Calibration for Humidity Instruments

Helping you make a better measurement.

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MEASUREMENT SOLUTIONS

Presenters

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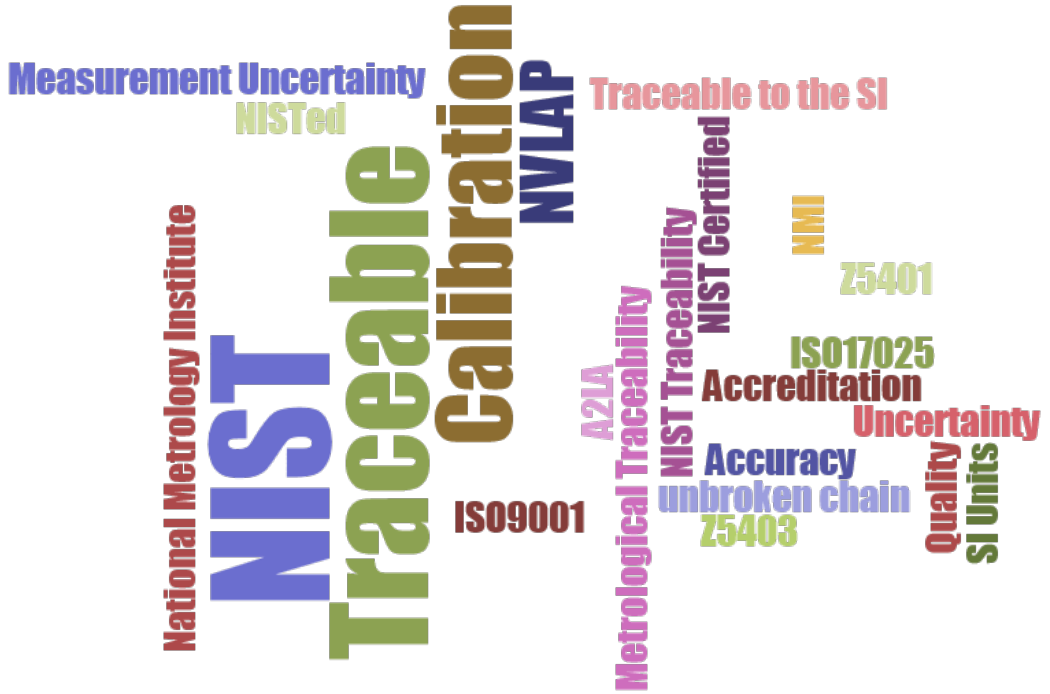
Agenda & Takeaways

Agenda

1. Terms & Definitions
2. Calibration Approaches
3. RH Generation Technology
4. RH Calibration Best Practices
5. Accredited Calibrations
6. Key Calibration Data

Takeaways for a Better Measurement

- Proper calibration means a better measurement
- All calibrations are not equal
- How to tell the difference between a good cal and a poor cal



Terms & Definitions

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Know the Difference

Calibration

- Compare the output of a measurement instrument to a reference instrument and reporting the result

Adjustment

- Change the reading of the instrument being calibrated to the reading of a reference instrument

Specification

- The stated performance of the instrument (usually by the manufacturer)

Traceability

What is “NIST Traceable”?

- Metrologically traceable to NIST's practical realization of the definition of a measurement unit

What is “Metrological Traceability”?

- Property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty

NIST
National Institute of Standards and Technology
U.S. Department of Commerce

Other Important Terms

Uncertainty (of measurement)

- Parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand.

Accuracy

- Accuracy refers to the closeness of a measured value to a standard or known value.

False Accept Risk

- The risk that a calibration result which is reported as in tolerance is actually out of tolerance.

Calibration Approaches

Lab Calibration

Pros

- Stability
- Fixed environment
- Controlled processes
- Lower uncertainties

Cons

- Logistics – need to bring in to lab
- Time
- Facility maintenance

Field Calibration

Pros

- In situ process
- Uninterrupted operations
- Faster than the lab process

Cons

- More variables
- Higher uncertainty
- Harder to control the environment
- Requires highly trained techs

Humidity Generation Technology

Saturated Salt Solutions

- Specific salts control an environment to a fixed relative humidity.
- A saturated salt water solution is created.
- Each salt creates a different equilibrium %RH value

