Catching the Drift:

What the Specifications of Your Humidity Measurement System Might be Missing

One of the hardest parameters to accurately measure, relative humidity is a pivotal factor across a broad spectrum of industries and often entails the potential to impact critical applications and public safety. In calibration, stability testing, or quality assurance processes, the intrinsic uncertainty of humidity measurement can be a major source of unnecessary cost, skewed data, and lost revenues.

Product data sheets for all relative humidity measuring devices must be scrutinized to ensure the system is sufficient for the application it will be used in. Basic knowledge of how these devices function will prove that often, critical information that is *not* provided by a manufacturer can be more revealing than what is.

Introduction

Understanding of how RH measuring devices function and how those functions are commonly represented in product specifications can help with selecting the right system.

Knowing what to look for in product specifications can also initiate incisive questioning of manufacturers about the accuracy of their humidity measuring systems.

Fact: All Humidity Sensors Drift

It's an immutable law of RH measurement. Sensors drift for the simple reason that they are "air breathers". Unlike temperature sensors, the internal structure of the humidity sensor must be in direct contact with the environment, which is constantly changing temperature and contains airborne contaminants. Both temperature and contaminants significantly affect the accuracy of any RH sensor. This is why, even if the calibration process were perfect (it isn't), once exposed to the real world, the measurement accuracy inevitably degrades.

RH Accuracy: Initial vs. One Year Later

There are two key accuracy values that must be considered when looking at any RH measuring device's product specifications. The first is Initial Accuracy; the other is One Year Accuracy.

Initial Accuracy is the device's accuracy when first deployed, fresh from calibration. This amount should include all known uncertainties:

- Calibration Uncertainty
- Temperature Effect & Mathematical Fit
- Hysteresis
- Measurement Resolution

One Year Accuracy is the accuracy of the device after a year of normal use — the typical interval between calibrations. Although One Year Accuracy is a critical value, it is usually excluded from product specifications.

The reason that the One Year Accuracy is such a key piece of information is that *all data gathered with an instrument since its last calibration is based solely on its accuracy when it's re-calibrated.*

For example, if your RH measurement device is found out-of-spec when re-calibrated, you will be faced with some hard choices. What products or tests were affected and to what extent?

Creating "Headroom"

Veriteq Instruments states the accuracy of their RH measuring devices after a year of typical use and over a wide temperature range on their spec sheets. The question is: why is the inclusion of these values on product specifications so rare within the industry?

To answer this question, it's vital to understand what determines sensor accuracy. There are three main elements:

- Sensor characteristics
- Calibration
- Sensor Measurement System (Electronics)

While Veriteq uses the best RH sensor available, as already stated: *all RH sensors drift.* To maximize overall accuracy, it is crucial to reduce errors that occur in the Calibration process and Sensor Measurement System.

This creates what Veriteq calls "Sensor Drift Headroom". In terms of instrument accuracy, "Headroom" is created by achieving optimal accuracy in Calibration and the Sensor Measurement System, thereby accommodating the impact of drift. Headroom in effect *anticipates* the drift by reducing or virtually eliminating all other sources of error.

Calibration Uncertainty

All humidity calibration chambers have an associated uncertainty, a major source of which is temperature non-uniformity. This must be factored into a measuring device's accuracy specification.

Before humidity calibration, Veriteq performs a high-accuracy temperature calibration on every data recorder. Each recorder's measured temperature is then able to compensate for chamber non-uniformity during RH calibration — greatly reducing this source of error.

Inside Veriteq's data recorders, the temperature sensor is placed right beside the RH sensor. This proximity allows both sensors to "read" the same environment, eliminating discrepancies between their measurements.

Temperature Effect & Mathematical Fit
Most RH measuring devices are calibrated to measure at one specific temperature (typically 25ºC). But, unless the device will only be used to measure humidity at that temperature, there can be significant temperature-related inaccuracies.

To solve this, there are 256 tables residing in the memory of every Veriteq humidity data recorder. These tables correlate humidity measurement over a wide range of calibrated temperatures. No two data recorders have the same set of tables because each set is calibrated to the unique components of every recorder.

Unlike other humidity recorders, Veriteq's is an "intelligent" device, because it contains explicit information on how to measure humidity over a wide temperature range. This is particularly important in the case of ICH (stability) applications.

Hysteresis
Hysteresis is the tendency of measuring devices to not return completely to their original state after a change has been measured. When measuring relative humidity, it can be a major source of error.

Unfortunately, too few data sheets include hysteresis as a factor in their accuracy values. If it appears at all, it's often de-emphasized by being placed far apart from the total accuracy specification. Hysteresis unmentioned or disconnected from an accuracy value should be considered product data obfuscation.

Measurement Resolution
Resolution is simply the smallest measurable increment that the device can detect. Veriteq uses a 12-bit high-resolution system that detects changes of as small as 0.05%RH.

Veriteq's Sensor Measurement System
A significant element that affects a device's accuracy is its electronic measurement system. Electronics systems are greatly impacted by temperature, which in turn affects overall measurement accuracy.

Veriteq's solution was to create a proprietary electronic system that has proved to be ultra-stable over wide temperature ranges. This new approach — based on a synchronous bridge measurement system — features low power and unmatched stability.[1]

Conclusion
Product specifications, often one of the only ways decision makers can select a suitable system, must be explicit, easy-to-understand, and straightforward.

All of the known influences and sources of error — calibration uncertainty, temperature effect, measurement resolution, and hysteresis — should be included in the accuracy value stated on any data sheet. If these values are not mentioned on a product data sheet, have they been included in that product's stated accuracy?

Manufacturers confronted with their own out-of-spec devices upon re-calibration, can always blame drift — rather than lack of diligence in eliminating sources of error.

About Veriteq
Since 1994, Veriteq Instruments has been innovating new methods to measure RH and temperature and provide users with accessible, validatable, and accurate data.

Providing solutions for both regulated and non-FDA/GxP industrial use, Veriteq works with a wide variety of industries and applications; from pharmaceutical companies, biotech and calibration laboratories, aerospace engineering facilities, to storage facilities for sensitive products.

Veriteq's system features an industry leading 10-year battery life and all products come with comprehensive specifications for Initial and One Year Accuracies.[2] Veriteq also provides software, monitoring and alarming solutions.

In essence, their approach is better technology, increased accuracy, and total transparency in product information. Veriteq's commitment to accuracy is evident in the solutions they create, as well as their product specifications, which are industry leading in depth and integrity.

For more information visit www.veriteq.com
Call 1 800 683 8374 (or 604 273 6850)
Email info@veriteq.com

VERITEQ
Superior Temperature & Humidity Monitoring

1 For an in-depth description of Veriteq's Sensor Measurement System, see "Methods of Accurately Measuring Capacitive RH Sensors" at: http://www.veriteq.com/download/Methods-of-Accurately-Measuring-Capacitive-RH-Sensors.pdf

2 Veriteq's data logger spec sheet "The Veriteq 2000 Series Temperature & RH Data Recorders" can be downloaded at: http://www.veriteq.com/download/datasheets/Veriteq-2000-Series-Datasheet.pdf