Calibration of Measuring Instruments

In daily usage, consistent differentiation between the terms calibration and adjustment is frequently neglected.

**Calibration** involves ascertaining and documenting deviation of the measured value from a retraceable, highly accurate test standard. The measured value obtained from a measuring instrument is thus compared with the known value of the test standard under specified reference conditions using reproducible measuring procedures. Calibration does not involve any manipulation of the measuring instrument, which remains entirely unchanged.

**Adjustment** involves the correction or balancing of a measuring instrument in order to eliminate systematic measurement deviation. The measured value obtained from a measuring instrument is thus adjusted to match the known value of the test standard under specified reference conditions. Adjustment always involves manipulation, which permanently changes the measuring instrument.

**Retraceability** of a calibration procedure means that the calibration sequence is reproducibly documented from the individual device under test all the way up to the national standard for the respective measured quantity. Retraceability of measurement results is assured by a country’s metrological infrastructure.

**Why do measuring instruments have to be calibrated?**

As a standard for quality management systems, DIN EN ISO 9001:2008 stipulates essential requirements for monitoring measuring instruments in section 7.6, insofar as they are used to assure compliant results, and thus uniform product quality as well. Measuring instruments must be retraced to national standards at regular intervals by means of calibration, and if necessary adjusted, and plainly labeled with their calibration status. If it is determined during calibration that the measuring instrument does not fulfill the specified requirements, the operating company must evaluate the validity of previously obtained measurement results and implement appropriate measures with regard to the measuring instrument itself, as well as all affected products.

Consequently, calibration at regular intervals assures the quality of the respective product or service on the basis of internationally comparable measurement results. This provides for legal security with respect to product liability, as well as for approval tests and audits.

Due to its assured retraceability to national test standards, DAkkS calibration is advisable for the recalibration of measuring instruments which, in turn, are used as test standards for monitoring other measuring and test equipment.

**Accredited Calibration (DAkkS calibration)**

The Deutsche Akkreditierungsstelle GmbH (DAkkS) is the national accreditation body for the Federal Republic of Germany for, amongst other functions, auditing, accreditation and monitoring of test and calibration laboratories in accordance with DIN EN ISO/IEC 17025. This standard includes requirements for the technical qualifications and competence of the laboratory, as well as its quality management system.

DAkkS calibration certificates can only be issued for the measured quantities described in the accredited laboratory’s QM manual and published by DAkkS. External audits and reaccreditation assure high levels of quality, which are achieved for the most part by means of retraceable test standards, defined ambient conditions and test procedures, and highly qualified personnel. The expenses associated with these procedures,
as well as the personnel required for their execution, pay for themselves in terms of highly precise measurement results, but are also reflected in increased calibration costs.

Worldwide recognition of DAkkS calibration certificates represents an additional advantage of accredited calibration. This is the result of multilateral agreements concerning mutual recognition of accreditation systems entered into by the European Cooperation For Accreditation (EA), as the European umbrella organization, and the International Laboratory Accreditation Cooperation (ILAC).

**Factory Calibration (ISO calibration)**

Factory calibration is frequently conducted by manufacturers or non-accredited laboratories, whose measuring equipment is subject to monitoring in accordance with DIN EN ISO 9001:2008. As opposed to accredited laboratories, no external assessment of technical qualifications and competence is required in this case.

The content to be included in factory calibration certificates can be agreed upon in cooperation with the calibration laboratory. If the utilized measuring procedure is not recognized, retraceability of the measurement results must be substantiated in the calibration certificate. Measuring uncertainty may be included, and the same criteria are normally used as is also the case with accredited calibration. The lower expenses associated with these procedures, as well as the personnel required for their execution, are reflected in reduced calibration costs as compared with accredited calibration.

ISO calibration is a genuine alternative in the event that DAkkS calibration is not available for the respective measured quantity, or is unattractive due to its higher costs. However, great caution should be exercised in the case of uncertain retraceability of measurement results. Auditors may dispute or reject factory calibration certificates under these circumstances.

