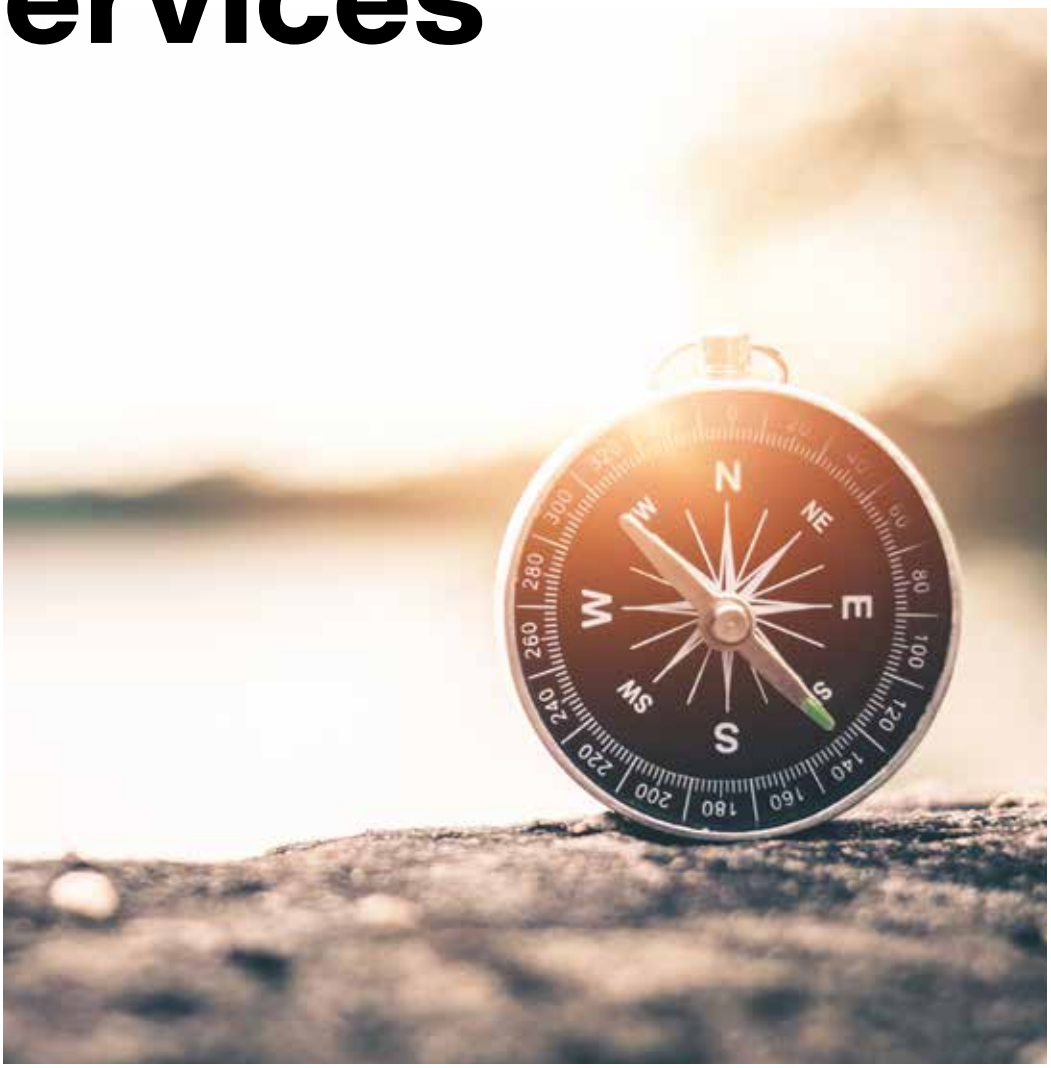
E+E

your partner
in sensor
technology.

Accredited Calibration Services



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Your Partner for Calibration

The monitoring of the measuring devices, their calibration and traceability are central topics of most quality assurance systems. A calibration determines and documents the deviation of a measuring device from a reference.

