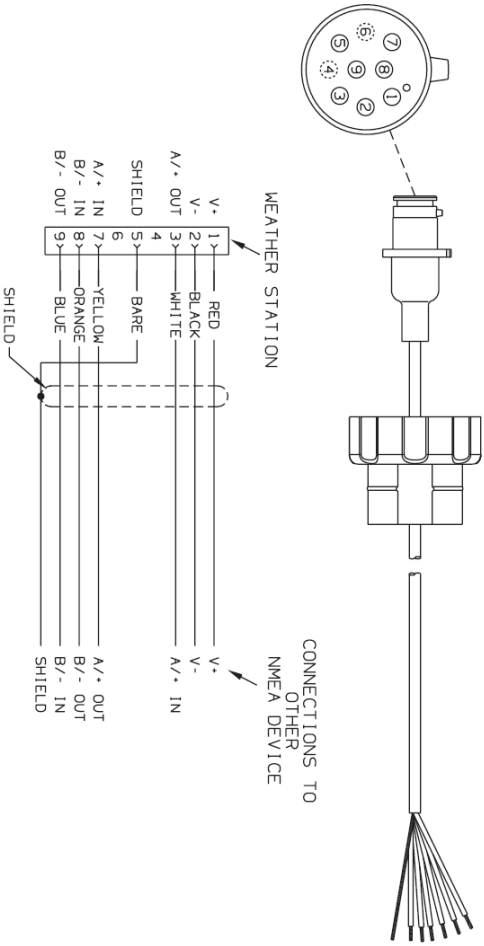
# Troubleshooting

If the the display shows **No data** (other than after clicking the **View** button) or if the wind and weather values do not change from 0:

1. Check that the pilot light on the Power Adapter is lit.
2. Confirm that the "PWR" light is lit.
3. Check that all connections are tight.
4. Verify that you are using the correct COM port for the station. If you are using a USB-to-serial adapter and are uncertain of the COM port number, follow the steps on page 13.
5. Ensure that the RX light is blinking (this is the signal from the sensor module). Otherwise, open the connector box and check the screw terminals with a voltmeter to confirm that:
    - "+12VDC" to "GND" is +12VDC (nominal).
    - "RD(B)" to "RD(A)" cycles once per second between +4.5VDC and 0VDC (this is the signal from the sensor module).
6. For further investigation, reference the diagram on the next page.
    - If the prior checks show power, but not signal, remove the sensor module from the cable and check that hole 1 (marked with a small dot) to hole 2 (clockwise next to hole 1) reads +12VDC (nominal).
    - Disconnect the power cable from the connector box, and use a continuity tester to check that all wires are intact between the sensor module connector and the screw terminals in the connector box.

**If a GPS position fix is not made after several minutes:**

1. Ensure you are outdoors with a clear view of most of the sky. Being able to see some sky through the trees is usually not sufficient
2. Try resetting the station with the **Reset** button in the station configuration screen (see p. 14). The TX should blink about once per second as commands are sent to the station.



# How the Sprayer Station Works

## About the Ultrasonic Wind Sensor

The ultrasonic wind sensor (an ultrasonic anemometer) measures apparent wind speed and direction. The Sprayer Station contains four ultrasonic transducers, visible through the four holes in the top of the sensor's wind channel. These transducers operate in pairs—one transducer injects a pulse into the air, and the other (directly opposite to it) listens for the arrival of that pulse. Each pulse bounces off the metal plate at the bottom of the wind channel and is carried by the wind to arrive at the opposing transducer a short time later.

When there is no wind, the pulse travels at the speed of sound from the sender to the receiver. Whenever the wind is blowing in that direction, the pulse will arrive sooner than if the air is still. Similarly, whenever the wind is blowing in the opposite direction, the pulse will arrive later than if the air is still. The four transducers take turns in sending and receiving pulses to cover all possible wind directions.

A microprocessor within the Sprayer Station then combines the measurements from all four transducers to calculate the resultant wind speed and direction. Throughout this process, the sensor monitors the air temperature, to compensate for the fact that the speed of sound in air changes with temperature.

## Understanding True and Apparent Wind

The Sprayer Station has the unique ability to display both true and apparent wind. True wind is the actual motion of the air relative to the earth. Apparent wind is the wind which an observer experiences while moving. It is the result of two motions—the actual motion of the air (the true wind) and the motion of the vehicle. If the vehicle is not moving, then the true and apparent wind will be the same.

There are two components to any wind measurement: speed and direction. By convention, the wind direction is an angle representing the direction from which the wind is blowing.

