Choosing a Personal Weather Stations

Personal Weather Stations (PWS) come in many shapes, sizes, and prices. In recent years, there have been several technological improvements which make it easier than ever to install and maintain a PWS at your home or business.

Some stations are completely ***wireless*** – meaning there are no holes to drill for wiring to get the data into your home!

Many stations are also solar-powered, relying on a rechargeable battery to power the instruments through the night or cloudy days.

Unfortunately, there is still a strong relationship between **cost** and **quality**. Many PWS that retail in the $100 to $300 range are plagued with poor quality sensors – poorly shielded thermometers, inaccurate humidity sensors, and rain gauges that are too small.

Nearly all PWS will record the following:

- Temperature
- Humidity (Dewpoint)
- Wind
- Precipitation
- Barometric Pressure

Some stations may include options for solar radiation, soil temperature and soil moisture, and multiple temperature and humidity sensors.

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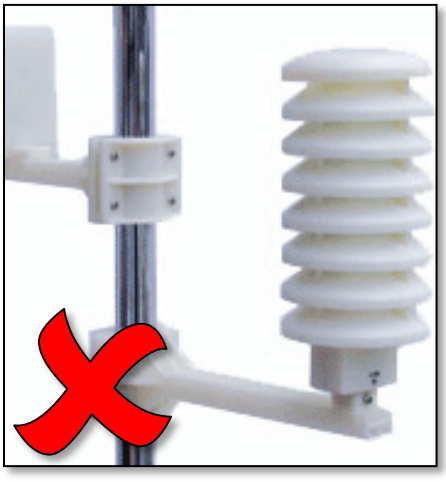
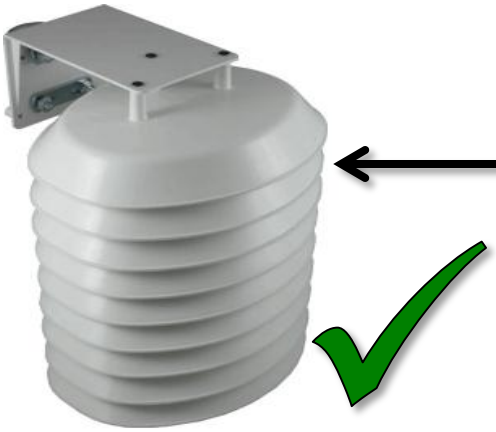
Temperature Sensors

AVOID temperature/humidity sensors that are not housed in a properly-sized radiation shield!

The temperature probe above has NO radiation shield and will likely report erroneously warm temperatures during the day.



While the sensor above *is* in a radiation shield, it is too small, with little space for proper airflow. It will likely report erroneously warm temperatures during the day.



However, personal weather stations with poorly-shielded temperature sensors can be outfitted with **after-market radiation shields** for improved performance.

The best temp/humidity sensors come enclosed in a 24hr ***Fan-Aspirated*** Radiation Shield. This keeps air flowing and prevents a 'warm bubble' from building up in the shield.

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Wind Speed/Direction

The most common anemometers come in two types: 'Propeller' or 'Spinning Cups.' Both work well in *most* weather…

However, both types of anemometers are susceptible to icing. Look for Black-colored anemometers, which will tend to 'thaw out' quicker than white-colored equipment.

Sonic Anemometers (left) are still fairly rare (and expensive), but are less likely to fail from icing. However, birds perching on the sensor probes can cause problems, and extremely high false wind gusts!

Plastic spikes and other creative solutions can keep the birds away, however.

Most PWS anemometers have wind speed reporting ranges of 0 to 100 mph or greater. Accuracy ratings are perhaps the most important factor when assessing an anemometer's quality. Look for accuracy ranges of ± 5% or better.