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 are compliant to worldwide recognized standards. Special calibration for air velocity, gas concentration carbon dioxide and humidity measuring devices can be performed in the Designated Institute (DI).

E+E Elektronik is commissioned to maintain the national standards for humidity, air velocity and gas concentration carbon dioxide in Austria as Designated Institute (DI) on behalf of the „Bundesamt für Eich- und Vermessungswesen“ (BEV).

Bundesamt
für Eich- und
Vermessungswesen

Designated Institute / NMI

Due to direct traceability with the DI / NMI (Designated Institute / National Metrology Institute), a NMI calibration certificate issued by the designated laboratory is of particular interest for devices employed by accredited calibration laboratories or other NMIs.

As highest measurement authority in the country, a designated laboratory own highest level of expertise with respect to specific physical quantities. As such the E+E designated laboratory can perform calibrations beyond the scope of the E+E accreditation.

Accredited Calibration 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 Digitization and Economic Location. Accredited calibration certificates document the traceability of the measured values to national standards. The accreditation and the monitoring is performed by Akkreditierung Austria. Each issued accredited calibration certificate is approved by an authorized signatory. Calibration certificates from accredited laboratories are necessary for measuring devices (such as factory standards) when the measured values have to be traceable.

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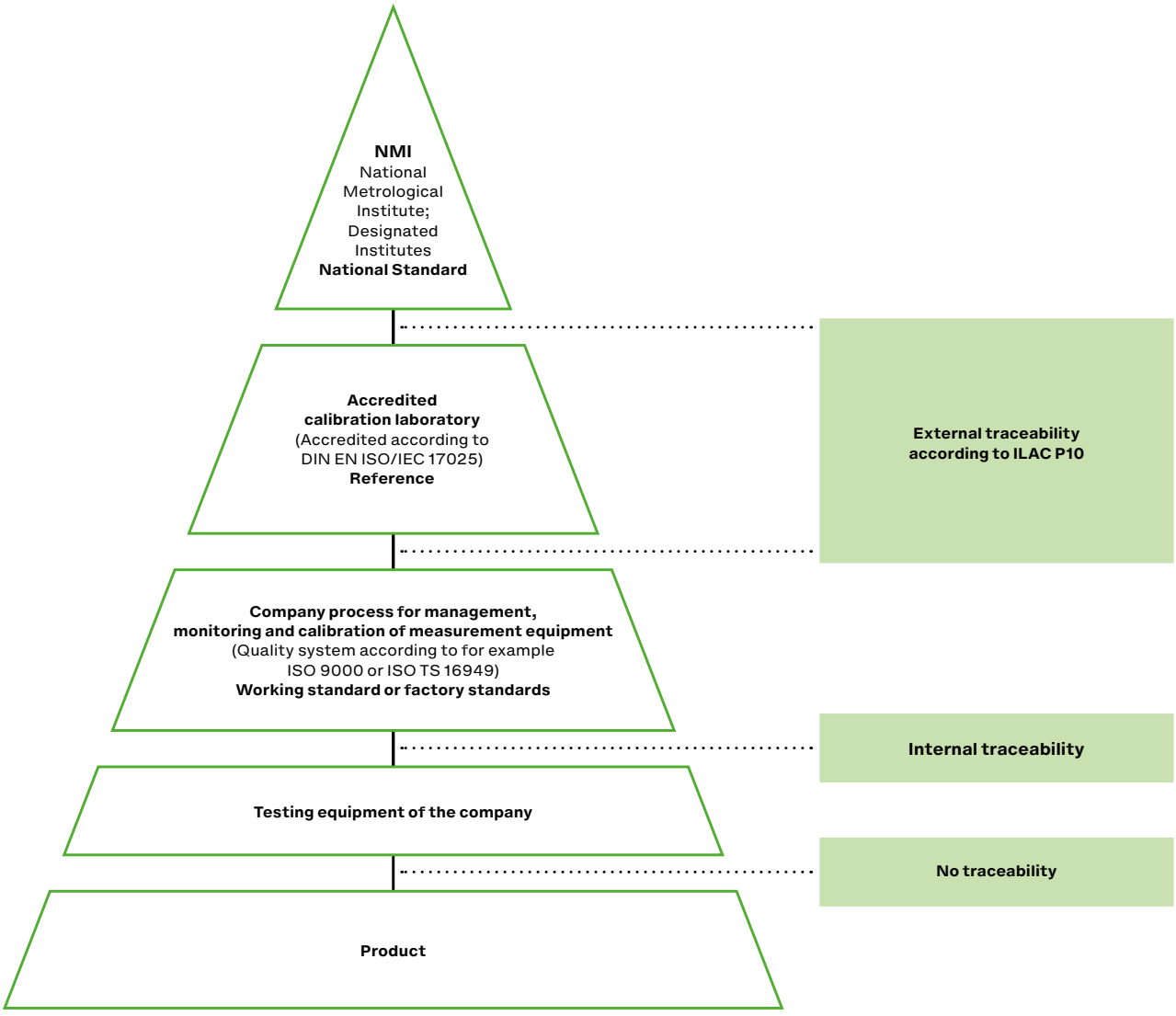
Calibration at the Highest Level