Consider the case of a vehicle proceeding at a speed of 15 mph in calm air. An observer on board would experience a wind of 15 mph from dead ahead. This apparent wind would be due solely to the motion of the vehicle. If a true wind of 15 mph was blowing from the rear, an observer would experience dead calm—no apparent wind. That is because the vehicle is moving at the same speed and in the same direction as the surrounding air.

Now, consider the more complicated situation of a vehicle proceeding at 15 mph with a true wind of 15 mph blowing from the side. To an observer on board, the apparent wind would be 21.2 mph blowing from an angle 45º off the front.

In order to calculate the true wind speed and direction when on board a moving vehicle, it is necessary to know the apparent wind speed and direction, the speed and course over ground of the vehicle, the compass heading, and the local magnetic variation. Note that heading and course are not the same thing: heading is the direction the vehicle is pointing, while course is the direction the vehicle is traveling. On land, heading and course differ only when the vehicle is stationary. The Sprayer Station can provide true wind speed and direction only if all of the data is available. The speed and course over ground must be provided by a GPS receiver—either built-in or networked. The heading may be provided by either the built-in electronic compass or by an external networked compass.

Because true wind is calculated using the data from several sensors, its accuracy depends on the accuracy of all the raw data used in the calculation. For instance, if the electronic compass is located near iron or a similar magnetic disturbance, the heading will be incorrect, and the true wind calculation will therefore be in error, perhaps by quite a bit. In another example, the speed and course over ground (SOG and COG) provided by the GPS receiver are averaged over time. If the vehicle is performing maneuvers, changing speed and/or direction, then it will take a few seconds for the SOG and COG values to "catch up".

The reported true wind values will therefore also be incorrect until the vehicle reaches a steady-state condition, traveling in a straight line at a constant speed.

**Electronic Compass**

The Sprayer Station includes a pair of magnetoinductive sensors that measure magnetic field strength in two axes on the horizontal plane of the Sprayer Station. From these measurements, it calculates the resultant magnetic heading angle, thereby providing a built-in electronic compass.

Like all magnetic compasses, the Sprayer Station compass will be affected by any ferrous or magnetic materials in the vicinity, such as metal structures, motors, speakers, etc. It will also be affected by nearby electric fields, such as the wiring for lights. These nearby sources of magnetic interference will distort the magnetic field and produce errors in the compass heading. These errors are known as magnetic deviation.

Although the Sprayer Station compass is a 2-axis device, the earth's magnetic field occurs in three dimensions. That is, part of the earth's magnetic field is oriented in the vertical direction. The closer one's location is to the north or south pole, the stronger this vertical component becomes in comparison to the horizontal components. The effect this has on the Sprayer Station is to introduce an error in the compass reading if the Sprayer Station is tilted from the horizontal plane. Therefore, it is important when installing the Sprayer Station to ensure the support pole is mounted vertically, and not tilted to one side. Also, keep in mind that when your vehicle experiences pitch and roll, the compass heading will be affected accordingly.

Because the compass heading is used in the calculations for true wind, any errors in the compass heading will also produce errors in the reported true wind speed and direction. This is adjusted for in the Sprayer Station by using the GPS-sourced course over ground when the vehicle is moving.

## Magnetic Variation and True Heading

The earth acts like a giant magnet, with a magnetic north pole and a magnetic south pole. The axis of the magnetic poles is offset approximately 11.5° from the axis of the earth's rotation. Therefore, the earth's magnetic north and south poles are in different locations than the earth's geographic north and south poles. In addition, the earth's magnetic field is non-uniform, and changes over time. Magnetic variation, also known as magnetic declination, is the angle between magnetic north and true (or geographic) north, at the observer's current location.

A magnetic compass measures heading with respect to magnetic north. To convert this magnetic heading to true heading (that is, heading with respect to true north), the magnetic variation must be added to the measured magnetic heading value.

Because magnetic variation changes with location and gradually over time, it is necessary to calculate the magnetic variation using the user's present position and the current date. Therefore it is necessary to have a GPS with a fix in order to provide magnetic variation and heading with respect to true north.

## Air Temperature Sensor

The Sprayer Station includes a built-in negative-temperature-coefficient thermistor that measures the ambient air temperature. This NTC thermistor is located in a thermally isolated region of the Sprayer Station housing that is open to the outside air.

## Relative Humidity Sensor

The Sprayer Station contains a capacitive cell humidity sensor that measures the relative humidity of the air. Humidity refers to the amount of water vapor in the air. Relative humidity is the percentage of saturation of the water vapor in the air. It is the ratio of the moisture content of the air to the saturated moisture level at the same temperature and pressure.