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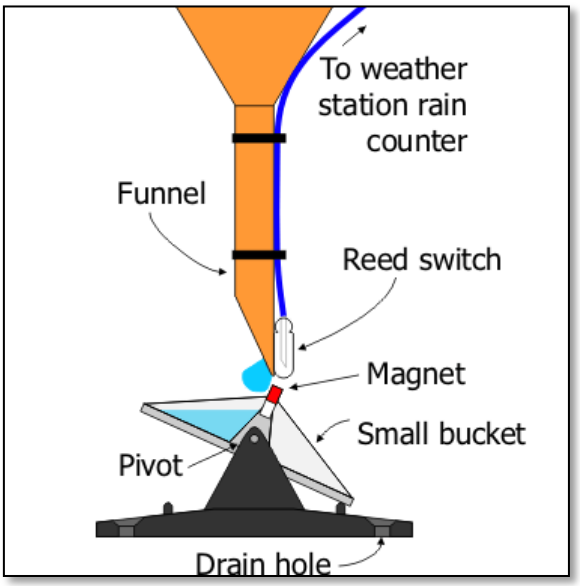
Precipitation

All PWS on the market today use “tipping bucket” rain gauges. The technology is fairly simple in principle. Essentially, rain fills up one side of a double-sided spoon (or ‘bucket’), and when a certain volume of rain is collected, gravity causes the bucket to pivot…draining the first bucket, and exposing a second, empty bucket. Each “tip” is calibrated to a given about of precipitation, usually 0.01 inches.



However, there is a drawback to simplicity. In cases of torrential rainfall, some rain may be lost “between tips.” This will result in a low-bias in ALL tipping bucket rain gauges. It is always good to have a standard rain gauge for final precipitation amounts… but standard rain gauges can’t report live data!

Avoid small rain gauges. The smaller the surface area that collects rainfall – the less accurate the measurement will be.

The rain gauge to the left has a funnel depth that is VERY shallow. This will allow large raindrops to partially “splash out” of the collection area, and it may overflow in heavy rainfall.

Look for a rain gauge with a wide diameter, preferably 4” or greater. The taller the rim or “walls” of the funnel…the better.

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Precipitation (cont.)

Data Resolution is very important when considering a rain gauge. Look for stations that report to the nearest one-hundredth of an inch (0.01). Some inexpensive models only report to the nearest 1 milimeter, or roughly 0.03 inches.

Snow can, and will, clog a rain gauge. While some PWS have optional rain gauge funnel heaters, they require a wired electric connection, and often cannot keep up with heavy snowfall. This is pretty much just a fact of life with Personal Weather Stations.

Humidity / Dewpoint

Personal Weather Stations calculate dewpoint based on temperature and Relative Humidity. However, some humidity sensors have very limited operating ranges, and high margins of error.

In very dry conditions, slight variations in Relative Humidity can have a tremendous impact on dewpoint values. For example, if the temperature is 52°F and the RH is 10%, the dewpoint will be -2.9°F. If the RH is 5%, the Dewpoint becomes -16.8°F.

Look for a PWS with Relative Humidity ranges as close to 0-100% as possible, with data resolution of at least 1%, and an accuracy rating of ± 3% or better.

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Barometric Pressure

Most Personal Weather Stations include an electronic barometer, usually built into the Display Console.

However, Barometric pressure can be described in several different ways, and every PWS seems to report something different!

Station Pressure is simply the true atmospheric pressure at a given location. It varies based on weather patterns, but also elevation. Higher elevation locations will always have lower Station Pressure than lower elevation sites.

Altimeter is calculated based on the station pressure and elevation, adjusted down to sea level.

Sea Level Pressure is *similar* to Altimeter, but is more complicated. Temperature changes over the past 12 hours are factored into the calculation, as a proxy for air density changes.

Unfortunately, Most Personal Weather Stations vaguely report "Barometric Pressure" without explicitly stating which type is actually being reported.

Example: Simultaneous Barometric Pressure Readings at Santa Teresa, NM

Station Pressure	882.67 mb	26.07 inHg
Altimeter	1025.8 mb	30.29 inHg
Sea Level Pressure	1024.7 mb	30.26 inHg

Due to constant problems with calibration and confusion over what type of Barometric Pressure is reported by a PWS, this weather element is of lesser importance when considering a PWS.

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