The National Metrological Institute (NMI) or 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 are not (or hardly) smaller than those of accredited topcalibration laboratories, but can also be provided for special calibration tasks as part of the internationally agreed calibration options (CMC data with CIPMMRA-Logo) published in the BIPM (Bureau International des Poids et Mesures).


NMI
National Metrological Institute; Designated Institutes
National Standard
Accredited calibration laboratory
(Accredited according to DIN EN ISO/IEC 17025)
Reference
Company process for management, monitoring and calibration of measurement equipment
(Quality system according to for example ISO 9000 or ISO TS 16949)
Working standard or factory standards
Testing equipment of the company
Product
External traceability according to ILAC P10
Internal traceability
No traceability

Accredited Calibration Services

Air Velocity

Carbon Dioxide

Dew Point

Flow

Humidity

Pressure

Temperature

Air Velocity

The air velocity measurement devices are calibrated by comparison with a laser Doppler anemometer in a homogeneous, reproducible flow (wind tunnel).
The E+E accredited calibration laboratory employs two tunnels for the air velocity range up 40 m/s (7874 ft/min) and up to 2 m/s (394 ft/min) respectively. E+E Elektronik maintains also the Designated Institute (DI) responsible for the Austrian national standard for air flow velocity.

Scope of Accreditation E+E Calibration Laboratory

Calibration		Calibration object	Measurement conditions	Measurement range	Calibration uncertainty
NMI	Lab	Special calibration of air velocity measuring instruments in the Designated Institute BEV/E+E			
AA 0608	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.
AA 0608	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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Traceability

Traceability describes the process in which the value displayed by a measuring device can be compared in one or several steps with a national standard for that specific physical quantity. The steps must form an unbroken chain of calibrations, which means that each measuring device in the chain is compared with a standard (reference) whose metrological characteristics are determined by a comparison with a higher-level standard. The laboratories and institutes which perform the comparisons within the chain must document their competence through an accreditation according to DIN EN ISO/IEC 17025. Traceable calibrations can be performed by accredited calibration laboratories or DIs respectively NMIs only.

Carbon Dioxide

The E+E accredited laboratory performs calibrations for CO_2 concentration in the range 5...300,000 ppm for all common CO_2 measuring devices such as sensors, handhelds, data loggers, spectrometers and for reference gases.

The calibration is performed as comparative measurement with a constant, free selectable CO_2 reference concentration generated according to the austrian primary standard. Due to the operation principle of the generator, the CO_2 reference concentration can be traced back to length, temperature and mass, which are fundamental physical quantities of the International System of Units (SI). Therefore, the E+E CO_2 reference generator is a primary standard.