**Calibration Intervals**

Time between any two calibrations of measuring and test instruments is known as the calibration interval and must be established and monitored by the user in accordance with his own requirements. Essential criteria for determining the calibration interval include:

- Measured quantity and permissible tolerance
- The extent to which the measuring and test equipment is subject to stressing
- Frequency of use
- Ambient conditions
- Stability of previous calibrations
- Required measuring accuracy
- Company-specific requirements specified by the quality assurance system

We recommend a calibration interval of 1 to 2 years for use under normal conditions. We recommend a calibration interval of 1 year for measuring instruments which are used on a regular basis for audits, evaluating work safety and assuring the quality of products and services, as well as under severe ambient conditions.
Strictest Standards for the GOSSEN Light Lab

The GOSSEN Light Lab is equipped with a tested and monitored optical table, whose traceability to the national standard maintained by the PTB (German Federal Institute of Physics and Metrology) is assured by means of a Wi41G standard lamp. The lab is subject to test equipment monitoring in accordance with DIN EN ISO 9001:2008, and is additionally accredited for illuminance by DAkkks in accordance with DIN EN ISO/IEC 17025 under registration number D-K-15080-01-01. And thus you can count on product quality, the competence of our employees, continuous external monitoring and international recognition of our calibration services. GOSSEN offers two different calibration certificates.

The factory calibration certificate encompasses testing and documentation of various degrees of illuminance and luminance with light type A over the entire measuring range from 2 to 10,000 lx or from 0.5 to 2000 cd/m² with 3% measuring uncertainty. Measuring uncertainty is 4.5% in the range of greater than 10,000 to 50,000 lx or greater than 2000 to 10,000 cd/m². Even larger values are measured with Xenon D65 over a range of greater than 50,000 to 100,000 lx or greater than 10,000 to 20,000 cd/m² with 10% measuring uncertainty. Date of calibration, the device’s serial number, references conditions, identification of utilized test equipment and permissible deviations are listed as well in accordance with the standards.

The DAkkS calibration certificate encompasses testing and documentation of illuminance with light type A including 10, 180 and 1800 lx within the DAkkS certified range of 1.75 to 2000 lx with 1.5% measuring uncertainty. Type of calibration, calibration object, calibration procedure, measuring conditions, measurement results and measuring uncertainty are described in detail as well. Calibration is limited to luxmeters which comply with at least class C in accordance with DIN 5032 or DIN EN 13032.

DAkkS or factory calibration certificates for devices from other manufacturers can be issued after determining that they are capable of being calibrated. If the device does not comply with at least class C, only factory calibration can be offered. Devices from other manufacturers cannot be adjusted.

The GOSSEN Light Lab offers the following calibration services:

- DAkkS and factory calibration for illuminance
- Factory calibration for luminance
- Adjustment of our own products, with additional receiving inspection report if required
- Express service upon request in emergencies

Calibration service includes the following points:

- Receiving inspection in order to determine whether or not the device complies with the specification
- Issuance of a standards-compliant calibration certificate
- Attachment of a calibration seal with calibration date
- Battery replacement for battery powered test instruments
- Cleaning of devices to be calibrated
Checklist for calibrations

Please provide us with the following data for a technical contact person at your company:

Company: ________________________________
Last name, first name: ________________________________
Phone: ________________________________
e-mail: ________________________________

Which calibration services would you like us to complete:

DAkkS calibration – illuminance
Factory calibration – illuminance
Factory calibration – luminance

If receiving inspection reveals that the instrument does not comply with the specification:

Return the instrument without calibration
Calibrate the instrument anyway
Ask the above specified contact person for further instructions

For GOSSEN instruments only:

Prepare receiving inspection report(s)
Adjust instrument
Prepare final inspection report(s)

Special requests / comments:
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