Calibration

Accuracy | Traceability | Documentation

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NATIONAL INSTRUMENTS

Calibration Made Simple

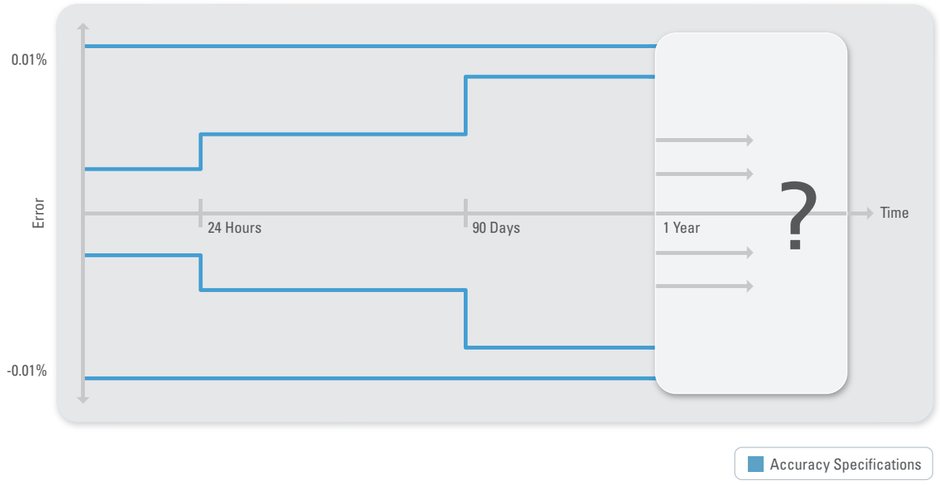
As a manufacturer of high-accuracy measurement products, National Instruments understands the need to maintain properly calibrated equipment. Calibration is the comparison of an instrument's actual measurement performance to a standard of known accuracy. With calibration, you can achieve the following:

- Ensure accurate measurements
- Trace measurements back to known and accepted standards
- Increase production yields
- Meet quality program requirements such as ISO 9001
- Provide a basis for comparing measurements between different users

Critical for maintaining performance and accuracy, calibration can be performed on a wide range of instruments.

Calibration Intervals

The accuracy of the electronic components of all instruments drifts over time, with factors such as time in service and environmental conditions contributing. Devices are designed and tested so this error is noted in accuracy specifications, but after a defined length of time called the calibration interval, most manufacturers no longer specify the measurement accuracy. To maintain specified measurement performance, instruments must be calibrated at regular intervals as defined by the manufacturer.



For most computer-based data acquisition and instrumentation hardware, NI supplies graduated accuracy tables.

Self-Calibration

Self-calibration, or internal calibration, uses onboard signal references to adjust measurement accuracy. During self-calibration, the instrument measures the onboard references and adjusts its measured performance to account for changes due to environmental effects such as temperature.

The adjustment of measured values during self-calibration does not account for the drift of the onboard signal reference and does not replace the need for external calibration. Performing regular external calibration helps ensure the onboard reference signals are accurate and maximizes overall measurement performance.

External Calibration

There are a number of reasons to send an instrument to the manufacturer or a suitable metrology laboratory for external calibration, including when you need to verify performance, when the calibration interval has expired or your predefined service time has elapsed, when the instrument has been operated in an extreme environment, or when measurements appear questionable. External calibration includes verification of the instrument's capabilities and provides for adjustments to measurement circuitry and onboard signal references if needed. Typically, a calibration certificate is issued verifying the instrument's measurement performance at the time of calibration.

System Calibration

System calibration, the most comprehensive method of calibration, quantifies and compensates for the total measurement error in a system. By applying known inputs and reviewing the resulting measurement, you can develop a model that represents the error of the system and compensate for this error by applying correction coefficients to your measured data.

