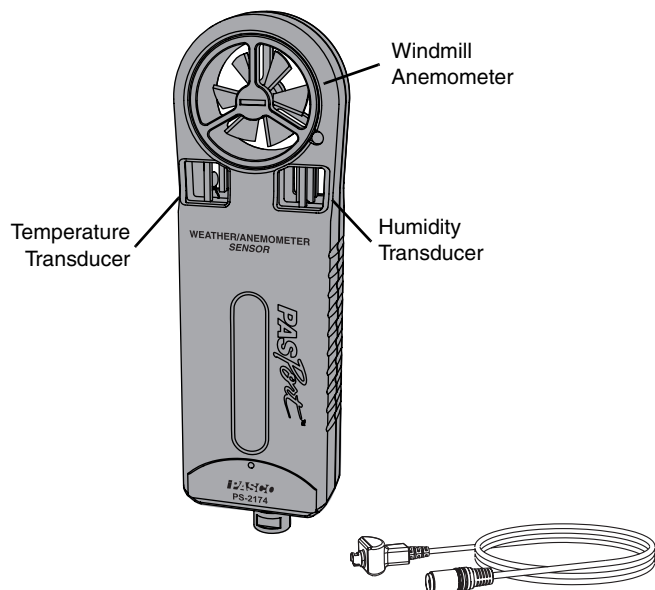


Weather/Anemometer Sensor

PS-2174



Included Equipment	Part Number
Weather/Anemometer Sensor	PS-2174
PASPORT Extension Cable	PS-2500
Additional Equipment Required	
PASPORT Interface	See page 4

Quick Start

1. Connect the Weather/Anemometer Sensor to your PASPORT interface.
2. If you are using a computer, connect the PASPORT interface to it and start DataStudio.
3. Shield the sensor from direct sunlight.
4. Hold the sensor so that so that air flows into the rear of the windmill.
5. Press or click the start button to begin recording data.

Introduction

The Weather/Anemometer Sensor measures

- wind speed,
- air temperature,
- relative humidity, and
- barometric pressure.

From these primary measurements it calculates

- wind gust speed
- dew point
- humidex
- wind chill, and
- absolute humidity.

The sensor connects to a PASPORT interface. If it is a logging interface (such as Xplorer or Xplorer GLX) in standalone mode, data are recorded and displayed on the interface itself. If the PASPORT interface is connected to a computer, data are recorded and displayed on the computer in DataStudio.

Set-up

Connect Sensor to Interface

Plug the sensor into any port of your PASPORT interface, either directly or using the PASPORT extension cable (PS-2500).

Sensor Positioning

- Optional: Screw a 1/4-20 threaded rod (such as CI-9874) or tripod into the mounting hole on the back of the sensor and mount it as illustrated (Figure 1).
- Hold (or mount) the sensor vertically so that air flows into the rear of the windmill (Figure 1).
- Shield the sensor from direct sunlight.

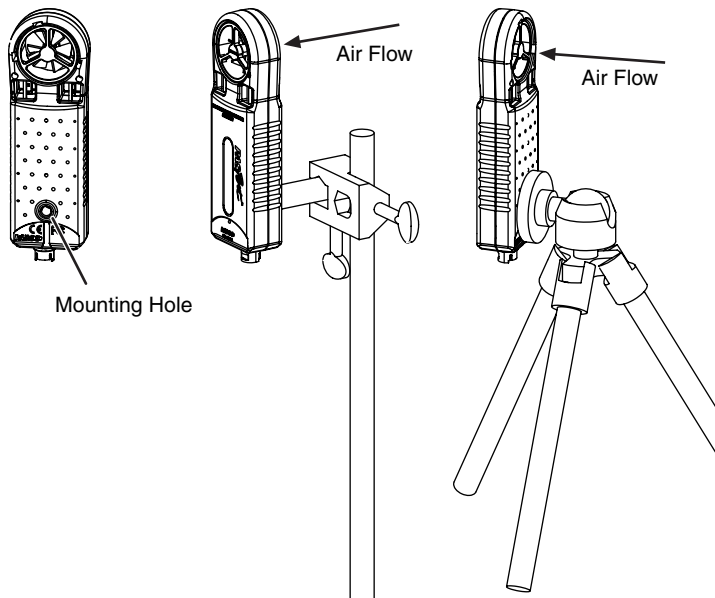


Figure 1: Mounting options and air flow direction

Interface and Software Configuration (Optional)

The interface or software automatically prepares itself for data recording when you connect the sensor. Follow the steps below to change the default settings.

GLX Configuration (Standalone Mode)

To Add Measurements to the Digits Screen

In the Digits screen, press **F2**, **F3**, or **F4** to display more measurements.

To Change the Displayed Measurement

In any display screen, press **✓** twice to open the data source menu, from which you can select a measurement for display.

To Change Measurement Units

1. In any display screen, press **✓** to light up the active fields.
2. Use the arrow keys to highlight the measurement unit.
3. Press **✓** to open the units menu, from which you can select a different unit.

