

Measuring relative humidity in test chambers



Unique solutions for:

- Continuous high humidity
- Aggressive gases
- Extremely dry environment
- Verifying high RH
- Pressure, RH, and temperature
- OEM solutions

Built-in value:

- Easy to install and maintain
- Low maintenance
- Proven and reliable designs
- Ability to customize
- Expert engineering support

Virtually every substance and material is sensitive to relative humidity (RH) and temperature in some way. Because of this there is a widespread need to create spaces where RH and temperature can be carefully controlled for the purpose of determining exactly how changing environmental conditions may affect the objects of interest.

These spaces may be small (table top size) or large (big enough to drive a truck into) and may or may not control other environmental parameters as well. For this discussion, all of these spaces will be referred to as “chambers.”

Selecting RH measurement devices for use in chambers requires careful evaluation. Due to the wide range of conditions chamber users and manufacturers need to create, there is no single measurement approach that will satisfy all needs. Aside from the obvious issues of temperature range and humidity range, more subtle factors must also be considered. For example, is it necessary to measure RH over the entire temperature operating range of a given chamber? Will condensation ever form within the chamber? Will unusual or aggressive gases be present within the chamber? Will the chamber run near 100% RH for extended periods of time? Start your search for RH measurement devices with these questions in mind.

Continuous high humidity

Environments that run at or near saturation are difficult for most electrical humidity sensors. Wet bulb temperature measurements can be accurate in saturated environments, but wet bulbs require constant maintenance and are less effective if the chamber will also operate in low RH conditions or at extreme temperatures. Vaisala has created “warmed probe” instruments specifically for high RH measurements. Warmed probes are automatically kept at a temperature several degrees higher than the surrounding temperature. This prevents condensation from forming on the sensor, keeping the measurement “on line” during condensation events. Warmed probes can also operate at temperatures and humidities where wet bulb measurement is not effective.

Aggressive gases

RH sensors must come into contact with the gas that they measure. RH sensors are manufactured from a variety of materials, and if the functional elements of a sensor change their properties as a result of contact with incompatible gases, this is manifest as sensor drift and loss of measurement accuracy. Vaisala has developed a “sensor purge” function that protects the most important functional element of the sensor. During sensor purge, the RH sensor is temporarily heated to over 100 deg. C, causing the sensor to outgas molecules that may be responsible for measurement inaccuracy. Sensor purge can be set to run automatically on a schedule of the user’s choice.

Extremely dry environment

Some environmental tests call for very low humidity; levels that may be 3% RH or lower. Most instruments that are specified for use over 0 to 100% RH do not perform well near 0, and in fact the desired measurement parameter is often no longer RH, but dewpoint temperature, or parts per million by volume (ppmv). Vaisala’s Drycap instruments can reliably measure water vapor levels as low as -80 deg C dewpoint. Measurements can be reported as dewpoint, ppmv, or a number of different parameters.

Verifying high RH

It is sometimes necessary to check chambers for correct operation at high humidity. This is difficult when the chamber is running at conditions that create a dewpoint temperature higher than ambient temperature. Test probes at ambient temperature, when inserted into the chamber, will become covered with condensation and the measurement will be erroneous. Vaisala addresses this problem with RH sensors that incorporate a “sensor pre-heat” function. Before insertion into the high RH environment, pre-heat is activated to raise the temperature of the sensor well above the chamber dewpoint temperature. The user then inserts the probe into the chamber and the probe cools to the chamber temperature, making an accurate measurement of RH and temperature within minutes.

Pressure, RH, and temperature

If it is desirable to monitor pressure as well as T and RH, Vaisala can provide one instrument for measuring all three parameters simultaneously. This is especially helpful when the humidity parameter of interest is pressure sensitive (for example, ppmv). These pressure sensitive parameters are calculated and displayed in real time, using the integrated pressure measurement.

Test and calibration

Users of chambers often need a tool to verify chamber conditions or calibrate the operating sensors within the chamber. Vaisala makes portable test instruments designed for these tasks. The MI70 measurement system provides a simple graphical user interface and a family of probes that can measure temperature, high RH, low RH, low dewpoint, and carbon dioxide concentration. Probes can be equipped with sensor pre-heat and sensor purge (see above). Data from all measurements can be viewed graphically, stored on the MI70, or transferred to a PC. In many cases, the MI70 can be directly connected to other Vaisala sensors, allowing for a fast and simple calibration interface.

