ENVIRO ALERT®

Understanding Temperature System Calibration

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Calibration, Certification, and NIST

Calibration is the process of comparing the measurements of a qualified standard of known accuracy with the measurements of the device being calibrated. In the case of temperature, this generally means comparing 3-5 points throughout its range and documenting both the standard's measurements as well as the measurements of the device being calibrated along with any error from nominal. Additionally, the uncertainty of the measurement standard must be known and factored into the results.

Certification is the process of providing assurance that a product conforms to a standard or specification. This does not necessarily mean that a system that has been certified is more accurate than one that hasn't. It's simply proof that it's been evaluated and that the specifications have been met and were documented. Two common types of certification are Certificate of Calibration and Manufacturer's Declaration of Conformity. A manufacturer's certification is considered a first party certification. Most others are considered third party certifications. At this time, Winland does not offer calibration services, though there are many third parties that offer this service – either on-site or by sending in equipment for calibration.

Another common certification is a NIST Traceable Calibration. NIST (National Institute of Standards and Technology) is a non-regulatory agency of the U.S. Department of Commerce. The following are the NIST requirements for traceability:

To achieve traceability of measurement results to standards maintained by NIST, you need to reference your measurement results through an unbroken chain of calibrations, including determining the uncertainties at each step, to NIST standards as the specified references. These references may be standards developed and maintained by NIST, NIST Standard Reference Materials (SRMs), or NIST-Traceable Reference Materials (NTRMs). [1] A NIST-Traceable Reference Material is a reference material produced by a commercial supplier with a well-defined traceability to NIST established via criteria and protocols defined and documented by NIST and tailored to meet the needs of the metrological community to be served. [2]

Winland Thermistor Probes

Winland thermistor temperature probes offer accuracy as well as direct interchangeability for diverse temperature sensing applications. The name "thermistor" comes from the device's major characteristic – a thermally sensitive resistor. NTC thermistor resistance decreases as temperature increases providing accurate measurement for small and large temperature fluctuations. For the best accuracy, thermistor sensors are designed to work within a specific temperature range. Winland temperature sensing options cover high, low, and ultra-low temperature ranges. Probes are selected by ensuring both the desired high and low temperature limits are well within probe range. As with all temperature probes, size and mass determine response time. Winland thermistor probes are made as small as practicable in order to deliver crucial high-speed response times yet maintain durability long-term. Winland thermistor probes are tested by the probe manufacturer on a 100% basis using instrumentation and standards that are ITS-90 traceable to NIST. Though thermistors are aged prior to utilization in probe assemblies, some minor drift can occur over time – appreciably only when exposed to higher temperatures. Figure 1 and Figure 2 below illustrate this. Since it's not possible to calibrate a thermistor once encapsulated in a probe assembly, periodic probe replacement is a good method of preventive maintenance and will ensure accurate readings.

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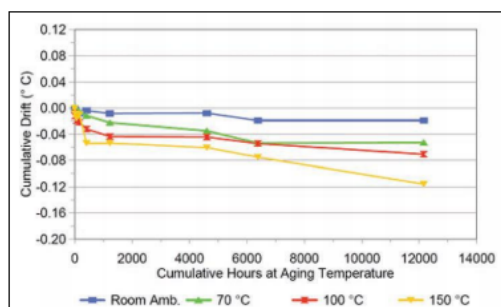| Operating Temperature	Epoxy-Coated	Glass-Coated
0°C	<0.01°C	<0.01°C
25°C	<0.01°C	<0.01°C
70°C	not available	not available
100°C	0.20°C	0.12°C
150°C	1.50°C	0.15°C
200°C	not applicable	0.20°C

Figure 1: Drift – 10 Month Data

Figure 2: Cumulative Drift

Winland thermistor probes have specified accuracies which vary by temperature. The following chart provides the various probe accuracies by temperature range:

Model Number(s)	-80 to -50°C (-112 to -58°F)	-50 to 0°C (-58 to 32°F)	0 to 70°C (32 to 158°F)	71 to 105°C (160 to 221°F)	106 to 150°C (223 to 300°F)
TEMP-L-S, TEMP-L-W	N/A	±0.55°C (0.99°F)	±0.20°C (0.36°F)	N/A	N/A
TEMP-H-S	N/A	N/A	±0.20°C (0.36°F)	±0.40°C (0.72°F)	±0.95°C (1.71°F)
TEMP-H-W	N/A	N/A	±0.88°C (1.58°F)	±1.45°C (2.61°F)	N/A
TEMP-UL-S	±1.00°C (1.80°F)	±1.00°C (1.80°F)	N/A	N/A	N/A

Winland EnviroAlert® Self-Calibration All of the EnviroAlert® products self-calibrate their A/D converters at power-up. In order to maintain long-term accuracy when reading the thermistor probes, the wired sensor inputs are calibrated by reading the short and precision resistor readings from each A/D channel. This is done once every 24 hours.

The fact that the EnviroAlert® has a self-calibration routine doesn't mean that the system has zero error in taking probe readings. In general, the largest error you can have throughout the range is due to rounding. Depending on the EnviroAlert® model being used along with how many digits are displayed to the right of the decimal point, it should be assumed that a 0.05° minimum error could be present when reading tenths and a 0.5° minimum error when reading whole numbers. Additionally, component failures could cause skewed readings. Fortunately, this is usually obvious with errors railing to the highest or lowest number in the programmed sensor type's range.

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Summary

In general, to maintain compliance you must diligently maintain a system of regularly scheduled calibrations. You must determine the error of the entire system as a whole in order to properly assess full system accuracy. Additionally, maintaining a calibration system provides assurance that your equipment is functioning properly.

NIST Calibrations have various options, including set points and length. Winland works with thrid-party labs to offer calibrations anywhere from 12 months to 24 months.

As an alarm device, measurement is only one part. It's very important that you periodically test the system's ability to trigger alarms through your security system resulting in your chosen method of notification.

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