

Precise Weather Measurement for Optimized Indoor Controls



As unpredictable as the weather tends to be, real-time localized weather data is essential for certain operations such as free cooling of buildings, highly intelligent building automation systems, and ventilation control in greenhouses. An alternative to relying on dense weather network systems is to utilize reliable multi-parameter weather stations on-site. Miniaturized weather stations have evolved to become more affordable and dependable.

Weather measurements of interest can include temperature, relative humidity (RH), wet bulb temperature, dew point, wind speed and direction, solar radiation, barometric pressure, carbon dioxide, and various states of precipitation (rain, snow, sleet, hail, etc.). Instrumentation to measure each of these parameters is available on an individual basis or as combination units. Selection of parameters and combination units will depend upon the application.

Measuring Outdoor Parameters

In many applications, a single outdoor **humidity** and **temperature** combination transmitter is the only reference point controlling various setpoints for building ventilation systems. Sensor selection is often overlooked, yet it is a critical decision that building or process owners must endure throughout the life of a building or project. A humidity sensor impervious to dust,

chemicals and not damaged by condensation is recommended. The minimum recommended accuracy is $\pm 3\%$ RH (preferred is $\pm 2\%$ or better); acceptable variation in temperature is $\pm 1^\circ\text{C}$ ($\pm 2^\circ\text{F}$). To ensure accurate readings, the humidity and temperature transmitter should be installed along the north facing side of the building out of direct sunlight. A solar radiation shield is recommended for direct sun exposure. The unit should be installed away from dryer vents or discharge air from condenser fans. It should also be installed a minimum of 30 cm (12") above the normal average snowfall accumulation.

In natural ventilation systems, pressure differences enable circulation of fresh air in buildings. Pressure differentials can be caused by changes in wind speed and/or direction. **Wind speed** and **direction** are monitored to open or close vents or louvers to optimize the flow of fresh air. Wind speed and direction are also measured to control automated blinds, shades, skylights and retractable roofs to prevent costly damage due to high wind conditions. To optimize performance, the anemometer and vane should be installed a minimum of 1.2 m (4 ft) above any obstructions that may hamper air circulation. They are typically mounted on the ends of masts or poles. A television antenna or pipe on a rooftop will also suffice.

Surge protectors can be used to protect the unit from lightning strikes. Other safety measures include installing a lightning rod with the tip at least one meter (3 ft) above the wind sensor to protect

both personnel and equipment. The rod must be properly grounded, compliant with all local applicable safety regulations. The wind sensor should not be installed above the top of the lightning protection rod.

To avoid the nuisance of replacing spent bearings typical of mechanical anemometer and vane failure, an ultrasonic wind speed and direction transmitter is recommended. An ultrasonic wind speed and direction transmitter has no moving parts and is maintenance-free. Its starting threshold is virtually zero, resulting in error-free readings.

Precipitation is an important parameter for controlling skylights, retractable roofs, outdoor sprinkler systems, or heated walkways. A common instrument for measuring precipitation is a tipping bucket. More high tech solutions such as optical sensors and acoustic sensors which have no moving parts are maintenance-free and eliminate splashing errors sometimes experienced by tipping buckets. Regardless of the technology used, the precipitation sensor should be mounted on the rooftop or the ground away from large obstacles. For example, if a structure is over 12 m tall (40ft) the rain gauge should be placed at least 24 m (80ft) downwind from it. Sources of artificial precipitation such as sprinklers should also be avoided. The top of the gauge should be level and heavy rain should not be permitted to splash on the sensor from nearby surfaces. It should also be in an area protected from strong winds if possible.

Integrated Multi-parameter Weather Station to Increase Efficiency

A combination weather station can be comprised of several or all of the outdoor measurement parameters mentioned above. Installing and integrating a compact multi-parameter weather station is usually more practical than wiring individual sensor outputs.

An optimal weather station should require little maintenance, especially if it is installed in difficult to reach areas such as building rooftops or on masts. The sensors need to have a wide operating temperature range (-40 to 60°C) and be housed in enclosures that are well-ventilated but also protect the equipment from dust, condensation, rain, solar radiation, etc. The weather station outputs need to be easily integrated into controls systems and/or viewed on a display by the end user.

Real-time accurate information of outdoor conditions is a valuable asset to building operators. Vaisala Weather Transmitter WXT520 is compact and incorporates six parameters: wind speed and direction, temperature, humidity, barometric pressure and precipitation. In addition to the weather transmitter, Vaisala's product portfolio includes individual transmitters for measuring humidity parameters (relative humidity, absolute humidity, dew point, wet bulb, enthalpy, mixing ratio), temperature, carbon dioxide, wind speed and direction, precipitation and barometric pressure. Learn more at www.vaisala.com/WXT520.

Installation Tips: Humidity and Temperature Transmitters

- Avoid areas near exhaust fans or shaded areas that may affect measurements.
- Locate sensors away from heat and moisture sources.
- Avoid locations where air circulation is obstructed by structures or equipment.
- Utilize a pole-mast installation kit for cooling towers or building rooftops.
- Protect the sensors from precipitation and solar radiation.
- Install units along north facing side of building.
- Place sensors a minimum of 30 cm (12") above the normal average snowfall accumulation.

Wind Speed and Wind Direction Transmitters

- Utilize a pole-mast installation kit.
- Install the sensor a minimum of 1.2 m (4 ft) above any obstructions.
- Incorporate a surge protector and lightning rod with the tip at least one meter (3 ft) above the wind sensor to protect both personnel and equipment.

Precipitation Gauges

- Mount unit on the rooftop or the ground away from large obstacles.
- Avoid sources of artificial precipitation such as sprinklers.
- Ensure the top of the rain gauge is level.
- Locate unit in wind protected area if possible.

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