CALIBRATION SERVICES

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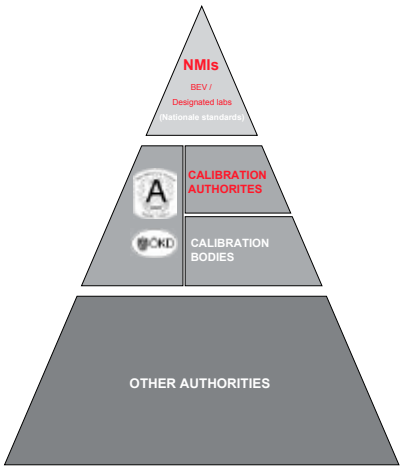
CALIBRATION AT THE HIGHEST LEVEL

The National Metrological Institute (NMI) or its Designated Institutes (DI) maintain the highest national measurement standards and ensure that the measurements correspond to the international system of units SI. NMIs and DIs participate in international comparative measurements with other NMIs and cooperate in technical committees to ensure that they are the top reference for measurement variables.

The measurement uncertainties of NMIs or DIs do not (or hardly) exceed those of accredited top calibration laboratories but can also be provided for special calibration tasks as part of the internationally agreed calibration options (CMC data) published in the BIPM (Bureau International des Poids et Mesures).



E+E YOUR PARTNER FOR CALIBRATION

Measuring control, calibration and traceability is a central topic of most quality assurance systems. During the calibration in measurement technology calibrators detect and document reliably and reproducibly how large the deviation of a measurement device to a normal is.

The reliable calibration of your measuring instruments either in our OEKD accredited calibration laboratory or directly at your site.

Special calibration of humidity and air velocity meters can be covered in our designated NMI calibration. Based on the agreements between the members of EA (European Cooperation for Accreditation) and ILAC (International Laboratory Accreditation Cooperation), calibration certificates issued by E+E conform to worldwide recognized standards.

E+E Elektronik is commissioned to provide the „National standards for humidity and air velocity in Austria“ as designated laboratory (NMI) by the Federal Ministry.

DESIGNATED NMI LABORATORY

Due to direct traceability with the NMI (National Metrology Institute), an NMI certificate is of particular interest to accredited calibration authorities.

For the highest measurement authority in a country there is the opportunity to build expertise about the measurement variables. In addition, within the frame of the technical possibilities qualified measurements can be performed beyond the OEKD accreditation.

ACCREDITED OEKD LABORATORY

The calibration laboratory of E+E Elektronik is accredited according to DIN EN ISO/IEC 17025, with identification number 0608, by Akkreditierung Austria / Federal Ministry of Science, Research and Economy. OEKD certificates document the traceability of measurements to national standards. The Akkreditierung Austria is responsible for the accreditation and supervision. Each OEKD certificate must be approved by an authorised signatory. OEKD certificates are issued for measuring instruments, when measurements need to be traceable (e.g. works standards).

HUMIDITY

Measurement under extreme climatic conditions is one of E+E Elektronik's specialities. The E+E OEKD Laboratory offers relative humidity calibrations in the temperature range from -70 to 200 °C.

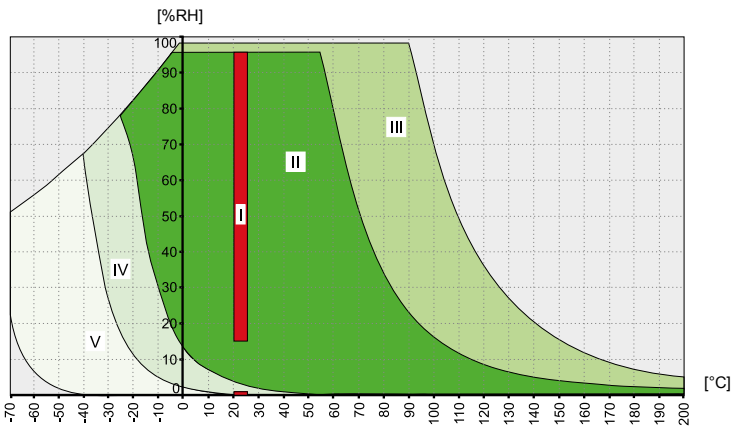
A complex two-pressure/two-temperature generator combined with a stable/homogenous temperature cabinet provides highest accuracy for relative humidity.