Scope of Accreditation E+E Calibration Laboratory

Calibration		Calibration conditions	Calibration range*	Calibration uncertainty*
NMI	Lab	Special calibration of CO_2 measuring instruments in the Designated Institute BEV/E+E		
AA 0608	Lab	(23 ± 5) °C ambient pressure	5...1,150 ppm 500...300,000 ppm	(6 + 1.07 % of m. v.) 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 φ in µL/L.

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ISO Calibration

ISO calibrations are comparative measurements of third party devices against in-house high quality reference equipment (factory-level standards). The comparative measurement is performed according to internal procedures which meet the requirements of ISO 9001 or IATF 16949 and provide information about the calibration condition of the specimen. The E+E reference equipment is traceable to national standards, but the ISO calibration process is not accredited. Consequently, ISO calibrations are not traceable and the measurement results are not internationally comparable.

Dew Point

The E+E accredited dew point calibrations impress with a very low measurement uncertainty and a range from -90 °C (-130 °F) frost point to +95 °C (203 °F) dew point.
Standard calibrations are performed in nitrogen. Calibrations of dew point hygrometers in other carrier gases such as methane are possible upon request. Special calibrations of dew point meters and dew point mirrors are possible in the Designated Institute.

Scope of Accreditation E+E Calibration Laboratory

Calibration		Calibration object	Measurement conditions	Measurement range[1)]	Calibration uncertainty
NMI	Lab	Special calibration of dew point measuring instruments in the Designated Institute BEV/E+E			
AA 0608	Lab	Dew point hygrometer (Dew point mirror) Dew point transmitter (Dew point hygrometer)	Air pressure max. 10 bar for t_f = -60 °C...t_d = 95 °C (950 ± 150) mbar for t_f < -60 °C	-75...<-55 °C -55...<-22.5 °C -22.5...70 °C >70...95 °C	0.05 - (55 + t_f) * 0.01 K 0.05 K 0.035 K 0.045 K
AA 0608	Lab	Dew point hygrometer (Dew point mirror) 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 + t_f) * 0.02 K 0.05 - (55 + t_f) * 0.006 K 0.05 K 0.035 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

E+E Lexicon

Accredited Calibration

The quintessential characteristic of an accredited calibration certificate is the traceability of measurement results and thus its international comparability. To achieve traceability, the calibration procedures of an accredited laboratory are evaluated and approved by independent assessors. Accredited calibration certificates state the measurement uncertainty which takes into account the calibration process itself. According to ILAC (International Laboratory Accreditation Cooperation) only calibration laboratories or Designated Institutes / NMIs accredited according to DIN EN ISO/IEC 17025 can perform traceable calibrations and guarantee full international comparability of the calibration results. A device which was merely compared with another, trace-able measuring device is not itself traceable since the measurement process was not performed in accordance with an accredited procedure.

Flow

The E+E accredited calibration bench is unique in Europe and offers flow and volumetric flow calibrations for inline and immersion flow meters at standard conditions in the range from 0.6 to 2300 m^3/h (0.35 to 1354 SCFM) in pipes from DN15 to DN80 (1/2 to 3“). The pressure in the calibration bench can be set between 1 and 10 bar (14.5 and 145 psi), which allows for highly accurate calibration under the real conditions in compressed air networks.

The E+E calibration laboratory operates also an accredited low flow calibration bench in the range from 0.06 l/min to 245 l/min at standard conditions. Calibrations can be performed in pipes from DN15 to DN50, at pressures between 1 and 10 bar (14.5 and 145 psi) and for air and non-air gases.

Scope of Accreditation E+E Calibration Laboratory

Calibration	Calibration object	Measurement conditions	Measurement range	Calibration uncertainty
AA 0608 Lab	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 m^3/h	0.003 m^3/h + 0.9 % of m.v.
AA 0608 Lab	Flow sensor/ Flow transmitter	0.1...1 MPa (1...10 bar) at (23 ±3) °C	0.06...245 l/min [1)]	0.12*Q0^2-0.48*Q0+1.66 (for range: 0.06...2.7 l/min) 0.008*Q0^2-0.14*Q0+1.86 (for range: 1.9...9.3 l/min) 0.0007*Q0^2-0.052*Q0+2.4 (for range: 9...46 l/min) 0.00004*Q0^2-0.0018*Q0+1.8 (for range: 45...245 l/min)