To Change the Sampling Rate

1. Open the Sensors screen by pressing **⬆** + **F4**.
2. Press **✓** to open the Sample Rate Unit menu. For rates faster than once per second, select *samples/s*. For slower rates, Select *seconds*, *minutes*, or *hours*.

3. Press **✓** to highlight **Sample Rate**.
4. Press **+** or **-** to change the rate or time between samples.

DataStudio Configuration

To Create a New Data Display

1. Double-click the Graph, Digits, or other display icon in the Summary bar. A list of data sources appears.
2. Select the measurement that you want to display and click **OK**.

To Change Measurement Units

1. Click **Setup** to open the Experiment Setup window.
2. Under the first or second Measurements tab, click the unit of measure that you want to change. A menu opens.
3. Click the desired unit.

To change the sampling rate

1. Click **Setup** to open the Experiment Setup window.
2. Click the units next to the sample rate setting. A menu opens. For rates faster than once per second, select *Hz*. For slower rates, Select *seconds*, *minutes*, or *hours*.
3. Click the arrow buttons next to the **Sample Rate** setting to change the rate or time between samples.

Data Collection

GLX (standalone mode)

To Display Data without Recording

Open the Digits or Meters screen. The GLX displays live data.

To Record Data

1. Press **▶**. The GLX starts recording data.
2. Press **▶** again to stop recording.
3. Press **▶** again to start recording in a new data run.

DataStudio

To Display Data without Recording

1. Open the Experiment menu and select **Monitor**. DataStudio displays live data.

2. Click **Stop** to stop monitoring data.

To Record Data

1. Click **Start**. DataStudio starts recording data.
2. Click **Stop** to stop recording.
3. Click **Start** again to start recording in a new data run.

Measurement Tips

Equilibration Time After a rapid change in temperature or humidity, the sensor may take several seconds to come to equilibrium with the environment. Observe the measurements and wait for them to stabilize.

Alignment with Wind Hold the sensor so that wind blows straight into the back of the windmill.

Shade The sensor, especially the temperature and humidity transducers, must be out of direct sunlight to make accurate measurements.

Moisture Protect the sensor from liquid water. The sensor must be dry and free of condensation to make accurate measurements.

About the Measurements

Primary Measurements

The four primary measurements are determined from the sensor's wind, temperature, humidity, and pressure transducers.

Wind Speed The sensor determines *Wind Speed* from the rate of rotation of the windmill. It assumes that air is flowing straight into the back of the windmill. Wind speed must be at least 0.5 m/s to be measured accurately. Wind speed is measured in units of m/s, km/h, mph (miles per hour), knots, and ft/s (feet per second).

Air Temperature Temperature is measured by the thermistor temperature transducer. To work accurately, the transducer must be in shade. Temperature is measured on the Celsius and Fahrenheit scales.

Relative Humidity Relative humidity is measured by the humidity transducer. To work accurately, the transducer must be in shade and at air temperature. Relative humidity is reported as a percentage representing the ratio of the partial pressure of water vapor to the saturated vapor pressure.

Barometric Pressure Barometric Pressure is measured by a pressure transducer inside the unit. The reported Barometric Pressure is the actual air pressure, not sea-level corrected pres-

sure. Barometric Pressure is measured in units of mbar, hPa, and inHg (inches of mercury).

Secondary Measurements

Each secondary measurement is a calculation based on one or more of the primary measurements.

Wind Gust Speed Wind Gust is the maximum speed detected since the previous sample. For instance, if the sampling period is 1 minute, each Wind Gust value is the maximum speed that occurred in the previous minute. At the default sampling rate of 5 samples/s, Wind Gust Speed does not differ much from Wind Speed; however, at slower sampling rates, the difference may be significant. Wind Gust is measured in units of m/s, km/h, mph, knots, and ft/s.

For the Wind Gust measurement to be valid, the sensor must remain powered between samples. If your logging interface is allowed to "sleep" between samples, wind gusts may not be captured.

The graph (Figure 2) shows wind speed recorded at 5 samples/s. The circles represent what the measured data would have been if the sampling rate had been set to 1 sample every 10 s. The triangles show what the wind gust data would have been at that sampling rate.

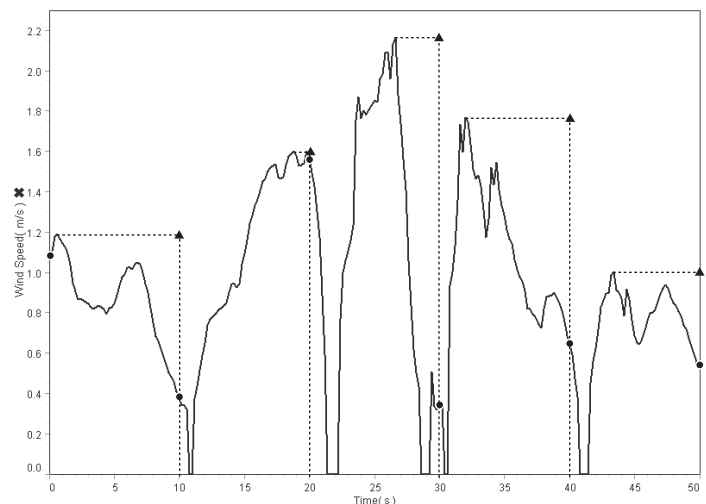


Figure 2: Wind Speed (circles) and Wind Gust (triangles)