Accreditation scope of the E+E Calibration Laboratory

Calibration		*Calibration object*	*Measuring condition*	*Measuring range*[1)]	*Measurement uncertainty*
NMI	Lab	Special calibration of humidity measurement equipment in the designated lab BEV/E+E			
OEKD	Lab	Hygrometer for the measurement of humidity	Gas flow max. 5 l/min Air pressure max. 10 bar Temperature range -40...180 C°[1)]	0...98 % RH; -40...<0 °C 0...98 % RH; 0...200 °C	0.2 % RH+0.6 % of m.v. 0.1 % RH+0.4 % of m.v.
OEKD	Lab	Humidity generator (z.B. Humor 20)	Temperature range (25 ±3) °C	10...95 % RH	(0.15+0.5 % of m.v.) % RH
OEKD	on-site	Hygrometer for the measurement of humidity	Comparative measuring with humidity generator at ambient temperature (25 ±10) °C	10...95 % RH	(0.5+0.6 % of m.v.) % RH

1) On request, certificates are possible in the extended measuring range -70...200 °C (-94...392 °F), in the „Designated laboratory" at the highest accuracy.
Other humidity measurement parameters on request (d_v, r, w_v, etc.)

SCOPE OF ACCREDITATION



ACCREDITED ON-SITE SERVICE

Take the opportunity of on-site calibration!

Range I is the E+E standard measurement range:
(23 ±3) °C, 15...95 % RH and 0 % RH

Ranges **II**, **III, IV** and **V** define extended calibration ranges with different delivery times and prices.

DEW POINT

The E+E dew point calibration bench impresses with a very low measurement uncertainty and a calibration range from -90 °C frost point (Tf) to 95 °C dew point (Td). Standard calibrations are carried out in nitrogen, other gases such as methane upon request. The E+E calibration service also offers special calibrations of dew point meters and dew point mirrors in the designated lab.

Accreditation scope of the E+E Calibration Laboratory

Calibration		*Calibration object*	*Measuring condition*	*Measuring range*[1)]	*Measurement uncertainty*
OEKD	Lab	Dew point hygrometer (Dew point mirror) Dew point transmitter (Dew point hygrometer)	Gas flow max. 5 l/min Air pressure max. 10 bar for Td -64.6...95 °C (950 ±150) mbar for Td <-64.6 °C	-75...<-55 °C -55...<-22.5 °C -22.5...70 °C >70...95 °C	0.05-(55+Tf)*0.01 K 0.05 K 0.035 K 0.045 K
OEKD	Lab	Dew point transmitter (Dew point hygrometer)	Pressure range 1...100 bar Air or nitrogen[2)]	-90...<-80 °C -80...<-55 °C -55...<-25 °C -25...20 °C	0.2-(80+Tf)*0.02 K 0.05-(55+Tf)*0.006 K 0.05 K 0.035 K
OEKD	on-site	Dew point generator	Gas flow min. 1 l/min Air pressure (950 ±150) mbar	-75...<-55 °C -55...<-22.5 °C -22.5...70 °C >70...95 °C	0.07-(55+Tf)*0.01 K 0.07 K 0.05 K 0.06 K

1) According to the BIPM Service category 3.1, „dew point“ is used as denomination for the measurand. For values <0 °C the value refers to frost point. Calibration for values <0 °C can also be carried out for the calculated dew point temperature.
2) Other gases, such as methane upon request

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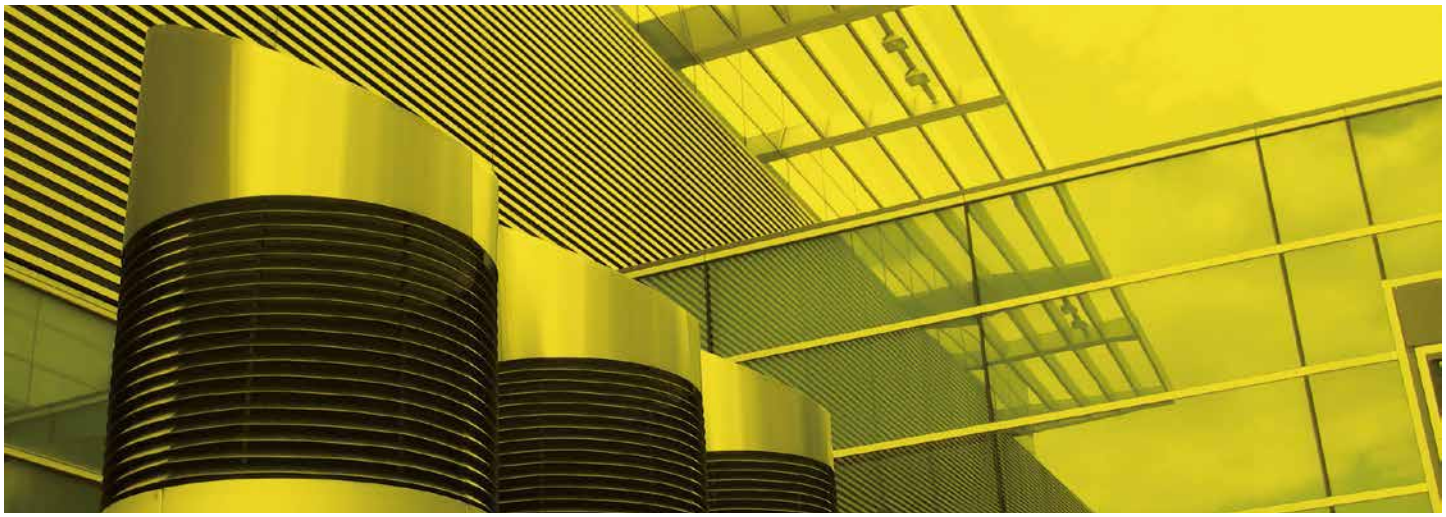
What does ACCREDITED CALIBRATION mean?