1) also for non-air gases

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Measurement Uncertainty

Every measured value is associated with an uncertainty. The measurement uncertainty describes to what extent a measurement can be traced to national standards and ultimately to International System of Units (SI) and is a feature of an accredited calibration procedure. The commonly specified extended measurement uncertainty is calculated from the standard uncertainty multiplied with an enhancement factor k=2. The test equipment on a higher level in the calibration hierarchy has a lower measurement uncertainty that equipment on a lower level. Accreditation according to DIN EN ISO/IEC 17025 requires the measurement uncertainty to be calculated according to EA-4/02 Guide to Expression of the Uncertainty of Measurement in Calibration (GUM).

Humidity

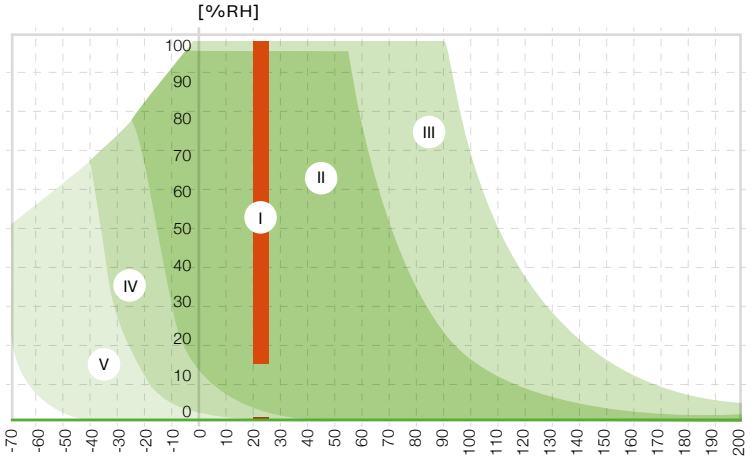
The E+E calibration laboratory is accredited for relative humidity calibrations in the temperature range -70 °C to 200 °C (-94 °F to 392 °F). The reference is a high-end, sophisticated dual pressure – dual temperature humidity generator, which combined with a stable and homogenous climate chamber provides highest accuracy for the calibration of hygrometers and humidity generators. E+E Elektronik is also a Designated Institute (DI) responsible for maintaining the national standard for humidity in Austria.

Scope of Accreditation E+E Calibration Laboratory

Calibration		Calibration object	Measurement conditions	Measurement range[1]	Calibration uncertainty
NMI	Lab	Special calibration of air velocity measuring instruments in the Designated Institute BEV/E+E			
AA 0608	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.
AA 0608	Lab	Humidity generator (z.B. Humor 20)[2]	Temperature range (25 ±3) °C	10...95 % RH	(0.15 + 0.5 % of m.v.) % RH

1) Calibration in the extended temperature range -70 °C to 200 °C (-94 °F to 392 °F) is performed upon request. Calibration for other physical quantities such as absolute humidity or mixing ratio is available upon request.
2) Wider ranges or dew point upon request.

Scope of Accreditation



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

Areas II, III, IV and V represent extended calibration ranges:
Price and delivery time upon request.

Pressure

E+E accredited laboratory performs calibrations of measuring devices for absolute, relative and differential pressure in the ranges:

Absolute pressure: 0.1...101 bar (1.45...1465 psi)
Relative pressure: -0.9...100 bar (-13...1450 psi)
Differential pressure: -0.05...9 bar (-0.73...131 psi)

Scope of Accreditation E+E Calibration Laboratory

Calibration	Calibration object	Measurement conditions	Measurement range	Calibration uncertainty
AA 0608 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
AA 0608 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
AA 0608 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
AA 0608 Lab	Differential pressure sensor	(23 ±3) °C	0.05...0.3 bar -0.05...0.05 bar	0.0000072 % of m.v. + 0.000026 bar 0.000000722 % of m.v. + 0.000006 bar

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Factory Calibration

A factory calibration certificate represents the manufacturer's confirmation that the product was manufactured and inspected in compliance with the applicable regulations using the appropriate materials and internal monitoring procedures. The factory calibration certificate is issued according to standards such as DIN EN 10204, documents the final inspection during manufacturing and is no legal poof for traceability. These certificates are offered at lower cost than the accredited calibration certificates and are frequently included in the standard scope of supply of measuring devices.