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Saturated Salt Solutions

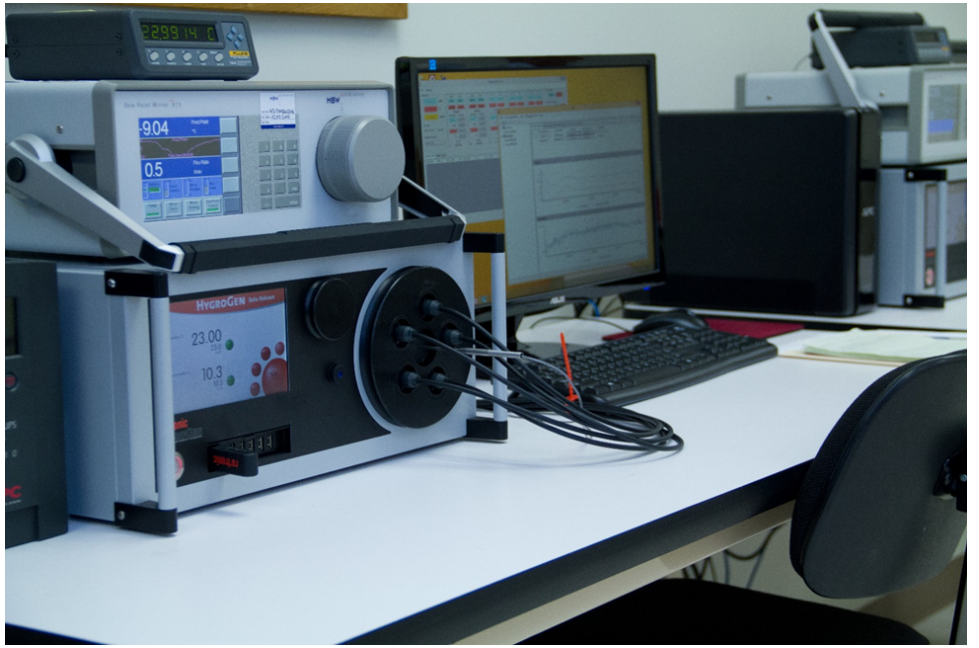
Pros	Cons
Low Cost	Highest Uncertainties
Self contained	Not temperature controlled
Portable	Salts and Water sensitive to contamination
	Can cause contamination of units under test
	Multiple salts baths needed to generate multiple RH levels
	Temperature sensitive

Use a saturated salt when:

- Spot check in hard to reach locations

Divided Flow Generators

- Mix Dry Air and Saturated Air to generate RH
- Controlled by RH sensor (typically capacitance based)
- Reference is either a Capacitance RH Sensor or a Chilled Mirror



Divided Flow Generators

Pros	Cons
Can be lower cost	Medium Uncertainties
Self contained	Not always temperature controlled
Generally considered portable	
Faster response times	
Allows for automation	

Use a divided flow generator when:

- Uncertainties are acceptable
- Speed is critical
- Size of generator is a factor
- Field calibrations

Two Pressure Generators

- Compress clean air
- Compressed air is saturated at a known temperature
- Air is expanded to atmospheric pressure into the test chamber
- No direct RH measurement for control. Uses Temperature and Pressure to calculate RH

Thunder Scientific 2500

Two Pressure Generators

Pros	Cons
Lower uncertainties	Higher Cost
Less sensitive to sensor drift	Requires clean high pressure air
Allows for automation	Slower response time
Doesn't require a separate reference standard	Generally low air flow rates

Use a two pressure generator when:

- Lowest uncertainties are required
- Laboratory based calibrations

Comments & Questions

If we don’t get to your question today, we’ll respond via email after the webinar.

Humidity Calibration Best Practices

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Relative Humidity Calibration Best Practices

- Measure as close as possible to the sensor
- Allow for equilibration (temperature & water vapor)
- Read results simultaneously
- Choose adjustment process carefully
- Follow manufacturers recommendations
- Calibrate the analog signal (if applicable)
- Consider spot checking in between calibrations

Accredited Calibrations

ISO 17025 Accredited Calibrations

- **Definition**
  - A calibration performed by a laboratory that can prove competence in a particular field of calibration to an outside body; A2LA, NVLAP

- **How do you know if you need accredited?**
  - Industry requirement
  - Internal procedures
  - Regulatory body
  - Credibility