e.g.: DAkkS (D), Akkreditierung Austria (ÖKD, A), SCS (CH), UKAS (GB), NVLAP (US)
The quintessential characteristic of an accredited calibration certificate is the traceability of measurement results and thus its international comparability.

Particularly important is the statement of measurement uncertainties, the determination of which includes the measurement process.

Independent assessors must also examine the suitability of the process or measurement process in order to assure traceability. According to international agreements (ILAC), only inspection laboratories accredited according to DIN EN ISO/IEC 17025 (calibration laboratories) are permitted to carry out traceable calibrations and thus guarantee complete international comparability of the calibration results. A device that was merely compared with a traceable measuring device is not itself traceable since the measurement process was not performed in accordance with an accredited procedure.

AIR VELOCITY



Two wind tunnels are available to calibrate the air speed: One free-stream wind tunnel up to 40 m/s with integrated temperature control up to 80 °C and one special wind tunnel for the low-flow range between 0.04 and 2 m/s. In combination with a laser Doppler anemometer, high reproducibility of results can be achieved.

Accreditation scope of the E+E Calibration Laboratory

Calibration		*Calibration object*	*Measuring condition*	*Measuring range*	*Measurement uncertainty*
NMI	Lab	Special calibration of air velocity measuring instruments in the designated lab BEV/E+E			
OEKD	Lab	Measuring instruments for recording air velocity	(23 ±3) °C ambient air pressure	0.04...2 m/s	0.004 m/s + 0.47 % of m.v.
OEKD	Lab	Measuring instruments for recording air velocity	5...80 °C ambient air pressure	0.3...40 m/s	0.004 m/s + 0.47 % of m.v.

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What does TRACEABILITY mean?

The concept „traceability“ describes a process in which the measured quantities displayed by a measuring device can be compared in one or several steps with a national standard for the indicated measurement quantities. These steps must form an unbroken chain of calibrations. In each case, one measuring device is compared with one standard whose metrological characteristics are determined by a comparison with a higher-level standard.

Departments which perform the comparisons within this chain have to document their appropriate competencies, e.g. through an accreditation in accordance with DIN EN ISO/IEC 17025.

Traceable calibrations can only be performed by accredited calibration laboratories.

MASS FLOW

The E+E OEKD Laboratory for air flow is unique in Europe and offers mass flow and volumetric flow calibrations for standard conditions in the range from 0.6 to 2300 m³/h.
To allow calibration as close as possible to the real application, the operating pressure in the system can be set between 1 and 10 bar.

Accreditation scope of the E+E Calibration Laboratory

Calibration		*Calibration object*	*Measuring condition*	*Measuring range*	*Measurement uncertainty*
OEKD	Lab	Mass flow sensor/ Flow transmitter	0.1...1 MPa (1...10 bar) at (23 ±3) °C	Flow rate at standard conditions (0 °C / 1013 mbar) 0.6...2300 m³/h	0.003 m³/h + 0.9 % of m.v.

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What does MEASUREMENT UNCERTAINTY mean?

The measurement uncertainty is a feature of an accredited procedure. It describes to what extent a measurement can be traced to national standards and ultimately to International System of Units (SI units). Usually, an extended measuring uncertainty is specified, which is calculated from the standard uncertainty multiplied with the extension factor k=2.

Each measuring value is associated with a (measurement) uncertainty. In the calibration hierarchy, testing equipment on a higher level has a lower measuring uncertainty that that on a lower level.

Accreditation in line with DIN EN ISO/IEC 17025 requires that measurement uncertainties are calculated according to EA-4/02 „Guide to Expression of the Uncertainty of Measurement in Calibration, GUM“.