Dew Point Dew Point is the temperature to which air must be cooled at constant pressure for water vapor to condense. Dew Point is reported as a temperature on the Celsius and Fahrenheit scales. The sensor calculates Dew Point (in °C) with the formula:

$$\text{Dew Point} = \frac{-430.22 + 237.7 \times \ln\left(\frac{\text{SatVP} \times \text{RH}}{100}\right)}{-\ln\left(\frac{\text{SatVP} \times \text{RH}}{100}\right) + 19.08}$$

where $\text{SatVP} = 6.11 \times 10^{7.75 \times T / (237.7 + T)}$ is the saturation water vapor pressure, RH is Relative Humidity (as a percentage), and T is Temperature in $^{\circ}\text{C}$.

Absolute Humidity Absolute Humidity is a measure of the mass of water vapor present in a given volume. It is reported in units of g/m^3 . The sensor calculates Absolute Humidity with the formula:

$$\text{Absolute Humidity} = \frac{13.24 \times \text{RH}}{T + 273.15} \times \exp\left(\frac{17.42T}{T + 239.7}\right)$$

Where RH is Relative Humidity (as a percentage), and T is Temperature in $^{\circ}\text{C}$.

Wind Chill Wind Chill indicates a combined effect of temperature and wind speed. It is reported as an apparent temperature on the Celsius and Fahrenheit scales. The sensor calculates Wind Chill (in $^{\circ}\text{C}$) using the formula:

$$\text{Wind Chill} = 0.0817(3.71\sqrt{V} + 10.45 - 0.28V)(T - 33) + 33$$

where V is wind speed in mph and T is temperature in $^{\circ}\text{C}$.

Humidex Humidex indicates a combined effect of temperature and humidity. It is reported as an apparent temperature on the Celsius and Fahrenheit scales. The sensor calculates Humidex (in $^{\circ}\text{C}$) using the formula:

$$\text{Humidex} = T + \frac{5}{9}(e - 10)$$

where T is temperature in $^{\circ}\text{C}$, and e is the water vapor pressure in mbar.

Sea-level Corrected Pressure

A typical weather station does not report the actual measured barometric pressure. Rather, it reports a “sea-level corrected” value. Use this formula to calculate the sea-level corrected pressure (in mbar):

$$[\text{Barometric Pressure (mbar)}] + 1013 * (1 - \exp(-h/7000))$$

where h is the sensor’s elevation in m. To have this calculation done automatically, enter it in the DataStudio calculator or GLX Calculator screen.

Specifications

Measurement	Range	Resolution	Accuracy (% of reading)
Wind Speed	0.5 to 29 m/s	0.1 m/s	$\pm(3\% \text{ of reading} + 0.2 \text{ m/s})$
Temperature	-20 to 55 $^{\circ}\text{C}$	0.1 $^{\circ}\text{C}$	$\pm 0.5 \text{ }^{\circ}\text{C}$
Relative Humidity	0 to 100%	1%	$\pm 2\%$
Barometric Pressure	150 to 1150 hPa	0.03 hPa	1 hPa

Compatible Interfaces

The Weather/Anemometer Sensor is compatible with all wired PASPORT interfaces and loggers including USB Link (PS-2100), Xplorer (PS-2000), PowerLink (PS-2001), and Xplorer GLX (PS-2002).

For wireless use, the Weather/Anemometer Sensor is compatible with AirLink SI model PS-2005A. It is not compatible with model PS-2005.

Technical Support

For assistance with any PASCO product, contact PASCO at:

Address: PASCO scientific
10101 Foothills Blvd.
Roseville, CA 95747-7100

Phone: 916-786-3800 (worldwide)
800-772-8700 (U.S.)

Fax: (916) 786-7565

Web: www.pasco.com

Email: support@pasco.com

Limited Warranty For a description of the product warranty, see the PASCO catalog.

Copyright The PASCO scientific 012-09911B *Weather/Anemometer Sensor Instruction Sheet* is copyrighted with all rights reserved. Permission is granted to non-profit educational institutions for reproduction of any part of this manual, providing the reproductions are used only in their laboratories and classrooms, and are not sold for profit. Reproduction under any other circumstances, without the written consent of PASCO scientific, is prohibited.

Trademarks PASCO, PASCO scientific, DataStudio, ScienceWorkshop, Xplorer and Xplorer GLX are trademarks or registered trademarks of PASCO scientific, in the United States and/or in other countries. All other brands, products, or service names are or may be trademarks or service marks of, and are used to identify, products or services of, their respective owners. For more information visit www.pasco.com/legal.