APPLIED IMAGE®
Where Your IMAGE Matters...

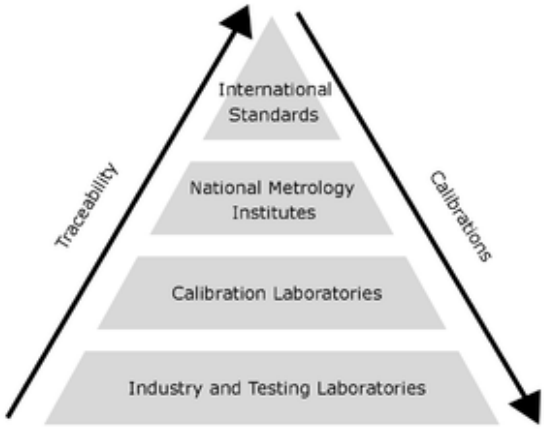
Measurement and Calibration: Quick Reference Guide

A guide to help improve product quality through accurate measuring devices.

What is Metrology?

Metrology is defined by the International Bureau of Weights and Measures (BIPM) as "the science of measurement, embracing both experimental and theoretical determinations at any level of uncertainty in any field of science and technology." It is a very broad field, but can be summarized through three basic activities:

1) the definition of internationally accepted units of measurement (SI Units),
2) the realization of these units of measurement in practice, and
3) the application of unbroken chains of traceability, each contributing to the measurement uncertainty.



Industrial metrology is concerned with the application of measurement to manufacturing processes as well as the resulting products being produced. In the industrial setting, the user of the instrument must be certain of the suitability of the measurement instrument, its calibration, and the quality control procedures under which they are operated.

Why use an accredited calibration laboratory?

Calibration laboratories are generally responsible for calibrations of industrial instrumentation or the reference standards used to calibrate them, or both. An accredited calibration laboratory is evaluated according to an international standard such as ISO/IEC 17025:2017. The accreditation process ensures the competence of the laboratory and provides a traceability link back to a national metrology institute (NMI).

ANAB

CERTIFICATE OF ACCREDITATION

ANSI National Accreditation Board
11617 Coldwater Road, Fort Wayne, IN 46845 USA

This is to certify that

Applied Image Inc.
1653 East Main Street
Rochester, NY 14609

has been assessed by ANAB and meets the requirements of international standard

ISO/IEC 17025:2017

while demonstrating technical competence in the field of

CALIBRATION

Refer to the accompanying Scope of Accreditation for information regarding the types of activities to which this accreditation applies

AC-2818
Certificate Number

ANAB Approval

Certificate Valid Through: 10/30/2021
Version No. 001 Issued: 10/30/2019

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

Some examples of NMI's are the National Institute of Standards and Technology (NIST) in the United States, the National Research Council (NRC) in Canada, the Korea Research Institute of Standards and Science (KRISS).

There is a significant difference between being compliant and being accredited. Often the term compliant is used when a company offering goods or services is not accredited to the particular standard referenced to as compliant. Choose an accredited laboratory over an ISO 17025 compliant laboratory to mitigate risk, increase confidence, and meet quality requirements.

Why do I need to calibrate my measuring instrument?

Calibration is an operation that establishes a relation between a measurement standard with a known measurement uncertainty and the device that is being evaluated. The process will determine the measurement value and uncertainty of the device that is being calibrated and create a traceability link to the measurement standard.

The four primary reasons for calibrations are to provide

- traceability,
- ensure that the instrument (or standard) is consistent with other measurements,
- determine accuracy, and
- establish reliability.

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.

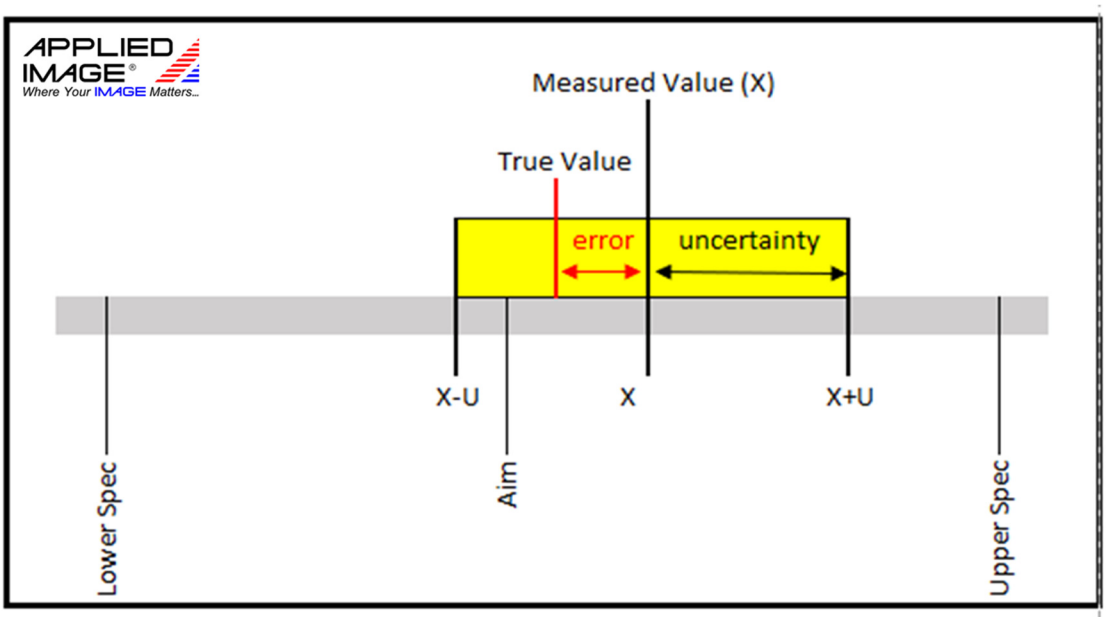
To guarantee the integrity of the measurements being made, most metrology systems require measuring instruments to be periodically calibrated against an appropriate reference standard.

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)



Error is not the same as uncertainty. In calibration, when we compare our device to be calibrated against the reference standard, the error is the difference between these two readings. The error does not have meaning unless we know the uncertainty of the 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.

APPLIED IMAGE

Custom Manufacturer of Precision Imaged Optical Components And Calibration Standards

Our assurances include

- risk mitigation using our ISO/IEC 17025:2017 accredited calibration laboratory,
- NIST traceable calibration standards and services that are made to customers' specific requirements,
- certified calibration results with extremely high accuracy and low uncertainties,
- third party calibration standards calibrated in our accredited metrology laboratory, and
- recalibration services at any interval required over the useful life of the standard.

If you have specific areas of interest, **Contact us** at www.appliedimage.com/contact-us for questions, to review drawings, or a quote for a Standard Catalog Product.