**Barometric Pressure Sensor**

The Sprayer Station contains a temperature-compensated, silicon, piezoresistive, pressure sensor. It measures atmospheric pressure for use as a digital barometer

**GPS**

The Sprayer Station has a built-in Global Positioning System with its own antenna, receiver, and position determining electronics. The GPS receiver receives radio signals from a constellation of orbiting satellites maintained by the U.S. government. By accurately measuring the time it takes for a transmission to travel from each satellite to the receiver, the unit is able to determine the distance between the satellite and the receiver. When the distance is known to three satellites, the unit is able to calculate the latitude and longitude of the receiver. This is known as a 2D (2 dimensional) fix. If the distance is known to four or more satellites, then the unit is additionally able to calculate the altitude of the receiver. This is known as a 3D, or 3 dimensional fix.

On average, the GPS receiver in the Sprayer Station takes approximately one minute to achieve a position fix after power is first applied. This is known as the "time to first fix." The GPS receiver has 16 channels to track satellites, and will use up to 12 satellites in computing a position fix.

The GPS receiver synchronizes itself to the atomic clocks on board each satellite. This allows the GPS receiver to accurately determine the date and time as well.

If the GPS receiver is mounted on a moving vehicle, its changing position over time allows the speed and course over ground to be calculated. The course reported by a GPS is always with respect to true north.

The ability of the Sprayer Station to calculate true wind speed and direction depends on the presence of a GPS fix. If the GPS receiver is not tracking at least three satellites, then the Sprayer Station will be unable to provide true wind data. (Apparent wind data should always be available, regardless of the status of the GPS receiver.)

# Specifications

| | |
|---|---|
| Wind Resolution - Speed: | 0.1 mph (0.2 km/h); Direction 1° |
| Wind Speed Range: | 0 to 90 mph (0 to 145 km/h) |
| Wind Speed Accuracy: | < 12 mph (19 km/h): ±1.1 mph (1.7 km/h) + 10%;<br>> 12 mph (19 km/n): ±2.3 mph (3.7 km/h) or ± 5% |
| Wind Direction Accuracy | [over range of 32° to 131°F (0° to 55°C)]<br>4 to 11 mph (6 to 18 km/h): ±5°;<br>> 12 mph (19 km/h): ±2° |
| Operating Temperature | -13° to 131ºF (-25ºC to 55ºC) |
| Temperature Accuracy | ±2ºF (±1.1ºC) with wind above 4.6 mph (7.4 km/h) |
| Barometric Pressure Range | 24 to 33 in-Hg (800 to 1100 hPa) |
| Barometric Pressure Accuracy | ±0.029 in-Hg (± 1 hPa) |
| Relative Humidity Range | 10 to 95% |
| Relative Humidity Accuracy | ±5% with wind above 4.6 mph (7.4 km/h) |
| Power Supply Voltage | 9 to 40 VDC; Current: <90 mA |

CE

This equipment has been manufactured for
Spectrum Technologies, Inc.
12360 S. Industrial Dr. East
Plainfield, IL 60585 USA

The Manufacturer's **DECLARATION OF CONFORMITY** is on file at the above address, and certifies conformity to the following:

| | |
|---|---|
| Model Number: | 3349SS |
| Description: | WatchDog Sprayer Station |
| Directive: | EN 60945:1997-EMC Art 3.1b 00/05/CE |
| | Maritime Navigation and Radiocommunication Equipment and Systems |
| Clauses: | 9.2 Conducted Emissions |
| | 9.3 Radiated Emissions |
| | 10.2 Conducted Low Frequency Interference |
| | 10.3 Conducted Radio Frequency Interference |
| | 10.4 Radiated Interferences |
| | 10.5 Fast Transients of Signal and Control Lines |
| | 10.8 Immunity to Power Supply Failure |
| | 10.9 Immunity to Electrostatic Discharge |

# Warranty

This product is warranted to be free from defects in material or workmanship for one year from the date of purchase. During the warranty period Spectrum will, at its option, either repair or replace products that prove to be defective. This warranty does not cover damage due to improper installation or use, lightning, negligence, accident, or unauthorized modifications, or to incidental or consequential damages beyond the Spectrum product. Before returning a failed unit, you must obtain a Returned Materials Authorization (RMA) from Spectrum. Spectrum is not responsible for any package that is returned without a valid RMA number or for the loss of the package by any shipping company.

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