Accredited Calibrations

Pros

- Reliability
- 3rd Party Accountability
- Audited quality system in place
- Documented and proven calibration capability

Cons

- More expensive
- Could take longer – equipment out of service
- Limited labs offer accredited calibrations

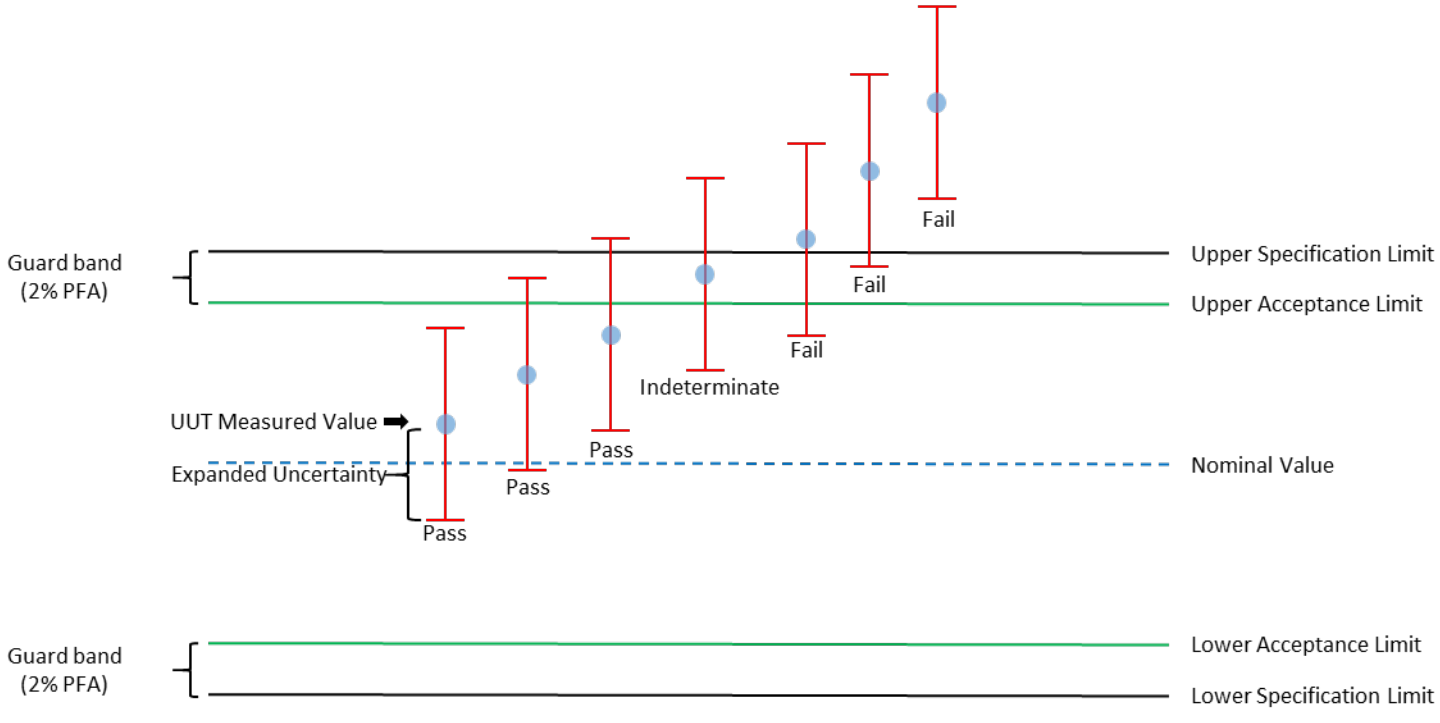
Key Calibration Information

Key Information

- **As Found Data**
  - How has my instrument been performing
- **As Left Data**
  - How is my instrument performing now
- **Calibration Uncertainty**
  - Required to provide metrological traceability
  - Key to understanding risk of False Accept

Taking Uncertainty into Account

- Uncertainty of measurement leads to risk of False Accept
- Guardband methods available to define and limit the risk
- Creates 3rd option for result: Indeterminate



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Takeaways

- Proper calibration means a better measurement
- All calibrations are not equal
- Best practices means lower uncertainty

Measurement Academy

- Resources for making a better measurement
  - Psychrometric charts
  - Technical notes
  - Humidity calculator
  - Application notes
  - more

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