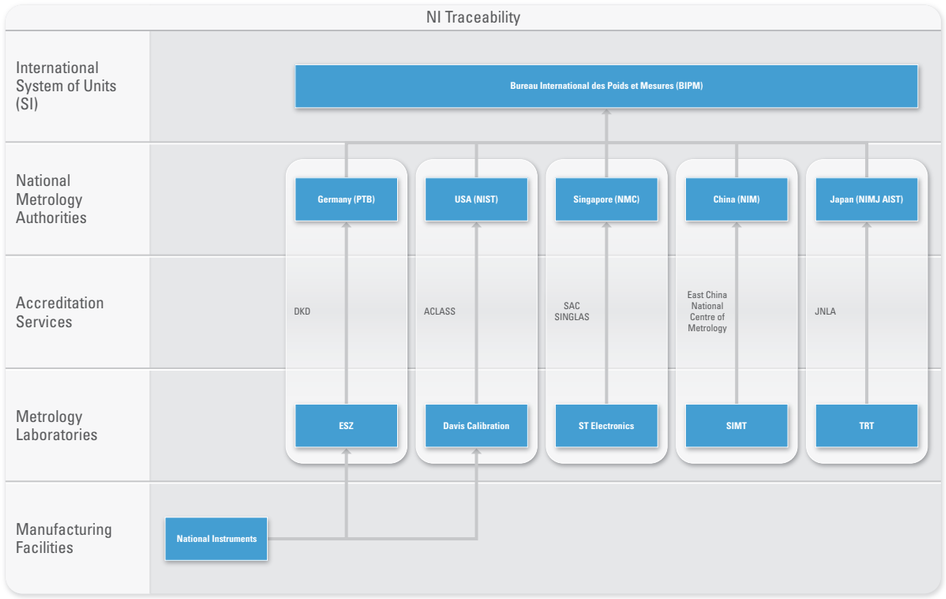
Computer-based data acquisition and instrumentation hardware is ideal for this type of compensation because you can quickly and easily apply your correction in software. System calibration does not completely replace the need to perform external calibration on individual system components in order to meet the requirements of quality programs.

The Importance of Traceability

One of the most basic requirements of calibration is proof of traceability, an unbroken chain of comparisons between an instrument's measurement and a known standard. Because these well-quantified standards are maintained by national and international organizations, they provide a reference for all traceable measurements. Traceability between your measurements and these standards provides the following advantages:

- The ability to trace your measurement uncertainty back to an accepted standard
- Acceptance of your instrument's measurement capabilities between countries
- Ability to determine the maximum uncertainty of your measurements
- Correlation between your measurements and those of other traceable entities

Traceability is defined at a number of levels. The Bureau International des Poids et Mesures (BIPM) ensures worldwide uniformity of measurements and their traceability to the International System of Units (SI). It does this with the authority of the Convention of the Metre, a diplomatic treaty among member nations. The BIPM also participates in and organizes international comparisons of national measurement standards, as well as conducts calibrations for member states.



Tracing your instruments' accuracy to known standards is a critical part of calibration.

NI provides a full range of calibration services.

Further down the chain, at the national level, each country has different legal metrology authorities. These bodies follow the guidelines defined by the BIPM and its associated committees to provide quality measurement standards for their associated countries. The National Metrology Institute (NMI) of each member state of the Convention of the Metre also participates in the Mutual Recognition Agreement (MRA). This document provides, among other things, a mutual recognition of calibration and measurement certificates issued by NMI.

Finally, each country has accreditation institutes that audit and accredit local metrology laboratories to the standards set forth by their NMI. In Europe, many of these accreditation institutes participate in the EA Multilateral Agreement (MLA) to ensure that accreditations in one country are acceptable in others.

Calibration and the NI Hardware Advantage

National Instruments computer-based data acquisition and instrumentation hardware is calibrated at the factory to ensure measurement accuracy and to verify that the devices meet published specifications.