TEMPERATURE

Depending on the requirements, calibration in air and calibration in the block calibrator are offered. With air as the medium, temperature calibration is limited to the range between -40 to 180 °C. For simple calibration in the block calibrator, the laboratory is certified for the temperature range -45 to 425 °C. The essential difference between air and block calibration is to be seen in how the heat generated in the test piece by the measurement medium is taken into account.

Accreditation scope of the E+E Calibration Laboratory

Calibration		*Calibration object*	*Measuring condition*	*Measuring range*	*Measurement uncertainty*
OEKD	Lab	Thermometer for air temperature	comparison measurement in temperature-controlled measuring chamber	-70...200 °C	0.05 K
OEKD	Lab / on-site	Contact thermometer (Immersion- and cut-in probe)	comparison measurement in dry block calibrator	-45...425 °C	<23 °C: 0.5*|t-23| + 28 mK ≥23 °C: 0.22*|t-23| + 28 mK

PRESSURE

Pressure meters for both absolute and relative pressure and differential pressure can be calibrated in the calibration lab at E+E Elektronik. A high-precision pressure calibrator is available for calibrating absolute and relative high pressure meters. For the calibration of differential pressure sensors, the differential pressure is generated via a constricted gas flow. The differential pressure is calibrated with the ambient pressure as the static pressure. All calibrations are carried out using nitrogen as the pressure medium.

Accreditation scope of the E+E Calibration Laboratory

Calibration		*Calibration object*	*Measuring condition*	*Measuring range*	*Measurement uncertainty*
OEKD	Lab	Absolute pressure sensor	(23 ±3) °C	0.1...1 bar 1...21 bar 21...101 bar	0.00028 bar 0.01 % of m.v. + 0.00018 bar 0.011 % of m.v. + 0.00006 bar
OEKD	Lab	Relative pressure sensor	(23 ±3) °C	-0.9...0 bar 0...<20 bar 20...100 bar	0.00028 bar 0.01 % of m.v. + 0.00028 bar 0.011 % of m.v. + 0.00016 bar
OEKD	Lab	Differential pressure sensor	(23 ±3) °C	0...0.3 bar 0.3...9 bar	0.19 % of m.v. + 0.00005 bar 0.16 % of m.v. + 0.00006 bar

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What does FACTORY CALIBRATION mean?

Factory calibrations are not legally valid documents for traceability verification; however, they do contain the manufacturer's confirmation that the products have been manufactured and inspected in compliance with the applicable regulations using the appropriate materials and internal monitoring procedures.

These calibration certificates are issued on the basis of standards like DIN EN 10204, for example, and represent documented final inspections of the producer. Such certificates can also be offered at low cost for products, or are included as standard.

CO_2

The calibration is performed as comparative measurement with a constant CO_2 reference concentration. The CO_2 reference concentration is generated by a special gas mixing pump according to DIN 51898-1 and is freely selectable. Due to the operating principle of the mixing pump, the gas volume flow and by this the CO_2 reference concentration can be traced back to length, which is a fundamental physical quantity of the International System of Units (SI). Therefore, the E+E CO_2 reference generator is a primary standard.

Calibration range

Calibration conditions	*Calibration range**	*Calibration uncertainty**
(23 ± 5) °C ambient pressure	5...1,150 ppm	(6 + 1.07 % of m. v.) ppm
	500...300,000 ppm	(6 + 0.38 % of m. v.) ppm

* The specifications apply to the mole fraction x in µmol/mol as well as the volume fraction j in µL/L.

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What does ISO CALIBRATION mean?

ISO calibrations are comparative measurements of external test candidates with in-house reference equipment (factory-level standards) as a service. The reference equipment utilized is traceable to national standards. The comparative measurement is carried out in accordance with internal procedures which meet the requirements in accordance with ISO 9001 or ISO TS16949 as well.

The comparative measurement merely provides information about the calibration condition of the equipment with the use of high-quality measuring equipment.

ISO calibrations purchased as additional external services are not traceable (there is no accredited process!). The measurement results are therefore not internationally comparable.

CALIBRATION PROCEDURE

Upon receipt of the measuring equipment an initial calibration is carried out in accordance with customer‘s specifications. The measured values are documented on a certificate.