Temperature

The E+E accredited laboratory performs calibrations of temperature measuring devices in air for the range -70 to 200 °C (-94 to 392 °F) as well as in dry block calibrators for the range -45 to 425 °C (-49 to 797 °F). The E+E on-site service is available for accurate calibration of stationary systems such as furnaces, climate chambers, refrigeration and freezer cabinets.

Scope of Accreditation E+E Calibration Laboratory

Calibration	Calibration object	Measurement conditions	Measurement range	Calibration uncertainty
AA 0608 Lab	Thermometer for air temperature	comparison measurement in temperature controlled measuring chamber	-70...200 °C	0.05 K
AA 0608 Lab	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

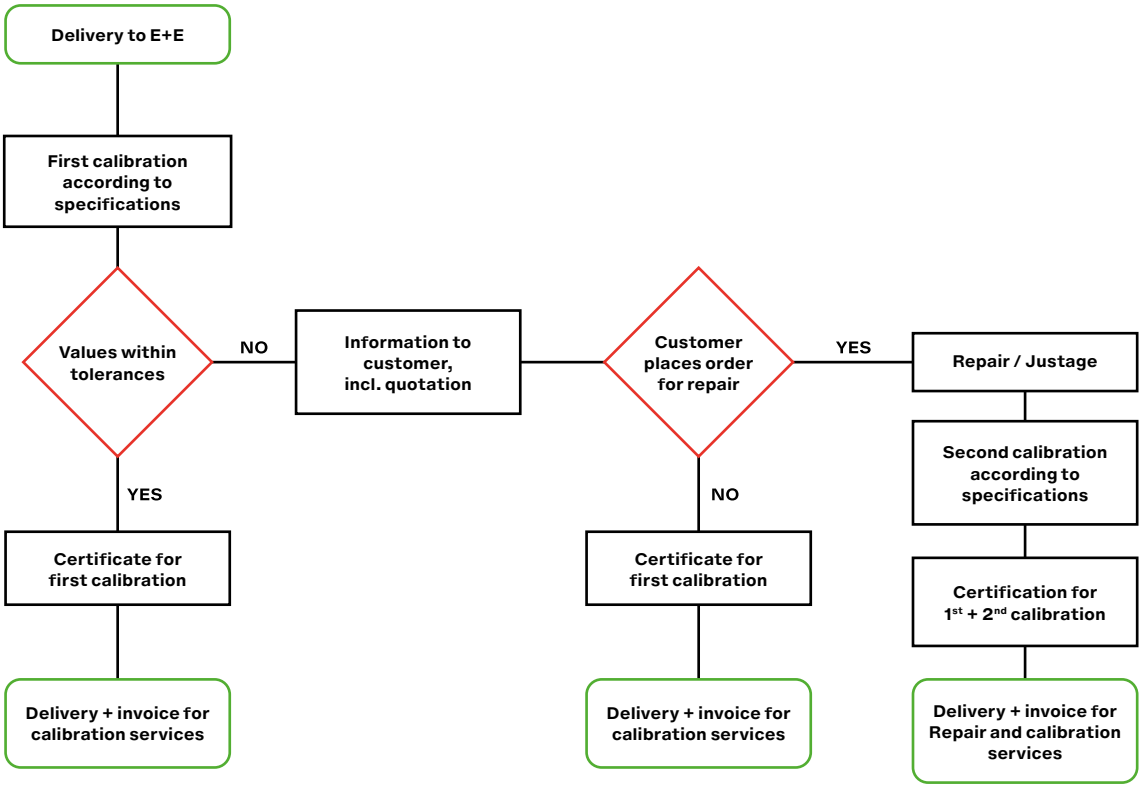
Calibration in the Laboratory

Upon receipt, the device to be calibrated (specimen) undergoes an initial calibration according to customer‘s specification. The calibration results are documented in an “as found” certificate.
In the frames of the initial calibration, the results can be compared upon request with the specified tolerances of the specimen. Based on this, the customer can validate the results of previous quality tests or initiate corrective actions.