NI products calibrated at the time of manufacture are traceable to international standards such as the National Institute of Standards and Technologies (NIST) in the Americas and the Physikalisch-Technische Bundesanstalt (PTB) in Europe. By performing calibration traceable to these standards, NI can help ensure that measurements taken in one country are accepted in all other participating countries. With this calibration, NI provides a certificate of calibration recognized in all countries as documented proof that the hardware meets published specifications. To maintain maximum measurement performance, NI can recalibrate your NI products to meet factory specifications.

Unlike traditional box instruments, computer-based hardware uses software applications that you create to define your measurement functionality. In this way, you can easily add error compensation and automate system calibration in your application software. By regularly calibrating your NI hardware and taking advantage of the flexibility that comes with software-defined instruments, you can maintain unquestionable measurement performance.

NI Calibration Certification

To help meet your calibration needs, National Instruments provides calibration support and services. These options include product recalibration services, manual calibration procedures, and automated calibration software specifically designed for metrology laboratory use. Used as part of your complete calibration solution, these offerings can help you ensure the accuracy of your instruments.

NI Calibration Service

National Instruments offers two service options for maintaining your instrument's measurement performance: Basic and Detailed Calibration. You can obtain these services for your instrument at the time of purchase, or anytime after, to maintain the instrument's performance.

After the calibration interval expires, you can return your products to NI for recalibration. To order recalibration, contact National Instruments to obtain a calibration Return Merchandise Authorization (RMA) number and specify the type of calibration service when you order.

Through independent calibration service providers, you can obtain additional NI product calibration services such as express calibration service, on-site calibration services, and calibration for all of your measurement hardware including instrumentation products that are not from NI.

Features	Basic Calibration Certificate	Detailed Calibration Certificate
Identity of device including: ▪ Date of calibration ▪ Traceability to international standards ▪ Environmental conditions	✓	✓
Standards used are listed on the certificate	✓	✓
Available as service by returning product to NI for recalibration	✓	✓
Available for purchase at time of order	Free	✓
Available in soft copy at ni.com/calibration	✓	–
Detailed measurement data	–	✓

NI Calibration Services

NI offers calibration solutions for all of your instrumentation, even hardware for other companies.

Basic Calibration

NI offers a Basic Calibration certificate with all new measurement products at no charge to you. This certificate states that the product is calibrated and provides traceability to internationally accepted standards, which can help you meet the requirements of quality standards programs such as ISO 9001.

Detailed Calibration

If your quality requirements state that you need more than a Basic Calibration certificate, NI offers Detailed Calibration service. Detailed Calibration certificates from NI contain detailed measurement data to help you meet the requirements of even more stringent internationally accepted quality standards. NI offers Detailed Calibration certificates for purchase at the time you acquire your measurement hardware.

Manual Calibration Procedures

To support more advanced metrology laboratories, NI provides access to manual calibration procedures, which offer detailed step-by-step instructions for verifying and adjusting the performance of NI products during calibration. These documents also define the required calibration standards, software functions, and test specifications used during the calibration.

NI Calibration Executive

Using manual calibration procedures can be slow and can require software development to adjust measurement hardware. For users and laboratories that do not have the time or expertise to develop their own calibration software, NI provides a turnkey calibration application – NI Calibration Executive.

NI Calibration Executive, which was developed primarily for metrology laboratories, automates the verification and adjustment of your NI products. By using NI Calibration Executive, you can easily automate your calibration operations and benefit from NI technology such as NI-VISA universal I/O interface software, IVI drivers, and NI TestStand and LabVIEW software. NI Calibration Executive:

- Externally calibrates most NI measurement devices
- Operates in automatic or manual mode through an intuitive user interface
- Automatically configures and controls calibration instruments
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NI Calibration Executive hardware adapter for NI 435x devices 778031-03
NI FP-TB-CAL calibration base for FieldPoint 777519-90
NI cFP-CAL calibration backplane for Compact FieldPoint 779646-01

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 2009-10627-911-101-D