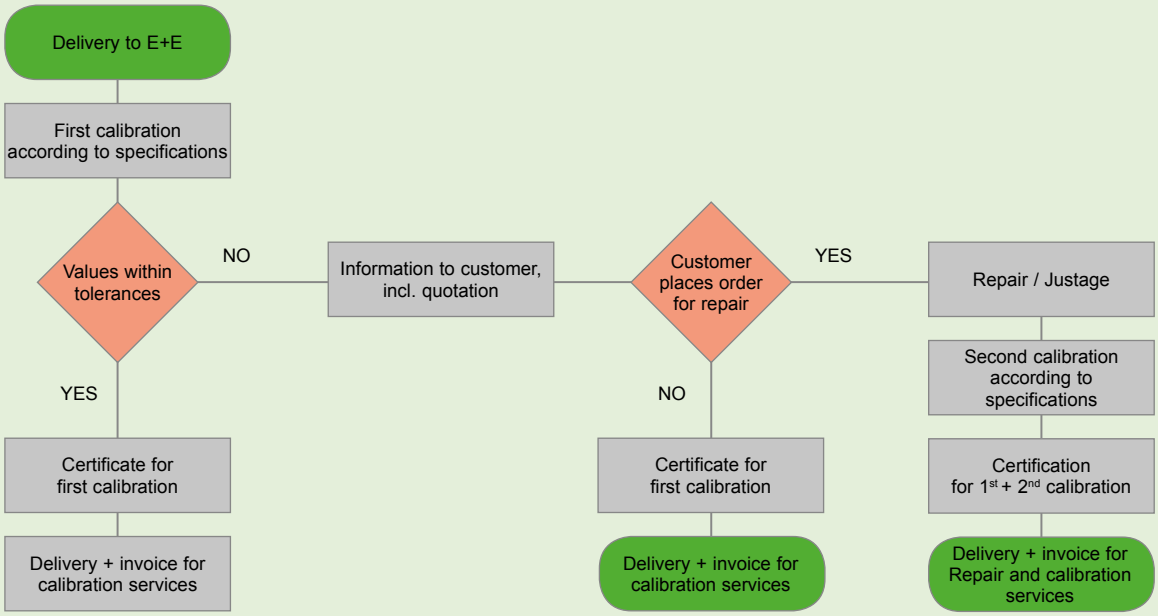
If requested, the measuring results will be compared with the specified tolerances of the measuring equipment as part of the initial calibration.

If the recorded values for the measuring equipment fall outside the permissible tolerances, the customer may use the information to validate the results of previous quality tests and eventually initiate appropriate corrective action.

At the request of the customer, a quotation will be issued for the cost of repair, respectively the adjustments. If E+E is not able to repair the equipment, it will be either returned to the customer or shipped directly to the manufacturer.

Once the equipment has been repaired and adjusted, the measuring values will be documented during the second calibration routine. Separate certificates are issued for the first and second calibration confirming the measured values ‚as received‘ and, as delivered‘.

Progression of a calibration



ON-SITE CALIBRATION

On-site calibration may be required for certain process and quality-relevant measuring points. For this purpose, E+E offers a manufacturer-independent calibration service for the physical quantities humidity and temperature. The on-site service covers the calibration of stationary and portable instrumentation as well as climate chambers with specific customer requirements.

Advantages

+ Traceability to national and international standards
+ Calibration of on-site equipment and measuring instruments possible
+ Independent supervision of test equipment by an accredited company
+ No malfunction of test equipment
+ Quick turn-around times
+ No transportation risks

E+E Elektronik Headquarters

E+E ELEKTRONIK - YOUR PARTNER IN SENSOR TECHNOLOGY.

E+E Elektronik GmbH, with headquarters in Engerwitzdorf, Austria, has been established in 1979 and is part of Dr. Johannes Heidenhain GmbH group.

Diverse. E+E Elektronik is a leading manufacturer of sensors and transmitters for a multitude of physical quantities and applications. Data loggers, hand-held meters as well as calibration systems and services round up the product portfolio.

Reliable. Best quality made in Austria, high accuracy and outstanding long-term stability, together with advanced understanding of customer specific requirements are the main competitive advantages of E+E Elektronik.

Versatile. Measuring devices from E+E Elektronik are used all over the world in most diverse industries such as building automation, meteorology, agriculture, food, pharmaceutical, process control or automotive.

Flexible. With own clean room sensor manufacturing, in-house design of state of the art electronics and highest competence in calibration, E+E Elektronik is the ideal partner for OEM customers.

Certified. The E+E quality assurance system is certified according to ISO 9001 and ISO/TS 16949. The company also complies with the environmental standard ISO 14001. The in-house calibration laboratories are accredited according to DIN EN ISO/IEC 17025.

Global. E+E Elektronik sales subsidiaries are located in China, Germany, France, Italy, Korea and the USA. Additionally, E+E maintains a worldwide network of distribution partners.

- HUMIDITY
- TEMPERATURE
- DEW POINT
- MOISTURE IN OIL
- MASS FLOW
- CO_2
- AIR VELOCITY

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