If the specimen proves defective or out of specs, E+E issues a quotation for repair or adjustment upon customer’s request. In case the specimen cannot be repaired at E+E, it will be returned either to the customer or directly to the manufacturer.

Once the specimen has been repaired and adjusted, it undergoes a second calibration and the results are documented in the “as delivered” calibration certificate.

Progression of a calibration



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 IATF 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.

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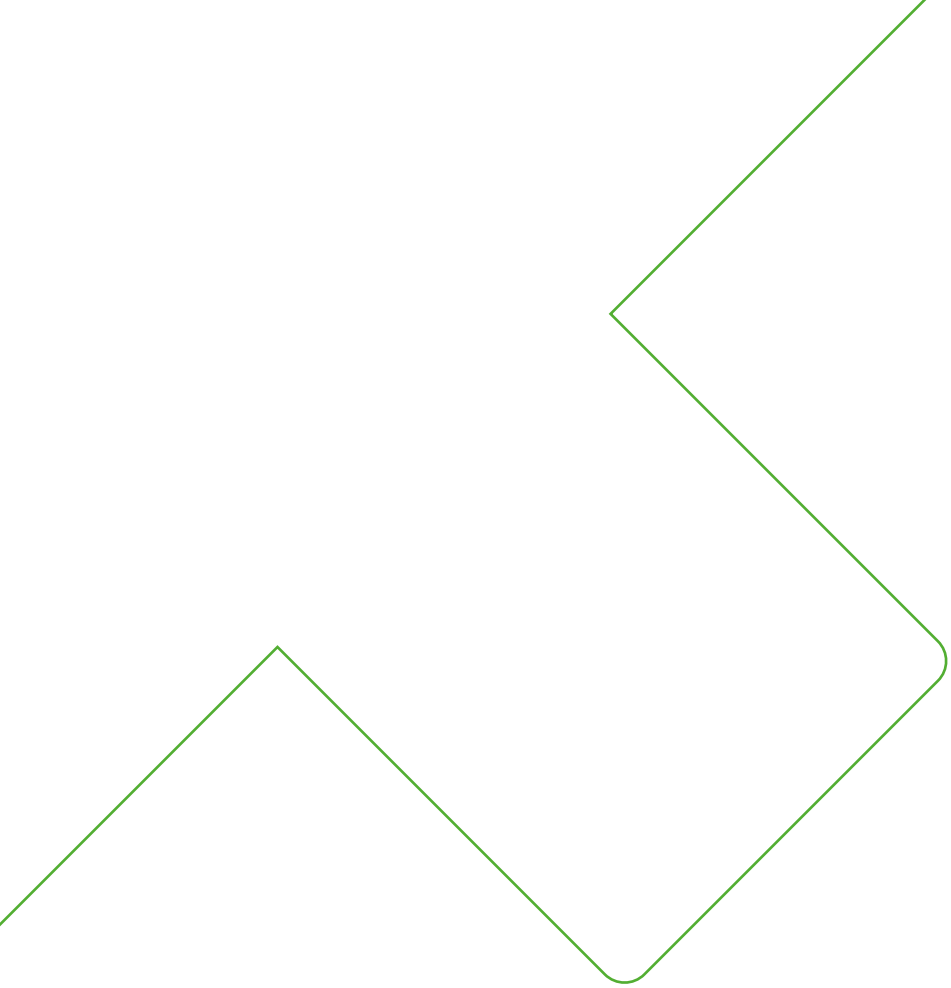

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