

What is measurement traceability, and why is it important?

We define measurement traceability as the "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."

Measurement traceability ensures that all testing and calibration results are traceable through NIST or another NMI to the International System of Units (SI). It's important because it gives you confidence and assurance that your measurement results agree with national or international standards within the statement of uncertainty in measurement. Without traceability, a laboratory can claim anything they want in a test or calibration report. With traceability and the independent verification of an accreditation or inspection body, you can minimize the risk of receiving false information.

The important thing to remember is the results you report to your customers may be used to provide calibrations, perform tests, manufacture products, or make decisions that could affect health, safety, and even legal proceedings. It is important!

Do I need my own calibration standard?

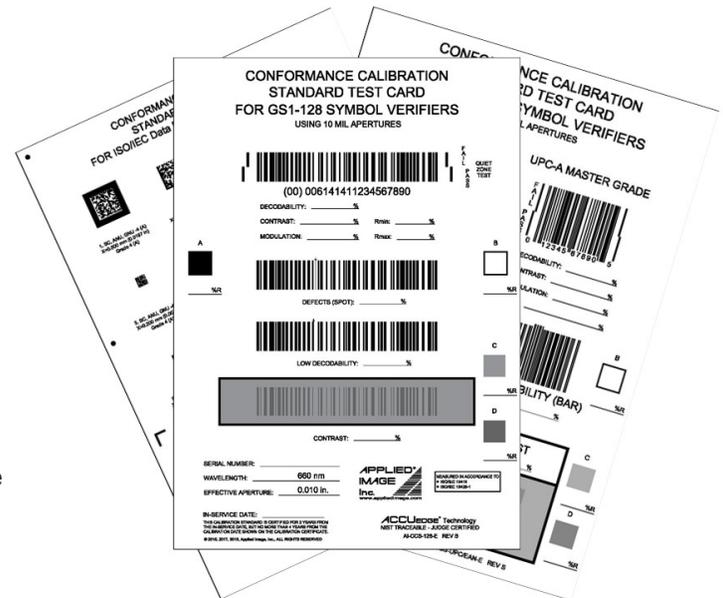
It's important to make sure that any measurements you are making, upon which decisions or representations of product quality are being made, can be reliably related to the appropriate reference value. Calibration standards are the fundamental reference for any measurement system.

There are three levels of standards in the hierarchy of metrology: primary, secondary, and working standards. Primary standards (the highest quality) do not reference any other standards and are kept in pristine condition.

Secondary standards are calibrated to a primary standard. Working or reference standards used to calibrate (or check) measuring instruments or other material measures are calibrated to secondary standards.

To guarantee the integrity of the measurements being made, most metrology systems require measuring instruments to be periodically calibrated against an appropriate reference standard.

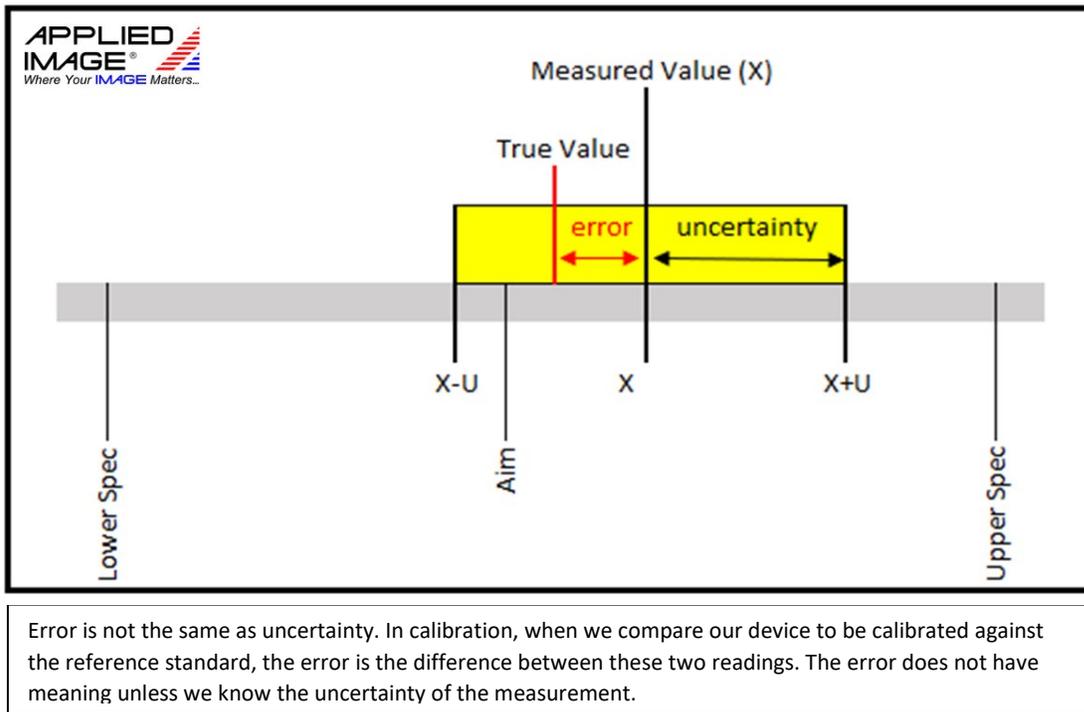
The frequency of these checks can vary dramatically, depending on the frequency of use and stability of the measurement instrument. Even if you send an instrument out for periodic calibration, it may be desirable to have a reference standard on-hand to validate daily results.



It's also important to periodically check the condition of the working standard itself, and many quality systems will require these also to be recertified on some periodic basis. Often a one- or two-year interval is applied, depending on the stability of the standard and the level of risk associated with the measurements being made.

Why should I care about uncertainty?

Measurement uncertainty, as used here, means the range of possible values within which the true value of the measurement lies. The GUM defines measurement uncertainty as a "parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand". (GUM - Evaluation of measurement data — Guide to the expression of uncertainty in measurement)



As mentioned above, a traceable measurement system accounts for all the components of uncertainty in a measurement system, and are reported as part of a calibration report.

It's important to understand how large the measurement uncertainty is in relation to the tolerance limits set on the measurement itself. For example, if you're interested in a measurement that has an aim value of say 10 mm, with a tolerance of ± 2 mm, you really want to make sure your measuring instrument has an uncertainty no greater than 10-25% of the overall tolerance range of the measurement of interest, in this case, no more than 0.5 mm.

Considerations for barcode applications

The barcode industry has used Conformance Calibration Standard Test Cards as the de facto calibration artifact for barcode verifiers since the early 1990's. These test cards, along with custom designed, photo-composed test cards have key attributes that ensure high accuracy, repeatability, and traceability to industry standards, and can be specifically used for:

- Barcode Verifier Calibration
- Scanner Performance Testing
- Print Quality Control
- Optical System Performance & Calibration
- Software Algorithm Validation
- Production Line Acceptance Testing

Critical to success, these high-quality calibration/test artifacts should provide:

- 1) High Dimensional Accuracy
- 2) Stable and Consistent Optical Properties
- 3) Certified Traceability to International Standards for dimensional and photometric measurements
- 4) Environmental and Mechanical Durability
- 5) Application-Specific Design Considerations